# Electrical World

A Review of Current Progress in Electricity
and Its Practical Applications



## Volume LXXXI

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# INDEX TO VOLUME LXXXI

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# Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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# A Year of Records

DURING 1922 the central-station branch of the industry passed three mileposts. First, the total amount of energy sold by the various generating and distributing companies passed the half-hundred billion mark, thereby realizing the prophecy made several years ago by the ELECTRICAL WORLD that this mark could be reached by 1923. Second, the gross income from the sale of energy passed the billion-dollar mark and the industry finds itself indisputably in a class with the other primary industries of the country the value of whose products is in excess of a thousand millions. Third, the capital invested now exceeds five billion dollars, placing the electric light and power business ahead of all the other branches of the electrical industry, with the possible exception of electric railways, the fifth among the primary industries of the country. If the capitalization of all the various branches of the electrical industry is combined, however, that industry stands second, being exceeded only by the steam railroads.

During December the calls for electrical energy, especially in the intensely industrial sections of the country, were so great that the distributing companies found themselves unable to furnish more. This was true despite the addition by the central stations of the country during 1922 of about 1,600,000 kw. in generator rating.

The manufacturing and distribution branch of the industry has broken no particular records. But its total volume of more than $920,000,000 of manufactured products is a wonderful accomplishment following the low level of 1921.

It has been a year of records. And another year of records must follow in 1923 if the installation of generating equipment, the continuing extension of distributing systems and the inevitable development of new utilizations of electric service are to keep pace with the present rate of evolution and progress.

# Giuseppe Faccioli

*An electrical engineer of the first rank, whose influence upon apparatus design and upon the national activities of the profession marks him as both specialist and leader.*

TWENTY years ago a young Italian engineer named Faccioli came to this country with the idea of finding out at first hand what was going on here in electrical development. He had spent the first years of his career designing alternating-current machinery and was keenly interested in American practice. He obtained a position with the New York Edison Company and after acquiring valuable experience in the laboratories of that organization determined to study metropolitan transit work. The Interborough Rapid Transit Company offered the desired opportunity. In 1904 he became a designing engineer for the Crocker-Wheeler Company, intending to return to his native country in a few months. Instead, while working upon the design of a new induction alternator for William Stanley, he attracted the interest of that electrical pioneer by initiating a method of calculating results in advance for new generating equipment. Giuseppe Faccioli became Mr. Stanley's chief assistant, remaining permanently in America, and today, as chief electrical engineer of the Pittsfield works of the General Electric Company and vice-president of the American Institute of Electrical Engineers for District No. 1, he stands among the honored leaders of the profession.

In the year 1906 the Stanley works became a part of the General Electric organization, and in 1908 Mr. Faccioli was transferred to the engineering department of the Pittsfield works. Three years later he became assistant chief engineer of the transformer department and in 1914 was appointed to the post he now holds.

The possibilities of high-tension transmission were early foreseen by Mr. Faccioli. Beginning with pioneer work on the systems of the Central Colorado Power Company and on high-tension switching and line oscillations on the system of the Great Western Power Company, he has for twelve or fifteen years given much time to the more profound problems connected with the development of transmission and related apparatus, including high-tension transformers, lightning arresters and other protective equipment.

Mr. Faccioli has been an indefatigable worker in the A. I. E. E. After having served year after year upon some of its most important committees and four years on the board of directors as manager, he was last year elected a vice-president. He is the author of many papers upon engineering subjects.

Mr. Faccioli was born in Rome on April 7, 1877. He was graduated in 1899 with high honors from the Institute of Technology, Milan, as a mechanical and electrical engineer.

# Editorial Comment

Electrical World, January 6, 1923

Volume 81 Number 1


## Sound Progress During 1922

ANALYSIS of the available facts about the electrical industry indicate that the growth which it has experienced during the past year has been sound and healthy and that despite conditions in other industries it has probably never experienced a more prosperous year, all factors considered, or entered upon the activities of a new year with any greater opportunities or greater assurance of development. It is now seen that the slump of 1921 was nothing more than a slight hesitation in the constant march ahead. The electrical industry is still young, but its aggressive management, sound policies and courageous practice have shown results, and as a consequence it has attained an enviable position in the nation and the future outlook is so auspicious it is impossible to set limits or even lines of growth.

THE central-station branch of the industry, which is of course the real business core, has reason for great pride in its accomplishments during the past twelve months. It has issued nearly six hundred million dollars in securities for refunding, for extensions and for new construction at a cost of less than 6 per cent, and in addition, through customer ownership campaigns, it has placed one hundred and seventy-five millions of dollars' worth of junior securities in the hands of its patrons. Incidentally, the customer ownership plan is now definitely recognized as a great constructive agency for securing and maintaining good public relations—and it might be added for encouraging responsible management.

It has so often been stated that it is almost accepted as a rule that the kilowatt-hour consumption doubles every five years, and if the thought of doubling by 1928 the fifty-two billion kilowatt-hours of 1923 almost staggers the imagination, nevertheless there is nothing to indicate that this will not take place. It is impossible even to predict the effect of the utilization of this great quantity of electricity on every aspect of national welfare.

In order to anticipate, and even in many cases to try to meet, this growing demand for electricity the industry has been exceptionally active in the construction of new generating stations, transmission lines and distributing systems. During the year applications have been made for the development of about eighteen million primary hydraulic horsepower, and there is now under construction more than two and one-half million primary horsepower in hydraulic developments. This new construction involves a direct investment of approximately eight hundred millions of dollars, to which, however, to get a better view of the picture, must be added the cost of transmission lines and distribution systems so that the total investment will exceed two billion dollars. When utilization equipment is added to this the total reaches figures it is almost useless to try to estimate accurately.

The advance of the industry has demanded advances in operating practices and in engineering development quite as significant as its business growth. The use of higher voltages and further interconnection of systems have been outstanding movements. Two hundred and twenty thousand volts will soon become commonplace. Radio and carrier-current equipment has been adapted to intra-system and inter-system communications in the interest of continuity of service. There have been great strides in the development of circuit breakers and use of automatic equipment. Larger and better boilers have been produced; higher steam pressures have been utilized, and powdered fuel has gained a place as a much stronger factor in central-station operation. The engineer has to his credit these and other developments, all of which have made possible better, more economical and more reliable service.

Meanwhile research and invention have been stimulated, and both within and without the industry has the commercial research department—whether pure science or engineering—been accepted and even appreciated as a valuable manufacturing activity. Outstanding among the research accomplishments have been the improvements in the vacuum tube, the development of higher voltage equipment, the discovery of new methods for determining stresses in metals, the production of new and better materials and the development of larger and better illuminating units.

IN THE manufacturing and distribution branches of the industry no marked changes have been consummated, but there has been a general stock-taking as a result of which it is safe to predict that future developments will be along sounder co-operative lines. The increase in the volume of business has been satisfactory. More than nine hundred and twenty million dollars' worth of manufactured products were produced, which afforded to nearly every company at least a normal and a profitable business. Any effect of the industrial slump was largely offset by the increased movement of central-station equipment. The end of the year is reached with many factories running at full load and with prospects ahead for full production in all lines in the near future. The hectic commercial condition of the radio field with its sudden popularity has settled down during the year to a sound business activity with real possibilities for development. The number of types and uses of household and industrial appliances was substantially increased, thus adding to the volume of energy-using devices which make life more livable and increase the use of electricity.

IN ITS political and social aspects the year was distinguished by the defeat of the California amendment for state ownership of water-power projects as well as by similar decisions in Georgia and Wisconsin. There have been activities either to limit or to broaden, depending on local conditions, the jurisdiction of state regulatory commissions. The controversy over the dis-

position of Muscle Shoals was most effective in exciting public interest in the question of how best to develop the nation's power resources. The general result has been, however, that public sentiment was never more favorably disposed toward everything electrical and that the electrical industry stands as a popular leader in national development.

## The Problems of 1923 Call for Creative and Constructive Ability

WHILE the industry should congratulate itself on past accomplishments and may bask somewhat in the sunshine of its apparent future, it is worth while at the beginning of the new year to point out some of the factors which restrict its rapid advancement. Not all that is mentioned here is new, but a gathering together of these elements should prove useful for summing up incentives for constructive thought and activity.

INABILITY to raise all the funds that can be profitably employed in the business is the greatest single deterrent. A solution of the tax-exempt security problem is needed and decisive action must eventually be taken. As has been previously pointed out, the tax-exempt security has introduced a problem on account of the graduated income tax; and while the elimination of the latter would restore former conditions in which the tax-exempt security was little questioned, nevertheless its existence has inspired a study of the situation which may indicate the better solution to be the elimination of this type of security rather than the graduated income tax. And, indeed, if we read social tendencies correctly, there is very little probability of the elimination of the latter. At present, with state and local securities aggregating more than ten billion dollars and increasing at the rate of more than one and one-half billions per year, and with more than twenty-three billions of federal issues of the same character, a serious political and financial condition exists which threatens the economic welfare of the nation. This condition is apparently bringing about a situation whereby earned incomes are taxed at a higher rate than capital incomes, the government is losing tax revenues, and finally there is a certain sidetracking of capital from investment in private enterprises.

ONE feature of the healthy growth of the electrical industry is the adequate, efficient and universal distribution of electrical utilization apparatus to secure maximum output for central stations, better service to the user and the most effective growth of the entire industry. In this task problems of manufacture and distribution are brought directly home to every one in the industry. There is real work to be done, for, as regards simplification of practices, advances in standardization, and the selection of the best channels and methods of distribution and marketing, it is recognized that an unsatisfactory if not chaotic state exists in many places.

WHILE technically the industry is well advanced and realizes most of its service possibilities, nevertheless in connection with cables, circuit breakers, transmission lines, insulators, motors and boilers there are still more problems to be solved in order that the industry may render its best service at greatest economy. The varied types of distribution systems, the uneasiness evidenced in trying to get away from needless expense in underground and station construction and the historic power systems with much uneconomical equipment brought about by the rapidly changing art, all point to engineering and economic questions which must be answered. Still other problems not yet outlined are brought about by the rapid extension of electrical service and the piling up of the consumption of electrical energy in congested districts.

DESPITE the California decision, state ownership of water powers is still an issue. Home rule and regulation has again become a political slogan in many sections. Muscle Shoals is still to be allotted and the effect of a final decision there will be far-reaching. In meeting these problems, which are largely those of public relations, the present advantageous position of the central stations must not be lost but rather capitalized.

THE commercial development task before the industry is, of course, to secure the greater use of electricity and electrical appliances in the home, eliminate the twenty-six million horsepower still privately generated and used in manufacturing establishments, and to secure the electrification of more railroads. Then again, in the marketing of electricity to the public in general the ever-present question of rates is met and there is more and more call for constructive and equitable—and easily interpretable—rate schedules. Another serious problem is that of extension of service into the rural districts, and this confronts every central station no matter what its size. The answer is being called for more and more insistently. This rural extension problem is a vexing combination of finance, public relations, utilization and engineering, and some solution must be found before embarrassing reactions occur.

MERELY listing these major problems indicates that they all affect more or less directly every activity of the electrical industry, and that no branch of the industry can afford to rest on its own laurels. Constructive work is required sufficient to keep every one in the industry busy. The tasks must be taken up with courage and vision and in a co-operative effort to secure results which will give correct and conclusive answers to the problems which are met.

### The Central Station Outstrips the Private Plant

BACK in 1904, less than twenty years ago, more than 72 per cent of the motor load of the manufacturing establishments and the mines of the country was carried by private generating plants. Today the central generating plant carries about 60 per cent of this industrial load. Such is the story of the rise of the central station and the consequent downward trend of private generation of electrical energy. Data collected from thousands of industrial plants scattered throughout the country and presented elsewhere in this issue indicate, however, that there were still (in 1920) seven primary industries in which the major portion of the motor load was carried by private generating plants. The central-station industry has accomplished great tasks, but the industrial power field is still white for the harvest.

Advocates of more intensive standardization campaigns will find additional arguments for their program in the data on motor-operating voltages collected in

this survey. The reports from 6,904 companies indicate that there are at least fifty-seven different voltages in actual use in the operation of the motors in the factories and mines. Doubtless concession to circumstances accounts for most of the variations from the usual figures, but it is questionable whether justifiable cause exists for such wide departures from the voltages accepted by the profession as standard. The iron and steel industry is the most serious offender in this regard, which is undoubtedly due to the fact that this industry has the largest number of private generating plants, many of which have been in service for several years. However, much encouragement may be taken from the fact that as a rule only standard voltages were reported by companies which purchase from central stations.

## Some of the Engineer's Pipe Dreams

NOW and then there comes even to the sanest of investigators a play of the imagination that encroaches on the realm of the magician. Often it is so specious that it bears its not unwilling victim away on the wings of prophecy, only to drop him into the hopeless morass of things that might be but are not. It is not easy to tell at a glance the phantoms of the fancy from the visions of the seer. Many never discover the difference, even if they desire to do so, and still more love the glamour of the improbable for itself and dwell perpetually on the borders of the unreal. Perhaps the best criterion of sound prescience is to subject the phantasm to the rigorous test of quantitative study. A great many things put on a brave front so far as qualitative tests go, only to disappear like a wisp of fog when the ruthless inquirer turns on the light of uncompromising figures.

Just recently a pair of technical sports, born of unbridled imagination, have attracted enough of public attention to demand investigation, and both being based on comprehensible theory, it is not difficult to bring them down to the region where weights and measures hold sway. One of these cheerful eidola is the production of "cold light." For years it has been with us, usually in the guise of the firefly's secret. Undeniably the insect does produce, by a chemical process which is beginning to be understood, a luminous effect at astoundingly high efficiency. But when one inquires how much, and whether the active substances can be obtained in quantity, one has to admit that the supply of light-bearing creatures is really not enough to furnish material for experimentation, and that there has not been the slightest hint of any possible synthesis, as in the case of most of the products of the physiological laboratory.

The latest aspect of the cold-light project is a study of substances sensitized by admixture of radio-active material as in the luminous dial of a wrist watch. An investigator has figured here a luminous efficiency of a very high order, unhappily linked with a brightness which is low even as compared with the firefly. And it therefore turns out not only that the light given is from a source inconveniently large for every-day purposes and obtainable only by the use of rare substances, but also that to replace this world's artificial light to any useful extent one would have to talk in tons instead of milligrams, aggregating more radioactive material than the imagination has yet touched as a possibility. It would be the case of the osmium lamp over again, but a thousand times worse. There is small hope of any illuminant under such a quantitative handicap, however alluring the efficiency. In fact, although numerous illuminants are known which are far more efficient than those ordinarily in use, all so far are attended by cost or inconvenience of a forbidding character.

Another recently revived chase of the will-o'-the-wisp has to do with electric heating for general use. In these days of sixteen-dollar coal and no cars to speak of the theory of heat from a wire at a quarter-million volts looks good until one coldly figures on conditions as they are. To start with, as a matter of sheer thermodynamics a big turbo-generator reckoned in thermal units at its busbars has barely the efficiency of a fireplace. And while we talk glibly sometimes of mouth-of-the-mine plants, there are in fact very few places in which coal can be delivered at the boiler room without as much labor and transportation as would suffice to load the same fuel for distance shipment. Water power looks a better bet, and yet to rely on it for heating in our climate would overrun the supply nature has provided. Any one who seriously figures out at current costs the price of station production, transmission and distribution for heating in a concrete case will quickly find that generalities do not audit bills and that we cannot thus escape the curse of an uncompromising climate.

The ELECTRICAL WORLD is a consolidation of the ELECTRICAL WORLD, the *Electrical Engineer* and the *American Electrician*, which was effected on Jan. 1, 1906.

The ELECTRICAL WORLD traces its history to the year 1874, at which time *The Operator*, entirely devoted to telegraphy, began its career. In 1883 the telegraph journal, which was a monthly, became *The Operator and Electrical World*, and on April 28 the paper was divided and the ELECTRICAL WORLD began its separate career.

In 1888 *The Electrician*, founded in 1882, became the *Electrical Engineer*, which remained a monthly until 1890, when its first weekly issue was witnessed.

In 1894 the ELECTRICAL WORLD adopted its present quarto style. The *Electric Railway Gazette* was absorbed in 1896, and in 1899 the ELECTRICAL WORLD and the *Electrical Engineer* were consolidated, the McGraw Publishing Company acquiring ownership and management. With this change came the adoption of the title ELECTRICAL WORLD AND ENGINEER, which the paper bore until 1906, when the *American Electrician*, a monthly founded in 1896 and owned by the McGraw Publishing Company, was absorbed. The paper has since been known as the ELECTRICAL WORLD.

Each of the editors of the various journals named contributed to the traditions and standing of the publication in the profession. C. O. Mailloux was in reality the first technical editor of the ELECTRICAL WORLD. Others who directed its editorial policy were Franklin I. Pope, Dr. Louis Bell, C. J. H. Woodbury, Joseph Wetzler, J. E. Woodbridge, Ralph W. Pope, N. S. Keith, H. W. Frye, G. H. Stockbridge, C. T. Rittenhouse, C. T. Child, C. P. Poole, T. C. Martin, W. D. Weaver, Frank F. Fowle, Dr. A. S. McAllister and F. M. Feiker.

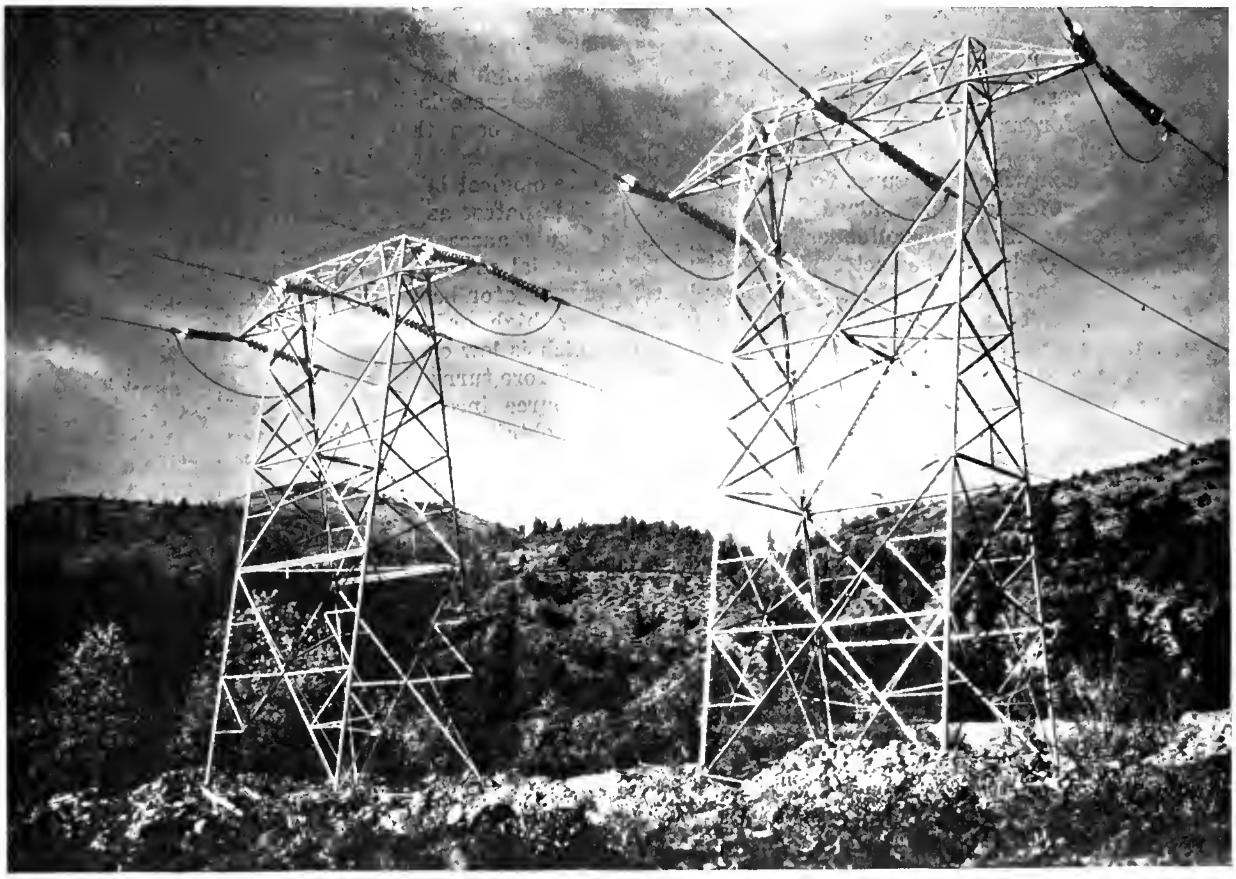
The present staff of the ELECTRICAL WORLD consists of:

*New York:* W. H. Onken, Jr., and H. V. Bozell, co-editors; L. W. W. Morrow, associate editor; Earl E. Whitehorne, commercial editor; Allen M. Perry, engineering editor; R. M. Davis, statistical editor; T. P. Kindig, H. M. Cunnington, R. L. Shepherd, F. C. Wells, assistant editors.

*Chicago:* J. C. Martin, Western editor; H. C. Anderson, assistant editor.

*San Francisco:* W. C. Heston, Pacific Coast editor.

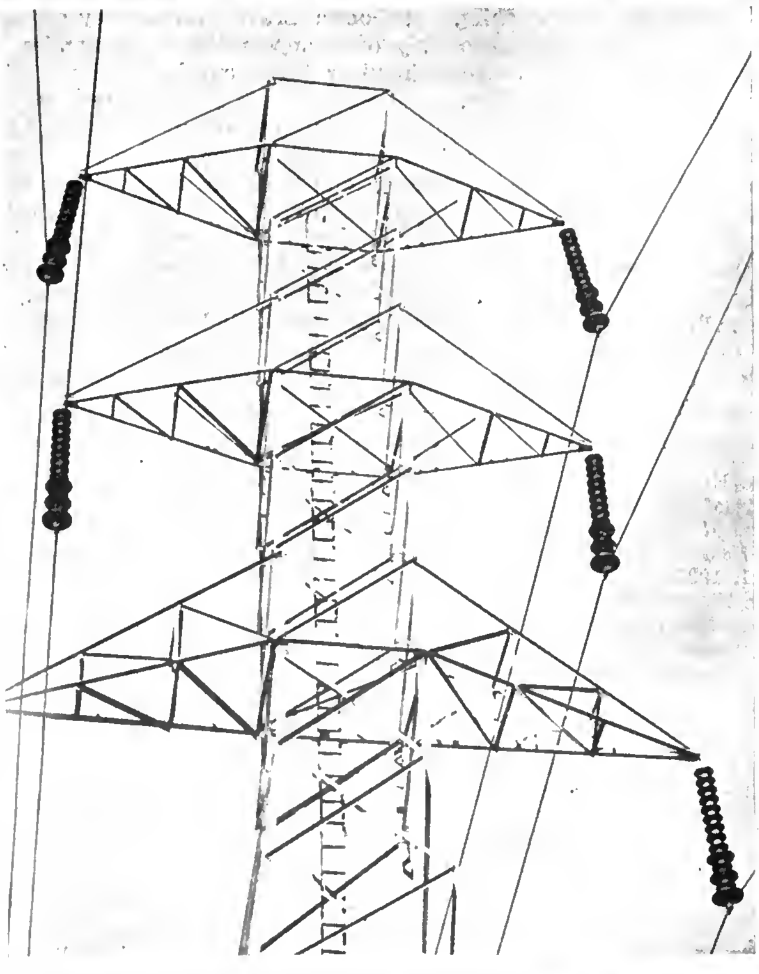
*Boston:* H. S. Knowlton, New England editor.



## The New World's Record Transmission Line

THE new 220-kv. trunk lines of the Pacific Gas & Electric Company constitute a world's record in the transmission voltage employed. Power is being transmitted over the only one of these circuits yet completed from the Pit River Plant No. 1 in northern California to the Vaca substation in the lower Sacramento Valley, a distance of 202 miles. The specially designed conductors used are composed of seven strands of copper cable, each of which is in turn composed of seven strands of single wire. The cable has a cross-sectional area of 500,000 circ.mil and weighs 8,400 lb. per mile. Six of these cables, constituting two complete circuits, are strung on steel towers spaced seven to the mile, embedded in concrete foundations and having a height of from 60 ft. to 97 ft., the 60-ft. towers being a special type utilized in the snowy regions. These two circuits have a capacity of 235,000 hp. at 220 kv. In the construction of this transmission line 10,000,000 lb. of copper cable and 16,000,000 lb. of steel were utilized. The cost of the line, exclusive of substations, will be approximately $33,000 per mile. The copper was purchased in a single order, the largest ever placed. It required 107 cars to ship the cable, which was wound on 1,928 reels, with one-half mile of cable to the reel.

The upper view shows some snow towers with strain construction. The lower view shows the special insulator strings adopted, each consisting of ten standard disks, four special units and a copper-disk corona shield.



# Recent and Prospective Developments of Underground Cable

*By D. W. Roper*
Superintendent of Street Department
Commonwealth Edison Company

Samples of Cable Have Been Made and Tested Successfully at 250 Kv.—Possibilities of Cables for 110-Kv. Operation Are Indicated—Some Points to Consider in Specifications

ABOUT 1900 two 25,000-volt underground cables, one paper-insulated and one rubber-insulated, were installed in St. Paul as part of a transmission line from a power house on the St. Croix River.* For about twenty years thereafter there was no material increase in the maximum operating potential of underground cables installed in this country. Recently some three-conductor, 33,000-volt cable has been placed in operation in Chicago, and the city of Los Angeles has ordered some three-conductor cable for operation at 35,000 volts. Another large company is now installing some single-conductor cable for operation at 44,000 volts between conductors, and still another company is investigating the feasibility of obtaining single-conductor cable for operation at 66,000 volts. These increases in the maximum operating voltage of underground cables have been made possible by the reduction in recent years of the dielectric loss in underground cables with impregnated paper insulation. Such losses have been reduced to so great an extent that they are now but a small fraction of the losses in the cables made five years ago, and it is possible to get cable in which the dielectric loss is so low that it does not seriously affect the carrying capacity of the cable. Several cable manufacturers have on regular commercial orders furnished cable having a dielectric power factor below 2 per cent at 80 deg. C., and the lowest record is below 1 per cent at that temperature. This means that when it is desired to increase the voltage the dielectric loss will not be the limiting feature.

*This installation was described in a paper presented by Henry Floy before the American Institute of Electrical Engineers on Nov. 23, 1900.

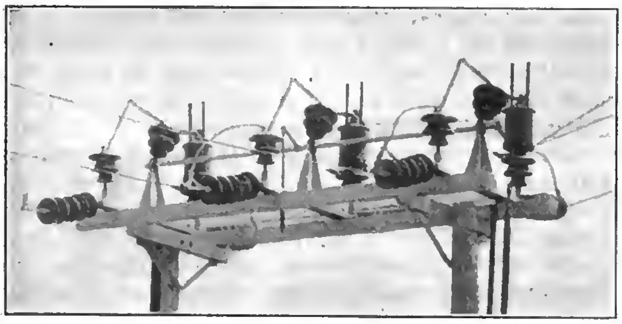
Some engineers have contended that the ionization loss at low temperatures would be a serious factor in the operation of high-voltage cables. One English manufacturer, however, advertises ozone-proof cables, and his published dielectric loss curves indicate that his cables are free from this trouble. If his claim is well founded and if past history can be used as our guide for predicting the future, we may safely assume that this one manufacturer will not long be the only one that can make cables free from ionization.

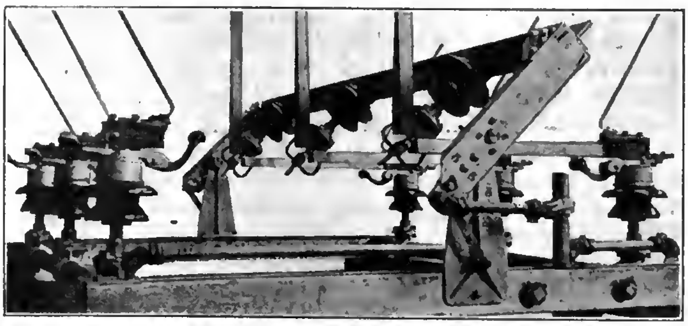
### Possibility of Cable Operation at 110 Kv.

The cable manufacturers and operating engineers who co-operated in preparing the National Electric Light Association cable specifications agreed that the dielectric strength of a short sample of cable should be four times the normal working pressure. One manufacturer has already made a sample of single-conductor cable that withstood a test in excess of 250 kv. between conductor and lead, and the test was discontinued before the sample failed, as the voltage had reached the maximum range of the testing transformer. This would indicate that so far as dielectric strength alone is concerned this sample would have been suitable for operation at 63 kv., which corresponds to 109 kv. between conductors on a three-phase circuit.

The article by J. L. R. Hayden and Dr. Steinmetz in the ELECTRICAL WORLD of Oct. 21, 1922, page 865, describes some experiments from which they conclude that dielectric failures were due to a pyro-electric effect. If this is the case, then with the reduction in the dielectric loss there should be a reduction in the heating which causes the failure, and it seems possible that

## Many Improvements Made in Outdoor Switches





Left—A combined oil circuit breaker and air-break switch with grasshopper action. Right—A unit type of three-pole double-throw air-break switch with roller arcing contacts and sleet hoods

with the very low-loss insulation that the cable manufacturers are now able to furnish we should be able to operate cables at a somewhat higher stress than heretofore without increasing the chances of failure of the insulation. This may mean that a lower ratio than four between the dielectric strength and the operating voltage is entirely feasible.

From the evidence at hand it appears that one sample of cable has been made with sufficiently high dielectric strength for operation as a single-conductor cable on a 110-kv., three-phase circuit. Other samples of cable have been made with a very low dielectric power factor, and still other samples have been made free from ionization. If it were possible to combine in one piece of cable all of the good features in the several samples of cable heretofore manufactured, then it would be entirely possible to secure single-conductor cable for operation at 110-kv., three-phase.

Although it is sometimes possible to locate a substation for reducing the line voltage from 110 kv. to some lower figure and have this substation act as a distributing station as well, it frequently happens that with the rapid growth of the city and the extension of its limits this high-voltage overhead line to the substation becomes seriously objectionable and may have to be removed. This would call for relocating the substation. The use of underground cable would avoid such relocation of a substation, and in some cases it will eliminate the entire cost of a substation which must be built at the city limits for the purpose merely of reducing the voltage and without serving at the same time as a distributing point.

### Points to Be Considered in Specifications

While it would be very rash to attempt at this time to write an exact specification for such a cable, it is suggested that it will probably be found desirable to include in the specifications the following features:

1. Careful and thorough testing and inspection of the raw materials as they are received at the cable factory. This may mean taking a sample of paper from each roll and a sample of oil from each container and carrying a sufficient minimum stock of these materials to make it possible to reject defective lots without interfering with production.

2. Thorough inspection and supervision during the process of applying the paper insulation to insure that the workmanship is 100 per cent perfect.

3. Recording instruments and records in connection with the drying and impregnating of the insulation so as to insure that a careless or inefficient workman has not reduced the time required for these processes in order to cover up unnecessary delays or inefficiency on his part.

4. A requirement that an examination of the insulation, after the standard bending test, shall disclose no torn paper.

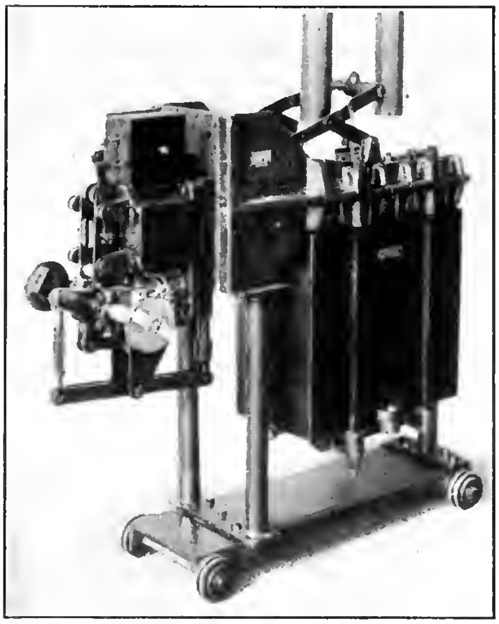
5. A routine test on each reel to insure thoroughness of impregnation.

6. A requirement that there be no ionization at normal working pressure and at the lowest operating temperature, together with a routine test on each reel of cable to insure that the cable meets the requirement.

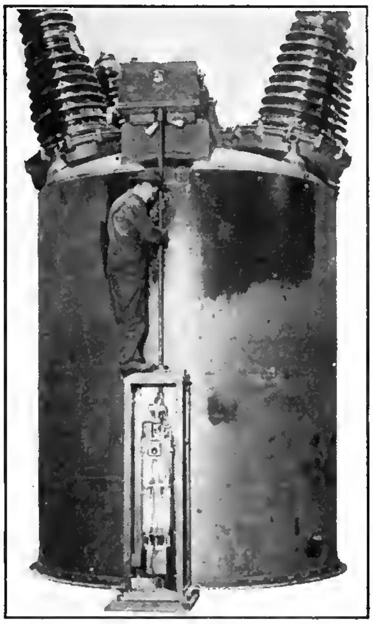
7. A guarantee that the dielectric power factor shall not exceed 2 per cent at 80 deg. C., together with a routine test on each reel.

8. A modification of the rule in the Standards of the American Institute of Electrical Engineers regarding the maximum permissible operating temperature of impregnated paper insulation in lead-covered cables so as to permit the operation of high-voltage cable at temperatures materially above the present limits.

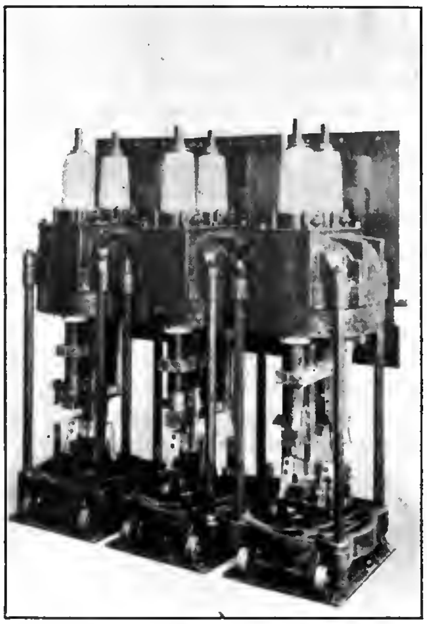
## Circuit Breakers Made More Rugged and for Higher Voltages



Left—Unit type of oil breaker with provisions for connecting adjacent units by a universal coupling.



Center — Solenoid mechanism for operating a 220,000-volt oil breaker. A new type for heavy duty service.

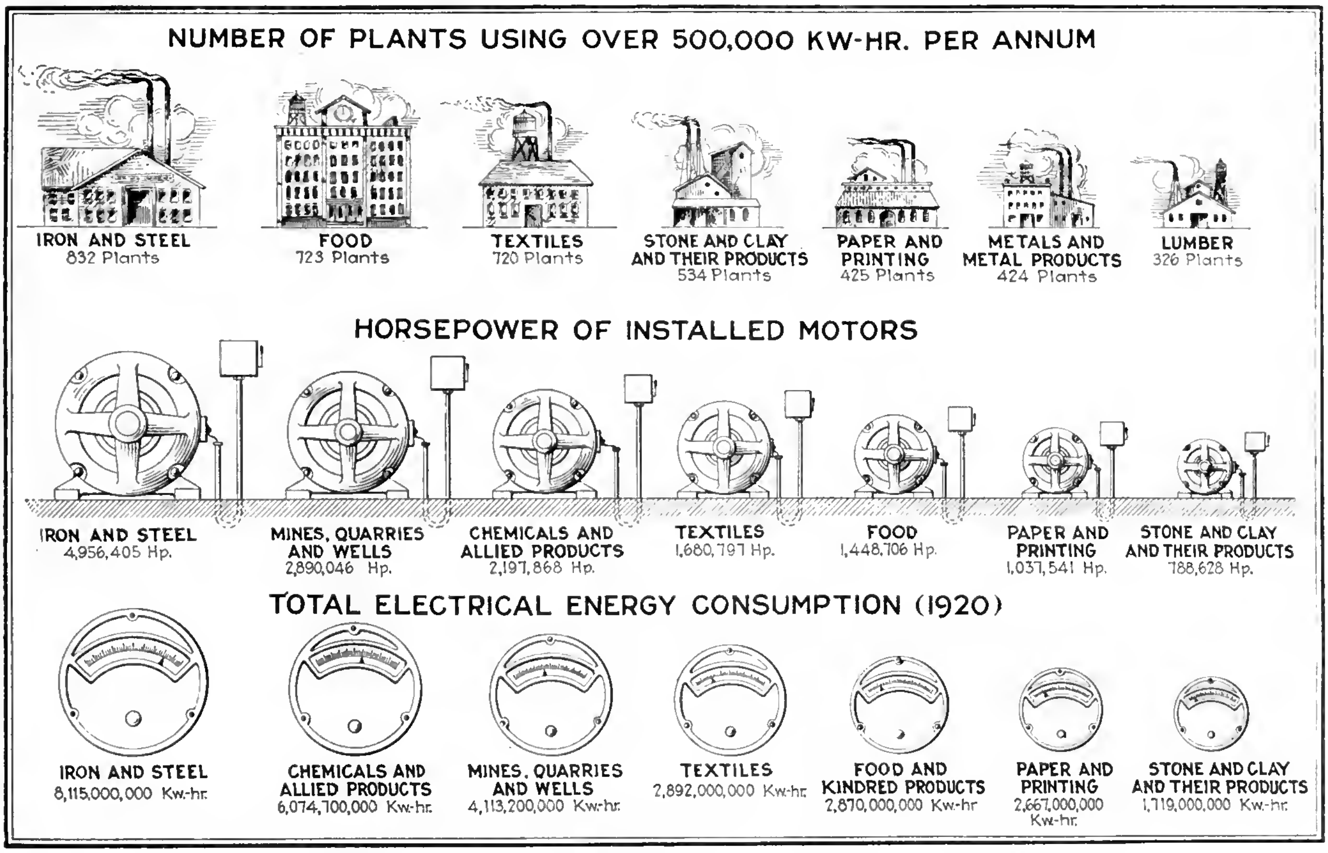


Right—Rugged construction, the use of inverted brushes and four breaks per pole are features of this breaker.

# Industrial Load of the United States

*By Robert M. Davis*
Statistical Editor ELECTRICAL WORLD

Central Stations Generate 57.2 per Cent of the Energy Used in the Industrial Plants and Mines of the Country—More than Fifty Motor-Operating Voltages Are in Use in the Entire Nation




THE IRON AND STEEL INDUSTRY LEADS ALL OTHER INDUSTRIES IN THE USE OF ELECTRICAL ENERGY

THE industrial leadership of the United States of America is made most apparent through the study of a summary of its manufacturing and mining industries. No single country or federation of states can present such an array of economic industrial figures, almost too great for comprehension.

Data gathered by the United States Census Bureau indicate that on Jan. 1, 1920, there were 312,102 manufacturing establishments and mining concerns operating in this country, of which 256,071 reported an installation of prime movers totaling 25,280,699 hp. These industries in the aggregate represent an invested capital of $51,796,717,267, or more than double the present debt of the United States. The value of manufactured and mined products totaled $65,576,542,739 during 1919, or approximately one-half the total net cost of the four years' war in so far as the Allies and associated powers are concerned. These industries support 11,628,295 employees at an annual wage of $13,423,-971,834.

Such is the potential manufacturing and mining power field of the electric light and power industry. It is probable that no other primary industry in this country affords such a vast and lucrative field for future development. The extent to which the central station has entered into the industrial life of the United States is clearly defined from a three-year nation-wide survey which has just been completed by the ELECTRICAL WORLD This survey was undertaken with the idea of ascertaining the extent to which electrical energy was being used by the industrial plants of the country and involved the sending out of about 95,000 questionnaires to the larger establishments.

The returns received from the survey have been divided into twenty-seven general industries, as indicated in the accompanying tables. The data are for the year 1920. Reports were received from approximately 20,-000 companies, of which 15,000 rendered complete or fairly complete data on the use of electrical energy in their respective plants. Reports from only a part of the

## Table I—General Economic Data on the Manufacturing and Mining Industries of the United States

(Taken from U. S. Census of Manufactures for 1919)

| Industry | No. of Establishments in U. S. | Capital | Rent of Power and Cost of Fuel | Value of Products | Employees: Salaried (Number) | Employees: Wage Earners (Number) | Fuel Used: Anthracite Coal (Long Tons) | Fuel Used: Bituminous Coal (Short Tons) |
|---|---|---|---|---|---|---|---|---|
| Agricultural implements | 521 | $366,962,052 | $5,038,512 | $304,961,265 | 12,488 | 54,368 | 13,497 | 549,557 |
| Chemicals and allied products | 15,132 | 7,649,330,879 | 527,425,809 | 8,541,535,212 | 209,338 | 778,525 | 4,969,958 | 93,699,545 |
| Electrical equipment and machinery | 1,404 | 857,855,496 | 13,739,110 | 997,968,119 | 59,065 | 212,374 | 175,800 | 1,091,704 |
| Food and kindred products | 64,297 | 4,938,904,356 | 143,263,853 | 12,473,383,522 | 173,899 | 716,950 | 1,949,596 | 15,648,552 |
| Iron and steel and their products | 18,229 | 9,113,106,993 | 507,460,870 | 9,823,520,388 | 247,384 | 1,724,598 | 1,585,137 | 36,409,807 |
| Leather and its products | 5,901 | 1,539,413,929 | 18,280,885 | 2,572,885,556 | 42,479 | 344,477 | 169,746 | 1,992,811 |
| Liquors and beverages | 6,354 | 781,571,615 | 15,712,617 | 603,895,215 | 14,523 | 55,442 | 414,790 | 2,072,748 |
| Lumber and its products | 39,560 | 2,608,791,263 | 24,823,032 | 3,082,114,124 | 76,294 | 857,713 | 153,404 | 3,435,845 |
| Metals and metal products other than iron or steel | 13,851 | 2,225,496,508 | 43,969,854 | 2,932,005,502 | 88,346 | 528,251 | 543,006 | 3,467,425 |
| Mines, quarries and wells | 21,997 | 7,108,623,496 | 123,509,588 | 3,158,463,966 | 97,612 | 987,184 | 8,697,367 | 16,339,839 |
| Paper and printing | 37,141 | 2,487,379,347 | 75,248,650 | 3,113,778,179 | 174,152 | 527,165 | 1,167,595 | 8,878,207 |
| Railroad shop construction and repairs | 2,474 | 1,138,858,163 | 39,164,041 | 1,911,110,901 | 40,534 | 570,927 | 678,341 | 7,911,952 |
| Stone and clay and their products | 12,513 | 1,070,948,750 | 89,700,265 | 819,213,546 | 27,945 | 226,686 | 592,724 | 15,854,900 |
| Textiles | 30,511 | 6,273,635,504 | 95,039,084 | 9,378,547,167 | 150,251 | 1,627,277 | 1,782,183 | 8,490,495 |
| Tobacco | 10,291 | 604,839,572 | 2,321,085 | 1,012,933,213 | 15,679 | 157,097 | 4 ,716 | 281,288 |
| Vehicles for land transportation | 21,035 | 2,059,574,555 | 27,617,069 | 3,500,567,173 | 65,040 | 440,430 | 98,765 | 2,112,591 |
| Miscellaneous | 10,891 | 971,424,789 | 17,181,820 | 1,349,659,691 | 49,610 | 274,092 | 204,042 | 1,555,297 |
| Totals for all manufacturing industries, mines, quarries and wells of U. S. | 312,102 | $51,796,717,267 | $1,769,496,144 | $65,576,542,739 | 1,544,639 | 10,083,556 | 23,240,667 | 219,792,563 |

## Table II—"Electrical World" Estimate of the Use of Electrical Energy by the Industrial Plants of the U. S. in 1920 and 1921

| Industry | Electric Generators (In Private Plants): Direct-Current No. | Direct-Current Total Rating, Kw. | Alternating-Current No. | Alternating-Current Total Rating, Kw. | Electrical Energy Consumed: Purchased from Public Utilities 1920, Kw.-Hr. | Generated in Private Plants 1920, Kw.-Hr. | Total Energy Consumed 1920, Kw.-Hr. | Total Energy Consumed 1921, Kw.-Hr. |
|---|---|---|---|---|---|---|---|---|
| Agricultural implements | 82 | 16,600 | 26 | 20,480 | 78,500,000 | 85,900,000 | 164,400,000 | 74,600,000 |
| Chemicals and allied products (total) | 2,707 | 328,020 | 994 | 623,130 | 3,425,200,000 | 2,6 9,500,000 | 6,074,700,000 | 3,222,200,000 |
| Rubber and rubber products | 91 | 14,200 | 98 | 82,300 | 340,000,000 | 284,700,000 | 624,700,000 | 457,300,000 |
| Glass and glass products | 302 | 50,800 | 106 | 38,700 | 151,700,000 | 198,000,000 | 349,700,000 | 231,900,000 |
| Chemicals | 966 | 103,200 | 331 | 207,200 | 1,264,000,000 | 895,000,000 | 2,159,000,000 | 1,253,000,000 |
| Smelting and refining of metals | 160 | 32,500 | 52 | 40,100 | 260,800,000 | 168,000,000 | 428,800,000 | 98,000,000 |
| Artificial gas manufacture | 80 | 8,520 | 27 | 17,030 | 111,700,000 | 73,800,000 | 185,500,000 | 185,000,000 |
| Miscellaneous chemical industries | 1,108 | 118,800 | 380 | 237,800 | 1,297,000,000 | 1,030,000,000 | 2,327,000,000 | 997,000,000 |
| Electrical equipment and machinery | 113 | 24,930 | 53 | 167,000 | 298,000,000 | 308,000,000 | 606,000,000 | 530,200,000 |
| Food and kindred products | 1,222 | 134,200 | 546 | 169,800 | 2,023,000,000 | 847,000,000 | 2,870,000,000 | 2,798,500,000 |
| Iron and steel and their products | 4,040 | 818,000 | 1,295 | 1,008,000 | 3,890,000,000 | 4,225,000,000 | 8,115,000,000 | 3,685,000,000 |
| Leather and its products | 253 | 22,550 | 79 | 71,000 | 201,000,000 | 167,500,000 | 368,500,000 | 239,500,000 |
| Lumber and its products | 667 | 42,600 | 523 | 111,600 | 396,000,000 | 276,300,000 | 672,300,000 | 810,000,000 |
| Metals and metal products other than iron or steel | 302 | 42,100 | 189 | 72,000 | 816,500,000 | 336,000,000 | 1,152,500,000 | 495,000,000 |
| Bituminous and anthracite coal mining | 1,960 | 314,500 | 298 | 234,500 | 1,228,000,000 | 1,231,000,000 | 2,459,000,000 | 1,903,000,000 |
| Metal mining | 602 | 96,300 | 91 | 71,600 | 700,000,000 | 376,800,000 | 1,076,800,000 | 465,000,000 |
| Stone quarries | 64 | 10,640 | 22 | 8,160 | 331,400,000 | 41,800,000 | 373,200,000 | 281,000,000 |
| Miscellaneous mines and quarries | 103 | 16,080 | 16 | 12,270 | 38,700,000 | 64,400,000 | 103,100,000 | 67,200,000 |
| Petroleum and natural gas | 62 | 9,920 | 9 | 7,380 | 62,300,000 | 38,800,000 | 101,100,000 | 95,000,000 |
| Paper and printing | 470 | 72,600 | 360 | 264,200 | 1,603,000,000 | 1,064,000,000 | 2,667,000,000 | 1,967,000,000 |
| Railroad-shop construction and repairs | 743 | 54,900 | 451 | 184,700 | 481,000,000 | 597,000,000 | 1,078,000,000 | 900,000,000 |
| Stone and clay and their products | 748 | 126,000 | 262 | 95,500 | 1,228,000,000 | 491,000,000 | 1,719,000,000 | 1,295,000,000 |
| Textiles | 1,418 | 120,100 | 1,168 | 648,000 | 1,652,000,000 | 1,240,000,000 | 2,892,000,000 | 2,740,000,000 |
| Tobacco | 60 | 7,980 | 22 | 3,840 | 19,400,000 | 18,200,000 | 37,600,000 | 36,500,000 |
| Vehicles for land transportation | 81 | 12,600 | 53 | 28,000 | 353,000,000 | 93,500,000 | 446,500,000 | 364,000,000 |
| Miscellaneous | 298 | 39,800 | 102 | 19,130 | 215,000,000 | 90,500,000 | 305,500,000 | 230,000,000 |
| Totals for all manufacturing industries, mines, quarries and wells of U. S. | 15,995 | 2,310,420 | 6,559 | 3,820,290 | 19,040,000,000 | 14,242,200,000 | 33,282,200,000 | 22,198,700,000 |

## Table III—"Electrical World" Estimate of Motors Installed in the Industrial Plants and Mines of the U. S.

| Industry | Motors Run by Purchased Energy: Number | Motors Run by Purchased Energy: Total Rating, Hp. | Motors Run by Energy Generated in Private Plants: Number | Motors Run by Energy Generated in Private Plants: Total Rating, Hp. | Total Motors in All Plants: Number | Total Motors in All Plants: Total Rating, Hp. | Distribution of Drives: Motors Under 5 Hp. | Belt, Number | Chain, Number | Directly Connected, Number |
|---|---|---|---|---|---|---|---|---|---|---|
| Agricultural implements | 4,594 | 47,842 | 3,399 | 52,421 | 7,993 | 100,263 | 2,012 | 3,632 | 241 | 4,120 |
| Chemicals and allied products (total) | 73,019 | 1,235,704 | 60,827 | 962,164 | 133,846 | 2,197,868 | 40,500 | 78,576 | 8,120 | 47,150 |
| Rubber and rubber products | 9,711 | 194,018 | 7,355 | 162,608 | 17,066 | 356,626 | ....... | ....... | ....... | ....... |
| Glass and glass products | 8,378 | 69,714 | 6,395 | 90,713 | 14,773 | 160,427 | ....... | ....... | ....... | ....... |
| Chemicals | 27,597 | 377,523 | 20,306 | 267,315 | 47,903 | 644,838 | ....... | ....... | ....... | ....... |
| Smelting and refining of metals | 5,058 | 173,495 | 4,787 | 111,768 | 9,845 | 285,263 | ....... | ....... | ....... | ....... |
| Artificial gas manufacture | 1,413 | 33,363 | 1,822 | 22,040 | 3,235 | 55,403 | ....... | ....... | ....... | ....... |
| Miscellaneous chemical industries | 20,862 | 387,591 | 20,162 | 307,720 | 41,024 | 695,311 | ....... | ....... | ....... | ....... |
| Electrical equipment and machinery | 42,023 | 235,605 | 38,472 | 243,761 | 80,495 | 479,366 | 46,400 | 47,931 | 764 | 31,800 |
| Food and kindred products | 118,234 | 1,056,146 | 37,589 | 392,560 | 155,823 | 1,448,706 | 68,500 | 93,493 | 20,330 | 42,000 |
| Iron and steel and their products | 166,794 | 2,376,931 | 124,199 | 2,579,474 | 290,993 | 4,956,405 | 73,230 | 131,993 | 8,800 | 150,200 |
| Leather and its products | 23,057 | 144,635 | 11,505 | 120,355 | 34,562 | 264,990 | 13,880 | 31,298 | 1,754 | 1,510 |
| Lumber and its products | 45,878 | 462,777 | 23,079 | 323,186 | 68,957 | 785,963 | 25,400 | 50,449 | 2,678 | 15,830 |
| Liquors and beverages | 14,420 | 87,718 | 11,164 | 85,898 | 25,584 | 173,616 | 11,230 | 15,344 | 3,340 | 6,900 |
| Metals and metal products other than iron or steel | 56,991 | 543,574 | 21,016 | 223,485 | 78,007 | 767,059 | 40,490 | 55,680 | 3,887 | 18,440 |
| Bituminous and anthracite coal mines | 23,088 | 889,539 | 24,849 | 893,214 | 47,937 | 1,782,753 | 16,640 | 12,712 | 1,825 | 33,400 |
| Metal mines | 11,274 | 507,461 | 5,599 | 273,241 | 16,873 | 780,702 | 5,850 | 4,501 | 642 | 11,730 |
| Stone quarries | 3,971 | 156,810 | 490 | 19,210 | 4,461 | 176,020 | 1,548 | 1,228 | 170 | 3,063 |
| Miscellaneous mines and quarries | 932 | 30,636 | 771 | 46,635 | 1,703 | 77,271 | 591 | 454 | 65 | 1,184 |
| Petroleum and natural gas | 1,849 | 45,134 | 1,330 | 28,166 | 3,179 | 73,300 | 1,103 | 848 | 121 | 2,210 |
| Paper and printing | 160,151 | 623,706 | 27,768 | 413,835 | 187,919 | 1,037,541 | 95,600 | 150,879 | 8,040 | 29,000 |
| Railroad-shop construction and repairs | 19,187 | 325,313 | 25,558 | 404,349 | 44,745 | 729,662 | 5,615 | 13,020 | 1,790 | 29,935 |
| Stone and clay and their products | 21,440 | 563,263 | 7,947 | 225,365 | 29,387 | 788,628 | 9,420 | 16,817 | 3,720 | 8,850 |
| Textiles | 157,760 | 959,845 | 69,019 | 720,952 | 226,779 | 1,680,797 | 136,800 | 100,609 | 18,170 | 108,000 |
| Tobacco | 3,382 | 14,430 | 1,842 | 13,447 | 5,224 | 27,877 | 3,532 | 4,543 | 114 | 567 |
| Vehicles for land transportation | 61,408 | 475,853 | 14,199 | 125,976 | 75,607 | 601,829 | 36,520 | 45,977 | 4,150 | 25,480 |
| Miscellaneous | 27,662 | 194,214 | 9,456 | 82,599 | 37,118 | 276,813 | 20,750 | 20,328 | 2,460 | 14,330 |
| Totals for all manufacturing industries, mines, quarries and wells of U. S. | 1,037,114 | 10,977,136 | 520,078 | 8,230,293 | 1,557,192 | 19,207,429 | 655,611 | 880,312 | 91,181 | 585,699 |

**Table IV—Direct-Current Motor-Operating Voltages of Industrial Plants in the United States**

| Industry | Total Number of Companies Reporting on Direct-Current Motor Voltages | 80 | 110 | 115 | 120 | 125 | 200 | 210 | 220 | 225 | 230 | 235 | 240 | 250 | 260 | 275 | 300 | 440 | 500 | 530 | 550 | 600 | 650 | 660 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Number of Companies Reporting Various Motor-Operating Voltages — Voltages | | | | | | | | | | | | | | | | | | | | | | |
| Chemicals and allied products | 115 | .. | 23 | 10 | 2 | 1 | .. | 1 | 31 | .. | 10 | 1 | 6 | 10 | 1 | 1 | .. | 7 | 1 | .. | 10 | .. | .. | .. |
| Electrical equipment and machinery | 67 | .. | 10 | 4 | 2 | 1 | .. | .. | 36 | .. | 6 | .. | 1 | 2 | .. | .. | .. | 5 | .. | .. | .. | .. | .. | .. |
| Food and kindred products | 157 | .. | 47 | 10 | 5 | 4 | .. | .. | 59 | .. | 13 | 2 | 4 | 5 | .. | .. | .. | 2 | 4 | . | 1 | 1 | .. | .. |
| Iron and steel and their products | 744 | .. | 82 | 16 | 8 | 8 | 1 | 1 | 353 | 2 | 125 | 1 | 24 | 56 | .. | 1 | 1 | 24 | 19 | 2 | 18 | 2 | .. | .. |
| Leather and its products | 52 | .. | 16 | 1 | 1 | 1 | .. | .. | 23 | .. | 6 | .. | 1 | 1 | .. | .. | .. | 1 | 1 | .. | .. | .. | .. | .. |
| Lumber and its products | 124 | .. | 30 | 2 | 7 | 6 | 1 | .. | 54 | .. | 4 | .. | 1 | 7 | .. | .. | .. | 5 | 2 | .. | 5 | .. | .. | .. |
| Metals and metal products other than iron or steel | 94 | .. | 23 | 4 | 2 | 1 | .. | 1 | 38 | .. | 7 | .. | 5 | 10 | .. | .. | .. | 1 | 2 | .. | .. | .. | .. | .. |
| Mining, miscellaneous | 200 | 2 | 1 | .. | .. | 2 | .. | 1 | 26 | .. | 8 | . | 1 | 127 | .. | 6 | .. | 5 | 10 | .. | 11 | .. | .. | .. |
| Paper and printing | 181 | .. | 25 | 14 | 5 | 6 | .. | 4 | 66 | 1 | 23 | 2 | 5 | 12 | .. | .. | .. | 7 | 4 | .. | 7 | .. | .. | .. |
| Railroad-shop construction and repairs | 18 | .. | 1 | .. | .. | 1 | .. | .. | 5 | .. | 4 | .. | .. | 2 | .. | .. | .. | 1 | .. | .. | 1 | 1 | 1 | 1 |
| Rubber and its products | 35 | .. | 7 | 1 | 1 | 1 | .. | .. | 10 | .. | 5 | .. | 1 | 4 | .. | .. | .. | 4 | .. | .. | 1 | .. | .. | .. |
| Shipbuilding | 14 | .. | 1 | .. | 1 | . | .. | .. | 5 | .. | 5 | .. | .. | 2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Stone, clay and glass | 94 | .. | 20 | 4 | 1 | 4 | .. | .. | 31 | 1 | 10 | .. | 6 | 10 | .. | .. | .. | 4 | 2 | .. | .. | .. | .. | 1 |
| Textiles | 312 | .. | 76 | 28 | 10 | 4 | .. | 1 | 114 | 2 | 24 | .. | 7 | 12 | .. | .. | .. | 5 | 17 | .. | 12 | .. | .. | .. |
| Tobacco | 4 | .. | 1 | .. | .. | .. | .. | .. | 2 | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. |
| Vehicles for land transportation | 36 | .. | 6 | 1 | .. | .. | .. | 1 | 19 | .. | 1 | 1 | 1 | 2 | .. | .. | .. | 4 | .. | .. | .. | .. | .. | .. |
| Miscellaneous | 166 | .. | 42 | 8 | 6 | 2 | .. | .. | 77 | 1 | 12 | .. | 2 | 7 | .. | .. | .. | 1 | 1 | .. | 7 | .. | .. | .. |
| Totals for all industries of U. S. (reported) | 2,413 | 2 | 411 | 103 | 51 | 42 | 2 | 10 | 949 | 7 | 263 | 7 | 65 | 269 | 1 | 8 | 1 | 77 | 63 | 2 | 73 | 4 | 1 | 2 |

industrial plants and mines of the country, such as were received by the ELECTRICAL WORLD, are, however, useless for practical purposes except as they may be made the basis for an estimate of the use of electrical energy by all the plants and mines of the country. The ELECTRICAL WORLD has accordingly made such an estimate for the various items covered in the survey, based upon the information given in the reports received and supplemented by federal census data. These estimates are presented in the accompanying tables.

For the first time in the history of the industrial utilization of electrical energy, the 1919 census data indicated that a major percentage of the energy used was purchased from public utilities as against private generation. The total consumption of electrical energy by the mills, factories, mines and petroleum fields of the United States during 1920 is estimated at 33,282,200,000 kw.-hr., of which 14,242,200,000 kw.-hr., or 42.8 per cent, was generated in private stations of the plants and mines. In 1904, less than twenty years ago, more than 72 per cent of the motor load was carried by private generating plants. In 1909 this percentage had dwindled to about 64 per cent and in 1914 to about 56 per cent, and at the present time it is only about 40 per cent. Such a remarkable growth in the use of central-station energy as against energy generated in private plants is an excellent testimony to the quality of service which the central station has been rendering and is rendering to the manufacturing and mining industries in general.

Based upon the returns received in the survey, it is estimated that there are 5,949 plants using more than 500,000 kw.-hr. of electrical energy per year. Iron and steel mills lead with 832 plants, and textile mills follow with 723 plants.

By far the largest user of electrical energy is the iron and steel industry, which in 1920 consumed 8,115,000,000 kw.-hr., or 24.4 per cent of the total electrical energy consumed for power purposes by the plants and mines of the country. The chemical and allied products industry is second, with a total consumption of 6,074,700,000 kw.-hr. The extent to which operations in all industries were curtailed during the late industrial depression is indicated by the large decrease in the amount of elec-

**Table V—Alternating-Current Motor-Operating Voltages of Industrial Plants of the United States**

| Industry | Total Number of Companies Reporting on Alternating-Current Motor Voltages | 110 | 115 | 120 | 125 | 200 | 210 | 220 | 225 | 230 | 240 | 250 | 400 | 440 | 460 | 480 | 500 | 550 | 600 | 1,100 | 2,200 | 2,300 | 2,500 | Miscellaneous* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Number of Companies Reporting Various Motor-Operating Voltages — Voltages | | | | | | | | | | | | | | | | | | | | | | |
| Chemicals and allied products | 302 | 18 | 1 | 1 | .. | 1 | .. | 132 | .. | .. | 1 | .. | 2 | 65 | .. | .. | .. | 43 | 1 | .. | 20 | 14 | .. | 3 |
| Electrical equipment and machinery | 107 | 12 | .. | .. | .. | .. | .. | 64 | .. | 4 | 1 | .. | .. | 14 | .. | .. | 1 | 6 | .. | .. | 4 | .. | .. | 1 |
| Food and kindred products | 363 | 35 | .. | 1 | .. | 1 | 4 | 204 | .. | 1 | 1 | 1 | 1 | 70 | .. | .. | 1 | 10 | .. | .. | 22 | 10 | .. | 1 |
| Iron and steel and their products | 1,080 | 57 | .. | 74 | 1 | 4 | 2 | 572 | .. | 20 | 11 | 11 | .. | 246 | .. | .. | 6 | 13 | .. | 1 | 42 | 13 | 2 | 5 |
| Leather and its products | 125 | 10 | .. | .. | .. | .. | .. | 79 | .. | .. | 1 | 4 | .. | 13 | .. | 1 | 1 | 12 | .. | .. | 1 | 2 | 1 | .. |
| Lumber and its products | 295 | 22 | 2 | 1 | .. | 2 | .. | 157 | 2 | 1 | | 4 | .. | 61 | .. | 4 | 2 | 16 | 1 | .. | 13 | 7 | .. | .. |
| Metals and metal products other than iron or steel | 191 | 13 | .. | .. | .. | .. | .. | 127 | .. | 1 | 1 | 6 | 1 | 30 | 1 | .. | .. | 1 | .. | .. | 6 | 4 | .. | .. |
| Mining, miscellaneous | 185 | 4 | .. | .. | .. | .. | .. | 53 | .. | 1 | 1 | 1 | .. | 64 | .. | .. | .. | 1 | .. | 1 | 36 | 17 | .. | 6 |
| Paper and printing | 212 | 12 | 1 | 2 | .. | .. | .. | 67 | .. | 5 | 1 | 1 | 1 | 48 | 1 | 2 | 1 | 40 | 6 | .. | 16 | 4 | .. | 4 |
| Railroad-shop construction and repairs | 41 | | 1 | .. | .. | .. | .. | 20 | .. | 2 | 1 | .. | .. | 13 | .. | 1 | .. | 1 | .. | .. | 1 | .. | .. | 1 |
| Rubber and its products | 58 | | | 2 | 2 | .. | .. | 11 | .. | 1 | 2 | 7 | .. | 18 | .. | 1 | .. | 5 | .. | .. | 4 | 2 | .. | 3 |
| Shipbuilding | 51 | 4 | | .. | .. | .. | .. | 16 | .. | .. | .. | .. | .. | 22 | .. | .. | .. | 2 | .. | .. | 4 | 2 | .. | 1 |
| Stone, clay and glass | 226 | 10 | | 1 | .. | .. | 1 | 116 | | | 2 | 2 | 1 | 54 | 1 | 1 | 2 | 14 | 1 | .. | 13 | 6 | .. | 1 |
| Textiles | 962 | 56 | 1 | 6 | .. | 7 | 5 | 481 | 2 | 2 | 7 | 10 | 1 | 88 | 1 | 1 | 4 | 205 | 13 | 2 | 30 | 32 | .. | 8 |
| Tobacco | 32 | 10 | .. | .. | .. | 1 | .. | 20 | .. | .. | | | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| Vehicles for land transportation | 70 | 5 | .. | .. | .. | .. | .. | 40 | .. | 2 | 1 | 1 | .. | 16 | .. | 1 | .. | 2 | .. | .. | 1 | 1 | .. | .. |
| Miscellaneous | 154 | 16 | 1 | 1 | .. | .. | .. | 88 | .. | 1 | 2 | 1 | .. | 32 | .. | .. | .. | 7 | 1 | .. | .. | 1 | .. | 3 |
| Totals for all industries of U. S. (reported) | 4,454 | 284 | 7 | 89 | 3 | 16 | 12 | 2,247 | 4 | 41 | 33 | 49 | 7 | 855 | 4 | 12 | 18 | 378 | 23 | 4 | 213 | 115 | 3 | 37 |

* Miscellaneous voltages: 30 volts, 1; 90 volts, 1; 100 volts, 2; 117 volts, 1; 130 volts, 1; 160 volts, 1; 235 volts, 2; 280 volts, 1; 350 volts, 1; 370 volts, 1; 410 volts, 2; 420 volts, 1; 430 volts, 1; 450 volts, 2; 570 volts, 1; 660 volts, 1; 800 volts, 1; 980 volts, 1; 2,000 volts, 2; 2,100 volts, 1; 2,400 volts, 1; 3,500 volts, 1; 3,800 volts, 1; 4,000 volts, 2; 4,400 volts, 1; 5,500 volts, 2; 6,600 volts, 2; 10,000 volts, 1; 11,000 volts, 1.

## Table VI—Size of Largest and Smallest Motors Installed in the Industrial Plants and Mines of the U. S.

| Industry | Total Number of Companies Reporting on Size of Motors | Largest Motor Installed (Number of Companies Reporting): Under 10 Hp. | From 10 to 25 Hp. | From 26 to 50 Hp. | From 51 to 100 Hp. | From 101 to 200 Hp. | From 201 to 300 Hp. | From 301 to 1,000 Hp. | Over 1,000 Hp. | Smallest Motor Installed (Number of Companies Reporting): Under ⅛ Hp. | From ⅛ to ¼ Hp. | From ¼ to ½ Hp. | From ½ to 1 Hp. | From 1 to 2 Hp. | From 2 to 3 Hp. | Over 3 Hp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chemicals and allied products | 427 | 35 | 82 | 122 | 107 | 59 | 11 | 11 | 0 | 18 | 96 | 32 | 55 | 49 | 54 | 115 |
| Electrical equipment and machinery | 161 | 19 | 65 | 35 | 19 | 10 | 8 | 5 | 0 | 30 | 66 | 22 | 22 | 10 | 2 | 8 |
| Food and kindred products | 557 | 91 | 178 | 126 | 78 | 54 | 12 | 18 | 0 | 26 | 148 | 80 | 104 | 67 | 47 | 68 |
| Iron and steel and their products | 1,857 | 78 | 480 | 463 | 392 | 161 | 64 | 73 | 46 | 116 | 450 | 282 | 336 | 176 | 193 | 290 |
| Leather and its products | 216 | 31 | 101 | 53 | 18 | 11 | 2 | 0 | 0 | 8 | 54 | 32 | 42 | 20 | 13 | 28 |
| Lumber and its products | 490 | 38 | 168 | 163 | 80 | 32 | 8 | 0 | 1 | 11 | 74 | 78 | 83 | 64 | 60 | 102 |
| Metals and metal products other than iron or steel | 298 | 24 | 112 | 73 | 50 | 12 | 7 | 11 | 7 | 34 | 91 | 35 | 49 | 35 | 28 | 26 |
| Mining, miscellaneous | 288 | 5 | 29 | 67 | 64 | 53 | 40 | 28 | 2 | 4 | 34 | 24 | 19 | 40 | 52 | 102 |
| Paper and printing | 362 | 72 | 96 | 53 | 44 | 50 | 23 | 23 | 1 | 22 | 137 | 50 | 44 | 32 | 30 | 38 |
| Railroad-shop construction and repairs | 60 | 0 | 7 | 17 | 17 | 11 | 1 | 7 | 0 | 4 | 12 | 11 | 4 | 6 | 8 | 13 |
| Rubber and its products | 75 | 5 | 5 | 5 | 11 | 13 | 17 | 17 | 2 | 12 | 24 | 8 | 18 | 2 | 2 | 2 |
| Shipbuilding | 44 | 1 | 1 | 1 | 5 | 12 | 6 | 17 | 0 | 7 | 11 | 10 | 6 | 1 | 4 | 5 |
| Stone, clay and glass | 336 | 36 | 74 | 74 | 58 | 62 | 14 | 18 | 0 | 16 | 58 | 31 | 40 | 48 | 40 | 101 |
| Textiles | 1,474 | 450 | 448 | 268 | 187 | 95 | 17 | 7 | 2 | 53 | 240 | 221 | 194 | 154 | 143 | 319 |
| Tobacco | 50 | 24 | 19 | 6 | 1 | 0 | 0 | 0 | 0 | 2 | 14 | 8 | 6 | 6 | 4 | 5 |
| Vehicles for land transportation | 118 | 13 | 35 | 30 | 19 | 11 | 5 | 5 | 0 | 6 | 29 | 20 | 19 | 10 | 10 | 19 |
| Miscellaneous | 343 | 69 | 138 | 68 | 32 | 21 | 11 | 4 | 0 | 30 | 109 | 55 | 33 | 33 | 28 | 29 |
| Totals for all industries of U. S. (reported) | 7,156 | 991 | 2,038 | 1,624 | 1,182 | 667 | 246 | 244 | 61 | 399 | 1,647 | 999 | 1,070 | 753 | 718 | 1,270 |

## Table VII—Frequencies Used in Industrial Plants and Mines of the United States

Number of Companies Reporting Various Frequencies Used (The first figure gives number of phases; the second figure the number of cycles)

| Industry | Total Number of Companies Reporting on Frequency | 1–25 | 2–25 | 3–25 | 3–30 | 1–40 | 2–40 | 3–40 | 1–50 | 2–50 | 3–50 | 1–60 | 2–60 | 3–60 | 4–60 | 2–100 | 3–120 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chemicals and allied products | 329 | 2 | 2 | 18 | .. | .. | .. | 4 | 1 | .. | 4 | 14 | 48 | 236 | .. | .. | .. |
| Electrical equipment and machinery | 137 | .. | 2 | 2 | .. | .. | .. | 1 | .. | .. | 2 | 8 | 20 | 102 | .. | .. | .. |
| Food and kindred products | 378 | .. | 1 | 18 | 2 | .. | .. | 2 | .. | 1 | 25 | 24 | 38 | 266 | 1 | .. | .. |
| Iron and steel and their products | 1,471 | 1 | .. | 118 | 7 | .. | .. | 7 | 1 | 1 | 16 | 47 | 192 | 1,079 | 1 | .. | 1 |
| Leather and its products | 132 | 1 | .. | 5 | .. | .. | .. | 1 | .. | .. | .. | 2 | 22 | 100 | .. | 1 | .. |
| Lumber and its products | 351 | 2 | .. | 8 | 8 | .. | .. | 6 | .. | .. | 2 | 11 | 46 | 268 | .. | .. | .. |
| Metals and metal products other than iron or steel | 228 | 1 | 1 | 18 | 7 | .. | .. | 1 | .. | .. | .. | 12 | 46 | 142 | .. | .. | .. |
| Mining, miscellaneous | 186 | .. | .. | 7 | .. | .. | .. | .. | .. | .. | .. | 4 | 8 | 167 | .. | .. | .. |
| Paper and printing | 221 | .. | .. | 24 | 1 | .. | .. | 12 | .. | 1 | .. | 8 | 23 | 152 | .. | .. | .. |
| Railroad-shop construction and repairs | 51 | .. | .. | 7 | 1 | .. | .. | 1 | .. | .. | .. | .. | 8 | 34 | .. | .. | .. |
| Rubber and its products | 59 | .. | 1 | 1 | .. | .. | .. | .. | .. | .. | .. | 10 | 5 | 42 | .. | .. | .. |
| Shipbuilding | 42 | .. | .. | 1 | .. | .. | .. | .. | .. | .. | 4 | 2 | 4 | 31 | .. | .. | .. |
| Stone, clay and glass | 253 | .. | .. | 13 | 2 | 1 | .. | 4 | .. | .. | 3 | 7 | 42 | 181 | .. | .. | .. |
| Textiles | 1,001 | .. | 1 | 20 | 4 | .. | 5 | 24 | 1 | 2 | 6 | 35 | 182 | 720 | 1 | .. | .. |
| Tobacco | 30 | .. | 2 | .. | .. | .. | .. | .. | .. | .. | 1 | 8 | 11 | 8 | .. | .. | .. |
| Vehicles for land transportation | 93 | .. | .. | 1 | 1 | .. | .. | .. | 1 | .. | 2 | 4 | 11 | 73 | .. | .. | .. |
| Miscellaneous | 195 | .. | .. | 5 | 1 | .. | 1 | 1 | 1 | .. | .. | 17 | 24 | 145 | .. | .. | .. |
| Totals for all industries of U. S. (reported) | 5,157 | 7 | 10 | 266 | 34 | 1 | 6 | 64 | 5 | 5 | 65 | 213 | 730 | 3,746 | 3 | 1 | 1 |

## Table VIII—Prime-Mover and Boiler Equipment of Industrial Plants and Mines of the United States

(Prime-mover data from U. S. Census of Manufactures for 1919; boiler data estimated by "Electrical World")

| Industry | No. of Plants Using Mech. Power | Total Hp. of Prime-Movers in Industrial Plants* | Steam Engines No. | Steam Engines Hp. | Steam Turbines No. | Steam Turbines Hp. | Internal-Combustion Engines No. | Internal-Combustion Engines Hp. | Waterwheels No. | Waterwheels Hp. | "Electrical World" Estimate of Boilers in Industrial Plants No. | "Electrical World" Estimate of Boilers in Industrial Plants Hp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Agricultural implements | 497 | 80,407 | 303 | 51,107 | 31 | 18,835 | 166 | 4,092 | 72 | 6,370 | 226 | 52,800 |
| Chemicals and allied products (total) | 10,487 | 2,162,852 | 13,810 | 1,350,292 | 1,707 | 634,159 | 2,577 | 148,665 | 491 | 27,892 | 9,343 | 2,216,000 |
| Rubber and rubber products | 494 | 236,747 | 491 | 120,773 | 67 | 106,401 | 40 | 3,859 | 29 | 5,545 | 823 | 221,000 |
| Glass and glass products | 1,481 | 162,548 | 459 | 83,893 | 29 | 22,646 | 420 | 53,458 | 231 | 2,545 | 407 | 96,000 |
| Chemicals | 4,140 | 500,329 | 3,225 | 302,595 | 366 | 174,861 | 725 | 14,720 | 133 | 7,748 | 2,480 | 587,000 |
| Smelting and refining of metals | 171 | 291,008 | 505 | 159,749 | 110 | 119,151 | 69 | 4,208 | 10 | 7,900 | 900 | 211,000 |
| Artificial gas manufacture | 767 | 206,091 | 2,868 | 148,393 | 650 | 49,928 | 151 | 7,574 | 1 | 12 | 1,066 | 248,000 |
| Miscellaneous chemical industries | 3,434 | 766,129 | 6,262 | 534,889 | 485 | 161,172 | 1,172 | 64,846 | 87 | 4,142 | 3,667 | 853,000 |
| Electrical equipment and machinery | 1,345 | 202,477 | 274 | 62,000 | 51 | 131,231 | 103 | 7,446 | 16 | 1,795 | 342 | 109,500 |
| Food and kindred products | 52,086 | 2,088,839 | 21,553 | 1,580,432 | 953 | 133,478 | 8,603 | 179,700 | 4,882 | 192,987 | 7,400 | 1,752,000 |
| Iron and steel and their products | 17,502 | 5,612,754 | 11,551 | 3,896,407 | 1,247 | 1,024,661 | 3,561 | 649,688 | 521 | 39,577 | 15,900 | 3,722,000 |
| Leather and its products | 4,718 | 242,891 | 1,637 | 191,363 | 146 | 38,092 | 234 | 8,403 | 64 | 5,004 | 896 | 184,000 |
| Lumber and its products | 36,865 | 3,008,512 | 38,973 | 2,618,388 | 806 | 252,309 | 3,411 | 59,325 | 1,733 | 77,200 | 18,200 | 3,580,000 |
| Liquors and beverages | 5,821 | 324,745 | 3,599 | 304,567 | 92 | 11,269 | 890 | 7,556 | 12 | 1,091 | 1,364 | 323,000 |
| Metals and metal products other than iron or steel | 9,547 | 462,920 | 1,553 | 295,773 | 164 | 132,286 | 947 | 25,438 | 146 | 9,243 | 1,447 | 332,200 |
| Bituminous and anthracite coal mines | 5,670 | 2,167,843 | 14,488 | 1,898,788 | 358 | 246,444 | 1,323 | 22,537 | 9 | 74 | 11,920 | 2,547,000 |
| Metal mines | 1,930 | 864,451 | 4,001 | 556,274 | 131 | 192,244 | 1,463 | 81,483 | 266 | 34,450 | 4,160 | 889,000 |
| Stone quarries | 1,490 | 219,938 | 3,397 | 194,477 | 23 | 14,286 | 440 | 9,045 | 18 | 2,130 | 1,160 | 248,000 |
| Miscellaneous mines and quarries | 956 | 120,153 | 1,343 | 73,108 | 43 | 21,341 | 425 | 20,874 | 34 | 4,830 | 524 | 112,000 |
| Petroleum and natural gas | 8,170 | 1,775,228 | 23,515 | 536,429 | 0 | 0 | 53,766 | 1,238,759 | 2 | 40 | 2,980 | 636,500 |
| Paper and printing | 30,261 | 1,764,352 | 3,809 | 664,519 | 283 | 146,656 | 4,571 | 23,693 | 2,655 | 917,932 | 3,113 | 874,000 |
| Railroad-shop construction and repairs | 2,068 | 486,742 | 2,671 | 389,032 | 169 | 86,370 | 185 | 10,399 | 6 | 498 | 1,710 | 418,000 |
| Stone and clay and their products | 9,800 | 915,392 | 7,335 | 737,965 | 154 | 91,827 | 2,872 | 69,874 | 109 | 15,239 | 3,167 | 747,500 |
| Textiles | 27,702 | 2,301,160 | 6,603 | 1,383,171 | 504 | 453,210 | 657 | 15,283 | 2,330 | 448,327 | 7,720 | 1,802,000 |
| Tobacco | 1,299 | 28,960 | 238 | 25,881 | 10 | 2,332 | 32 | 345 | 9 | 279 | 627 | 78,600 |
| Vehicles for land transportation | 19,654 | 230,242 | 947 | 121,604 | 68 | 70,548 | 3,715 | 35,456 | 75 | 2,591 | 960 | 254,800 |
| Miscellaneous | 8,203 | 219,841 | 1,301 | 167,243 | 87 | 30,972 | 882 | 14,031 | 123 | 7,523 | 1,137 | 236,000 |
| Total for all manufacturing industries, mines, quarries and wells of U. S. | 256,071 | 25,280,699 | 162,901 | 17,098,820 | 7,027 | 3,732,550 | 90,823 | 2,632,092 | 13,573 | 1,795,072 | 94,296 | 21,114,900 |

* Includes water motors.

**Table IX—Types of Motor Control Used in Industrial Plants and Mines of United States**

| Industry | No. of Companies Reporting on Motor Control | Snap Switches | Knife or Safety Switches | Auto-Starters | Magnetic Switches | Remote Control | Circuit Breakers |
|---|---|---|---|---|---|---|---|
| | Number of Companies Reporting Various Types of Motor Control | | | | | | |
| Chemicals and allied products | 361 | 71 | 260 | 196 | 88 | 70 | 163 |
| Electrical equipment and machinery | 142 | 69 | 121 | 80 | 41 | 30 | 47 |
| Food and kindred products | 448 | 116 | 367 | 222 | 101 | 60 | 194 |
| Iron and steel and their products | 1,645 | 410 | 1,357 | 958 | 431 | 379 | 753 |
| Leather and its products | 180 | 46 | 156 | 74 | 49 | 24 | 66 |
| Lumber and its products | 402 | 79 | 337 | 170 | 66 | 34 | 146 |
| Metals and metal products other than iron or steel | 264 | 71 | 224 | 139 | 55 | 42 | 101 |
| Mining, miscellaneous | 239 | 49 | 176 | 146 | 89 | 44 | 185 |
| Paper and printing | 313 | 94 | 260 | 155 | 78 | 82 | 146 |
| Railroad-shop construction and repairs | 53 | 14 | 44 | 37 | 14 | 17 | 26 |
| Rubber and its products | 52 | 24 | 47 | 40 | 27 | 28 | 34 |
| Shipbuilding | 44 | 13 | 29 | 30 | 10 | 12 | 18 |
| Stone, clay and glass | 290 | 58 | 214 | 140 | 65 | 53 | 121 |
| Textiles | 1,094 | 284 | 848 | 482 | 161 | 102 | 446 |
| Tobacco | 34 | 12 | 31 | 16 | 2 | 2 | 11 |
| Vehicles for land transportation | 102 | 26 | 78 | 56 | 30 | 29 | 45 |
| Miscellaneous | 285 | 90 | 236 | 119 | 58 | 56 | 118 |
| Totals for all industries of U. S. | 5,948 | 1,526 | 4,785 | 3,060 | 1,365 | 1,064 | 2,620 |

trical energy consumed in 1921 as compared with 1920 and shown in Table II.

There are 1,557,192 electric motors installed in the factories and mines of the country, with a total rating of 19,207,429 hp. Of these motors 655,611, or 42.1 per cent, are under 5 hp. About 56.6 per cent of the machines are belt-driven, 37.5 per cent are directly connected, and only 5.9 per cent are chain-driven.

Perhaps one of the most noteworthy facts resulting from the data collected through the survey is the large number of voltages in actual use in the operation of motors. It is apparent that there is much remaining to be done toward the standardization of voltages in the country at large. The 6,504 companies reporting motor-operating voltages indicate that there are twenty-three voltages in use for the operation of direct-current motors and fifty-one voltages in use for the operation of alternating-current motors. It appears that about 39 per cent of the direct-current motors are operated at 220 volts, but a large percentage are also operated at 110, 115, 230 and 250 volts. Iron and steel mills particularly reported a high percentage of direct-current motors operated at other than 220 volts. Approximately one-half of the alternating-current motors are operated at 220 volts, and about one-fifth are operated at 440 volts. Three hundred and twenty-eight plants reported the use of primary voltage (i.e., 2,200 volts or 2,300 volts) for operating alternating-current motors.

A careful study of the tabulated returns indicates that a very high percentage of the odd voltages are in use in plants generating their own energy. As a rule only standard voltages are reported by companies purchasing their energy from central stations. This difference is due in large part to the fact that a considerable proportion of the private generating plants have antiquated equipment as compared with the up-to-date central-station equipment. Ohio and Pennsylvania appear to be in most need of voltage standardization.

Out of a total of 7,156 companies reporting on size of motors, about 43 per cent indicated that the largest installed motor was under 25 hp. About 23 per cent of the companies reported that the smallest motor installed ranged between $\frac{1}{8}$ hp. and $\frac{1}{4}$ hp.

It is estimated from the reports of 4,307 companies that there are 667,770 refillable or renewable fuses used monthly by the industries covered in the survey. Standard fuses total 356,330 per month, or a total of 1,024,100 fuses of both general types per month.

### Field for Future Electrification

The electrical industry as a whole is, perhaps, most interested not so much in the past growth and present status of the electrification of industry as in the length and breadth of the field for future electrification. A study of the prime-mover data presented in Table VIII indicates that the industrial field of the central station is only about one-third developed. It is, of course, too much to assume that in course of time all industry will be electrified, or that the private plants will cease to exist, but, notwithstanding these facts, a large field for future industrial power growth is open to the central generating station.

Although the iron and steel industry far outstrips any other in the consumption of electrical energy, there are several other primary industries which are more highly electrified by central-station energy. The data indicate that the so-called "chemicals and allied products industry" is the most highly electrified from central-station energy. This highly diversified industry is 36.4 per cent electrified, not considering that portion using energy generated in private plants. The food industry is also a large patron of the central station, being 33.5 per cent electrified by central-station energy.

**Table X—Types of Fuses Used in Industrial Plants and Mines of the United States**

| Industry | Total Number of Companies Reporting on Fuses | Standard Fuses: Number of Companies Using This Type | Standard Fuses: Fuses Used per Month, Number | Standard Fuses: Fuses Used per Month, Number per Motor | Refillable and Renewable Fuses: Number of Companies Using This Type | Refillable and Renewable Fuses: Fuses Used per Month, Number | Refillable and Renewable Fuses: Fuses Used per Month, Number per Motor | "Electrical World" Estimate of Fuses Used per Month by All Industrial Plants of U. S.: Standard | "Electrical World" Estimate: Renewable and Refillable |
|---|---|---|---|---|---|---|---|---|---|
| Chemicals and allied products | 254 | 127 | 4,615 | 0.781 | 218 | 13,480 | 0.865 | 28,400 | 84,400 |
| Electrical equipment and machinery | 112 | 65 | 28,900 | 0.506 | 72 | 10,080 | 0.701 | 31,500 | 11,380 |
| Food and kindred products | 343 | 166 | 8,720 | 0.883 | 239 | 7,330 | 0.667 | 75,600 | 63,770 |
| Iron and steel and their products | 1,291 | 540 | 15,100 | 0.612 | 1,058 | 56,240 | 0.623 | 38,380 | 142,700 |
| Leather and its products | 154 | 68 | 1,527 | 0.673 | 131 | 5,050 | 0.971 | 7,050 | 23,400 |
| Lumber and its products | 314 | 126 | 1,943 | 0.808 | 265 | 5,190 | 0.621 | 12,480 | 33,200 |
| Metals and metal products other than iron or steel | 197 | 99 | 2,540 | 0.988 | 152 | 6,920 | 1.011 | 20,050 | 57,300 |
| Mining, miscellaneous | 154 | 49 | 582 | 1.350 | 127 | 2,970 | 0.815 | 10,640 | 54,000 |
| Paper and printing | 217 | 116 | 3,520 | 0.416 | 164 | 3,070 | 0.558 | 47,400 | 41,300 |
| Railroad shop construction and repairs | 48 | 20 | 1,435 | 1.273 | 41 | 2,400 | 1.087 | 19,230 | 32,200 |
| Stone, clay and glass | 227 | 83 | 1,858 | 0.705 | 182 | 4,815 | 0.690 | 5,680 | 14,730 |
| Textiles | 701 | 346 | 12,640 | 0.518 | 496 | 8,200 | 0.238 | 48,700 | 31,600 |
| Tobacco | 28 | 16 | 144 | 1.290 | 25 | 77 | 0.341 | 2,240 | 1,190 |
| Vehicles for land transportation | 86 | 22 | 733 | 0.743 | 77 | 7,820 | 0.711 | 4,630 | 48,400 |
| Miscellaneous | 181 | 82 | 1,077 | 0.558 | 146 | 7,020 | 0.960 | 4,350 | 28,200 |
| Totals for all industries of U. S. | 4,307 | 1,925 | 85,334 | 0.807 | 3,393 | 140,662 | 0.724 | 356,330 | 667,770 |

# Active Year in Power Transmission

*By Percy H. Thomas*
Consulting Engineer, New York City

Cost of Superpower Lines Not Prohibitive—Excessive Conductor Pulls Should Be Relieved—Tendency to Omit Circuit Breakers, Arresters and Ground Wires—Stabilizing Line Potential—Corona as a Limit

THE year just past has been one of seasoning in the high-tension transmission field rather than a year of new undertakings. After such advances as the Murray superpower report and the 220,000-volt transmission projects in California, a pause for digesting the new ideas and the working out of details was appropriate.

For example, a considerable amount of sober study has been given to the practical aspects of very long transmission systems, such as those proposed in the superpower report between the St. Lawrence and the Niagara power sites and the seaboard. These projects seem surprisingly simple as the plans have worked out, and their cost is by no means prohibitive. Attention may be profitably given to the operating features, starting, interruptions, lightning protection, etc.

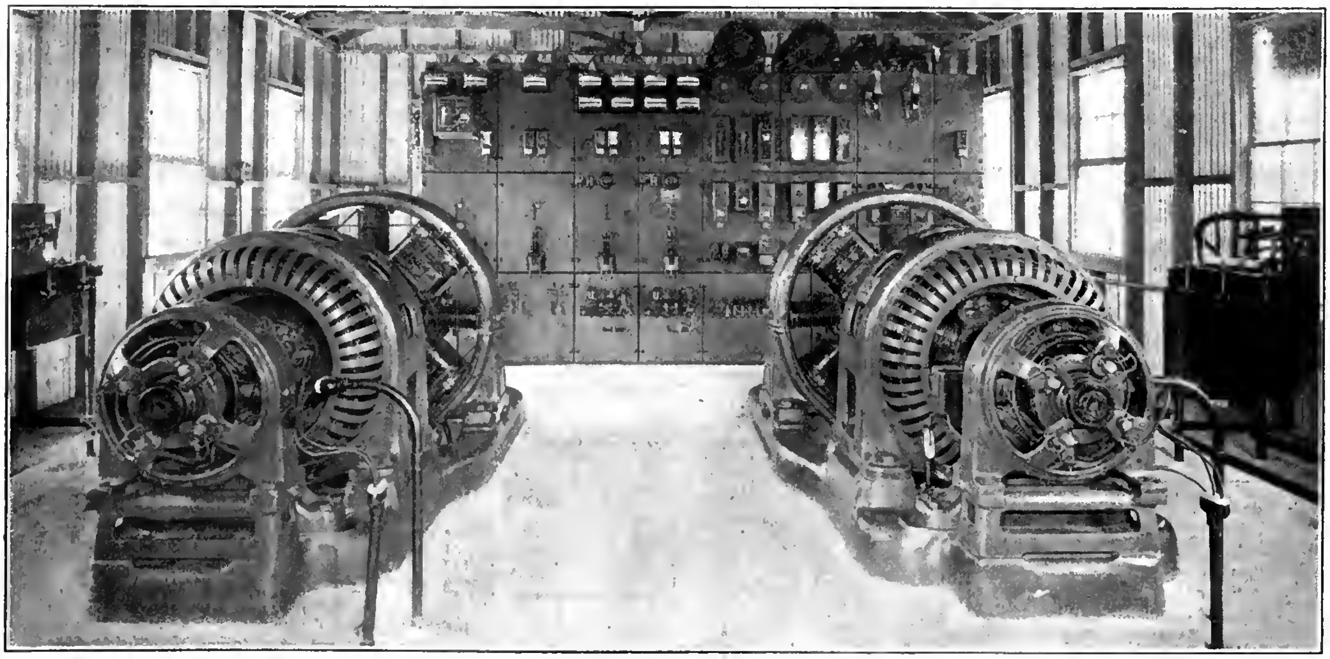
As far as line structures go, there are no new problems of magnitude involved. On the other hand, with the ever-extending systems an opportunity is presented of introducing innovations for lessening costs. The best interests of the industry require a careful consideration of all safe methods of lessening the investment to permit the widest extension of transmission that a proper economy will justify.

One detail of very great importance in the design of super-transmission lines is the so-called suspension clamp. Very strong conductors are used with such lines, and if the towers are to be designed to withstand the full stress on broken conductors, they will be extremely expensive and very heavy. On the other hand, if these clamps are so designed as to allow the conductor to slip when there is an excessive pull, and if the tower be designed to take advantage of this fact, a great deal of weight and cost can be saved.

One question that is receiving consideration is the omission of high-tension oil breakers in super-tension transmission systems, such as those employing 220,000 volts. Where such breakers are used at the ends of very long lines the openings of the breaker on one end of a line, when excited at the other, will cause an excessive rise of potential on the open end. With no chance of the circuits being opened the control of such a condition is much easier; furthermore, the saving of cost is very material.

The question as to the desirability or necessity of stabilizing the potential at the middle of a very long transmission line by synchronous condensers at that point has received some attention, and there is some-

## Automatic Substations Are Popular in Industrial Service



In mining and other industrial service the full automatic substation has made a very favorable impression. This year has also witnessed the development of the full automatic alternating-current substation for distribution service.

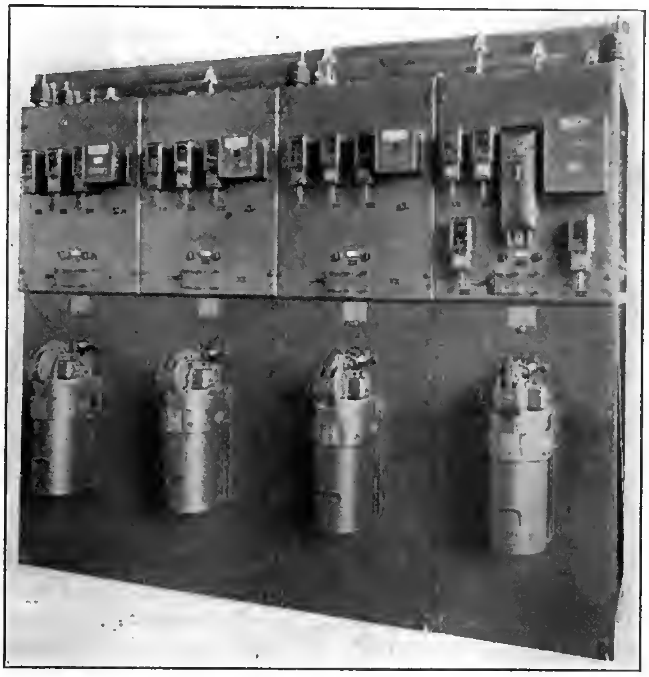
thing to be said both pro and con. The omission of the middle-point station certainly simplifies the operation very much and cheapens the cost. On the other hand the handling of the charging current and the tendency of the potential of a long line to "bow up" in the middle of the line are much helped by the stabilization of the middle point. Furthermore, if the load transmitted is not properly proportioned to the voltage of the line, bad regulation and efficiency result without the middle-point condensers.

The significance of corona as a limitation in transmission is now being fully realized. For 220,000 volts a conductor diameter of approximately 1 in. is required with the usual spacings, but a conductor of this diameter in copper represents a lower resistance, and hence higher cost, than is warranted by any power that can be transmitted with a reasonable drop over the line on account of the reactance of the line. The same statement applies to aluminum conductors, though to a less extent. The use of a steel core in the aluminum restores the balance, however, and presumably the same thing will be done by using a steel core with copper. The use of the copper with a rope strand, which very materially increases the diameter, gives another solution, as is shown by its use in the Pit River transmission system. When we pass to 260,000 volts, corona requires a diameter of approximately 1.15 in. with a resistance of 75 per cent of the resistance of the inch diameter conductor, while the reactance of the cable is not greatly changed. This means a still greater disproportion between resistance and reactance, which requires more radical modifications of conductor design. There has been a great activity in large transmission systems in foreign countries, new machinery having been partly supplied by United States and partly by foreign manufacturers, although the extra-high-tension equipment was furnished largely from this country. Notable installations are the 150,000-volt line in Formosa designed to withstand typhoons with a wind velocity up to 150 miles per hour, the large steam development in southern Australia and the system of the Compañia Chilena de Electricidad, Ltd., of Santiago, Chile. The latter plant, started by Chilean capital and afterward merged with a larger system controlled by English capital, has just completed a 34,000-hp. station and 110,000-volt transmission line to the city of Santiago and is extending this to form a network over central Chile. This plant, which will supply the power for the electrification of the Chilean State Railways, contemplates development in the near future to approximately 100,000 kw. installed capacity. This is a very notable installation for South America.

Foreign plants as well as American plants have been seriously short of power to supply their demands.

Among the contributions of the past year to the technical societies one of the most notable bearing on the subject of transmission was the paper of R. J. C. Wood* before the Pacific Coast convention of the American Institute of Electrical Engineers. This paper gives the results of careful studies that have been made by the Southern California Edison Company for converting its 150,000-volt Big Creek transmission system into a 220,000-volt system and the tests on its 27-mile trial 220,000-volt line. These studies constitute the most practical and constructive contribution to the data on 220,000-volt transmission that has appeared in some time, and a very brief summary may be permitted here. The adaptation of the company's existing 150,000-volt generating station to the converted 220,000-volt line is accomplished by auto-transformers, star-connected, with neutral grounded and a large capacity tertiary winding. Similar auto-transformers are used at the receiving end, but with a ratio of approximately two to one. This is mentioned as a notable though unusual expedient and as solving an awkward condition. The paper summarizes the tests made on insulator strings, and the conclusion arrived at was that by using ring shields around the line unit the same insulator string might be used on 220,000 volts as had been used on 150,000 volts without any greater strain on the unit most stressed than was the case before. Very possibly if new towers had had to be built a somewhat different layout might have been adopted. It will be found of interest to compare these insulator studies with those described by Frank Baum at Salt Lake City in 1921.

## Marked Improvements in Relays and Breakers



The reclosing circuit breaker for feeder service and the development of more rugged and simpler relays have increased the reliability of service.

### CORONA LOSS SHOWS UNIFORMITY

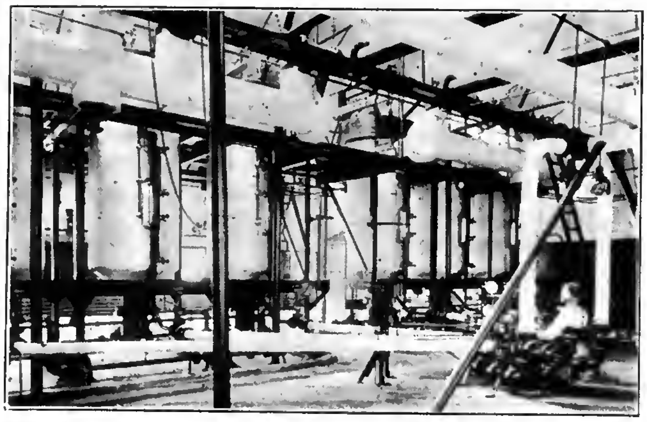
The careful and illuminating measurements of corona loss on this 27 miles of test line check very satisfactorily with the Peek formulas as to form, with some irregularities as to temperature. The constant $M_0$ varies from about 0.7 to over 0.9 between storm conditions and fair-weather conditions. This is about the same range as Peek's values.

It is interesting to note that the charging current of the 27-mile test line equipped with rings is 7½ per cent

*See the ELECTRICAL WORLD for Feb. 11, 1922, page 277.

more than the theoretical charging current of the conductors alone. It was surmised that this was due to the guard rings and the effect of insulator surfaces. There is a growing tendency to eliminate overhead ground wires, and even lightning arresters, especially on lines operating at very high tensions. This change is not based on any concrete evidence from operation, but on the gradual realization of the great cost and complication of the arresters and the limited usefulness that they can have. The trend during the next year will be watched with interest by all operating engineers.

## Electric Heating Used



The use of electricity for heating water is limited to special conditions, but this view shows the attractive appearance of a plant containing two 30,000-kw. boilers.

Among the less important growths in practice may be mentioned the more general use of tertiary windings to suppress the third harmonics in certain cases and to serve for the supply of a synchronous condenser or to insure a positive three-phase short circuit with a single-phase ground. The necessity of having the tertiary winding of sufficient capacity or adequately protected to stand the heating effects of circulating current due to such a single-phase ground is now recognized as some burn-outs have occurred with low-capacity tertiary windings.

High-tension disconnecting switches are now often made for group operation from remote handles and may be interlocked to prevent careless operation. They may also be made for operation by motors.

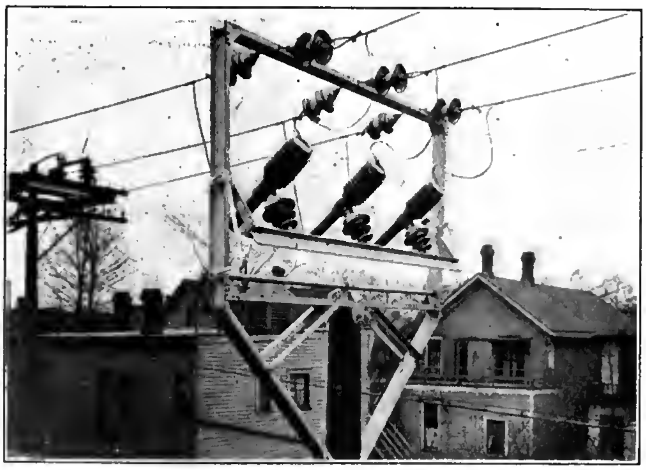
The number of 130,000-volt and 150,000-volt lines steadily increases, with new ones in Brazil and New England.

Steady progress is being made in the study of relays, and their performance has been more reliably and accurately determined. It is possible by co-ordinating the selection and setting of relays with the short-circuit kva. that may be expected at various points in a system, as derived from calculation, to get selective and reliable protection. This has been more difficult in the past. A most important test† of oil breakers was made on the lines of the Consolidated Gas, Electric Light & Power Company's system at Baltimore last year. A full and careful set of tests was made on two makes of breakers of various types, and oscillographs were taken of current and voltage so that their performance was known under definite conditions. The breakers on the whole did well, but as a consequence of the tests a distinct improvement has been made in the way of preventing the throwing of oil, which has been a limiting and troublesome feature. It is a remarkable fact that these tests were made in part on the main system simultaneously with normal operation and without material disturbance of the regular consumers. These tests, while, of course, very technical in their nature, are of very great value to the art. They were described in papers before the A. I. E. E. at the Niagara convention and caused spirited discussion.

During the year there has been some discussion of the theoretical performances of very long lines with lengths up to 3,000 miles, and the periodic character of the typical line has been brought out. That is, the generator voltage, current and power factor of a line delivering a fixed load at a fixed voltage do not increase by regular curves as the lines become longer and longer, but have alternately rising and falling values, according to the relation of the length of the line to its wave length for the frequency used. A 60-cycle line has a wave length of about 3,000 miles, so that a line of that frequency will have a very wide range of regulation with variation of load when of quarter-wave length, or 750 miles, and a very narrow range of regulation with change of load at half-wave length, or 1,500 miles, and again a wide range at three-quarters wave length, or 2,250 miles. These characteristics may have an important bearing on transmissions exceeding five or six hundred miles and may in the more or less distant future determine the frequency of a circuit.

While the record-breaking sleet storm which occurred in New England in the fall of 1921 does not, of course, belong to the year just past, it may be well to turn again to the lessons learned from it. It was proved once for all—though perhaps for the second or third time—that it is not feasible to build transmission lines against any possible sleet; a reasonable compromise must be made. This being the case, is it not incumbent on the industry to make the fullest practicable use of substitute methods, such, for example, as the melting off of sleet? The sleet load is the determining factor in transmission line design and melting methods are needed.

## Outdoor Switches Are Improved



A view of a 37,000-volt, 300-ampere, triple-pole, liquid-break switch with tilting contact for outdoor service.

†See ELECTRICAL WORLD for July 1, 1922, page 21.

# Future Policies of Smaller Utilities

*By H. H. Hunt*
Vice-President Stone & Webster, Inc.

Greater Saturation of Investment, More Economical Supply, Better Distribution Engineering and Administrative Skill Essential to Their Safety and Growth

I HAVE been asked to outline the probable trend of development in equipment and administrative policies of small and medium-sized central-station companies during the next few years. The service furnished by such properties is no longer a luxury but one of the essentials of every-day life in all but the smallest isolated communities. Unreliable service from crude and inefficient equipment at high rates and in correspondingly small volume is no longer tolerated. The public today is demanding dependable and closely regulated service in unlimited quantities and at reasonable rates wherever electric transmission or distribution lines are within reach.

### Maximum Use of Investment

The fundamental problem today of public utilities large or small is that of making every dollar of investment yield the greatest and most efficient possible service. Since pre-war days there have been radical changes in the conditions under which central stations operate. We have come to recognize fairly well-defined limits of investment which could be profitably made to yield a dollar of revenue. The unit investment in central stations today is at least 60 per cent greater than in 1914. Much of the new equipment which was demanded during the war period cost considerably more than this. Contrary to the hopes of many people, there appears to be slight prospect of any great downward trend of construction costs for a considerable number of years. During the period of higher prices the average rates charged by central-station companies have increased approximately 20 per cent, and the pressure for reduction of present levels in rates has already begun in spite of the prevailing and anticipated abnormal costs of fuel and the inability of the central stations so far fully to recover the losses sustained early in the period of rising costs before rate increases were authorized.

With such a substantial change in the ratio of investment to revenue as above indicated, central stations are faced with the serious problem of making each unit of equipment assume greater burdens than heretofore or to improve the load factor of the system and thereby secure more revenue per unit. Undoubtedly both these efforts must be made if the former ratios of investment to revenue are to be restored.

With respect to more intensive use of investment, it is evident that central-station experiences during the war period, when rapidly increasing demands for service called for continuous use of practically all available reserve equipment, demonstrated that previous conceptions of required reserve capacity were unnecessarily liberal, and that, with present standards of reliability, an increasing proportion of available equipment may be kept regularly employed. In this way each unit of station capacity may yield greater average output and greater revenue. The same is true of distribution transformers and, to a less extent, of distribution lines. Careful studies of transformer loads, particularly in the case of smaller systems, commonly show underloading and corresponding excessive losses. There is a profitable field of investigation in the methods and standards of distribution construction, with opportunities for simplification and greater reliability, together with reduced investment per unit of product distributed. With growth in their output even the smaller stations may profitably consider the use of larger generating units than have heretofore been available, with their lower cost per kilowatt and higher efficiencies. The extent to which refinements in efficiency through higher steam pressure, superheat, vacuum, better heat balances, etc., are justifiable in smaller stations is a matter for careful engineering study in each case.

### Advantages of Interconnection

In spite of possible improvement in efficiencies of small central stations, there is a wide margin between them and the very large stations which are being built throughout the country. This raises the question as to the future field for the small generating plant as a competitor with so-called superpower plants with their vast transmission networks. Even in localities where power supply from remote steam or hydro-electric sources is not economical, there are still possibilities of economy by interconnection with adjoining systems through which combined reserve capacities may be reduced and maximum advantage taken of the highest generating efficiencies and diversities in the combined systems. The advantages so far demonstrated by interconnections between neighboring systems clearly indicate that the future should see a large expansion of this policy, accompanied by the abandonment or curtailed operation of many small steam plants or their conversion into substations. The perfection of automatic devices and of outdoor types of transforming and switching equipment will doubtless mean that many of these new installations will be of the self-operating type, installed at low cost and lacking many complicated and expensive features which have heretofore been considered necessary.

The more intimate future relationship between smaller central stations suggests the advantage of common administration, and it is to be expected that centralized management will extend its advantages, already enjoyed by more than 75 per cent of the central-station investment in this country, to many now independent

properties. It is to small properties of this character that centralized management offers the greatest opportunities through furnishing to the group of managed properties the administrative skill, purchasing capacity and engineering, construction and financing resources which no one of them alone could command, thereby producing savings which will permit the continued supplying of electric service under conditions as to rates and service which are satisfactory to the public.

### Financial Prospects

With respect to financing policies of the future, it is gratifying to note that central-station companies have emerged from the period of almost prohibitive costs and restricted supply of capital and are now able to procure at fairly satisfactory rates the funds necessary for the reasonable and economic expansion of their properties. Throughout the war period it was necessary for public utilities to do a large part of their financing through the sale of short-term, high-interest-bearing notes, the balance being done through the sale of bonds. This resulted in an unbalancing of the financial structure of these properties, calling for early efforts at readjustment. Fortunately it is now possible for a large proportion of the central-station companies to undertake new financing through the sale of junior securities, at present preferred stocks with a tendency toward common stocks. The customer-ownership movement has made rapid strides and accomplished remarkable results in improving public relations, as was clearly demonstrated by the defeat of the proposed state ownership of water powers at the recent California election. Sale of junior securities, particularly common stock, of small central stations may not now be practicable on a large scale, but it is to be expected that the next few years will see satisfactory development in this direction.

The economies in construction, management and financing above considered will not in themselves be sufficient fully to restore to central stations the credit standards which they need. There must be, in addition, intensive studies of operating methods and economies. A promising and important field is in power-generating costs. A considerable number of central stations have undertaken power-station betterment work with gratifying results. Specific cases show reductions in switchboard costs amounting to from 20 to 40 per cent. Such gains are possible only through immediate supervision of operations by skilled engineers, a systematic maintenance program and continued regular scrutiny of operating results by a supervisory staff.

Under present disturbed coal conditions fuel oil offers attractions to many central stations. Because of the large initial investment necessary for conversion from coal to oil fuel the lower cost of the fuel itself does not offer the same advantages to small, low-load-factor stations as it does to large plants; and so the question of fuel for the smaller plants requires careful engineering analysis as well as forecasts of future fuel conditions. Because of their limited resources, small properties cannot safely undertake as radical changes in operating methods and policies as might be permissible under certain conditions for larger systems. This applies not only to power supply but to all phases of the company's business.

A feature by no means negligible in the administration of public utility properties is good housekeeping. Clean and attractive offices, power plants and premises improve the morale of the organization, produce increased efficiency and promote favorable public relations.

### Helpfulness of Appliance Load

The more intensive use of central-station investments required for their continued profitable operation calls for more careful future attention to commercial policies. Creditable progress has been made in improving system load factors and diversities by increasing the large power loads. Many central stations have also carried on active appliance campaigns and have placed many devices in customers' homes. To a large extent these devices are more helpful to the central station in demonstrating the necessity and convenience of central-station service than as revenue producers. The annual revenue from many of the popular appliances, such as vacuum cleaners, washing machines, etc., is quite small, and, in view of the losses commonly incurred in the selling of these appliances, the question may well be raised whether the sales efforts could not more profitably be directed to service applications involving greater energy requirements. Cooking and refrigera-

## Rehabilitations and Extensions Occur in Street Lighting

The increased use of multiple feed, greater intensities and the use of prismatic and non-dust accumulating reflectors have improved street lighting

tion are two promising fields of this character, and with further improvements in available equipment, the revenue possibilities of the central station from these sources should be substantially increased.

The problem of serving many small scattered customers is one that vitally concerns the smaller central stations, as does also the problem of outlying extensions. Carefully developed standards of rural construction, involving safety but low investment, are problems to be solved. The investment on customers' premises in service, meters, etc., costing more in many cases than the entire balance of the company's investment for the customer's service, is a large factor in high customer cost. With no prospects of substantial reduction in actual customer investment under present standards of metering, the solution of the problem of high customer cost would seem to lie in greater customer consumption.

It is the general practice of large central stations to prepare budgets covering both operation and construction, the latter looking ahead for a considerable term of years. Such budgets should also be prepared for smaller companies. They are just as important in small properties as in large ones because of the narrower margin of resources already referred to. A forecast of capital requirements and the possibilities of meeting the increased fixed charges thereon is particularly important.

Although small central stations have peculiar difficulties and problems which larger systems escape, they have advantages in possibilities of more intimate personal contact between customers and the operating organization which should make for more harmonious public relations. If these companies bring to bear upon their peculiar problems, including greater saturation of investment, more economical power supply and better distribution engineering, the best administrative skill which they can obtain, directly or through association with other similar properties, they will be able to maintain the confidence of both customers and investors upon whom they depend and to meet promptly the recurrent calls for expansion which are incident to the growth of every community, however small it may be.

The narrowing margin of profit brought about by the high cost of construction and operation and the more complete regulation by the public through public utility commissions and other similar agencies calls for thoroughly scientific management of all phases of the public utility business.

# Economies of Interconnection

### Vast Possibilities for Safeguarding Service and for Producing Electricity with Minimum of Fuel, Water, Money, Material and Human Endeavor—Typical Examples Taken from Actual Practice

IT IS chiefly because of the diversity of use of service that electric light and power stations can exist. High station load factor is a goal worth striving for, since it makes for efficiency of production and maximum use of investment, and if high station load factor is coupled with maximum system diversity factor, the goal is doubly attractive.

Now just as one office building may differ from another office building in load characteristics, so may one system differ from another system, and by combining the two certain economies become possible. Thus a block system is better than several isolated plants. A central station is an improvement on the block system. A superpower station is more economical than several small central stations, and an interconnected superpower system represents the highest development of the art. Ignoring all other possible economies, the saving in investment in reserve plant alone often warrants the interconnection of systems even though no power be normally transmitted over the tie lines.

It is essential that greater use be made of present investments in electric public utilities because the time is not far distant when the demands for service will far outrun the ability of the industry to command the necessary funds with which to provide that service. Thus efficiency in the use of money will be exacted of the electric light and power industry just as economy in the use of fuel, oil and water is insisted on in every-day operation, and there is every reason to expect the industry to show the same skill in the use of one as in the other. Up to the present perfection has been sought along engineering and operating lines and financial considerations have not received their just due.

The problem facing the electric public utilities of the country, however, is broader still and embraces the conservation of fuel, water, labor, money, materials and human endeavor. In a measure interconnection encompasses many of these and most of the advantages to be gained through it have fortunately already been demonstrated in practice. Only those, however, who have experienced the benefits of interconnection have any idea of its maximum possibilities.

The Boston-Washington Superpower Survey made by the national government showed the immense savings attainable through interconnection in the restricted area studied. But interconnection is no new expedient so that those contemplating it need not rely on academic studies for proof of its efficacy. Vast interconnected networks have been in existence for some time, notably in California, in Washington and Oregon, in Illinois and Wisconsin, in Michigan, Texas, Tennessee, Alabama, Georgia, South Carolina, North Carolina, Pennsylvania, and throughout the New England States and New York, and the results obtained in every case have more than surpassed expectations. In few of the existing interconnected systems, however, have the maximum attainable advantages been approached.

#### ADVANTAGES OF INTERCONNECTION

The beneficial effects of interconnection may be summarized as follows:

1. Interconnection makes possible the fullest utili-

zation of water powers and watersheds through exclusive hydro-electric systems or in hydro-electric systems operated as auxiliaries to large steam-electric systems. It also enables the interconnected system to take advantage of the diversity existing between watersheds and water storage.

2. Interconnection materially increases the load which may be carried on otherwise separate systems owing to diversity in peaks. This increase ranges from 15 per cent to more than 30 per cent.

3. Interconnection enables a generating system to operate with less equipment in reserve, and in fact in very large interconnected systems no reserve equipment need be provided at all. The reserve is in the system.

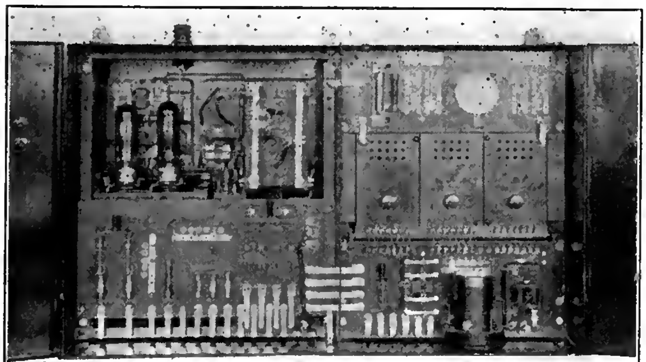
4. Interconnection of steam-electric stations or a combination of steam and hydro-electric stations enables a considerable saving to be made in fuel. In the case of exclusive steam plants the most efficient stations may be operated at maximum load factors while the less efficient plants need be called into service only when required.

5. Interconnection makes possible a greater utilization of an investment by providing load for equipment before the local market can absorb it. This condition is subject to change. One year one system may have surplus power for sale because of the installation of new equipment or the acquisition of a new source of power supply, while the next year conditions may be reversed and the neighboring system may have a surplus.

The above are merely abstract enumerations of some of the advantages of interconnection. As practiced at present the interchange of power is practically limited to an interchange between companies owning the interconnected transmission lines. To be most effective interconnections must be made on a larger and grander scale so as to bring about a more flexible arrangement which will permit the interchange of power not only between adjoining companies or systems but between systems that may be interconnected through other systems. But even as they are, limited by the size of the tie lines or the transforming equipment at the junction point, the results amply warrant the practice.

It is obvious that a hydro-electric system with water passing over the dam for a considerable portion of the time should be interconnected with a steam-electric station so as to use all of the water available without wastage and permit a considerable saving in fuel on the part of the steam-electric system. The advantages in such cases are mutual and instances of this kind abound.

## Radio Used Extensively in Power Service



A view of a late type of carrier current sending and receiving set for interstation communication

### Examples of Interconnection

Typical examples of interconnected systems predicated on actual practice are given herewith. While they do not show every possible combination, they portray different conditions and indicate the greater economies still available to those who will take the trouble to make a thorough investigation of the possibilities. The ultimate goal is a vast interconnected network stretching from border to border and from coast to coast. By means of such a system every water power in the country will be made available for development, huge steam stations become the rule, and the electric public utilities will reach their highest productive efficiency coupled with maximum financial economy.

*Case* 1.—Two hydro-electric companies—A, operating two stations aggregating 11,000 kw., and B, operating three stations aggregating 19,000 kw.—have their power plants on the same stream. The load curves on the two systems differ considerably. They interconnect through a 6,000-kva. tie-in transformer. The load carried by the tie-in transformer since it was put in service four years ago has averaged 3,000 kva., representing water that would otherwise have gone to waste.

*Case* 2.—A 12,000-kw. steam-electric station, using fuel oil, interconnects with a 150,000-hp. hydro-electric system through an 80-mile wooden-pole line costing $150,000. Since the tie-in has been effected more than 25,000,000-kw.-hr. of hydro-electric energy, or from 85 to 90 per cent of the energy requirements of the smaller company, is transmitted annually over the line at an approximate saving of 100,000 barrels of oil.

*Case* 3.—An 8,000-kw. hydro-electric station on a stream possessing a fairly constant flow but with no facilities for pondage is tied in with the steam-reserve station rated at 5,000-kw. During approximately 100 hours of the year the load on the system is 13,000 kw. At night the load drops off to 2,000 kw. and during the day it hovers around 10,000 kw. As normally operated the company uses its steam plant only as needed to supplement the hydro-electric supply. Therefore the wastage of water during the night is considerable. Not far distant is an 80,000-kw. steam station which is fully loaded at the winter peak. An interconnection between the two systems was effected whereby the first system is enabled to shut down its steam station all summer and the second system not only supplies most of the power which the first system was heretofore compelled to generate in its own steam station, but in addition is enabled to shut down its own less efficient turbines during the time when the first system has water power to spare. When load conditions warrant, the second system sells all the surplus energy available. By means of the interconnection the second system is enabled to make a saving of 4 mills on every kilowatt-hour it receives from the first system during the night, and inasmuch as it cost the first system more than 1 cent a kilowatt-hour to generate energy in its steam plant, the energy which it receives from the second system to replace that which it would have to generate itself in this plant enables it to make a saving of approximately 1 cent a kilowatt-hour.

*Case* 4.—A hydro-electric system has a 5,000-kw. steam-reserve station at one end of its line which is called on to produce about 20,000,000 kw.-hr. yearly. In the same district is another hydro-electric system operating at a different frequency but with ample capacity and water storage. Interconnection was effected between the two systems through a 5,000-kw. frequency changer, since which time the steam station has been completely shut down, effecting a saving of more than 92,000 barrels of oil a year.

*Case* 5.—Company A has a 95,000-kw. steam plant and a peak load of 95,000 kw. Company B has waterpower varying with the season. During low-water periods it can generate 500,000 kw.-hr. a day; during high-water periods there is available water for approximately 5,000,000 kw.-hr. a day. Its peak is 50,000 kw. and hydro-electric equipment of that rating is installed. Interconnection between the two systems was effected, and as part of the agreement com-

pany B doubled the capacity of its hydro-electric equipment. Normal operation under the interconnection arrangement is as follows: Company B doubled its business with no increase in its fixed charges except for the waterwheels and generators. During low water it shuts down its entire system at night and stores the water. While its station is shut down it purchases all of its energy from company A. When, however, company A's peak load comes on, company B carries its own peak, the stored water enabling this to be done; but when the peak is passed company B takes energy again from company A and stores water until the peak of the next day. During the high-water periods company B carries its own peak load and also its night load and in addition sells company A energy at night and at any other time except the peak from water which would otherwise pass over the dam.

*Case* 6.—A gas and electric company has an output of 9,000,000 kw.-hr. a year, which is generated in a steam station requiring 4.5 lb. of coal per kilowatt-hour. Interconnection was effected with a large system possessing seven hydro-electric and two steam stations. The gas and electric company was thereby enabled to shut down its steam station and take all its energy from the larger system. The latter supplies most of the energy from hydro-electric sources and about 10 per cent from its steam stations, which, however, generate a kilowatt-hour on less than 2 lb. of coal.

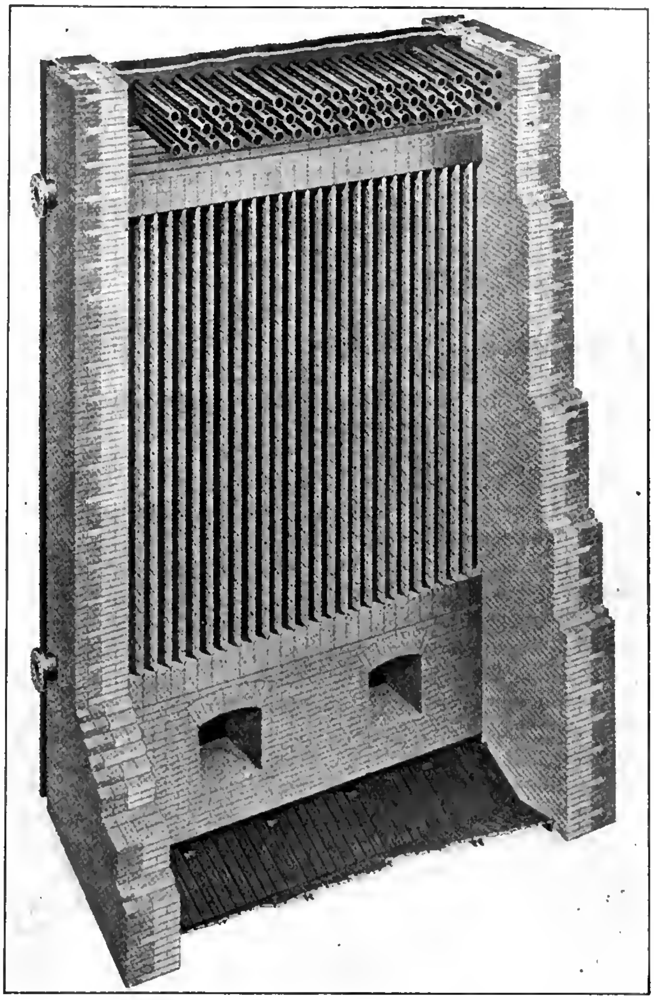
*Case* 7.—Four transmission systems serve as many states and all possess hydro-electric and steam stations which are interconnected. In this system, aggregating 1,000,000 hp., all available waterpower at any point is fully utilized before steam is called upon and the water power itself is operated at an efficiency wholly impossible before the interconnections were effected. Excessive drought caused system A to seek every available source of supply, and system D, 700 miles distant, was the only one having any reserve capacity. The excess in system D was therefore transferred to the lines of system C, which in turn furnished an equivalent amount of energy to system B, and system B transmitted a similar amount to system A, thereby relieving the shortage. In the territory served by system D is a large modern steam turbine station rated at 60,000 kw. This station, which was built as a part of a war industry, was normally idle. Anticipating a shortage in its own supply, system D, assisted by systems B and A, underwrote a lease on the 60,000-kw. plant, which was held in reserve for the entire section. The station can be put into operation on a few hours' notice and has carried loads as high as 30,000 kw. during extended periods of drought.

*Case* 8.—A study of the loads of three independent steam-electric systems in one of the most populous centers of the country indicates a diversity in excess of 12 per cent. The total load on the three systems approximates 1,000,000 kw. Through a diversity which interconnection would make available 100,000 kw. in installed generating capacity could be saved, in addition to 75,000 kw. in emergency reserve requirements. Thus interconnection between these systems would result in an increase of effective generating capacity of 175,000 kw., corresponding to an investment approximating $20,000,000. That sum is more than would be required to build the necessary tie lines, including the step-up and step-down transformer stations.

*Case* 9.—Company A has an installation of 100,000 kw. in modern turbines and its cost for coal and labor approximates 8 mills. Company B has an installation of 50,000 kw. in modern steam turbines and its cost for coal and labor is 9 mills. Company C has a 5,000-kw. reciprocating engine and its cost for coal is 1 cent per kilowatt-hour and labor amounts to $50 per shift. Between stations B and C there is a 3,000-kw. line, and another tie line of similar capacity connects stations A and C. The operations are as follows: During the summer company C shuts down, taking all of its load up to the capacity of the tie line from company B and whatever else is necessary during the summer peak from company A. During the winter company C takes its light load from company B, but starts up once a day and carries the whole of its own peak. Recently company A installed a new turbine capable of taking care of two years' growth. This has enabled company C to run with only a part of its reciprocating equipment during the winter peak, and during part of the winter, owing to spare capacity on the systems of A and B, station C was able to shut down for a month.

*Case* 10.—A hydro-electric system possessing three water-power plants is so situated as to be able to operate at full capacity all the year round with no steam reserve. Having 8,000 kw. to spare, a 35-mile line was built to supply a much larger system possessing both hydro-electric and steam-reserve stations. As much as 51,000,000 kw.-hr. has been transmitted over this interconnection in a year, thereby relieving the auxiliary steam plants of the larger system of that amount of load and saving 230,000 barrels of oil.

## Furnaces and Boilers Improved



A more complete knowledge of combustion and the increased prices of fuel have aided the development of furnaces and boilers. View of a radiant type of superheater exposed to the direct heat of the fuel bed.

### Limitations to Economies Effected

It will, of course, be appreciated that in all of the examples cited the actual savings were not so great as indicated, as maintenance and fixed charges on the transmission and some differences in plant costs other than fuel must be deducted before the net economic result is obtained. Examples may be cited of still more intricate interconnected systems and of the additional savings which have been made possible where the operation of the various systems is centered in one system operator.

Involved in all interconnections of this kind is the question of rates. Obviously the price of interchange energy must never be such as to impose on the purchaser a greater burden than he would have to carry with the use of his own power sources, nor should it be so low as not to yield a profit to the seller. The major profit should go to the company exercising the maximum initiative whereby the economies through interchange have been made possible.

# Equipment Development in 1922

*By Allen M. Perry*
Engineering Editor ELECTRICAL WORLD

### Tendency Toward Concentration of Generation and Transmission of Electrical Energy Has Forced Higher Rating and Reliability in Equipment—Improvements in Industrial Equipment Have Extended Applications

PRODUCTION and development of electrical and allied mechanical equipment have been very encouraging during the past year, according to the reports from a large number of manufacturers. While the design and construction of most equipment have been along established lines, with improvements only in details, there have been a number of major developments in apparatus during the past year which have been influenced by the tendency to concentrate generation, transmission and distribution of electrical energy into units of greater rating, higher voltage and higher efficiency to secure better economy.

Never before has there been such activity in hydro-electric development, and manufacturers have felt its effect in the demand for hydro-electric equipment as well as for the high-tension transmission apparatus necessitated by this development of water power. Unusual demand for heavy-duty oil circuit breakers, unprecedented production of transformers of all classes and record-breaking calls for outdoor electrical equipment have been reported by various manufacturers. Nor has illumination been overlooked. Streets which have remained inadequately lighted for years have been provided with modern equipment, and interest has been quite generally aroused in better school lighting.

It would be repetition to outline detailed changes in operating practice during the past twelve months, since this has been ably done throughout the year in articles prepared by men actively engaged in the industry. Therefore a phase of electrical development which has only incidentally been touched in such articles—namely, equipment development—will be described in this article.

To make the information as nearly complete as possible 250 of the leading manufacturers in electrical and allied mechanical fields were asked the following questions:

1. What new apparatus or equipment has been developed and placed on the market during the past year which will have marked influence on future engineering practice or will make possible greater reliability or economy of operation?
2. What engineering investigations have you made or are you conducting to determine ways of developing or modifying apparatus so that it will meet operating requirements more effectively?

Some of the manufacturers addressed failed to reply, but the information from about fifty companies is presented below under major classification heads. In reporting developments it will be attempted, as far as space permits, to refer to operating conditions which influenced the development, and also to point out the significance of what has been done.

*Stokers and Furnaces.*—While the use of pulverized coal did not originate in the past year, the tendency toward its adoption under central-station boilers increased considerably. Many large stations are now considering it seriously and some new stations will use it. Every one is pretty well convinced of the practicability of burning pulverized fuel and of the efficiencies obtained even with low-grade fuel, but there is still a dearth of actual data showing the fixed charges and the operating and maintenance expenses involved. The advent of pulverized coal has stimulated strong competition on the part of multiple-retort and traveling-grate stokers, which are still the mainstay of all central stations. Efficiencies are being obtained with low-grade Western fuel on forced-draft chain grates which are comparable with the performance of forced-draft stokers burning Eastern fuel. Brush-shifting alternating-current motors have been applied for stoker drive, but there is still opportunity to improve greatly the means of utilizing alternating current for such service.

Considerable attention is being given to boiler furnace construction which will conserve heat and reduce maintenance. Excellent results are reported with high-temperature furnace insulation in firebrick form which will withstand a pressure of 40 lb. per square inch at 1,900 deg. F. without shrinkage. Attention is also being given to the possible use of new materials that will reduce maintenance cost and increase operating efficiency. The value of air or water cooling as well as of high refractory bricks around the fuel and clinker line of furnace side walls is quite generally recognized. The development of low-pressure forced-draft stokers with liberal air space has been undertaken. New boiler and furnace designs have been developed during the past year in which particular consideration was given to fuel characteristics, furnace volume, excess-air requirements for complete combustion ahead of the tubes, etc. Curved or sectional walls have been employed to allow expansion, while brick roofs and side walls have been supported on girders to relieve the furnace walls of excess pressure. To allow greater gas velocities baffles have been rearranged and remarkable improvement has thus been achieved.

One of the most radical departures in furnace arrangement was made in the past year at one of the Detroit plants by placing thirteen retorts which are the equivalent of twenty-six ordinary retorts under type W Stirling boilers having 23,650 sq.ft. of heating surface apiece. The stokers have tuyères, grate bars and side walls that move parallel to the coal feed.

*Boilers and Economizers.*—Several manufacturers report having given serious consideration to the adaptation of boilers to higher steam pressures and temperatures. One company furnished some remarkable boilers designed for 350-lb. operation for the Waukegan plant, the superheaters being placed between two banks of

boiler tubes instead of in the last pass, as has been the practice before. Boilers for one of the Ohio plants of the American Gas & Electric Company will have to operate at 500 lb. pressure. The highest pressures for which boilers have been ordered is 600 lb.

In the design of boilers the radiant heating surface is being increased where possible. Double-deck construction is being used in central stations not employing economizers. Where economizers are used the pressure type are being provided consisting of modified boiler head sections having one pass and operating on the counterflow principle with high-gas velocity. Radiant-type superheaters and steel-tube cast-iron shell economizers have come into more prominence during the last year.

The establishment and maintenance of a heat balance is being given more attention, an automatic method for performing this function having been developed which is applicable to duplex-driven auxiliaries and is actuated by the feed-water temperature. The load is automatically divided between the motor and turbine drive.

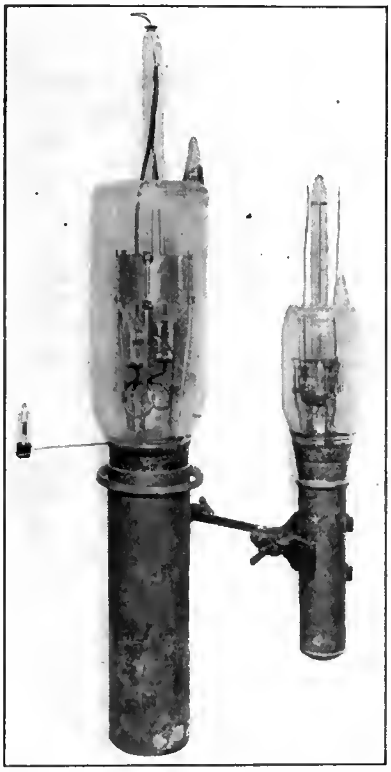
*Turbo-Generators and Auxiliaries.*—Elimination of causes of past turbine trouble, the development of record-breaking sizes, provision for bleeder or mixed pressure operation and acceptance of orders for turbines operable at the high steam pressures previously mentioned are the outstanding features of turbine development during the past year. The difficulties experienced with buckets and wheels due to axial vibration and the approximate coincidence of four-node and six-node critical speeds with the operating speeds have been carefully studied and have been overcome. Among other improvements which have been made are the provision of removable and replaceable low-pressure nozzles, improvement of nozzle partitions, provision of steam-sealed labyrinths with non-corrodible teeth, the use of cast-steel valve casings and turbine heads for temperatures of 450 deg. F. and greater, the elimination of vertical joints in high-pressure casings, and the redesign of emergency governors which permits testing them without disconnecting the generator from the line.

Another large turbine manufacturer reports that it has prevented leakage of steam past the turbine blades by new type of shroud ring and has avoided excessive blade lengths by low-pressure bleeding. Multiple-stage bleeding is coming into greater use for feed-water heating even in the smaller size units, a new line of bleeder or mixed-pressure condensing turbines having been developed for ratings of 500 kw. to 3,500 kw., 3,600 r.p.m.

The most remarkable steam turbines for rating are the single-case units being constructed for the Brooklyn Edison Company, which are rated at 62,500 kva. The 35,000-kw. base-load turbines which are being built for the American Gas & Electric Company to operate at 500 lb. pressure and 725 deg. F. are unapproached by any other turbines on order so far as pressure and temperature are concerned.

As mentioned previously, water-power development has been more active during the past year than ever before, one manufacturer alone having had three-quarters of a million horsepower of water turbines under construction or on contract at one time. One outstanding development of the past year is the turbo-type impulse wheel for heads of 800 ft. to 1,000 ft. Most of the innovations in hydro-electric development, however, like high-head reaction wheels, propeller-type wheels, submerged wheels, new developments in draft tubes, siphon type spillways, etc., were made more than a year ago; but numerous improvements have been made therein during the past year, and the apparatus has found application which proves the value of these developments. For example, practically continuous operation for eighteen months of the 25,000-hp. vertical reaction turbine at Kern River No. 3 under a head of 810 ft. has successfully demonstrated the practicability of this type of turbine. This is further evidenced by the fact that the Portland Railway, Light & Power Company has recently ordered a 35,000-hp. Francis-type turbine which will operate under a head of 850 ft. The Caribou development, involving 32,500-hp. turbines operating under 1,008 ft., has been in operation one year, and at least two projects are under development with heads exceeding 1,200 ft.—both in California, one on the American River, the other on San Gorgonio Creek. The 28,000-hp. water turbines for the Manitoba Power Company are remarkable as the first installation of very large size of the new propeller-type of wheel, while the installation at Mitchell Dam, Alabama, will be unique because of its backwater suppressor.

**Vacuum Tubes for Power Applications**



The year has witnessed the development of a 1,000-kw. power tube. View of a 100-kw. power tube recently produced.

For rating the 65,000-kva., 1,200-volt, 25-cycle water-wheel generators for the Niagara Falls Power Company have the record. These units have an auxiliary generator between the main unit and the exciter supplying auxiliary power and will be guaranteed to operate at 97.8 per cent efficiency at 90 per cent power factor, full load. An unusual application is being made for the Tallassee Power Company, involving a 31,250-kva., 60-cycle, 13,200-volt generator which will be placed on top of an existing 18,000-kva., 30-cycle generator, all to be driven from one waterwheel, to supply separate sources of electric power or serve as frequency changers.

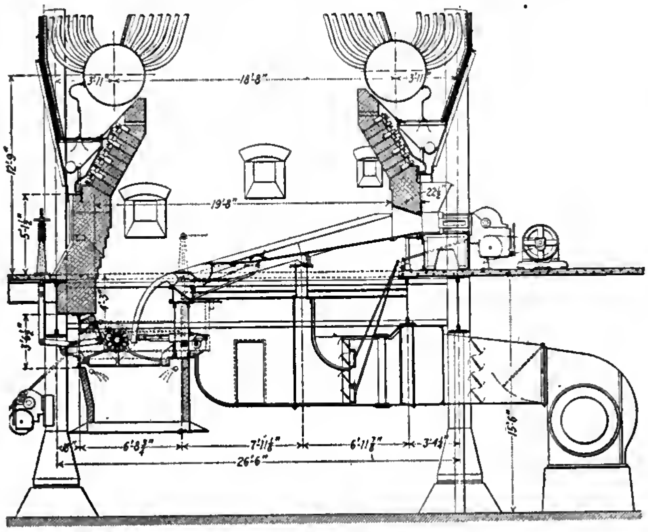
Various applications of automatic control to small hydro-electric plants containing synchronous equipment have been made. This seems to be one means whereby small remote hydro-electric power can be developed economically and interconnected with existing systems.

Improved grades of sheet steel for generator armatures have been developed, one company announcing that a new steel has been developed which reduces iron losses 25 per cent. Improved forms of ventilation at high speeds are also reported by this company and another.

Owing to the large volume of air needed for ventilating large steam turbo-generators and the necessity of reducing fire hazards, closed-circuit ventilation has gained in popularity. For use with this system a modified form of air washer and cooler has been developed during the past year and inert gases have been introduced for smothering fires.

*Switching and Protection.*—According to the reports received from manufacturers, there was an unusual amount of development in oil circuit breakers, relays, instrument transformers, reactors, lightning arresters, disconnecting switches and air and oil-break switches for outdoor use. Greater ruggedness and better design of contact mechanisms made marked changes for the better.

## Bigger Boilers and Furnaces Used



The year has witnessed an increase in the size of boilers and volume of combustion chamber. A section of furnace and stoker for type W Stirling boilers.

Isolation of phases and electrical and mechanical interlocking of disconnecting switches and circuit breakers was extended in the year, at least in stations of the larger size. No definite opinions have been expressed yet regarding the minimum size of station in which phase isolation and interlocking can be economically applied, nor has a definite decision been reached on vertical versus horizontal phase isolation. As mentioned previously, the developments have been influenced chiefly by the tendency to concentrate energy production and transmission and to obtain more reliable service.

*Circuit Breakers.*—Circuit breakers rated at 220,000 volts are in service, and extensive tests have been conducted on electric service systems which afford data to enable intelligent modification of circuit breakers which will adapt them to more severe duty. At present there seems to be some delay in coming to a decision regarding the number of "shots" for which circuit breakers shall be rated, but it is hoped that the differences of opinion will be removed soon. Considerable attention is being given to the rupturing capacity of oil circuit breakers, one manufacturer reporting circuit breakers which have resilient tanks, oil separators, four-break contacts, inverted brushes and vertically laminated bridge arms to facilitate alignment and contact. This company is also investigating the value of eight breaks in series, arcing tips, operation at higher speed and the ejection of gases caused during rupturing. Truck-type switchboards are becoming more popular and a new unit-type switchboard is announced which possesses nearly all the merits of the truck board and some others.

*Relays.*—There is a greater tendency to relieve operators of functions which relays and automatic control equipment can perform better. For example, a thermal relay with two operating points has been developed to reduce the number of shutdowns from overload by automatically changing the load-limit setting. When the first limit is reached the second limit is automatically established; when this is reached the relay operates to shut down the equipment. The same company has developed a field relay and a field-building relay, an overload-discriminating device and an improved mechanism for operating circuit breakers. The field relay is provided with a copper damper to prevent drop-out with momentary reduction in the field current. The field-building relay permits rapid building up of the field by shorting a part of the field resistance until a predetermined voltage is attained. Overload discrimination has been made possible by using an inductive shunt which sends current through a bucking bar that operates to open the circuit breaker when the rise of current is rapid, as during short circuits. The new circuit-breaker, operating mechanism utilizes the stored energy of a rotating mass, thereby reducing the amount of power required. It is particularly applicable to reclosing circuit breakers which must function a number of times in succession.

For automatic station operation another manufacturer has developed a polarity-directional relay, an induction over-current relay with auxiliary current scale and a sectionalizing relay of the impedance or distance type.

*Instrument Transformers and Regulators.*—Several developments in instrument transformers have been made, notably a heavy-current through-type transformer for 300 amp. to 2,500 amp., interchangeable high-side, dry-type current and potential transformers and oil-immersed weatherproof current and potential transformers up to 300 amp. for pole mounting, and a two-stage current transformer with a one-turn primary. The latter is asserted to be indestructible by short circuits, and its accuracy is equal to that of the best multi-turn type.

For close regulation of voltage an induction-type regulator has been developed with a new magnetic type of brake which is noiseless and quick-acting.

*Reactors.*—Causes of reactor trouble have been studied very carefully during the past year with a view to ascertaining the remedies, and the results have been very satisfactory. Thermal and mechanical stresses during short circuit are well under control despite the fact that electromagnetic stresses may reach 700 tons. Some small, rugged, efficient, semi-porcelain-clad reactors have been developed with generous conductor cross-sections and better ventilation which have withstood rain tests at 28,400 volts. Single-phase and three-phase feeder reactors have also been improved and developed. The protecting value of reactors in extensive electric service systems seems to be firmly established, and even smaller companies are using them without materially affecting the regulation, losses or power factor.

*Supervisory Control.*—With a tendency toward automatic generating stations and substations and the necessity for system operators to keep closely in touch with conditions over the entire system has come the development of two types of supervising control. One, the selector type, is for use where few operations per

station are required and the system is extensive. It utilizes three telephone wires between stations. Impulses sent out from the system operator's office operate selectors in the remote station and in turn perform specific operations which are reported by means of red or green signal lamps through the medium of auxiliary switches. The second type, known as the distributor system, is employed within a radius of 20 miles of the central office and where a large number of operations is involved. Distributors in each one of the stations as well as the central office operate in synchronism, giving positive or negative impulses that operate relays and auxiliary switches on the apparatus controlled. Operation is reported by auxiliary switches actuating the distributors. Four wires are essential between stations.

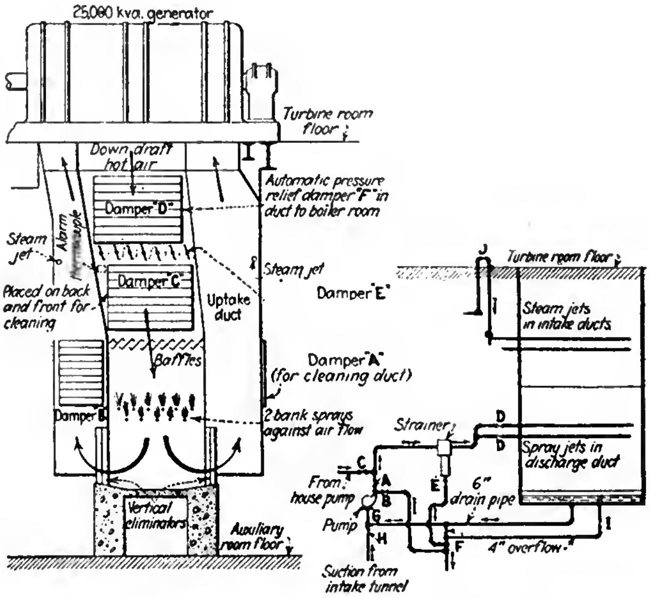
*Outdoor Switches.*—Developments in outdoor switching equipment consisted chiefly of improved air-break and disconnecting-switch construction, with remote operating mechanisms therefor. A combined oil-and-air-break switch has been developed for outdoor use on light loads which is capable of breaking the charging current of long lines. Failure of the oil pot would not ground the circuit, it is claimed. Some of these switches are being used on the Pacific Gas & Electric Company's lines. Another novel liquid-break switch for pole-top mounting has been developed the contactor of which is operated by tilting the container. Some units of this type are in service in the Middle West. The manufacturer has also developed an improved three-phase, vertical-break, double-throw air-break switch with self-aligning contacts, arcing rollers and sleet hoods. The entire switch is a unit instead of being made up of sections. Besides this an outdoor fused disconnecting switch in which the fuse is bridged by a porcelain tube has been developed. Another group-operated outdoor disconnecting switch, the three elements of which can be mounted one above the other in a vertical plane and interlocked with the oil circuit breaker if desired, has been developed for ratings up to 800 amp. and 150 kv. The manufacturer has also developed an outdoor grounding switch which can be operated by remote control if desired. Remote control mechanisms, operable on alternating current or direct current, are available with overload tripping devices if desired. Another motor-operated mechanism for high-tension disconnecting and air-break switches, suitable for remote control, is also available. "Disconnects" with only two insulators per phase instead of three have been marketed. The expulsion-fuse type disconnecting switch is available for ratings up to 7,500 volts and 200 amp. and is capable of rupturing 2,000 amp. The manufacturer claims that these switches have functioned satisfactorily up to 20,000 kva.

Expulsion fuses for 66-kv. circuits and air-break switches for 100 kva. and above are available.

*Lightning Arresters.*—Only one distinctly new type of arrester has been reported this year, namely, the "autovalve," which requires no charging. Where used for protection of distribution transformers it has been so successful that it is being extended to station protection. Operating data should now be available on the oxide-film type of arrester. The compensated-disk gap and flash-rod types of lightning arresters reported last January have been applied during the past year. The demand for the former has extended to the lower-voltage field. Three new designs have been made, one for 600-volt direct-current service, one for 2,300-volt service and one for steam-railway signal circuits.

*Line Supports and Insulators.*—The large amount of high-tension transmission and interconnection undertaken during the past year and the effect of the severe sleet storm in New England a year ago have enlarged the circle of interest in the design of line supports. The question has arisen in various quarters whether tower-design practices will have to be revised in so far as stiffness formulas, safety factors and assumptions of broken wires are involved. In general it is not believed that it is economical to design towers which will stand such severe sleet storms as the one last year unless a weak link is placed somewhere between the line support and the conductor itself to relieve the stress under abnormal conditions. The relative values of painting and galvanizing are again up for reconsideration. A manufacturer of expanded steel poles announces that larger sections are available for heavier loading and that precast foundations and easily attachable arm fixtures can be provided.

## Closed-Circuit Ventilation




The inclosed system of ventilation is extending and the year has witnessed the introduction of air washers and also the use of inert gases for fire-extinguishing purposes.

The most notable high-tension lines undertaken during the last year are those of the Southern California Edison, the Pacific Gas & Electric and Great Western Power Companies. The first two will operate at 220 kv. and the latter at 165 kv. The construction which facilitates these supervoltages is being rapidly completed.

While there was apparently considerable investigation of the insulator problem during the past year, very little is reported by manufacturers. In general standard disks of extra large diameter and strength are being used on a supervoltage line, sometimes with grading shields or high-capacity disks next to the line. No radical innovations have been made in insulators, the chief development being refinement in details of design and manufacture. Drop-forged caps have been adopted for 10,000-lb. and 18,000-lb. standard and heavy-strength units, the 18,000 lb. units being provided with heat-treated vanadium-steel connecting pins. Insulators with this improvement are being used extensively on the largest systems, including 220,000 volts. The manufacturer reports it is using the vacuum process of producing in-

sulator clay to eliminate air content, to secure greater homogeneity and to increase the possibility of making a greater variety of shapes. Gratifying results have been reported with link-type insulators.

In the past there have been a great variety of insulator test methods favored by operating companies. Recently several companies which have used the 60-cycle flashover or high-frequency tests have adopted the overpotential test. Various studies of insulator deterioration are being made including the effect of weathering.

*Transformers.*—Unprecedented production of all classes of transformers took place during the past year, more transformers of 10,000 kva. and higher ratings being ordered and constructed than during all the preceding years combined. The most recent development has been to leave some space over the oil in the top of the tank and provide means for keeping it filled with nitrogen gas. This not only prevents oil fires but reduces oxidation of the oil, serves as a buffer in case sudden pressures occur within the tank, and also saves filling the tank entirely with oil. This feature will be incorporated in a 25,000-kva. bank of transformers to be furnished to the Middle West Utilities Company.

The ratings of transformers have been going up and up. For example, a 36,700-kva, 50-cycle, single-phase auto-transformer rated at 150/220 kv. will be installed by the Southern California Edison Company. The manufacturer of this transformer will furnish the Japanese government with a 21,000-kva., 50-cycle, single-phase transformer rated at 66/150 kv. To make it possible to tie together two 50-kv. systems and adjust the exchange of energy, a 15,000-kva., three-phase 48-64/48-60-kv. transformer has been equipped with a ratio adjuster which can be remotely controlled. For dimensions probably the 20,000-kva., 50 cycle, 220/72-kv., single-phase water-cooled transformer which is being constructed is the largest.

To remove objectionable triple harmonics a 5,550-kva., 50-cycle auto-transformer rated at 220 kv.Y/150 kv.Y has been constructed for the Southern California Edison Company with a tertiary winding. It will be used to interconnect lines on which no lightning arresters are installed. The Southern Power Company will install an 18,750-kva., 60-cycle, 102/66-kv., three-phase transformer which will have a continuous rating of 25,000 kva. A rather unique transformer having three windings for simultaneous operation has been constructed which is rated at 12.000 kva., 60 cycles, 44-13.6/23-40-kv., three phase, with 50 per cent overload for two hours. One of the windings is rated at 12,000 kva. at 44 kv., another at 8,000 kva. at 13.6 kv., and the third at 4,000 kva. at 4 kv. The manufacturer announces that ratio adjusters are being applied to larger-size transformers, these devices having been standardized for currents up to 500 amp. and modified for 1,250 amp. at 13.2 kv. and for 2,200 amp. at 150 kv. One-million-volt testing equipments have been constructed for test purposes. One of the sets, consisting of four 250-kva., 250-kv. transformers, has been built for the California Institute of Technology.

To facilitate the cooling of transformers where water is scarce forced-draft radiators have been developed on which low-pressure air jets can be directed. The manufacturer has also developed an indicating and signaling flow device for water-cooled transformers which is positive, simple and strong in action, utilizing the Venturi-tube principle to actuate a rubber diaphragm. This company is also manufacturing a portable electrically heated centrifugal oil drying and purifying outfit and has extended the use of welded tanks to distribution transformers of 10 kva. to 100 kva. rating.

While pressed-metal tanks are not new, one manufacturer has announced that they are being employed for all distribution transformers.

*Substations.*—In the substation field the major development has been the application of automatic control to alternating-current feeders. Kansas City furnishes a good example of such a station having two or more incoming feeders with two or more banks of transformers and the usual number of outgoing feeders, all automatically controlled. In three-wire motor-generator substations the latest development is the application of automatic control for cutting in a differential field to protect the sets during overload. Automatic control has also been extensively applied in the coal mines, and notably by the Star Coal & Coke Company, where two unit motor-generators are installed with reclosing circuit breakers on the feeders. Among other examples of the application of automatic control is the installation of the Penn Public Service Company, where automatically controlled 5,000-kva. synchronous condensers are in successful operation.

### NEW AUTOMATIC EQUIPMENT PRODUCED

In applying automatic control to substations many automatic features which have been made a part of modern manually operated stations have been incorporated, but new devices have had to be developed also. Among them are direct-current and alternating-current reclosing circuit breakers and slip relays of the balanced type. The latter will perform the switching operation when a synchronous motor pulls out of step. The high-reluctance commutating-pole 60-cycle converter is an accomplishment of the past year. It incorporates flash barriers and a new design of brush holder which covers only a small portion of the commutator periphery, reduces flashing and makes the brushes readily accessible. The adjustable notching relay which functions after a predetermined number of operations is another development which has enabled automatic control.

Among other pieces of apparatus which have been developed for substation use and are particularly interesting are some synchronous condensers with two ratings—namely, 30,000 kva., 7,920 volts, 60 cycles, 600 r.p.m., or 25,000 kva., 6,600 volts, 50 cycles, 500 r.p.m.—for the Department of Public Service of Los Angeles. There are also the 30,000-kva., 6,600-volt, 50-cycle, 600-r.p.m. synchronous condensers for the Southern California Edison Company, the 35,000-kva frequency changers for the Brooklyn Edison Company, the 20,000-kva. synchronous condensers for the Pacific Gas & Electric Company, and synchronous motors for 100 and 80 per cent power factor in sizes of 50 hp. to 2,000 hp. and with speeds of 327 r.p.m. to 1,800 r.p.m. Sturdy static condensers have also been developed in power sizes.

A new automatic series cut-out for street-lighting circuits has been developed which is simple, requires no adjustment and involves carbon gaps and solenoid-operated contacts.

*Meters.*—Considerable attention has been devoted to demand meters during the past year, one for measuring kva. demand comprising two polyphase elements geared so that the energy component actuates the stylus while the reactive component controls the motion of the chart. Another is composed of ordinary watt-hour meter elements, one set of which is operated proportional to

the kilowatt-hours and the other proportional to the kilovolt-ampere-hours. The shafts operate a pantograph. The manufacturer has also perfected a remote indicating and recording instrument operated by impulses and utilizing ordinary telephone or telegraph wire for the connecting link. Distance will have no effect on its accuracy, it is claimed.

Watt-hour meters with bottom terminal chambers adapted to safety cabinets have been developed in 5, 10, 15 and 25-amp. sizes for two-wire and three-wire, 110-volt and 220-volt circuits. All have the same dimensions. The same company has developed a demand attachment for watt-hour meters to indicate the fifteen-minute demand and total kilowatt-hours consumed during any given period.

*Illumination and Lighting.*—Extensive investigations have been conducted during the past year on illumination matters, such as the extent of electric sign advertising, legibility of electric signs, overcoming daylight reflection in show windows, revision of motor vehicle headlamps to comply with legal requirements, the adequacy of street lighting, attracting power of show-window lighting, improvement in optical elements for motion-picture projectors, school lighting, and the effect of artificial light on plant growth. It has been found that only about 3⅓ watts is used for electric advertising per capita, or 5 kw.-hr. per year per capita. By using 1,000 foot-candles to 2,000 foot-candles for illuminating the inside of show windows the effect of daylight reflection can be overcome. The survey of street-lighting practice seems to indicate a tendency toward three to ten times the previously prevailing intensity. As regards the attracting power of light it was found that 40 foot-candles is 33 per cent more attractive than 15 foot-candles and 100 foot-candles is 75 per cent more attractive than 15 foot-candles.

Among the outstanding developments in the illumination field have been the "glassteel" diffuser, the 75-watt white diffusing-bulb, gas-filled incandescent lamp, the 1,000,000-lumen incandescent lamp, the 25,000-lumen gas-filled incandescent lamp for street lighting, the 250-watt concentrated-filament lamp for projection work, a new spray coating for coloring lamps, and improvements in luminous arc-lamp electrodes.

The "glassteel" diffuser is a modification of the RLM reflector. It has an enameled-steel reflector and a glass diffusing globe which together enable some light to be directed at the ceiling. It is adapted to clear gas-filled lamps, producing a brightness of only 2 cp. to 5 cp. per square inch with an efficiency of 65 per cent. It is made in two sizes—18 in. for 100, 150 and 200-watt lamps and 20 in. for 300-watt and 500-watt lamps.

The new spray coating for coloring lamps is practically permanent, cleanable and a good diffuser of light, thereby broadening the field of color lighting.

The new electrodes for luminous-arc lamps are compressed square or oval cross-sections, made in such a way as to increase the life and efficiency. Luminous-arc lamps are still being used extensively for the highest-class illumination, notably in Detroit, Salt Lake City, Buffalo, Toledo, Philadelphia and Pittsburgh.

White-way lighting is extending to business districts, residence streets, parks, boulevards, etc. The totally inclosed semi-indirect prismatic glassware for street lighting is a development of the past year which gives a smooth surface and sharp slope, preventing dust accumulation. The East Cleveland street lighting is a notable example of modern lighting. On residence streets 150-watt gas-filled lamps, staggered 250 ft. on centers, are used; on thoroughfares, 1,000-cp. gas-filled lamps are placed 280 ft. on centers. One-piece rippled-glass globes are used in baskets with porcelain-enameled reflectors and dome prismatic reflectors. On thoroughfares crystal glass is used and on residence streets opal glass. Lamps are fed in multiple from back-of-lot lines.

*Electric Ovens and Furnaces.*—A notable expansion has occurred during the past year in the use of electric heating devices for industrial processes, particularly in heat treating of metals, baking enamels and foundry cores. Small and medium-size ovens with 275 cu.ft. to 1,000 cu.ft. capacity for operation at 100 deg. F. have been developed, and furnaces have been built for baking vitreous enamel on bathtubs with absolute temperature control and freedom from gases and fumes. Electric ovens and low-temperature electric furnaces have also been extensively applied during the past year for melting non-ferrous metals, as well as for heat-treating ferrous metals.

In the higher-temperature furnace field a start has been made in applying large electric steel refining and superheating furnaces in conjunction with blast furnaces by using a Bessemer furnace between them. The possibilities with this combination deserve more study. There is also an opportunity for improvement in quality and saving in metal loss by considering the electric furnace in melting ferro alloys before they are added to the open-hearth furnace.

### ELECTRICITY USED UNDER BOILERS

*Electric Steam Boilers.*—Equipment for generating steam with electric power has aroused interest in various parts of the country, especially where fuel is scarce and surplus water power is available at a low rate. High-tension electric steam generators of the kind announced last January have been installed to the extent of 150,000 kw. in the past year and are operating at 99 per cent efficiency, according to the manufacturer. One big advantage of such boilers is their lower first cost compared with fuel-fired boilers and their flexibility and ease of control. Another electric steam generator has been developed which is also extremely simple, reliable, compact and high in efficiency. Its chief difference from those previously developed is a separation of the steam generating space from the hot well and the provision of adjustable circulation between the two which enables regulation for steam demand and energy input and facilitates forcing.

*Welding Equipment.*—A new constant-current set, a constant-potential set and two portable welding outfits are announced. The constant-current machine is now being tested, but the constant-potential machine, which is rated at 400 amp., is already available. The latter has three resistors (two for metallic and one carbon welding) which permit three separate or combined operations to be performed simultaneously. One portable welding set is driven by a gas engine, and the other is a semi-automatic set which allows the operator to direct the arc but still retains the continuous feed. The demand for more rapid deposition of metal in arc welding has influenced the use of larger metal electrodes and higher currents, namely, 300 amp. and larger.

*Industrial Heating.*—Electricity as a source of heat for industrial plants has also been employed during the last year, notably by the Canadian Cottons Company.

*Motors and Control.*—Several interesting motors and speed regulators have been developed, but the principal

progress has been made in perfecting the applications of motors and control apparatus to various industrial processes, among which are paper making, calendering, newspaper printing, metal rolling and reeling, woodworking, textile manufacturing, hoisting, refrigeration.

A synchronous motor with high starting torque and an induction motor with a rolled sheet copper rotor winding are two outstanding motor developments. Both the stator and the rotor of the synchronous motor can revolve. In starting, the stator is allowed to revolve, then the field is applied, and a band brake is gradually applied to the stator, thereby bringing the rotor up to speed. With this arrangement a starting torque equal to the pull-out torque of the motor can be obtained. The motor is economical of space, avoids clutches and extends the field of application of synchronous motors. The induction motor with the rolled sheet-copper rotor winding has a very high starting torque per ampere, owing to the skin effect of the rotor during starting. The open-slot construction employed does not appreciably increase the no-load current, and the zig-zag leakage is reduced.

A new line of induction motors which can be started on full-line voltage without a starting compensator or excessive starting current is available. The change in secondary resistance is automatic so that it is particularly adapted to push-button starting. Owing to the high-starting torque it can, according to the manufacturer, be selected for full-load running conditions instead of starting torque.

Ball-bearing, polyphase, squirrel-cage and slip-ring motors have been announced which have high power factor and operate silently even with a large number of poles. Another high-power-factor, constant-speed, high-torque motor has also been announced. Rugged construction is provided by an exceptionally large shaft and bearings and a dust-proof housing. The coils are wound in phase groups without connections and are impregnated with insulating compound. Adjustable connection blocks and pull boxes are provided which are adapted to either solid or flexible conduit. The fan blades and improved ventilating path give promise of low temperature operation. For machine-tool drives a multi-speed motor has been developed which has four separate windings.

The "thermaload" starter which was announced last year has been extended in use. Since it automatically resets itself after each tripping it is limited to use with momentary-contact switches, but it is now furnished with hand reset if desired.

For sectional drive where exact speed ratios must be maintained between individual-motor drives a direct-current motor-speed regulator has been developed which involves a mechanical differential attached to the two drives which must be kept in unison. A contactor is operated by the differential if there is any change in the speed ratio, and this actuates a vibrating-type relay which applies full corrective power for speed readjustment. Tests on this regulator, using 100-hp. motors, showed that correction for 100 per cent load change could be made in two seconds.

*Paper.*—Improvements have been made in sectional paper-mill drive and control by two companies which greatly simplify the drive and control and make it more effective in operation. One sectional paper-mill control involves a voltage regulator for each section so that any change in load speed will automatically and instantaneously apply full corrective power to the drive involved. For maintaining constant speed relationship between the various sections, dependence is placed on a synchronous motor tie-in with the main drive. Two contact disks are driven by the synchronous motor and the main drive respectively. These contacts rotate in the same direction, making and breaking contact at a rate depending on the angular displacement between the two disks. The making and breaking of the contact either short-circuits or inserts resistance into the direct-current motor field, thereby maintaining a fixed speed on the direct-current motor. Paper-calender drive and control has been perfected by utilizing a new commutator-type frequency changer to supply the motors when threading in the paper.

Full-automatic, direct-current control for large newspaper presses has also been developed which can operate three octuples, four sextuples, or four decuples and a quadruple. It has a simpler and more substantial pilot motor and pilot switch than formerly.

*Steel Mills.*—Improved control of cold-roll strip reels and rod reels have been reported. The first involves a generator driven by the last stand of rolls; this supplies power to the motor driving the reel. Across the field resistance of this motor is a voltage regulator controlled by the armature current. This combination maintains constant torque and consequently constant tension.

In the control of rod reels, an example of which exists at the Minnesota Steel Company's plant, a small alternating-current generator is driven by the main motor and another by the reel motor, the two driving a mechanical differential which operate a vibrating-type relay if their relative speeds change. This relay acts to increase or decrease the field on the reel motor.

*Wood and Machine Tools.*—In the woodworking and machine-tool fields there is a tendency toward using built-in direct-connected motors. To obtain the high speeds necessary induction frequency changers must be used in some cases. A wood molder having four motors for the cutting head and one four-speed motor for the feed has been developed. The head-drive motors are operated at 3,600 r.p.m. All five motors are controlled from one case, starting Y and running delta. Overload on any one motor will shut down all.

*Hoisting.*—Hoist and crane developments are reported by three manufacturers. One refers to a flywheel balancer set controlled by a current regulator which helps carry the peak loads during intermittent hoisting and stores energy between demands. This is being used by the Lehigh Valley Railroad at Jersey City. Where heavy-duty cycles are encountered in hoisting it is customary to use mill-type motors. Where hoist motors are liable to be abused the tendency is to use automatic control.

For general purposes unit-type portable hoists in half-ton and ton sizes are available for 25-ft. lifts at the rate of 25 ft. per minute. An improved crane brake is available which has interchangeable parts and easily adjustable brakeshoes.

Multi-voltage elevator control and micrometer leveling for passenger elevators has found increasing application during the past year.

*Miscellaneous.*—Among other remarkable electrical developments during the past year are the pallophotophone (or photographic recording and reproduction of sounds), carrier-current interstation communication, large electron valves, machine switching for telephone service, electric propulsion of ferryboats, and renewed interest in steam-railroad electrification, especially in foreign lands.

# The World's Consumption of Electrical Energy

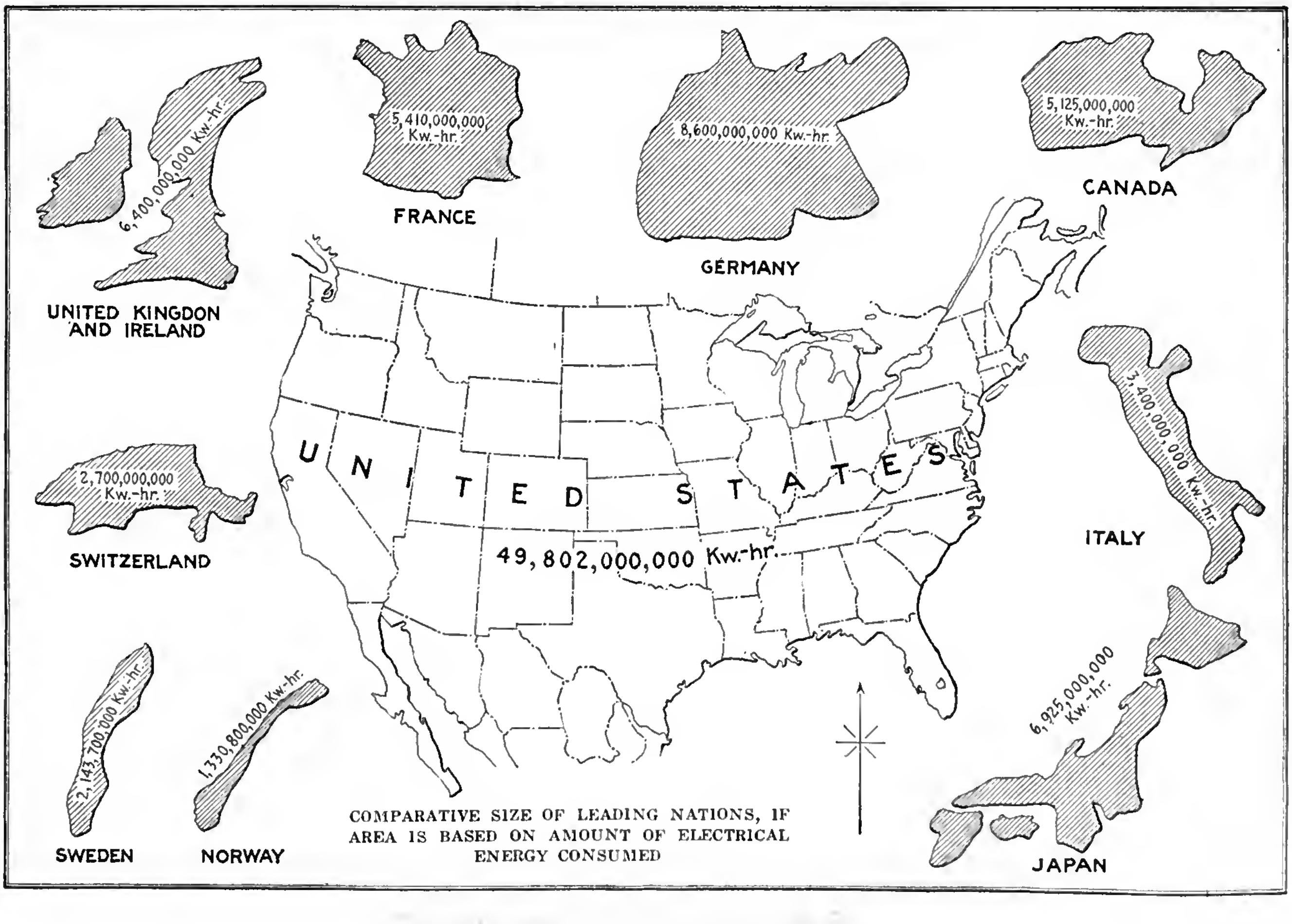
The United States Leads All Nations in Total Energy Consumption, but Switzerland Leads in the Consumption per Inhabitant—Total Generator Rating Placed at 46,427,690 Kw.

ELECTRICAL energy as a source of light, heat and power has woven itself into the domestic, business and commercial fabric of the world as few other forces of all time have done. From the frigid regions to the equator and from the Occident to the Orient nations are vying with each other in the electrification of their factories, mines and railroads and in the electric lighting of their homes. Peoples which are slow to adopt customs of other lands are adopting electrical energy with enthusiasm, until it may be stated with confidence that the central station bids fair to be the great equalizer of the world.

In an endeavor to ascertain the present status of the electrification of the nations in both hemispheres, the ELECTRICAL WORLD sent requests to the American diplomatic representatives in all foreign countries asking for certain data relative to the consumption of electrical energy in these countries for light and power during 1920. Foreign governments co-operated, and replies were received which made possible the presentation of the detail figures in the accompanying table. The world in 1920 consumed a total of 99,456,300,000 kw.-hr. of electrical energy, or at the rate of 57.8 kw.-hr. per inhabitant. Of this amount, 15,183,300,000 kw.-hr., or 15.3 per cent, was consumed for lighting purposes, and 84,273,000,000 kw.-hr., or 84.7 per cent, was used in the industrial activities of the world. It is probable that the energy generated by the steam and hydro-generating plants of the world totaled about 115,000,000,000 kw.-hr. during 1920.

It is estimated that of the 1,720,000,000 inhabitants of the world, only 111,822,000, or 6.5 per cent, are living in electrically lighted dwellings. There is estimated to be a total of 25,349,000 central-station customers, but it must be remembered that this does not in any way represent the total number of consumers of electrical energy, since there are many thousands of private plants making it for their owners' use.

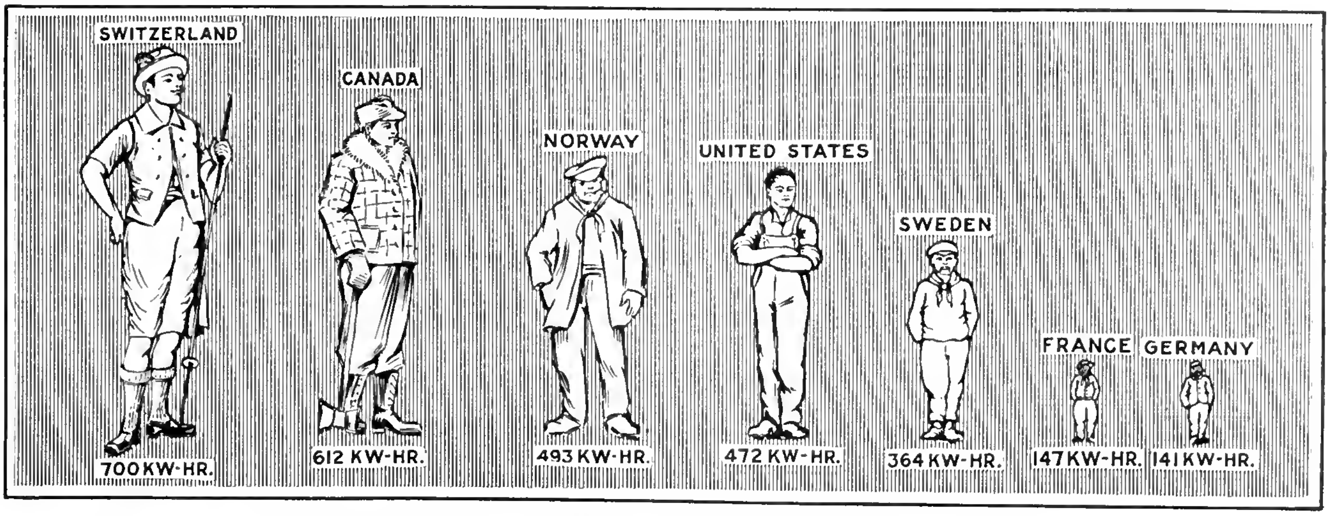
The huge output of electrical energy was made possible by an estimated generator installation of



COMPARATIVE SIZE OF LEADING NATIONS, IF AREA IS BASED ON AMOUNT OF ELECTRICAL ENERGY CONSUMED

# Consumption of Electrical Energy by the Various Nations of the World

| Country | Population | Dwellers in Electrically Lighted Abodes 1920 | | Total Number of Central-Station Customers | Electrical Energy Consumption | | | | Water Power | | | Electric Generator Rating | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Fuel-Burning Plants | | Hydro-Electric Plants | | |
| | | Number | Per Cent of Total Population | | Lighting, Kw.-Hr., 1920 | Power or Power and Light, Kw.-Hr., 1920 | Total Electrical Energy Consumed, Kw.-Hr., 1920 | Kw.-Hr. Consumed, per Inhabitant | Potential (Minimum), Hp. | Developed Hp. | Per Cent of Total Developed | Rating, Kw. | Per Cent of Total | Rating, Kw. | Per Cent of Total | Total Generator Rating, Kw. |
| Totals for world | 1,720,000,000 | 111,822,000 | 6.5 | 25,349,000 | 15,183,300,000 | 84,273,000,000 | 99,456,300,000 | 57.8 | 439,000,000 | 23,695,080 | 5.4 | 30,192,480 | 65.4 | 16,235,210 | 34.6 | 46,427,690 |
| Totals for North America | 145,000,000 | 43,065,000 | 29.7 | 10,608,000 | 7,536,100,000 | 47,776,700,000 | 55,312,800,000 | 382.2 | 62,000,000 | 12,866,380 | 20.8 | 18,941,000 | 70.4 | 7,969,000 | 29.6 | 26,910,000 |
| Totals for South America | 61,000,000 | 2,915,000 | 4.8 | 68[illegible],000 | 290,000,000 | 705,000,000 | 995,000,000 | 16.3 | 54,000,000 | 426,200 | 0.8 | 608,080 | 64.1 | 341,920 | 35.9 | 950,000 |
| Totals for Africa | 140,000,000 | 380,000 | 0.3 | 77,000 | 48,000,000 | 1,216,000,000 | 1,264,000,000 | 9.0 | 190,000,000 | 12,050 | 0.0 | 308,400 | 97.3 | 8,600 | 2.7 | 317,000 |
| Totals for Europe | 475,000,000 | 39,587,000 | 8.3 | 9,335,000 | 4,977,200,000 | 28,553,300,000 | 33,530,500,000 | 70.5 | 45,000,000 | 8,877,200 | 19.7 | 8,210,000 | 53.7 | 7,071,700 | 46.3 | 15,281,700 |
| Totals for Asia | 890,000,000 | 24,300,000 | 2.7 | 4,268,000 | 2,185,000,000 | 5,845,000,000 | 8,030,000,000 | 9.0 | 74,680,000 | 1,358,250 | 1.8 | 1,690,000 | 70.0 | 723,990 | 30.0 | 2,413,990 |
| Totals for Oceania | 9,000,000 | 1,575,000 | 17.5 | 378,000 | 147,000,000 | 177,000,000 | 324,000,000 | 36.0 | 13,320,000 | 155,000 | 0.1 | 435,000 | 78.3 | 120,000 | 21.7 | 555,000 |
| NORTH AMERICA | | | | | | | | | | | | | | | | |
| United States | 105,766,000 | 39,000,000 | 36.8 | 9,598,000 | 6,870,000,000 | 42,932,000,000 | 49,802,000,000 | 472.0 | 30,500,000 | 9,540,000 | 31.3 | 18,406,000 | 76.3 | 5,724,000 | 23.7 | 24,130,000 |
| Canada | 8,370,000 | 3,200,000 | 38.3 | 800,000 | 581,000,000 | 4,544,000,000 | 5,125,000,000 | 612.0 | 20,000,000 | 2,755,980 | 13.8 | 250,000 | 11.9 | 1,850,000 | 88.1 | 2,100,000 |
| Newfoundland | 261,000 | 45,000 | 17.2 | 10,000 | 3,500,000 | 1,700,000 | 5,200,000 | 20.0 | 400,000 | 60,000 | 15.0 | 5,000 | 10.0 | 45,000 | 90.0 | 50,000 |
| Mexico | 16,767,000 | 320,000 | 1.9 | 80,000 | 32,000,000 | 237,000,000 | 269,000,000 | 16.0 | 6,000,000 | 450,000 | 7.5 | 100,000 | 25.0 | 300,000 | 75.0 | 400,000 |
| Central America, including Panama | 6,000,000 | 125,000 | 2.1 | 30,000 | 12,400,000 | 24,000,000 | 36,400,000 | 6.1 | 5,000,000 | 38,400 | 0.8 | 15,000 | 30.0 | 35,000 | 70.0 | 50,000 |
| Cuba | 2,900,000 | 300,000 | 10.4 | 75,000 | 29,700,000 | 23,000,000 | 52,700,000 | 33.0 | .......... | ......... | .... | 150,000 | 100.0 | 0 | 0.0 | 150,000 |
| West Indies, exclusive of Cuba | 4,936,000 | 75,000 | 1.5 | 15,000 | 7,500,000 | 15,000,000 | 22,500,000 | 4.5 | 100,000 | 22,000 | 14.7 | 15,000 | 50.0 | 15,000 | 50.0 | 30,000 |
| SOUTH AMERICA | | | | | | | | | | | | | | | | |
| Colombia | 5,475,000 | 125,000 | 2.3 | 25,000 | 13,000,000 | 16,000,000 | 29,000,000 | 5.3 | 4,000,000 | 25,000 | 0.6 | 30,000 | 60.0 | 20,000 | 40.0 | 50,000 |
| Venezuela | 2,848,000 | 75,000 | 2.9 | 15,000 | 7,000,000 | 11,000,000 | 18,000,000 | 6.3 | 3,000,000 | 12,500 | 0.4 | 21,000 | 70.0 | 9,000 | 30.0 | 30,000 |
| Guianas | 437,000 | 20,000 | 4.6 | 4,000 | 2,000,000 | 1,000,000 | 3,000,000 | 6.9 | 3,800,000 | 0 | 0.0 | 5,000 | 100.0 | 0 | 0.0 | 5,000 |
| Brazil | 30,491,000 | 1,000,000 | 3.3 | 200,000 | 99,000,000 | 47,000,000 | 146,000,000 | 4.8 | 25,400,000 | 250,000 | 1.0 | 50,000 | 20.0 | 200,000 | 80.0 | 250,000 |
| Argentina, Paraguay and Uruguay | 9,919,000 | 1,250,000 | 12.6 | 350,000 | 125,000,000 | 115,000,000 | 240,000,000 | 24.0 | 7,300,000 | 25,200 | 0.3 | 391,080 | 95.4 | 18,920 | 4.6 | 410,000 |
| Bolivia | 3,000,000 | 40,000 | 1.3 | 8,000 | 4,000,000 | 5,000,000 | 9,000,000 | 3.0 | 2,500,000 | 12,000 | 0.5 | 5,000 | 33.3 | 10,000 | 66.7 | 15,000 |
| Chile | 4,000,000 | 250,000 | 6.3 | 50,000 | 25,000,000 | 475,000,000 | 500,000,000 | 125.0 | 2,500,000 | 60,000 | 2.4 | 100,000 | 66.7 | 50,000 | 33.3 | 150,000 |
| Ecuador | 1,300,000 | 35,000 | 2.7 | 7,000 | 3,000,000 | 1,000,000 | 4,000,000 | 3.1 | 1,000,000 | 5,000 | 0.5 | 1,000 | 20.0 | 4,000 | 80.0 | 5,000 |
| Peru | 3,530,000 | 120,000 | 3.4 | 24,000 | 12,000,000 | 34,000,000 | 46,000,000 | 13.0 | 4,500,000 | 36,500 | 0.8 | 5,000 | 14.3 | 30,000 | 85.7 | 35,000 |
| AFRICA | | | | | | | | | | | | | | | | |
| Union of South Africa | 6,000,000 | 345,000 | 5.8 | 70,000 | 34,000,000 | ............ | 1,194,000,000 | 199.0 | 1,600,000 | 6,000 | 0.4 | 295,000 | 98.4 | 5,000 | 1.6 | 300,000 |
| Miscellaneous | 134,000,000 | 35,000 | 0.0 | 7,000 | 14,000,000 | 56,000,000 | 70,000,000 | 0.1 | 188,400,000 | 6,050 | 0.0 | 13,400 | 78.8 | 3,600 | 21.2 | 17,000 |
| EUROPE | | | | | | | | | | | | | | | | |
| Sweden | 5,885,000 | 1,000,000 | 17.0 | 225,000 | 167,400,000 | 1,976,300,000 | 2,143,700,000 | 364.0 | 4,500,000 | 1,200,000 | 26.7 | 100,000 | 10.0 | 900,000 | 90.0 | 1,000,000 |
| Norway | 2,700,000 | 575,000 | 21.3 | 125,000 | 100,800,000 | 1,230,000,000 | 1,330,800,000 | 493.0 | 5,500,000 | 1,350,000 | 24.6 | 100,000 | 9.1 | 1,000,000 | 90.9 | 1,100,000 |
| Finland | 3,330,000 | 277,000 | 8.3 | 80,000 | 50,000,000 | 54,000,000 | 104,000,000 | 31.0 | 1,500,000 | 185,000 | 12.3 | 10,000 | 8.3 | 110,000 | 91.7 | 120,000 |
| Czechoslovakia | 14,000,000 | 1,400,000 | 10.0 | 350,000 | 190,000,000 | 105,000,000 | 295,000,000 | 21.0 | 2,600,000 | 125,000 | 4.8 | 105,000 | 58.3 | 75,000 | 41.7 | 180,000 |
| Italy | 40,000,000 | 4,500,000 | 11.3 | 1,000,000 | 612,000,000 | 2,788,000,000 | 3,400,000,000 | 85.0 | 3,800,000 | 1,150,000 | 30.3 | 400,000 | 28.6 | 1,000,000 | 71.4 | 1,400,000 |
| Switzerland | 3,860,000 | 1,000,000 | 25.9 | 225,000 | 200,000,000 | 2,500,000,000 | 2,700,000,000 | 700.0 | 1,400,000 | 1,070,000 | 76.5 | 100,000 | 10.0 | 900,000 | 90.0 | 1,000,000 |
| Germany | 60,900,000 | 8,810,000 | 14.5 | 2,035,000 | 1,100,000,000 | 7,500,000,000 | 8,600,000,000 | 141.0 | 1,350,000 | 1,000,000 | 74.2 | 2,600,000 | 81.3 | 800,000 | 18.7 | 3,400,000 |
| France | 36,700,000 | 5,000,000 | 13.6 | 1,250,000 | 652,000,0000 | 4,758,000,000 | 5,410,000,000 | 147.0 | 4,700,000 | 1,400,000 | 29.8 | 750,000 | 37.5 | 1,250,000 | 62.5 | 2,000,000 |
| United Kingdom and Ireland | 46,080,000 | 7,800,000 | 16.9 | 1,750,000 | 830,000,000 | 5,570,000,000 | 6,400,000,000 | 139.0 | 585,000 | 210,000 | 36.0 | 2,800,000 | 93.3 | 200,000 | 6.7 | 3,000,000 |
| Belgium | 7,600,000 | 1,500,000 | 19.7 | 325,000 | 240,000,000 | 500,000,000 | 740,000,000 | 97.0 | small | 700 | .... | 600,000 | 99.9 | 500 | 0.1 | 600,500 |
| Denmark and Iceland | 3,362,000 | 1,000,000 | 29.8 | 205,000 | 67,000,000 | 123,000,000 | 190,000,000 | 57.0 | 500,000 | 1,500 | 0.3 | 100,000 | 98.9 | 1,200 | 1.1 | 101,200 |
| Netherlands | 6,600,000 | 925,000 | 14.0 | 190,000 | 78,000,000 | 265,000,000 | 343,000,000 | 52.0 | 0 | 0 | .... | 200,000 | 100.0 | 0 | 0.0 | 200,000 |
| Portugal | 6,000,000 | 300,000 | 5.0 | 75,000 | 10,000,000 | 9,000,000 | 19,000,000 | 3.1 | 300,000 | 12,000 | 4.0 | 50,000 | 83.3 | 10,000 | 16.7 | 60,000 |
| Spain | 20,500,000 | 2,000,000 | 9.8 | 500,000 | 200,000,000 | 800,000,000 | 1,000,000,000 | 49.0 | 4,000,000 | 600,000 | 15.0 | 125,000 | 20.8 | 475,000 | 79.2 | 600,000 |
| Miscellaneous | 217,483,000 | 3,500,000 | 1.6 | 1,000,000 | 480,000,000 | 375,000,000 | 855,000,000 | 3.9 | 14,265,000 | 573,000 | 4.0 | 170,000 | 32.7 | 350,000 | 67.3 | 520,000 |
| ASIA | | | | | | | | | | | | | | | | |
| China | 400,000,000 | 1,000,000 | 0.3 | 200,000 | 125,000,000 | 610,000,000 | 735,000,000 | 1.8 | 20,000,000 | 1,650 | 0.0 | 280,000 | 99.7 | 990 | 0.3 | 280,990 |
| India | 319,075,000 | 150,000 | 0.0 | 38,000 | 30,000,000 | 220,000,000 | 250,000,000 | 0.8 | 27,000,000 | 180,000 | 0.7 | 50,000 | 21.2 | 186,000 | 78.8 | 236,000 |
| Japan | 77,000,000 | 23,000,000 | 29.9 | 4,000,000 | 2,010,000,000 | 4,915,000,000 | 6,925,000,000 | 90.0 | 6,000,000 | 1,100,000 | 18.3 | 1,300,000 | 72.3 | 500,000 | 27.7 | 1,800,000 |
| Miscellaneous | 93,925,000 | 150,000 | 0.2 | 30,000 | 20,000,000 | 100,000,000 | 120,000,000 | 1.3 | 21,680,000 | 76,600 | 0.4 | 60,000 | 61.9 | 37,000 | 38.1 | 97,000 |
| OCEANIA | | | | | | | | | | | | | | | | |
| Australia | 5,420,000 | 1,000,000 | 18. | 250,000 | 100,000,000 | 160,000,000 | 260,000,000 | 48.0 | 620,000 | 60,000 | 9.7 | 400,000 | 89.0 | 50,000 | 11.1 | 450,000 |
| New Zealand | 1,218,000 | 375,000 | 30.8 | 80,000 | 38,000,000 | 6,000,000 | 44,000,000 | 36.0 | 3,800,000 | 60,000 | 1.6 | 25,000 | 33.3 | 50,000 | 66.7 | 75,000 |
| Miscellaneous | 2,362,000 | 200,000 | 8.5 | 148,000 | 9,000,000 | 11,000,000 | 20,000,000 | 8.5 | 8,900,000 | 35,000 | 0.4 | 10,000 | 33.3 | 20,000 | 66.7 | 30,000 |




SWITZERLAND LEADS IN CONSUMPTION OF ELECTRICAL ENERGY PER INHABITANT

46,427,690 kw., of which 30,192,480 kw., or 65.4 per cent, was operated by fuel power and 16,235,210 kw., or 34.6 per cent, was hydro-electric. The United States Geological Survey has estimated that the minimum potential water powers of the world total 439,008,000 hp., and it is estimated from the most recent data that only 23,695,080 hp., or 5.4 per cent of this great source of power, has been developed. It would seem that the production of hydro-electric energy is still in its infancy.

The consumption of electrical energy in the United States in 1920 was almost exactly equal to the consumption of all the remaining nations of the world combined. Including the energy generated in private generating plants, the United States consumed a total of 49,802,000,000 kw.-hr. during that year, of which 6,870,000,000 kw.-hr., or 13.8 per cent, was consumed for lighting purposes and 42,932,000,000 kw.-hr., or 86.2 per cent, was used in the factories and mines, on the farms and in the operation of the electric railways of the country. During the year 1922 it is probable that more than 55,000,000,000 kw.-hr. was consumed in the United States. Germany was second in electrical consumption, with 8,600,000,000 kw.-hr., if the various British commonwealths are taken separately.

While the United States far outstrips all other nations in total electrical energy consumption, the little republic of Switzerland easily leads in consumption per inhabitant, with 700 kw.-hr. Following in order come Canada, with 612 kw.-hr. per inhabitant; Norway, with 493 kw.-hr. and the United States with 472 kw.-hr.

# Security Prices Advance During 1922

## New Electric Light and Power Bond Issues Total $589,960,990 for the Year—Refunding Operations Were a Feature

IN PERIODS of disturbed business conditions there always arises a decidedly favorable attitude toward bonds of capably managed and conservatively capitalized organizations with stable earning power. Electric light and power companies generally fall within this class, and accordingly in the year 1922 there occurred a period of unprecedented activity in their financing. During the war and for more than two years following

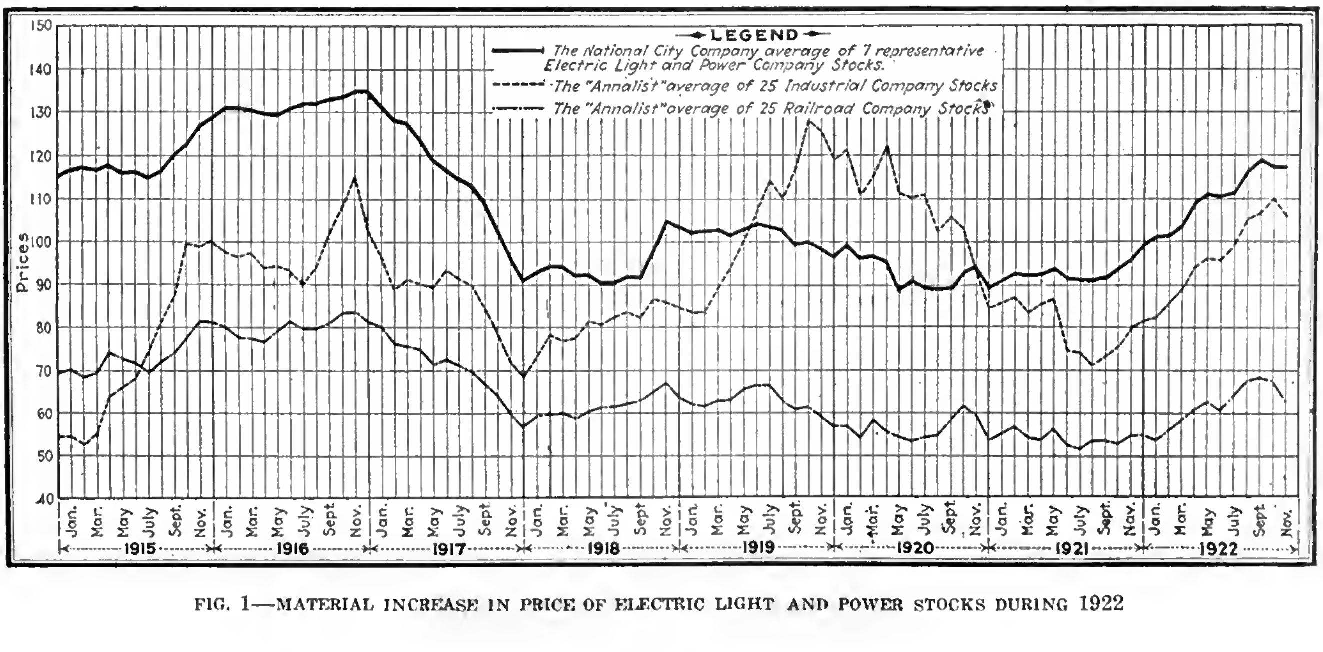



FIG. 1—MATERIAL INCREASE IN PRICE OF ELECTRIC LIGHT AND POWER STOCKS DURING 1922

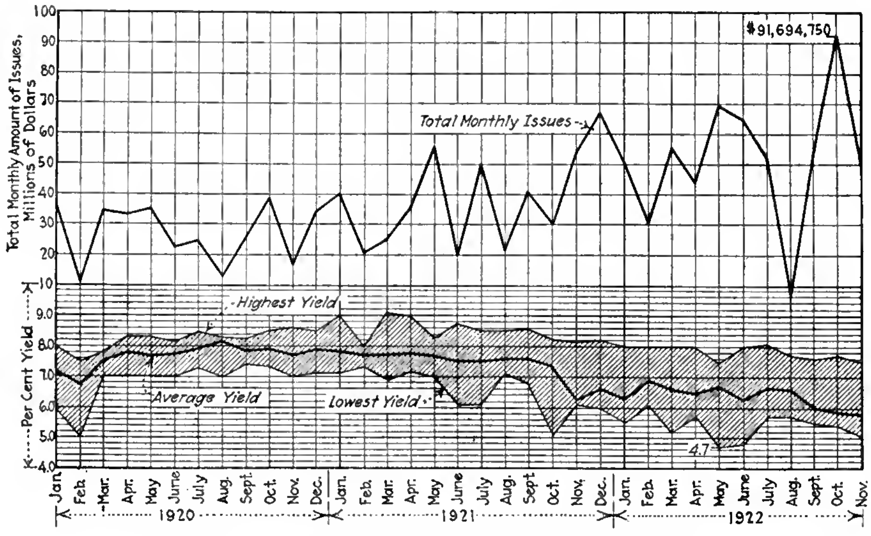



FIG. 2—MONTHLY ISSUES OF ELECTRIC LIGHT AND POWER SECURITIES, AND THE GRADUAL DECREASE IN YIELD

public utilities were hard hit by high operating costs and legal restrictions of rates. New legislation and recent court decisions, among the more notable of which was that handed down by the United States Supreme Court declaring New York State's eighty-cent gas law to be unconstitutional, have placed them on firmer ground and permitted in many cases rates that insure a reasonable return on invested capital.

Great improvement in the financial position of electric light and power companies throughout the United States in the past year attracted the attention of thoughtful investors, with the result that their securities were eagerly sought. Evidence of the increasing demand for and faith in public utility securities is seen in the fact that insurance companies, which invest millions of dollars every year for policy holders, have come to regard utility securities as a most desirable investment. This is a rather recent development—in years gone by the insurance companies invested their funds largely in railroad bonds and real-estate mortgages. Trustees and savings banks, when the state laws permit, are also coming more and more into the utility investment market. The fact that institutions such as these recognize the inherent soundness and desirability of such investments must be taken as significant of their intrinsic worth.

A feature of the year's financing of electric light and power companies was the unusually high percentage of new issues put out to refund called obligations which had been issued at a time when funds were costly. Corporations have been taking advantage of a comparatively easy money market to reduce their fixed charges by issuing new bonds bearing a lower coupon or by augmenting their capital stock largely through sales to their customers. A total of $80,587,290 has been issued in stocks since the beginning of the year. Whereas during 1921 it was possible only in rare cases to issue bonds bearing 5 per cent interest, 43 per cent of the total amount of mortgage bonds issued in the past year bore interest at that rate.

The accompanying graph shows the fluctuations in the rate of return yielded the investor. A comparison with the figures for 1921 reveals a marked decrease in yield, which ranged from the exceedingly low figure of 5.82 to 6.90. January's issues yielded on an average 6.28 per cent, a lower figure than was reached during the entire year 1921. February's yield was the highest of the year—6.90—and from that month until August the average rate of return fluctuated, ranging from 6.22 to 6.74. After midsummer the yield continuously declined until December, when the rate jumped to 6.59.

A further evidence of the optimistic feeling prevailing in the general securities market and in the case of the electric light and power securities as a group is to be seen in the rapid and almost uninterrupted rise in the averages of stocks. It is to be noted that the trend of prices of the seven electric light and power stocks selected by the National City Company has more than kept pace with the increases shown by the industrial stocks and the railroad stocks, records of which are kept by the *Annalist*. The electric light and power stocks have over a long period of years shown fluctuations in price far less in proportion than have the other classes of stocks. The industrials must of course, in connection with deflations in prices, take considerable inventory losses. The electric utilities, however, by virtue of the fact that their only commodities on hand consist of stored fuel and electricity on the wires, are in a truly enviable position on this score.

The future of the electric light and power industry appears to be indeed bright. With more constructive rulings by many public utility commissions, with judicial recognition of the right of companies to charge such rates as will make possible a fair return on investments, and with the sympathetic attitude of a large part of the general public, the central-station companies seem to be on the verge of a period of unprecedented prosperity.

ELECTRIC LIGHT AND POWER SECURITY ISSUES IN 1922

| | Amount of Issue | |
|---|---|---|
| MORTGAGE BONDS (average yield 6.01 per cent): | | |
| 45 issues at 5 per cent | $174,538,000 | |
| 7 issues at 5½ per cent | 28,150,000 | |
| 54 issues at 6 per cent | 158,902,800 | |
| 6 issues at 6½ per cent | 16,045,000 | |
| 19 issues at 7 per cent | 26,140,900 | |
| 1 issue at 7½ per cent | 500,000 | |
| 2 issues at 8 per cent | 725,000 | |
| 134 issues | | $405,001,700 |
| DEBENTURES (average yield 6.60 per cent): | | |
| 9 issues at 6 per cent | $26,800,000 | |
| 2 issues at 7 per cent | 4,500.000 | |
| 11 issues | | 31,300,000 |
| NOTES (average yield 6.29 per cent): | | |
| 2 issues at 5½ per cent | $16,000,000 | |
| 5 issues at 6 per cent | 14,750,000 | |
| 3 issues at 7 per cent | 3,800,000 | |
| 3 issues at 8 per cent | 650,000 | |
| 13 issues | | 35,200,000 |
| PREFERRED STOCK (average yield 6.96 per cent): | | |
| 2 issues at 6 per cent | $5,500,000 | |
| 28 issues at 7 per cent | 54,346,210 | |
| 8 issues at 8 per cent | 19,875,000 | |
| 38 issues | | 79,721,210 |
| MISCELLANEOUS ISSUES (average yield 6.68 per cent): | | |
| 1 issue at 5 per cent | $1,000,000 | |
| 6 issues at 6 per cent | 35,172,000 | |
| 2 issues at 7 per cent | 1,600,000 | |
| 1 issue at 8 per cent | 100,000 | |
| 2 issues | 866,080 | |
| 12 issues | | 38,738.080 |
| Total of all issues of year | | $589,960,990 |

# Big Strides Made in Industrial Electric Heating

*By J. L. McK. Yardley*
General Engineer
Westinghouse Electric & Manufacturing Company

## Applications of Industrial Electric Ovens and Heat-Treating Equipment Extending — Electric Steam Boilers for Special Service Have Aroused Interest

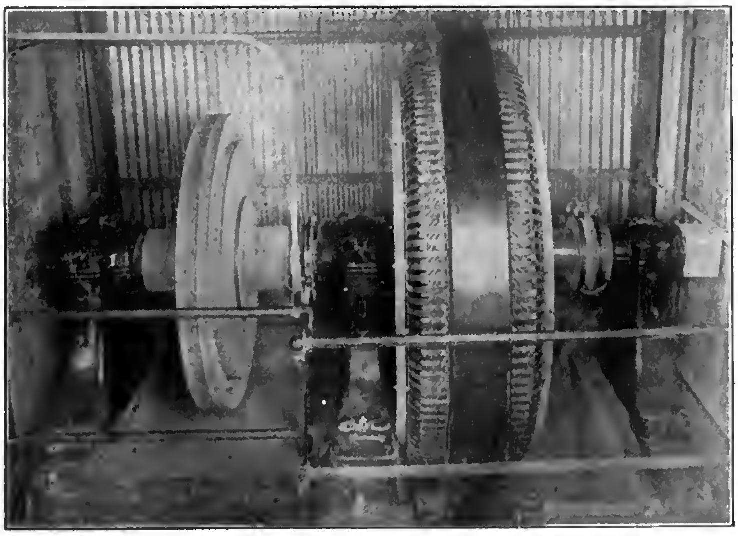
CONTINUED progress is being made in the development and application of apparatus for utilizing electric heat in industrial processes. Most striking, perhaps, are the strides which have been made in electric ovens, heat-treating furnaces and electric steam boilers. Arc-type melting and refining furnaces have become well established, and inductive heating has the inherent advantage of generating heat where it is desired, which makes its potentialities considerable. Rivet-heating apparatus has been developed to the point where it can meet moderate demands at low operating expense. Control apparatus for all of the foregoing apparatus has kept pace with these developments so that accurate and reliable operation is practically assured.

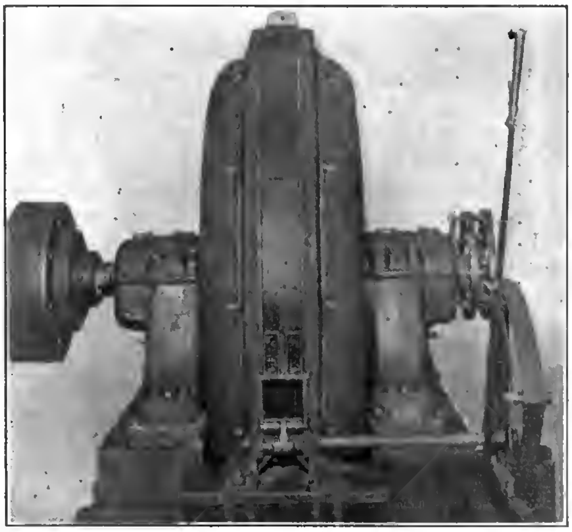
The development of the industrial electric oven rests upon a firm engineering and commercial foundation. Applications in the baking of electrical apparatus, foundry cores, japan, enamel and other processes requiring temperatures between 200 deg. and 700 deg. F. are continually extending. In the smaller sizes there is a tendency toward shelf-type ovens and toward vertical or tower construction for the particular purpose of saving floor space and employing some of the generally unutilized overhead spaces. Fortunately this sort of thing may be done in some low-temperature ovens if a relatively light conveying mechanism may be used, as the total weight is not so great but that the whole installation may be carried upon a comparatively light steel framework. Such possibilities are not inherent in industrial furnaces for higher temperature operations, owing especially to the much greater weight of refractories and heat insulation.

### ELECTRIC FURNACE AT 2,000 DEG. F.

The industrial electric furnace for heat-treatment operations of many kinds gives increasing indication of coming into its own at no far distant date. In the past there has been considerable disappointment through mistakes and inadequacies in initial constructions and through misapplications, due in all cases observed to insufficient analysis and preliminary consideration of the underlying situation, the exact condition the furnace must meet and the changes in conditions which it would introduce. However, experience and knowledge have multiplied. In the approximately 20 per cent chromium and 80 per cent nickel alloy we have a heating element of very long life if it is not mistreated. We have furnace constructions in crucible, pit, chamber

## Simplification Has Occurred in Machine Control and Protection and Improved Designs Are Available





The use of high torque, rotating stator, brake-band type of synchronous motor (shown at right) extends the field of application where space requirements may prevent the use of the clutch connection shown on the left.

and car-bottom types which approach in ruggedness the fuel-fired furnaces without unduly losing in efficiency. However, the details of many process applications must yet be solved by experts. Recent successful installations indicate that, with the help of moderate-priced power, we are honestly entering a period of extensive electrical applications for hardening, tempering, patterning, annealing, cementation or case-hardening and other processes requiring temperatures ranging from 1,800 deg. F. down to, say, 1,200 deg. F. The field for applications of electrical power in heat within this range of temperature is unquestionably one of the largest still potential. The estimate in the N.E.L.A. 1921 Power Sales Bureau report of a potential total connected load in glass annealing of 60,000 kw. covered merely one part of this field.

### Electric Furnace at 2,500 Deg. F.

Probably second to the above is the extensive field of forging operations, supplemented by high-speed steel heat-treatment processes, demanding temperatures within the range of 2,000 deg. to 2,400 deg. F. If the possibility of brass melting in the more than 3,600 brass foundries of the country be included, the potential field for electric power in heat at such temperatures is indeed great. Much commendable work, both in design and in application, has been done. More remains to be done in developing furnaces which will be readily and economically applicable to such processes. The engineering difficulties are great, owing particularly to the fact that the only practical resistor elements available, carbon and graphite, are rapidly oxidizable at the temperatures required. The resistors must, therefore, be absolutely secluded from oxidizing atmospheres in order to have long life and low maintenance. Hence in these applications the competition of fuel-fired furnaces, and in the case of brass of the arc and induction types of electric furnace, has been more difficult to meet.

The electric steam boiler, which is a special form of electrode-type furnace, has aroused considerable interest during the past year or two. The principle was employed on a big scale over fifteen years ago at Niagara Falls in the three-phase water rheostats which were used for loading the then largest 12,000-volt alternators while making acceptance tests. It has been incorporated in a number of very simple boiler constructions in which the amount of steam produced, and hence the amount of power consumed, may be controlled, automatically if desired, by regulating the water level. The electric steam boiler may become a very practical and helpful auxiliary to supplement or temporarily supplant the fuel-fired boiler in industries which require large quantities of steam and which are so located geographically as to have available waste or cheap hydro-electric power. The particular field for such boilers in large sizes would appear to be as an auxiliary to hydro-electric systems in territories where it has been found impracticable to approach 100 per cent load factor with pulp grinding, electrochemical, electrometallurgical or other loads.

It appears more than probable that a host of successful applications will be found for electric steam boilers in small sizes; say 5 boiler-hp. or less, in locations having moderately priced electric power, generated by steam or water power, in special processes, in isolated parts of industrial plants, in garages, in public buildings, in laundries and domestic use, in climates having only brief and irregular periods of low temperature. Such applications probably must usually be new or isolated or beyond the capacity of existing fuel-fired boiler plants. It is obvious, for instance, that when public service companies such as the Boston Edison Electric Illuminating Company will sell steam in quantities less than the output of a 5-hp. boiler at $1.30 per 1,000 lb., and at a smaller price for larger quantities, only very special and exceptional circumstances would permit the existence of an electric steam boiler within reach of its steam lines.

Today there are probably more than a thousand arc-type melting and refining furnaces in the world, of which more than four hundred are in the United States and employed in the iron and steel industry. The special reasons for the expansion of electric steel making are the reduction of wholesale power rates, the extreme flexibility and adaptability of electric furnaces to a wide range of uses, and the quality of the products. With the electric arc furnace a reducing atmosphere can be maintained which enables the removal of sulphur and manganese sulphide, thus making it possible to readily eliminate oxides. The furnace may be used alone or in conjunction with the Bessemer or open-hearth type, or both. It may also be used in connection with the blast furnace or cupola for making semi-steel, gray-iron and malleable-iron castings. Furthermore, it may be operated either acid or basic. The popularity of the arc furnace is increasing most rapidly in the small high-grade steel or iron foundry, owing to its advantages in small units for making frequent small heats. The desirability of relatively high voltage for melting and low voltage for refining is now generally recognized.

### Arc Furnace Coming Back

As a means of melting brass the arc-type furnace is attracting increased recognition, the advantage of rapid operation outbalancing the early criticism that the arc would unduly volatilize the non-ferrous materials. Possibly the best indication of the sound basis on which this application stands may be read in the recent announcement by one of the oldest and best known builders of fuel-fired melting furnaces for brass of a line of electric furnaces for brass melting employing the arc principles. The construction embodies the familiar pair of horizontal electrodes operated from a single-phase transformer; otherwise it retains the seasoned features of the oil-burning furnace, with some modification perhaps.

The possibilities of inductive heating should be kept in mind since it generates heat directly in the material to be heated. When suitable heat insulation is provided, the temperatures obtainable are limited only by the fusion temperatures of the best refractories.

The high-frequency induction furnace has come as a boon to the scientist engaged in the study of properties of matter at high temperature and under controllable chemical conditions. It is commercially promising for heating in vacuum, for melting silver, gold, platinum and precious alloys, and for melting of very high-grade alloys of steel and non-ferrous metals. The units are small, so that a total of over 1,000 kw. installed, or double the amount two years ago, represents a widely diversified field and indicates a growth that appears healthy.

The low-frequency induction furnace is being applied —particularly for commercial uses—in the melting of

non-ferrous metals and the production of brass. In fact, some foundries where continuous operation is the rule use this type of furnace only. New modifications of the low-frequency induction type are being brought out from time to time, indicating the interest that is taken in improving this application, although it seems to be on a successful basis already where established.

An example of the employment of commercial frequencies in a somewhat similar manner is found in the type of rivet heater in which the rivet forms a part of the transformer secondary circuit and is heated by the $I^2R$ losses. The outstanding characteristic of this type is that the individual rivet may be heated exactly when wanted. However, constant attendance or close-control mechanism are necessary to prevent burning; otherwise, if the rivet is not required just when expected, then the energy of heating is wasted.

### New Type of Rivet Heater

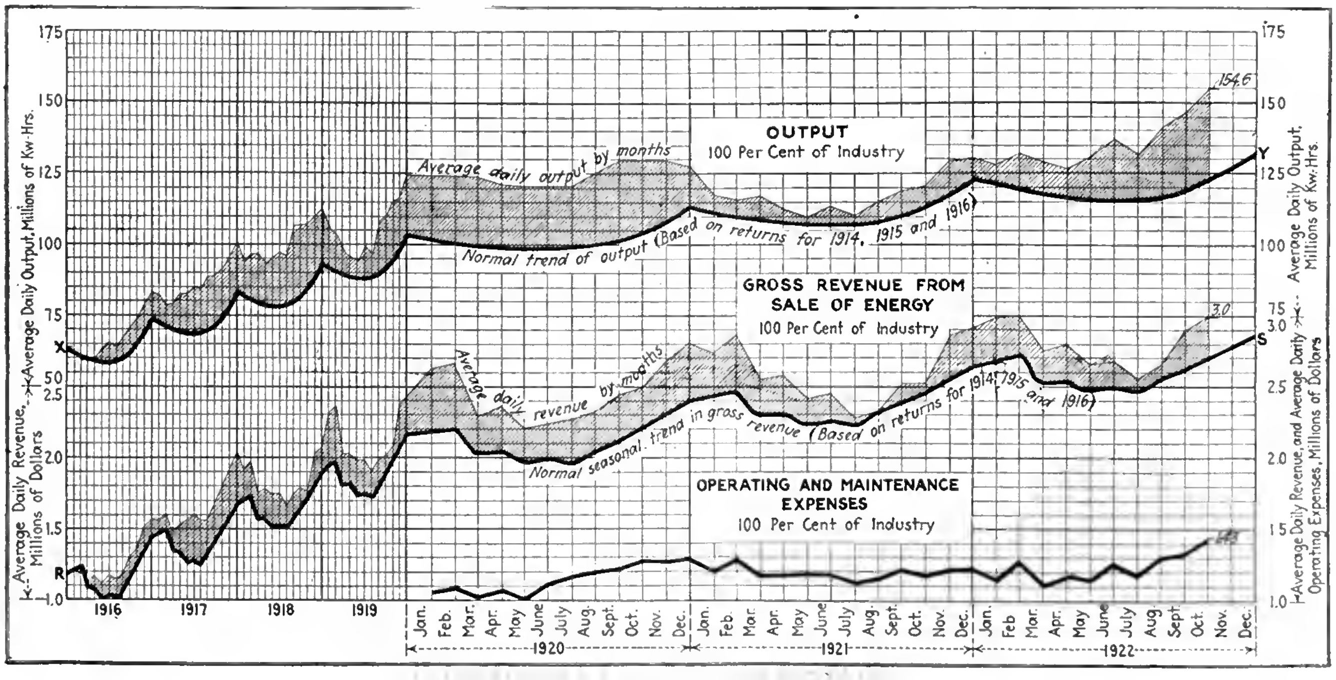
A type of rivet heater which gives promise of becoming popular consists of a chamber capable of holding fifty rivets or so, air-tight, except at the door, perhaps lined with non-oxidizing metal, and surrounded by heating elements and generous heat insulation. Such a heater kept filled with rivets and under pyrometric control is capable of meeting sudden demands for rivets in small quantities at any moment; still, it operates at a very low expense between demands owing to low radiation losses and the absence of attendance.

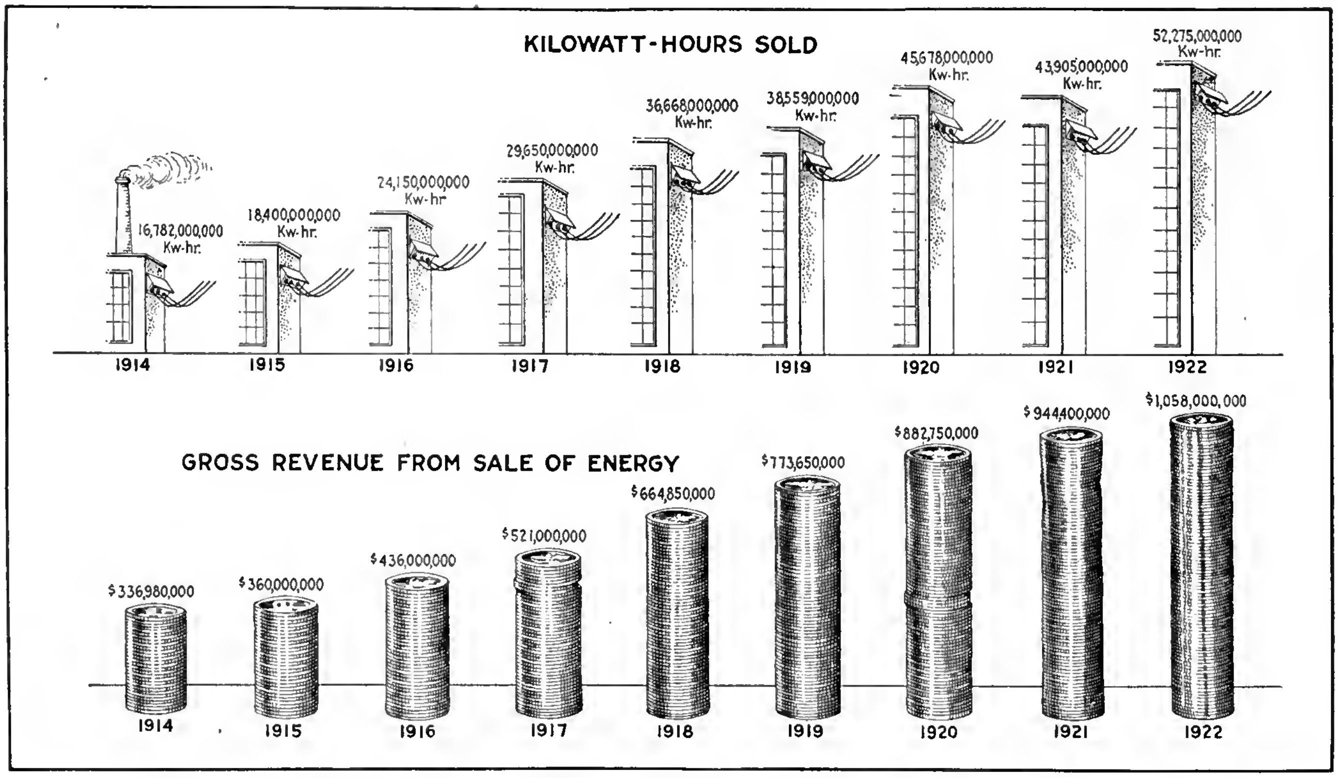
The regulation of the arc-type furnace, owing to the highly concentrated heat and intense temperature of the arc, must necessarily be controlled by current or kilowatt input. Several effective regulators have become fully developed which will hold the input with sufficient accuracy to a constant value according to the setting. The setting is changed during the cycle by the operator, as determined by the maximum permissible power demand and by the particular melting and refining periods desired for the kind and amount of charge. Induction furnaces require special controlling apparatus. For the resistor type of furnaces, at least below 2,500 deg. F., methods of pyrometric control have been fully worked out by which the electrical input in the furnace is controlled according to the temperature of the work itself by means of one or more thermocouples placed in the furnace chamber adjacent to the work. The actual temperature variation below the maximum, within a furnace chamber, over a cycle, of course, depends upon the initial temperature and weight of charge, the amount of stored heat in the furnace walls and the rate at which energy is given up by the heating elements and absorbed by the charge after power is turned on. Radiant-type heating elements disposed as uniformly as possible about the work tend to give up heat at the greatest rate, owing to the resistance to heat flow from the source being a minimum. The maximum chamber temperature and the actual operating temperature after the work has reached the desired temperature are susceptible of the closest possible control by the pyrometric method, inasmuch as commercially available indicating and recording pyrometers are highly sensitive and, through secondary relays, will actuate contactors in the supply circuit upon changes in temperature even so little as one-half of 1 per cent above and below the setting. The accuracy, flexibility and reliability of pyrometric control, more than anything else probably, constitute the appeal of the industrial electric furnace in heat-treatment processes.

# Energy Output More than 52,000,000,000 Kw.-Hr.

THE year which has just closed was one of record accomplishments by the electric light and power industry. For the first time the industry really takes its place among the giants of the business world of America. The upward swing has never been so pronounced as it was during 1922, and it points unmistakably to still greater accomplishments during the coming year.

Statistically, at least, the greatest advance made during the year was in the amount of energy sold, gross income from sale of energy, increase in invested capital,






THE INDUSTRIAL DEPRESSION OF 1921 WAS REFLECTED IN THE SALE OF ELECTRICAL ENERGY, BUT THE YEARLY GROSS REVENUE HAS NEVER SUFFERED A DECREASE

increased installed generator rating, and the large number of new customers added to the lines. It is estimated that 52,275,000,000 kw.-hr. of electrical energy was sold by the industry during 1922, which is an increase of 18.8 per cent over 1921 and 14.4 per cent over 1920, the peak year of post-war industrial activity. It must be remembered that this huge figure does not represent the actual amount of energy consumed during 1922, but is the amount of energy actually sold by the various distributing companies, some of which was sold to other public utilities for resale and so is counted twice in the resulting tabulation.

Data so far issued by the United States Geological Survey indicate that the energy actually generated during 1922 will total about 48,100,000,000 kw.-hr., of which about 8,700,000,000 kw.-hr. was lost in transmission, giving a total of about 39,400,000,000 kw.-hr. as the electrical energy consumed by central-station customers during 1922. It is estimated that this record output figure required an added generator installation in the year of approximately 1,650,000 kw. in the central generating plants of the country. Even with this large addition to the total generator rating many central stations in intensely industrial sections of the country were reporting inability to supply the energy requirements, especially during November and December.

For the first time the electric light and power industry takes its place among the billion-dollar industries of the country in value of products. It is estimated that the gross revenue from sale of energy during 1922 totaled $1,058,000,000, which is $113,600,000, or 12.0 per cent, above that reported for 1921. This large increase is undoubtedly due to the addition of about 1,200,000 new high-revenue domestic lighting customers and about 150,000 commercial lighting customers during the year, although the record industrial energy requirements of the last third of the year must not be overlooked in this connection. It is estimated that the operating and maintenance expenses of the industry totaled $484,000,000 during 1922, which is approximately $52,000,000 over that reported during 1921. The expenses for the year would undoubtedly have been materially less had it not been for the coal shortage and consequent high price of fuel in the last half of the year.

In amount of invested capital, the electric light and power industry assumes a place of added importance as a member of that select group of six industries with a capitalization of more than five billion dollars, the other members of which are chemicals and allied products, food and kindred products, iron and steel, mines and quarries and the textile industry. The capital invested in the electric light and power industry on Jan. 1, 1923, is estimated at $5,100,000,000, which is an increase of $500,000,000 over that of Jan. 1, 1922. The National City Company, which keeps very close new-capital tabulations, estimates that of this new capital invested in the industry during 1922 approximately $250,000,000 was from the sale of securities and $250,000,000 was from reinvestments of earnings in the property.

The accompanying curves indicate that the average daily energy sold during October was 154,580,000 kw.-hr., which was 5.4 per cent above the previous record figure, reached in September. The average daily gross revenue from the sale of energy during October was $3,006,000, which was a few thousand dollars below the record revenue reported during February, 1922. Every section of the country except the South Central and the Mountain Pacific States reported large increases in output over September. The decrease in the Western States was probably due to the seasonal decrease in energy requirements by irrigation customers.

# Hydro Projects Will Total $778,300,000

## Active Applications Filed with the Federal Power Commission Total 334, Involving 17,692,109 Primary Horsepower — Projects Involving 2,531,489 Primary Horsepower Now Under Construction

THE activities of the Federal Power Commission form an excellent barometer of present and future hydro-electric developments in this country. There are very few water powers of any magnitude the development of which does not to some degree affect public lands or navigable streams, thereby falling under the jurisdiction of the Federal Power Commission.

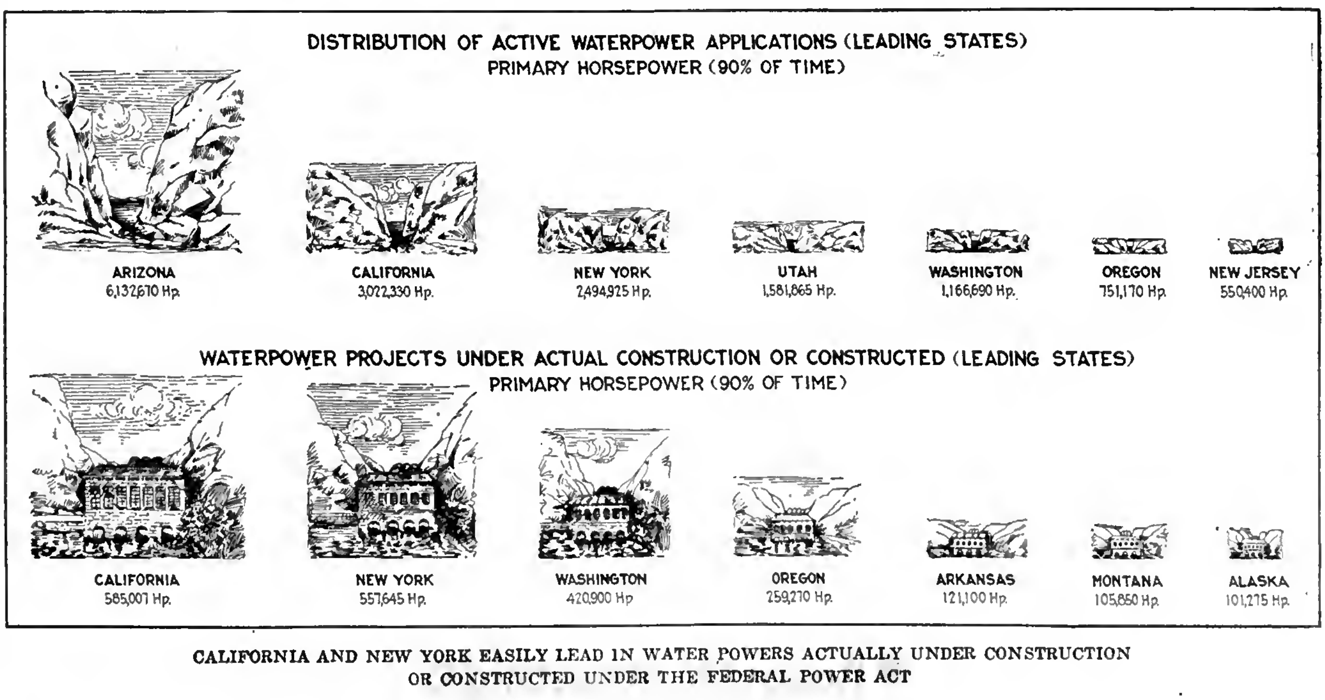
On Dec. 1 334 active applications were on file with the commission, of which thirty-four were for transmission lines. The projects involved in these applications total 17,692,109 primary horsepower available 90 per cent of the time and an estimated installed capacity of 27,804,394 hp. During the fiscal year 1921 a number of deductions were made on account of withdrawals and rejections. These, if included, would involve a total of 21,004,759 primary horsepower and an installed capacity of 31,938,694 hp. The Federal Power Commission has issued sixty-nine final permits and sixty-five licenses, involving a total of 2,531,489 primary horsepower and an estimated installed capacity of 4,898,509 hp. The distribution of these hydro-electric projects by states will be found in Table I.

The estimated capital involved in the water-power projects now under preliminary or final permits and licenses totals $778,300,000, distributed as follows:

| | |
|---|---|
| Investment involved in projects now under preliminary permits, if finally constructed under licenses | $576,000,000 |
| Investment involved in projects under license constructed and under construction | 283,200,000 |
| Investment involved in projects already constructed at time of obtaining license | 80,900,000 |
| Net investment involved in projects now being constructed | 202,300,000 |
| Total investment involved in projects now under construction or to be constructed under license, plus investment involved in projects now under preliminary permits | 778,300,000 |

Assuming that for each kilowatt developed $110 will be spent for transmission equipment, $100 for distribution installation and $750 for customers' lamps, motors and appliances and wiring of houses and factories, a total of about $4,993,000,000 will be spent as a direct result of these developments. Adding these two totals together gives a total probable capital investment of about $5,771,300,000. This figure does not take into consideration the further investment for reserve steam-plant equipment, which would undoubtedly bring the total amount thus invested to well over the six-billion-dollar mark.

Probably the most significant fact to be derived from these figures is the insistent demand all over the country to have water power developed. This is doubtless primarily the result of the post-war coal situation, but the movement has been materially aided by the passage of the federal water-power act. Coupled with this is the thought that east of the Rocky Mountains practically all feasible water power is likely to be developed within a comparatively short time, although in this area coal will probably always be the mainstay for power production. In the West there is ample water power to supply all needs for at least a century, and probably much longer, and as time goes on the relatively cheap power of this region would seem almost inevitably to lead to the building up of industrial centers of considerable magnitude. A start in this direction has already been made. In a few regions such as central California and the Salt Lake basin complete development of the important water powers is already in sight, but in these localities there still remains a possibility—




CALIFORNIA AND NEW YORK EASILY LEAD IN WATER POWERS ACTUALLY UNDER CONSTRUCTION OR CONSTRUCTED UNDER THE FEDERAL POWER ACT

TABLE I—ACTIVITIES OF THE FEDERAL POWER COMMISSION COVER EVERY SECTION OF THE COUNTRY

| State and Section | Distribution of Active Applications: Number of Water-Power Applications | Number of Transmission Lines | Primary Horsepower (90% of Time)* | Est. Installed Capacity** | Distribution of Licenses Authorized: Number of Water-Power Licenses | Number of Trans.-Line Licenses | Primary Horsepower (90% of Time) | Est. Installed Capacity | Distribution of Permits Authorized: Number of Water-Power Permits | Primary Horsepower (90% of Time) | Est. Installed Capacity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| United States | 300 | 34 | 17,692,109 | 27,804,394 | 40 | 25 | 883,969 | 2,079,524 | 69 | 1,647,520 | 2,818,985 |
| SECTIONS | | | | | | | | | | | |
| New England | 2 | 0 | 50,000 | 50,000 | 0 | 0 | 0 | 0 | 1 | 20,000 | 20,000 |
| Middle Atlantic | 19 | 0 | 3,312,325 | 4,554,130 | 3 | 0 | 346,495 | 624,330 | 2 | 212,500 | 262,500 |
| South Atlantic | 17 | 2 | 129,550 | 259,130 | 0 | 1 | 0 | 0 | 9 | 34,430 | 101,530 |
| East North Central | 6 | 0 | 55,353 | 82,650 | 2 | 0 | 10,210 | 20,250 | 2 | 42,850 | 54,250 |
| West North Central | 17 | 1 | 144,130 | 296,800 | 0 | 1 | 0 | 0 | 5 | 22,700 | 47,700 |
| East South Central | 14 | 0 | 198,280 | 556,250 | 2 | 0 | 25,330 | 106,000 | 3 | 3,015 | 15,000 |
| West South Central | 8 | 0 | 156,000 | 289,200 | 1 | 0 | 17,400 | 60,000 | 4 | 143,700 | 241,000 |
| Mountain | 67 | 11 | 8,397,351 | 11,677,309 | 10 | 10 | 8,719 | 25,869 | 12 | 277,645 | 579,625 |
| Pacific | 115 | 20 | 4,940,190 | 9,622,160 | 17 | 13 | 470,567 | 1,236,010 | 18 | 794,610 | 1,356,830 |
| Alaska | 35 | 0 | 308,930 | 416,765 | 5 | 0 | 5,205 | 7,065 | 13 | 96,070 | 140,550 |
| RANKING STATES | | | | | | | | | | | |
| Arizona | 13 | 1 | 6,132,670 | 8,231,000 | 0 | 1 | 0 | 0 | 2 | 73,400 | 150,000 |
| California | 83 | 18 | 3,022,330 | 6,072,310 | 14 | 12 | 445,107 | 1,205,850 | 8 | 139,900 | 253,150 |
| New York | 9 | 0 | 2,494,925 | 3,072,830 | 2 | 0 | 345,145 | 580,330 | 2 | 212,500 | 262,500 |
| Utah | 8 | 0 | 1,581,865 | 2,238,665 | 1 | 0 | 40 | 40 | 3 | 7,225 | 13,625 |
| Washington | 18 | 1 | 1,166,690 | 2,040,410 | 1 | 0 | 100 | 100 | 4 | 420,800 | 623,800 |
| Oregon | 14 | 1 | 751,170 | 1,509,440 | 2 | 1 | 25,360 | 30,060 | 6 | 233,910 | 479,880 |
| New Jersey | 3 | 0 | 550,400 | 662,300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Alabama | 9 | 0 | 102,130 | 364,000 | 2 | 0 | 25,330 | 106,000 | 3 | 3,015 | 15,000 |
| Arkansas | 6 | 0 | 112,000 | 230,200 | 1 | 0 | 17,400 | 60,000 | 3 | 103,700 | 186,000 |
| Wisconsin | 1 | 0 | 10,043 | 20,000 | 1 | 0 | 10,043 | 20,000 | 0 | 0 | 0 |
| Alaska | 35 | 0 | 308,930 | 416,765 | 5 | 0 | 5,205 | 7,065 | 13 | 96,070 | 140,550 |
| Other states | 101 | 13 | 1,458,956 | 2,946,474 | 11 | 11 | 10,239 | 70,079 | 25 | 357,000 | 697,480 |

* Add 3,312,650 hp. for deductions made during fiscal year 1921 on account of withdrawals and rejections for total applications.
** Add 4,134,300 hp. for deductions made during fiscal year 1921 on account of withdrawals and rejections.

one might almost say a certainty—of obtaining large blocks of energy by long-distance transmission lines from regions in which a great surplus of water power is available.

The administration of the water-power act by the Federal Power Commission has been hindered by an insufficient engineering staff, the direct result of small Congressional appropriations. The cost of administering the act has been low, especially when the flood of applications involved is taken into consideration. The commission's expenses for the fiscal year ended June 30, 1921, its first year of operation, were $29,371.74, of which about one-third was the cost of the initial equipment for its offices. The commission deposited in the Treasury $8,963.57 from fees prescribed in licenses issued during that year. The operating expenses for the fiscal year 1922 in round numbers will be $37,000, and receipts, including land rentals, will total $29,000. Therefore, the net cost of operations during the second year will be $19,500, as compared with $20,630.09 for the first year. With the exception of the salary of the executive secretary of the commission, the salaries have been borne by the three government departments, according to the water-power act, and the field work has been largely delegated to the field forces of these departments.

Following is a summary of the cost of administering the federal water-power act during 1921 and 1922:

| | 1921 | 1922 |
|---|---|---|
| Operating expense | $29,371.74 | $37,000.00 |
| Salary expense | 59,878.63 | 81,049.78 |
| Field expense | 20,710.00 | 30,000.00 |
| Gross expense | $109,960.37 | $149,971.78 |
| Deducting administrative fees received from licenses for water-power development | 8,741.65 | 24,500.00 |
| Net cost of administering the act | $101,218.72 | $125,471.78 |

Table II gives detailed cost data on some of the more important projects now under construction. Cost data on other projects under construction appeared in the May 13, 1922, issue of the ELECTRICAL WORLD.

Some valuable cost data are also contained in the applications for transmission lines. The 220,000-volt, single-circuit, three-phase steel-tower line leading from the Pit River development in California is especially interesting. One section of this line consists of 27.8 miles of steel-reinforced 518,000-circ.mil aluminum-steel reinforced cable and 32.2 miles of 500,000-circ.mil stranded copper; the total section is estimated to cost $1,060,000, exclusive of right-of-way or overhead charges. Another section consists of 32.2 miles of 500,000-circ.mil stranded copper and cost $470,000.

TABLE II—COST ESTIMATES ON IMPORTANT PROJECTS BEING CONSTRUCTED UNDER LICENSES ISSUED BY THE FEDERAL POWER COMMISSION

| No. of License | Name of Company | Name of Stream | Total Cost of Dam | Total Cost of Power House | Hydraulic Equipment: Hp. | Hydraulic Equipment: Total Cost | Electrical Equipment: Kva. | Electrical Equipment: Total Cost | Project as a Whole: Total Cost | Project as a Whole: Cost per Installed Hp. |
|---|---|---|---|---|---|---|---|---|---|---|
| 309 | Clarion River Power Co. | Clarion River, Pa. | $1,800,000 | $450,000 | 44,000 | $350,000 | 41,500 | $875,000 | (a) $6,460,000 | $147 |
| 155 | Southern Sierras Power Co., No. 1 | Fall and Snow Creeks, Cal. | ........ | 27,500 | 3,750 | 20,000 | 2,000 | 43,000 | (a) 656,000 | 175 |
| 155 | Southern Sierras Power Co., No. 2 | Fall and Snow Creeks, Cal. | ........ | 27,000 | | 15,000 | 1,500 | 33,000 | | |
| 135 | Portland Ry. Lt. & Pwr. Co. | Oak Gun Creek, Ore. | ........ | 110,000 | 30,000 | 240,000 | 25,000 | 270,000 | (a) 2,685,000 | 90 |
| 271 | Caddo River Pwr. & Irr. Co., No. 1 | Ouachita River, Ark. | 1,680,000 | 224,000 | 40,000 | 480,000 | 37,500 | 684,000 | (a) 3,900,000 | 98 |
| 271 | Caddo River Pwr. & Irr. Co., No. 2 | Ouachita River, Ark. | 2,000,000 | 222,000 | 40,000 | 390,000 | 37,500 | 644,000 | (a) 4,155,000 | 104 |
| 120 | Southern Calif. Edison Co., No. 3 | Big Creek, Cal. | 1,200,000 | ........ | 195,000 | ........ | ........ | ........ | 13,089,000 | 67 |
| 20 | Utah Power and Light Co. | Bear River, Ida. | 470,000 | 430,000 | 21,000 | 170,000 | 20,000 | 350,000 | (a) 2,500,000 | 119 |
| 187 | Yuba Development Company | Yuba River, Cal. | 600,000 | 25,000 | 1,000 | ........ | ........ | ........ | 894,200 | 128 |
| 185 | Southern Sierras Power Co. | Mill Creek, Cal. | ........ | 27,000 | 3,300 | 25,000 | 3,000 | 87,000 | (a) 630,000 | 190 |
| 52 | City of Dothan | Choctawhatchee River, Ala. | (b) 503,500 | ........ | 3,000 | 31,000 | 2,800 | 73,000 | (d) 658,000 | 220 |

(a) Overhead included in total cost but not in detail items. (b) Includes Power house
(c) Dam already built, cost of power-house and equipment included under electrical equipment. (d) Exclusive of land damages and engineering.

# Practical Economies the Keynote

*By Earl E. Whitehorne*
Commercial Editor ELECTRICAL WORLD

### Manufacturer and Distributor Have Determined to Eliminate Waste Through Standardization, Simplification and Curbing Useless Competition

FROM the viewpoint of the manufacturer and the jobber the past twelve months in the electrical industry have been extremely interesting and significant, and the next year promises even more important developments. As in nearly all other industries, the overshadowing problem of the moment is one of practical economies. A great desire is expressing itself through every branch of industry that ways may be found to reduce the cost of the nation's goods through the elimination of waste both in distribution and in production. This has an academic sound, but it remains the fact and it affects all men; and the year has seen a very practical evidence of the determination of both organizations and individuals at least to start some effort that will help toward the realization of such a benefit.

Courage has come back into the business of the country, and there has been much intensive selling both by the manufacturer and the distributor, but it has not been the type of free and open market building with intense absorption in the pursuit of orders that we knew for so long before the war and through the days of boom that followed. There has been an unhappy strain running clear across it. For while men have been busy, they have not been enjoying the measure of prosperity that the volume of business would seem to indicate. Good times were seen to be returning, and yet it was patent to all that these "good times" were unhealthy at the core and it was known that "something" had to be done to cut down costs, relieve excessive prices and produce profits that would compensate for the work and risks entailed. And so a spirit of unrest has existed and there has been a struggle for relief manifested in several directions.

#### The Need for Simplicity

Manufacturers have more generally begun to recognize the need for simplification of their lines through reduction in the great number of excess varieties. They have been scrutinizing their catalogs and devising ways to retire numbers that differ only superficially and duplicate one another in the essentials and by this duplication increase inventories for both the jobber and dealer as well as for the manufacturer, eventually causing increased cost to the ultimate purchaser.

At the present time, to take a common illustration, there are on the market an unconscionable number of sockets. Again, one manufacturer has actually on schedule 3,200 standard motors, most of them differing from one or many others only in some trifling detail that might well be brought to a common standard but for the profligate habit of giving unnecessarily costly service and paying extravagant deference to the whims of the buyer or the endeavor to develop something just a little "different" for a "selling argument." There is no lack of other striking examples within the observation and knowledge of every one.

How to deal with the actual act of simplification—how to proceed—is the unanswered question. That such excesses exist in many lines is recognized freely, but fear of competition interposes many obstacles to action. Many believe that if they "cut out" this type or that, some other firm will specialize upon it and profit at their expense. Moreover, the process of simplification must be so under control that it will not exert an influence against the development and perfection of new inventions and stifle the progress of the art and the industry.

#### The Need for Statistics

It is also the common concern of both the manufacturer and distributor that their part of the electrical industry is today operating almost without statistical knowledge. As a result there has been a tremendous amount of varied and hit-or-miss production and numerous cases of over-stock or under-stock due to ignorance of the market. The industry, for example, does not know how many small motors are made in any period, nor what at any time has been the production or the sales, nor what is the condition of the stocks over the country. It is the same with other commodities.

The practical usefulness of such statistics in these times is clear. For such knowledge would in itself tend to reduce stocks of both raw materials and manufactured products and to decrease the number of styles, types and varieties. It would also produce a greater flexibility in the adjustment of price changes and the maintenance of adequate reserves. Today, when a slump in business comes unexpectedly, no one is cognizant, except in the most general way, either of its cause or its probable duration or effect, and factories proceed as long as possible running at full time and building up stock, buoyed up by the hope that an early reaction will find them in readiness for profitable sales. And this old stock but adds to the confusion and the burden of the situation.

These are all influences in production and in distribution, elements in the present excessive cost of goods, part of the problem which all men of the industry are pondering today. Electrical men are trying to see their way through and out of it and realizing more and more how all are involved in it, the burden that it lays upon the business of the light and power company and the contractor, as well as the manufacturer and jobber. For it is in these fundamentals, these background elements, that the trouble apparently lies.

Through a period of thirty years of rising prices,

increasing prosperity and advancing standards executives of the industry have kept too close a focus upon themselves and their own organization problems of activity and growth and have given little concern to the economics of the industry itself. It has been no part of the bustle of the business day to see that the electrical industry was fabricating all its parts into an efficient and enduring system.

### The Need for Inspection Uniformity

And so, to glimpse another side of it, there has evolved through all the influences of chance a great diversity of state and governmental requirements resulting in a baffling absence of uniformity in inspection standards in different sections of the country. A safety switch, for instance, might be required in Oregon to have its cover hinged on the side, in Colorado at the top, in Ohio at the bottom, and in Connecticut all hinges might be banned and screws required. Wide difference is found in the requirements for fusing and connecting motors and in other details of electrical installation where either fire or safety hazard is involved, varying not only with the state and city but often with the interpretation given to these rules by local inspectors.

Such a condition, developing gradually through lack of guidance and control, has naturally administered a further impulse to the increase of varieties and stocks and added just so much more to the burden. It will inevitably demand some sort of a constructive, remedial treatment that will establish uniformity and eliminate the waste now so conspicuous by setting up common standards that can be applied throughout the land and that will afford a greater measure of stability because they will not change too rapidly or without ample warning so that stocks and production may be adjusted.

These are all parts of the picture, elements in the all-embracing economic problem that is engaging the best minds of industry today. It is a time of close analysis. Men are searching for facts and the process has not yet reached a stage where these facts have been made articulate to any satisfactory extent. But there are plenty of definite evidences of the inclination in the electrical industry through the closer organization of the groups and the greater activity they are exhibiting. The union of the Associated Manufacturers of Electrical Supplies, the Power Club and the Electrical Manufacturers' Club is an expression of it. The twelve months' analysis of the jobbers' cost of doing business which became available this year is an expression of it. The investigation into the cost of merchandising by large central-station companies reported this fall is an expression of it. The organization of separate merchandise departments by the industry's two largest manufacturers, to focus constructive effort on the development of better retailing through the industry, is an expression of it. The closer relations which have been established between these two great manufacturing institutions and the respective groups of jobbers who form their distribution systems is another expression of it. It is a broad mass movement in the right direction, a general impulse driving men to find the truth as their only recourse if the problem that besets them is to be solved.

But there is no place where any one can put his finger on the record of last year and say: "Here is where the movement started. Here is what has been accomplished." It is all in the formative stage in which men have been spending more time in looking beyond their own office walls and studying their industry. And they have done more than this. They have talked and argued out some common principles and purposes and they have taken practical, progressive steps to organize these purposes into co-operative action.

Simplification is a problem of production. First, it is a problem of the individual because each manufacturer first must scrutinize his own line and see where he can save. Then it becomes an industry problem if uniformity and standardization are to be achieved. And already many companies are taking the first steps in this elimination process.

### Problems First of the Individual

The production of statistics is also first a problem of the individual, for each man must make up his own mind that he will develop the statistics that are needed on his own production and contribute them to the knowledge of his industry. Then it becomes a matter of compiling and combining these statistics into mass figures. A considerable degree of progress has been made toward the establishment of such a statistical service from the electrical industry, to report on production, stocks and sales, the figures to be cleared through the United States Department of Commerce in accordance with the plan of Mr. Hoover.

And to a certain degree in the same way the more immediate and pressing problem of waste in distribution is first of all an obligation on the individual. For, although one is apt to think of it as essentially a trouble with and of the jobber, the fact remains that all have a part in it. The line that the manufacturer sells the jobber and the way he sells it is a part of it. The material that the central-station company, contractor or dealer buys from the jobber and the way he buys it is a part of it. For excess varieties, shipping units that require avoidable repacking, overstocking through ignorance of market trends, small-order purchasing and extravagant demands for service all contribute to the price that must be charged when goods are sold. And all this is now being recognized more and more, for the public is insistently demanding a less expensive system of distribution of the goods it buys, and there is a power behind such a demand that cannot be denied.

### Too Much Competition

Steadily comes the growing conviction that at the bottom of it all is an uneconomic excess of competition—too many manufacturers producing duplicating lines in too great variety and too small volume, too many jobbers stocking and selling too many lines of too many articles and both buying and selling them in too many small shipments, too many contractors and retailers doing each so small a part of the available business that too few can prosper. It is the outgrowth of the rapid rise of this electrical industry, which has made it a loadstone to ambitious men. It is the product of boom times and quick expansion. And the inflexible laws of economics will operate and through consolidations and bankruptcy reduce this waste, also a painful but a curative process as it affects the industry in its entirety.

These have been the movements of the past year. These are the trends that will be seen in active progress through the years immediately ahead. And wise is the man who will take heed and look ahead into this evolution, that he may find and take his place in it.

# Commercial Trends of the Year

An Analysis of Central-Station Commercial Practice Shows a Spectacular Awakening to New Thoughts, Activities and Policies

OUT OF the background of the year that has just passed stand some very definite and important trends in central-station commercial practice. There have been no revolutionary changes, no violent contradictions of former theory. Rather there has been a reawakening, part of the general recovery from the commercial doldrums in which the business of the country was so long becalmed. But is has been a spectacular awakening, and out of it have come abrupt transitions of thought and policy that are notable in the commercial history of light and power companies. And some of the incidents of this awakening offer valuable material for guiding thought on the part of executive and department managers who have in their keeping the framing of the programs for commercial development that will function through the next few years. During 1922 the central-station industry apparently succeeded in shaking off the apathy that followed the benumbing influences of the war, when, from the standpoint of commercial organization, the companies found themselves, in a bad way. Salesmen had been transferred to other departments or been discharged or had found for themselves other jobs when the selling activities were curtailed or abandoned. Department managers had gone elsewhere to find a living opportunity or had become so demoralized and discouraged by the restrictions put upon them that for the most part they were either treading water or drifting with what little progressive current they could discover. Executives had turned their minds from the subject and occupied themselves with other things. Then suddenly it came over them all at once that times at last were changing—had changed.

THE ELECTRIC VEHICLE HAS PROVED ITS ECONOMY IN CITY DELIVERY SERVICE

For money had at last become plentiful and cheap enough to borrow and to spend. People had begun to buy things once again with something like the pre-war appetite. It had therefore again become possible to take up the work of creative market development and sell light, heat, power and appliances in the old way or a better way, and to provide capacity where expansion could not be undertaken without it.

This change of heart came in a great, slowly gathering ground swell of sentiment that swept the industry from stem to stern. Department managers felt the unfolding of opportunity for renewed selling and appealed to their chief. The executives thought more and more about it, talked together when they met and gradually gained conviction. Finally the hobbles began to be loosened and commercial staffs were told to go ahead. And it was only a step from there to the point where the executives were beginning to exert pressure upon their selling people to speed up the program for new business, and that is substantially the state of things today. But it is not so simple as it looks, because comparatively few central stations have carried through an organization adequate for the proper handling of the situation now that the time is right and the word has come to go ahead. This commercial reawakening in the central-station world, this new, eager effort to get back to work and sell electric service to the community for all that it may do, has manifested itself in very clear-cut reactions. There is probably no executive and no department manager who would not have preferred to sit back and make a careful analysis of the market and the opportunity—as to both the qualitative and the quantitative aspects. For it is only in the well-balanced selective development of business that the highest returns of profit can be obtained and the highest value in service rendered. But the spirit of the year was all against it. The demand was for something to be done at once, and the facilities for doing the job were almost universally inadequate. Therefore the only course was to turn to the most available source of business and to attempt to specialize on selling that would bring the best results with the minimum of work and delay.

The result has been a very extensive activity in the stimulation of house wiring by central stations, a new movement to develop a better standard of store and window lighting, renewed interest in appliance retailing, followed by a searching inquiry into merchandising policies, and a very much greater attention to the possibilities of the electric vehicle. At the same time the sale of industrial power and heat has stiffened and increased, and a very general movement has been seen in the demonstration of electrical appliances to the public, as an educational influence, and in the organization of co-operative leagues representing all the electrical interests in a community to advance the common cause.

All these things, of course, are not the clear-cut products of the year 1922 alone. In several instances headway had been gathering for some time back, but it is fair to say that the trend crystallized in 1922 into definite form and progress that demands attention.

The trend in wiring has been spectacular. In Cincin-

nati twenty thousand homes were wired last year and 15,000 the year before in a great, intensive drive to put electric light into every household. The work has been done by organized high-pressure selling with a crew of salesmen working from house to house. This campaign is now completing its second year and will continue until the approach to virtual saturation makes it expedient to taper off into the work of equipping with appliances these homes already wired.

There has been intense activity in all sections of the country. Electrical contractors, after their lean years, have actively co-operated whenever the central station has led the movement with selling and publicity, and in every case it has been demonstrated that house wiring can be sold. Out of it has come a new mental attitude toward wiring. The Central Maine Power Company conducted a spirited campaign and in a period of six weeks wired 2,214 homes. In Boston, Philadelphia, Buffalo, Cleveland, Cedar Rapids, Denver and on the Pacific Coast homes that had been long passed by as an unpromising field have been wired through the influence of a selling impulse that emanated from the central station. The central station, therefore, is beginning to recognize the great opportunity for load building that can be developed through the installation of electric facilities in more and more homes. In Cleveland, St. Louis and other cities this has taken the form of a service to furnish wiring plans that is having great influence in increasing the number of outlets going into homes and in bettering the market for appliances.

GOOD ILLUMINATION IS A RECOGNIZED ASSET IN SALES STOREROOMS AND APPLIANCE SHOPS

The trend toward store lighting appeared for two reasons: Present conditions offer tremendous opportunity for improvement; then it is a business that is easily accessible, because the stores are for the most part grouped in a shopping center, and any success in selling improved equipment to them will set up a wave of interest in improved illumination among all merchants. A recent survey in Cleveland developed the fact that 30 per cent of the store lighting and 72 per cent of the window lighting could be classed as poor, and this in itself indicates the amount of business that awaits the central station in this field.

### New Interest in Store Lighting

A very definite effort is being made under the leadership of the N. E. L. A. Commercial Section Lighting Sales Bureau to prepare statistical data on store-lighting practice that will give the salesman the same sort of well-grounded facts that have been in a large measure responsible for the improvement in the standard of industrial illumination. In Chicago, in Boston, in New Orleans, in Duluth, the lighting companies have been particularly active in this work and have made remarkable progress. The attention of the industry has been aroused and store lighting is proving a most profitable source of increased business.

### Merchandising Policies an Issue

The trend in appliance selling has been a matter of almost universal interest. With the general quickening of household buying, dealers and central-station companies have put more and more effort into the sale of household services and the market has responded. In Chicago a system of selling from wagons was introduced, each wagon working in a district, served by a crew of canvassers who sold from house to house, and so successful has the effort been that in spite of the fact that the central station there maintains a very large electric shop and five branch stores, about 60 per cent of all appliance sales are being made by the outside men.

There has also been an interesting movement by a number of central stations toward the establishment of branch stores. The Texas Power & Light Company, the Kansas Gas & Electric Company and the Pennsylvania Power & Light Company have all opened a chain of stores in the various communities they serve, and in these the appearance of the store and the method, stock, prices and policies have been standardized. So well has the idea of central-station merchandising taken hold that the Union Gas & Electric Company of Cincinnati, having sold out its appliance business some time ago to an independent dealer, has bought it back again and is organizing for an energetic appliance-selling campaign. In Philadelphia the company has adopted mail-order methods and a far more aggressive policy.

The whole central-station industry is gradually becoming convinced that the light and power company should sell appliances and at a profit, and this has led to a thorough investigation of the present cost of selling merchandise by a group of the larger companies. As a result it has been demonstrated, as was announced in the fall, that as a class central-station companies are ignorant of their cost and are actually losing money on appliance sales. This has focused the thought of the entire industry on the weakness of present merchandising policy. Much good is bound to result.

### Vehicles to the Front

The electric vehicle is coming surely back to life as a central-station commercial objective. The trend is unmistakable. In New York, Chicago, Boston, New Orleans, Los Angeles and Fresno vehicle departments are now in operation. Realization that one 5-ton truck will consume 10,000 kw.-hr. per year, or the equivalent of 100 flatirons, is making an impression on the minds of executives who are looking about for load. Manufacturers have responded to this encouragement and are advertising to truck owners more energetically and effectively. A parade of 125 electric trucks was staged on Fifth Avenue during the Electric Show in New York, and a fleet of electric taxicabs is now in operation in that city. The electric vehicle is gaining.

Power sales have been maintaining a steady progress, but it is no longer necessary for the power salesman to camp on the prospective power user's doorstep to

secure his motor load. Central-station power salesmen have succeeded in establishing personal confidence, and power users are now ready to accept their statements of the advantages of electric drive.

One feature which has been overlooked is the installation of adequate lighting equipment in factories at the same time that motors are put in. Some companies, notably the one in Dayton, have made headway in this direction. Power customers are depending more and more on the advice of power engineers on motor equipment, particularly in application to special machines. Frequently when new machines are bought from tool manufacturers, instead of ordering motors to come with the machines the central station is called upon to specify the motor.

### Industrial Heating Increasing Rapidly Because of Its Economy

Industrial heating is rapidly coming to the front, and it is expected that it will ultimately exceed the motor load. Installations of enameling ovens with connected loads from 300 kw. to 1,500 kw. have become not uncommon. Strangely enough, the larger installations are easiest to sell, probably because of their great economy, which the larger industries are quick to recognize. The smaller devices, such as muffle furnaces, small heat-treating ovens, soldering irons and so forth, still require considerable educational work.

### Industry Promotion Work

The most conspicuous expression of this awakening of commercial thinking and activity in the electrical industry has, of course, been the organization of the Joint Committee for Business Development to lead a broad industry-wide movement for more and better business. It embraces in its membership today the following associations:

Association of Electragists—International.
Canadian Electrical Association.
Electrical Manufacturers' Council, consisting of the Associated Manufacturers of Electrical Supplies, Electrical Manufacturers' Club and Electrical Power Club.
Electrical Supply Jobbers' Association.
Fixture Dealers' Society of America.
Illuminating Glassware Guild.
National Council Lighting Fixture Manufacturers.
National Electric Light Association.
Society for Electrical Development.

Representing all branches of the industry, this committee is endeavoring to knit together the combined efforts of all into a balanced, progressive campaign that will speed up the development of this waiting market.

### Forming a Co-operative Agency Under the Leadership of the Central Station

The very fundamental of its philosophy is that the central-station company must assume the creative leadership of electrical promotion work in every community, and the emphatic expression of the doctrine has undoubtedly done much to impress upon central-station executives not only the fact that it is time to go after business once more, but that the light and power company must initiate, inspire and guide the local co-operative work. Through the co-operation of the jobbers and contractor-dealers a census of the entire country is being made to determine who are the men in each town best fitted to serve as a committee of three to maintain contact with the Joint Committee for Business Development and become the nucleus of a local league of electrical men. About one thousand five hundred communities have already been analyzed, and the work of establishing committees is going forward.

The Society for Electrical Development is acting as the workshop of the joint committee and actively promotes the organization of electric leagues. At the call of the society a conference of local league representatives was held last fall and a number of new leagues are being established. At the present time there are about forty-five local co-operative associations of this kind in operation.

### Home Electric Gains in Popularity

Meanwhile the "home electric" has gained steadily in popularity and effectiveness. More than eighty of these practical demonstrations of electricity in the home have been exhibited in nearly as many cities to an average attendance of twenty thousand, and thus more than a million and a half people have been able to hear the whole story and see what modern electric service can be made to mean in the household. One central station after another is beginning to realize that here is a great

SMALL HEATING DEVICES HAVE BECOME POPULAR IN INDUSTRIAL SERVICE

opportunity to carry its message to a great self-selected audience of interested householders. And whereas a few years ago the "home electric" was a new idea, an enterprising novelty, today it has reached the stage of common practice among companies that are commercially alert.

Such is the story of the commercial activities of 1922 among the central stations. There has been a conspicuous increase in general activity along the line of business promotion in practically all sections of the country, but it has not been of uniform intensity as applied to all classes of business. It has not been a general advance on the market in which the selling has been directed to all possible sources of opportunity, although that has been the desire. Rather it has been an effort to turn "prospects" into new load and income wherever the short-handed and disorganized commercial personnel could make the quickest contact and produce the most effective results. Undoubtedly it indicates the course which will be followed in the coming months. It promises progress, particularly in wiring, in store lighting and in merchandising. At the same time through invention of new devices and a greater realization of uses for electricity opportunity is afforded to secure a great volume and diversity in load and to more readily secure a variety of business.

# Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

## Co-operation the Keynote of Expansion

*To the Editors of the* ELECTRICAL WORLD:

I would like to suggest to you a matter that has been in my mind for many years with reference to the necessity for co-operation between the various branches of the industry. I have the viewpoint of a consulting mechanical and electrical engineer and also that of an operator interested, in the capacity of consulting engineer, in the operation of public utilities, and still again that of the electrical contractor, having spent considerable time in that business a number of years ago.

The operator devotes much effort to increase the sale of electrical energy through elaborate window and store displays, commissions to employees, monthly-payment plans, display advertising and house-to-house canvasses. The ELECTRICAL WORLD has been of great assistance to the business in stimulating interest in this development.

The consulting engineer has recognized the growing demand for electricity and has kept pace with this development by educating clients in the advantages of modern appliances and of outlets ample in number and capacity to take care not only of present demand but of possible future needs. Consulting engineers have designed feeders and sub-feeders of such capacity as would give proper service under increased demand. The ELECTRICAL WORLD has again materially aided such efforts to lighten the efforts of the operators in their sale of electrical devices.

The electrical contractor, however, needs education along the line of co-operation. In his efforts to get business he destroys the confidence of the public in the operator and consulting engineer and the entire electrical profession.

He frequently condemns the equipment sold by the operator as being inefficient in comparison with equipment which the contractor himself sells, and he does not base his statements on any tests or accurate information. He frequently condemns the operator's sales efforts, not realizing that these efforts are helping to increase his own business. He frequently condemns the design made by consulting engineers in order to suggest a reduction in number or capacity of outlets or a reduction in feeders and sub-feeders, thus enabling him to make a reduced price, though not one commensurate with the actual saving in material and labor, and thus permanently limiting the use and sale of energy-consuming devices together with the labor of installation. The electrical contractors go so far as to look upon the engineers as competitors in their endeavor to make designs for architects for which they receive little or no pay.

These same contractors frequently go to the owners instead of the architects when they find that some other contractor has made a design and suggest that the other contractor is a favorite of the architects and that no one else will get a fair deal in the architect's office. At times this may be true, but such condemnation again destroys confidence in the entire profession.

When contractors make designs it occasionally happens that, for example, they call for an excessively long run of heavy feeders where a much shorter run is possible, or lead-covered cable is specified where none is required, and then they submit bids on their own specifications, offering a reduction in price on the change to a correct design. Such practice is neither clever nor consistent with good business.

There is no reason why a contractor should not make designs if he receives compensation for them, but generally he could devote his whole time more profitably either to designing or to contracting, but not to both. When he does make the design it is more ethical not to submit a bid on it, as the dual position of contractor and engineer is as difficult to fill successfully as is the dual position of general contractor and architect.

The electrical contractors need to adopt a code of ethics similar to those of the Rotary Club and other professional and business organizations. The ELECTRICAL WORLD could be of material assistance in educating the contractor to seeing the possibility of an increase in business to himself and to the consulting engineer, manufacturer, jobber, dealer and operator if he would co-operate in the encouragement of more liberal but not extravagant design.

The contractor could materially assist in educating architects and builders in the employment of consulting engineers for the proper design of electrical installations, and thus avoid what is at present the unnecessary and unprofitable burden of free designs by the contractor.

Co-operation is the keynote of expansion and continued success of the entire electrical industry.

HERMANN C. HENRICI.

Henrici-Lowry Engineering Company,
Kansas City, Mo.

## Size of Automatic Stations

*To the Editors of the* ELECTRICAL WORLD:

From time to time a question is asked as to the maximum size for which an automatic station or an automatic substation can be recommended. This question is becoming more prominent as the economies shown by automatic stations come to be appreciated by operators. It is one to which a specific answer cannot be given, since in each case the maximum size depends upon the circumstances. As a matter of fact, the maximum size of an automatic station presents no technical difficulties. The size is in almost every case limited by the financial considerations. For example, no one questions the installation of a 2,000-kw. automatic railway substation or a 5,000-kw. automatic hydro-electric station. However, it would be questionable if any one would recommend installing a 200,000-kw. completely automatic station.

An analysis of the problem makes it apparent that the dominating factor in the maximum size of an automatic station is the relation between the attendance charges and the fixed charges based on capital investment. Where the attendance charges are high compared with the fixed charges a complete automatic station is, in practically all cases, warranted. Where the attendances charges are only a relatively small percentage of the fixed charges complete automatic operation does not seem warranted.

It may be seen from this review that there is no fixed maximum limit for the size of an automatic station, but that this limit is one dictated largely by financial parameters.

CHESTER LICHTENBERG.

General Electric Company,
Schenectady, N. Y.

# Central Station and Industrial Practice

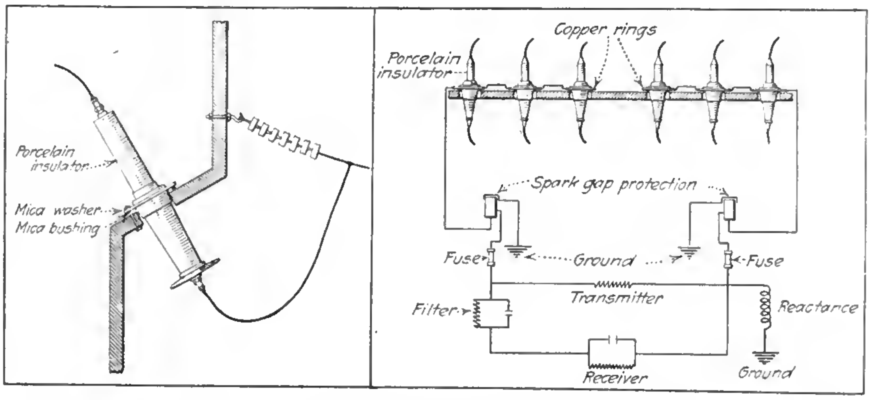
**Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants**

## Telephony Over Power Lines in Europe

SATISFACTORY communication is being conducted over high-voltage power lines in Europe on at least a dozen systems. Use is made of a carrier frequency superimposed on the low-power frequency, and the transmission line and ground are employed to complete the oscillatory circuit. The cost per station is from $3,000 to $4,000, and some of the important installations are:

| Country | Location | Distance, Miles | Voltage |
|---|---|---|---|
| Germany | Golpa-Rummelsburg | 90 | 110,000 |
| Germany | Hirschfelde-Dresden | 60 | 110,000 |
| Germany | Harbke-Nachterstedt | 30 | 50,000 |
| Switzerland | Geneva-Lusanne | 45 | 55,000 |
| Sweden | Untra-Vartan | 90 | 110,000 |
| Norway | Aarlifoss-Skien | 50 | 65,000 |
| Norway | Askim-Kristiania (Toien) | 50 | 65,000 |

One of the first installations was that between the Aarlifoss Power station and Skien, Norway, a distance of 50 miles. Each station has a 10-watt transmitter, receiver, calling apparatus, switchboard with provision for automatically charging the storage battery and a 600-volt motor-generator. All this apparatus is in the room where the transmission lines lead out, while the telephone transmitter and receiver are on the desk of the engineer in charge of the station. By lifting the receiver off the hook the tubes are lighted, the motor-generator is started, and high-frequency waves are sent out which operate a relay in a resonant circuit, causing a bell to ring. When the receiver at the distant station is raised the bell is disconnected, tubes are lighted and the motor-generator started. Different wave lengths are used for transmission and reception, namely 1,560 m. and 1,720 m., so that two-way speech is possible.



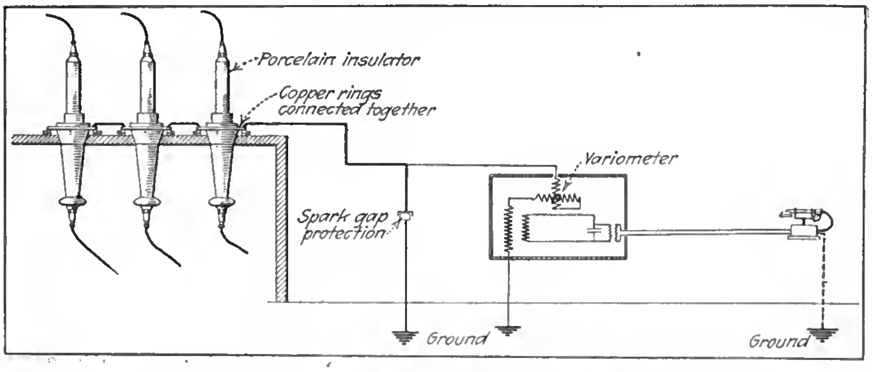

EVEN WITH TRANSMISSION LINE BROKEN OR GROUNDED INTELLIGIBLE CONVERSATION IS POSSIBLE WITH CARRIER CURRENT SYSTEM

Left—Coupling of telephone apparatus to 110,000-volt line by means of copper rings around center of bushing. Right—Coupling apparatus for two 110,000-volt lines.

Coupling the apparatus to the high-tension lines was a difficult problem. At first wires were strung below the lines as far as the first or second tower from the station. This construction did not give desirable results, however, as the capacity between the coupling antenna and ground was much larger than between the antenna and the transmission line, resulting in considerable loss.

At the present time roll-paper condensers are used between the carrier-current apparatus and transmission lines operating at voltages up to 75,000. In the system between Aarlifoss and Skien and that between the transformer stations at Askim and Kristiania (Toien), which were only recently installed, these condensers have an outside diameter of about 3 in. and a length of about 4 ft. Two of these are connected in series and are tested at ten times transmission voltage so as to insure protection to as great a degree as possible from high voltage on the telephone apparatus. Additional protection is secured by means of a spark gap with low break-down voltage and large current-carrying capacity (200 amp. at 2,000 volts to 3,000 volts), fuses and insulation of the open oscillating circuit of the apparatus from the closed oscillating circuit.

With high voltage (80,000 to 110,000) the cost of condensers becomes prohibitive and the danger from high voltage increases. At these voltages the coupling is made by means of a copper ring concentric with the entrance insulator at the building wall. Since there is a voltage of approximately 100 between this ring and ground, it is insulated from the wall by three porcelain insulators. Where there is only one three-phase line, the rings around the three entrance insulators are connected together and used as coupling capacity to the transmission line. In this case the ground is utilized to complete the




COUPLING OF TELEPHONE APPARATUS TO A 110,000-VOLT TRANSMISSION LINE AND GROUND

oscillatory circuit. Where there are two transmission lines capacity rings are used on the second line instead of a ground return.

This system of telephony has marked advantages over ordinary line telephony in that it is only little affected by even large disturbances on the transmission line. Even with one or two conductors of a line broken or grounded, it is possible to carry on intelligible conversation. When the system was first installed at Aarlifoss and Skien, interesting tests were carried on to see to what extent the line could be damaged and communication still possible. The two stations are connected to the same conductor, and there are two three-phase lines. Not only was the conductor to which the stations were connected broken, but the whole three-phase line was broken and grounded in three places, and it was still possible to communicate.

CLIFFORD N. ANDERSON,
New York, N. Y. Engineer.

## Comparative Cost Data for A.-C. Substations

SOME preliminary cost data have become available for purposes of comparing automatic and manually operated substations. These figures should be of interest to any one considering the installation of automatic stations. The difference in the cost of construction for the stations cited in the accompanying tables is not marked, though it should be noted that their capacities are not on a strictly comparable basis.

Operating expenses, however, vary in a marked degree, those of the lowest-cost manual station being from five to ten times those of the two automatic stations per kilowatt-hour handled, while the two remaining manual stations multiply these differences by from two and one-half to three.

COST OF ALTERNATING-CURRENT SUBSTATIONS

| | Automatic Station, A | Manual Stations, 1 | 2 | 3 |
|---|---|---|---|---|
| Designed capacity | 12,000 | 10,000 | 10,000 | 6,000 |
| Installed capacity | 6,000 | 10,000 | 6,000 | 4,500 |
| Cost per kva. installed capacity | $30.00 | $26.00 | $26.00 | $33.00 |
| Estimated cost per kva. at full rated capacity | 24.00 | 26.00 | 20.00 | 28.00 |
| Estimated ultimate cost per kva. at full rated capacity with spare transmission line and transformer | 32.00 | ...... | ...... | ...... |
| Estimated cost of self-restoring equipment for circuits and additional cost of high-capacity oil switches over those regularly used in manually-operated stations per kva. of rated capacity | Approx. 3.50 | ...... | ...... | ...... |

Regarding the design of automatic substations, provision is made in must cases for a liberal duplication of transmission facilities from sources of supply as well as duplicate transforming equipment with a complete spare unit in reserve. Protective and control equipment for incoming lines and transformers is usually adapted for multiple or unit operation of lines or transformers, or both, this being supplemented with added protection against overloading and overheating of transformers.

One of the most important features to be considered in any station of this type is the selection of switching equipment of adequate capacity to meet successfully any conceivable emergeny.

Perhaps the most radical departure from usual practice in manually operated stations is the almost universal elimination of double high-and-low-tension buses. The newer construction includes either no high-tension bus and a single low-tension bus or sectionalized single high-and-low-tension buses with manually operated non-automatic switches installed between sections for emergency use.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

OPERATING AND MAINTENANCE COSTS OF AUTOMATIC ALTERNATING-CURRENT SUBSTATIONS

| Station Equipment | Station A* | Station B |
|---|---|---|
| Incoming—13,200-volt lines | 3 | 2 |
| Outgoing—13,200-volt linea | 1 | 1 |
| Outgoing—2,600/4,500-volt, four-wire overhead and underground circuits | 6 | 3 |
| Transformera (self-cooled and water-cooled), three-phase, kva | three 2,200/3,000 | One 3,000/5,000 |
| Street-lighting equipment | 0 | 0 |
| Output, 1921—kw.-hr | 24,647,700 | 4,300,090 (6 mos.) |
| Station operating and maintenance cost, cents per kw.-hr., 1921 | 0.0219 | 0.0105 |

* Station A operated witn part attendance.

OPERATING AND MAINTENANCE COSTS OF MANUALLY OPERATED SUBSTATIONS

| Station Equipment | Station 1 | Station 2 | Station 3 |
|---|---|---|---|
| Incoming 13,200-volt lines | 5 | 3 | 3 |
| Outgoing 13,200-volt lines | 4 | 2 | 3 |
| Outgoing 2,300/4,000-volt, four-wire overhead and underground lines | 16 | 7 | 6 |
| Transformers, three-phase, kva | Two—3,000/5,000<br>Two—1,750<br>One—500 | Four—1,500 | Three—1,500 |
| Street-lighting equipment | 0 | Six C.C. tranaformers | Four rectifiera Two C.C. transformers |
| Output, 1921—kw.-hr | 16,661,000 | 5,964,000 | 5,728,000 |
| Station operating and maintenance cost, centa per kw.-hr | 0.1063 | 0.2598 | 0.314 |

## Better Voltage Regulation Increases Output

A SEVERE loss of business due to low voltage was suffered by a power distribution company serving three towns with a combined population of 1,500. This company bought all of its energy from a transmission company. The writer was called upon to estimate the reduction in output due to the low voltage and to suggest means for correcting this trouble. The solution of this problem brought out some facts which it is thought will prove of general interest.

No reliable records of the power demand and voltage being available, the necessary data were secured by the installation of a curve-drawing voltmeter and a wattmeter. The records for a single day are shown in the accompanying illustration. The regulation is seen to be very poor, about 15 per cent. The peak load is 120 kw. and the load factor about 40 per cent. The load was supplied over a single-phase line of No. 6 B. & S. copper, 30 miles long, at 13,200 volts.

Having the load curve and the voltage curve, the load curve can be corrected to what it would have been if the voltage had been held at 120 volts and the load had consisted entirely of lamps by the use of the lamp-voltage-lamp-power consumption curve. Such a correction was made, as shown in the curves. Taking the area between the two curves, the increase in energy was found to be 5.5 per cent. This is the possible increase in gross receipts due to perfect regulation unless peak load customers pay a higher energy rate than the weighted average energy rate of all the customers. The fig-

ure represents also the loss of gross income under the conditions of poor regulation. This figure will vary from day to day as the load varies with the changing seasons.

The yearly loss must be estimated from the daily load charts. In the case under consideration the conditions on the day tested were assumed to hold for a six-month period and the loss was neglected for the next six months.

A study of the load curve indicates overlapping of the power and lighting loads at 5:30 p.m. Any discrepancy in the calculations due to assuming that the entire evening load is caused by lamps will be counterbalanced by the error due to assuming that there are no lamps or heating devices in operation during the daytime. The morning peak, between 7 and 7:30, is probably due to lamps and heating appliances.

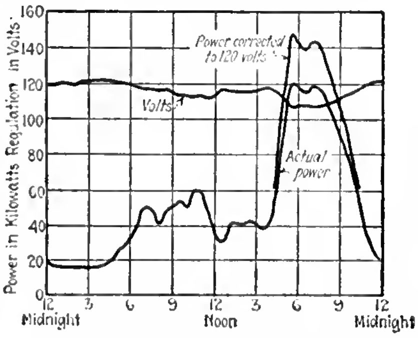
### Various Methods of Correction

Knowing the magnitude of a loss in revenue, every manager wishes to know how the loss may be reduced and how much the reduction will cost. Voltage losses can be reduced by increasing the size of the copper composing the transmission line or can be overcome by installing regulators. An examination will now be made as to the relative cost of each of these methods. In order to have the discussion concrete, the following assumptions will be made: Cost of generating station and transmission line, $175 per kilowatt capacity; annual gross receipts, $50 per kilowatt of peak load at full voltage; annual operating expenses, 70 per cent of gross receipts; cost of coal and water, 50 per cent of operating expenses. The load curve given is the average load curve encountered in small towns.

The only increase in expenses caused by having perfect regulation will be that due to the increased coal and water used. A 5.5 per cent increase in energy sold will therefore cause a 3.6 per cent increase in receipts after deducting the cost of the increased coal and water used. This will increase the net income available for payment of fixed charges and dividends by 12 per cent or $1.80 per year per kilowatt of peak load. The actual increase may be greater than this, because under prevailing rates the increased energy consumption is largely due to residence customers, who pay the highest energy charge.

Doubling the wire will cost in this case about $30 per kilowatt and decrease the regulation to half its former value, neglecting the voltage drop in the line transformers. This will result in an increase in income of 90 cents per kilowatt, or 3 per cent on the additional investment to the property.

The regulation can also be reduced to half its former value by adding a wire and making the transmission line three-phase at an expenditure of about $20 per kilowatt. This will result in an increase in income of 90 cents per kilowatt, or 4.5 per cent on the additional investment. A regulator can be installed for about $11 per kilowatt, resulting in practically perfect regulation and securing an increase in net income of $1.80




INCREASE IN ENERGY CONSUMPTION DUE TO BETTER VOLTAGE REGULATION

per kilowatt, or 16 per cent on the additional investment.

The reduction in the line-resistance losses by installing larger copper or making the line three-phase will make a better showing for these methods of improving the regulation. The cost of the losses in the regulator will cause a poorer showing to be made by the regulator. The superiority of the regulator will still hold good, and the voltage regulation will be better when a regulator is used.

One utility manager reports an increase in business of 10 per cent during the year following the installation of voltage regulators. It has been common experience that complaints as to rates being high usually follow a lowering of the standard of voltage regulation. No electric power company can therefore afford to get along without a fairly comprehensive voltage survey being made often enough to determine whether the regulation is satisfactory on all parts of the system.

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## No Dangerous Strains from Sudden Steam Discharges

NO DEGREE of shock whatever was shown when the effects of large sudden steam discharges from boilers were investigated by the American Society of Mechanical Engineers' research sub-committee on sudden initial pop lift of safety valves. The results obtained by this committee, of which P. G. Darling is chairman, were presented at the recent annual meeting of this society. The tests were conducted to determine whether there is a shock to the boiler which under any condition may become dangerous or cause damage when a relatively large steam discharge is suddenly released or such a discharge from a boiler is suddenly stopped, as in the opening and closing of a safety valve.

The tests covered sudden steam discharges which in size, relative to boiler capacities, were far in excess of the capacity of any safety valve which would ever be attached to the boiler. With a 75-boiler-hp. Almy water-tube boiler at the plant of the Crosby Steam Gauge & Valve Company at Boston (actual test in this case being made by the Massachusetts Institute of Technology) the maximun discharge tried was approximately three times the total safety-valve requirement of the A. S. M. E. Boiler Code. On a 94-boiler-hp., 300-lb.-pressure Babcock & Wilcox boiler installed in the plant of the Consolidated Safety Valve Company at Bridgeport, Conn., more than seventeen times the total valve capacity for the boiler was instantaneously relieved in the attempt to produce a shock. When it is considered that two or more valves would be called for by the A. S. M. E. Boiler Code, the sudden steam relief that was tested at Bridgeport would be thirty-four or more times the largest valve which would generally be used with this boiler. The locations of the pressure indicators in the Bridgeport test, selected because considered the most likely points to receive shock, are believed to be representative enough to justify the conclusion that no shock would be detected from an attachment at any other place.

In the opinion of the committee the investigation might be continued with prolonged trials on different types of boilers under different conditions of steaming, and with additional points of attachment for the pressure indicators. However, con-

sidering the fact that no degree of pressure increase or shock whatever was detected under the severe steam-discharge conditions tried, the committee believes that it is extremely unlikely that any boiler conditions would be found so radically different as to produce a shock. In other words, if a pressure-increase shock could be produced by any reasonable boiler operation, the committee believes that the conditions of their tests were representative enough to insure detection of such shock.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Combined Red and White Safety Isle Fixture

TO SECURE the proper functioning of safety isle lighting units, it is necessary that they be of a character easily seen both in daytime and at night. While a red globe placed at the top of a pole in the center of the zone has certain advantages in that when the light is on it may be clearly seen, it is open to the objection that the base of the post is not sufficiently lighted. These illuminating fixtures can be installed for a small portion of the cost of illuminated signs for the same purpose and the maintenance cost is practically negligible.

The objection has been entirely overcome by the simple and inexpensive fixture shown in the accompanying illustrations and employed by the South Park Commission in Chicago. A number of these fixtures have been tried out for some time at busy intersections on Chicago's boulevards and have been found very satisfactory. A translucent globe is used in place of the usual expensive ruby globe. The fixture for the lights on multiple circuits consists of a conical metallic reflector constructed in two parts which is assembled after being placed within the translucent globe. The globe in turn is carried on a four-lamp cluster supported from the globe holder below. This is shown at the bottom center. The cluster is arranged with two ruby incandescent lamps above and two clear lamps below as illustrated and is supported from the globe holder at a predetermined position. When the globe is placed on the holder the assembled shade adjusts itself on the cluster and divides the globe into two compartments. The upper position of the globe shows red while the lower portion illuminates the safety zone surrounding the fixture.

Day and night views of a safety isle equipped with the fixtures are shown on the left and right of the illustration. A number of the fixtures are proving very satisfactory as boulevard crossing signals. In this case the fixture is used on the regular series boulevard lighting standards (top center), the lamp cluster being replaced by the use of a ruby-glass inverted bowl inclosing the upper part of the standard series tungsten lamp. The reflector is supported from this ruby-glass bowl. The illuminating effect of the street light is not affected by the installation of the fixture as only the upward rays are utilized for creating the red signal.

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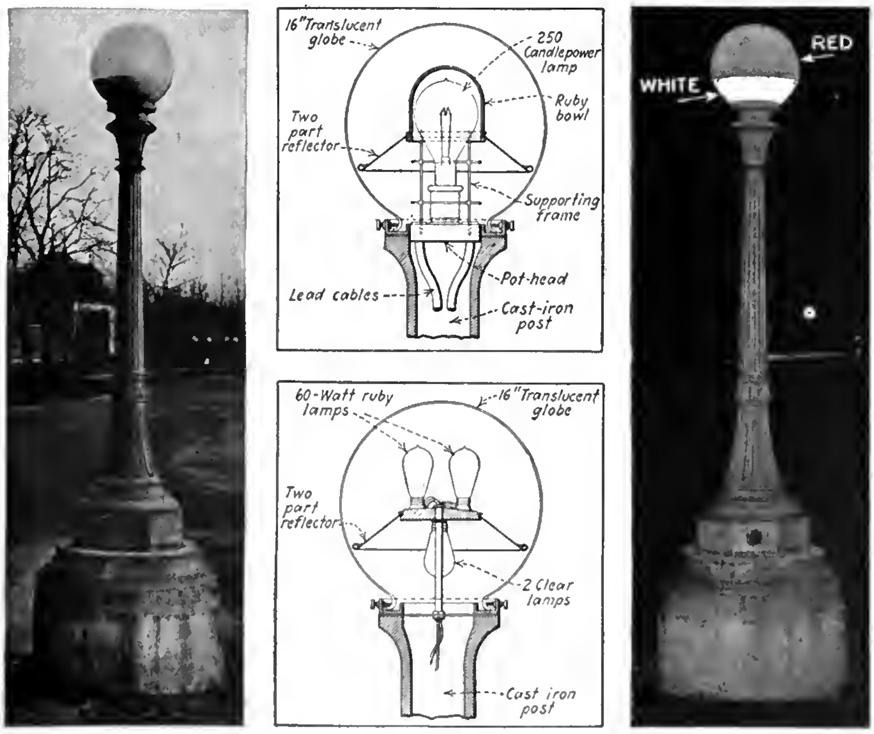
Chicago, Ill.




ARRANGEMENT OF BOULEVARD CROSSING AND SAFETY ISLE LIGHTING FIXTURES USED BY SOUTH PARK COMMISSIONERS IN CHICAGO

The white light from the bottom of either fixture, as shown in center, illuminates the lighting standard and prevents automobile drivers from running into it. The top of each globe is red and gives the driver warning of the presence of the standard. Day and night views of the safety isle fixture are given on either side.

## Standard Busbar Ratings Adopted

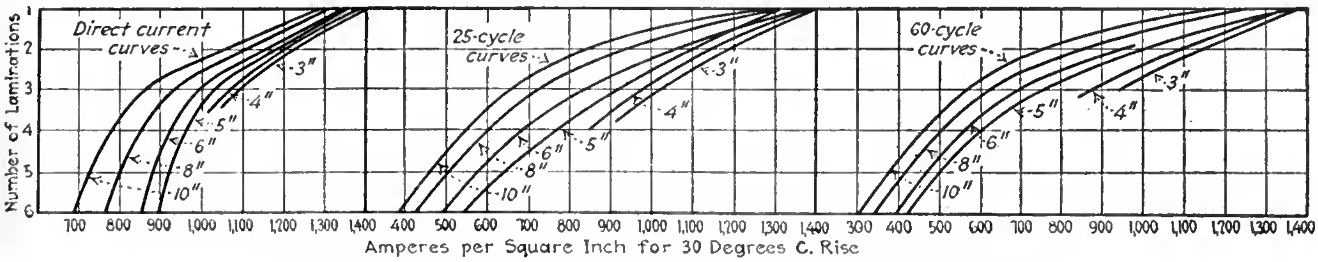
CERTAIN revisions of the rules on application and rating of busbars and connection bars have been developed by the Power Switchboard and Switching Equipment Section of the Electric Power Club and adopted as standards at the fall meeting of the club at Asheville, N. C.

The standard now specifies that all busbars shall be rated on a basis of temperature rise instead of current density. The current-carrying capacities of the usual sizes of copper buses, based on a 40 deg. C. ambient temperature, are given in the accompanying curves. These curves are to be used for currents not exceeding 3,000 amp. The spacing between laminations is $\frac{1}{4}$ in., each lamination being $\frac{1}{4}$ in. thick. A spacing of 8 in. is left between phases. Slightly increased capacity is obtained by replacing each $\frac{1}{4}$-in. lamination with two $\frac{1}{8}$-in. laminations and using $\frac{1}{8}$-in. spacing because of the increased radiating surface. However, this advantage is gradually offset by increased inductance as the number of laminations increases per phase and as the spacing of phases decreases.

The standard practice in the rating and application of busbars and connection bars as revised is as follows:

On account of the variation in radiation, skin effect and reactance due to the arrangement of busbars, ampere ratings of bus and connection bars shall be based upon temperature rise instead of on a constant-current density.

A contact pressure of 250 lb. per square inch shall be the minimum for good engineering practice in




CURRENT-CARRYING CAPACITY OF THE USUAL SIZES OF COPPER BUSES BASED ON 40 DEG. C. AMBIENT TEMPERATURE

bolted or clamped connections of bars.

All contact surfaces of buses and connections shall be cleaned by sandpapering or other suitable means immediately before bolting.

On account of the low temperature at which the oxidization of copper commences a maximum operating temperature of 70 deg. C. shall be used in the design of copper buses and the connections thereto, except that on extended bus systems isolated from apparatus where unusually heavy contact pressure is employed at joints and connections a maximum temperature of 80 deg. C. may be used.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Meter Testing Aided by Use of Test Panels

TO FACILITATE the testing of large power meters, provide greater safety for the tester and comply with the new electrical safety order of the Industrial Accident Commission of California, the Southern California Edison Company has developed and standardized a plug-type meter-testing panel. Most power companies in California use the over-all or primary method of testing their meters, which introduces complications on account of the difficulty of connecting the testing equipment into the circuit without interrupting the customer's service.

The panel shown in Fig. 1, with meter and relay mounted, is neat and inexpensive and by means of the test receptacles provides a ready means of testing the meter in a minimum of time and with greater safety to the tester. A small panel retained by wing nuts and sealed covers the plug receptacles, except when the meter is being tested. This type is constructed on one panel, the main-line switch being installed elsewhere. Fig. 2 is a rear view of this same panel, showing the method of installing the receptacles for connection to their proper line and load wires for three-phase installations.

Another standard test pane is shown in Fig. 3. In this type the meter, main-line switch, test panel and motor-starting compensator are all mounted on the same angle-iron frame. The wiring diagram shown in Fig. 4 for use with this panel indicates the connections for testing the meter either with phantom load or using the customer's load. A large percentage of meters are tested with the customer's load, making it unnecessary to isolate the meter for phantom-load testing. Such cases are those of pumping plants, refrigeration machinery, etc., where the load is fairly constant.

The two installations described above are made up to and including 440-volt service. With voltages above 440 and up to and including 2,300, a special test panel is used. The method in primary testing is similar to that heretofore described, with the exception that no phantom loading is attempted unless a water rheostat is available and is used for test load.

A still further development in test equipment is found in the diagram shown in Fig. 5. This type of installation is used mainly in substations and for the larger customers who take 10,000-volt or 15,000-volt delivery. Provision has also been made in this type of installation for connecting the testing equipment into the circuit without interrupting the customer's service. By opening certain of the switches shown all connections may be made to the dead end of these switches with safety to the tester. W. R. FRAMPTON,

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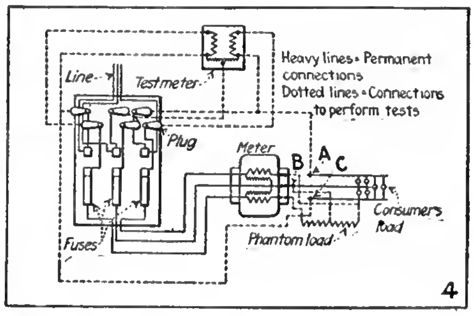
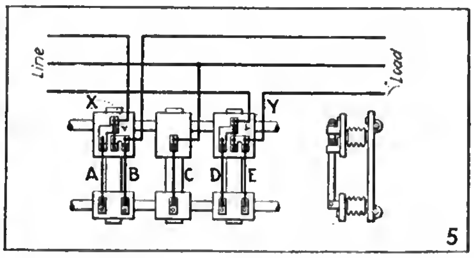



NEAT AND INEXPENSIVE PANELS PROVIDE MEANS OF TESTING METERS IN MINIMUM OF TIME AND WITH SAFETY

Fig. 1 — Plug-type meter-testing panel adopted by Southern California Edison.

Fig. 2—Rear view of panel shown in Fig. 1, showing method of making connections.

Fig. 3—Test panel in this type of installation is mounted in connection with main-line switch. All wiring is in conduit.

Fig. 4—Testing consumer's meter with phanton load without disturbing the load; wiring diagram for panel shown in Fig. 3.

Fig. 5—Connections for 15,000-volt test switch. Under normal conditions of operation all disconnecting switches are closed as shown. When cutting in for testing purposes, switches A, B, C, D and E are opened and connections are made on the lower terminals. After connections are made, the switches A, B, C, D and E are closed and X and Y are opened, cutting in the testing equipment, after which the test may be made with safety.

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## Commercial Problems for 1923

**Need of Organizing New-Business Departments for More Efficient Operation and the Training of Suitable Salesmen Principal Causes of Concern**

CENTRAL-STATION new-business managers are confronted by a number of outstanding commercial problems which must be worked out during the year 1923. In the order of their importance these problems may well be grouped as bound up in: First, improved new-business organization; second, training competent salesmen; third, a definite merchandising policy with an accurate method of cost keeping; fourth, careful planning for a selective development of business in the territory; fifth, closer attention to the quality of residential wiring and to the adequacy of store lighting; sixth, proper allocation of expenditures for advertising and the promotion of new business; seventh, development of electric transportation.

Central-station executives, after their war-time experience with power shortage, are unanimous in the belief that new business of a highly diversified character should be built up. However, they feel that the old pre-war policy of "new business for the sake of additional load" will not fit present-day conditions. Consequently, while new business should have a load-building value where it involves the sale of energy-consuming devices, these sales should be made at a profit and this particular branch of the commercial department must be put on a self-suporting basis. The possibilities of commercial development, judging by the past growth of the industry, are almost unlimited, and it is generally believed that now is the time to put sales departments on a firm and lasting basis.

### New-Business Organization

Of first importance, naturally, is the question of departmental organization. The work of the central-station sales department may be divided into two general heads—(1) selling energy or load building, and (2) selling energy-consuming devices at a profit, or merchandising. While the two are intimately related, it is important that their activities be kept distinctly separate in order that accurate records may be kept of what each accomplished.

Load building involves the sale of energy from which profit will be realized, and the cost of such commercial operations should be charged to the promotion of the business. Much more thought is needed as to the kind of business which it is most profitable for a company to go after, and while this is governed to a considerable extent by the industrial nature of the community, it is essential that a company know just what the power, commercial and residential potentialities of its territory are. Therefore a survey of the territory to show where new customers can be taken on and how the loads of existing customers can be increased is necessary in order to lay out a fitting sales program. Large power and commercial customers will not be overlooked because of their size, but it is easy to underestimate the value of the many smaller users of energy which make up the real bulk of the business. In order, though, to reach out and get this prospective business, it is necessary for the central station to maintain actively at work a force of salesmen who can represent the company in the territory.

Here is probably the most puzzling problem of all for the new-business manager. There are not many central-station salesmen or representatives left. During the war many of them went into other fields, and those that remained have, through their added experience, now become rather highly specialized in some particular line—power, industrial heating or illumination—or else they have gone with a smaller company as commercial manager. This makes it necessary to find and train an almost entirely new lot of salesmen. This was considered sufficiently difficult in former days, when an old, experienced salesman could take a new man out and break him in, but now it must be met in some other manner. For a while it seemed that it would be possible to obtain salesmen by advertising for canvassers, in the belief that it would not be necessary for these men to know very much about the electric light and power business. This has not worked out well because the caliber of the men who present themselves in answer to advertisements is low. They cannot be classed as other than peddlers, and the turnover in salesmen is exceedingly high. Only by sifting all applicants carefully can any really good salesmen be found. The ratio of salesmen retained to the total number employed during a year runs as high as one in twenty in one company.

### Selecting Salesmen

However, the situation is by no means hopeless, and a solution is being found by several companies in employing as salesmen only the highest grade of men they can find. It will be necessary to offer higher compensation in some cases, but this will be offset by the fact that more conscientious men are obtained. This practice has several advantages. Men with better selling experience will be attracted to the central station. They are men who will gain knowledge of the business more quickly and will not, as a rule, require so long a training period nor so much supervision. They will be steadier because they are not looking for a stop-gap job for a few months. For the most part, they want a permanent place, and where the remuneration is sufficient they can be counted on to stay.

The matter of finding younger men to train as salesmen presents a somewhat different problem, for quite often they are not sure that they want to remain in the central-station business, and even so they may not be adapted to the selling end. Some companies are solving

this question by taking on a certain number of young men each year in a cadet capacity as they graduate from high school or college, and by giving them about three months' experience in each of the different departments the kind of work for which they are best suited is determined at the end of a year or eighteen months. By reason of this practice those who reach the commercial department will make very capable salesmen.

### Salesmen's Compensation

One thing more which will seriously affect the question of finding the right men for salesmen is the methods of compensation. Probably no two companies use exactly the same basis for paying salesmen. Methods vary, the most usual forms being flat salary with no commission, salary plus commission, drawing account with commission and straight commission. Some companies have tried out all these forms of compensation and have yet to determine which is the most satisfactory. This lack of uniformity is a serious handicap in developing and retaining permanent sales forces, and a more nearly standard method could well be adopted. A set rule, of course, could not be used by all companies, but in making up a schedule of compensation two important elements should be considered. First, commission or salary should be proportionate to the value of the business, and, second, the salesman should receive compensation sufficiently liberal to keep their enthusiasm from lagging from month to month. Opportunity for advancement is one other element, aside from actual compensation, which will go far in holding a sales force together and keeping men on their toes.

The problem of merchandising is an interesting one. Whether or not the central-station company shall merchandise electric appliances may depend upon the local situation. But the fact that some companies which discontinued their appliance-sales departments are now reviving them on a larger scale than formerly indicates that it is advisable in many instances for the central station to show the way in merchandising practice. In all such cases the business is to be conducted along ethical lines, with a view to making a profit.

To do this merchandising must be made self-sustaining. Its cost of operation must be kept entirely separate from other commercial activities, and it should not look for or expect financial support from the company because of its load-building value. This is not only poor business for the company, but it is a form of unfair competition with other legitimate electrical dealers.

When a company has definitely decided to go into merchandising it must carefully analyze the local situation with reference to the location of its store to the best advantage. The electrical store itself or appliance salesroom, as the case may be, must be equipped as a real store and not be merely a makeshift display room as an adjunct to the cashier's window where customers pay their bills. Furthermore, if the central-station company would make a profit from its merchandising, it must learn to be a merchant. Costs of doing business must be kept accurately and stocks and turnover must be most carefully watched so that leaks may be stopped. The idea that should be kept ever foremost is that the business is being conducted to make a profit.

In developing the fields for new business the central station should not devote attention to one class of business at the expense of another. Where this has happened in the past it has not been intentional, for after the lighting load had brought about the high daily peak it became imperative that a day load be found, and after the power load got under way it grew so rapidly that in 1920 it came near swamping the electric light and power companies. Therefore in the future it is advisable to keep some semblance of balance between the lighting and power loads because of the well-known advantages of diversity, particularly diversity in revenue in times of industrial depression.

### Residential Load

The possibilities of additional lighting business are only just now being fully appreciated. In the residential sections many companies measure their degree of success by the number of customers connected, and they feel that the increasing number of meters indicates that they are rapidly approaching the point of saturation and must look to other fields for more business. However, it is pretty generally admitted that the lighting of the average home is inadequate, that the sale of appliances is hampered by the lack of a sufficient number of outlets, and that a campaign for the education of the public to a more complete use of the service must be made.

Electrical homes will prove of enormous value in stimulating public interest and new homes will be wired properly. But the educational work,

## Electric Heating May Exceed Motor Load

THE rapid development of the electric heating load is typified in this large oven for baking enamel on automobile fenders. The oven is 12 ft. wide, 8 ft. high and 134 ft. long and has a demand of 450 kw. Heating engineers maintain that there exists in every industrial plant manufacturing processes which can be made more economical through the application of electric heat. They also predict that this load will, in the not very distant future, exceed the motor load by a ratio of between two and three to one.

particularly as to old costumers, cannot stop there. It should be carried to them by the central-station salesmen, through direct mail and newspaper advertising and by practical demonstrations of home lighting. If residential customers are to be profitable customers, they should be fairly generous users of energy, and to this end the value of adequate wiring for better lighting and the utilization of appliances should be fully impressed on them by the company. This is one of the big jobs that the central station must learn to do.

### Commercial Lighting

Store lighting also still offers an opportunity for load building no less than that offered by home lighting. In fact, it has been proved that only 30 per cent of the stores in an average city have adequate lighting. This class of business is quite often at the very door of the central station, and it is not difficult to demonstrate to a merchant the value of good lighting. Therefore the central station can to advantage develop one of its salesmen as an illuminating engineer who can perform a distinct service for commercial lighting customers and at the same time build up a highly profitable load for his company. The problem here is first to develop the salesmen and then to implant in the minds of the merchants an appreciation of the profit value of a high standard of illumination.

### Heating and Motor Loads

Power business is coming more easily to the central station because of the admitted economy of central-station service as compared with the isolated plant, but it must not be forgotten that this is largely the result of years of tedious missionary work on the part of the power salesman. In that time he has developed the personal confidence of his "prospects" in what he says and in the company back of him and now we see the results of this work. With the increasing motor load the field of industrial electric heating is developing, and the most optimistic heating engineers expect that this load will soon overshadow the motor load by a ratio of three to one. In this field again the power salesman must carry on his personal campaign of education until he establishes the confidence of the skeptical "prospect," when the business will come on the lines with perhaps greater rapidity than the power business. This kind of industrial business always means long pull ahead and needs sympathetic and patient support from central-station executives.

Closely allied with the power business is the growing popularity of the electric vehicle in the field to which it is adapted. So far the central-station company has not been able to give the proper attention to electric transportation because so many other things appeared to demand attention first. The great obstacle has been inertia in taking hold of the electric vehicle and doing a real selling job. But there is an opportunity for team work and co-operation between the central-station men and the vehicle and battery manufacturers. The problem depends much, however, on the establishment of suitable service facilities.

In many of its new-business operations the central station has what might well be termed traditional handicaps to overcome. It has long been the policy to conduct the sales department with the sale of more energy as its main purpose. If a deficit was shown, it was charged to promotion of the business. But the development of the industry has reached a point where the new-business department should be able to pay its own way. Central-station executives and commercial managers recognize this and are bending their efforts in that direction. Several definite changes in policy will go far to bring it about.

First, there must be a fundamental change in the philosophy of these departments; that is, the aim should be to merchandise for profit, not for the sale of energy. Second, there should be an improvement in the technic of retail operation to include proper cost figures with more sales per dollar of operating expense. Third, there should be adequate margins of profit. Fourth, there should be greater efficiency in spending money for promotion, advertising and other new-business expense. Fifth, there should be established a stable and permanent commercial organization which will not change with the seasons. Sixth, there should be a careful analysis of the local territory with the view to planning a definite sales program which will then be religiously adhered to.

# What Some Companies Did in 1922

## New-Business Activities Which Marked the Commercial Reawakening of Central Stations Generally in All Sections of the Country

AT THE beginning of 1922 a strong upward swing in business was under way, and the year as a whole was characterized by solid, consistent improvement along commercial lines in the central-station industry. This condition was by no means confined to any particular section or group of states, but rather the quickening of business activity was general and uniform throughout the country.

The revival in merchandising extended all over the Eastern and New England States and the experiences of individual companies is typical. The Massachusetts Lighting Companies had the best year in appliances in its history. The Worcester (Mass.) Electric Light Company's merchandise sales to Dec. 1 totaled \$109,119, against the entire 1921 total of \$110,731. The increase over 1921 to the above date was \$17,463, and the holiday trade was expected to carry this gain far ahead. Appliance sales in the Tenney companies have been running about double those of last year for months, and in some cases even better. Electric radiators, vacuum cleaners, hollow ware and irons have moved in great volume. The Boston Edison Company alone sold 1,600 radiators after August. The Pittsfield (Mass.) Electric Company opened a new appliance store on a main thoroughfare late in the fall, with excellent results. In communities served by non-merchandising central stations, like Fall River, Springfield and Greenfield, Mass., business for electrical dealers shared in the incoming tide of prosperity. The electric shop of the Narragansett Electric Lighting Company, Providence, R. I., did a land-office business in appliances in the year just closed.

Store-lighting activity developed in many communities almost into a race among competitive merchants and neighboring manufacturers to install modern illumination at higher intensities. In Boston the Bureau for Better Illumination rounded out the year with a total of two thousand visitors, and its work will be continued in 1923. A great wave of new business is now sweeping in as a

result of the educational work of this bureau. A number of New England central stations are planning to do intensive work in illuminating engineering this year, and the demand is active for men trained in this specialty.

With better industrial conditions power sales have risen rapidly of late. By Feb. 1 one customer of the Bristol & Plainville (Conn.) Electric Company will have increased its demand from 3,000 kw. to 6,000 kw. Seven hundred horsepower in shoe factories alone has lately been installed by the Haverhill (Mass.) Electric Company. Industrial electric heating developed steadily during the year at Hartford, Manchester, Worcester, Boston, Springfield and other places in New England. Small-plant betterment work absorbed a large connected load in new motors throughout this district. In Providence an industrial electric heating store was opened during the year, this being probably the first of its kind in the United States. Power business developed in the Montpelier, Vt., district, and the diversified service of the Central Maine Power Company increased substantially. Conditions improved much during the year among the power customers of the leading hydro-electric companies.

Industrial electric trucks and tractors were in improving demand in 1922, as manufacturing conditions strengthened. Electric road trucks sold slowly until about Sept. 1, when a turn for the better occurred which has been well sustained and which makes the 1923 outlook better than for many years.

### House Wiring in New England

There were so many wiring campaigns in New England in 1922 that space will not permit more than a brief reference to them. The Tenney companies' plan allowing two years to pay was most successful. The Central Maine Power Company put through an intensive campaign resulting in 2,214 contracts in five weeks. The Worcester Electric Light Company obtained two and one-half times as many house-wiring contracts in 1922 as in 1921. To Nov. 1, 1921, the company took on 523 new house-wiring customers, representing an outlay of $82,769 and the installation of 1,121 new meters. At Providence, in Salem, Fitchburg and Malden, Mass., in Boston and many other places the past year's activity in house wiring has been striking.

The Elmira (N. Y.) Water, Light & Railroad Company continued its policy of increasing the residential load by the sale of domestic appliances and by the end of the year expected to add something over 1,000 kw. by this means. The value of such a load is shown by the fact that the company's income from its residential customers has been 20 per cent greater than in 1921.

At Norfolk, Va., the Virginia Railway & Power Company concentrated its efforts on ice and cold storage plants, with the result that it has contracted for 3,000 kw. additional, which will bring the company's refrigeration load to 5,000 kw.

### Central and Southern Companies

In the Central and Southern States the commercial activity was no less marked. The Commonwealth Edison Company's appliance sales in Chicago have increased and the outside selling force has been augmented until there are now 150 salesmen working from the company's trucks. Their sales for the year will total over $1,000,000. The Duluth (Minn.) Edison Electric Company is employing two lighting salesmen who are constantly calling on commercial lighting customers with excellent results.

The Union Gas & Electric Company continued its house-wiring campaign in Cincinnati and expected at the close of the year to have contracted for wiring 20,000 old houses as compared with 17,000 in 1921. This company retired from merchandising several years ago, but has again gone in for the sale of electric appliances stronger than ever and has leased a building for this purpose.

The New Orleans Public Service Incorporated has given particular attention to building seasonal business where needed to balance its load and has taken on a very profitable raw-water ice-plant load. This company has also established an electric vehicle department which has already produced very satisfactory results in increased business. The Consumers' Electric Light & Power Company, also operating in New Orleans, has pursued a merchandising policy with a view to load building and earning a profit and has conducted active campaigns to increase its commercial lighting load and the sale of electric appliances. This company is now making a survey of all customers to ascertain what appliances they are using and to interest them in further use of the service.

In the West and on the Pacific Coast also there has been a marked growth in the appliance business. In some sections this amounts to an increase of 40 per cent over the business done in 1921. This is attributed primarily to the convenience-outlet campaign which is beginning to show real results from the publicity work of the past few years. The California Electric Co-operative Campaign now recognizes other channels than the electrical dealers in the merchandising of appliances as a large percentage of the sales are through the department, hardware and furniture stores.

The possibilites of commercial lighting have become apparent and a survey of a large number of stores made by the California Co-operative Campaign during the past year indicated that the intensities varied from three-quarters of a foot-candle to 18 foot-candles, showing the necessity of intelligent illumination work. One merchant in a large California city, who a year ago made an investment of $10,000 in window lighting, finds that adequately illuminated show windows are the best means of advertising and selling and in moving to another location has ordered wiring, fixtures, lamps and other equipment costing $25,000. The Co-operative Campaign is now constructing a portable window-lighting exhibit which will be taken from place to place, and special merchants' day programs will be put on.

### Western Power Development

In power there has been a steady, natural development. In the Northwest there has been a noticeable increase in the use of electric drive in the lumber industry because of its great economies and flexibility. In California there are now three thousand wells being pumped with electric motors on the lines of one central station alone. There has also been a healthy increase in electric pumping for irrigation.

The California Co-operative Campaign will lay particular stress on education within the industry and education of the public. Ten electrical homes will be shown during the year. These will be in charge of high-class demonstrators who will be thoroughly competent to "sell" the electrical idea. Particular stress is to be laid on the use of electric ranges and water heaters. Ten illuminated billboards will be erected on the main arteries of travel of the state to tell the message twenty-four hours a day.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Operating Features of the Montville Power Station.*—Numerous instruments and carefully kept records have aided in maintaining high operating efficiency in this 20,000-kw. plant of the Eastern Connecticut Power Company. A comprehensive description is given of the coal-handling methods, feed-water preparation, boiler operation, equipment and transmission and distribution systems. Several typical log sheets used at this station are included.—*Power Plant Engineering*, Dec. 15, 1922.

*Calculation of High-Pressure Penstocks.*—A. HRUSCHKA.—If the methods suggested by different authors for calculating penstocks for hydro-electric plants are compared, many contradictory details will be found which, if followed, will result in widely differing data. The author has therefore studied the different methods, has eliminated what appeared to him faulty and has compiled a comprehensive collection of data and formulas upon which to calculate the forces in a penstock and to design the penstock. Two main classes of penstocks are being used, the axially movable type, with anchors in the form of stuffing boxes or dilatation joints, and the solidly anchored pipe-line type, without dilatation joints but with yielding elbows at points off the straight path. The many individual forces occurring during the operation of a penstock are mathematically investigated, and finally their combined action, as it manifests itself at the anchors of the pipe line or in the elbows, is calculated. The proper dimensions of the cement blocks or pillars supporting the line are given from an investigation of the mechanical forces exerted by the line upon these points. The present boom in the erection of hydro-electric plants, especially in countries lacking an adequate coal supply, makes this elaborate treatise especially timely.—*Elektrotechnik und Maschinenbau*, Nov. 12 and 19, 1922.

## Generation, Control and Switching

*Cooling of Turbine Generators.*—A. R. SMITH.—A difficulty in thoroughly cleaning the air used for cooling turbine generators has led to the introduction of the recirculating system. The various methods for cooling the air when recirculated are discussed in this article, which compares all systems of generator cooling from numerous standpoints. With the direct system it is possible to discharge the air into the boiler room and burn it. With the indirect system using surface coolers it is possible to absorb all or part of this heat by circulating the condensate through the surface cooler.—*General Electric Review*, December, 1922.

*Air Flow in Electrical Machinery.*—C. J. FECHHEIMER.—The manner in which a vapor flows is one of the most important and perhaps the most difficult of the problems of mechanics. Only recently have quantitative solutions been obtained for certain cases, and these have come with the advent of the aëroplane, by use of which studies have been successfully made. An attempt is made to describe the laminar and turbulent flow of air in electrical machines, and a few applications are described.—*Electric Journal*, November, 1922.

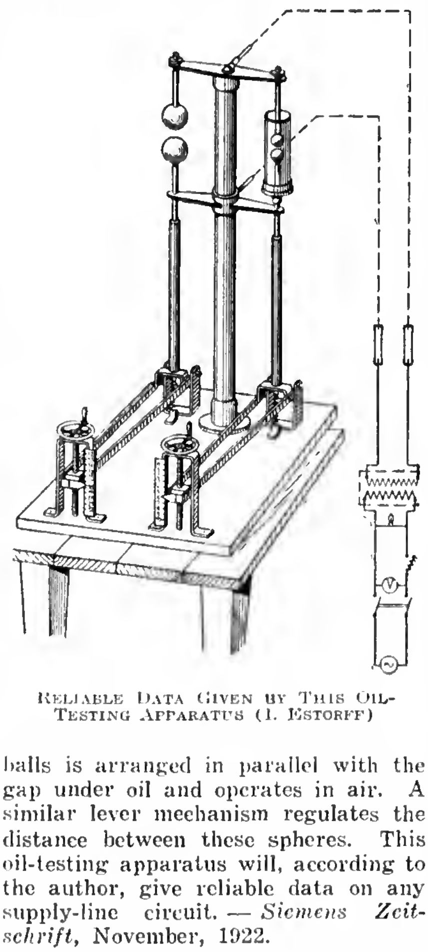
## Transmission, Substations and Distribution

*Modern American Practice on Power Transmission.*—Y. FUKUDA.—A review article showing the progress made in America in high-voltage transmission. The author also deals with the Boston-Washington Superpower Zone, backwater suppressor, low-head, high-speed water turbines, automatic water plants, the use of aluminum cables, insulators for extra-high-voltage transmission, electric vehicles, electrification of steam railways and load-dispatching and plant-inspection methods.—*Journal of the Institute of Electrical Engineers of Japan*, November, 1922.

*Electric Power in Iron and Steel Works.*—A. DAVIDSON.—The author gives a user's opinion on the question of alternating current versus direct current in iron and steel works. He claims that direct current is not suitable for all purposes, and the choice is, therefore, between alternating current for the large motors, with direct current for the small motors, and alternating current throughout. In either case three-phase generation should be used. The finances of the possible schemes are discussed, and the last is shown to be the cheapest. Certain technical questions, such as speed control, power factor and frequency, etc., are dealt with, the author showing that he supports the alternating-current system.—*Electrician*, Nov. 24, 1922.

## Units, Measurements and Instruments

*Oil-Testing Apparatus.*—I. ESTORFF.—It is customary to measure the dielectric strength of oil for oil switches or transformers with a fixed spark gap inserted into a sample of the oil, raising the voltage on the gap gradually until breakdown and reading the tension on a voltmeter. To insure reliable test data a pure and undistorted sinusoidal voltage must be used to feed the transformer. What appears to be a simpler apparatus is described in this article. Instead of a fixed spark gap, an adjustable gap is used, the movable electrode being arranged at the short end of a ten-to-one lever. Turning a handwheel on an insulated spindle increases or decreases the distance between the sphere electrodes, placed one above the other in a glass vessel containing the oil, and indicates at the same time their distance. This feature does away with the necessity of a gradual increase of the voltage and obviates, therefore, the regulator or the variable choke coil. To be independent of the form of the voltage wave, a second sphere gap with 50-mm.



RELIABLE DATA GIVEN BY THIS OIL-TESTING APPARATUS (I. ESTORFF)

balls is arranged in parallel with the gap under oil and operates in air. A similar lever mechanism regulates the distance between these spheres. This oil-testing apparatus will, according to the author, give reliable data on any supply-line circuit. — *Siemens Zeitschrift*, November, 1922.

*Measuring the Rotary Magnetic Hysteresis Losses.*—TETSUTARO MIYAZAKI. — Many investigations into rotary magnetic hysteresis have been made, but the results show a great discrepancy. This is thought due to the errors of various measuring methods as well as the difficulty of separating the hysteresis losses from the masking effects. Instancing the irregularity of the electromagnetic field brought into existence by the unsymmetrical forms of test pieces, the author describes a comparatively accurate method consisting of measuring the torque of a solid spherical test piece in a rotary magnetic field.—*Journal of the Institute of Electrical Engineers of Japan*, November, 1922.

### Illumination

*Illuminating Engineering Society Papers.*—The December issue of the society's transactions contains several papers presented at the Swampscott (Mass.) convention. The first two papers are "Overcoming Daylight Reflections in Show Windows," by Ward Harrison and H. T. Spaulding, and "The Effect of Light on the Drawing Power of the Show Window," by Walter Sturrock and J. M. Shute. Abstracts of these two papers may be found in the convention report on page 759 of the Oct. 7 issue of the *Electrical World.* A tentative draft of a code of luminaire design drawn up by the committee to co-operate with fixture manufacturers (M. Luckiesh chairman) is a third paper. An attack upon the problem of glare from the angles of visual acuity and shade perception is the basis of research undertaken by a sub-committee on this subject, headed by Louis Bell, which submitted a report. Abstracts of these papers may be found on page 761 of the Oct. 7 issue of the *Electrical World.* A complete discussion of all the papers is included in the transactions.—*Transactions of the I. E. S.,* December, 1922.

### Motors and Control

*Equalization of the Energy Demand in Coal Mines and Rolling Mills.*—T. STEIN.—The difference is pointed out between energy variations of the minute and of the hour character as regards duration, and it is shown how they originate and how they affect the operating machinery. An equalization of the minute variations is accomplished by the steam capacity of boilers, by exhaust-steam accumulators and by flywheels. A live-steam accumulator permits the equalization of hour variations for both the heat generation and the heat demand. Their use may result in coal economies of from 10 per cent to 15 per cent. A number of diagrams show steam and electric connections for different operating conditions, and the most suitable electric machines for these systems are described.—*A. E. G. Mitteilungen,* October, 1922.

### Heat Applications and Material Handling

*Electrical Developments in Iron and Steel Works.*—JAMES SMITH.—The author reviews recent developments in the use of electricity in iron and steel works. He deals with lifting and handling appliances. Details are given of modern cranes, magnets, shunting locomotives, charging machines, stripping machines, plate-handling devices and excavating appliances. The electrical equipment used for driving and controlling these machines is described.—*Electrician,* November, 1922.

*Standards for Resistance Welding Transformers.*—For this special class of machinery it is essential that careful consideration be given to the viewpoint of the manufacturer, user and central-station man, in order that a rating may be arrived at which will be equitable to all. For this purpose the sub-committee on rating of welding machines of the American Welding Society has proposed standards for resistance welding transformers. These standards include continuous rating, intermittent rating, classification of insulating materials, method of loading transformers in temperature tests, input tests under load conditions, no-load and load losses, efficiency, power factor, voltage, insulation and nameplate rating.—*Journal of the American Welding Society,* November, 1922.

### Electrophysics, Electrochemistry and Batteries

*Spectro-Photo-Electrical Sensitivity of Argentite.*—W. W. COBLENTZ.—An investigation made into the effect of crystal structure upon photo-electrical sensitivity as observed in two crystal forms of silver sulphide, argentite and acanthite. Experimental data are given on the effect of temperature, of the intensity of the radiation stimulus and of mechanical working of the material upon the spectro-photo-electrical sensitivity of argentite. These observations are then compared with similar data previously published on acanthite. From a comparison of the reactions of these two crystal forms of silver sulphide under various conditions it appears that the crystal structure has a marked effect upon photo-electrical sensitivity.—*Scientific Paper No. 446 of the Bureau of Standards.*

### Traction

*Electric Locomotives for South African Railways.*—A short article giving briefly an account of the seventy-eight locomotives which have been ordered for the South African Railways for the electrified section of the main track between Glencoe and Pietermaritzburg, a distance of 171 miles. These locomotives are designed to haul passenger and freight trains over the electrified area and are so arranged that they can be worked alone or with other locomotives in multiple-unit operation.—*Electrician,* Nov. 17, 1922.

*Paris-Orleans Railway Electrification Is Progressing.*—The large number of locomotives which have been ordered for initial installation will be largely of French make, but America will furnish the control equipment. Details of the control equipment and the rigid test to which they were put are described.—*Electric Railway Journal,* Nov. 4, 1922.

### Telegraphy, Telephony, Radio and Signals

*General Equations of a Balanced Alternating-Current Bridge.*—VLADIMIR KARAPETOFF.—Owing to the developments in the art of electrical communication and to the improvements in the sources of high-frequency sinusoidal currents, the use of the Wheatstone bridge for the measurement and comparison of inductances and capacities has increased considerably. For this reason the author deduces a general equation of the alternating-current bridge which would comprise the various actual bridge arrangements of any specific case. These formulas have enabled new bridge arrangements to be devised without deducing fundamental equations or constructing vector diagrams.—*Philosophical Magazine,* November, 1922.

*The Wave Filter and Its Inductance Coil.*—A theoretical and experimental investigation concerning wave filters with the view of studying their properties and the conditions under which they can attain maximum efficiency, especially in the case of radio receiving instruments. An ideal filter ought to transmit smoothly within a definite range current of any frequency with minimum attenuation. However, because of resonance effect between the filter and receiving instruments, and further because of the attenuation of the filter being variable, depending upon the impedance of the receiving instrument, the wave amplitude of the receiving current fluctuates with the frequency within the range. In causing a band-wave filter in which one factor—either inductance or capacitance—is omitted to transmit completely a wide range of frequencies it is difficult to suppress abruptly currents of frequencies lying just outside either limit of the intended range.—*Researches of the Electrotechnical Laboratory,* Tokyo, Japan.

### Miscellaneous

*Helpful Relations Between the College and the Industries.*—R. L. WALES.—To present a fairly complete analysis of the problem the author has assembled facts and suggestions concerning it. In training men to be of service to the industry, the end in view, the personal qualifications of the student, the courses of study, the duration of the training period and the character of the instruction are controlling factors. The problem may be analyzed from two points of view, one considering the possible contributions of the college to industrial success and the other the reciprocal relation of the industries to the college. The duty of the college is to supply adequately trained men for the various phases of industrial leadership and operation and to serve as a center of information to which the industries may turn for assistance in the solution of technical problems. In training industrial leaders the need is suggested for stressing fundamentals rather than specializations through a type of teaching that develops in the student the habit of getting down to simple rock-bottom principles. Besides supplying trained men, the colleges may be of the greatest value through their organization for consultation and research. The industries in turn may help by impressing on the students the reality of engineering and the usefulness of engineering training.—*Engineering Education,* November, 1922.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## A Seven-Mile Power Cable

**Great Western Company to Lay 11,000-Volt Submarine Cable Under San Francisco Bay**

WHAT will, it is said, be the largest and longest submarine power cable ever installed will be laid across San Francisco Bay about Jan. 10 by the Great Western Power Company, at a cost of approximately $500,000, to bring additional hydro-electric power into San Francisco and to make possible a reduction in the amount of electricity it has been necessary to generate in the company's steam plants. The cable will be approximately seven miles in length and will be laid from the south end of Brooks Island, near Richmond, to Pier 41 in San Francisco. It will be an 11,000-volt, three-conductor, 500,000-circ.mil cable capable of transmitting 10,000 kw.

Because of the unusual size of the cable it was shipped from the factory of the American Steel & Wire Company coiled on gondola freight cars instead of on reels. Gondola cars of the largest capacity obtainable were used, and the cable was shipped in 4,800-ft. lengths, nine cars in all being required. The entire length of 38,500 ft. of cable will be coiled in circular pancake-like coils on a special cable-laying barge with all splices made, so that the submarine conductor may be laid in one continuous operation. It is estimated that about seven hours will be required for laying the cable. This is the method employed in laying transoceanic cables, but it is the first time it has ever been used for laying a long submarine power cable.

## Washington Court Reaffirms Phillippay Decision

The decision of the Supreme Court of the State of Washington in what is known as the Phillippay case (see ELECTRICAL WORLD for Aug. 12, 1922, page 345), denying damages to a telephone company for inductive interference from a power line of the Pacific Power & Light Company, was unanimously reaffirmed by the court on Jan. 2. In this case the court held that the prior occupancy of a highway by the telephone company did not give it the right to collect the cost of metallicizing its line from the power company when the latter's transmission lines were properly built.

In reaffirming its decision the court said: "The statement in the opinion of the department to the effect that priority in time does not give a superior right seems to have caused some alarm. Let it be said that this statement must be read and understood as applying only to the facts of the particular case."

## Public Ownership Man Put on California Commission

Four appointments by Governor Stephens of members of the California State Railroad Commission have just been announced. Clyde L. Seavey, city manager of Sacramento, was appointed for a term of six years to succeed H. Stanley Benedict of Los Angeles, whose term expired on Jan. 1. The other appointments were Harley W. Brundige of Los Angeles, now president of the commission, to a four-year term to succeed the late Harvey D. Loveland; Egerton Shore, member of the State Board of Control, to a four-year term to succeed Chester H. Rowell, resigned, and James T. Whittlesey of San Francisco to the unexpired two-year term of Mr. Brundige.

The appointment of Mr. Seavey, who is a strong advocate of public ownership, was a surprise. Seavey was one of those instrumental in framing the water and power act defeated at the state election in November and was active in its support.

## Pacific Gas & Electric Rates to Be Reduced

A new schedule of rates for the Pacific Gas & Electric Company has been ordered by the California State Railroad Commission, effective Feb. 20. The new schedules are based on a valuation of $109,723,695. This valuation has been placed upon the properties of this large California utility, serving twenty-seven counties in the central and northern part of the state, after an investigation by the commission lasting over a period of nearly two years. The company claimed a valuation of $170,711,271 as a basis for rate-making purposes. In determining the valuation the commission followed its practice of using the historical reproduction cost method.

Under the new schedules lighting rates will be reduced about 12 per cent, power rates generally will be reduced about 10 per cent and a uniform schedule will be made applicable to all parts of the system.

Rates for San Francisco are fixed so as to do away with discrimination between competitive districts of the city.

The decision was handed down on Dec. 30.

## Coal and the Utilities

**J. W. Lieb and Others Tell the United States Commission the Facts of the Situation**

A PRESENTATION of facts regarding coal supplies to public utilities during and since the war was made to the United States Coal Commission at Washington on Wednesday of this week by John W. Lieb as chairman of the joint fuel committee of the three national utilities associations. All the members of the commission were present.

Mr. Lieb said that because of the depletion of normal coal reserves public utilities would approach April 1 virtually dependent upon coal received on their contracts and such as might be purchased in the "spot" market. He declared that a strike would result in inability of the utilities to supply electrical energy, gas or street-railway and interurban transportation. Statistics regarding the three utility industries represented were given showing the extent to which the public depends upon their services. The suggestion was made that the commission should consider the feasibility of requiring railroads and mines to develop some method of coal storage. It was also suggested that consideration should be given to the feasibility of backing up the utilities' coal contracts with strict priority orders. A third suggestion was that a method be worked out whereby utilities may be assured at all times of coal complying with specifications regarding heat-unit content, volatile content, low ash content, etc. Suggestion also was made as to the desirability of a method whereby coal producers would offer attractive seasonal prices and operators attractive seasonal freight rates, in order to encourage storage of coal not only by public utilities but by others consuming large quantities. Many additional facts were stated by Mr. Lieb, who was questioned at length by members of the commission regarding all phases of the electrical industry.

Following Mr. Lieb's presentation special statements regarding the three industries and their problems were made by O. H. Fogg for the American Gas Association, Judge C. L. Henry for the American Electric Railway Association and M. H. Aylesworth for the National Electric Light Association. Chairman Hammond of the commission requested that specific data be furnished to the commission regarding matters brought out. The commission will report to the President on Jan. 15.

## Smith for Home Rule

**Favors Constitutional Amendment to This End and Sweeping Changes in Commission Law**

GOVERNOR SMITH of New York in his inaugural message at Albany this week made recommendations for "home rule" of utilities and sweeping changes in the public service commission law along the lines which have been predicted and have already received much publicity. He also made a declaration in favor of state development, ownership and control of water powers, postponing specific advice on this matter till later in the legislative session. On the regulation of utilities he said in part:

"Probably no political principle has received so much statewide discussion as the question of a greater grant of power by the state to municipalities over such things as are wholly local. The cities of the state today, and particularly New York City, find themselves restricted by what is really a charter of limitation. The phenomenal growth of the cities brings up constantly for settlement new problems that the city should be left free to determine without interference by the state.

"The Legislature of 1921 passed an amendment to the constitution to bring this about which is now pending before your honorable body for passage the second time. If, in your judgment, this amendment accomplishes the purpose, it should promptly pass. If objections raised against it are of a minor nature it might be well to pass it any way and then start the legislative machinery again looking to further amendment that will cure any defect to which any real objection has been made. . . . Whatever action is taken on the present amendment at this session, I suggest for your consideration the initiation of a new amendment that would give to the communities of the state that full degree of local self-government which they are demanding and to which they are justly entitled. . . .

"Illustrative of this whole principle has been our treatment of the subject of control of public utilities. . . .

### ATTACKS STATE REGULATION

"The Public Service Commission of the state exercises regulatory powers over all public service corporations except railroads within the city of New York. In the fifteen years that have passed since the organization of the two public service commissions we have had fifty-four commissioners and the Public Service Commission has not yet succeeded in being much more than an object of political patronage. I think that I am within the truth when I say that the theory in itself never commanded a great amount of public respect. It makes little difference upon what you predicate it. The people in cities are unable to understand why the state interfered with the things that they believe to be local to themselves.

"In the last reorganization of the State Public Service Commission in 1921 the people of the state found that the control that they exercise over their own public utilities through their franchise agreements was taken away from them and vital portions of the contracts were nullified and the powers formerly exercised by the cities were transferred to the Public Service Commission. No defense can be made of this as it constitutes an absolute denial of self-government and home rule in the matter of contracts in all the cities of the state. The Public Service Commission is merely the agency of the state for the exercise of police power. There is no reason why the state should not select a municipality as its agent. To my mind we would get a better result.

"There are certain public utilities that are not within the confines of a single city, as their operations are either between cities or statewide. As to these utilities the state must retain its powers of control and regulation. It may also be that some of the cities of the state may be unwilling to assume the obligations of regulation. We must not force it upon them, as that would again constitute an interference with home rule. . . .

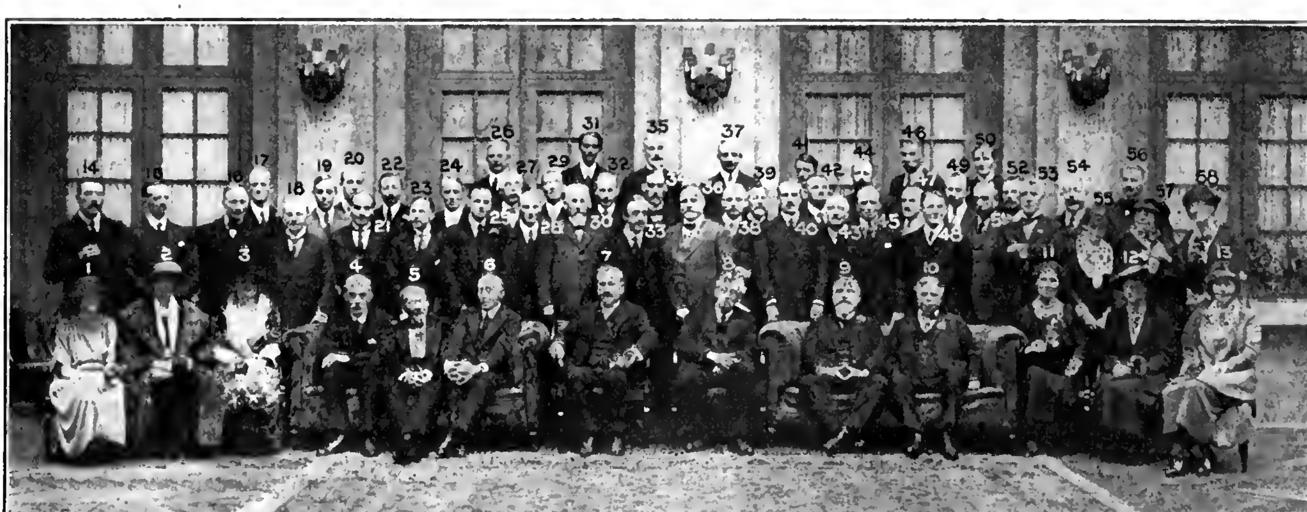
"In order to carry out this policy, the present Public Service Commission should be abolished and power given to the Governor to appoint not more than three commissioners to regulate such utilities as will not be regulated by the cities, either because they operate outside the corporate limits of a city or because the city may, by proper resolution, request the state to do it.

### FOR MUNICIPAL OWNERSHIP

"I recommend that in the preparation of the legislation to abolish the present Public Service Commission the power heretofore held by cities over the terms of their franchises be returned to them, where it belongs. . . .

"Directly in line with this program

## Delegates to the International Electrotechnical Commission Session at Geneva



4. Sir Richard Glazebrook (Great Britain).
5. Dr. Strecker (Germany).
6. Signor Semenza (Italy).
7. Dr. Mailloux (U. S. A.).
8. Colonel Crompton (Great Britain).
9. M. Boucherot (France).
10. Dr. Wheeler (U. S. A.).
14. M. Girault (France).
15. Colonel Gunton (Great Britain).
17. Mr. Hobart (U. S. A.).
18. Prof. Kloss (Germany)
19. Mr. Magalhaes (U. S. A.).
20. Mr. Cooper (U. S. A.).
21. Signor Barbagelata (Italy).
22. M. Belli (Switzerland).
23. Mr. Skanoke (Norway).
24. Mr. Rodgers (Great Britain).
25. Mr. Hunter (Great Britain).
26. Dr. Sharp (U. S. A.).
27. Mr. Meares (India).
28. Dr. Fleischmann (Germany).
30. M. Brylinski (France).
31. Mr. Good (Great Britain).
33. Mr. le Maistre (England).
34. M. de Montmollin (Switzerland).
36. Mr. Huber (Switzerland).
37. Mr. Roth (France).
38. Mr. Everest (England).
39. Mr. Hunziker (Switzerland).
40. Signor Vannotti (Italy).
41. M. Darries (France).
42. Dr. Sulzberger (Switzerland).
43. Prof. Morelli (Italy).
44. M. Dupont (Belgium).
45. Mr. Collens (U. S. A.).
46. Prof. Lorin (France).
48. Mr. Skinner (U. S. A.).
49. Dr. Rüdenberg (Germany).
51. Mr. Smith (England).
53. Gen. Harries (U. S. A.).
54. Mr. Doane (U. S. A.).
56. Mr. Rechniewski (France).

is the municipal ownership of public utilities. Public utilities have become so essential to the life of our great cities that the cities themselves should be permitted to purchase, build, own or operate them when a municipality determines this to be in its best interest."

## Activities of Power Board

**Loose Project Formally Disapproved—Advocates of Girand Plan Welcome Fall's Retirement**

AS ANTICIPATED (see ELECTRICAL WORLD, Dec. 16, page 1349), the Federal Power Commission has formally declined the application of Col. C. E. Loose for a license covering a power project on the East Walker River, in California. This action insures the use of the reservoir site in question for irrigation purposes.

After investigation the commission has ruled that navigation will not be affected by the proposed development of the River Falls Power Company of Andalusia, Ala., which desires to erect a 30-ft. dam in the Conecuh River near Palsaliga Creek.

The questions involved in the use of the so-called Narrows site on the Ouachita River, 10 miles below Hot Springs, Ark. (see ELECTRICAL WORLD, Dec. 23, page 1407), will be considered at a hearing before the commission, which will be held probably in the week of Jan. 15.

### THE GIRAND DEVELOPMENT

With Secretary Fall's retirement from the Cabinet announced for March 4, the proponents of the Girand development at Diamond Creek on the Colorado River are in hope that the new Secretary of the Interior will take a different stand on that proposal. It is believed that the Girand license would have been authorized had not Secretary Fall been in a position to block it. Mr. Fall wanted the government to construct the works necessary to the utilization of the waters of the Colorado River. The two other Secretaries who with him have composed the Federal Power Commission are understood to favor the Girand project so that the Arizona copper companies and other interests may have at the earliest time the power of which they are in such great need. The water-power act provides, however, that no license shall be granted for a project affecting any reservation of the United States unless the Secretary having administrative control sanctions the plan. In this case the Hualpai Indian reservation follows the south bank of the Colorado in the Diamond Creek area. This gave the Secretary of the Interior legal power to block the project single-handed.

In that connection an interesting development is the activity of the Southern California Edison Company at Glen Canyon, just above Lee's Ferry. It is understood that the California Edison has drilled that area and has found solid rock at levels which would be entirely satisfactory for dam foundations.

## Street-Lighting Tables for 1923

FOLLOWING its practice for thirty-four consecutive years, the ELECTRICAL WORLD has prepared tables showing the proper time for lighting and extinguishing street lamps. The tables for 1923 are now ready, and a copy of them will be sent free to any subscriber upon request to ELECTRICAL WORLD, Tenth Avenue and Thirty-sixth Street, New York. For more than one copy a charge of 25 cents each is made to cover a portion of the postage, printing and compilation costs.

## New York State Amends Its Plea on Power Act

The United States Supreme Court has granted the motion of the State of New York for leave to amend its bill of complaint and amended bill in the suit to test the validity of the federal power act and to restrain the Federal Power Commission from exercising jurisdiction over certain waterways in New York. In its amended petition the state claims that the exercise of alleged unlawful authority by the Federal Power Commission will subject the state to a multiplicity of lawsuits and deprive it of the constitutional right to handle affairs within its own boundaries when they do not affect other commonwealths.

Since 1903, the petition declares, the state has spent more than $200,000,000 on its waterways, and it is preparing to spend large sums for the development of navigation and for hydro-electric projects on the St. Lawrence, Mohawk, Hudson and Oswego Rivers. The state contends that its rights of ownership are challenged and that the Federal Power Commission is going beyond the regulation and control of waterways for the specific purpose of navigation. Such control, the state in its amended petition claims, is all that the water-power act sought to confer and the only authority that can be exercised properly by the Federal Power Commission.

## Alabama Power to Take Over Montgomery Utilities

The two lighting companies of Montgomery, Ala., with the street-railway system and the gas service, are to be taken over by the Alabama Power Company as soon as the approval of the Public Service Commission is granted. Thomas W. Martin, president of the Alabama Power Company, has announced the purchase of the properties following the advocacy of the transfer by the Montgomery Chamber of Commerce and other local interests. No statement concerning the purchase price was made. The Montgomery Light & Traction Company and the Montgomery Light & Water Power Company, which own the electric light and power, street-railway and gas services of the city, have been administered by a court receiver for several years.

Negotiations for the sale were, according to announcement, begun some months ago by the Chamber of Commerce, as the result of inquiries from companies which desired to locate in the Montgomery district if adequate power at suitable rates could be obtained. W. F. Black, secretary of the chamber, said that some of these prospective industries had found that power rates did not compare favorably with those in other parts of the South. Mr. Black predicted that this condition would be changed if the Alabama Power Company obtained control, and as a result of representations made to the chamber in person by Mr. Martin and Vice-president R. A. Mitchell the members unanimously adopted a resolution favoring the transfer.

## Role of the Engineer

**Two Sections of American Science Association Devote Meetings to Its Consideration**

ENGINEERING was represented at the Boston gathering of the American Association for the Advancement of Science last week in two of the many sections—Section K (social and economic sciences), of which Dr. Henry S. Graves of the Yale Forestry School is chairman, and Section M (engineering), of which the chairman is F. M. Feiker, vice-president McGraw-Hill Company, Inc. At a joint session of the two sections John T. Black, State Health Commissioner of Connecticut, spoke on "Conservation and Industrial Waste," and William S. Murray, New York, on "Conservation of Power." O. C. Merrill, executive secretary of the Federal Power Commission, and Gen. Harry Taylor, Corps of Engineers, U. S. A., were unable to present their papers because of badly delayed train schedules.

"The Place of the Engineer in Civilization" was the keynote of the meeting of Section M. Dr. Ira N. Hollis, president of Worcester Polytechnic Institute, led the discussion, instancing the factors of transportation and communication as vitally touching the activities of men in every walk of life and dwelling on the need for the engineer to make an analytical study of the facts governing the solution of present-day problems. A similar point of view was expressed by Harrington Emerson, who alluded, as did Dr. Hollis, to the engineer's control of the instruments of production. Dr. J. B. Tyrrell told of the growth of the mining industry in Canada. The paper of C. F. Scott, professor of electrical engineering at Yale, was read in his absence by Dr. D. C. Jackson. It dealt with new phases of

engineering education and pointed out that the large part played by engineering in modern life made it essential that the training of engineers be approached with a new viewpoint of the engineer's place in the community.

Contributions from several delegates laid stress on the contention that the next step in engineering is to relate the problems of the material advance in civilization to the human problems of civilization.

# Philadelphia & Reading Plans Mine System

### Five or Six Large Modern Electric Power Stations Are to Be Tied Together to Feed Coal-Mining Machinery in Two Pennsylvania Counties

ONE of the largest purely industrial electric systems in America, and probably the largest in the world devoted solely to coal mining, is planned by the Philadelphia & Reading Coal & Iron Company for the operation of its coal mines in Schuylkill and Northumberland Counties, Pennsylvania. It will eventually comprise five or six large modern power stations, tied together in one great system supplying power for the company's forty-odd operations, for the Pottsville shops and for incidental uses. The individual plants will generate from 15,000 kw. to 20,000 kw. each, and the total power will be at least 100,000 hp.

There will be 85 miles of high-tension line, carrying a current of 23,000 volts, and additional secondary mileage in the way of service connections and direct cables to the mine pumps. These pumps will operate without the voltage being reduced. Some of the pumping installations are already finished.

#### What the Development Means

The Philadelphia & Reading project will bring about the almost universal substitution of electricity for other forms of power in operating the company's mine and breaker machinery, and it also implies the elimination of seventeen engine-driven non-condensing power plants—sixteen at mines and one at the Pottsville shops.

Two modern electric plants which will be incorporated in the new system already are in operation—a 5,000-kw. plant at Good Spring and a 4,800-kw. plant at Locust Spring. These plants are tied together now in a system which runs from Brookside, in the west end of Schuylkill County, to Pine Forest, a little north of Pottsville, thence north to Indian Ridge, near Shenandoah, and thence west through the Mahanoy Valley to Locust Spring. Fifty-five miles of primary high-tension line is already built. A line is now under construction from Locust Spring to Bear Valley, west of Shamokin, and later a short link will run from Bear Valley to North Franklin at Trevorton, the extreme northwest of the Reading properties. Next summer a line will be run south from Pine Forest to Pottsville, to supply the shops, and another line will run from Pine Forest to Silver Creek on the east. At Silver Creek one of the proposed new plants will be built.

An additional extension from Indian Ridge to North Mahanoy and the territory now supplied by the old North Mahanoy plant will round out this high-tension network. The old electric plants will not be scrapped but will be retained as emergency units.

The great extent to which electricity is used by the Reading, even under the present system of isolated stations, is shown by the fact that it is now operating more than 100 miles of underground trolley line, has 140 electric locomotives in service, operates 106 electric pumps and charges about 9,000 electric lamps for miners.

The Good Spring plant, opened in June, 1919, was the first unit designed for the proposed new system, and it typifies in a general way what will be done at other plants. This station was placed at Good Spring because that point is central for the Tremont district, because ample supplies of barley coal were available at that colliery, and because Pine Creek, near by, supplied sufficient water for effective operation. The boiler plant and dynamo room are constructed of brick and steel. There are seven Stirling water-tube boilers generating 4,500 hp. and fitted with Coxe traveling stokers. Coal is supplied from overhead bunkers, which are fed by a conveyor line from a large bin, the bin in turn being supplied with coal by an aërial tramway running to the foot of the breaker. Ashes are disposed of by a flushing system which washes them into a large tank, whence they are hauled by a 20-ton car to the spoil bank.

The generating equipment consists of 5,000-kw. steam-turbine generators operating at a pressure of 150 lb. and condensing at a vacuum of 28.5 in. The condensers are of the barometric type.

Power is generated at 6,600 volts and conducted to an eleven-panel switchboard equipped with indicating and recording instruments for measuring electric current. It is controlled through oil circuit breakers and is distributed to the colleries in the Tremont district at a line voltage of 6,600. For long-distance transmission there is a transformer station which steps up the potential to 23,000 volts, and it is carried through the rest of the circuit at that voltage. At each colliery supplied from this high-tension line a transformer station is installed equipped for measuring and controlling the power consumption at that mine, the voltage being stepped down from 23,000 to 2,300 for colliery distribution. At present there are twenty-two transformer stations installed, having a combined capacity of 25,300 kw. Oxide film lightning arresters are installed.

## Progress of Metric System

Substantial progress toward the wider adoption of the metric system in America was emphasized on Dec. 30 at the annual meeting of the American Metric Association in Cambridge, Mass., in connection with the national convention in the same city of the American Association for the Advancement of Science. Well-attended sessions were held at the Massachusetts Institute of Technology. Dr. George F. Kunz, New York, presided.

Dr. A. E. Kennelly emphasized the value of common units in applied science, in his address upon "The Metric System in Electrical Engineering." He described the metric basis of electrical measurements, pointed out the growing popularization of metric terms through radio and other channels, and predicted the ultimate general adoption of the metric system in the United States.

B. L. Newkirk, General Electric Company, Schenectady, N. Y., in a paper on "The Metric System in the Electrical Industry," reviewed the growth of metric measurements in the past half-century and pointed out that there is no hope of getting the non-English-speaking world to adopt non-metric units. If the world is to "get together" at all, it must be on a metric basis.

Superintendent Meyer of the American Bosch Magneto Company, E. A. Marsh, consulting superintendent American Waltham Watch Company, and T. H. Miller of the De Laval Separator Company reviewed the successful use of the metric system in their plants, and Walter Wood of Philadelphia emphasized its business-getting value in selling material to foreign countries. Howard Richards described the use of the metric system in the shops of France and Germany, as observed last summer.

Interest in the meetings was increased by the appearance of opponents who spoke on behalf of the Secretary of War, the United States Navy and industrial organizations that look with disfavor upon the general use of the metric system.

During its convention the American Association for the Advancement of Science reaffirmed its belief in the metric system and passed a resolution recommending the use of metric units by scientific men in all papers of a professional character, with non-metric units in parentheses.

## Water-Power Control Issue Reappears in Maine

State development of storage reservoirs is expected to come up again for consideration at the next biennial session of the Maine Legislature, which convenes at Augusta on Jan. 8. It is understood that Senator Ralph O. Brewster of Portland will introduce a constitutional amendment giving the state the right to create and finance water-storage districts, build dams and establish reservoirs for power development, and that the measure will have the backing of Governor Baxter, long an advocate of this policy.

# New Plant in Anthracite Field

## East Penn Electric Company Expects First 50,000-Kw. Section of Its Power House at Pine Grove, Pa., to Be Finished This Summer —Extreme Simplicity a Marked Characteristic

THE first 50,000-kw. section of the East Penn Electric Company's plant at Pine Grove, Pa., which is four or five miles from the anthracite mines, will be completed about June or July. With a cooling pond and a regulating reservoir to conserve the flow of Swatara Creek, on which the plant is built, sufficient circulating water will be obtainable for a 300,000-kw. development, according to the J. G. White Engineering Corporation, which designed the plant. Among its chief features are its sectional development and its extreme simplicity, the object being to minimize the number of operators required. The station is laid out for 50,000-kw. extensions with the boiler aisles at right angles to the turbine hall, permitting the change of turbine and boiler sizes or even the use of powdered fuel. Although traveling-grate stokers are employed in the section now nearing completion, it is most likely that the extensions will use powdered coal and possibly larger turbo-generators.

Anthracite "fines," containing 11,500 B.t.u. and 20 to 25 per cent ash, will be received by railroad and dumped into track hoppers, elevated to an outdoor overhead bunker at the end of the firing aisle and from there carried by means of weighing larries along the boiler-room aisle to the stoker hoppers. This arrangement has permitted the use of lighter steel in the boiler house. Outdoor storing and reclaiming of coal will be performed by a locomotive crane. The ash hoppers will dump directly into railroad cars. These cars as well as coal cars will be switched by steam-storage locomotives.

### STOKERS AND BOILERS

Extra long (18-ft.) forced-draft traveling-grate stokers capable of operating at 300 per cent of nominal rating with natural draft are being installed with direct-current motor drive. The stack will be 350 ft. high. To relieve pressure on the furnace firebrick and also to facilitate replacement of sections, the furnace-wall facing is horizontally sectionalized by interlocking tile courses, each of which supports only six courses of firebrick.

Because of the limitation imposed by the width of forced-draft traveling-grate stokers available at the time of beginning the plant, it was considered economical to install boilers with only 8,000 sq. ft. of heating surface per unit, but they are arranged in batteries with ventilated walls between them, this ventilation being facilitated by the interlocking tile construction. Larger boilers can be used next time because wider stokers will be available. The boilers are designed for 300 lb. pressure and 600 deg. to 650 deg. total temperature and are twenty tubes high, with the superheater placed above the sixth row. The entire length of the lower six rows of tubes is exposed to the radiant heat of the furnace. No economizers will be used, because the coal burned is cheap.

The simplest possible piping layout will be employed without crossovers and interconnections, but the very best material and workmanship obtainable will be incorporated to prevent any contingency arising which would require a more flexible arrangement. By making use of de-aërators it has been possible to use wrought-iron feed-water pipes.

FIRST 50,000-KW. SECTION OF THE PINE GROVE (PA.) PLANT AS IT WILL APPEAR WHEN COMPLETED

The house turbines which supply all power for station auxiliaries are operated at such a load that their exhaust steam will maintain the feed-water temperature at 240 deg. constantly. Such operation is permitted by a tie-in transformer between the house generator and outgoing transmission line, containing a total of 20 per cent reactance, to prevent disturbances on the line interrupting auxiliary service.

Surface condensers with divided water boxes and two circulating pumps are employed, the latter being driven in such a way that they can operate on siphon feed or against spray-head pressure, or both.

### FIRST GENERATORS RATED AT 12,500 KW.

Two 12,500-kw., 12,000-volt generators with direct-connected exciters and face-plate regulators will be used in the initial installation. The generators will be tied directly with 12,000/66,000-volt, three-phase transformers without intermediate circuit breakers or low-tension buses. Emergency excitation will be provided.

All auxiliaries except the stoker drives and part of the boiler-feed pumps are driven by alternating-current motors, the stoker drive being direct current and the non-electrical boiler-feed pumps turbine driven. The alternating-current drives will be supplied by 2,300-volt feeders, local substations and steel-inclosed control equipment. Most motors will be operated at 2,300 volts, but where a lower voltage is necessary transformers will be installed in the local substations. As mentioned before, the auxiliary service will be supplied by a 2,300-volt house generator from duplicate buses. Local substations will be provided for each turbo-unit to serve the circulating and condensate pumps and small house-lighting transformers, for the boiler-house auxiliaries and for the emergency exciters and miscellaneous equipment.

No signals except a general standby signal will be used between the main switchboard room and the turbine room. Instead, a loud-speaking telephone will be used in the switchboard room, while head sets with telephone jacks will be installed at convenient points around the turbines and auxiliaries. In addition to this equipment there will be an automatic intercommunicating system.

### RELAY PROTECTION

Differential protection will be provided for the generators and transformers which will trip the main high-tension circuit breakers, the generator field switch and the neutral switch. Overload protection will not be provided for the generators except in the form of bell-alarm and signal indications on each generator. However, overload and balanced protection will be provided on the outgoing lines.

The 66,000-volt outdoor substation is very compact, this being made possible by a judicious use of a new design of motor-operated disconnecting switch throughout. Two double-circuit transmission lines will run from the substation to a 69,000/24,000-volt substation at Fishbach, Pa., where distribution will be carried on at 24,000 volts.

# Boston Electrification Project Revived

Comprehensive plans for the electrification of railroads in the Boston metropolitan district will be discussed at a conference to be called early this month by Mayor Curley, following a report by Walter Stuart Kelley, an electrical engineer who has been investigating the subject for some time. Leading mercantile, transportation, financial and other interests, with the Department of Public Utilities and other public officials, will be asked to participate. Electrification of railroads and other improvements have been discussed before legislative committees and the public utility commission off and on for years, and it is hoped that through unifying public and official views progress may this year be made toward the ends so long recognized as desirable.

## Boston Versus Cleveland

**Electric Service Conditions in the Two Cities Compared in Massachusetts Rate Case**

EXTENDED comparisons between the engineering and economic conditions affecting service costs were presented at a recent hearing in the Boston Edison rate case before the Massachusetts Department of Public Utilities by L. L. Elden, electrical engineer of the Edison Electric Illuminating Company of Boston. On behalf of petitioners for a reduction in Boston rates below the present maximum of 9.5 cents, considerable stress has been laid in these proceedings upon the 5-cent maximum rate of the Cleveland Electric Illuminating Company. Mr. Elden went to Cleveland a few weeks ago to study the plant and operating conditions there in this connection, and upon his return he presented an exhaustive analysis of the estimated effect of applying Cleveland conditions to Boston Edison operations, showing that were conditions comparable substantial reductions might be effected in the Boston rate.

The Boston Edison company's contention in this protracted rate case is that comparisons of operation among different companies are useless unless conditions are similar, and that where conditions are dissimilar differences in prices are not only justifiable but required. There are a number of fundamental differences between the Cleveland and Boston conditions. The Cleveland company, with a peak demand only about half as much again as Boston's, sells nearly twice as much energy. Within comparable areas there are about a thousand substantial industrial power customers at Cleveland against two hundred at Boston. The Cleveland company's load factor is higher, and because of the company's ability to sell large blocks of energy at high tension its distribution efficiency is much better than Boston's. Cleveland serves 293 square miles against Boston's 570, and the former has 30 per cent as much underground cable mileage to maintain as does the latter, approximately one-third as many miles of conduit and about half as many manholes. Boston has about twice as many poles to maintain, and the cost of overhead-line maintenance at Boston would be reduced by 45 per cent if Boston enjoyed Cleveland conditions. Twenty times as much street-lighting cable is in use at Boston, which maintains a 6.6-amp. street-lighting service against a 4-amp. service in Cleveland. Shorter circuits and fewer lamps per mile at Cleveland favor that company, as well as the use of 4,000 volts in street lighting compared with 6,000 volts and 8,000 volts at Boston.

### THREE SUBSTATIONS TO ONE

Boston operates thirty-two substations against ten in Cleveland having attendants. If Boston's peak load could be handled within a Cleveland area, twenty-two substations could be eliminated and the attendance reduced from 238 to 60. Twelve storage batteries could be eliminated at Boston if Cleveland's output and Boston's peak could be handled in the Cleveland area on the basis of Boston operating costs. Boston furnishes lamps and renewals in its rate schedule; Cleveland does not. Cleveland supplies a very large high-tension output to street railways, whereas Boston supplies railways with low-tension energy, requiring additional investment in substations and equipment not needed by the Cleveland company. In many other features detailed in Mr. Elden's testimony it was shown that the "spread" between the two maximum rates of these cities was founded upon economic and engineering conditions.

The next hearing in the Boston rate case is scheduled for Jan. 11. In the meantime reports are current that the city authorities may conclude that with the realization of the voluntary and planned rate reduction program announced some months ago by the company as its goal it may be expedient to drop further proceedings before the commission.

## Brief News Notes

**Continental Company Buys Nebraska Utility.**—The Continental Gas & Electric Corporation has contracted to purchase immediately the Lincoln (Neb.) Gas & Electric Light Company. President Rufus E. Lee of the Continental company is laying plans to make this newly acquired property the center of a large Nebraska system. Increases in plant capacities will be necessitated.

**Houston Company to Expand.**—The Houston (Tex.) Lighting & Power Company, it is officially announced, contemplates the erection in the near future of a power plant on the Houston Ship Channel to be known as the Deepwater station. The tentative plans call for an ultimate development of 150,000 kw. and the present installation of 40,000 kw. The plant is to be ready for operation early in 1924.

**American Gas & Electric Acquires Ohio Service Company.**—A controlling interest in the Ohio Service Company is reported to have been sold to the American Gas & Electric Company of New York by the United Service Corporation of Scranton, Pa. The new owner will, it is said, operate the Ohio Service Company, which serves many Ohio towns with electric light and power, in connection with the Ohio Power Company at Canton.

**United Illuminating Company to Increase Stock.**—The United Illuminating Company, New Haven and Bridgeport, Conn., has arranged for an increase of capital stock, issuing 9,805 shares at \$100 par to stockholders, at the rate of one new share for each seven now held. The rights expire Jan. 20, 1923, and payments are to be made as follows: Twenty per cent by February 10, 40 per cent by June 10 and 40 per cent by Oct. 10.

**Ohio Utility Financing Close to Million Mark.**—Public utilities in Ohio sold \$91,750,379 in securities during the first ten months of 1922, according to a report from the Ohio Committee of Public Utility Information. Distributed as to population, this means that more than \$15 for every man, woman and child in Ohio was invested in additional capital for all classes of utilities. Of this total, the electric light and power utilities received \$39,902,188, or 43.5 per cent. Most of the recent issues have been absorbed by the utilities' customers.

**Electrification Project Between Dallas and Denton.**—Engineers are now employed in working out the plans for the electrification of the 32-mile stretch of track of the Missouri, Kansas & Texas between Dallas and Denton, according to C. W. Hobson of Dallas, head of the Southwest General Electric Company. One of the changes on the line that will have to be made will be the installation of a block signal system. The electric interests will bear the entire cost of electrification, Mr. Hobson said, under the agreement with the railroad.

**"Service at Cost" Proposed for Colorado Springs.**—The franchise of the Colorado Springs (Col.) Light & Power Company expires early in 1923, and the company has proposed to the City Council that the city arrange to accept as a renewal of the franchise "service at cost," the city to distribute the electricity over its own wires. The City Council is deliberating upon further development of the Pike's Peak hydroelectric project, which, if fully developed at a cost of about \$1,800,000, would give the city a municipally owned plant.

**Consolidation in Washington State.**—Arrangements have been completed for a merger of the Tacoma Gas & Fuel Company and the Puget Sound Gas Company with the Mountain States Power Company. All three companies are controlled by the Standard Gas & Electric Company, and President H. M. Byllesby states that their plants are modern and efficient and that the earnings of all of them should increase, slowly in the case of Tacoma and Puget Sound, but rapidly in the case of Mountain States Power Company. The properties are contiguous and are susceptible to the economies of unified management.

**Consolidation Will Save \$100,000 a Year.**—The proposed absorption by the Interstate Public Service Company of Indianapolis of seven companies owned by the same interests that own the Interstate Company will reduce the fixed charges of the companies approximately 100,000 a year, Harry Reid, president of the first-named company, testified recently before the Indiana Public Service Commission. He said that the absorption would reduce by \$1,848,106 the securities and debts now against the properties and that much better financ-

ing, more direct operation, less overhead expense and more scientific management all around would result from a merger.

**Wisconsin University to Teach Meter Theory and Operation Again.**—The University of Wisconsin will for the third time give a short, intensive course for electric metermen at the College of Engineering Laboratories, Madison, from Jan. 29 to Feb. 2. Questionnaires have been sent out to determine the qualifications of the men desiring to attend, in order to classify them into groups of equal experience. The work will be divided into five sections—indicating instruments, watt-hour meters, instrument transformers, demand meters, and miscellaneous work. A small fee will be charged. C. M. Jansky is professor of electrical engineering.

**Transportation to Denver N. E. L. A. Meetings.**—A special compartment car will be reserved for delegates from the East to the meeting of the Commercial National Section of the N. E. L. A. to be held in Denver on Jan. 24-26. This car will be attached to the "Lake Shore Limited" leaving New York by the New York Central route on Saturday, Jan. 20, at 5.30 p.m. and reaching Chicago at 4 p.m. Sunday. Sunday night will be spent in Chicago, and the car will be attached to train No. 9, over the Burlington route, leaving Chicago at 10.30 a.m. Monday and arriving in Denver at 3.30 p.m. Tuesday. The total one-way fare is $107.61. Reservations should be made at once through Clarence L. Law, chairman transportation committee, New York Edison Company, Irving Place and Fifteenth Street, New York.

**St. Louis Utility Changes Name.**—The Union Electric Light & Power Company, St. Louis, has been granted permission by the Public Service Commission of Missouri to change its corporate name to the St. Louis Electric Light & Power Company. The transfer of assets of the latter concern to the Missouri Electric Light & Power Company and the further transfer of assets to the new Union Electric Light & Power Company was also authorized. These changes are part of the reorganization and refinancing plan of the Union Electric Light & Power Company made necessary by the construction of its new Cahokia plant on the Mississippi River. Under a recent order of the commission, the authorized capital stock of the new company will be $25,000,000 preferred and 650,000 shares common stock of no par value.

**Davis Bridge Dam Power House.**—Work on the New England Company's Davis Bridge development is progressing rapidly. The dam will be 200 ft. high, about 1,200 ft. wide at the base and will extend across the valley of the Deerfield River for about 1,200 ft. The power house, to be built below Readsboro, Vt., will be about 60 ft. x 110 ft. in plan with a substructure of concrete located on a ledge and a superstructure of brick-steel construction. Since the power house will be about 150 ft. from the river bank, the tailrace is being excavated across the intervening flat, and the material is being used to grade the outdoor transformer and switching station area. Two vertical units of about 20,000 hp. each are to be installed first.

**Lecture Course Planned by Oklahoma A. and M.**—Plans have been completed for a series of eight lectures on public utility subjects to be delivered at the Oklahoma Agricultural and Mechanical College at Stillwater during the present school year. These lectures will cover various branches of the public utility industry and will be delivered by officers and executives of local utility companies. The first lecture was given on Dec. 11 by George A. Davis, assistant to the vice-president, in charge of public relations of the Oklahoma Gas & Electric Company. His subject was "What Is a Public Utility?" The other lectures are scheduled to be presented before the engineering school and the general student body. This service has been started by the speakers' bureau of the Oklahoma Utilities Association.

## Associations and Societies

**New York Section, I. E. S.**—Theater lighting will be the topic of the meeting of this section of the Illuminating Engineering Society on Jan. 11. It will be discussed by lighting engineers who are connected with prominent theaters.

**Middle West Division, N. E. L. A.**—A conference of the Middle West Geographic Division, N. E. L. A., is called by President Bell to meet at the Muehlebach Hotel, Kansas City, on Wednesday, Jan. 10, at 10 a.m., to consider finances and other matters of interest to the industry.

**Coming Meetings of A. I. and S. E. E.**—The Philadelphia Section of the Association of Iron and Steel Electrical Engineers meets tonight (Jan. 6), when W. J. De Voe will speak on automatic electric services. The Cleveland Section will hold its annual dance and "get-together" meeting on Jan. 13. The Chicago Section will hear an address on "Radio" by a General Electric Company engineer on Feb. 14.

**January Section Meetings of the A.I.E.E.**—The following Institute section meetings have been scheduled for January, 1923: Boston, Jan. 9, "The Doble Method of Testing Insulators," Frank C. Doble; Detroit-Ann Arbor, Jan. 12, "Electric Transportation System of a Large City," H. M. Gould; Pittsburgh, Jan. 9, "Alternating-Current Substations for City, Industrial and General Distribution Work," A. H. Kehoe; New York, Jan. 19, "The Modern Physics," Dr. M. I. Pupin; Pittsfield, Jan. 18, "Power Development at Niagara," J. L. Harper; Toronto, Jan. 12, "Industrial Heating"; Jan. 26, "Large Power Distribution and Control," P. E. Hart; Worcester, Jan. 18, "The New England Power System," S. C. Moore.

**Electrical Club for Sacramento.**—Nearly a hundred representatives of the electrical industry of Sacramento, Cal., met with a large delegation from the San Francisco Electrical Development League last month to discuss the advisability of forming a permanent electrical club in the Sacramento district. The purposes of the club would be social, educational and commercial. A resolution favoring its formation was passed.

**Western Association of Electrical Inspectors to Discuss Code Revision.**—At the eighteenth annual meeting of the Western Association of Electrical Inspectors, which will be held at the Hotel Sherman, Chicago, Jan. 23, 24 and 25, almost the entire program will be devoted to presentation and discussion of proposed changes in the National Electrical Code. The meeting will thus be one of the most important the association has held. It is planned to have the chairman of each standing committee or the chairman of each technical sub-committee of the electrical committee of the National Fire Prevention Association present the changes in the code related to the work of each committee and explain the reasons for and import of each suggestion.

### Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published on page 78 of this issue of the ELECTRICAL WORLD.]

Federated American Engineering Societies—Washington, Jan. 11-12.

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Grodon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Iowa Engineering Society—Des Moines, Jan. 23-26.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26. H. M. Northrup, 23 Erie St., Milwaukee.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14; executive committee, Atlantic City, Feb. 15-16. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

American Physical Society—New York, Feb. 24. D. C. Miller, Case School of Applied Science, Cleveland.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

American Electrochemical Society—New York, May 3-5.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

## Recent Court Decisions

**Contracts Voided for Want of Mutuality.**—In suits brought by the incorporated town of Laurens and other towns in Iowa against the Northern Iowa Gas & Electric Company the United States Circuit Court held that contracts between the towns and the electric company obligating the company to furnish electricity to the towns without requiring the towns to purchase the electricity, except as they might desire, cannot be specifically enforced, the contracts being void for want of mutuality.

**Telephone Workman Maintaining Wires on Electric Light Company's Poles Not Trespasser.**—A telephone workman climbed an electric light pole bearing telephone wires on which he had been told to work and was killed by contact with electric light wires insufficiently insulated (Cappuccio vs. Hammonton Electric Light Company). The defendant claimed that the workman was a trespasser, that there was no proof of negligence on its part and that the man was guilty of contributory negligence since he wore no rubber gloves and did wear spurs. The Supreme Court of New Jersey ruled against the defendant on all three contentions, pointing out that the question of gloves and spurs was in this case immaterial since the victim of the accident made contact with the high-tension wire with his knee. (118 At. 712.)*

**Contract Rates Binding Until Exercise of State Regulatory Power.**—In Sumter Gas & Power Company vs. City of Sumter, the United States Circuit Court of Appeals for the Eastern District of South Carolina found that where a city is empowered to make regulations with respect to streets, but is not empowered to make contracts fixing the rates to be charged by corporations given the right to use streets, the state has a right in the exercise of its police power to change the rates fixed by the contract giving a company the right to use the streets; but where the state does not exercise its right to change such rates, the rates are binding on both parties and cannot be changed by the court. A further finding was to the effect that where a city without the right to so do entered into a contract with a company fixing the maximum rates to be charged by the company the Legislature by ratifying such contract could make it an irrevocable contract with the same force and effect as if the statute authorizing the city to regulate rates had been enacted cotemporaneously with the ordinance granting the company the franchise fixing the rates, since the company, having accepted the agreement and received the benefits, could not complain of its subsequent legislative sanction and ratification. (283 Fed. 931.)

**Contributory Negligence as a Question of Law.**—Two boys, walking along a path at night, came into contact with a loose wire hanging from a telephone line and swung it in such a way that it came into contact with a trolley transmission line and both boys were killed. The Supreme Court of Pennsylvania, in Sebring vs. Bell Telephone Company and Flesher vs. Same, has declared that the boys were not guilty of contributory negligence as a matter of law, that the proximate cause of the injury was rightly left to the jury to determine, and that the telephone company was guilty of negligence in not inspecting its line, from which testimony showed that the loose wire had hung for weeks. (118 At. 729.)

**Rule Requiring Deposits Held to Be Discriminatory.**—The Court of Appeals of Kentucky has declared for the plaintiff in Barriger vs. Louisville Gas & Electric Company, finding discriminatory a rule whereby about 10 per cent of the consumers were required to put up deposits or furnish a written guaranty that their bills would be paid, while about 90 per cent were not required to furnish security of any kind, all the consumers being charged the same rates for services rendered. The deposit was ordered returned to the plaintiff with the interest due, but the court refused to allow him to sue for similar relief to about three thousand others, holding that the claims of other consumers were several and could not be joined in one action. (244 So. 690.)

**Power of Courts to Reverse Ohio Commission.**—Pointing out that on reviewing an order of the Ohio Public Utilities Commission it is not the province of the court to fix a rate or make stipulations concerning the service to be furnished, but only to determine whether the commission's order is unlawful or unjust, the Supreme Court of Ohio reversed the commission in an action brought against it by the city of Cincinnati because of a new schedule of telephone rates authorized by the commission. No authoritative opinion was filed because the judges did not agree on their grounds for the judgment. The chief justice, however, held that the company had failed to sustain the burden of proof and criticised the method of valuation followed. (137 N. E. 36.)

**No Recovery for Injury to Boy Courting Danger.**—An eight-year-old boy was injured when, in order to get a birds' nest, he climbed to the high part of a railroad bridge and touched a bare electric wire 19 in. from the strut which he had climbed. Damages awarded his guardian were affirmed by the United States Circuit Court (Fruchter vs. New York, New Haven & Hartford Railroad), and the case was appealed to the United States Supreme Court on a writ of certiorari. This court has reversed the judgment and remanded the case, finding an absence of any evidence that the railroad company directly or by implication invited or licensed the boy to climb to the point from which he touched the wire, in opposition to the supposed theory of the trial jury that the structure was both dangerous and attractive to children and that failuse to supply proper guards, human or mechanical, constituted negligence. (43 S. C. R. 38.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

## Commission Rulings

**Franchise-Tax Exemption Not a Factor in Valuation.**—In reducing from the \$104,000 requested to \$78,100 the amount of 7 per cent preferred stock which the San Diego Consolidated Gas & Electric Company would be permitted to issue to purchase the Coronado system of the United Light, Fuel & Power Company, the California Railroad Commission excluded from the valuation \$25,000 said to represent the value of the exclusive franchise rights possessed by the Coronado Company in its territory. No value, the commission maintained, can be placed on a franchise on the theory that an existing utility can operate without payment of a franchise tax while a new utility would have to pay such a tax.

**Public Rights in Water Powers.**—Seventy-six investigations undertaken by the Public Utilities Commission of Utah into contracts made between the Utah Power & Light Company and large users of power were brought to a close recently when the commission ordered the standard schedules to apply to the Bamberger Electric Railroad with some special allowances. In this case the equity of special rates from the power company to the railway company was predicated upon the value of certain water rights which the railroad company had surrendered, the power company acquiring the benefit inherent in them. The commission refused to entertain a valuation of these water rights based on comparison with the cost of coal. The State of Utah, it pointed out, has splendid natural advantages regarding the development of water rights, and to put "value upon water rights equated to the competitive cost of coal which must later be capitalized and reflected in rates paid by the consumers would operate to deprive the public of these natural advantages and be destructive of public right. To value water rights solely upon this basis would benefit hugely the owners of these water rights who secured them under state and federal laws at nominal expense and would be inimical in the end to the very parties who now propose it. The benefit of available water power should move to both the producer and consumer of water power. This cannot be under any such theory."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## Friends Honor Dr. Weston

Dr. Edward Weston, head of the Weston Electrical Instrument Company, was the guest of honor at a dinner given on Thursday evening, Dec. 28, at the Hotel Commodore, New York City. Prof. Michael I. Pupin of Columbia was toastmaster and the guests presented Mr. Weston with a silver loving cup. Dr. Weston is a charter member of the American Institute of Electrical Engineers and a past-president of the organization.

**H. V. Rees**, who has been with the Fruit Growers' Express Company for some time, has joined the commercial department of the Ohio Power Company.

**F. L. Ball**, local manager of the Fitchburg (Mass.) Gas & Electric Light Company, has been elected vice-president of the Fitchburg Chamber of Commerce.

**Otto E. Osthoff**, vice-president of H. M. Byllesby & Company and of the Standard Gas & Electric Company, has withdrawn from these corporations and their subsidiaries as of Dec. 31.

**M. F. Riley** of New York, president of the Birmingham Water Works Company, has resigned to become president of the Potomac Public Service Company of Maryland, which is also a subsidiary of the American Water Works & Electric Company.

**Yasuhige Hayashi**, managing director of the Uji River Electric Company and vice-chairman of the board of directors of the Nippon Electric Company of Osaka, Japan, recently visited California and made a study of high-tension transmission systems. He is especially interested in the transmission of energy at 220,000 volts.

**Clarence A. Whitmyer** of the General Electric Company succeeded George R. Lunn as Mayor of Schenectady on Jan. 1, when Mr. Lunn became Lieutenant-Governor of New York. Mr. Whitmyer, who is president of the Common Council, has obtained a year's leave of absence from his position with the General Electric Company and will serve the remaining year of Mr. Lunn's term as Mayor.

**R. S. Johnson**, senior student in electrical engineering, has been appointed to the electrical fellowship maintained by the Wisconsin Utilities Association at the University of Wisconsin on the nomination of Edward Bennett, professor of electrical engineering at the university. The fellowship is maintained to encourage research work on problems whose solution helps to improve the quality of service rendered by public utilities and to bring students more closely in contact with the operating difficulties of the different companies. This year Mr. Johnson will devote his research work to the problems involved in eliminating electric disturbances on telephone circuits.

## Major Bennion Receives the Distinguished Service Medal

Major Howard S. Bennion, the assistant chief engineer of the Federal Power Commission, a post he has held since the commission was created, has been presented with a distinguished service

H. S. BENNION

medal by the Secretary of War. The medal was awarded to Major Bennion for his accomplishments as chief of camouflage with the American Expeditionary Forces.

Major Bennion has served with the Corps of Engineers since his graduation from West Point in 1912. He was graduated from the Army Engineer School in 1915. After the armistice Major Bennion was placed in charge of road maintenance throughout a large portion of the devastated area in France. With the completion of that service he was made a member of the United States Liquidation Commission in Paris and later was made executive officer of the Chief Engineer of the American Expeditionary Forces.

**Capt. Clarence S. Jarvis** of the United States Army Engineering Corps was the speaker at the weekly luncheon of the Provo (Utah) Rotary Club Dec. 8. He spoke on the engineering features of the Colorado River project and outlined engineering problems involved in the building of the dam.

## E. C. Headrick Chosen to Advisory Board of Electrical Body

E. C. Headrick, an electrical contractor of South Denver, Col., and a member of the advisory board of the Electrical Co-operative League, has been elected to serve on the executive committee of the Association of Electrical Contractors and Dealers. Mr. Headrick, who is the first Denver man to be named on this board in many years, will represent the Mountain Division of the Association of Electragists International, comprising Colorado, Wyoming, Utah, New Mexico, Arizona, Montana and a part of Idaho. He succeeds E. H. Hardley of Salt Lake City. For several years Mr. Headrick was president of the local association of electrical contractors and dealers, and he is a past-chairman and one of the organizers of the Electrical Co-operative League.

**Warren R. Voorhis**, who has been associated with the American Water Works & Electric Company, Inc., New York City, for several years, was recently elected a vice-president of the company by the board of directors.

**S. A. Wills**, formerly power engineer for the Atlantic City Electric Company, has been transferred to the Ohio Power Company's Canton office. Both these companies are properties of the American Gas & Electric Company.

**Paul Wilson**, who for seven years has managed the office of the San Joaquin Light & Power Company at Madera, Cal., has been promoted to the position of district manager at the Fresno office. Mr. Wilson took up his duties there on Jan. 1.

**James A. Bennett**, Meriden, Conn., has been appointed sales manager of the Connecticut Telephone & Electric Company, Meriden, Conn., manufacturer of electrical and telephone goods. Mr. Bennett succeeds Charles E. Stahl, resigned.

**John W. Carpenter**, vice-president and general manager of the Texas Power & Light Company, has just completed a trip of several weeks through the cotton-mill regions of the United States. He made the trip to complete a survey of the textile situation with the view of assembling complete data for use of communities on the lines of his company's transmission system and for others in Texas who may desire the information.

**H. W. Watt**, engineer of electric distribution of the Westchester Lighting Company, has returned from a meeting in Albany of the managing committee of the Electric Section of the Empire State Gas and Electric Association. Mr. Watt said that the committee plans to map out a program of study of new processes and developments in the electric central-station field with a view to the general adoption by companies in New York State of any feature found to possess possibilities of economy or operating efficiency.

### Changes at Schenectady

Vice-president G. E. Emmons of the General Electric Company recently announced a reorganization of the general manufacturing department of the company effective on Jan. 1. It includes the appointment of H. F. T. Erben, heretofore manager of the Schenectady works, as vice-chairman of the manufacturing committee and ranking member of the general manufacturing staff.

The vacancy thus created in the position of manager of the Schenectady plant has been filled by the advancement of Charles E. Eveleth, who had served since Sept. 1 as assistant works manager under Mr. Erben. Mr. Eveleth becomes works manager. J. A. Smith will continue as general superintendent and in the absence of Mr. Eveleth will be in charge of the works.

The general manufacturing department, of which Vice-president Emmons is in charge, will be as follows: H. F. T. Erben, vice-chairman of manufacturing committee and ranking member of the staff; J. T. Broderick, secretary of the manufacturing committee; L. G. Banker, general purchasing agent; M. C. Fitzgerald, manager of transportation department; W. C. Fish, manufacturing engineer; W. B. Curtiss, supervisor of production; G. S. Maxwell, supervisor of costs; E. Z. Steezer, supervisor of industrial relations.

**James J. Withrow** is now manager of the Sheridan County Electric Company, Sheridan, Wyo., replacing Judson Bibb.

**W. B. McGorum** has been transferred from the statistics department of the Stone & Webster organization to the Key West (Fla.) Electric Company.

**N. S. Patterson**, formerly superintendent of the meter department of the Natrona Power Company, Casper, Wyo., is now resident manager of the Big Horn Utilities Company.

**John S. Ferguson**, formerly associated with the Massachusetts Institute of Technology, has joined the statistics department of the Stone & Webster organization.

**H. V. Schreiber**, associated with the Charles B. Hawley Construction Company of Washington, D. C., is at present in New Zealand, where he will spend five or six months.

**E. A. Hanff**, formerly electrical engineer with the Pittsburgh Electric Furnace Corporation, has become associated with William Swindell & Brothers, Pittsburgh, in the electric furnace department.

**William E. Horner** is now superintendent of the Heber (Utah) City Light & Power Company, succeeding E. Parley Cliff, who died last May. Mr. Horner has been associated with the company for more than ten years.

**Alexander Macomber** of the engineering firm of Macomber & West, Boston, has been elected treasurer of the Charlestown (Mass.) Gas & Electric Company, succeeding Samuel J. Fowler, who is retiring from active connection with the company, though continuing as a director. Mr. Macomber, who is well known in utility circles throughout New England, will continue his active connection with his engineering firm.

**Roy E. Heffner**, until recently instructor in the department of electrical engineering, Cornell University, has become affiliated with the John B. Stetson University, Deland, Fla., where he will teach in the newly organized engineering college.

**C. O. Mailloux**, president of the International Electrotechnical Commission, returned to this country recently. Mr. Mailloux sailed for Europe early in November to attend the meeting of the commission held in Geneva.

**G. I. Dorr** has resigned his position with the Star Electric Motor Company and will be affiliated with the sales department of the Continental Electric Company, Inc., manufacturer of electric power apparatus. Mr. Dorr will make his headquarters at the main office of the company at Newark, N. J.

**C. M. Stevenson**, who was district sales manager at Toledo, Ohio, for the Colonial Steel Company until the branch was discontinued, has severed his connection with the organization, having been elected a director and appointed general manager of the Reinforced Switch & Manufacturing Company, Pittsburgh, manufacturer of a patented reinforced switch and fuse clip.

### L. W. Staunton New Brandes Advertising Manager

L. W. Staunton, former research manager of the Herold-Garber Company, Indianapolis, has been appointed advertising manager of C. Brandes, Inc. Previously Mr. Staunton was in charge of the merchandising section, department of publicity, Westinghouse Electric & Manufacturing Company, in which capacity he had considerable responsibility in the production of radio publications. Most of Mr. Staunton's business experience has been along advertising and sales lines. Previous to his connection with the Westinghouse company he was affiliated with the publicity department of the Taylor Instrument Company of Rochester, N. Y.

### A. S. M. E. Gives Prizes

Prof. Robert C. Heck of Rutgers College has been awarded life membership in the American Society of Mechanical Engineers for a paper on "Steam Formulas." R. H. Heilman, industrial fellow at the Mellon Institute, Pittsburgh, and F. L. Kallam, graduate student at Leland Stanford, Jr., University, were awarded junior prizes of the society. Mr. Heilman's paper dealt with "Heat Losses from Bare and Covered Wrought-Iron Pipe at Temperatures Up to 800 Deg. F." Mr. Kallam won the honor for a "Preliminary Report on the Investigation of the Terminal Conductivity of Liquids."

### Dr. Franklin Heads American Chemical Society

Dr. Edward C. Franklin, professor of organic chemistry at Leland Stanford, Jr., University, has been elected president of the American Chemical Society, succeeding Dr. Edgar F. Smith of the University of Pennsylvania.

Dr. Franklin was a member of the advisory board of the United States Bureau of Mines in 1917-1918 and physical chemist of the United States Bureau of Standards and consulting chemist of the Ordnance Bureau of the army during the war. His work on liquid ammonia as an electrolytic solvent is familiar to all chemists. Dr. Franklin was born at Geary City, Kan., and is a graduate of the University of Kansas.

## Obituary

**Solomon Lewenberg**, formerly a member of the Massachusetts Gas and Electric Light Commission, died at Boston on Dec. 24. Mr. Lewenberg, who was born in Boston in 1876, was a lawyer by profession. He served on the commission from 1916 to 1919.

**Frank Kivel**, publicity manager for the Denver Gas & Electric Light Company, died recently at the age of forty-two. Mr. Kivel, who was a native of New Hampshire, went to Denver about fifteen years ago. He was a member of the publicity committee of the National Electric Light Association. Interment was at Dover, N. H.

**James P. Dusenberry**, aged seventy-eight, a director of the Public Service Corporation of New Jersey and formerly its treasurer, died of heart disease on Dec. 24 at his home in Newark, N. J. He was treasurer of the old Newark Gas Light Company, and when it was absorbed by the Public Service Corporation he became treasurer of the latter. He retired from that post eight years ago.

**Charles Perry Lindsley**, vice-president of the Lindsley Brothers Company of Spokane, Wash., died at Hot Lake, Ore., Dec. 27, at the age of fifty-five years after an illness of several months. Mr. Lindsley was president of the Lindsley Brothers Canadian Company, Ltd., at Nelson, B. C., and vice-president of the Barnes-Lindsley Manufacturing Company, manufacturer of Douglas-fir cross-arms at Portland, Ore. He was one of the promoters of the Cœur d'Alène Electric Railway Company and the Pend d'Oreille River Navigation Company and a pioneer in the lumber and cedar-pole industries. He was born in Neenah, Wis., going to Spokane in 1901, where he, with his brothers, E. A. and G. L. Lindsley, organized the Lindsley Brothers Company, which is one of the largest producers of Western red-cedar poles in the United States and Canada.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Review of the 1922 Electrical Market

**Total Production Estimated at $920,000,000 — Wholesome and Steady Growth a Feature—Economic Trend Steadily Progressive—Slight Setbacks Were of Constructive Character**

By H. M. Cunnington
Trade and Markets Editor Electrical World

A WHOLESOME and steady growth marked the manufacturing division of the electrical industry in the year just ended. Total production of the year is conservatively estimated at $920,000,000. This figure compares with $625,000,000 in 1921, a year of depression, and with $1,250,000,000 in 1920, the peak of the boom period.

According to reports from a large number of manufacturers, the production of electrical and allied mechanical equipment has been almost phenomenal. Orders have come chiefly from central-station companies, as distinguished from other users of electrical equipment, although the industrial-plant users of electrical equipment were at one time large buyers. The unprecedented demand from central-station companies during 1922 is attributed by many manufacturers to the fact that public utilities were unable during the war to make necessary extensions, repairs and improvements, owing to the unavailability of equipment and scarcity of money at reasonable prices. As a result, utilities have not expanded at a normal rate during the last four or five years, but now they are in an enviable financial condition and money is available at more reasonable rates, which enables them to make up for past inactivity and buy in heavier volume. Some manufacturers also report a large demand for electrical and allied equipment which is directly or indirectly the result of increased building.

A notable expansion in the use of industrial heating devices, furnaces, ovens, etc., is noted. As compared with 1921, the volume of applications of this nature for the year just ended showed an increase of more than 50 per cent in kilowatt capacity. This particular method of applying electricity for industrial heating has now been on a practical commercial basis for about six years, during which time the heating units installed have aggregated about 500,000 kw. in capacity.

### New Construction Helped All Lines

The greatest factor entering into the increased consumption of electrical apparatus and supplies has been the record-breaking volume of construction started and completed during the year. Conduit stocks have been abnormally low all through the latter nine months as a principal result, wire mills have rushed to keep up with orders, and manufacturers of all relative supplies have progressed accordingly. As was to be expected, with the general growth of demand, a gradual stiffening of prices of conduit, armored cable and wire occurred in the market during the year.

In general, the economic trend of the electrical industry was almost steadily progressive. Even when slight setbacks occurred, they were of constructive character. Prolonged strikes in the railroad and coal industries only temporarily checked progress of manufacturers in gathering together their raw materials for production and timely shipments. Although manufacturers encountered other obstacles, substantial recovery in the industry would not have come if previous far-reaching readjustments had not eliminated many of the weak spots and placed business on a more stable basis.

**Lamps.** — All through the year there has been an increased demand for blue sign lamps. The demand for better street lighting, lamps and equipment has shown a marked increase, due to the recognition of the fact that good street lighting is effective in increasing the speed safety of traffic and in reducing crime. A large number of cities which have held back in semi-darkness for a period of years are now taking advantage of lower costs to make much-needed improvements. In view of the extensive building program, much attention has been given the subject of school lighting. In the past year several large cities gave careful consideration to this subject—for the first time. There has been a notable increase of interest in equipment suitable for the lighting of all classes of outdoor sports, fostered, no doubt, by lower installation cost.

### Conduit Stocks Low During the Year

**Conduit.** — All during the year the lowest stock in the wiring line was rigid conduit. Raw-material shortage was the principal reason for this condition. When shipments from the mills did commence to improve, heavier demands from the building industry caused greater concern. Prices were strong throughout the year.

**Motors.** — Business in motors showed constant improvement all through the year Although small-order sales dominated the market, their persistence and tendency to multiply offered much encouragement to the manufacturer and jobber of first-class products. During the past year sales of motors were subject to extremely acute competition and were accompanied by more "proposition" work and technical analysis than has been the case for a long time. On this account certain new designs of motors have made better headway in the market than might have been expected, and the competition between makers of advanced designs and some of the older builders of motors was exceptionally sharp for the amount of business offered.

**Control Devices.** — During the earlier months of the year competition was very keen among manu-

facturers of control devices. In comparison with the business of later months very little business was in the market. Between January and May prices were reduced materially and some attractive orders were secured merely on price bases, and special prices were made in special cases. During the latter half of the year business picked up and there was some strengthening of prices.

**Switchboards and Panelboards.**—Although business in switchboards and panelboards was sluggish during the first five months, a continued increase became apparent in the middle of the year and improvement continued throughout the remaining months. Conditions in the northern part of the country were slightly better than in the southern sections. Construction, as in other lines, caused the curve of sales to mount rapidly in the last half of the year.

**Residential Meters.** — Consumption of watt-hour meters (house type) is conservatively estimated at 1,750,000 for the year 1922. Manufacturers have reported that production of this article is well over the 1,900,000 mark. The associated activity of meter protective and safety equipment also had a remarkable development.

**Hollow Ware.** — Excellent business in appliances for table service was enjoyed throughout most of the year. A leading manufacturer of these devices states that during the last few weeks stocks were greatly reduced and in some cases jobbers' stocks were cleaned out by the unordinary heavy purchasing during the Christmas season. Heavier appliances were active throughout the year, which was contrary to jobbers' expectations. Toasters, irons, grills and percolators were particularly strong throughout the year, and during December some manufacturing by night shift was reported. Very little complaint is heard from the consumers in the matter of prices and interest seems to be increasing each month. Raw materials were not plentiful throughout the year because of poor railroad transportation. However, there is improvement in that quarter and easier and more profitable days are promised for the manufacturers.

**Dry Batteries.** — Although production of dry batteries was almost 20 per cent lower than the 50,000,000 manufactured in 1921, the market during the past year was one of strength, considering the ever-increasing popularity of bell-ringing transformers and other apparatus which are rapidly taking the battery's place in the market. During the year large numbers of batteries were sold to the radio enthusiasts. Railroads and the automotive fields were also large purchasers.

### STORAGE BATTERIES GAINED MATERIALLY

**Storage Batteries.** — A gain of 25,000,000 in production of storage batteries was shown in 1922, due to the increased activity in the radio line and in automobiles.

**Trucks.**—Business men today are looking into the question of delivery costs as never before and are finding that too great a percentage of their gross receipts is being spent for delivery charges. With accurate costs from their own haulage and delivery records, they have found that electric trucks are very much more economical for haulage and delivery on city routes than either gasoline trucks or horses. The sales of electric trucks during the twelve months just ended indicate a steadily increasing demand. Production in 1921 was 1,000, compared with 1,250 in 1922. The year 1922 found a much greater demand for electric trucks for city deliveries, and the outlook for 1923 is excellent. There are now nine manufacturers of electric street trucks, with every probability that some of the gasoline-truck manufacturers wil be included by the end of 1923.

### BETTER SELLING HELPED VACUUM CLEANERS

**Vacuum Cleaners.** — By better training of salesmen and improving selling methods manufacturers and jobbers of vacuum cleaners have developed a greater potential market than they had in the years 1920 and 1921. There was very little "order taking" during the year; instead, it was twelve months of stiff competition and directed sales efforts. It is said that 700,000 vacuum cleaners, valued at $35,000,000, were manufactured during the year just ended. This is an increase of 100,000 cleaners over 1921, but a large decrease of 325,000 cleaners from the year 1920. Better general business conditions, of course, caused this improvement in the market. Shipments generally were prompt all during the year, averaging from one to ten days. Very few price reductions were made during 1922, although a few manufacturers during the days of heavier competition included attachment sets free in order to gain better attention.

**Farm - Lighting Plants.** — Large crops for the farmers have permitted the expenditure of more money for general improvements in the rural districts. According to one of the largest manufacturers of these sets, sales have been very large. The outlook for the future winter months is very encouraging. Deliveries have been affected somewhat by the recent railroad tie-up, but the year ended showed decided improvement. Exports have been unusually good.

**Wiring Devices.** — Gradual improvement in the demand for wiring devices is noted. The expansion of the building industry was a helpful factor in the situation. Plants throughout the country ran full

## Interesting Financial Comparisons

| | | |
|---|---|---|
| Electrical Manufactured Products, | 1922 | $920,000,000 |
| | 1921 | 625,000,000 |
| | 1920 | 1,250,000,000 |

| | | | | | |
|---|---|---|---|---|---|
| Farm crops (value), | 1922 | $7,572,890,000 | Pig iron output (tons), | 1922 | †23,793,000 |
| | 1921 | $5,729,912,000 | | 1921 | †14,894,000 |
| Merchandise exported, eleven months, | 1922 | $3,491,633,000 | Unfilled steel tonnage, | 1922 | 6,840,000 |
| | 1921 | $4,188,832,000 | | 1921 | 4,250,000 |
| Commercial failures, | 1922 | $615,257,000 | Cotton consignments, bales, | 1922 | †5,561,000 |
| | 1921 | $627,401,000 | | 1921 | †4,896,000 |
| Bond sales (par value), | 1922 | $4,130,900,000 | Dun's index number, | 1922 | $185,462 |
| | 1921 | $3,402,538,000 | | 1921 | $164,531 |
| Stock sales (shares), | 1922 | 262,500,000 | ‡ Federal Reserve ratios, | 1922 | 80.4 per cent |
| | 1921 | 173,127,000 | | 1921 | 73.1 per cent |

† Eleven months. ‡ Highest ratios.

time through the year. Raw material was plentiful and buying was well distributed. Foreign trade went to very low levels, the exchange situation barring much expansion in that field.

**Poles.** — During the months of March, April and May producers of poles showed their confidence in that market by raising their prices twice. The first time was the middle of March, when the increase was confined to a few sizes. Prices previous to March had been descending for more than a year. This current increase, it was pointed out, was a definite sign that the market was again on the up grade and that the producers, as opposed to the small brokers or selling agencies, were once more in control of the situation. Demand in all sections of the country remained good, with some sections, such as the Southwest, particularly active. Stocks generally were good, although not too heavy, and producers found little trouble in making shipments until the recent rail difficulties.

**Porcelain.** — A noticeable improvement in the low-tension or dry-process electrical porcelain business was evident all through the year. This improvement was particularly noticeable in the demand and distribution of standard items as sold by the jobbing trade. These products entered directly into the construction of the many new building erected.

## Production of Electrical Equipment and Supplies During 1920, 1921 and 1922

| Item | 1920 (Revised) | | 1921 | | 1922 | |
|---|---|---|---|---|---|---|
| | Number of Units | Value | Number of Units | Value | Number of Units | Value |
| **Insulated Copper Wire:** | | | | | | |
| Rubber covered | ... | $85,000,000 | ... | $40,000,000 | ... | $60,000,000 |
| Total code | 1,700,000,000 ft. | 30,000,000 | 1,271,000,000 ft. | 17,408,000 | 1,700,000,000 ft. | 25,000,000 |
| No. 14 code | 1,105,000,000 ft. | 11,250,000 | 890,000,000 ft. | 5,785,000 | 1,200,000,000 ft. | 7,000,000 |
| Flexible cords | 204,000,000 ft. | ... | 95,000,000 ft. | ... | 133,000,000 ft. | 1,500,000 |
| **Generators:** | | | | | | |
| Waterwheel | ... | ... | 196,000 kw. | 1,100,000 | 200,000 kw. | ... |
| Turbo | ... | ... | 510,000 kw. | ... | 575,000 kw. | ... |
| **Motors:** | | | | | | |
| Fractional | ... | 40,000,000 | ... | 15,000,000 | ... | 30,000,000 |
| 1 hp. to 50 hp. | ... | 66,000,000 | ... | 30,000,000 | ... | 50,000,000 |
| 51 hp. to 200 hp. | ... | 11,000,000 | ... | 5,000,000 | ... | 7,500,000 |
| Above 200 hp. | ... | 4,000,000 | ... | 1,000,000 | ... | 1,600,000 |
| **Transformers:** | | | | | | |
| 5-kva. and under | 330,000 | ... | ... | ... | ... | ... |
| Above 5 kva. | 660,000 | ... | ... | ... | ... | ... |
| Distribution type | ... | 11,400,000 | ... | 6,000,000 | ... | 12,000,000 |
| Power type | ... | 13,200,000 | 1,950,000 | 6,000,000 | ... | 11,000,000 |
| **Meters, Watt-hr. (house)** | 2,200,000 | ... | 1,500,000* | ... | 1,750,000* | ... |
| **Control, industrial** | ... | 25,000,000 | ... | 15,000,000 | ... | 25,000,000 |
| **Lamps:** | | | | | | |
| Type "B" | 172,000,000 | ... | 134,000,000 | ... | 165,000,000 | ... |
| Type "C" | 43,000,000 | ... | 27,000,000 | ... | 40,000,000 | ... |
| Carbon | 15,000,000 | ... | 7,000,000 | ... | 5,000,000 | ... |
| Miniature | 105,000,000 | ... | 105,000,000 | ... | 95,000,000 | ... |
| **Socket Devices:** | | | | | | |
| Heating appliances: | | | | | | |
| Domestic | ... | 23,400,000 | ... | 14,040,000 | ... | 17,000,000 |
| Industrial | ... | 1,500,000 | ... | 900,000 | ... | 1,100,000 |
| Fans | 950,000 | 13,900,000 | 700,000 | 10,000,000 | 900,000 | 10,500,000 |
| Washing machines | 600,000 | 72,000,000 | ... | ... | ... | ... |
| Vacuum cleaners | 1,025,000 | 51,000,000 | 600,000 | 30,000,000 | 700,000 | 35,000,000 |
| **Wiring Supplies:** | | | | | | |
| Rigid conduit | 140,000 tons | 20,300,000 | 58,000 tons | 7,000,000 | 80,000 tons | 10,000,000 |
| Non-metallic flex. conduit | 100,000,000 ft. | 4,700,000 | 98,000,000 ft. | 2,500,000 | 175,000,000 ft. | 2,500,000 |
| Metallic flexible conduit | 2,300,000 ft. | 150,000 | ... | 100,000 | ... | 150,000 |
| Flexible armored conductor | 71,000,000 ft. | 6,400,000 | ... | 4,000,000 | ... | 5,000,000 |
| Outlet boxes and fittings | ... | 1,800,000 | ... | 1,200,000 | ... | 2,000,000 |
| Tape: Friction | 18,000,000 lb. | ... | 10,800,000 lb. | ... | 15,000,000 lb. | ... |
| Rubber | 2,000,000 lb. | ... | 1,200,000 lb. | ... | 3,000,000 lb. | ... |
| Fuses: Renewable | ... | 3,500,000 | ... | 2,000,000 | ... | 2,500,000 |
| Non-renewable | ... | 3,500,000 | ... | 2,500,000 | ... | 3,000,000 |
| **Schedule Material:** | | | | | | |
| Key sockets | 13,500,000 | ... | 7,500,000 | ... | 14,500,000 | ... |
| Pull sockets | 9,000,000 | ... | 5,000,000 | ... | 9,500,000 | ... |
| Keyless sockets | 5,500,000 | ... | 2,750,000 | ... | ... | ... |
| Flush switches | 9,000,000 | ... | 6,000,000 | ... | 7,500,000 | ... |
| Exposed switches | 8,000,000 | ... | 4,000,000 | ... | 4,500,000 | ... |
| Plugs | 15,000,000 | ... | 8,000,000 | ... | 10,000,000 | ... |
| Receptacles | 15,000,000 | ... | 8,000,000 | ... | 10,000,000 | ... |
| **Storage Batteries** | ... | 125,000,000 | ... | 83,000,000 | ... | 125,000,000 |
| Starting and lighting | 3,500,000 | 52,500,000 | 3,200,000 | 40,000,000 | ... | 65,000,000 |
| **Dry Batteries** | 65,000,000 | ... | 50,000,000 | ... | 45,000,000 | ... |
| **Electric Vehicles:** | | | | | | |
| Trucks | 5,000 | 22,000,000 | 1,000 | ... | 1,250 | ... |

* Consumption

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Hydraulic Turbine Business Has Favorable Outlook

Although underlying factors are somewhat different from what they were last year, there is no reason why this year's hydraulic-turbine business should not be at least as favorable as it was last year. This is the opinion of Arnold Pfau, hydraulic department, Allis-Chalmers Manufacturing Company, Milwaukee. He says that one factor which seems to deserve even more serious consideration than it probably did last year is the uncertain political situation in Europe, which is bound to affect our country. He says:

"If our foreign markets remain closed or poor to say the least, our industries will naturally work at small load factor so that the power now available will be sufficient. If the price of coal is not materially reduced, there should naturally be a strong tendency to utilize water, which would necessarily favor new developments and possibly reconstruction of present equipment."

## Says Electric Washer Sales Gained 44 per Cent

A year ago the American Washing Machine Manufacturers' Association issued a statement through the ELECTRICAL WORLD to the effect that the year 1922 would show steady and substantial gains in washing-machine sales. According to E. B. Seitz, secretary of that organization, that prediction has been fulfilled. For the first eleven months of last year the gain for all washers has been approximately 37 per cent over the corresponding period of 1921; the gain for electric washers has been about 44 per cent. Every month has shown an improvement over the preceding month with the exception of July, the strike month, and November, beginning the pre-inventory decline. The volume in dollars for the year should show nearly a 50 per cent increase for the electric machines, indicating that somewhat stronger prices have prevailed.

Washing-machine manufacturers confidently expect this improvement to ontinue throughout the year 1923. They are buying against increased production and in many cases enlarging manufacturing capacity to provide for a thriving year's business. Among the pertinent reasons given for this optimism are: First—There were more than 1,200,000 homes wired in 1922, and a very high percentage of these were wired for the sole purpose of enabling the housewife to have the use of electrical appliances. Second — Sales are easier on a rising market. Third—"Orphaned" washing machines of bankrupt companies have disappeared from the market. Fourth—A more thorough appreciation of the other man's problem prevails as between manufacturers and dealers. Fifth—The great electrical program for America will undoubtedly reach its widest stage of development in 1923.

## Recent Tariff Decisions

Union of South Africa.—It has been decided that wireless-telegraph apparatus, including broadcasting sets, is subject to an import duty of 20 per cent ad valorem under the Union of South Africa tariff. British goods are entitled to a rebate of 3 per cent.

Australia.—According to recent decisions, the following import duties are leviable under the Australian Commonwealth customs tariff: Accumulators for stationary use and plates for use therewith, 10 per cent ad valorem under the general and 5 per cent under the intermediate tariff, British goods free; electrical equipment, consisting of motors, controllers, switches and auxiliary apparatus, for the operating of "bogy" and other tramcars, 10 per cent under general and free under intermediate and British preferential tariffs; electric regulator equipment for controlling two 100-kw. alternators and 600-kva. rotary converters, including transformers and switchgear, 10 per cent, 5 per cent, free; 600-kva. synchronous condensers, 10 per cent, free; 600-kva. synchronous converters and mixed-pressure turbines (ordered prior to March 1, 1922), 10 per cent, 5 per cent, free.

## Brazil Offers Opportunities

The market for electrical goods in Brazil promises to develop considerably in the next few years. The position of the United States is very good and American firms are well represented in the field. At the present time American products are in good demand, with Germany felt as the nearest competitor.

## Possibilities in Nanking

Market possibilities for electrical goods in the Nanking district of China are by no means limited, when it is considered that this area contains 50,000,000 to 60,000,000 inhabitants, with numerous large cities and towns as yet without electric light plants. In fact, the electric light only made its advent there in the last decade and the rapid extension of the use of electricity has been remarkable.

Chinese buyers show a decided unwillingness to purchase by correspondence, and the use of catalogs and literature alone are equally ineffective. The greatest success has been achieved by firms that either maintain their own representatives in Shanghai or have given agencies to American firms in that center which are equipped to handle electrical materials and supplies to advantage. It is considered best to give agencies only to firms having Americans in their employ. Otherwise they very often do not push the American product.

## The Metal Market

**Consumption in All Metals Continues Excellent—Higher Copper Prices—Lead Remains Inactive**

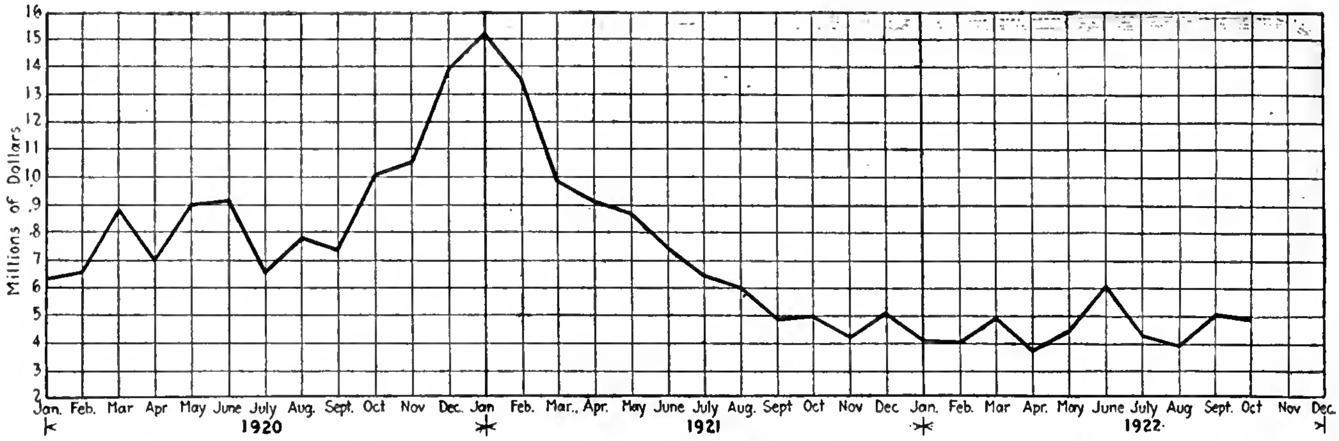
All of the producers who were selling copper at 14.50 cents a week ago seem now to have raised their price to 14.75 cents, delivered, although it might be possible for large consumers with plants in and about New York City still to obtain copper for early delivery at the lower price. There is some tendency among producers who are well sold up to quote 14.87½ cents, but this price so far has been largely a nominal one, although it would be difficult to obtain copper for April or later delivery at much under that figure. Fundamental conditions are so good that producers are decidedly optimistic. Consumption in all metals continues excellent.

The lead market has been decidedly inactive, and few important orders have been placed, and these mostly at average prices. Plenty of lead seems to be available at 7.25 cents, New York, even for prompt delivery. In the Middle West supplies of spot metal are not so large, but most consumers are satisfied with January shipment. St. Louis prices are showing a slight tendency to advance. Desilverized is commanding about 5 points premium at some consuming centers in the Middle West.

The slightly weaker zinc market is attributed by some producers to a stagnant domestic market and by others to a poor demand from abroad compared with a few weeks ago. Probably both are correct. At any rate, it has not been difficult to obtain metal for both prompt and forward delivery in ordinary tonnages. Although some business has been quoted at 7 cents, it has practically all been confined to carload lots. The premium for prompt shipment has disappeared. High grade is selling at 7.75 to 8.25 cents.

NEW YORK METAL MARKET PRICES

| | Dec. 27, 1922 Cents per Pound | Jan. 3, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 14.50 | 14.75–14.87½ |
| Lead, Am. S. & R. price | 7.25 | 7.25 |
| Antimony | 6.40 | 6.35 |
| Nickel, ingot | 36.00 | 36.00 |
| Zinc, spot | 7.05 | 7.05 |
| Tin, Straits | 38.00 | 38.87½ |
| Aluminum, 98 to 99 per cent | 23.00 | 23.00 |




TOTAL OF ELECTRICAL APPARATUS EXPORTS FROM THE UNITED STATES DURING THE YEARS 1920, 1921 AND 1922

## Electrical Apparatus Exports in 1922

Although the total of electrical apparatus exports during the year just ended are far below the peak of the boom years, 1919 and 1920, a healthy condition persists in spite of the difficulties in the foreign markets.

The highest amount of the year, a figure of over $6,000,000, was lower than the lowest amount in all of the year of 1920 and the first six months of 1921. The lowest amount of exports was in April, when they fell below the $4,000,000 mark.

The figures for the first ten months of 1922 are very low in every instance when compared to the months of the two previous years; in no instance will any of these approach previous years' figures.

The greatest recorded drop in exports was for motors, falling from over fifteen million dollars in 1921 to $2,534,137 for the first ten months of 1922. In 1920, motor exports were $13,263,657, and in 1919 they were $10,635,476.

Fan exports held up fairly well throughout the year. They are expected to end the twelve months of 1922 with a total near to $800,000, which figure compares with $1,270,153 in 1921, with $1,365,766 in 1920 and with $1,421,160 in 1919.

Copper wire and cable exports are almost 70 per cent lower than they were in 1921, and it is said that the amounts for the months of November and December will not help these exports in any material way. Last year the total for ten months amounted to $2,895,193, compared to $9,029,525 in 1921, $8,178,539 in 1920 and $8,815,212 in 1919.

Dry batteries exports were other heavy losers during the year. The total for the whole year 1922 is expected to reach close to $1,000,000. This amount compares with $3,821,645 in 1921, $6,633,542 in 1920 and with $5,998,223 in 1919.

Total exports of rheostats and controllers for the twelve months of 1922 are expected to reach or to exceed $800,000.

EXPORTS OF DRY BATTERIES, MOTORS, RHEOSTATS AND CONTROLLERS, FANS, LAMPS, COPPER WIRE AND CABLE, DOMESTIC HEATING AND COOKING APPARATUS DURING 1919, 1920, 1921 AND THE FIRST TEN MONTHS OF 1922

| | Jan. | Feb. | March | April | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dry Batteries** | | | | | | | | | | | | | |
| 1922 | 71,306 | 72,770 | 110,108 | 85,795 | 106,118 | 109,494 | 70,440 | 79,787 | 88,441 | 79,714 | ... | ... | 873,973 |
| 1921 | 655,712 | 451,756 | 412,019 | 430,235 | 430,432 | 246,844 | 183,525 | 175,878 | 271,232 | 211,758 | 175,674 | 176,580 | 3,821,645 |
| 1920 | 374,730 | 526,972 | 690,866 | 487,472 | 676,624 | 578,146 | 497,657 | 444,859 | 607,936 | 483,109 | 615,402 | 649,769 | 6,633,542 |
| 1919 | 345,811 | 420,437 | 579,708 | 547,430 | 516,001 | 787,748 | 379,021 | 587,951 | 442,588 | 507,704 | 406,722 | 477,102 | 5,998,223 |
| **Motors** | | | | | | | | | | | | | |
| 1922 | 186,350 | 223,875 | 245,584 | 295,152 | 244,245 | 254,112 | 327,063 | 200,614 | 292,539 | 264,603 | ... | ... | 2,534,137 |
| 1921 | 2,064,424 | 2,426,433 | 1,571,601 | 1,711,620 | 1,641,827 | 1,437,812 | 1,121,583 | 959,773 | 537,558 | 525,142 | 495,966 | 950,285 | 15,444,024 |
| 1920 | 733,822 | 825,727 | 1,247,85 | 923,096 | 1,132,811 | 1,250,638 | 709,086 | 845,729 | 1,230,408 | 1,255,539 | 1,406,149 | 1,702,846 | 13,261,657 |
| 1919 | 680,882 | 1,107,268 | 838,448 | 829,113 | 817,118 | 1,562,521 | 546,794 | 729,608 | 733,891 | 1,007,930 | 1,003,864 | 778,039 | 10,635,476 |
| **Rheostats and Controllers** | | | | | | | | | | | | | |
| 1922 | 73,535 | 63,697 | 52,216 | 43,170 | 67,239 | 86,103 | 39,346 | 89,626 | 106,414 | 62,246 | ... | ... | 683,592 |
| 1921 | 161,253 | 114,235 | 87,649 | 164,745 | 101,663 | 85,568 | 61,755 | 64,456 | 45,304 | 77,735 | 46,381 | 33,649 | 1,044,393 |
| 1920 | 18,558 | 86,482 | 72,896 | 66,389 | 43,365 | 83,504 | 26,283 | 730,818 | 33,309 | 64,251 | 100,295 | 81,569 | 1,407,719 |
| 1919 | 48,436 | 16,442 | 38,565 | 30,798 | 64,478 | 65,384 | 26,854 | 45,833 | 38,326 | 63,153 | 40,655 | 35,836 | 514,760 |
| **Fans** | | | | | | | | | | | | | |
| 1922 | 47,061 | 77,229 | 112,302 | 96,953 | 70,794 | 93,742 | 51,463 | 36,036 | 59,537 | 45,575 | ... | ... | 690,332 |
| 1921 | 358,444 | 309,373 | 179,939 | 120,361 | 77,480 | 45,540 | 37,566 | 32,233 | 21,129 | 15,444 | 43,479 | 29,165 | 1,270,153 |
| 1920 | 29,587 | 79,780 | 115,069 | 149,728 | 152,100 | 191,434 | 87,892 | 54,911 | 70,489 | 55,212 | 122,132 | 257,432 | 1,365,766 |
| 1919 | 176,526 | 121,003 | 269,934 | 96,433 | 201,125 | 130,817 | 142,103 | 53,099 | 49,768 | 79,406 | 68,298 | 32,648 | 1,421,160 |
| **Lamps** | | | | | | | | | | | | | |
| 1922 | 117,937 | 143,692 | 181,991 | 95,406 | 127,438 | 92,120 | 103,422 | 94,028 | 126,705 | 164,895 | ... | ... | 1,247,634 |
| 1921 | 630,939 | 613,955 | 319,490 | 408,753 | 369,411 | 258,602 | 164,491 | 94,981 | 79,090 | 110,119 | 88,099 | 149,545 | 3,287,475 |
| 1920 | 218,920 | 373,309 | 448,422 | 364,882 | 344,226 | 377,125 | 251,317 | 217,113 | 249,502 | 372,955 | 488,036 | 486,002 | 4,191,809 |
| 1919 | 598,415 | 422,739 | 440,475 | 468,140 | 480,351 | 535,434 | 245,630 | 363,792 | 369,631 | 343,149 | 297,368 | 329,074 | 4,894,198 |
| **Copper Wire and Cable** | | | | | | | | | | | | | |
| 1922 | 290,996 | 229,848 | 327,663 | 308,340 | 286,738 | 310,295 | 275,370 | 217,264 | 349,037 | 299,621 | ... | ... | 2,895,168 |
| 1921 | 2,903,359 | 1,123,873 | 721,647 | 807,218 | 860,491 | 588,211 | 496,928 | 305,829 | 270,145 | 177,536 | 411,389 | 362,899 | 9,029,525 |
| 1920 | 661,842 | 567,036 | 543,546 | 526,556 | 791,303 | 593,370 | 558,791 | 420,208 | 635,641 | 575,041 | 1,003,898 | 1,301,307 | 8,178,539 |
| 1919 | 804,481 | 710,830 | 1,025,867 | 789,991 | 838,188 | 1,420,699 | 659,893 | 741,443 | 301,315 | 487,444 | 535,746 | 499,315 | 8,815,212 |
| **Domestic Heating and Cooking Apparatus** | | | | | | | | | | | | | |
| 1922 | 22,951 | 30,511 | 48,123 | 59,947 | 47,554 | 36,186 | 36,116 | 30,164 | 56,748 | 76,789 | ... | ... | 445,089 |
| 1921 | 291,546 | 381,742 | 180,693 | 165,962 | 101,745 | 77,866 | 54,262 | 69,660 | 95,699 | 74,302 | 70,155 | 73,818 | 1,637,450 |
| 1920 | 113,819 | 140,020 | 135,450 | 140,715 | 227,227 | 164,344 | 124,485 | 118,817 | 95,986 | 182,715 | 151,001 | 206,548 | 1,801,127 |
| 1919 | 98,515 | 71,136 | 151,693 | 153,342 | 146,765 | 192,551 | 156,745 | 124,668 | 91,881 | 164,114 | 117,772 | 110,575 | 1,579,757 |

# The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on **Monday** of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

THE year 1923 opens with very low appliance stocks in all sections of the country. Construction programs for the coming winter and spring months are most favorable to the whole industry. Some lengthening in motor deliveries for the East is reported. The recent advance in copper is now reflected in the wire market. Prices for sockets and pole-line hardware are firmer. Fixtures and lamps generally are more active than two weeks ago. The outlook for 1923 business is full of optimism.

### Year Starts with Action

**New York.**—The first week of the new year started with more action and lower stocks than did the first week in January, 1922. Wiring-device prices show added strength, motors are in great demand and stocks are low. Fixtures are active with firm prices. Increasing activity in wire is shown. Armored cable has changed from a steady to active demand, and the supply is higher than a few weeks ago. Demand for poles has fallen from active to slow. Pole-line hardware is also slow, as well as the demand for porcelain. Supply of fuses is somewhat better than a week ago. Lamp stocks are higher. Demand for heating appliances has changed from active to slow. Calls for radio sets and parts are fewer following the heavy holiday buying. Betterment in the washing-machine and vacuum-cleaner markets is reported.

**Chicago.**—With most of the electrical jobbers studying inventories, last week passed rather quietly. Jobbers are all pleased with the Christmas trade since they say it was better than last year's by 10 to 20 per cent. Changes in both price and demand have been few. High-tension manufacturers report another active week. One company sold two 66,000-volt, 9,200-kva. outdoor substations to a utility in the Southwest and two 33,000-volt substations for the Middle West with capacities of 600 kva. and 900 kva.

**Boston.**—New England's new trade year opened with greatly depleted appliance stocks, lengthening deliveries on motors, scarcity of rigid conduit and an upward trend in prices. The recent advance in copper price has been reflected in wire, and quotations in sockets and pole-line hardware are firmer. The demand for lamps continues very active, and in some quarters deliveries tend to lengthen. Fixture sales are exceedingly active and building operations continue at favorable rate. Deliveries are giving trouble on products from the Middle West and steel-making districts, and railroad embargoes are impeding the flow of washing machines and other products into this section. Optimism is widely felt regarding the outlook for the 1923 business.

**Atlanta.**—The holiday trade just past has been probably the greatest in the history of this section, all jobbers reporting a very successful season, with a small carry-over and good collections. The regular industrial trade, of course, has shown the inactivity generally expected during this time of the year, due to stock taking and closing of books for the calendar year. A very prompt revival, however, is expected, as it is necessary to replenish stocks for the expected demand for 1923. The building trade continues active. A great deal of residential building is going on, particularly in Atlanta. A large number of the industrial organizations are adding to and improving their present equipment, and in addition to this a number of industries are seeking and finding satisfactory locations in this section of the country. The Atlanta bank clearings for the year just closed will exceed those of 1921 by a hundred million dollars, and as the majority of this gain was experienced during the latter part of the year, the bankers and industrial leaders are extremely optimistic over the prospects for 1923.

**Cleveland.**—There is every indication that good business will continue as orders on hand assure production until well into the spring. Stocks are low and demand is strong for the season. Central-station business is very promising, statistics and indices showing an increase of 28 per cent in power consumption for the year 1922 compared with 1921. Although appliances have been in good demand, dealers believe they overestimated the holiday trade, the conservative faction scoring again. Stocks are low, however, and demand fair. Credits continue to be rather tight, but bank deposits are increasing. Although business casualties were greater during the past year, the employment situation has been relieved most satisfactorily. Builders and building contractors are confident of another successful year and many large undertakings are planned.

### Busy with Inventories

**St. Louis.**—The usual after-the-holidays recession in sales obtained during the week, merchandising being exceptionally quiet and many industrial concerns being busy with inventories. However, dealers' and jobbers' stocks of merchandise were considerably reduced by the holiday buying, and replacement orders are now being made. Prospects for power-apparatus sales during the coming year are excellent, and a large quantity of industrial building is planned. It is indicative of the general improvement in manufacturing that Federal Reserve Bank reports for this district show increases in November, 1922, as compared with November, 1921, of 30 per cent in industrial consumption of central-station power, of 7 per cent in sales of boots and shoes, of 38 per cent in stove sales, 42 per cent in wire-rope sales, 30 per cent in steel output, 47 per cent in flour production, 20 per cent in furniture and 24 per cent in electrical goods. Similar increases are reported in virtually all other lines of industry. The fundamental and underlying conditions are good. There is virtually no involuntary non-employment, agricultural conditions are promising and farm prices are getting nearer their proper relative level, profits are again appearing, old debts are being liquidated, money rates are easier, and there is general confidence in the future.

### Collections Slightly Slower

**New Orleans.**—Collections are slightly slower than they were one month ago. This is largely due to the fact that residential construction has been in the lead, and electrical installations in residences are made almost entirely by the "curbstone contractors" who are so eager for jobs that they are apt to underbid on them and have trouble meeting their bids. Business in electrical devices has been seriously injured by the department stores. These establishments have made "leaders" of electrical equipment, selling at cost, below cost or so near to cost that a profit cannot be considered. This situation has kept electrical dealers from stocking heavily and from pushing devices on the market. Their advertising, they reason, would simply go to increase the sales of the department stores.

**St. Paul-Minneapolis.** — Central-station business is at a standstill with no construction of new power or telephone lines. Stocks of small-size conduit are slightly bettered by recent shipments. Better calls for wiring devices and lamps are reported. House wiring is very active. The electrical industry generally has just had the most favorable year since the war. Commercial fixtures are moving quickly.

**Salt Lake City.**—A survey of a dozen or more representative wholesale lines shows an increase in sales ranging from 10 to 15 per cent for November, 1922, over the same month in 1921. Jobbers of electrical merchandise have planned their budgets for the new year on conservative lines but with a view of handling a larger volume of trade. January, 1923, finds jobbers in a healthy condition. As to stocks, there are few shortages. There is some non-employment, but pending construction will furnish work for all as soon as winter has passed.

**Denver.**—Complete returns on Christmas business in Denver and the surrounding territory bear out conditions reported just prior to the holidays. Buying started slowly in electrical lines and sales records showed an immediate jump when a co-operative advertising campaign was started in the papers.

# Demand, Supply and Price Trend of Eighteen Commodities as Sold in Fourteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Heaters, Batteries and Tape

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Heating Appliances | Radio | Washers, Cleaners |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **New York** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Slo. | Slo. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Sdy. | Slo. | Sdy. | Sdy. |
| Supply | Nml. | Hi. | Low | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Hi. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Frm. | Inc. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Dec. | Frm. |
| **Chicago** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Frm. | Inc. | Frm. | Frm. | Inc. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Dec. | Frm. |
| **Boston** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Slo. | Slo. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Sdy. | Slo. | Sdy. | Sdy. |
| Supply | Nml. | Hi. | Low | Low | Low | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Hi. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Frm. | Inc. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Dec. | Frm. |
| **Atlanta** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slo. | Act. | Sdy. | Slo. | Act. | Slo. | Slo. | Act. | Slo. | Act. | Act. | Act. | Act. | Slo | Act. | Act. | Slo. |
| Supply | Low | Low | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **Cleveland** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Act. | Act. | Act. | Slo. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Slo. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Inc. | Frm. | Inc. | Inc. | Frm. | Frm. | Dec. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **St. Louis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Slo. | Slo. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **New Orleans** | | | | | | | | | | | | | | | | | | |
| Demand | Slo. | Sdy. | Act. | Act. | Act. | Act. | Slo. | Slo. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Slo. | Slo. | Slo. |
| Supply | Low | Nml. | Low | Low | Low | Low | Low | Low | Nml. | Nml. | Hi. | Low | Nml. | Nml. | Low | Nml. | Hi. | Hi. |
| Price trend | Inc. | Frm. | Inc. | Frm. | Inc. | Inc. | Inc. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **St. Paul-Minneapolis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Slo. | Act. | Sdy. | Slo. | Slo. | Slo. | Slo. | Sdy. | Sdy. | Slo. | Act. | Act. | Act. | Slo. | Slo. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Dec. | Frm. | Frm. |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slo. | Act. | Sdy. | Slo. | Act. | Sdy. | Slo. | Act. | Act. | Slo. | Sdy. | Slo. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Hi. | Nml. | Nml. | Low | Hi. | Nml. | Nml. | Low | Nml. | Hi. |
| Price trend | Inc. | Frm. | Inc. | Frm. | Inc. | Inc. | Inc. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Inc. | Frm. | Frm. | Dec. | Frm. |
| **Denver** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slo. | Slo. | Slo. | Act. | Slo. | Sdy. | Slo. | Sdy. | Sdy. | Act. | Act. | Slo. | Slo. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Low | Nml. | Nml. | Low | Low | Hi. | Nml. | Low | Nml. | Hi. | Hi. | Nml. | Nml. | Hi. | Low |
| Price trend | Inc. | Inc. | Inc. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Dec. | Frm. |
| **San Francisco** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Slo. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Hi. | Hi. | Nml. |
| Price trend | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Inc | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Slo. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Hi. | Hi. |
| Price trend | Inc. | Inc. | Inc. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |

Those jobbers and dealers who tied in with the campaign obtained splendid results. Five leading jobbers report all seasonal merchandise moved, including large quantities of staples such as flat-irons and curling irons. Tree-lighting outfits have been cleaned out for first time since the war. It is conservatively estimated that Christmas sales were 50 per cent better than in the previous year. Depletion of stocks has assisted in taking annual inventories. Replacement will take place gradually, looking toward increased sales again in early spring. On the whole, jobbers' stocks are low, which with average demand will give good orders to manufacturers in all lines. The motor market is inactive.

San Francisco.—A 50 per cent increase in the value of building permits was the average registered by California cities in 1922 over 1921. Total for year, estimated: Los Angeles, $120,000,000; San Francisco, $50,000,000, and Oakland, $25,000,000. Next year is expected to show a similar increase, but this may be limited by labor and raw-material shortages.

Jobbers report a big year in sales volume, ranking close to the two post-war years, but one comparatively low in gross profits owing to keenly competitive conditions, mainly caused by overproduction and diverted efforts by former war factories. A résumé of Christmas sales shows a good movement in smaller appliances, somewhat better than last year, but a rather poor sale for larger appliances, despite special appeals to holiday purses. Several manufacturers are planning early spring campaigns to balance the usual seasonal lull in building and to endeavor to put retail sales in better proportion with construction. Dealers' business has not kept pace with the contractors.

Portland-Seattle.—Electrical jobbing houses have been closed for the most of the holiday week for inventory purposes. They report business for the past year to have been very good, and Christmas trade is estimated to be from 30 to 50 per cent better than a year ago. Holiday lines were practically cleaned out and hold-over stocks are small. In any case this satisfactory condition is attributed to more careful buying than formerly. There has been a great deal of electrical contracting work during the past year due to the large amount of building in this section, but much of this business has been taken on a close margin which is not conducive to a healthy financial condition. Electrical dealers are apparently in a somewhat better condition, and one of the leading firms reports that December will show the best monthly record in their history. An active demand and a low supply continue in conduit.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## New Production Record Made by Philadelphia Wire Firm

The average weekly production of the Philadelphia Insulated Wire Company, Philadelphia, from the period of July 1 to Dec. 15 was 108,970 lb., according to officials of that company. This is a new high record for the firm. In 1917, the best previous year in its history, the average weekly production, based on the entire year, was 70,000 lb. In 1921 the average weekly production over the period of July 1 to Dec. 15 was 21,600 lb. The company's total production for 1922, it is estimated, was 4,500,000 lb., which was approximately 1,500,000 lb. in excess of the 1917 figure.

## Pettingell-Andrews Adds to Line

The Pettingell-Andrews Company, Boston, has taken a territorial agency for the "Yale" line of electric flashlamps, manufactured by the Yale Electric Corporation, Brooklyn, N. Y. This house will also distribute the "Thor" vacuum cleaner of the Hurley Machine Company, Chicago, in addition to other products of this manufacturer as hitherto jobbed by the Boston company.

## To Sell "A & F" Heating Material

In order to provide a better service and allow undivided attention to manufacturing, the Arthur-Fowler Company has concluded an agreement with the Washington Electric Supply Company of Spokane for the distribution of "A & F" range boiler heaters, flexible tank covers, "Enamet" covers, utility tanks and its entire line of heating and insulating material.

The Arthur-Fowler Company reports a remarkable growth of sales of plastic water heaters for the year 1922 and an increase of over 200 per cent in the sale of utility tanks and range boiler covers.

## S. A. Woods Motor Line Enlarged

Motors up to and including 50-hp. rating in polyphase designs are now being marketed by the S. A. Woods Machine Company, Boston, which has been expanding its business steadily during the past year. To a representative of the ELECTRICAL WORLD M. F. Fitch, sales manager of the motor division, stated recently that within the year the factory organization has been increased in size and that a better volume of business was enjoyed than was the case in 1921. Despite some difficulties in the supply of raw material, motors are being manufactured for stock as well as for immediate distribution, and no orders have been lost during the year because of inability to make specified deliveries. Plans are in effect to increase the company's sales representation in the Middle West and on the Pacific Coast. Mr. Fitch declared that the outlook for 1923 is excellent in the motor field.

## Black & Decker Announce Drill Price Reductions

Following a reduction from $39 to $28 in the price of the Black & Decker quarter-inch portable electric drill on Nov. 10, the Black & Decker Manufacturing Company announces further cuts on certain popular items which are now being manufactured in such quantities as to make the following reductions possible:

| Item | Old Price | New Price | Reduction |
|---|---|---|---|
| Quarter-inch drill | $39 | $28 | $11 |
| Half-inch special | 85 | 68 | 17 |
| Bench drill stand | 33 | 28 | 5 |
| Post drill stand | 36 | 32 | 4 |
| Six-inch electric bench grinder | 56 | 38 | 18 |

## Walker & Pratt Appointment

J. F. Senior has been appointed sales representative of the Walker & Pratt Manufacturing Company, Boston, with headquarters at Omaha, Neb. He will cover the Middle West. The Southeastern district will be covered by E. H. Beyersdorfer, with headquarters at Cincinnati. The company's electric range business is improving, and the outlook for the new year is excellent, according to officials of the company.

## Manufacturer of Royal Cleaners Reports Increasing Business

In order to provide more space for manufacturing purposes, the P. A. Geier Company, Cleveland, manufacturer of Royal electric cleaners, has moved its executive offices and service department from the St. Clair Avenue plant to another plant at 540 East 150th Street. The old office space thus available, amounting to more than 15,000 sq.ft., will hardly more than relieve congestion, and provision for enlargement is being contemplated.

The Geier company, which also manufactures vibrators, hair cutters and dryers, reports a steady increase in business in all departments. Several sales contests during the past year have given gratifying results. One of these conducted during the summer season when the appliance business normally suffers a slump, resulted in sales equal to the best month in the company's history, while a contest just concluded has so stimulated the trade as to make the present factory enlargement imperative.

## General Electric Announces Bonus to Employees

The General Electric Company announced on Christmas Day that supplementary compensation equaling 5 per cent on earnings for the six months ended Dec. 31 would be paid on or about Feb. 1 to each employee receiving $4,000 or less per year who has completed five years of continuous service at the close of the year and who is still in the employ of the company at the date of distribution of the extra compensation.

The official statement says: "The payments will be made to employees in one-year 7 per cent investment bonds in ten-dollar units or multiples thereof and the balance, if any, in cash. The payment is made in bonds in the hope that it may become part of the recipients' savings instead of being used for current expenditures."

Gerard Swope, president of the company, says in the statement that no change in the policy of paying supplementary compensation will be made without one year's notice, but that a change may at any time be made without notice in the character of securities in which such supplementary compensation is paid.

## Koehler Manufacturing Company Business Very Active

Excellent business is reported by the Koehler Manufacturing Company, Marlboro, Mass., in both storage-battery safety lamps and battery plates, following a recent inquiry. This company was incorporated in 1917 with H. G. Powning as president and W. S. Field as secretary and treasurer. Owing to the constantly increasing volume of business it has been necessary to expand the plant until at present it occupies a total floor space of more than 50,000 sq.ft. in four manufacturing establishments. A new two-story brick-and-steel building has recently been completed which is occupied by the tap and die and press departments. Two of the company's plants are now producing nearly 100,000 storage-battery plates weekly.

## Westinghouse Springfield Factory Has Larger Force

The Westinghouse Electric & Manufacturing Company had 3,400 employees working at its East Springfield (Mass.) plant Dec. 31, or 400 more than on Nov. 1, according to Works Manager Arthur B. Reynders Small motors have for the time being distanced automotive and radio equipment as the leading product, though an improved radio demand was noted during the pre-holiday period. Revival of industries and farm prosperity are credited with the demand for small motors which now puts orders several months ahead of production. Having used up its reserve supply of parts, the factory is building motors complete throughout, and this is partly responsible for the recent increase of the plant force over the November basis.

## Frank Ridlon Head Anticipates Busy Year

Business during 1923 will show marked improvement over 1922, according to a press statement by Edward G. Young, president Frank Ridlon Company, Boston. Mr. Young reported that the sale of motors by his house had increased substantially during 1922 and that both the repair and engineering departments were fully manned during the past year. The construction department of this organization, which is one of the oldest and largest merchandisers of used and new motors in the country, is now located at Brockton, Mass., under the name of the Hallstone-Ridlon Electrical Company. Electrical supplies and appliances are distributed from this point, and business has grown so much of late that it has been difficult to handle the volume offered. Commenting on electrical price trends, Mr. Young stated that in his opinion prices cannot be expected to fall lower at present, and that an upward movement is more likely than a drop. Motor prices, he stated, are 40 to 50 per cent below the 1921 peak.

## Sanford Riley Stoker Acquires Ground Coal Company

The Sanford Riley Stoker Company announces that it has acquired control of the Ground Coal Engineering Company, Chicago, designer and builder of pulverized-fuel installations. This acquirement will supplement the company's stoker work for industrial furnaces. The Ground Coal Engineering Company has been incorporated under the laws of Massachusetts and will be a subsidiary of the Sanford Riley Stoker Company with headquarters in Worcester.

It is also announced that the Underfeed Stoker Company of Canada, Ltd., Toronto, will represent the Sanford Riley interests in Canada. The headquarters of William Pestell, sales manager of the Sanford Riley firm, have been transferred to Worcester from New York City. The office of sales in the New York territory will be retained at 103 Park Avenue, New York City.

## Wico Company's Business Grows

The Wico Electric Company, Springfield, Mass., has decided to occupy on March 1 the first unit (400 ft. x 90 ft.) of its new plant in West Springfield. Construction of a second unit will begin soon afterward. Figures for the first eleven months of 1922, Treasurer Edward L. Stoughton says, show an increase of 216 per cent over the corresponding period of 1921. A good business has been done in motorcycle batteries, and there has been a big expansion in magnetos for stationary engines. A new magneto for small high-speed motors has just been introduced and will soon be put in quantity production. The company purposes to double its production force on occupying its new building.

**The Tri-City Electric Company**, Newark, N. J., announces that the office of the president and general manager, held in the past by Joseph Spurr, has been assumed by George M. Ellis, formerly vice-president and general manager of the Mohawk Electric Supply Company, Syracuse, N. Y. H. C. Calahan, formerly of the New York office of the General Electric Company, will be associated with Mr. Ellis in the capacity of sales manager.

**The Hurley Machine Company**, West Twenty-second Street, Cicero, Ill., manufacturer of electric washing and ironing machines, is taking bids for a one-story addition, 61 ft. x 130 ft., to cost approximately $35,000. Edward N. Hurley is president of the company.

**The Robinson Electric Company**, 1135 North Fortieth Street, Philadelphia, has leased property at 809 Race Street for branch works.

**The Seyler Manufacturing Company**, Pittsburgh, manufacturer of pole-line and high-tension hardware, has recently broken ground for several new buildings, increasing its floor space an additional 15,000 sq.ft. The buildings in this section will be used for the manufacture of brackets and specialties.

**The Monitor Controller Company**, Baltimore, manufacturer of automatic motor starters and controllers, announces that it has recently appointed J. E. Wood in charge of its Cleveland sales office. The company recently opened a new sales office at 609 Whitney Central Building, New Orleans, in charge of P. E. Lehde.

**The Electrical Dealers' Supply Company**, Chicago, has acquired a site, 256 x 325 ft., on Diversey Boulevard, near Oakley Avenue, for a new three-story plant, estimated to cost $150,000, to be used for the manufacture of electrical fixtures and equipment. Bids will be taken at once for the structure and it is expected to be completed early in May. Samuel M. Crowen, 10 South La Salle Street, is architect. Simon Frankel is president of the company.

**The Marine Electric Company**, Louisville, recently reported a business of more than $100,000 for 1922, with prospects of a volume in excess of $150,000 in 1923. The company is working on installations of light, power and telephone systems.

**The American Electric Service & Maintenance Company**, Springfield, Mass., has practically doubled its force for repairing transformers in the last four months. A. M. Scofield, general manager, estimates that 60 per cent more business was done in 1922 than in 1921, with an even larger increase in sight for 1923. The company finds that its plant, completed last spring, is inadequate, and plans to add to its space the present Wico Electric Company factory, adjacent to its own quarters in Liberty Street, on the removal of the former to West Springfield on March 1. This will make possible the addition of new equipment to effect a more rapid and efficient service.

**The Sangamo Electric Company**, Springfield, Ill., announces that it has recently appointed R. H. Wilson district representative with headquarters in Tulsa, Okla., to cover southern Missouri, Arkansas, Oklahoma and a part of Texas. The company also announces the appointment of the Enterprise Electric Company, Lincoln, Neb., as its agent in that territory.

**The Arrow Electric Company**, Hartford, Conn., manufacturer of wiring devices, announces that Edward P. Doherty has recently joined its sales organization. Mr. Doherty will travel part of the company's Southern territory and will have his headquarters in Atlanta. He will cover South Carolina, Georgia, Florida and border towns of North Carolina. For the last four years, Mr. Doherty has sold wiring devices in all of the Atlantic Coast States.

## Oldest Vulcanized-Fiber Manufacturer and Others Consolidate

Consolidation of the oldest manufacturer of vulcanized fiber in the world, the American Vulcanized Fibre Company, Wilmington, Del., with the National Fibre & Insulation Company and the Keystone Fibre Company, Yorklyn, Del., is announced. The merger was effective Jan. 1. The consolidated concern is known as the National Vulcanized Fibre Company.

J. Warren Marshall, former president of the National Fibre & Insulation Company, is president of the new company and will have charge of the production end of the business. Claude W. Sutton, who was president of the American Vulcanized Fibre Company, is vice-president and in charge of sales.

The American Vulcanized Fibre Company was formed in 1873, only four years after the process of vulcanizing fiber was discovered, and was responsible for the first commercial production of this commodity and for its adaptation to many uses. The National Fibre & Insulation Company came into existence in 1904, and the Keystone Fibre Company two years later. The consolidation was brought about by an outright purchase of the assets of the American Vulcanized Fibre Company by the shareholders of the National Fibre & Insulation Company. The Keystone Fibre Company was a selling agency only, operated by the National Fibre & Insulation Company. Economics of management and a notable strengthening of marketing service will be effected by a joining of facilities, it is expected. The central offices of the National Vulcanized Fibre Company are at Wilmington, Del.

## Foreign Trade Notes

EXTENSION TO ELECTRIC SYSTEM IN BAURU, BRAZIL.—A loan of 1,500,000 milreis has recently been floated by the Companhia Paulista de Forza e Luz, *Commerce Reports* states, for the purpose of increasing its service in the northeastern section of the State of São Paulo. The proposed work includes a 2,000-hp. hydro-electric generating unit for the power plant at Bauru, a 60,000-volt transmission line from Salto do Avanhandava on the Tiete River to Bauru, and three substations, one of 1,000 kw. capacity and two of 2,000 kw., and additional distribution lines.

COMPANY FORMED TO INSTALL AN ELECTRIC PLANT IN JUTLAND, DENMARK.—A company will be formed on a co-operative plan, the central organization to be known as the Sonder Jyiland Hojspaendings Vaerk, *Commerce Reports* states, to erect a large power station at Aabenraa to supply electricity in South Jutland. Money for the proposed plant has been assured through the assistance of the State.

ELECTRIC PLANT PROPOSED FOR COBDOGLA, AUSTRALIA.—A scheme has been submitted to the South Australian government for the erection of a central power plant at Cobdogla to supply electricity for all the Murray River settlements between Cadell and Chaffey, a distance of about 170 miles. It is proposed to install a plant at Cobdogla to extract alcohol from wood fuel and use it for motive power for the proposed plant. The Adelaide Electric Supply Company is also considering supplying electricity in this district from its plant at Osborne, or in case the Moorlands lignite deposit proves to be a paying proposition a power station may be established at Moorlands. The distance from Osborne to Cobdogla is about 100 miles, and from Moorlands to Cobdogla about 80 miles. This proposal has nothing to do with the project for developing the water power of Murray River and carrying out water conservation works at Lake Victoria, the Hurme Reservoir, Jorumbarry and Wentworth, which, according to the annual report of the Murray River Commission, has already cost £1,255,141.

FOREIGN TRADE CONVENTION.—The tenth national foreign trade convention of the National Foreign Trade Council will be held at New Orleans on April 25, 26 and 27, 1923, it was announced by O. K. Davis, secretary of the council. As in former years, leading foreign traders from every part of the United States and every line of industry, as well as a considerable number of business men from foreign countries, will be in attendance at the convention.

## Foreign Trade Opportunities

**Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.**

Purchase or agency is desired in Italy (No. 4,841) for small radio receiving sets and apparatus.

An agency is desired in Norway (No. 4,861) for electric vibrators (massage) and wireless-telephone apparatus.

An agency is desired in Hungary (No. 4,865) for medium-priced automobiles and automobile accessories, including self-starters, dynamos and self-igniters, etc.

Purchase is desired in Italy (No. 4,875) of electric bulbs and other electrical accessories for house and office use and radio receiving sets.

An agency is desired in Norway (No. 4,883) for radio telephones.

Purchase or agency is desired in Italy (No. 4,887) for adjustable electric reading lamps and shades for residences.

An agency is desired in Mexico (No. 4,909) for electrical supplies and machinery and automobile supplies.

An agency is desired in Chile (No. 4,910) for electrical machinery, construction material and railway supplies, etc.

An agency is desired in Switzerland (No. 4,912) for electric washing machines.

Purchase is desired in Switzerland (No. 4,766) of mica and micanite, insulating varnish and synthetic resins for insulating.

Purchase is desired in Australia (No. 4,787) of electric lighting plants for country use of 1½ hp. up and of farm-pumping engines.

Purchase is desired in Turkey (No. 4,808) of household refrigeration plants, particularly those electrically operated.

Purchase is desired in Mexico (No. 4820) of X-ray units.

Purchase is desired in Mexico (No. 4,826) of electric motors, alternating-currents, and planing machinery for a sawmill.

Purchase and agency is desired in Poland (No. 4,829) of table telephone apparatus, copper wire, lead-covered cable, dry batteries and storage batteries.

Purchase is desired in Switzerland (No. 4,833) of friction and rubber insulating tapes.

Purchase is desired in Spain (No. 4,821) of rails, switches, trolley wire and machinery for an electric car-line repair shop.

NEW TELEPHONE SYSTEM FOR CHINA.—According to advices from Consul Carlton bids will soon be asked for the construction of a modern telephone system in Amoy City, South Fukien, China, to cost about $400,000.

## New Apparatus and Publications

OIL ENGINES.—The De La Vergne Machine Company, foot of East 138th Street, New York City, is distributing bulletin No. 180, covering its type "SI" oil engines. Bulletin No. 181 describes its vertical Diesel engine type "SI."

MECHANICAL STOKERS AND FURNACE EQUIPMENT.—The Combustion Engineering Corporation, 43 Broad Street, New York City, has issued a booklet which gives a description of all its products.

CAST-STEEL VALVES.—"Reading Cast-Steel Valves" is the title of a circular issued by the Reading Steel Casting Company, Inc., Bridgeport, Conn., in which it describes a new line of "Reading" cast-steel gate valves recently placed on the market. Circular No. 2 covers the "P. & C." new bronze union-bonnet renewable-disk globe and angle valves, and No. 3 the "P. & C." bronze regrinding union-bonnet globe and angle valves.

LABOR-SAVING TOOLS.—The Paragon Power Specialties Company, Hartford, Conn., is distributing a booklet covering the "Paragon" labor-saving tools for the boiler room.

RADIO DETECTOR.—The Hutchinson Radio Company, 342 Madison Avenue, New York City, has recently placed on the market a radio detector under the name of "Phonophane."

WATER-TUBE BOILERS.—The George T. Ladd Company, First National Bank Building, Pittsburgh, is distributing bulletin No. 20, covering the "Ladd" water-tube boilers. Bulletin No. 21 issued by the company gives a supplementary description of its large water-tube boilers installed at the River Rouge plant of the Ford Motor Company.

PULVERIZED-FUEL SYSTEMS.—The Combustion Engineering Corporation, 43 Broad Street, New York City, is distributing a leaflet entitled "A Record of Performance with 'Lopulco' Pulverized-Fuel Systems," showing boiler tests made with powdered coal in two large power stations.

STEAM-JET AIR PUMPS.—Bulletin No. 116 issued by the Wheeler Condenser & Engineering Company, Carteret, N. J., covers its various types of steam-jet air pumps.

METERS.—The Bailey Meter Company, 2015 East Forty-sixth Street, Cleveland, is distributing bulletin No. 33 describing the "Bailey" fluid meters for steam and water. Bulletin No. 7 calls attention to its various products, including boiler panel, multi-pointer gage, ash-pit loss recorder, etc.

SMALL MOTORS.—The Master Electric Company, 438 First Street, Dayton, Ohio, is manufacturing a new motor in sizes from ⅛ hp. to 1½ hp. Its lines of "Master" motors is from ⅛ hp. to 1½ hp. The company has issued its 1923 data book and price list, covering its products.

GEAR-SPEED REDUCERS.—The Jones Foundry & Machine Company, 4,401-51 West Roosevelt Road, Chicago, has issued catalog No. 26, covering the "Jones" spur gear-speed reducers.

RADIO SUPPLIES.—"Rasco Has It" is the title of catalog No. 8 issued by the Radio Specialty Company, 96-98 Park Place, New York City, covering its line of "Rasco" radio supplies.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

CLAREMONT, N. H.—The installation of a new street-lighting system is under consideration by the Selectmen.

WAKEFIELD, MASS.—Bonds to the amount of $50,000 have been authorized to place the high-tension lines underground. The Edison Electric Illuminating Company of Boston will expend $135,000 to put its high-tension lines underground from the Woburn station to the Wakefield line. The town will place the wires underground from the Wakefield line to the distributing station.

NORWICH, CONN.—The Eastern Connecticut Power Company is negotiating for the plants and system of the People's Light & Power Company and the Danielson & Plainfield Gas & Electric Company, which operates in Danielson, Plainfield, Brooklyn, Dayville and several other towns in that vicinity.

STAFFORD SPRINGS, CONN.—The Rockville-Willimantic Lighting Company contemplates extending its service to West Stafford, Forestville and Orcutville, a distance of about 3 miles.

## Middle Atlantic States

BROOKLYN, N. Y.—The stockholders of the Brooklyn Edison Company voted to increase in capital stock from $30,000,000 to $50,000,000. Of the proceeds $15,000,000 will be utilized to erect a new generating station at Hudson Avenue and the East River, to have an ultimate capacity of 400,000 kw. and other power-plant extensions. In addition the company will expend an average of $500,000 a month during 1923 for new machinery and equipment for existing power houses, substations and extensions to transmission lines.

GLENS FALLS, N. Y.—Arrangements are being made by E. J. Worden to erect an electric power plant on Canada Street. The surplus water of the Lake George Water Company will be used to generate electricity, which will be available in emergencies on the Worden properties.

LONG ISLAND CITY, N. Y.—Motors, controllers and other electric power equipment will be installed in the proposed plant of the Latham Lithographing & Printing Company, 32 West Forty-second Street, New York, to be erected on Woodside Avenue, at a cost of about $1,000,000.

OGDENSBURG, N. Y.—The Ogdensburg Paper Company will install electric power equipment in connection with a proposed addition to its plant, to cost about $150,000.

RUSH, N. Y.—The question of having the transmission line extended from East Henrietta to Rush is under consideration. The cost is estimated at about $6,000.

CAMDEN, N. J.—The Philadelphia & Reading Railway Company will build an electric generating plant at its local terminal, now in course of construction, to cost about $3,000,000. Four electrically operated ferry slips will be installed.

ELIZABETH, N. J.—Motors, controllers and other electric equipment will be installed in the printing plant to be erected by the Elizabeth *Daily Journal*, 74 Broad Street, to cost about $200,000. C. Godfrey Poggi, 275 Morris Avenue, is architect.

NEWARK, N. J.—Bids will be received by the Board of Education, City Hall, until Jan. 10 for electrical work in the addition to the Milford school. Robert D. Argue is secretary.

WILDWOOD, N. J.—The Ottens Ice & Cold Storage Company will install electric power equipment in its proposed ice and cold-storage plant, to cost about $70,000. Mark B. Reeves, Wildwood Trust Building, is architect.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company is negotiating for the purchase of a number of power companies in Northumberland County and will merge the systems. Additional transmission and distributing lines will be erected.

DRUMS, PA.—The Pennsylvania Power & Light Company will build a transmission

line to Drums for local service. A line also will be erected from Shamokin to a substation at Island Park.

ERIE, PA.—A permit has been granted to the Erie County Milk Association to erect a new power house on Peach Street between Twentieth and Twenty-first Streets.

LEBANON, PA. — The Keystone Macaroni Company will build a one-story power house at its local plant.

LEMOYNE, PA.—The West Shore Lumber Company will build a one-story power house, 40 ft. x 60 ft.

PHILADELPHIA, PA.—The Philadelphia Electric Company has acquired the Penn Electric Light Company and plans extensions and improvements.

YORK, PA.—The installation of municipal electric plant, to cost about $250,000, is reported to be under consideration by the City Council.

APPOMATTOX, VA.—Arrangements are being made to rebuild the municipal light and power plant, recently destroyed by fire. C. A. Hancock is chairman of the committee.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Jan. 19 for electrical and mechanical equipment, including lightning arresters, electrical wire, etc. (Circular 1506).

WASHINGTON, D. C. — Bids will be received by the Chief Signal Officer, United States Army, until Jan. 12 for telephone supplies (Circular PR-13538-1 CP). Also, until Jan. 11 for 2,400 dry batteries (Circular PR-13260-2CP).

## North Central States

BAD AXE, MICH. — The Great Lakes Electrical Company, recently organized, plans to erect a transmission line to furnish service in this section, including Brown City, Mayville and Elkton. Power will be supplied by the Detroit Edison Company, which will extend its transmission line from Port Huron to a point near Brown City. John Clark, Bad Axe, heads the new company.

GRAND RAPIDS, MICH.—The Consumers' Power Company contemplates extensions and improvements to its local system, to cost about $400,000.

LANSING, MICH. — The Durant Motor Company contemplates doubling the capacity of the power plant at its local works.

MOTTVILLE, MICH.—The Middle West Utilities Company, 72 West Adams Street, Chicago, has acquired a power site on the St. Joseph River for a power plant, to cost $400,000. It will be operated by the Michigan Gas & Electric Company, a subsidiary.

PORT HURON, MICH.—The New Egyptian Portland Cement Company, Ford Building, Detroit, plans to install a power house in connection with its new local plant.

DELPHOS, OHIO.—The Northwestern Ohio Power Company is erecting a new electric transmission line from the local plant to Van Wert, where the current will be distributed in Convoy and Ohio City.

GEORGETOWN, KY. — The Kentucky Traction & Terminal Company is planning to rebuild its local electric substation, recently destroyed by fire.

PADUCAH, KY.—Plans are being prepared by the Pillsbury-Becker Engineering Company, 119 South Eleventh Street, St. Louis, for an ice-manufacturing plant for the Paducah Electric Company, to cost about $700,000.

STEFF, KY. — The Spring Lick (Ky.) Coal Company, recently organized, contemplates the installation of electric power and mechanical equipment at its properties near Steff. George W. Heheman, Prospect, is president.

MOUNT VERNON, ILL. — The Mount Vernon Car Manufacturing Company will install electric power equipment at its proposed addition, to cost about $250,000.

CHETEK, WIS.—The Wisconsin Hydro-Electric Company, Amery, has acquired the property of the Chetek Light & Power Company.

MARSHFIELD, WIS.—To meet the increasing demand for electrical service extensive additions will have to be made to the municipal electric plant. The installation of a 7,500 kw. turbo-generator unit is under consideration. The question of securing electricity from the transmission systems of the Wisconsin-Minnesota Light & Power Company, Eau Claire, or the Wisconsin Valley Electric Company, Wausau, is also under consideration.

STEVENS POINT, WIS.—Plans are being prepared by L. E. De Guere, Wisconsin Rapids, engineer, for a two-story paper mill and hydro-electric plant, to cost about $300,000.

STRATFORD, WIS.—The Stratford Light & Power Company contemplates building a hydro-electric plant with steam auxiliary power station and distribution system, to cost about $65,000.

THREE LAKES, WIS.—The Council is considering issuing bonds for the installation of a municipal electric lighting system, energy to be secured from the municipal electric plant at Eagle River.

TOMAH, WIS.—The plant and holdings of the Tomah Light & Power Company have been acquired by the Middle Wisconsin Power Company. The new owners, it is understood, will connect its lines with the transmission system of the Central Wisconsin Power Company and will distribute electricity to a number of towns in this vicinity.

RED WING, MINN.—The City Council has engaged L. P. Wolf, St. Paul, consulting engineer, to prepare preliminary plans for a municipal electric plant and pumping station for waterworks and also for an ornamental lighting system. The cost is estimated at about $350,000.

ST. PAUL, MINN.—The St. Paul Gas Light Company is reported to have purchased an island in the Mississippi River at the edge of the city on which it proposes to build a hydro-electric plant, to cost about $1,250,000.

ST. PAUL, MINN.—A ten-year construction plan involving an expenditure of $80,000,000, has been announced by the Northern States Power Company. Work will soon start on the first unit, which is a new steam-driven power plant on the Mississippi River at St. Paul. The second unit, a hydro-electric plant, will be located on St. Croix River, near here, and will be built in 1923. The cost of the two plants is estimated at $10,000,000.

DAVENPORT, IOWA.—The Rural Power Company has been granted franchises to erect electric transmission lines on a number of roads in Scott County.

EXCELSIOR SPRINGS, MO.—The North Missouri Power Company, which has acquired the property of the Excelsior Springs Water, Gas & Electric Company and plants in several other towns in this part of the state, is considering the construction of a new power plant.

FRANKLIN, MO.—The Missouri, Kansas & Texas Railroad Company, St. Louis, has plans under way for the erection of a power house, in connection with a new engine house and shops, to cost about $85,000.

KANSAS CITY, MO.—The Santa Fé Railway Company plans to build a series of power plants in connection with the proposed electrification of its main trunk line. The Keese Engineering Company, Los Angeles, is preparing preliminary plans.

RUTLEDGE, MO. — The citizens have voted to secure electricity for local service from the Edina (Mo.) Light Company.

LINCOLN, NEB.—The Continental Gas & Electric Company, which has acquired the property of the Lincoln Gas & Electric Company, is preparing plans for an addition to the local power plant.

## Southern States

GREAT FALLS, S. C.—The Great Falls Power Company has increased its capital stock from $17,000,000 to $20,000,000, part of the proceeds to be used for extensions and improvements.

ATHENS, GA.—The Georgia Brick Company will rebuild its power house and manufacturing plant, recently damaged by fire, causing a loss of about $40,000.

JACKSONVILLE, FLA.—The City Commission will install a new lighting system on Twenty-sixth Street from Myrtle Avenue to Davis Street.

CHATTANOOGA, TENN. — The Dixie Spinning Mill, Inc., will build a power house in connection with its proposed plant, comprising nine mill units, to cost about $5,000,000.

CHATTANOOGA, TENN.—Plans have been completed by the Western Union Telegraph Company, 195 Broadway, New York City, for the construction of a general repair plant in Chattanooga, to cost about $250,000.

KNOXVILLE, TENN. — The Cherokee Brick Company, recently organized, will build a power house in connection with its proposed plant to be erected near the city, to cost about $250,000. J. Albert Robbins is president.

PIKEVILLE, TENN.—The Pocahontas & Sewanee Coal Company will install electric power equipment at its mines.

HALEYVILLE, ALA.—Plans are under consideration for the installation of a municipal electric plant and waterworks system. The equipment will include two 100-hp. engines and two 65-kw. generators.

BURBANK, OKLA.—Preliminary plans are under way for extensions and improvements in the municipal electric plant and system.

CLINTON, OKLA.—Plans are being prepared by V. V. Long & Company, Colcord Building, Oklahoma City, engineers, for extensions to the municipal electric light plant and waterworks system.

NOWATA, OKLA.—The proposal to issue $111,000 in bonds for new pumps, a 2,000,000-gal. reservoir, power plant and mains will be submitted to the voters on Jan. 23.

CANTON, TEX.—A bond issue of $50,000 has been sold, the proceeds to be used for a municipal electric plant and waterworks.

DALLAS, TEX.—Plans for the proposed municipal public market in Dallas provide for a power house and ice-manufacturing and refrigerating plant. The cost is estimated at $500,000. Charles L. Sanger is chairman of the municipal market committee.

FORT WORTH, TEX.—A bond issue of $250,000 is being arranged for extensions to the municipal light and power system.

FORT WORTH, TEX.—W. P. Gilbert will install electric power equipment in his proposed ice-manufacturing plant in the Hemphill Heights section, to cost about $75,000, of which $45,000 will be used for machinery.

PERRYTON, TEX. — The citizens have voted to issue $100,000 in water and light bonds.

WICHITA FALLS, TEX.—The installation of an electric power plant to supply electricity for the ornamental lighting system and street lamps is under consideration.

## Pacific and Mountain States

WINTHROP, WASH.—The Upper Methow Valley Light & Power Company, recently organized, plans to supply electricity for lamps and motors in the Methow Valley.

BANDON, ORE.—The Council has authorized a special election to vote on the proposal to issue $40,000 in bonds for extension to the municipal hydro-electric system.

ALHAMBRA, CAL. — An ornamental street-lighting system will be installed on Garfield Avenue between Hellman Avenue and Ramona Boulevard.

AZUSA, CAL. — The Azusa Ice & Cold Storage Company plans to rebuild its power house and plant, recently destroyed by fire, causing a loss of about $100,000.

FORTUNA, CAL. — John F. Williams, Fortuna, and associates have applied to the State Water Commission for permission to construct a hydro-electric plant on the North Fork of the Eel River, Mendocino County, with initial installation of 22,600 hp., to cost about $2,000,000.

FULLERTON, CAL. — The Placentia Orange Growers' Association will install electric power equipment at its proposed local precooling and refrigerating plant, to cost about $150,000.

GLENDORA, CAL.—The Southern California Edison Company will make extensions and improvements to its local distributing system, to cost about $20,000.

NEEDLES, CAL.—The Santa Fé Railway Company, Kerckhoff Building, Los Angeles, will install electric power equipment in connection with its proposed local ice and precooling plant, to cost about $250,000.

PETALUMA, CAL.—The Petaluma Ice & Cold Storage Company will install electric power equipment in connection with its proposed plant addition at East Petaluma, to cost about $100,000.

SAN FRANCISCO, CAL.—The lighting committee of the Board of Supervisors has recommended replacing the gas lamps on Fifth Street from Market to Mission Street with electric lamps. The committee also voted to increase the number of street lamps on Mason Street from Market to Sutter Street.

STOCKTON, CAL.—Electric power equipment will be installed in the ice and precooling plant to be erected by the Terminal Cold Storage & Warehouse Company, to cost about $250,000. N. E. McLean, 16 California Street, San Francisco, is architect.

TAFT, CAL. — Preliminary plans are under way for the installation of an ornamental lighting system on Fourth and North Streets.

TURLOCK, CAL.—The Turlock Irrigation District has applied to the State Water Department for permission to construct a hydro-electric plant on the Tuolumne River, to cost about $480,000.

WEIPPE, IDAHO.—The E. T. Chapin Pole Company, Spokane, Wash., contemplates the construction of a power house in connection with its proposed mill, to cost about $100,000.

TONOPAH, NEV.—The Bellehelen Merger Mines Company will install electric power equipment in connection with its proposed new mill, to have capacity of 50 tons a day.

## Canada

WINNIPEG, MAN.—Tenders will be received by the Public Utilities Committee until Jan. 25 for three transformers for the proposed standby plant. The cost is estimated at $210,000. J. G. Glassco is manager of the Winnipeg hydro-electric system.

ST. JOHN, N. B.—The New Brunswick Electric Power Commission is considering a hydro-electric development at Nepisiquit Falls, to cost about $500,000. C. O. Foss is engineer.

STAMFORD, ONT.—The officials of the township are plannnig to have the lines of the Hydro-Electric Power Commission of Ontario extend through the township. The cost is estimated at $38,000.

TORONTO, ONT.—Plans are under consideration by the Hydro-Electric Power Commission of Ontario for another hydro-electric project on the Niagara River, to develop an additional 50,000 hp. Adam Beck is chairman of the commission.

MONTREAL, QUE.—The Southern Canada Power Company contemplates another large hydro-electric development on the St. Francis River next year, to develop about 30,000 hp.

MONTREAL, QUE.—Plans have been prepared by the Back River Power Company, care of J. R. Walker, 35 Common Street, for construction of a dam across the Rivière des Prairies, just below Visitation Island, to develop 50,000 hp. T. Pringle & Son, 20 St. Nicholas Street, are engineers.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued Dec. 12, 1922)

1,438,636. TERMINAL PROTECTOR FOR ELECTROLYTIC CONDENSERS AND RECTIFIERS; J. Coulson, Wilkinsburg, and C. J. Rottmann, Pittsburgh, Pa. App. filed March 13, 1918. Water vapor maintained about the electrode terminals.

1,438,646. SWITCH AND FUSE BOX; H. F. Hitner, Pittsburgh, Pa. App. filed Dec. 9, 1920. Multiple-fuse blocks with switch for each block.

1,438,649. MOTOR-CONTROL SYSTEM; H. D. James, Edgewood Park, Pa. App. filed March 13, 1920. Dynamic braking of series electric motors.

1,438,690. TROLLEY SWITCH; A. Bogdanski, Cohoes, N. Y. App. filed Sept. 27, 1922. Facilitates passage of trolley over switch.

1,438,722. ELECTROLYTIC ANODE; R. A. Price, Berwyn, Ill. App. filed March 7, 1921. Anode hook and suspending bar to reduce high-resistance contact.

1,438,728. ELECTRIC STARTING MOTOR; H. Steinhart, Stuttgart, Germany. App. filed Dec. 31, 1919. Two-circuit automobile starter.

1,438,732. TELEPHONE EXCHANGE SYSTEM; W. C. Weaver, East Orange, N. J. App. filed Dec. 27, 1918. Toll-line operator's signal.

1,438,736. TELEPHONE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed Jan. 16, 1920. Automatic switches for interconnecting lines.

1,438,742. ELECTRIC IRON; G. R. Blakesley, Edgerton, Wis. App. filed Dec. 2, 1920. Switch under handle for controlling current.

1,438,743. TELEPHONE-EXCHANGE SYSTEM; E. H. Clark, New York, N. Y. App. filed Oct. 4, 1918. Automatic system terminate in semi-automatic exchange.

1,438,744. TELEPHONE EXCHANGE SYSTEM; E. H. Clark, New York, N. Y. App. filed Feb. 7, 1919. Indicator for automatic system connected to manual exchange.

1,438,751. CONDUIT FOR THERMO-TEMPERATURE CIRCUITS OF GRAIN TANKS; L. H. Des Isles, Chicago, Ill. App. filed July 6, 1918.

1,438,753. RHEOSTAT; H. A. Douglas, Bronson, Mich. App. filed June 1, 1922. Spiral winding with rotating contact.

1,438,758. MACHINE SWITCHING DEVICE; C. L. Goodrum, New York, N. Y. App. filed Feb. 24, 1919. Automatic or semi-automatic type.

1,438,789. RELEASING DEVICE FOR OVERLOAD SWITCHES; L. Schon, Essen-on-the-Ruhr, Germany. App. filed Dec. 3, 1920. Time-limit device.

1,438,799. INCRUSTED METAL DESIGN ON CERAMIC SUBSTANCES AND PROCESS OF MAKING SAME; E. Warrin, Upper Montclair, N. J. App. filed June 30, 1920. Combined etching and electroplating process.

1,438,828. METHOD AND APPARATUS FOR SELECTIVELY TRANSFERRING ELECTRICAL OSCILLATORY ENERGY; H. W. Houck, New York, N. Y. App. filed March 29, 1920. Generation, transmission and reception of oscillatory energy.

1,438,833. CONTROLLING SYSTEM FOR SIMULTANEOUSLY FIRING A NUMBER OF GUNS FROM A CENTRAL STATION; P. Kaminski, Berlin-Pankow, Germany. App. filed March 29, 1921.

1,438,841. TELEPHONE-EXCHANGE SYSTEM; A. E. Lundell and E. H. Clark, New York, N. Y. App. filed Sept. 6, 1919. Machine-switching equipment.

1,438,854. COUPLING TRANSFORMER FOR RADIO SYSTEMS; R. S. Piper, Chicago, Ill. App. filed June 15, 1922. Inductive coupling between antenna and secondary circuit.

1,438,858. INSULATING TUBING FOR ELECTRICAL CONDUITS AND METHOD OF MAKING SAME; O. Rey Zurich, Switzerland. App. filed May 1, 1919.

1,438,866. ELECTRIC RAILWAY BRAKE; W. H. Sauvage, Buffalo, N. Y. App. filed June 8, 1920. Brake operated by motor.

1,438,934. ELECTRIC REGULATION; J. L. Creveling, White Plains, N. Y. App. filed Aug. 17, 1916. Voltage regulator for generator.

1,438,936. ELECTRICAL FURNACE; A. Eimer, New York, N. Y. App. filed Aug. 24, 1921. For melting silica, quartz, etc., for molding.

(Issued Dec. 19, 1922)

1,438,938. TRANSMISSION SYSTEM; J. F. Baldwin, Jr., East Orange, N. J. App. filed March 29, 1920. Four-wire repeater telephone systems.

1,438,944. ELECTRIC REGULATOR; R. D. Conway, Chatham, N. J. App. filed July 24, 1919. Arrangement for regulating current flow in a circuit.

1,438,945. ELECTRIC REGULATOR; R. D. Conway, Chatham, N. J. App. filed July 24, 1919. Means for insuring constant flow of current over a circuit obtained by using thermionic tubes.

1,438,946. ELECTRIC REGULATOR; R. D. Conway, Chatham, N. J. App. filed Dec. 8, 1919. Means for insuring constant flow of current through a circuit.

1,438,947. ELECTRIC REGULATOR; R. D. Conway, Chatham, N. J. App. filed Dec. 9, 1919. Constant-current system controlled by thermionic tubes.

1,438,953. LIGHTNING ARRESTER; G. R. Folds, Evanston, Ill. App. filed July 12, 1919. Saw-tooth arrester construction for communication systems.

1,438,954. LIGHTNING ARRESTER FOR COMMUTATION SYSTEMS; G. R. Folds, Evanston, Ill. App. filed Nov. 12, 1919. Means for electrically separating line and ground springs.

1,438,959. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; J. W. Lattig, Bethlehem, Pa. App. filed Aug. 29, 1904. Circuit arrangement for machine switching system.

1,438,960. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; J. W. Lattig, Bethlehem, Pa. App. filed Aug. 29, 1904. Meter-control relay for recording calls.

1,438,961. PRINTING-TELEGRAPH SYSTEM; A. E. Lundell, New York, N. Y. App. filed May 25, 1918.

1,438,969. VACUUM TUBE; L. R. Spengeman, Jersey City, N. J. App. filed Sept. 17, 1918. Top of electron-tube filament held taut by spring.

1,438,974. PIEZO-ELECTRICAL VOLTAGE INDICATOR; E. C. Wente, New York, N. Y. App. filed Nov. 13, 1920. Instrument for recording wave forms of alternating current.

1,438,976. ELECTRIC REGULATOR; P. I. Wold, East Orange, N. J. App. filed June 8, 1918. Regulating motors or generators with thermionic tubes.

1,438,987. HIGH-FREQUENCY TRANSLATING CIRCUITS; L. Espenschied, Hollis, and H. A. Affel, Brooklyn, N. Y. App. filed Sept. 30, 1919. Arrangements for modulating currents of various frequencies.

1,438,988. HIGH-FREQUENCY TRANSLATING CIRCUITS; L. Espenschied, Queens, and H. A. Affel, Brooklyn, N. Y. App. filed Sept. 30, 1919. High-frequency translating circuits for modulating currents of various frequencies.

1,438,989. HIGH-FREQUENCY TRANSLATING CIRCUITS; L. Espenschied, Queens, and H. A. Affel, Brooklyn, N. Y. App. filed Sept. 30, 1919. Modulation of several frequencies by means of an arc.

1,439,016. PROJECTOR ELECTRODE; W. R. Mott, Lakewood, Ohio. App. filed July 28, 1919. For motion-picture machines.

1,439,036. VOLTAGE-REGULATING CIRCUIT; S. Suekoff, Chicago, Ill. App. filed July 10, 1920. Automatically maintains constant-voltage on storage battery.

1,439,071. SECRET-SERVICE CORD CIRCUITS; H. D. Currier, Chicago, Ill. App. filed March 20, 1915. Telephone system using link or cord circuits.

1,439,094. HEATING BAG; H. Gingras, Quebec, Can. App. filed April 17, 1922. Heating element between two stones that are surrounded by asbestos.

1,439,117. TELEPHONE INSTRUMENT; J. S. Newman, Cleveland, Ohio. App. filed Aug. 16, 1915. Relates to carbon transmitting equipment.

1,439,121. HEATING UNIT FOR SADIRONS; A. E. Reimers, Middletown, N. Y. App. filed Dec. 13, 1920. Heating element and its casing independent unit.

1,439,123. METHOD OF MAKING ELECTRICAL RESISTANCE UNITS AND THE LIKE; L. T. Richardson, New Brunswick, N. J. App. filed Oct. 27, 1920. Resistance units covered with vitreous or similar fired coatings.

1,439,124. AUTOMATIC TELEPHONE SYSTEM; R. G. Richardson, Chicago, Ill. App. filed Feb. 14, 1916. Employs finder switches for connecting calling line with a selector switch.

1,439,130. AUTO SIGNAL; O. Schwimmer, Los Angeles, Cal. App. filed Jan. 10, 1919. Indicates direction of travel.

1,439,134. MODULATING METHOD AND SYSTEM; L. J. Sivian, East Orange, N. J. App. filed April 7, 1919. Generation of oscillations having amplitude which varies according to a desired wave form.

1,439,155. STORAGE-BATTERY INSULATOR; F. J. Erickson, Minneapolis, Minn. App. filed July 14, 1921. Plate separators of rubber.

1,439,212. PORTABLE AUDIPHONE TRANSMITTER; C. E. Williams, Chicago, Ill. App. filed Nov. 5, 1920. For partially deaf people.

1,439,213. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed April 24, 1919. Interconnecting apparatus for telephone lines.

1,439,335. ELECTRIC STOVE; A. Selvatico, Milan, Italy. App. filed Aug. 13, 1921. Air circulated internally and around element and reflected against oven plate.

1,439,340. HIGH-TEMPERATURE PREHEATER FOR FLUIDS; P. St. Clair, Jr., Niagara Falls, N. Y. App. filed May 24, 1919. For various synthetic ammonia processes.

1,439,363. RECEIVING SYSTEM FOR RADIANT ENERGY; J. H. Hammond, Jr., Gloucester, Mass. App. filed Dec. 13, 1919. Insulator for supporting antenna upon marine vessel.

1,439,387. WRAPPING MACHINE; W. M. Wheildon, Ashland, Mass. App. filed Jan. 14, 1921.

1,439,404. ILLUMINATED TOOL; C. L. Cotharin, Chicago, Ill. App. filed March 11, 1922. Detachable handle contains flashlight battery and bulb.

1,439,408. FLASHLIGHT; I. L. Ferris, Bridgeport, Conn. App. filed Sept. 14, 1921. Adjustable mounting for lamp bulb to permit focusing.

1,439,427. AUTOMATIC TELEPHONE EXCHANGE; F. A. Lundquist, Chicago, Ill. App. filed July 19, 1917. Improvement in mechanical construction of line switches.

1,439,429. BATTERY HOLDER; A. S. Lyhne, Bridgeport, Conn. App. filed Feb. 12, 1921. Facilitates the changing of dry cells.

1,439,430. WEATHERPROOF BATTERY CASE; A. S. Lyhne, Bridgeport, Conn. App. filed Feb. 12, 1921. Dry-cell case for bicycles, boats, etc.

1,439,438. ELECTRIC FLUSH RECEPTACLE; W. J. Newton, Bridgeport, Conn. App. filed April 24, 1920. Adjustable wall case and outlet-box type provided with face plates.

1,439,457. STORAGE-BATTERY CLIP; H. E. Walker, Chicago, Ill. App. filed May 10, 1921.

1,439,471. INCANDESCENT LAMP; P. E. Hohl, Cleveland, Ohio. App. filed May 4, 1921. Construction facilitates insertion and renewal of filament.

1,439,480. FORMING FLANGES ON TUBES AND SIMILAR ARTICLES; G. H. Phelps, Warehouse Point, Conn. App. filed July 8, 1921. By application of resistance heating.

1,439,483. AUTOMOBILE STORAGE-BATTERY-CHARGING SYSTEM; J. A. Ritter, Lansdowne, Pa. App. filed Feb. 1, 1922.

1,439,495. RADIO RECEIVING APPARATUS; H. M. Williamson, Chicago, Ill. App. filed Sept. 25, 1922. Provided with apparatus to filter out static or foreign waves.

# Directory of Electrical Associations

Printed in the First Issue of Each Volume

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co., Birmingham, Ala.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill.

AMERICAN ASSOCIATION OF OPERATING ENGINEERS. Secretary, H. C. Bristol, Calderwood, Tenn.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Executive secretary, J. W. Welsh, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Colin G. Fink, Columbia University, New York City.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 West 39th St., New York City.

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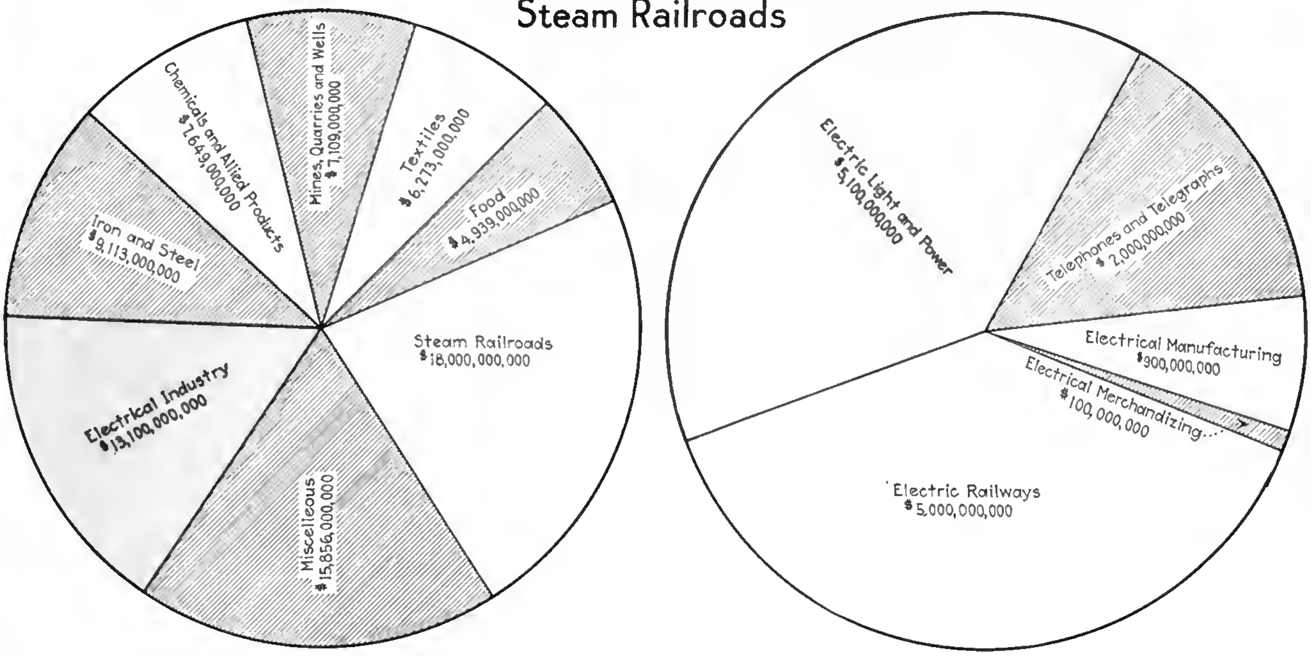
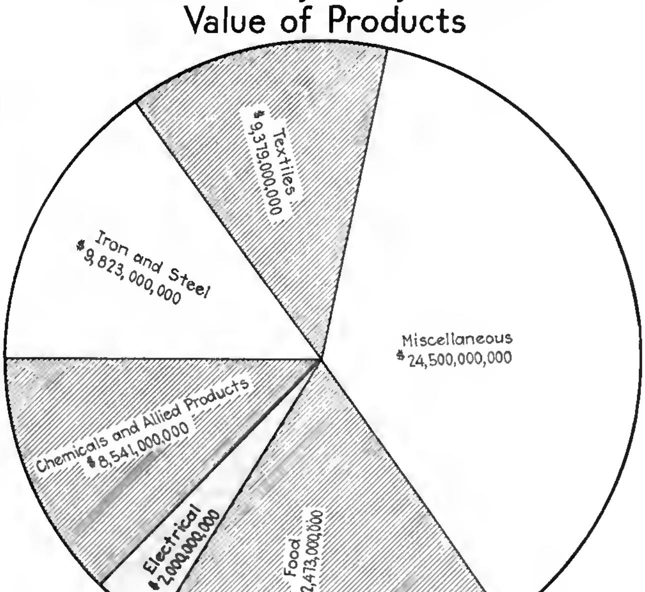
# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## The Capitalization of the Electrical Industry is exceeded only by the Steam Railroads



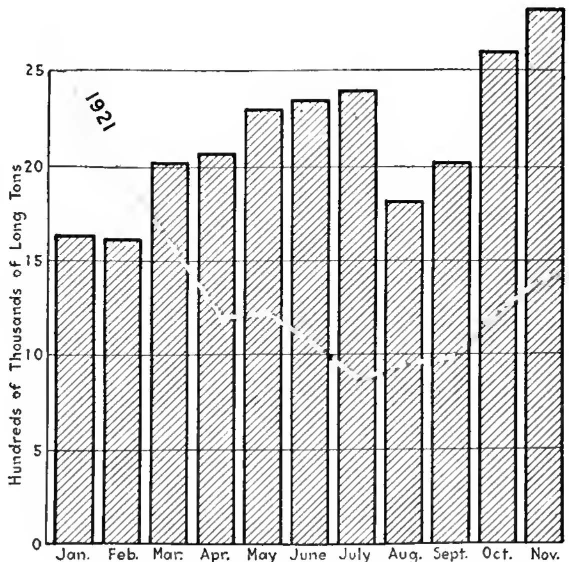

## Food Industry easily leads in Value of Products



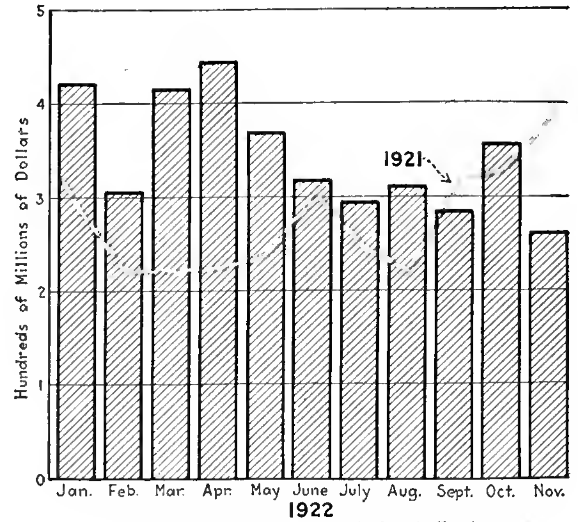

### The Place of the Industry

FROM its small beginning in the last quarter of the nineteenth century, the federation of American activities which is known as the electrical industry has become second only to that backbone of American business life, the steam railroad. Not only is this true as regards the amount of money invested in the two industries, but in influence and indispensability this newcomer is today pressing the railroads for premier place.

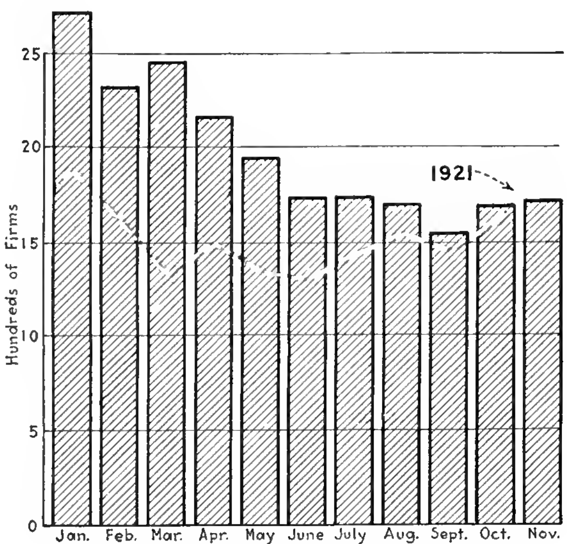
Within the family itself the same contest exists between the electric light and power companies and the electric railways. In this instance, however, it would appear that the electric railways are running a losing race. The end of 1923 should see the electric light and power companies many hundreds of millions ahead in number of dollars invested.



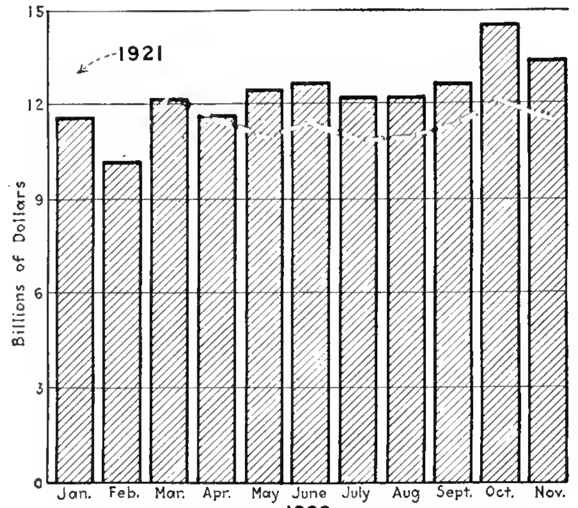

1922
Pig-Iron Production



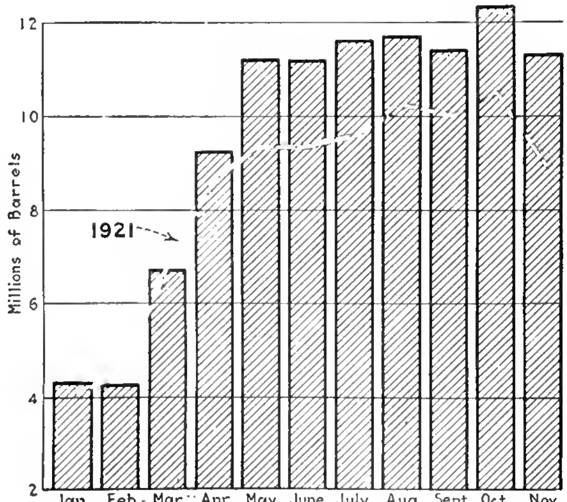

1922
Total Bond Sales, New York Stock Exchange




1922
Business Failures




1922
Bank Clearings
(Outside of New York City)




1922
Portland Cement Production

# The Business Horizon Is Clear

AT THIS TIME of the year it is customary for business to pause long enough to take account of the progress made during the twelve months just elapsed, and from this standpoint to make some conjectures as to the coming months of the new year. Most industries can view the progress of the past year with a feeling of satisfaction in spite of the many difficulties which have been experienced. At the close of 1922 there are no serious obstacles in sight which should hinder further advances during the early part of the new year. The unsettled conditions in foreign countries, particularly in Europe, are still depressing our trade, and, to a certain extent have, no doubt, kept the prices of agricultural products below the level of other commodities. However, within the past two months this latter condition has, in a measure, been relieved, and the apparent progress toward a settlement of the German reparations question during the past week is certain to bring added relief to the industry of America and of the world at large.

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# *An Achievement in Efficiency by Electric Utilities*

CONSERVATION has long been uppermost in the mind of every manager and operator of an electric public utility. While the word has usually been associated with water power, it is equally applicable to steam power.

For years engineers have insisted on and manufacturers have produced apparatus of greater reliability and efficiency. With rising costs of labor, fuel and equipment, it was necessary for utility operators to exert themselves to the utmost if the cost of service to the customer were to be kept down. How well the task has been performed and to what extent coal has been conserved let the government say.

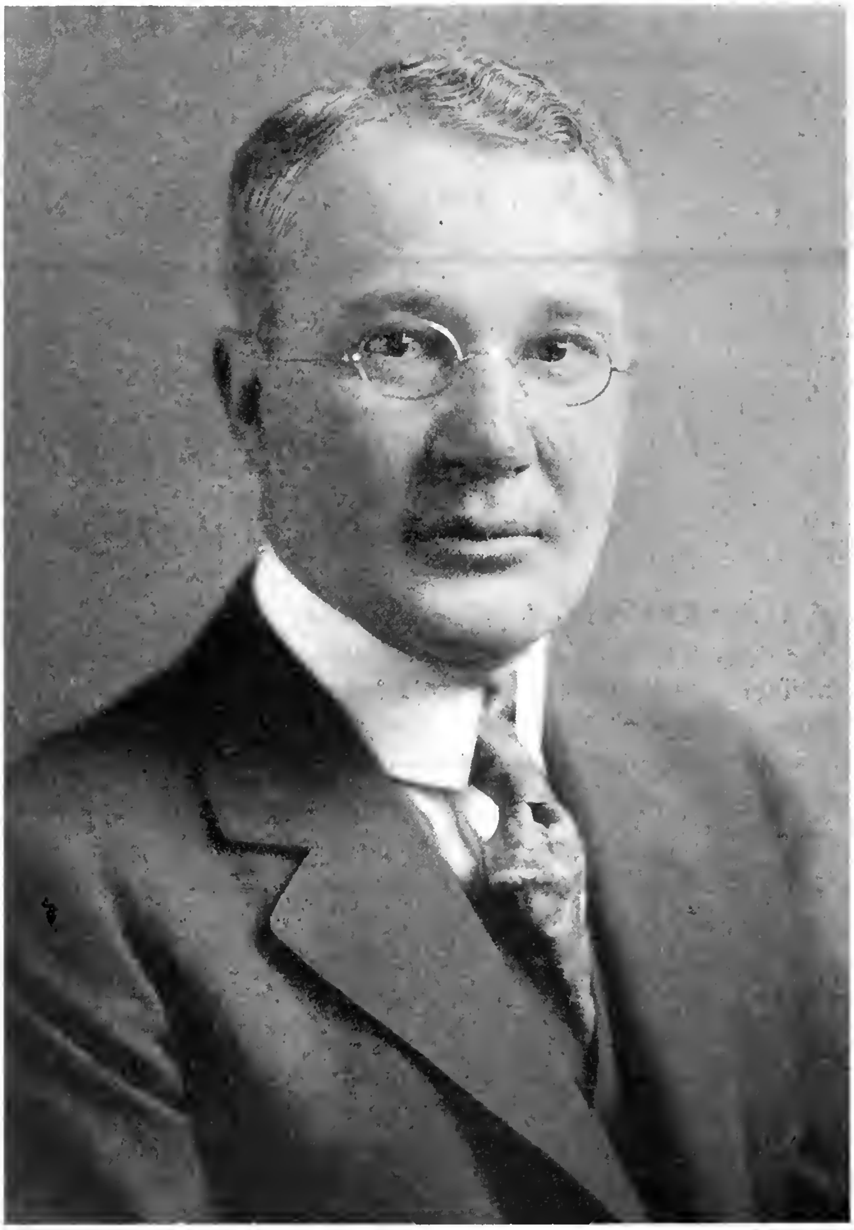
BURIED in the circular on "Production of Electric Power and Consumption of Fuel," issued by the United States Geological Survey on Jan. 4, 1923, is this tribute: "An examination of the table showing the average daily consumption of fuels by electric public utility plants shows that the fuel consumed in November, 1919, and in November, 1922, was very nearly the same. The production of electricity, however, in November, 1922, was about 25 per cent greater than in November, 1919, indicating a remarkable increase in efficiency in the utilization of fuels and in plant operation during the past three years. This represents the saving of about 750,000 tons of coal and its equivalent in other fuels in a single month as compared with November, 1919."

STATISTICS compiled by the government show that the average daily consumption of fuel by electric light and power companies during 1922 was slightly less than the average for 1919. Yet there were 13,000,000,000 more kilowatt-hours generated in 1922 than in 1919!

Thus there was an actual saving in fuel in 1922 as compared with 1919, due to the greater efficiency of electric public utilities and to water-power development, of at least 15,000,000 tons. Truly this is a most creditable showing for an industry already quite efficient, and is a wonderful tribute to the enterprise, skill and resourcefulness of those who have put their thought and labor into it.

# Wigginton E. Creed

*A man with progressive views on public policy, utility regulation and the development of national resources in the West.*



FUNDAMENTALLY the theory of the American nation is based upon the rights and duties of the individual, with government a necessary provision for safeguarding the common interests. There is perhaps no figure in the public utility field today who is more imbued with this idea than Wigginton E. Creed, president of the Pacific Gas & Electric Company. He believes that individual enjoyment of rights and performance of duties is best expressed in private operation of business. This belief has been well expressed during Mr. Creed's leadership of the Pacific Gas & Electric Company since 1920, but it had its inception long before. As president of the East Bay Water Company, just previous to taking up his present work, he had already distinguished himself by his progressive views on public policy, utility regulation and competent organization. He tolerates nothing less than good service from public servants, but in return he asks for public confidence.

Mr. Creed was born in Fresno, Cal., and educated in the public schools of Oakland and the University of California. After graduation in 1897 he taught school for some time in order that he might continue his study of the law. An active legal practice followed, but even while so employed his interest had begun to focus upon the public utility problem, and when questions of municipal rates threatened to prove troublesome for the Contra Costa Water Company Mr. Creed was persuaded to take charge of the litigation for that company. So thorough was his mastery of the situation that upon the successful termination of the case he was besought to take the presidency of the company and thus became the chief figure in its reorganization and complete financial rehabilitation. Since that time he has been actively associated with the public utility business in California.

With a keen, analytical mind and a grasp of financial problems which enables him to handle business situations with ability Mr. Creed combines great force in public speaking. He understands the importance of public relationships and is today one of the most distinguished figures in the public utility field, not only in the West, but in the nation at large.

In addition to his public service work, he is active in the management of many industrial organizations. As chief executive of the Columbia Steel Company he has been instrumental in preparing for an extension of the steel industry on the Pacific Coast.

As president of the Pacific Gas & Electric Company Mr. Creed has been influential in the building of a chain of five hydro-electric plants on the Pit River to develop 600,000 hp. of electrical energy for the use of San Francisco and other coast cities.

Editorial Comment

Electrical World, January 13, 1923

Volume 81 Number 2

# Editorial Comment

### Regional Research Overcomes Many Objections

IT HAS been said by skeptics that the sum total of achievements of a committee is inversely as the cube of the number of its members. This applies in particular to national committees of volunteer workers widely scattered geographically. When it comes to research, a kind of work which demands utmost concentration and continuous effort, the exponent 3 in the above adage must be probably raised considerably. Its exact value will be found in time from the meager results of the work of some of the research committees organized by the National Research Council.

We therefore note with pleasure an improvement in the usual method of committee work in the so-called regional research recently adopted by the American Welding Society. It seems that a year or two ago such a regional research committee (on arc welding of cast iron) was organized, with all the members living in and around Albany and Schenectady. The committee made splendid progress; in fact, as stated in the *Journal* of the society, the progress was at a rate approximately four times as fast as could be expected from a nationally scattered committee. Whatever the unit of "slowness" used in this statement and by whatever means the ratio of four to one was determined, the local committee evidently acquitted itself so well that such regional research is now to be used in other activities of the American Welding Society.

The advantages claimed for this plan are as follows: (a) It permits the holding of regular, frequent meetings without unnecessary loss of time and expenditure of money on the part of committee members. (b) It permits sustained interest of members as the frequency of meetings and their regularity do not allow time for the members to forget what happened at the previous meeting. Useless repetition of discussion is largely eliminated. (c) A particular investigation may be carried to a successful completion in a very short time. (d) It promotes interest in research in a particular locality and renders financing of the costs of investigations much easier.

It is to be hoped that this plan, if successful, may be followed by other national engineering societies.

### Tactful Announcements of New Business

WHEN a central-station company obtains a contract from a user of industrial power who has long been on the sales department's list of difficult "prospects" it is only natural that jubilation should be felt in the utility organization. The service to be supplied may be auxiliary or it may displace an isolated plant or other source of power no longer equal to the demands of economy or plant expansion. The mere fact of admission is so gratifying to the central-station manager whose men have been working on the problem, perhaps for years, that there is often a temptation to spread the good news abroad and sometimes, we fear, to overemphasize the part central-station service will henceforth play in the affairs of the industrial establishment.

Faith in the future acquisition of more business may be strong in the central-station family, but in telling local communities that this or that industrial plant has "come over" the utmost care should be taken to state the exact facts of the situation. Any attempt to capitalize a large industrial-power contract by leaving the newspaper reader or other person told of the change to infer that the central station is going to be the "Mr. Fixit" of the community is very poor policy. Manufacturers who have long operated private plants are often proud of their equipment and personnel, and announcements of the adoption of central-station service should be free from objectionable "slants."

A newspaper advertisement or story which expresses or implies the idea that a victory has been won over the industrial plant by the central-station company, or which intimates that the service to be supplied cuts more figure than it actually does in the plant's activities, is a mistake. Of course, it is hardly a secret if an industrial concern decides to buy central-station energy; but tact in announcing such a contract and a disposition to show the new customer a copy of the reading or advertising matter before it goes out will help to insure good feeling all around. No customer should be exploited without his consent. The economies of central-station service are too well established to require ill-advised and blatant announcements of what is going to be done. It is far better to make news announcements simple and accurate, with the approval of the customer, leaving until later the publication of results.

### Phenomenal Increase in Water-Power Development

WHEN the policy of the national government with relation to water-power development was expressed in the act of 1920 the assumption was that privately owned and publicly regulated electric utilities would undertake to harness the water courses of the country for the general welfare. To that end the law was designed as well as the rules and regulations drawn up under it. That the plan was wise and practicable is proved by the results. More water-power developments are under construction at the present time than at any previous period in the nation's history. Since the act was passed the Federal Power Commission has issued sixty-nine final permits and sixty-five licenses involving installations aggregating 5,000,000 hp. Thus within two years the country has witnessed 300 per cent more water-power development than was constructed under federal authorization in the twenty years preceding the

passage of the present act, showing that water-power development may be promoted or retarded according to the character of the governing laws. It is of course fortunate that the administration of the water-power laws is in the hands of so experienced and qualified an engineer as O. C. Merrill, whose vision broadens with the passing years.

According to statistics published in last week's issue there were on file on Dec. 1 with the Federal Power Commission three hundred applications for water-power development, involving a maximum installation of 27,-800,000 hp. Not all of this is capable of immediate development, but the record shows that approximately three-fourths of a billion dollars is involved in projects now under permit. The electrical industry could not at once command all of the money necessary to carry out complete development of all the water powers of the country, nor is other industry in any position at once to absorb the power. While it is recognized that development must precede use, and that the two must travel hand in hand, it must be recognized that the greatest water powers are remote from the great industrial centers. That is to say, industry hovers along the Atlantic seaboard, whereas our greatest water powers are west of the Rockies. There are, however, great water-power possibilities in the Appalachian region and these are being developed as quickly as capital can be martialed and use found for the power.

The country is thoroughly educated to the use of more and more water power, and the constant bickering and strife over coal production simply serves to hasten the day when every watercourse capable of economic development will be harnessed. Great as has been the progress within the past two years, indications are that this phenomenal rate of growth will not only be maintained but considerably increased within the next decade. Economic conditions are so shaping themselves as to bring this about.

## Power Factor and the Consumer

ONE of the broadest fields for economic engineering effort is to be found in connection with power-factor improvement. Each year there is a wider recognition of the necessity for establishing standards limiting the amount of reactive power to be supplied by the central station. In the relation between consumer and utility the final word in power-factor correction rests with the consumer. The small user of power is in general the greatest offender, and the reason for this is obvious. Limitations exist in the type of equipment he can utilize in his business, involving questions of speed, size and number of motors, etc. This class of consumer rarely selects his own equipment, but he relies on machinery or motor salesmen, his contractor or the power sales force. With changes in type or amount of production his power demands may change so that a correctly designed installation at the start yields a low power factor under the new conditions.

Surveys made by some of the larger companies indicate the necessity of periodic power-service tests if the best interests of the consumer are to be conserved. There is no sovereign remedy for power-factor troubles. As is elsewhere pointed out in this issue in an article by L. J. Murphy, power-factor correction is a real engineering question and each case must be handled with due consideration of all the economic features which are involved.

## The World's Work in Electricity

TO SUMMARIZE the world's consumption of electrical energy would appear to be a colossal task. It does not, of course, admit of exact knowledge, but every country can with some degree of precision estimate its own quota, and the final addition may be reckoned at least a good approximation to the truth. Such a calculation is more likely to understate the facts than to overstate them, because in every country there are electrical plants which may escape notice because of their small size or isolation, and their aggregate output might add materially to the figures reported. The ELECTRICAL WORLD'S tabulation, which was presented in last week's issue, relates to the last year for which data are obtainable from the far-spread territory included, and the prodigious total of kilowatt-hours consumed in 1920 rises to substantially a hundred billion. Two years' additional growth has doubtless caused even this aggregate to be surpassed. Whatever sources of minor error may affect the total, the general relations between the uses of electricity in one or another region appear with reasonable accuracy, and comparisons of this sort are decidedly instructive.

Of course, it is a familiar fact that electrical output on the North American Continent is relatively very large. It is, indeed, more than half—about 55 per cent —of the total, of which percentage about nine-tenths is in the United States. It is interesting, however, to know that Canada outruns us in the uses of electricity. A larger percentage of her population live in electrically lighted abodes than is the case south of the international border, and the total kilowatt-hours consumed per inhabitant in Canada is 30 per cent greater than here. When we cast about from country to country to see where the next place in the line belongs we find that as regards general distribution the third honor goes to New Zealand. Japan, however, follows the United States in the actual number of inhabitants living in electrically lighted dwellings, thereby offering a market for domestic appliances second only to that of the United States. Again, Switzerland, although slightly inferior in the distribution of electric light as such, heads the entire list in the total use of electrical energy, with 700 kw.-hr. per year per inhabitant. With more than three-fourths of her total available water power already developed, surely the little republic is making wonderful use of its "white coal."

On the whole, however, the world's water power is very badly developed indeed, less than 6 per cent of the potential minimum being already utilized. In percentage of water power kept busy Switzerland naturally stands at the head, with Germany a very close second and the United Kingdom a bad third, but still a little ahead of the United States.

The world as a whole is producing nearly twice as much electrical energy from fuel-burning plants as from water power. The moral should be evident. We have in the United States coal-burning and oil-burning plants rated roughly at 18,500,000 kw., as against hydro-electric properties rated at less than 6,000,000 kw. Canada, with relatively more water and less coal, reverses the ratio in a very striking manner, nearly 90 per cent of the generator rating being from water power. If our fuel supply is to be saved, we must from grim necessity turn more and more to water. With half the world's consumption of energy, the United States is using approxi-

mately two-thirds of the world's whole output in steam-driven apparatus. Consider what the economic results would be if our water power were put to as good use as that in Switzerland or Germany.

With the present grave fuel situation, it should be sufficiently clear that we cannot afford to go on for long in our present path, that we must at all hazards make better use of our water power, and that the efforts of our governments should be turned to encouraging rather than hampering the immediate utilization of every stream that gives hope of economic development.

### Uniform Classification of Accounts

CALIFORNIA at times chooses to follow her own notions rather than join with her sister states for the sake of uniformity. Where the honor or rights of the state are concerned such a course is commendable. No state can guard too jealously those rights and privileges not vested in the national government by the Constitution. We are not sticklers for uniformity merely for uniformity's sake, because that fetish stifles initiative. Too often it "gets by" under the guise of efficiency. However, there are uniformities which, viewed from any angle, are desirable, and to reject them is not always wise or prudent. We are surprised to note, therefore, that the California Railroad Commission has adopted the classification of accounts of the Federal Power Commission instead of that just promulgated by the National Association of Railway and Utilities Commissioners. The latter classification was revised especially to meet the desires of Far Western companies for a functional set-up of fixed-capital accounts, and, with other amendments passed at Detroit last month, the classification was presumed to meet all the requirements of utilities and state regulatory bodies. The Federal Power Commission's classification, although based largely on that of the commissioners, has injected into it certain mandatory practices of the Interstate Commerce Commission which are not applicable to the electrical industry and which do not conform with accepted principles of accounting. Knowing the progressiveness of the California Railroad Commission, we cannot feel that it will long retain an obsolete accounting system in place of one that is demonstrably sound and workable.

### More Light Needed on Transients

GOOD service, continuous and dependable, is the ideal of electric utilities, and the energies of the engineers engaged in developing the art are largely devoted to the realization of this ideal. But this very feature of dependable service is one of the real limiting factors in promoting the more extended use of high-voltage systems. Upon the technical or engineering limits involved in extending the voltage upward, and therefore in extending the economic transmission distance of transmission lines, research and thought have made less headway than in most other electrical lines since the time of Maxwell.

As is well known, whenever a change occurs in the steady conditions of an electrical system abnormal disturbances in the nature of high voltage or current surges are introduced. These disturbances may occur when energizing a line, opening a line, putting on a load or paralleling two lines, or they may result from grounds or short circuits. Whatever their cause, they seldom occur twice in the same place or form, and too frequently they cause service interruptions.

The problem of gaining accurate knowledge of these transients and of protecting the system against interruption is far from a solution. To start with, only the fundamental fact is known that these time and space transients occur in different parts of the system and involve an energy change and dissipation. An exact knowledge of the alternation and distortion of the disturbing waves is missing, and to complicate matters there is a disagreement of opinion as to the actions which cause attenuation and distortion.

It is agreed that Joulean and dielectric losses produce both distortion and attenuation, but in what degree is still a question. Authorities like Steinmetz and Carson disagree as to the effect of radiation and even as to the mechanism of propagation of these waves, and thus quantitative underlying principles are missing whereby the practical equipment can be made to eliminate the disturbances or render them harmless.

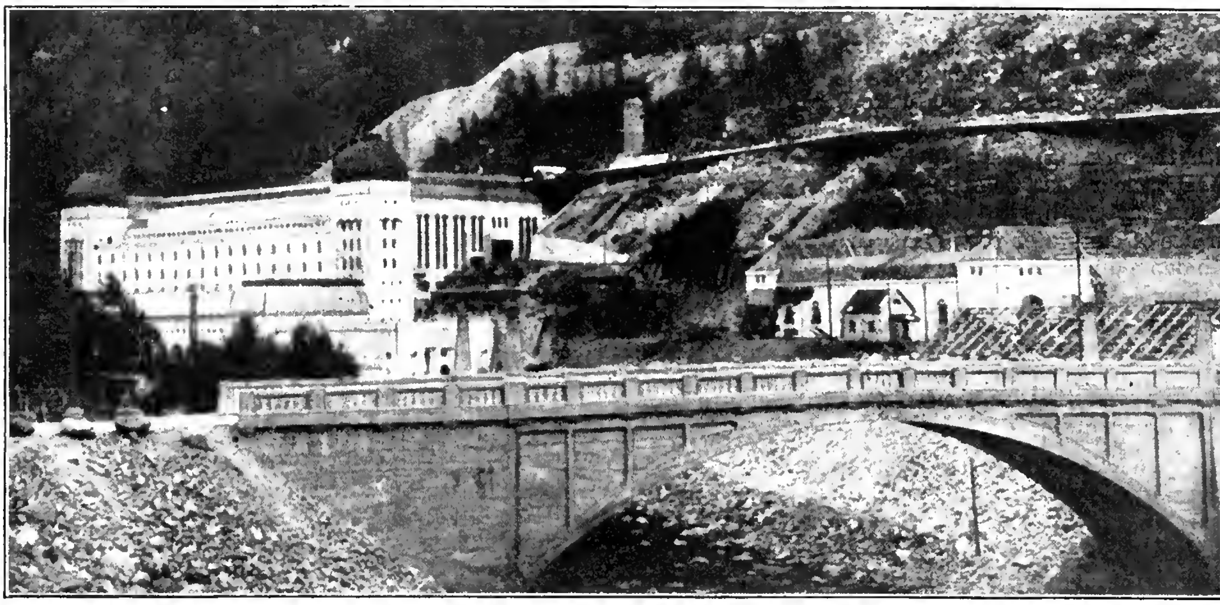
Research work of the highest grade is needed on this problem because its solution will have a tremendous influence on the introduction of the economies resulting from the more extensive use of high-tension interconnected systems.

### Transmission or Distribution, Which Is It?

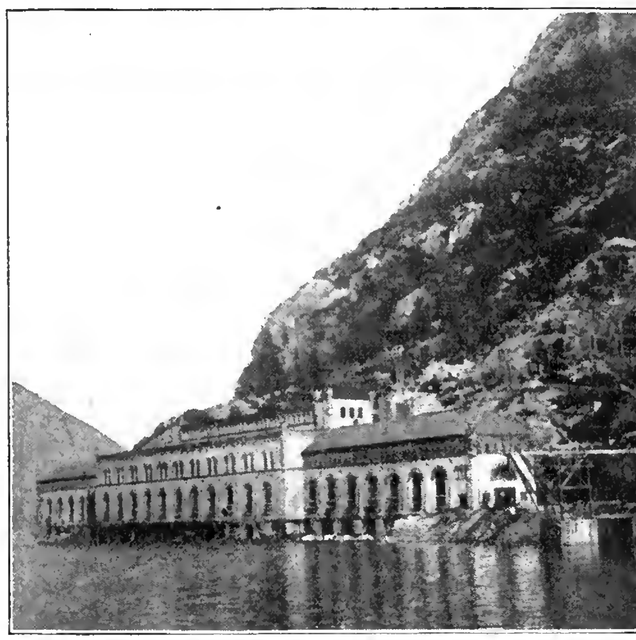
ALMOST always when discussion concerning lines for the carrying of electrical energy arises those taking part in it fall into confusion in using the terms "transmission" and "distribution." This is usually because the meaning of the words is thought of in terms of voltage. Circuits of a given voltage may perform transmission functions on one property and distribution functions on another. This confusion of terms is bad enough in technical and operating discussion, but in matters of accounting it is almost past remedy. Accounting classifications are usually designed to maintain a separation of the two property values. Owing to the shifting of lines from the performance of one function to the performance of the other it is a question whether any accounting classification that has existed over a fairly long period of years can be unraveled so as to tell the true story of investment as between the two.

To get away from the confusion it will be necessary to think of circuits in terms of functions performed rather than in terms of voltage. An analysis of the mental conception of the two things that seems to exist in every discussion indicates that "transmission" covers the bulk transfer of power from a generating point for some distance to a center of distribution, such as a substation, from which it is taken over other circuits. "Distribution" covers the circuits carrying the energy from the point where it is delivered by bulk transmission circuits to the final consumer. Suggestions have been made in private and informal discussions that the definitions indicated by the above distribution would go a long way toward clearing up the confusion, since the separation is based on functions performed rather than on an arbitrary assumption.

The determination of the question will have added significance of great importance to consumer and operator alike if the recent recommendation of the utility rate committee of the National Association of Railway and Utility Commissioners becomes standard practice. This committee recommended that "transmission" systems be considered a part of "plant" in valuation, rate-base and rate-analysis studies.



# European Power Stations Are Noted for Their Architecture

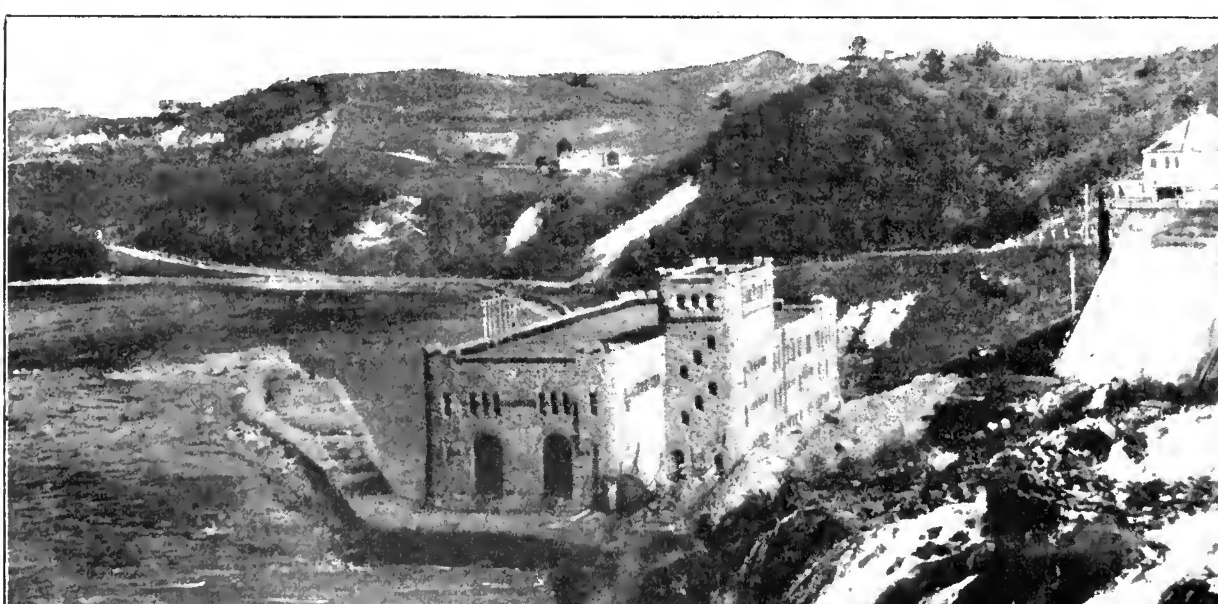


Views of hydro-electric power stations in Norway, showing how they harmonize with their surroundings.

The upper view shows the Saaheim station in Rjukan, which develops 150,000 hp. The station building is of reinforced concrete.

The Tyssedal station, shown in center, is on a lake with storage of 300,000,000 cubic meters.

The lower view shows the Nedre Lerfoss station, near Trondhjeim. The building is of gray granite and contains three units with a total rating of 10,500 hp.



# Automatic Substations Success in St. Paul

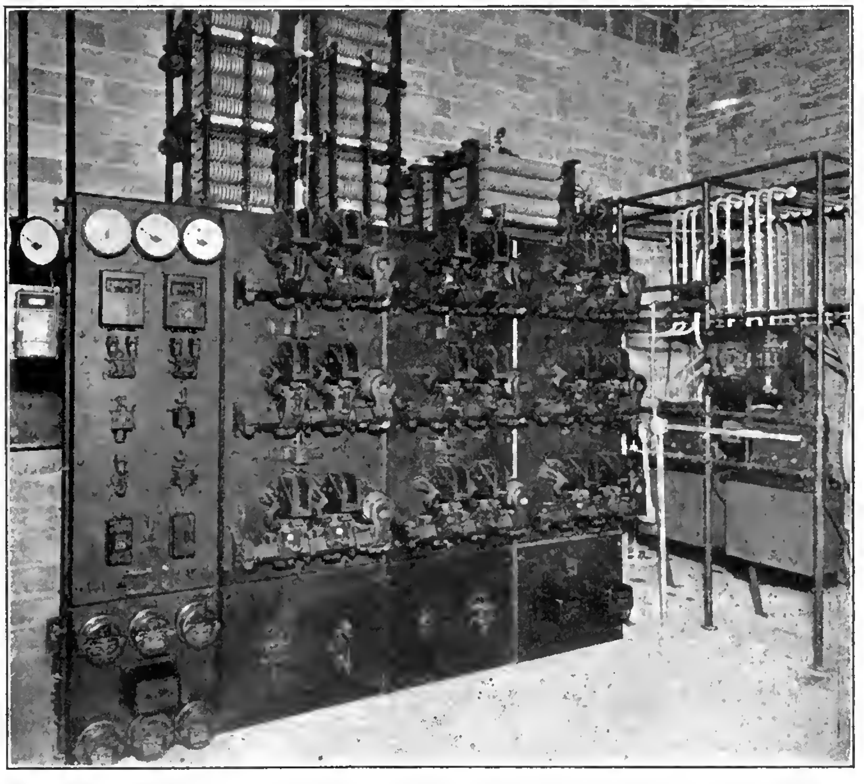
## Two Years' Experience of St. Paul Gas Light Company Brings Entirely Satisfactory Results—Both Alternating-Current and Direct-Current Stations in Use

By ROBERT REINBOLD
*Superintendent of Switchboards St. Paul Gas Light Company*

**WHAT is the legitimate field of the automatic substation? This article describes the main features of two installations in St. Paul which have proved so successful over two years of service that it is difficult to discuss operating problems. In short, the installations have functioned with only routine adjustments that cannot be styled troubles and have become a necessary part of the system. The natural inquiry is why should such substations not be applied to all situations, particularly the big direct-current areas in the big metropolitan centers. Engineers who have investigated them for the larger service point out that they are so far installed on small Edison networks with a maximum of approximately 25,000 kw. in load, where it is the policy to restrict direct-current load and where future growth will not justify substations with operators, and that possibly they can be applied in the lightly loaded outer territory surrounding a large direct-current territory. Whether they can be adapted to a heavily loaded business district where faulty operation of a single relay could drop loads up to 10,000 kw. and cause progressive disturbances to the rest of a network carrying 100,000 kw. or upward is a question to which the investigators have not been able to return a satisfactory answer. As an instance of success in the smaller field the St. Paul installation, embracing both an alternating current and a direct-current substation, is worth studying and affords evidence of worthy service in this application.**

ABOUT two years ago the first three-wire full automatic motor-generator applied to an Edison three-wire direct-current system was put in operation. This station, owned by the St. Paul Gas Light Company, has continued in successful operation ever since. In this article it will be described along with an alternating-current automatic substation owned by the same company and built during the summer of 1920.

The fulfillment of a contract to supply direct current to a large building then being erected made it necessary either to run more direct-current feeders from the nearest station, located three blocks distant, to boost the direct-current network already somewhat overloaded at this point, or to install a new station in or near the building. The load on the nearest substation had reached the practical limit of its capacity, making additional equipment imperative, but no space for it was available. Insufficient duct space in the street made the running of new feeders an expensive undertaking. The load expected from the building was less than 500 kw.; therefore manual operation was not to be considered. Thus the decision which brought about the first attempt at full automatic operation was a matter of economy and circumstance.



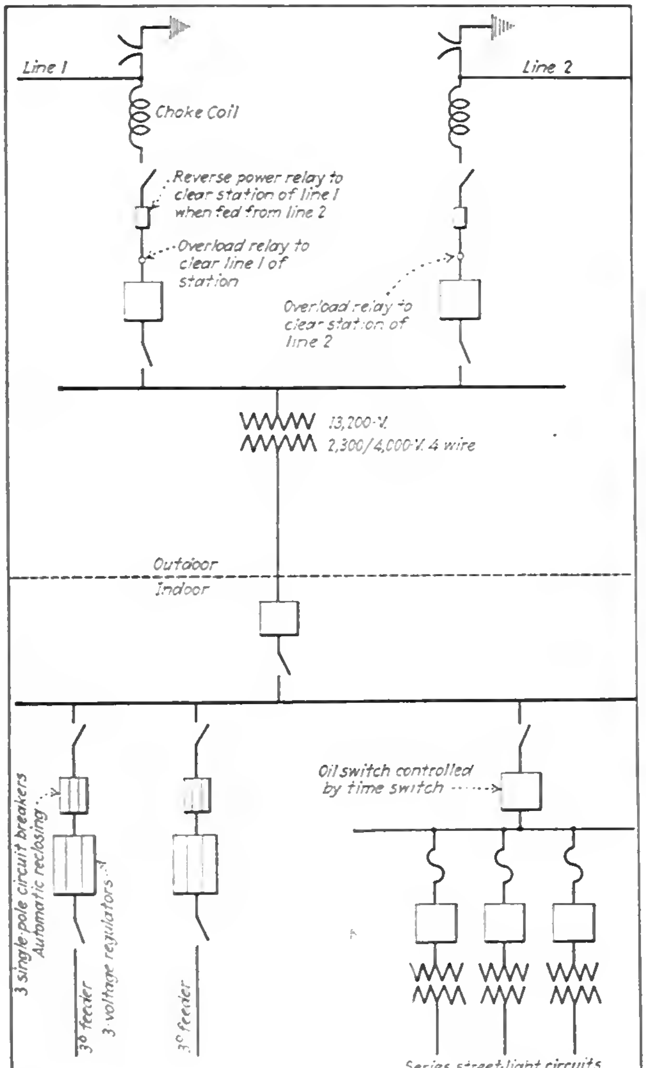
SWITCHBOARD AND MACHINE INSTALLATION AT THE AUTOMATIC DIRECT-CURRENT SUBSTATION OF THE ST. PAUL COMPANY

The apparatus is guarded from the effects of high temperature by temperature relays and an unusually complete ventilating system.

This station is in the new building, on the floor of the engine room below the sub-basement. The generator is rated at 125/250 volts, 500 kw., three-wire, with a nearly flat voltage characteristic, drooping slightly beyond full load. The motor is synchronous, rated at 1,200 r.p.m., three-phase, 4,000 volts, 60 cycles, direct-connected to the generator and mounted on the same bedplate with it. The automatic equipment is of the lock-out type, and each operation is carefully "shadowed" to prevent trouble in the event of failure on the part of any relay. The motor is protected against burn-out from continued overload or abnormally high room temperature at normal load, owing to failure of the ventilating system, by a temperature relay. All bearings are also protected by temperature relays. Each opening in the walls of the station is guarded by a self-closing fire door held open by a fuse link.

An 8-in. tile wall separates the station equipment from other equipment on the same floor, forming an inclosure about 20 ft. x 20 ft. in size and 24 ft. high. The floor is about 50 ft. below the street level, making ventilation somewhat difficult, since it was found not feasible to run a ventilation duct outside the building. The difficulty, however, was overcome by installing two exhaust fans in

the wall near the floor to move the cold air into the room, and a large opening near the ceiling on the opposite wall permitted the heated air to escape into the engine room and sub-basement. This has at no time caused uncomfortable temperatures in the sub-basement, since the space is large and below the street level. Placing of the fans near the floor makes inspection and repairs easier than if they were installed near the ceiling in the usual way. These fans have a total capacity of about 16,000 cu.ft. per minute. The smaller fan runs only when the station




TYPICAL WIRING DIAGRAM OF ALTERNATING-CURRENT AUTOMATIC SUBSTATION USED BY THE ST. PAUL GAS LIGHT COMPANY

is in operation, but it was found an advantage to have the other fan run continuously, so that if the station is automatically shut down on account of overload the room and motor temperature is quickly brought down to a point where the station will automatically return to service.

The operating conditions required the equipment to be so arranged that in the event of low voltage on the direct-current network caused by trouble at the manual station the control will automatically insert resistance between the station and the system, thus keeping the voltage up to standard on the building service. The resistors are protected by temperature relays, which control the automatic switches connecting the station with the network, thus enabling the station to separate itself automatically from the network if the voltage reaches a very low value and causes overheating of the resistors.

It was found very important that the operator at the nearest direct-current station should know at all times what the automatic station is doing. Therefore two wires were run between these stations and the neutral of the direct-current network is being used as common return, forming two circuits, one of which is connected to the secondaries of a current transformer in one of the motor leads of the automatic station and at the manual station to an ammeter, thus providing the operators with indications of the load carried by the automatic station. The other circuit is connected to a signal lamp at the manual station and is controlled by the resistor-contactor at the automatic station. It indicates to the operator the cutting in of the resistor between the network and the station.

At the manual station advantage is taken of the flat voltage characteristic of the generator at the automatic

TO SAVE SPACE THE USUAL SWITCHBOARD PANELS ARE OMITTED IN THE SEMI-OUTDOOR TYPE ALTERNATING-CURRENT AUTOMATIC SUBSTATION OF THE ST. PAUL COMPANY

Instruments, relays and reclosing devices are placed on small transite panels mounted on the switch-supporting structures.

station when the operator, if necessary, shifts the load to or from the automatic station by a slight change in the voltage at the manual station.

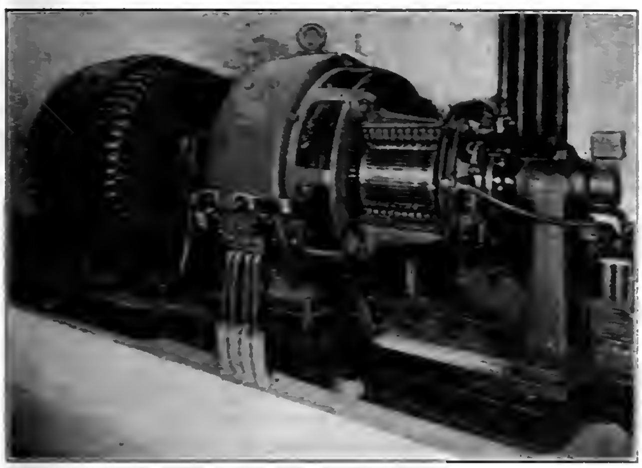
One of the difficulties and almost the only one to be overcome during the trial immediately following the completion of the installation was the "coming in" out of step of the motor on recovery of the alternating-current voltage after a momentary failure before the generator voltage had fallen to a sufficiently low value, since the motor fields were connected permanently across the generator leads. This possibility was removed by placing a contactor in the motor-field circuit to open the field when the running switch of the motor opened, thus at once reducing the generator voltage to zero. The contactor automatically recloses when the motor starting switch closes, permitting the generator to build up.

The operation of the automatic station has been entirely satisfactory, and it has also proved very valuable in emergencies such as those caused by heavy-voltage fluctuations due to the failure of a transmission line throwing all synchronous apparatus out of step. In all such cases the automatic station immediately came back, and with the storage battery, which also comes in automatically under such conditions, carried

the entire direct-current load until the manual stations could be returned to service. This station is visited daily to change charts on graphic instruments and read the meters. Once a week a general inspection is made and all contacts subjected to dust and arcing are cleaned.

### THE ALTERNATING-CURRENT STATION

The alternating-current automatic station referred to in the beginning of this article is of the semi-outdoor type. All of the high-tension equipment, consisting of transformers, lightning arresters, oil switches, etc., is located in the yard. Feeder regulators, oil circuit breakers, constant-current transformers and instruments for street lighting are in the station building. The station being in a residence district, special effort was made in the design of the building and its surroundings to insure an attractive appearance. The building is of brick and concrete construction and fireproof throughout. Floor drains are provided for each oil circuit breaker and feeder regulator, so that in case



ONE OF THE MOTOR GENERATORS USED IN DIRECT-CURRENT SUBSTATIONS

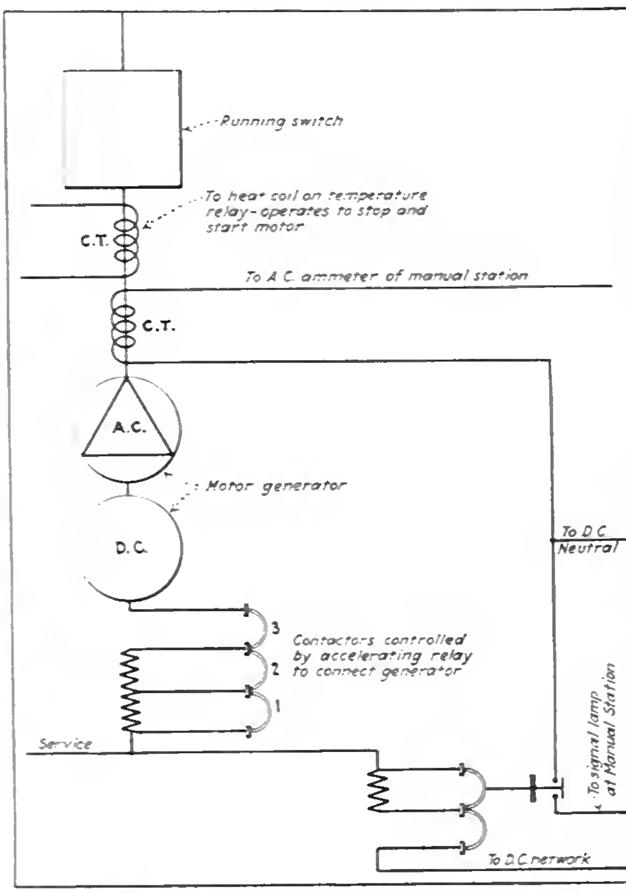
an oil container is ruptured the oil is quickly drained out of the building into a tank buried in the yard, thus removing fire hazards.

Space was provided for three 1,000-kva., four-wire, three-phase, 2,300/4,000-volt feeders with a single-phase regulator and single-pole independently controlled oil circuit breaker in each phase. Each circuit breaker is provided with an overload relay and a reclosing device, the latter set to reclose the breaker twice before locking out. The time interval between opening and closing is two and one-half seconds. The overload relays are set for 135 per cent load and a definite minimum time setting of 1 second at 1,000 per cent of load. This has been found completely successful thus far. Numerous cases of line trouble from severe storms have caused the reclosing device to operate several times without a single outage of more than two and one-half seconds, which affords evidence of reliability in service.

Only one ammeter is used for the load indication on these feeders. Transfer of the ammeter is made to any phase of either of the feeders by simple arrangement of three three-circuit ammeter switches, leaving room for an additional feeder to be connected through another ammeter switch.

Overload relays, reclosing devices and ammeter switches are mounted on small transite panels set in the framework supporting the busbars, disconnecting switches and oil circuit breakers, thus doing away with the usual switchboard panels, and a considerable saving of space is effected thereby.

In addition to the two 1,000-kva. regulated feeders there are seven 30-kw. constant-current transformers, including the necessary equipment for seven series street-lighting circuits. These transformers are connected to an auxiliary bus through oil switches and to the main bus through an oil switch controlled by a time switch. In this manner the turning on and off of the street-lighting circuits is taken care of automatically. One small marble panel is used for each series circuit on which are mounted an ammeter and an oil switch. These panels are arranged in pairs, allowing space




TYPICAL WIRING DIAGRAM OF DIRECT-CURRENT AUTOMATIC SUBSTATION USED BY THE ST. PAUL GAS LIGHT COMPANY

between pairs for passageways to the rear of the panels and to permit removal and replacement of the transformers.

Two alarm bells are placed in the station. One vibrates slowly and rings whenever a feeder switch is locked out automatically owing to a permanent short circuit on the feeder. The other bell, which vibrates rapidly and is muffled, rings only when the station is dead owing to failure of the 13,000-volt trunk lines which feed it. The use of alarm bells in an unattended station seems strange until it is explained that a device has been installed in connection with the telephone which enables the load dispatcher to listen in from any telephone in the city to ascertain the operating conditions of the station. If an outage is reported, the trouble dispatcher may listen in and know whether it is caused by an open breaker, dead station or line trouble. The control current for closing and opening switches is 24 volts direct current, supplied by four 6-volt, 80-amp.-hr. automobile-

starting batteries. These are tested daily and recharged once a month by means of a small portable arc rectifier located in the station.

The outdoor part of this station consists of four 600-kva., 13,200/2,300-volt step-down transformers, fed by two 13,000-volt trunk lines through two 25,000-volt outdoor-type oil circuit breakers and protected by two electrolytic lightning arresters. Normally, however, only one line is in use; the other is used only in emergencies and controlled at the steam station. The metering is done on the high-tension side and outdoor metering transformers are used. The meters and relays are installed in the building. All supporting framework is made of 1¼-in. iron pipe and standard reamed fittings. Copper tubing is used for both high-tension and low-tension bus, and the spare transformer is provided with leads so that it can be connected in a few minutes.

### Routine Inspection

This station is visited twice daily, except Sunday, when only one visit is made. The purpose of these visits is to test the series circuits, batteries and reclosing devices, charging the arresters, changing charts on the graphic instruments and reading the meters.

Another station, which contains both alternating-current and direct-current equipment, is being changed from manual to automatic operation and will embody nearly all the automatic features contained in the stations above described together with new features since developed. Automatic operation of stations generally shows very gratifying results both in economy and service, but each case must be decided individually as no standard procedure can be laid down which will be suitable in all or perhaps even the majority of cases. Manual operation of stations cannot equal automatic operation. It is impossible for any combination of operators so to co-ordinate their movements that the results equal in promptness and accuracy those of automatic operation.

For the successful operation of automatic stations rigid inspection must be the rule. This inspection must be systematic, periodical and thorough. Spasmodic and superficial inspection will lead to neglect and unsatisfactory operation and possibly to disastrous results.

# Power Progress in Sweden

**Large Increase in High-Tension Transmission Mileage —Interconnected System Is Now Favored by Co-operative Committee**

AT A RECENT meeting of the Swedish Engineering Association the activities during the last five-year period of the Royal Swedish Board of Waterfalls were outlined by W. Borgquist, chief director of the association's electrical department. The speaker pointed out that, while the increase in aggregate generating capacity of the Swedish state plants has been rather moderate, the total installed capacity growing from about 160,000 kva. to 250,000 kva., there has been a tremendous development of transmission and distribution facilities. During the coal crisis of the war an insistent cry for electric service was raised by communities, industrials and farmers everywhere, and the construction of distribution lines therefore was rushed at top speed all over the country. During the last five years the total length of state-operated high-tension lines then increased from 700 km. to 1,500 km., while the length of secondary distribution lines operated at 20,000 volts to 10,000 volts in the same period increased from 800 km. to about 3,700 km. The return of the central Swedish system reached a maximum of 8 per cent during 1917, but since then it has been slowly sinking, last year's books showing a margin of 5.3 per cent. At the close of 1921 the total investment amounted to about 130,000,000 crowns,* exclusive of stations now under construction.

An important phase in last year's development was the building of a 315-km., 132,000-volt tie line right across Sweden, from Trollhättan to Västeras. This line is the first in Europe to be operated at so high a voltage, and the towers are so constructed that after reinsulation the voltage may be raised to 220,000 volts if conditions warrant. Through this line the state plants in middle Sweden are connected into a great central block, with a generating capacity of about 200,000 kw. This has made possible the establishment during times of water shortage of a rational load-dispatching service, controlled from a central office in Stockholm. At times of surplus power from Trolhättan about 20,000 kw. has been transmitted over the line, which has allowed the steam reserve plant at Västeras to remain idle most of the time. An important link in the power-conserving scheme is the new hydro-electric station at Motala. Owing to its position between two lakes this plant offers excellent opportunities for establishing complete hydraulic regulation over a period of a week, and therefore it should be of great importance as a peak-load plant. The ultimate capacity of the station is 25,000 kw., only one-third being yet installed.

### Superpower System Planned

The Trollhättan tie line is intended to form the first link in a system of extra-high-tension trunk lines which may ultimately span not only Sweden, but Norway and Denmark as well, thus forming an inter-Scandinavian superpower system. It is only a question of time when another link in this system will be built north from Västeras to some large power sites in Norrland, which have been purchased by the Swedish government. Another extension is planned from Trollhättan to the south end of Sweden, to connect the state "central block" with the system of the South Sweden Power Company, Sweden's biggest power enterprise, with a generating capacity of 70,000 kw.

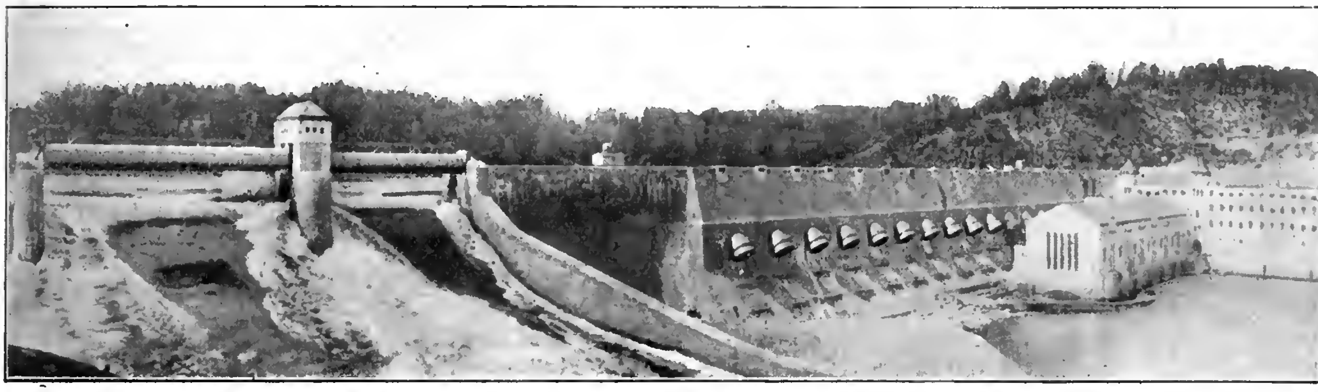
The bigger problem of the inter-Scandinavian system is being studied by a committee of two representatives from each of the three countries involved. The private power system in south Sweden is already connected to the Danish network by a cable in the Strait of Oresund, but plans are under consideration to lay down cables for higher tension and to connect these to a line over Trollhättan to the Norwegian power plants along the river Glommen. There is here not only a question of establishing seasonal power interchange between Sweden and Norway, but the trunk-line system actually would serve to transmit energy from the large water-power resources of Norway right through Sweden and over to a future Danish high-tension distributing system. Interest centers at present on the problem of stability of such a vast system, containing a great number of synchronized stations, widely spaced, where the voltage lag from the first generator to the last consumer will be considerably in excess of 90 deg.

*At the old rate of exchange a Swedish crown was equivalent to about 33 cents.

# Hydraulic Power Plant Practice in Northern Europe

## Skeptical Regarding Outdoor Installations—Connecting Generators and Transformers Directly—Higher Reactance and Regulators—Oil Circuit Breakers with Multi-Contacts and Explosion Chambers

By CLIFFORD N. ANDERSON
*Engineer, Dwight P. Robinson, Inc.*



VAMMA STATION, ON THE GLOMMEN RIVER, DEVELOPS 200,000 HP. IT HAS BEEN IN OPERATION SINCE 1915 AND FURNISHES POWER TO CHRISTIANIA

IN NORTHERN Europe one invariably finds that the native engineer gives a large amount of credit to the American engineers for being ultra-practical, but takes credit to himself for being theoretical and for ability to incorporate the artistic in the commonplace. Take, for example, the outdoor switching station. This seems to be confined chiefly to American engineering practice; the European is afraid of it. He is afraid we are leading him astray. He isn't accustomed to observing his transformers and circuit breakers standing in the rain or half covered with snow, and cannot be reconciled to the idea. "It may be all right over there," he will say, "but the climate is too wet over here."

Yet, the few examples the Europeans have are working wonderfully well. Conditions about as severe as any which could be imposed on an outdoor station are found at the station of Bjolvo, situated on the Hardanger fjord on the west coast of Norway. The precipitation here is unusually heavy, with rain nearly three hundred days out of the year, and in winter the station is at times almost half buried in snow. In the six years that this station has been in operation there has not been the least trouble. One of the engineers of the Allgemeine Elektricitäts Gesellschaft said that probably one reason why outdoor stations were not used in Europe was because a start had not been made on them during the war. As far as he could see, a transmission line was only the extension of the buses inside the station, and there ought to be no reason why outdoor stations would not work. In fact, he held, there were conditions under which they most certainly should be recommended.

The power houses as a rule are very attractive, and some of them might be mistaken for medieval castles or similar buildings. Inside walls are tinted with delicate colors, plaster frieze near the top, tiled baseboards and trimmings, clustered lights in the ceiling and ornamental wall luminaires adding to their attractiveness.

Of late years there has been a tendency in Germany to build the switching bay in one or two floors with the transformers separated from the circuit breaker and bus section. All the heavy machinery is thus on the ground floor, the oil breakers on both sides of the bus being operated from a common aisle and the condition of the knife switches being visible to the operator from the ground floor. A typical example is shown in the accompanying illustration which indicates the manner in which the high-tension lines are led outdoors. This method of protecting the entrance insulator from rain and weather is very popular and almost universally employed by German engineers.

The switching gallery in existing stations usually overlooks the generator room. The newer stations are, however, being built with the control room separated from the generator room, communication with it being made by means of visual signals. Generator and circuit-breaker control are operated from benchboards, while transmission-line control and instruments are mounted on vertical boards. The benchboards are constructed of sheet iron, pebbled and bronzed, and are really more attractive than slate or marble and easier to install.

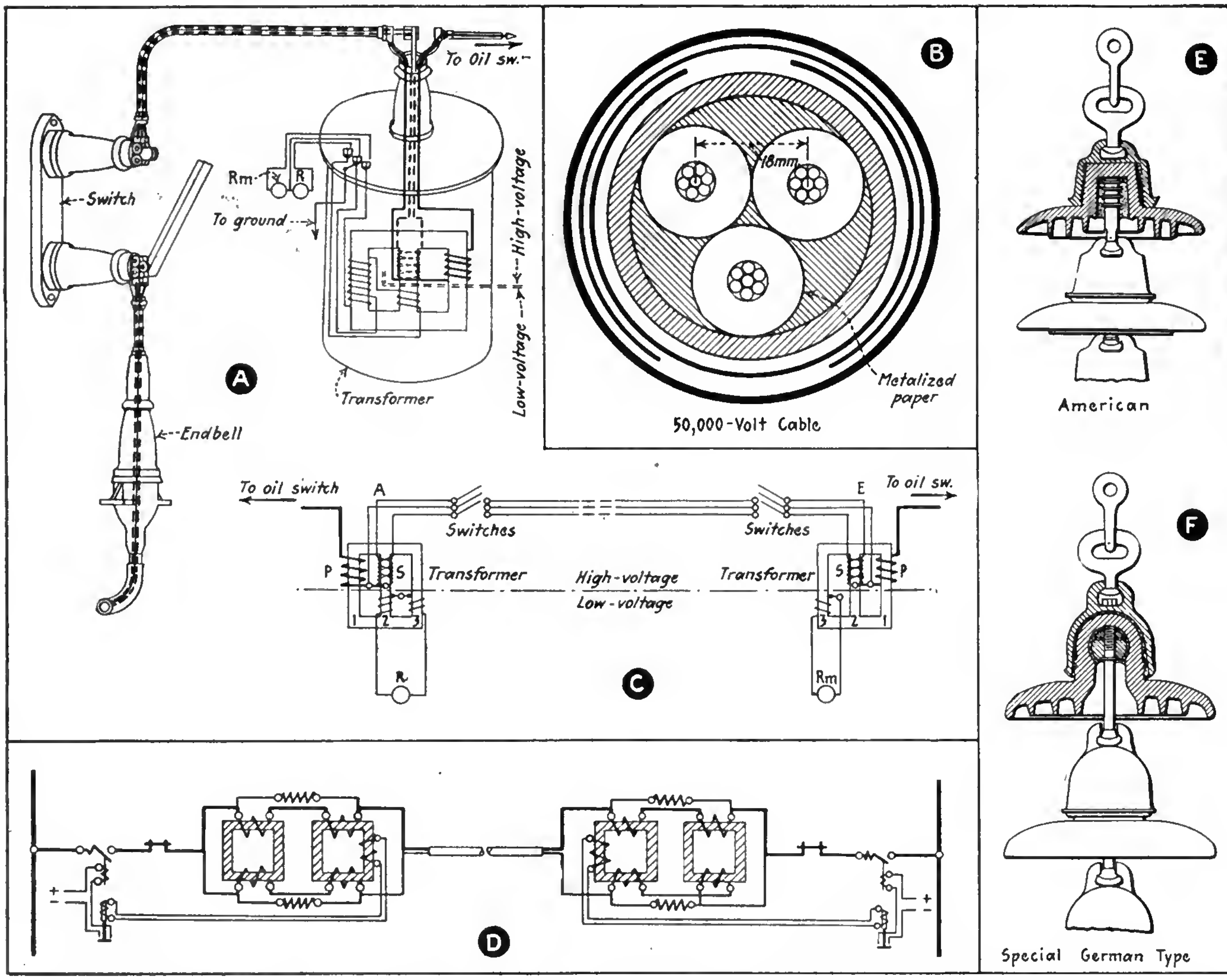
### Connecting Generators and Transformers Directly

Generators are generally wound for 6,000 volts. There are stations built for 10,000, 11,000 and even 15,000 volts, but the tendency of today is toward the lower voltage. The critical breakdown voltage with the machine insulation used abroad, due to brush discharges, is about 35,000 to 40,000 and cannot be raised even by increasing the insulation thickness two or three times. With a safety factor of one to four for 10,000

volts, it is one to seven for 6,000 volts. A higher generator voltage can therefore be secured only at the expense of the safety factor.

With the advent of the larger present-day units the tendency is to regard the generator and the transformer as a unit and to connect them directly together without circuit breakers. Notable German examples of this are the 50,000-kw. generators at the Goldenberg power station and the 25,000-kw. generators at Hirschfeld and Golpa. Formerly generators were built with reactances of only 3 per cent to 4 per cent, and the short-circuit currents might go up to five, ten or even 30 times normal current. Now generators are built with reactances of 7, 8, 9, and even up to 25 and 30 per cent, so that the short-circuit current is reduced to 60 to 80 per cent of normal current with no load excitation and to 1.6 to 1.8 times normal current with light load excitation. In spite of this the short-circuit currents are too large to admit of the low-tension bus system, and breakers as well are avoided. The increase in inherent reactance is at the expense of regulation, but this is taken care of by potential regulators. For more than 500 r.p.m. these generators are more expensive than the ones previously built, but those under 500 r.p.m. are less expensive.

With a ground on one phase of the high-tension transmission lines, the voltages of the other two phases to ground rise to line voltage. On account of the capacity series coupling between the transformer primary and the secondary windings, the potential of the unaffected phases to ground is distributed over the capacitative series-coupled transformer and the generator to earth in inverse proportion to the capacity of these parts. The capacity of the transformer in relation to the generator is often quite large, and so the generator's voltage to ground may rise to such a high value that it may puncture the generator windings. In order to prevent this, and to limit the current in case of a ground, an ohmic resistance from 0.5 ohm to 2 ohms per generator, computed from the charging current, is connected between the neutral of the generator and ground. The material for the resistance has been of thin resistance bands in a water bath utilizing the cooling water of the transformers. Relays are placed in this circuit which operate the generator oil circuit breakers as soon as the current exceeds 20 per cent normal. With modern power stations where the generator is directly connected with its transformer the relay acts upon the breakers on the high-tension side of the transformer and also simultaneously decreases the generator excitation.




A, C AND D—PFANNKUCH AND LYPRO SYSTEMS OF CABLE PROTECTION. B—CROSS-SECTION OF 50,000-VOLT, THREE-PHASE CABLE. E AND F—COMPARISON OF TYPICAL AMERICAN AND SPECIAL GERMAN PORCELAIN INSULATOR CONSTRUCTION

In general, all relay protection, consisting of

excess-current relays set for 20 per cent overload, reverse-power relays on the high-tension side of the transformer, differential relays utilizing the current transformer in the generator neutral, and excess-current relays on the high-tension side of the transformers, act together upon the high-tension breakers and upon the generator excitation. Demagnetization of the fields is accomplished by opening a short-circuiting switch, which introduces a high resistance in the excitation circuit, or by short-circuiting the field.

### Cables Used Between the Generators and Transformers

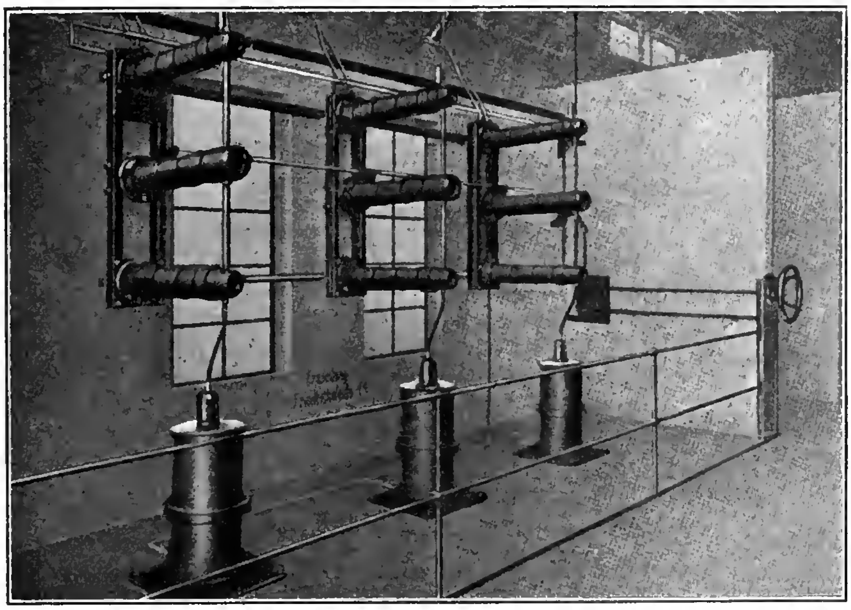
Whenever possible the connection between the generator and the transformer is made by cable instead of by busbars. If a failure occurs on the transmission line, waves with a steep wave front may be set up and capacitatively transmitted to the low-tension side of the transformer. If the connection is by means of buses, these waves may be transmitted directly to the generator and may cause burning out of coils. Cables have a large capacity which attenuates these waves. (In the Golpa station, in Germany, with four 23,000-kva. units installed, nine three-phase copper cables of 185 sq.mm. in cross-section are used.) Where it is not possible to use cable, capacity is sometimes connected in parallel with the busbars. As an added supplement to the condensers, 300 ft. or more of cable is used. As the capacity between primary and secondary windings of large transformers ranges from 0.2 mfd. to 0.5 mfd., the charging currents may be quite large and the precautions are well worth while.

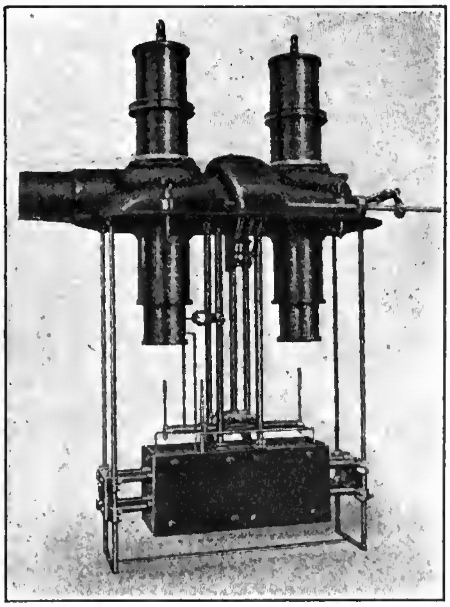
Three-phase transformers are used almost exclusively in Europe as contrasted with three single-phase transformers here. These are now built up to 60,000 kva. rating, and examples are installed at the Rheinisch Westfälian Elektricitätswerke. The transformers are connected delta on the low side and star on the high side.

In order to economize on oil in the large transformers, the container is built as small as possible and consequently the casing is very close to the windings. The windings are therefore in three layers, of which the inside and the outside layers are low-tension and the middle one high-tension. With this method the delta-star system of connection must be used, otherwise stray fields will set up eddy currents in the casing of the transformer.

At the present time transformers are being fitted with reactance coils in the line, but as the transformers are being built with larger and larger safety factors, they will probably be discontinued. For example, a 110-kv. transformer for a Bavarian power station was tested for half an hour at 220 kv. Two per cent of the entrance coils and 2 per cent next to the neutral should stand the operating voltage between two neighboring coils for two minutes. The rest of the coils should stand a potential of 60 kv. between two adjacent coils. Reactance coils for such transformers are considered superfluous.

Oil-circuit-breaker explosions are not feared so much now as formerly. Inflammable oil, even if desirable, cannot be used on account of its attack on the contacts making them unfit for use after several weeks. The English insulate the conductors and insist on a safety factor of seven. Siemens-Schuckert builds containers of extra-heavy boiler plate, while the Allgemeine Elektricitäts-Gesellschaft employs a quenching chamber. With 30 atmospheres pressure inside the quenching chamber there is a pressure of only 0.5 atmosphere on the container wall. For large currents, rapid breaking contacts of 0.01 second are used, and for 110 kv. or more four contacts are used. A 110-kv. breaker with ten contacts manufactured by Brown-Boveri for a power station in Bavaria was tested for 250 kv. and 260 amp., making the rupturing capacity 300,000 kva. Oil breakers for three-phase lines over 35,000 volts are built as three single-phase units. In Germany all large transformers are equipped with breakers employing "fore" contacts, which introduce a resistance before the circuit is actually made. It is noticed on long transmission lines where this type of breaker is not used that occasionally flashover of the entrance insulator at the distant station occurs. The resistance is calculated so





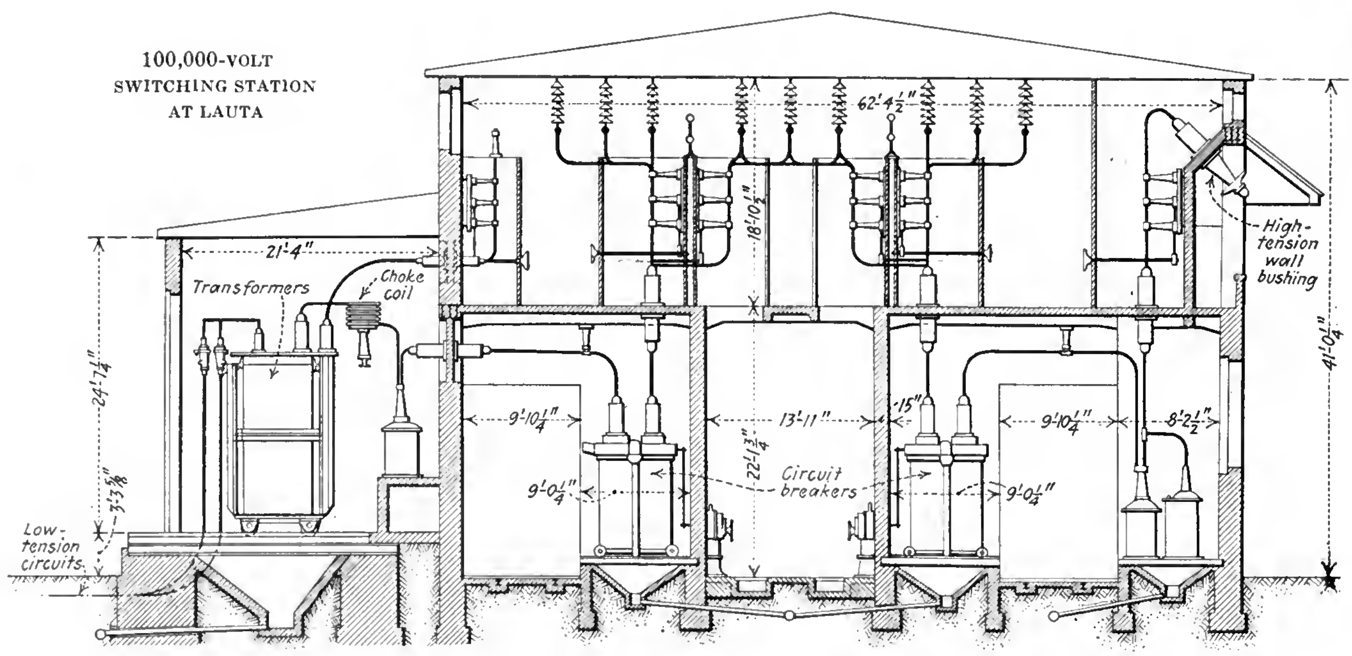
LEFT—100,000-VOLT DISCONNECTING SWITCHES WITH PAPER INSULATORS. RIGHT—100,000-VOLT CIRCUIT BREAKER WITH PAPER TERMINALS

that the charging current causes a 70 to 80 per cent loss in the uncoupled voltage.

Considerable use is made in Germany and to some extent in the Scandinavian countries of apparatus for automatically connecting two generators in parallel. The type most used is one manufactured by Voight & Haefner which employs a voltage relay, a phase relay and a time relay. The operator adjusts the voltage and the frequency of the two machines as near to the same values as possible, and when they are in phase for a sufficient length of time, as determined by the time relay, the generator circuit breaker is closed automatically. The setting of the time relay may be varied, but is usually around five to six seconds.

Of late years large-capacity current transformers (200 amp. or more) have been of the air type as these have been found to stand up better under strong dynamic forces. They are well suited for instruments and relays but not accurate enough for meters. Instrument transformers were formerly fused, but it was found that the fuses burned out frequently without cause, so that now only knife switches are used.

100,000-VOLT SWITCHING STATION AT LAUTA




### Paper Insulators and Porcelain Units Operating in Compression

Considerable interest has been manifested in large insulators of other material than porcelain because it is difficult to get porcelain insulators of the size required for voltages above 110,000. Excellent results have been obtained with paper insulators. The advantages claimed are that they are virtually unbreakable, their length can be adjusted by placing them in a lathe and in case of a flashover the outside layers can be removed, the surface relacquered and the insulator again put in operation. They cannot, however, be used out of doors, and in regions where the humidity is high they cannot even be employed indoors, as the paper is hygroscopic and breakdowns result. In one hydroelectric station in Norway which sought to use them the insulators became badly charred, due no doubt to moisture from the ouside. They are used extensively, however, for bus supports and for large disconnecting switches. They present an attractive appearance. A visit to the large transformer factory of the A.E.G. at Oberschöneweide, near Berlin, disclosed the fact that all its high-voltage transformers have paper-insulator terminals. These are provided with brush-discharge rings which increase the breakdown voltage 50 to 60 per cent.

### Suspension Insulators Assembled in Parts After Separate Firing

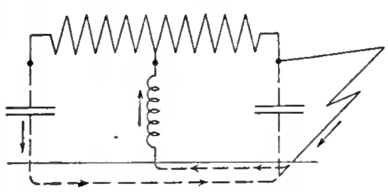
An unusual and ingenious development in suspension insulators, which is pointed to with a great deal of interest, is shown in an accompanying illustration. Since porcelain shrinks a little on firing, the small doughnut-shaped ring is first fired and shrunk. It is then just small enough to enter the spherical cavity in the top of the insulator, after which the cap and ring are fired together. The ring does not shrink any more, but the outside cap will shrink sufficiently to keep the ring in place inside the cavity. A nut of suitable shape is then placed on the bottom of the ring, and the ring and nut are turned so that the latter is at the top of the cavity, when the bolt is inserted. Paper is used as a buffer, furnishing an elastic medium between the bolt and the porcelain ring, and cement is placed between the ring and the cap to distribute the pressure.

The claims for this insulator are long life because of prevention of breakages due to different expansion coefficients of porcelain, cement and iron; a large unit capacity, resulting in better voltage distribution on a string of insulators, and a higher breakdown voltage due to better field distribution.

Cables are used more in Europe than in the United States. The limits usually placed on cables are 80,000 volts for single-conductor and 40,000 volts for multiconductor cable. Cables rated at 30,000 volts, three-phase, are quite common, and 50,000-volt, three-phase cables have been manufactured. At high voltages, however, the thickness of the insulation required makes the cable hard to handle and expensive. Besides, dielectric losses are great. Measurements on a 165-mile cable system of three-phase conductors, each of 250,000 circ.mils, showed a dielectric loss of 113 kw. at 30,000 volts.

Great claims are made for cable protective systems, of which the A.E.G. and Siemens-Schuckert both have their systems. These will be briefly described.

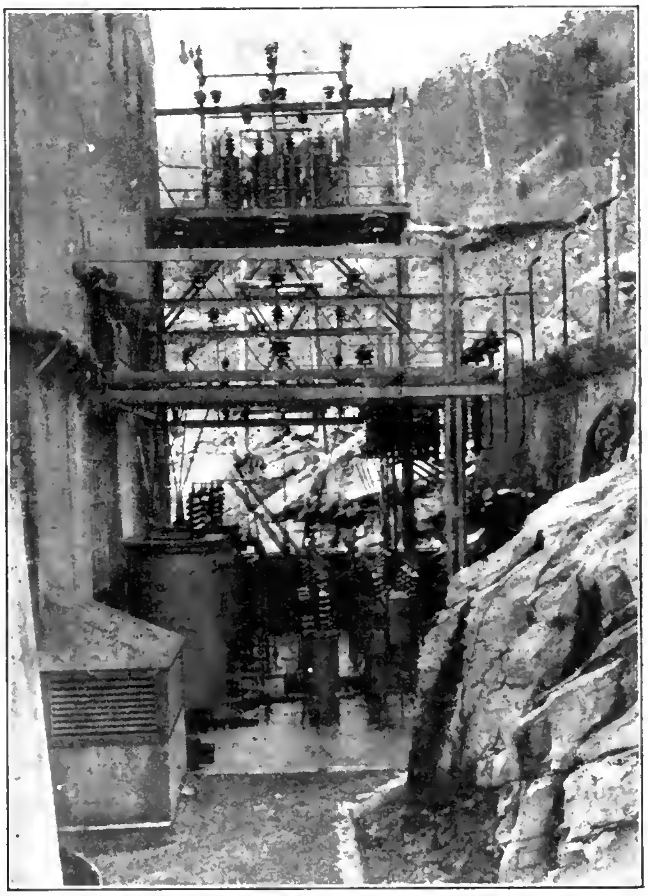
In the Pfannkuch system of the A.E.G. the individual conductors in the outer layer of the cable are purposely rather poorly insulated from each other and from the central core by means of paper. The odd and even conductors are connected together respectively so that there are really three paths through the cable. By means of a special differential transformer at each end the potential of the one path is raised slightly above that of the core and the other is diminished to a like degree. This potential is about 20 volts to 50 volts. In case of mechanical injury or injuries affecting the electrical qualities of the cable the slight insulation between the neighboring conductors is broken down, more or less, and the potentials of the different paths are varied. Through the differential transformer and connected relay the circuit breaker acts instantly. No pilot wire is needed; the action is independent of the direction of the current and external currents, and the circuit is broken while the damage to the cable is being done and really before the short circuit or ground is fully a reality. The only disadvantage claimed by the manufacturers is that a specially constructed cable is necessary and therefore cannot be applied to systems where the cable is already in.



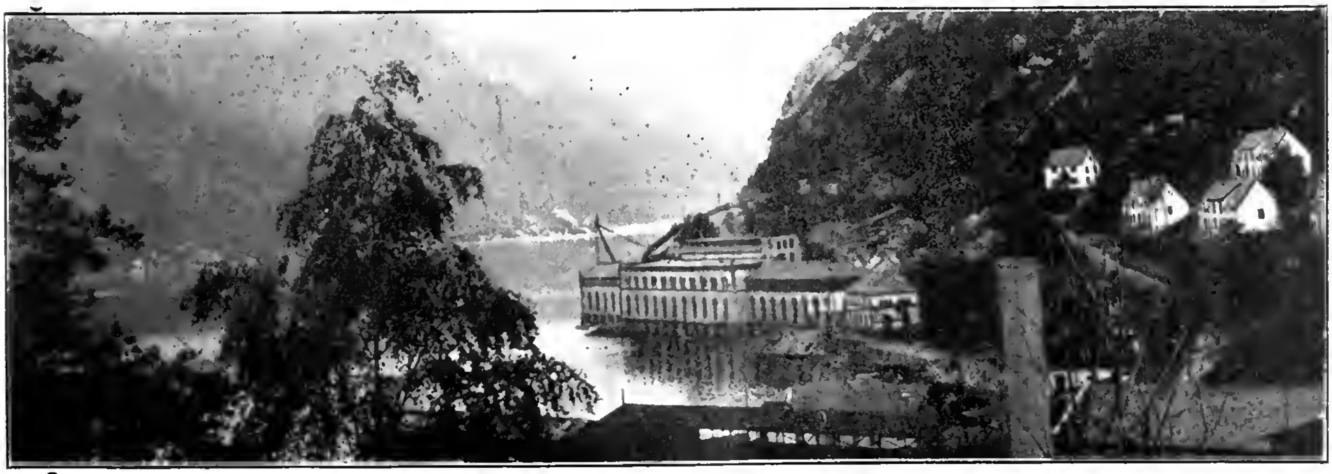
THE PETERSEN COIL INTERPOSES A LOCAL RESONATE CIRCUIT IN THE GROUND CONNECTION

The Lypro system of Siemens-Schuckert is similar to the one just described with the slight exception that there are only two paths through the cable instead of three and that the voltage difference is 120 volts.

A discussion of protection against high voltages would require an article in itself, and hence the matter can only be briefly summarized here. For a long time the European engineer has felt at a loss in regard to high-voltage protection. He has tried countless types of apparatus—horn gaps and multigaps with all their modifications, condensers, water-drip apparatus and other things, but they have all, with the possible exception of horn gaps and series resistance, fallen into disuse and installations have been disconnected. Electrolytic arresters are only used in a few American installations and oxide-film arresters are practically unheard of. Within the past few years, however, a device has been found which Europeans believe is a cure for many of their troubles—the Petersen coil and its modifications. It has been welcomed enthusiastically and is being installed in all the new stations and many of the old ones. As an instance of its popularity it may be recounted that Professor Petersen, while visiting a large hydro-electric power station in Norway where a large number of different types of protection apparatus were installed, including electrolytic equipment, told them to throw it all in the scrap heap and install a Petersen coil—and they did it! It is to be hoped, how-



AN OUTDOOR INSTALLATION AT THE BJOLVO STATION OPERATES SATISFACTORILY, ALTHOUGH OFTEN PARTIALLY COVERED WITH SNOW



A 140,000-HP. DEVELOPMENT AT SORFJORDEN HAS FIFTEEN PELTON UNITS

ever, that real data furnishes the evidence in favor of the coil, but such data was not found.

Dangerous voltages may arise from an innumerable number of causes, but the majority fall into three classes—switching phenomena, intermittent grounds and atmospheric disturbances.

It is recommended that the reactance coils composing the Petersen coils should be installed whenever the current due to ground on the high-tension side is in the neighborhood of 5 amp. or more. In computing this current it is considered that 100 km. of transmission line operated at 10,000 volts and 50 cycles has a current of about 2.5 amp. without ground wire and one of 3 amp. with ground wire. For cable systems the current ranges from 40 amp. to 100 amp., depending on cross-section and voltage. The coil is said to be most effective when the frequency of the oscillatory circuit formed by the capacity to earth of the whole system and the reactance of the coil is equal to the normal transmission frequency.

As the A.E.G. manufactures the Petersen coil, other manufacturing companies have their special coil. The Siemens-Schuckert is of the transformer type with the neutral of the star-connected primary grounded and a variable reactance introduced in the delta-connected secondary. It was admitted by a Siemens-Schuckert engineer that there was no question that the Petersen coil was an excellent device for handling voltages up to 50,000, but he was afraid of resonance disturbances above that. The coil manufactured by Brown-Boveri is practically the same as the Petersen coil with the exception that it is calculated for 25 per cent dissonance.

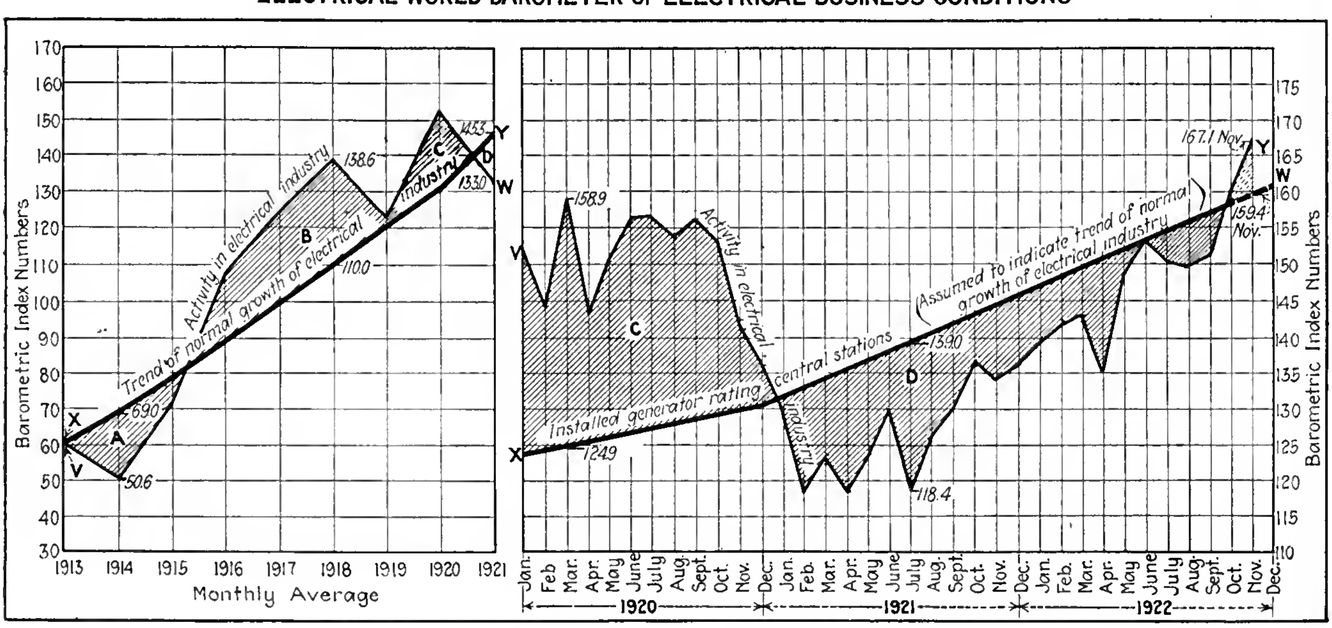
## Further Progress in Production

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that November activity within the industry was materially in excess of that experienced during October. The largest consumption of cotton since 1917 and further high records since 1920 in the output of pig iron, steel ingots, coke, zinc, locomotives and leather emphasized the sustained and basic character of industrial production during November. The usual seasonal decline of building construction in that month failed to materialize.

The "ELECTRICAL WORLD Barometer" indicates that in the month of November business conditions in the electrical industry, taken as a whole, continued to show the monthly improvement which started in September. The basic data indicate an increase of 6.7 points on the Barometer scale as compared with October. The electrical industry as a whole was operating at 7.7 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In October it was operating at 2.4 points or per cent above the point of normal demand.

The returns for November continued to point clearly to the probability that a long season of unusual activity is just opening up for the electrical industry. In many sections collections are reported still generally slow, and other retarding influences from the recent depression are holding back much of the possible progress. But the business is undoubtedly to be had, and its development awaits only the toning down of these retarding influences.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS




### THE BASIS FOR THE "ELECTRICAL WORLD BAROMETER"

By the "electrical industry" is meant the electric light and power branch, the electrical manufacturing branch and the electrical merchandising branch, taken as a group. The chart is not believed to be barometric for these branches as units.

By reason of their large influence on activity within the electrical industry the following nine primary industries have been adopted as a basis for the "activity curve" of the electrical industry: Active cotton spindles, pig-iron production, bituminous-coal production, copper production, news-print-paper production, passenger automobile production, truck automobile production, yellow-pine lumber production and Portland cement production.

Activity in each of these basic industries referred to its own normal growth curve is found, and then this index of activity is applied to the electrical industry in proportion to the influence of the particular basic industry on the electrical industry. The estimated horsepower of the motors installed in the plants of the various basic industries has been taken as a basis for weighting the industries in their influence on the electrical industry. In weighting the lumber and Portland cement industries the large domestic load of the electric light and power branch and the sale of domestic apparatus have been taken into consideration. Applying these weights to the activity in each basic industry, adding the totals and dividing by the total of the weights gives the activity in the electrical industry referred to as the "trend of normal growth of the electrical industry."

The line showing the "trend of normal growth of the electrical industry" is based upon the rating of the active installed generators of the central stations of the country. Further details concerning the development of the "Barometer" will be gladly furnished upon request.

# Power Factor as It Affects the Consumer

## Causes of Poor Power Factor—Remedial Measures, Including Rearrangement of Motors and Use of Synchronous Apparatus, Phase Advancers and Condensers—Economic Factors Which Should Be Considered

By L. J. MURPHY

*General Engineer Westinghouse Electric & Manufacturing Company*

INDUCTION motors, particularly when underloaded, cause a poor power factor on a system, and when a large part of the load of a central station consists of induction motors naturally the power factor will not be very high. For a long time a poor power factor was considered a necessary evil and little or nothing was done toward correcting it.

During the recent war, when production was at its highest, the central stations began to realize that their generators were being worked above their rated capacity while their prime movers were considerably underloaded, naturally resulting in poor economy of operation. As their load increased they also began to realize that it would be necessary to take action to overcome this evil, particularly since it meant the installation of additional costly electrical equipment on their part, which would be unnecessary if their customers had maintained a reasonable power factor. To the central stations poor power factor meant increased generating capacity, increased excitation losses, larger line losses and a more expensive distribution system than was really necessary. Obviously, a poor power factor was something about which there was cause for worry and concerning which there was justification in the contention that the consumer should bear some portion of the expense.

To accomplish this end the central stations, as a rule, imposed a penalty upon plants for their poor power factor. This penalty in the majority of cases was based upon the maximum demand and a power factor of 80 per cent. For all power factors below 80 per cent the demand charge was increased in inverse proportion to the power factor; that is, if the power factor were 60 per cent and the maximum demand was 1,000 kw., then the maximum demand upon which the demand charge would be based would be $80 \div 60 \times 1{,}000$, or 1,333 kw. In some cases a bonus was allowed the customer for power factors above 80 per cent, and the same general scheme of calculating the demand was used in this case.

With this system of charging the burden of the expense caused by a poor power factor rightfully fell upon the shoulders of the consumer whose power factor was low. In very few cases the energy rates were decreased if the consumer's power factor was good, but in most cases only the demand charge was affected.

The first question naturally asked by the consumer of power is: What are the causes of a poor power factor and how can it be corrected? The chief causes of poor power factor where induction motors are used are, first, overmotoring the machine; second, the use of low-speed induction motors, and, third, the use of individual motors on machines where the motors run continuously but the load on the machine is of an intermittent nature, as, for instance, punch presses or shears.

Overmotoring is by far the worst offender. It is a well-known fact that induction motors when operating at light loads, as is the case with an overmotored machine, have poor power factors, and in order that the plant may have the highest power factor obtainable, it is essential that the motors be operated as near to full load as possible. When a new plant is installed it is quite often the case that very little is known regarding the horsepower requirements of the various machines, and it is left to the manufacturer of the machine or to the power company's solicitor to determine the proper size and type of induction motor to be used. The machine manufacturer knows the horsepower requirements of his product, but feels that in order to play safe and to take care of any emergencies he should specify a motor with a horsepower rating perhaps 10 or 20 per cent in excess of that actually required. His estimated figure usually is high enough to take care of the most unfavorable condition to be found, and therefore will easily suffice for plants where the operation is not so severe. The power company's solicitor and the motor salesman, in order to insure that the motor will not be overloaded, usually figure on a reasonable factor of safety, and if the power requirements of the machine are less than expected, owing to conditions in the process of manufacture, then the natural result is overmotoring. Where a motor is to replace one already installed overmotoring seldom occurs as the actual power requirements of the machine can be measured. Both the power companies and the electrical manufacturers have done good work in aiding the power consumer in the proper selection of motors.

### Low Speed Induction Motors Draw Large Magnetizing Current

An induction motor having a large number of poles—i.e., a low-speed motor—requires considerably more magnetizing current than an induction motor having a small number of poles. The magnetizing current determines to a large extent the power factor of the motor, and if it can be kept low, the power factor will naturally be increased. Obviously, then, it should be the desire of the power consumer to utilize high-speed motors in all cases where possible in order to keep this magnetizing current down to a minimum.

There has been much discussion as to whether individual motor drive or group drive is the better method for operating a number of similar machines. Both methods have their advantages, but as far as power factor is concerned the group drive generally gives the better results, inasmuch as a higher load factor is maintained on the motor. Individual drive, however, reduces the losses caused by belting and line shafting, giving a lower energy consumption.

Cases can be cited where by rearranging the motors in the plant the power factor has been increased from

5 to 10 per cent. This procedure, however, usually entails the elimination of several larger-size motors and the purchase of a few smaller motors to take their places. Before installing any power-factor-correcting features this procedure for bettering power-factor conditions should be thoroughly investigated.

Aside from rearranging the motors in a plant, power-factor correction can be obtained by the use of synchronous motors, phase advancers, static condensers and synchronous condensers. Some of the relative merits of each will be given below.

The design and construction of the synchronous motor is such that it is possible for it to be built for very low speeds with good performance at a lower cost than an induction motor of the same rating and speed. It is applicable as a directly connected machine to air compressors, ammonia compressors, fans and centrifugal pumps, and can be used with clutches on any other form of drive on which induction motors are now supplied. The synchronous motor can be designed to operate at a leading power factor, thereby supplying a considerable corrective effect to the rest of the plant, but in cases where the synchronous motor load is almost the entire load a motor designed for 100 per cent power factor only is required.

While a synchronous motor has larger losses than some other forms of power-factor-correcting devices, yet the greater portion of its losses can be charged to the losses which would be found in the induction motor ordinarily used on the application. This feature is illustrated in the accompanying table where the losses which could really be attributed to power-factor correction amounted to only 1 kw. In some cases, particularly with very low-speed machines, it might work out that the losses in the synchronous motor will be less than in the induction motor. If a synchronous motor is replacing an induction motor the investment charges against power-factor correction can be reduced by the value of the induction motor which the synchronous machine is replacing. Moreover, no extra operating charges are incurred, since the same man who previously operated the induction motor can now take care of the synchronous motor.

A phase advancer can be applied only to wound-rotor motors of suitable characteristics. It is connected in the secondary circuit of the wound-rotor motor and operates to supply the magnetizing current for that particular motor, thereby making the motor practically a 100 per cent power-factor machine over the usual operating range of load. In so doing it increases the current in the rotor of the motor, and if the rotor has not been liberally designed, the phase advancer cannot be applied. An examination of the accompanying curve shows the action of a phase advancer on the performance of a 150-hp. slip-ring-type motor.

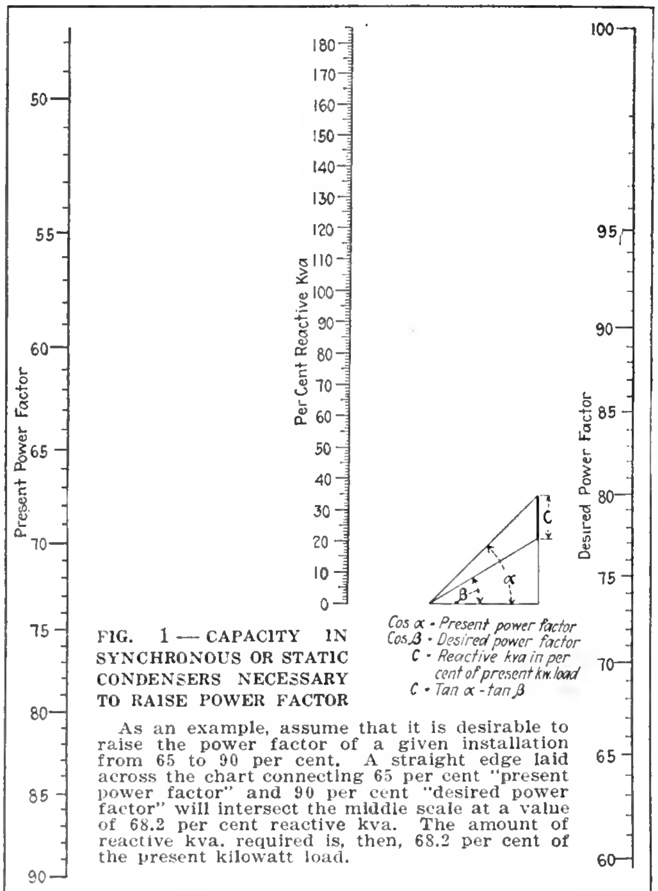



FIG. 1 — CAPACITY IN SYNCHRONOUS OR STATIC CONDENSERS NECESSARY TO RAISE POWER FACTOR

As an example, assume that it is desirable to raise the power factor of a given installation from 65 to 90 per cent. A straight edge laid across the chart connecting 65 per cent "present power factor" and 90 per cent "desired power factor" will intersect the middle scale at a value of 68.2 per cent reactive kva. The amount of reactive kva. required is, then, 68.2 per cent of the present kilowatt load.

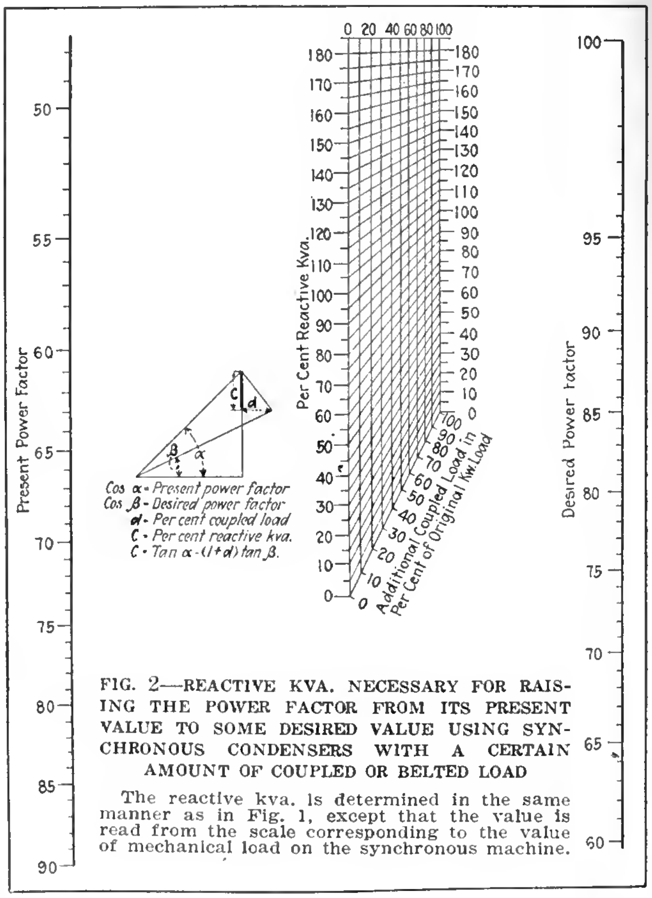



FIG. 2—REACTIVE KVA. NECESSARY FOR RAISING THE POWER FACTOR FROM ITS PRESENT VALUE TO SOME DESIRED VALUE USING SYNCHRONOUS CONDENSERS WITH A CERTAIN AMOUNT OF COUPLED OR BELTED LOAD

The reactive kva. is determined in the same manner as in Fig. 1, except that the value is read from the scale corresponding to the value of mechanical load on the synchronous machine.

During the last few years a number of electrical manufacturers have made considerable progress in developing a static condenser for power-factor correction. This type of corrective device requires no special foundation and little or no attendance, and where the service voltage is such that no transformer is required to furnish the proper voltage to the condenser the losses in it are negligible, being less than one-half of 1 per cent. It cannot, however, be readily adjusted to meet various conditions of loading in the plant, since the condenser effect is constant.

Its initial cost is somewhat higher than other forms of power-factor-correcting devices. The losses in static

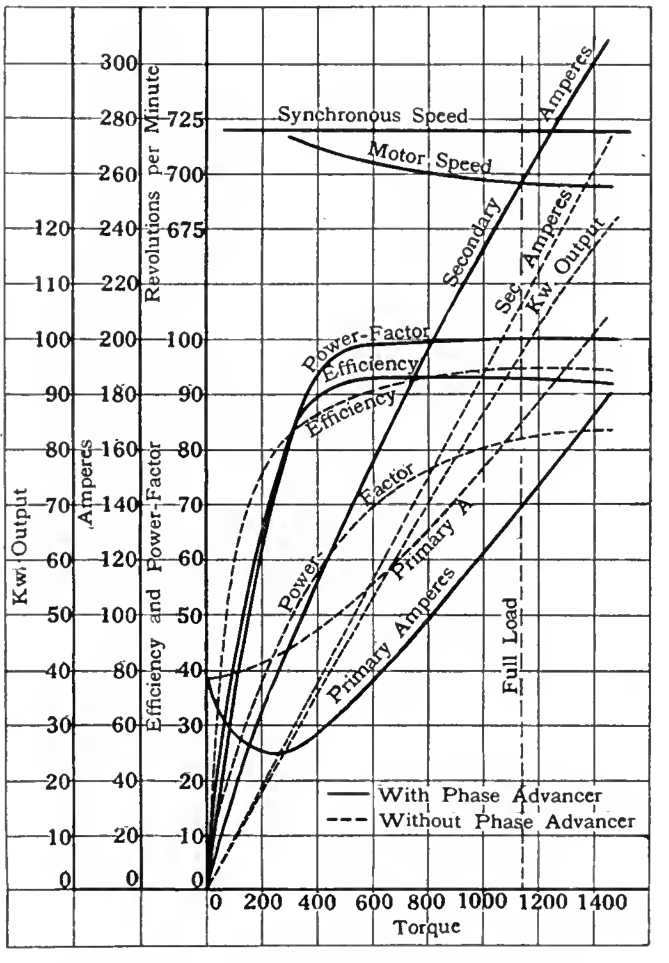
condenser equipments complete with transformers where required vary from $2\frac{1}{2}$ to 3 per cent. Owing to the fact that static condensers consist of a large number of small units, the price is naturally a direct function of the kva. required, and for this reason a static condenser does not compare favorably with other forms of power-factor correction where large corrective effects are involved.

The synchronous condenser is practically the same in construction as the synchronous motor, except that its mechanical parts are not designed to transmit any mechanical load. Its losses vary from about 11 per cent for the small commercial size, namely, 100 kva., down to 4 per cent for the larger sizes, namely, 1,500 kva. The price per kva. is not constant as is the case with static condensers, but decreases with the size, so that in the larger sizes the synchronous condenser is really the more desirable.

### ALL ANGLES SHOULD BE INVESTIGATED

The power consumer, in determining whether power-factor-corrective devices should be installed, should investigate the situation from all angles, particularly in regard to the aspect of economy. If it happens that he is being penalized several hundred dollars a month on account of his poor power factor, he is invariably under the impression that if he corrects his power factor he can save the greater portion of this penalty. Such, however, is not always the case, for the power-factor-correcting devices require a certain amount of power and the cost of this power is liable to be as great as or even much greater than the penalty. The cost of this additional power is not readily discernible in the power bill, and the consumer is under the impression that the amount saved on his maximum-demand charge is clear profit. However, the power companies have usually investigated this feature and offer a premium for good power factor which is sufficient to make the installation profitable to all concerned. Investigation of the power rates and the cost of power-factor correction by the consumer may disclose the fact that while a saving could be accomplished by correcting this power factor to unity, yet a still greater saving could be obtained by correcting only up to 90 per cent.

In comparing the economy of the different forms of power-factor correction, suppose, as an example, that a plant is taken which has an average load of 300 kw. at 70 per cent power factor and it is desired to increase the power factor to 85 per cent. To bring about this increase will require 120 reactive kva. Suppose also that in the above plant there is operating a 200-hp. low-speed slip-ring-type motor driving an ammonia compressor which operating at three-quarters load has a power factor of 70 per cent. With these conditions any of the various means for correcting power factor could be employed, and it remains to determine which one will work out to the maximum benefit of the purchaser. Providing the characteristics of the slip-ring motor are satisfactory a phase advancer can be applied. A synchronous motor designed for 100 per cent power factor operation, if used to replace the induction motor, will eliminate the 120 reactive kva drawn by the induction motor, and bring the power factor of the plant up to the desired figure. The other corrective devices can be used in any plant.




PERFORMANCE CURVES OF MACHINE WITH AND WITHOUT USE OF PHASE ADVANCER

An examination of the accompanying table shows that under the conditions assumed the phase advancer is the most desirable proposition, with the static condenser without transformer showing up almost as well. However, it quite often happens that the slip-ring motor is not adaptable to the application of a phase advancer and the voltage of the plant is such that a static condenser cannot be applied without the use of transformers. If such were the case, the synchronous motor replacing the slip-ring motor would undoubtedly be the best proposition to consider. Obviously, then, a power-factor-correcting device which would be satisfactory in one plant would not work out advantageously in another plant. The impression might be obtained from the table that a synchronous condenser could never be applied as a means of correcting power factor, but if a plant which requires a rather large cor-

PRINCIPAL ITEMS OF EXPENSE IF A STATIC CONDENSER, PHASE ADVANCER, SYNCHRONOUS MOTOR OR SYNCHRONOUS CONDENSER IS EMPLOYED

| Item | Static Condenser — With Trans. | Static Condenser — Without Trans. | Phase Advancer | Synch. Motor | Synch. Condenser |
|---|---|---|---|---|---|
| Initial cost | $3,600 | $2,600 | $800 | $3,500 | $2,600 |
| Cost of installation | 200 | 200 | 200 | 800 | 800 |
| Value of equipment replaced | ...... | ...... | ...... | 800 | ...... |
| Investment chargeable to power-factor correction | 3,800 | 2,800 | 1,000 | 3,500 | 3,400 |
| Losses in kw | 3.6 | .6 | 2.0 | 12.0 | 11.0 |
| Losses in equipment replaced | ...... | ...... | ...... | 11 | ...... |
| Losses chargeable to power factor correction | 3.6 | .6 | 2.0 | 1.0 | 11.0 |
| Cost of power per year (7,200 hr.) at $1\frac{1}{2}$ c./kw.-hr | 388 | 65 | 216 | 108 | 1,188 |
| Interest and depreciation 12 per cent | 456 | 336 | 120 | 420 | 408 |
| Attendance and upkeep chargeable to power-factor correction | ...... | ...... | 20 | ...... | 150 |
| Total cost per year | $844 | $401 | $356 | $528 | $1,746 |

rective effect, say 1,000 kva., is taken as an example and all the machines are small so that synchronous motors could not be used economically, then the synchronous condenser would compare favorably with the static.

The three main points then to be considered in selecting the proper power-factor-correcting device are as follows: First, the power losses in the corrective device; second, the interest and depreciation of the investment; third, increased operating expense.

In order to assist the consumer of power who is not thoroughly acquainted with vector diagrams in determining the proper size of corrective apparatus, two charts are presented.

The power consumer will quite often find that where previous to correcting his power factor he was unable to install any additional load on account of the fact that his power transformers were overloaded he can now make a considerable increase in his load without exceeding the carrying capacity of his transformer.

The charts (Figs. 1 and 2) were prepared by W. E. Douglass of the Westinghouse Electric & Manufacturing Company.

# Keep Public Contacts from Sparking—II

## Further Suggestions for Avoiding Possible Points of Friction in the Daily Contact of the Employees of the Utility with the Community

By E. L. MILLIKEN
*Stone & Webster Management Division*
*Assistant Manager Blackstone Valley Gas & Electric Company*
*Woonsocket, R. I.*

IN A recent article in the ELECTRICAL WORLD on improving public relations H. A. Lemmon said:

"The secret of the whole thing, if it be a secret, is to be found in taking care of the little things, the minor points of contact with people. Very small keys will open very large doors both in an organization and in a community."

It is equally true that small keys will lock shut large doors. Through some doors can come consumer faith and trust. We should have on our rings the keys to open these. From other doors, if they are allowed to remain open, may issue influences that breed distrust and antagonism. We should have and know the keys to these doors in order that we may close them and keep them closed securely. The locking or the unlocking of these doors lies within the power of the executive, through the setting, in little ways like those suggested below, of thoughtful policies that please the public.

*Operation of Company Trucks and Automobiles.*—It may seem far-fetched to connect the operation of cars and trucks with public relations. The fact remains that there is an opportunity, through proper education of those driving such company vehicles, to lock one door of complaint and criticism.

If you have ever driven your own car behind a large oil company's tank truck, which had the owner's name emblazoned on it in large letters, and the truck hogged the road and forced you to the ditch or prevented your passing it, you must admit that you did not feel particularly like patronizing one of that company's filling stations when you ran out of gas on the road. Neither is your wife partial to a grocer whose truck, driven without regard to pedestrians, splashes her clothes at some street crossing. Again, you cannot be too favorably impressed with the management of a company whose trucks, recklessly driven by your house, endanger the lives of your children. Suffice it to say that cars and trucks of central stations should be driven with due regard to traffic laws and the rights of pedestrians.

*Moving Poles.*—Some city franchises practically enable the central-station company always to charge for moving poles if it sees fit to do so. To exercise this right is probably unwise. It emphasizes first the existence of poles on the streets, which may cause an agitation for underground service. Secondly, it places the company in a position of insisting on its rights in matters of small importance. Rights are nice things to possess, but it is not always wise to enforce them.

*Extension of Service.*—A liberal and equitable policy in extending service, particularly within and adjacent to city limits, makes friends for a central-station company. Frequently political considerations require unusual expenditures of this nature. If possible, it is better to meet them gracefully and quickly, because usually they must be made eventually.

Where a particular extension is to be refused, a close study should be made before it is refused, for sometimes dollars seemingly unwisely spent may be returned tenfold. People today have so many affiliations socially and in a business way that the pigeons may come home to roost any time. The management should keep a close check on extensions from the psychological side as well as the economic side.

This may seem too liberal a policy to pursue and is not to be taken as always applying to what are known as rural extensions. When, as stated, it applies to the policy prevailing in and around a city or town, there is not much to be lost, because cities and towns are growing so rapidly that what today may be an unwise investment may a week or a month or a year from now prove decidedly profitable.

*Cut-outs for Non-Payment.*—The uncollectible accounts of lighting companies have usually been held at a low figure, because in each case there has always been hanging over the customer, like the sword of Damocles, the possibility of being cut out for nonpayment. It has been perfectly proper and just that the company should have this privilege. At the same time it is a power which should be exercised judiciously, and in general it has so been exercised. On the other hand, the routine and manner of making cut-outs for non-payment is worthy of considerable study.

In the first place, regardless of how the collection department may look upon a customer who is affected

with chronic delay in payment of his bills, the fact is that once he does pay up in any given instance he is then a customer of good standing and entitled to every consideration—at least until his next offense.

A rather usual routine in handling such cut-outs is for the collection department to notify the order clerk to issue a cut-out, which cut-out order is then either sent to the operating department or to certain employees who are charged with collecting from customers. They either collect the bill or disconnect the service.

There is always the possibility that between the time when the order is issued and the time when the employee arrives on the customer's premises prepared to execute it the customer may have called at the office and made either a full payment or a partial payment satisfactory to the collection department. The cashier taking this payment may be the only person having full knowledge that the payment has been made. It therefore becomes necessary that before any employee actually disconnects service to any customer he should first communicate with the collection department by telephone and ascertain whether the account has been paid. This also requires that the cashier keep a record of such payments so that the information may be given promptly.

This co-operative effort will obviate the very disconcerting situation of a customer's service being disconnected after he has actually paid up. Usually such a customer is in a rather disgruntled frame of mind at being prodded to pay his bill, and if after finally paying he then finds that his service after all has been disconnected, his perturbation is naturally much increased. If this situation arises out of the company's routine methods, the customer is somewhat justified in his attitude.

### Interruptions Cause Good Will

*Good Will from Emergencies and Interruptions to Service.*—It sometimes seems a paradox that out of serious interruptions to service can come good will. Nevertheless, such is the case, and this will be attested by no mean number of public service companies which have come through trying times as the result of severe storms or fire. When these emergencies arise and service is cut off either completely or to a large portion of the customers, there immediately comes the opportunity to do favors for individuals or for large sections of the public. During such periods the "contact" employees of any company should be led to feel that their duties are no less important than those of the operating men, who are charged with the specific duty of effecting repairs, rehabilitating parts of plants which are destroyed, and in general performing those functions which appeal to the layman as more spectacular than sitting by a telephone and receiving requests for service and endeavoring to have them executed.

The public in general either understands the forces beyond the control of a public service company which bring about catastrophes and service interruptions or it can be easily made to understand the situation by proper publicity during or immediately after the interruptions occur. It is surprising to note what allowances the public seems to make in such cases once it realizes the facts. When the entire organization affected bends its energies day and night to resume service there is no question that the customers appreciate and are grateful for what is done for them. There may be some who take the efforts of the company's employees as a matter of course and feel that it is no more than they should expect. These, however, will be found to be in the minority.

Therefore, "contact" employees, and all of those in an organization charged with improving public relations, should look upon every catastrophe affecting service as an opportunity to improve good will. When this is done rarely will the company come out of such a period of stress without an increased number of friends.

*Supervision.*—Lack of proper supervision, resulting in men loafing on outside jobs, naturally costs a company good money. It is then paying for something it does not get. The dollars and cents loss, however, may be small compared to the loss in prestige the company suffers through the public getting the idea that in handling work its officials are inefficient.

For example, picture the effect on a prospective customer who, on account of his remote location, is obliged to pay a portion of the cost of running an electric line or laying a gas main to his premises if the construction crew sent is too large or if the foreman goes away and the men "take it easy" during his absence. The prospective customer naturally feels that he is being called upon to pay for some or all of this waste time. His opinion of the company will not be of the best.

### Labor Affects Public Relations

Just so, the manner in which the ground man digs holes or the laborer ditches has a bearing on public sentiment by no means unimportant. No company can afford to stand before the public as inefficient. When we contend that we must receive a fair return on our investment, the public in turn may well insist that the work of creating that investment be done as efficiently as possible.

It is to be noted that not only our customers of today are our critics, but in the future as the ownership of our securities is spread more thinly among the public, including our customers, these owners of securities will naturally become more critical of our work, because in their minds they will feel that it is their funds we are spending.

*The Effect of Method of Compensation for Salesmen.*—There are today probably two schools of thought as regards the most effective method of paying salesmen. One believes in a straight salary basis, the other in a salary plus commission basis. The former policy may not produce so large a volume of sales measured in dollars and cents, or in any other unit, but it does tend toward better satisfied consumers.

It is easier to imbue a straight-salaried salesman with the spirit of service. The introduction of a commission or bonus puts sales upon a competitive basis, where the consumer's viewpoint is too frequently ignored. Two satisfied consumers are better assets than three dissatisfied consumers, or even than two who are content plus one who has cause for complaint due to misrepresentations made at time of sale. Grouchiness and the spirit of complaint are just as contagious as happiness. Misery not only likes company, but many times company courts misery.

Particularly liable to strain public relations are appliance campaigns by outside organizations. The salesmen employed are generally guided solely by their desire to make the biggest day's income. They have no constant interest in the local company. They are not a

part of its organization and frequently are only temporary employees of the outside organization handling the campaign. If such organizations are to sell in any territory, it is better that they do it under their own name. The electric company may well steer clear of such entangling alliances.

*Team Work in the Organization.*—One manager of a large central-station company stated to the writer recently that in fully 75 per cent of all of the cases where the consumer complained the company was in some way at fault. The importance of this statement is increased when it is realized that the company in question has a most liberal service policy and that all down through the organization there exists to a high degree the "spirit of service."

Undoubtedly fault on the part of the company may be due to two things, the personal equation of the individual employee or lack of team work and even friction within the organization. Errors due to the personal equation can be largely reduced by the proper choice and training of personnel.

Lack of team work is more difficult to remedy. Good men individually may not work well as a team. In our dealings with our consumers there are so many interdepartmental relations that opportunities for slips are many. Then, too, the aims of certain departments naturally tend toward friction with other departments unless constant care and supervision are exercised. The sales department chafes at the restraint of the collection department, which many times is called upon to place its "N.G." on certain new business which the sales department may have developed only after strenuous effort. The operating departments are frequently taken to task by the sales department because the former fail to make connections and set meters quickly enough to satisfy the new consumers which the latter has secured.

These are but two of many possible causes of internal friction. The remedy lies in educating the respective departments to a reality of the trials and tribulations of the other departments. "Get-together" meetings help to iron out these difficulties. The interchanging of employees between departments for a short period, as, for example, the putting of salesmen into the meter and service departments, and vice versa, helps the employees of each department to understand the viewpoint of the other departments with which they have relations.

This clearer understanding reached, then the organization is better able to function as a whole and by the better service rendered lock the door against a great mass of justified complaints from consumers. A general prescription for the difficulty may perhaps be contained in the motto, "Don't sell—serve." The commitment of all departments, and particularly the sales department, to this policy will give rise to a different viewpoint all down through the organization and among the various divisions.

*Local Purchasing by Central Stations.*—Local purchasing has been discussed from certain angles from time to time. Its value is further enhanced by the central-station company being thus better able to enlist the aid of local dealers and manufacturers in furthering legitimate company policies in times of stress as well as improving conditions in times of peace. Local merchants and manufacturers have really a greater incentive to support the company than many consumers who own company securities. Many of the former usually get more dollars in profits on merchandise sold than the latter receive in dividends. Where a man's or a business firm's dollars come from, there lies his or its interests.

*Donations and Contributions.*—The tendency is for the demands of charity to increase. Where commission regulation prohibits the company from making such contributions, except for certain purposes, the number of disbursements is naturally less. However, such donations and contributions are prominent more because of their number than because of any actual large percentage of gross income so disbursed.

To be sure, the central station is in a way the trustee of funds intrusted to it by the public for use in rendering a certain public service. But this trusteeship many times may best be exercised by being liberal in contributing to local activities, because the favorable sentiment created reacts to the company's benefit and hence to the good of all in the community. Whatever benefits the company does actually benefit the community, and hence its consumers, and the converse is equally true about injuries.

# Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

## Opposition Test of Polyphase Meters

*To the Editors of the* ELECTRICAL WORLD:

In the article appearing on page 1394 of the Dec. 23 issue of ELECTRICAL WORLD entitled "Testing of Polyphase-Type Watt-hour Meters" D. C. Hoffman refers to the "opposition" test for balance in a polyphase meter. Personally, I have not favored this method for the reason that with potential applied in the normal way on both elements (one current reversed to give the opposition) the friction compensation still acts in the same forward direction for both elements. If the torque adjustment is then made, it will result in one element being slower than the other by twice the amount of the friction compensation per element. This perhaps is not enough to condemn the practice for ordinary field tests.

In another part of the article Mr. Hoffman makes no reference to the phase relation between potential of one phase and current from another phase for the purpose of making the registration correct at 50 per cent power factor. If the lag resistance is precisely adjusted, the meter then will be correct for both lead and lag. If not, the error for the other condition will be twice as much as the error remaining for the condition (lead or lag) used in making the adjustment.

I am not in agreement with the proposed use of a phantom load. Resistance in the primary may regulate current magnitude well enough, but it will throw the resultant power factor wholly into doubt. The proper place for resistance to regulate current magnitude and preserve some semblance of unity power factor is in the low-voltage secondary circuit of the phantom load. Apart from the regulation of current magnitude, there should be enough voltage on the secondary circuit to permit the insertion in that circuit of enough resistance, even at maximum rating of the load box, to insure that the secondary current is approximately in phase with

the primary voltage; otherwise the power factor will be appreciably less than unity at times when unity is desired and seriously less than 50 per cent when that figure is desired. A. E. KNOWLTON,

Assistant Professor of Electrical Engineering.
Sheffield Scientific School, Yale University,
New Haven, Conn.

### Testing of Polyphase-Type Watt-Hour Meters

*To the Editors of the* ELECTRICAL WORLD:

In the ELECTRICAL WORLD for Dec. 23, page 1394, Dan C. Hoffman has an enlightening article on the practical testing of polyphase meters. However, there is a slight error in his "hook-up" which I would like to correct.

When the two elements of the meter are connected in series, whether for balance or regular test, the lower shunt coil should be grounded to the upper series coil instead of to the lower. In Mr. Hoffman's diagram the losses of the lower shunt coil will register on the upper series element, and, although the error is slight on full load, it is very noticeable on light load, especially with the smaller sizes of meters. METER TESTER.

Central Illinois Public Service Company,
Beardstown, Ill.

### Electric Drive for Paper Machines

*To the Editors of the* ELECTRICAL WORLD:

In your issue of Nov. 11 there is an article on sectional electric drive for paper machines in which the following statement is made: "The war gave impetus to this development so that three distinct systems are now available—Westinghouse and General Electric in this country and the Harland system in Canada." This statement may lead to a misconception.

We wish to say that the Harland drive is available in the United States as well as in Canada. Arrangements have been made for its manufacture in the United States, and the sales representation is in the hands of Thomas H. Savery, 1718 Republic Building, Chicago, who is well known in the paper trade.

It may also be of interest to your readers to know that the first Harland Electric Drive was installed and put into operation in the year 1913 and has been running satisfactorily ever since. The war delayed its development owing to the fact that the works of the Harland Engineering Company were fully occupied with war service. Immediately after the war, however, the development of this drive was actively prosecuted, and the apparatus has met with a very large degree of success and given complete satisfaction to all who have installed it. R. N. NORRIS,

Managing Director.
Harland Engineering Company of Canada, Ltd.,
Montreal, Que.

### New Zealand Leads in Proportion of Savings-Bank Depositors

*To the Editors of the* ELECTRICAL WORLD:

I noticed in a recent issue of your paper that you quite rightly asserted that the number of savings-bank depositors is a measure of the industrial stability of a country. You followed this by pointing out that the number of accounts in the United States is 100 per 1,000 persons, in France 346 per 1,000 and in England 302 per 1,000. May I point out that the proportion of post office savings bank depositors in New Zealand is 518 in every thousand? H. A. HUGGINS,

Controller of Savings Banks and Accounts.
Wellington, New Zealand.

### Laminated-Frame Arc-Welding Generator

*To the Editors of the* ELECTRICAL WORLD:

In the Oct. 1 issue of the ELECTRICAL WORLD there appeared a discussion by Pliny P. Pipes under the caption "Laminated-Frame Arc-Welding Generators." While we agree with many of the points brought out in Mr. Pipes' discussion, we do not believe that the advantages set forth for the laminated-frame construction really warrant this type of machine in preference to solid-frame types of welding generators.

In the design of arc-welding generators the question of arc stability is of great importance, and many different schemes are used for obtaining it. The use of inductance properly disposed is commonly resorted to in obtaining this essential characteristic. In all types of welding generators inductance is placed in the external circuit, regardless of the type of frame construction used.

With laminated-frame construction it is true that the generator is more responsive to arc changes, but it is impossible to make these responses rapid enough to eliminate entirely the use of an external reactance, and for this reason the extra cost of manufacturing a machine of this design is not warranted when the same results can be obtained by using generators of less costly construction simply by using external reactance in the arc circuit.

If Mr. Pipes' inference that the damping effect in the generator frame is equivalent to placing a reactance in series with the arc circuit were correct, a laminated-frame generator would require more reactance in the arc circuit than would a solid-frame construction, because so-called damping effects are less in the laminated-frame construction. Actually, the greater the damping effect of the generator frame the larger is the reactance required in the arc circuit. However, this is such a minor point in the proper performance of a welding generator that it can be neglected.

The laminated frame has no practical advantages over the solid frame as regards the efficiency of machine operation. It is recognized that both hysteresis and eddy-current losses are less in a given volume of laminated sheet metal than for the same volume of rolled steel. However, the total iron loss in the frame of a machine is negligible compared with the iron loss in the armature. This is due to the fact that the flux changes in the frame of a generator through a range of certain positive values at a very low frequency, whereas in the armature of a machine the flux reverses from a maximum in one direction to a maximum in the other direction as often as an armature tooth traverses the distance between poles of opposite polarity. In fact, the iron losses in the frame of a machine will not be greater than one-fourth of 1 per cent of the total output of a machine, and for this reason can be neglected when establishing fundamental designs for arc-welding generators. Incidentally, iron losses in the frame of a machine are never considered in calculating machine designs.

Since, then, the efficiency of a machine is not appreciably affected by the type of frame construction, and since it is necessary to use an external reactance for either type of frame—that is, whether laminated or rolled—the solid-frame arc-welding generator should have preference over the laminated frame on account of its less expensive construction. H. E. DRALLE,

General Engineering Department,
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

# Central Station and Industrial Practice

**Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants**

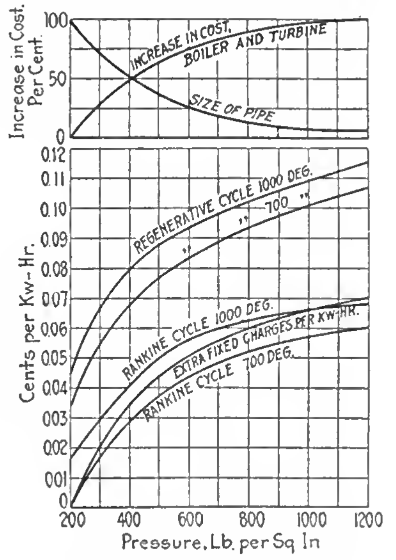
## Higher Steam Pressures and Temperatures

IN COMMENTING on the paper presented at the annual meeting of the A. S. M. E. by George A. Orrok and W. S. Morrison (published in considerable detail in the Dec. 8 issue of the ELECTRICAL WORLD) Peter Junkersfeld brought out the vital question whether higher steam pressures and temperatures pay. He also called attention to the use factor of a number of turbine installations running from twenty to thirty hours per year up to 6,000 to 7,000 hours per year. Mr. Junkersfeld's discussion is given in part below:

Mr. Orrok shows that temperatures of from 700 deg. F. to 750 deg. F. should not be exceeded for the present, and in the accompanying illustration [reproduced from the paper] he shows that extra fixed charges are always greater than the saving of coal at $6 per ton for the Rankine cycle (ordinary operation) of 700 deg. F. maximum temperature. It is a comparatively simple matter to derive all but one of the curves for coal of a different price and quality. The exception is the curve of "extra fixed charges per kilowatt-hour." The determination of fixed charges is one thing, but fixing charges per kilowatt-hour is quite another matter. This curve will be high with some companies and low with others, being based on three items, namely, (a) extra construction cost, (b) percentage of interest, depreciation, etc., and (c) kilowatt-hours per year over which the number of dollars per year resulting from (a) and (b) may be spread. The effect of kilowatt-hours per year or annual output is so much greater on extra fixed charges per kilowatt-hour that for the purpose of discussion it may be assumed that the extra construction costs and the percentage of interest, depreciation, etc., are both constant for a number of central stations whose extra fixed charges per kilowatt-hour are to be determined. Only one factor has to be dealt with, namely, output or, as specifically defined, "generator capacity factor."

This factor, which is the ratio of the actual output t the possible output of a steam turbine as rated with all its accessories, when averaged over a period of years, is much less than usually supposed, especially among central stations that have a substantial annual average increase in output.

An examination of the experience of seven companies with fourteen power stations and ninety-two steam turbines, aggregating 1,730,000 kw. rating, shows that in substantially the same twelve-month period one had an average generator capacity factor on all its turbine units of 44 per cent and another had one of 25 per cent. The extra fixed charges per kilowatt-hour for the latter would be almost double that for the former. It was also noted that only two out of seven companies had an annual capacity factor of 60 per cent or better on any one turbine. The company whose successive installations apparently gave improved economy and reliability and which made good use of its equipment had the average capacity factors during a twelve-month period shown in the accompanying table. Only one company had turbines still available for use, two in number, that had been in service eighteen years, and only three companies had such turbines, nineteen in number, that had been in service fourteen years or more.




COST OF INSTALLING AND ECONOMY IN USING PRESSURES ABOVE 200 LB.

Saving afforded in cents per kilowatt-hour, based on the Rankine cycle at 200 lb. and 700 deg. maximum temperature and coal at $6 per ton. At the top of the figure are two curves showing the increase in cost of boiler and turbine and the decrease in size of pipe required for a given quantity of steam. The extra fixed charges are always greater than the coal saving for the Rankine cycle (ordinary operation) at 700 deg. F. maximum temperature, and the additional gain for 1,000 deg. F. maximum temperature barely exceeds the additional fixed charges.

AVERAGE CAPACITY FACTORS OF ONE COMPANY'S TURBINES FROM ONE TO ELEVEN YEARS IN SERVICE

| Years of Turbine Service | Per Cent | Years of Turbine Service | Per Cent |
|---|---|---|---|
| 1 | 77 | 9 | 3 |
| 3 | 55 | 10 | 4 |
| 4 | 38 | 11 | 2 |
| 5 | 32 | | |
| 8 | 23 | Average | 37 |

An average experience curve for these seven companies, all in large and growing cities, indicated a capacity factor of about 58 per cent on turbines one year old and 30 per cent or less on turbines ten years old. The actual average of five turbines that were eleven years old was only 20 per cent, but this point was below the average curve.

The falling off with age of the capacity factor of turbines reflects good operating procedure with improved equipment in the successive installations. The fact that only one company operated its one-year-old turbines at 77 per cent, another at 52 per cent, and the third at only 23 per cent, and that the average of ten turbines two years old operated by six companies was only 50 per cent, indicates that there is still very great room for improvement in construction and operation of equipment with what might today be called moderate pressures and superheat.

### DATA ON HIGHER PRESSURE TURBINES INCOMPLETE

The turbines considered above were all operated at pressures from 150 lb. per square inch to 250 lb. per square inch at the throttle and total temperatures from 475 deg. F. to 600 deg. F. Some of the companies have turbines with 300 lb. pressure, but are not included because a full year's service had not been completed at the end of the year 1921, the period from which most of this experience record was taken.

In the foregoing wherever reference is made to turbine experience it means not only the turbine proper, but also includes the condensing equipment, piping and other mechanical accessories, the generator, excitation, switching equipment and other electric accessories.

The development toward higher steam pressure and superheat has been under way for many years and will inevitably continue. It should be given every reasonable encouragement consistent with established scientific facts and sound economic possibilities. It should be remembered however that this development in the past in a broad and over-all aspect has tended toward lower construction as well as lower operating costs of the station.

The development now seems to tend toward higher costs of construction and of operation with the exception of fuel. It thus becomes even more necessary than heretofore to determine proper balances between fuel saving and what Mr. Orrok has called "extra fixed charges per kilowatt-hour." The latter is, therefore, particularly important, and especially because experience has shown that it varies so widely from turbine to turbine, from station to station, from company to company and from year to year.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Relative Merits of Three Methods of Charging Batteries

AS IS generally understood, the constant-current method of charging both lead and nickel-iron batteries consists in connecting a variable resistance in series with the battery and connecting it to a charging circuit having any voltage higher than the full-charge voltage of the battery. The charging current is maintained virtually constant throughout the charge at the normal charging rate. This is accomplished by varying the resistance in series with the battery, adjusting it to give a current value slightly higher than the normal charging rate and, after the current has fallen off to a value below the normal rate, again adjusting it to a slightly higher value, thus maintaining an average equal to the normal charging current.

With a nickel-iron alkaline battery the charge is terminated when the voltage reaches approximately 1.85 volts per cell. In the case of a lead battery the charge is continued at the normal rate until free gassing begins, accompanied by a comparatively rapid rise of voltage, when the charging current is reduced to the finishing rate, which is somewhere between 25 per cent and 40 per cent of normal, depending on the make of the battery. This results in simultaneous reduction of the battery voltage, and the charge is then continued at the finishing rate until the battery voltage reaches a one-hour maximum as indicated by three half-hourly readings of equal values, the current being held constant, after which the charge is terminated.

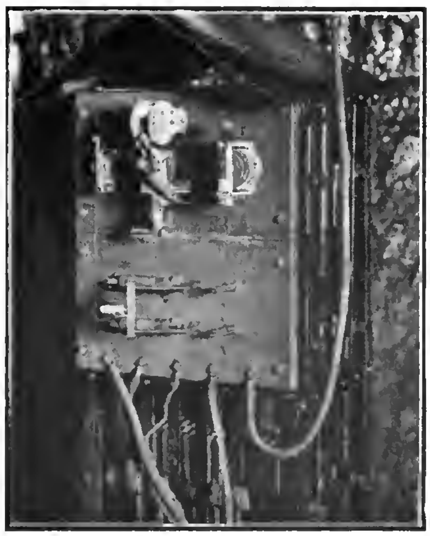
In order to keep the charging current practically constant it is necessary to adjust the resistance at more or less frequent intervals, these intervals being dependent on the difference between the battery and the line voltages. With a battery having a voltage slightly lower than the line voltage, as, for instance, a battery of forty cells being charged from a 110-volt circuit, it will probably be necessary to adjust the rheostat at half-hour intervals; but for a similar battery being charged from a 220-volt circuit adjustments may be made at very much longer intervals. Observations of gassing and readings of battery voltage must be taken at suitable intervals to determine the points at which to reduce the rate and terminate the charge.

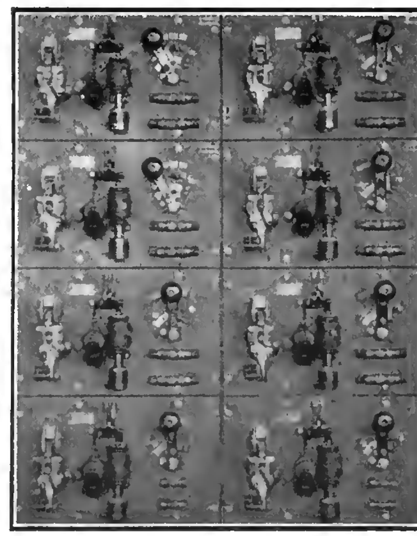
The chief objection to the constant-current method is the necessity for keeping a competent attendant to regulate the current from time to time and take voltage readings. If he is not attentive to his work, the batteries under his care will probably be either overcharged or undercharged, and in either case their useful life will be shortened.

This objection to the constant-current method is not inherent in the constant-potential method of charging, the basis of which lies in the fact that a proper charge for any lead battery can be obtained by applying a fixed charging voltage of approximately 2.3 volts per cell.

In charging batteries by the constant-potential method the battery, without series resistance, is connected directly to a circuit, the voltage of which is maintained constant throughout the charge at a value determined by the number of cells in the battery. For lead batteries this voltage is ordinarily about 2.3 volts per cell and for nickel-iron batteries 1.7 volts per cell. In cold weather a somewhat higher voltage may be required. Under these conditions the time required for charging a battery which has previously delivered its rated output can be reduced to five or six hours in the case of a lead battery. Seven hours, however, is required for a total charge for a nickel-iron battery. This time is not changed regardless of the method of charging used, as the average rate of charge is equivalent to the normal rate. Owing to the fact that the battery voltage is low at the start of the charge, the charging current tapers, starting at a high value and falling off as the charge progresses. In the case of the lead battery the initial inrush current is about four times normal, and it is about twice normal for the nickel-iron battery.

The constant-potential method of charging requires a definite constant charging voltage for each battery, which voltage seldom, if ever, corresponds to that of a power circuit. It is therefore necessary to install a separate power supply or provide some special means of obtaining the proper charging voltage. Where batteries of different numbers of cells are used, the problem is more complicated as a different charging voltage may be required for each battery.





FIXED RESISTOR METHOD OF CHARGING BATTERIES ELIMINATES KEEPING ATTENDANT ON DUTY DURING CHARGE

Left — Charging panel installed underground in mine for charging locomotives by this method. Right—Frame of eight resistor charging sections, each section controlling a charging circuit and having a remote control relay which automatically establishes the charging circuit upon plugging into the battery.

In the case of lead batteries an objection to this method of charging is the fact that the capacity of all the conductors must necessarily be increased about 300 per cent in order to provide capacity for the inrush current, which lasts only a few minutes. All fuses or other overload devices must also have a capacity for the maximum current and thus be useless as a protection throughout the remainder of the charge.

By inserting a resistor in the battery circuit, this heavy initial inrush is cut down to the point where heavy leads, switching equipment and fuses

are not necessary. This is known as the fixed resistor method of charging, and retains the chief advantages of the constant potential method.

The chief advantage of fixed-resistor charging is that the expense of keeping a responsible attendant on duty is saved since no attention is required during the charge; and, as the battery automatically receives the proper amount of current at every stage of the charge, it receives better treatment than when charged by any method which depends upon the operator to adjust frequently the charging current at the proper value and to terminate the charge. This elimination of the human element is a strong argument for fixed-resistor charging with automatic amperehour meter cut-off, as the useful life of the batteries is probably shortened more often by improper charging than by any other cause.

F. LEPORT SPANGLER.

Cleveland, Ohio.

# Concrete Poles Used on 132,000-Volt Line

### Minimum Hazard of Contact and Maximum Adaptability at Low Cost Offered by "Pi" Construction—Puzzling Transportation Problem Solved

THE 132,000-volt cross-country trunk line recently built in Sweden between Trollhättan and Västeras is carried out for a stretch of about 80 miles on poles of steel-reinforced concrete. Though concrete poles have been used rather extensively in Switzerland and Germany for lines of moderate voltages, this line is believed to be the first extra high-tension development employing such poles.

The type of pole adapted for the line may be characterized as the Π type. Each pole consists of two masts, carrying a horizontal cross-beam 57 ft. from the ground, and the conductors are arranged horizontally 20 ft. apart. About 400 suspension poles on the line are built of concrete, some with steel, some with concrete cross-beams, the remaining 1,200 poles being made of structural steel, as are all the strain towers.

The concrete masts were manufactured by the so-called Schleuderbeton process. The reinforcement consists of steel rods placed around the circumference and interwoven by heavy steel wire. The steel skeleton is placed in a large hollow mold, which by special machinery is set in rapid rotation around its axis while the concrete mixture is poured


SMOOTH AND DENSE CONCRETE POLES SHOW SURPRISING STRENGTH AND ELASTICITY

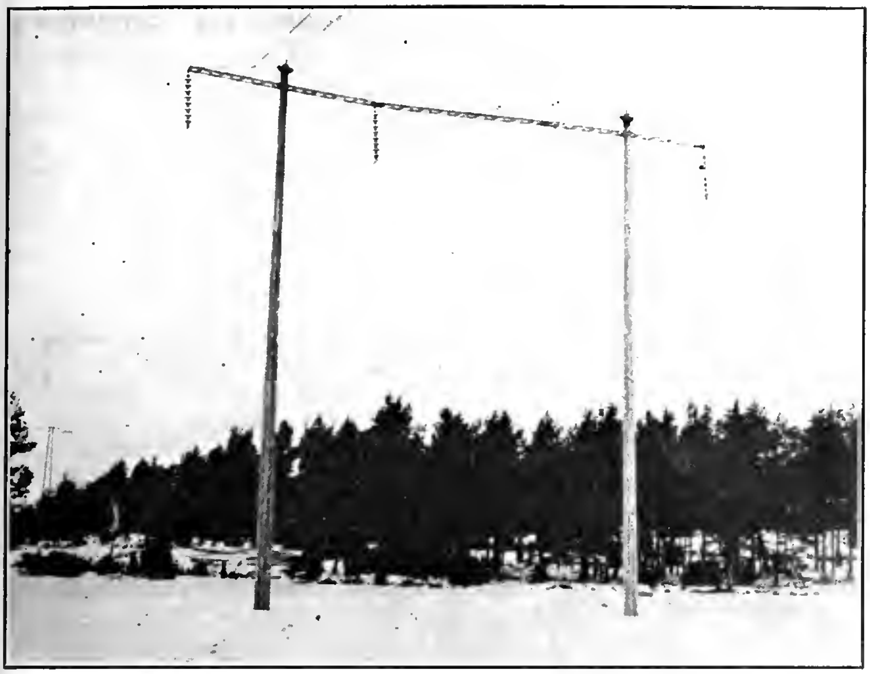
in. Owing to the centrifugal action the surface layer of the concrete comes out extremely smooth and dense, and the poles exhibit a surprising strength and elasticity.

Each mast weighs about 8,000 lb., is 61 ft. long and has a diameter at the base of 19.7 in., tapering to about 9 in. at the top. The cross-beam weighs 4,400 lb. and is 59 ft. long, with a diameter of 11 in. The masts are guaranteed to withstand a cross-pull of 1,320 lb. at the top with a factor of safety of four. One of the accompanying illustrations shows a mast being tested at 6,750 lb. As indicated in the photograph, the top deflection at this pull was about 4.6 ft. After this exaggerated test the pole showed neither cracks nor permanent deflection. Later the same mast was tested up to 7,600 lb. and it then gave a deflection of fully 10 per cent of the pole height without breaking.

At first some doubt was felt as to the feasibility of transporting these large masts from the factories in Germany to their sites in Sweden without so great a degree of breakage as to make the expense prohibitive. The masts, however, proved to be much easier to handle than was anticipated, and not a single piece had to be discarded. The majority of the 800 masts were taken by rail and ferry, on special cars, nine to the cars, but some were reloaded on seagoing barges and towed to Gothenburg. The transport from the nearest rail station and out to the sites presented some puzzling problems but was managed satisfactorily in the following way: The base of the mast was anchored to a motor truck, and somewhat below the middle the mast was supported by a special trailer. When the truck could get no further the masts were rolled over the fields by two horses, each attached to a sling of wire rope around either end of the mast.

The other illustrations show how the masts were raised and the cross-beam being hoisted into place. With both masts in place concrete foundations were cast around the butts. From a practical point of view the poles proved successful, the simple method of pole erection cutting down field work considerably. Although the first cost—all transportation damages, etc., included—came out about as high as for the steel poles used on the line, the concrete poles probably will be cheaper in the long run, since concrete needs no

CONCRETE POLES CARRIED FROM GERMANY TO SWEDEN BY TRAIN, BARGE AND MOTOR TRUCK WITH NO BREAKAGE



A SECOND CIRCUIT MAY BE ADDED BY SIMPLY ADDING ONE POLE AND EXTENDING CROSSARM

painting and requires practically no upkeep.

The Π-type pole is not a special feature of this line. This type of construction with wooden poles was used to a great extent on 77,000-volt lines built in Sweden during the war, when structural steel was scarce. The poles have proved that they have several advantages besides that of being very cheap where considerations of right-of-way do not enter. Theory as well as practice show that the horizontal arrangement of the wires offers a minimum of hazard of wire contact due to sleet storms, frost, etc. Furthermore, the Π-pole can be easily adapted to meet a growing power demand. On the Trollhättan-Västeras line only three 200,000-circ.mil copper wires were pulled, although the poles are designed for conductors of three times that size. The line is operated at 132,000 volts, but the clearances in the poles will permit the voltage to be raised to 220,000. By simply adding one mast to each pole and extending the cross-beam space may be provided for six conductors, and even as the poles stand now there is room for a fourth (reserve) cable.

EDY VELANDER.

Stockholm, Sweden.

## Fire-Extinguishing Liquid Specifications

SPECIFICATIONS for fire-extinguishing liquid, with carbon tetrachloride base, issued by the Federal Specification Board of the Bureau of Standards state that carbon tetrachloride is the only suitable liquid known which is a non-conductor of electricity for use in hand fire extinguishers in fighting incipient fires in connection with electrical apparatus. The board points out, however, that the fumes generated in extinguishing fires with carbon tetrachloride are intensely irritating and poisonous and that the liquid is unsafe for use in confined spaces. The specifications as officially adopted by the Federal Specification Board on July 3, 1922, are given in part below:

The liquid shall be capable of extinguishing fires caused by the burning of inflammable liquids and solids, shall be a non-conductor of electricity and shall consist of carbon-tetrachloride containing other suitable products necessary to produce a liquid conforming to the following requirements when tested according to the methods outlined in circular No. 134 of the Bureau of Standards:

*Appearance* — It shall be a clear, homogeneous, mobile liquid.

*Specific Gravity*—The specific gravity at 15.5 deg. C. shall not be less than 1.500.

*Cold Test*—The liquid must have a cold test not higher than minus 45.5 deg. C.

*Distillation* — Not over 2 per cent shall distill below 60 deg. C. At least 90 per cent shall distill between 70 deg. C. and 80 deg. C. At least 99 per cent shall distill below 100 deg. C.

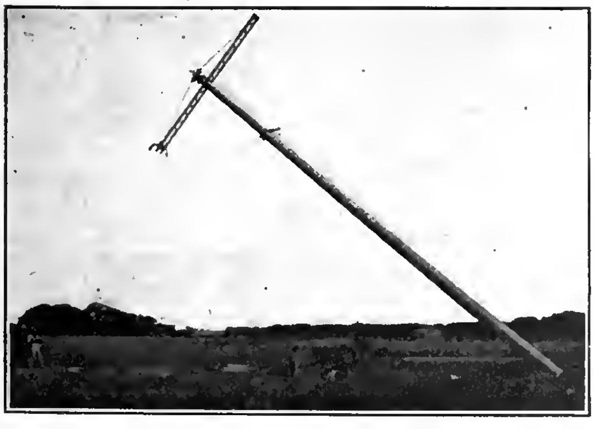
*Impurities*—The liquid shall be free from nitrobenzine, water, acid or alkali and free halogens, and shall not contain more than 1 per cent by weight of carbon disulphide. It shall not corrode metals used in fire extinguishers.

FIELD EDITOR ELECTRICAL WORLD.

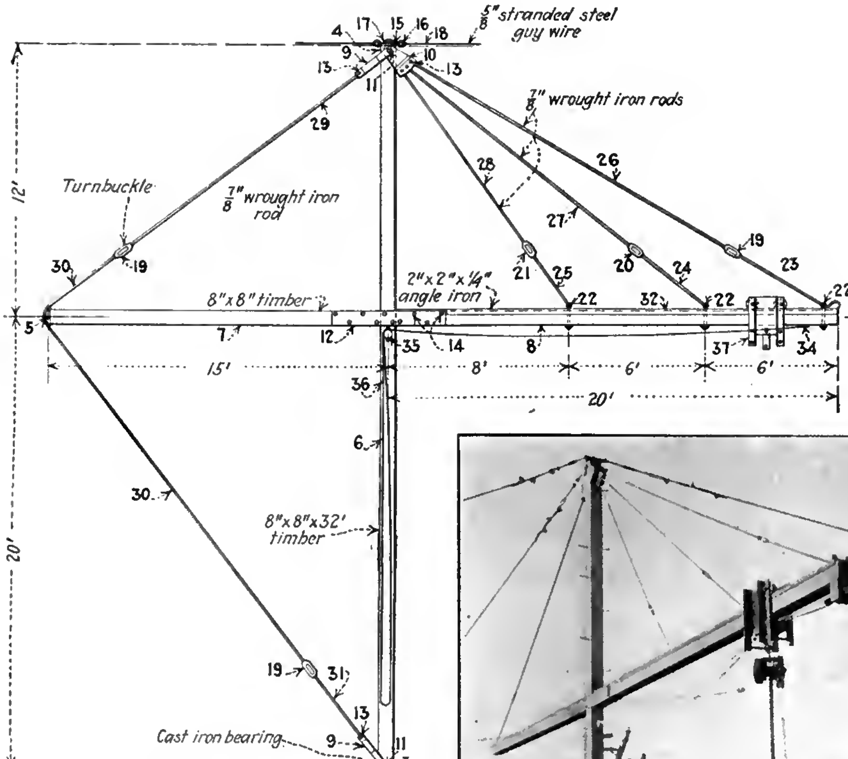
New York, N. Y.

## Rotary Crane for Handling Transformers

FOR handling transformers and heavy wire reels in its main storeyard the Northwestern Electric Company of Portland, Ore., has installed a simple jib crane, shown in the accompanying illustration. Previous to this time a small rotary crane without jib traveler was used. This crane could be used only to swing heavy loads on and off trucks as it had no traveler on the



THE 8,000-LB. CONCRETE MASTS WERE RAISED AS ORDINARY POLES, WHILE CONCRETE CROSSARM WAS HOISTED BY SPIRAL DERRICKS




CRANE USED BY NORTHWESTERN ELECTRIC COMPANY REDUCES TIME AND EXPENSE OF HANDLING TRANSFORMERS

The construction details of the handling crane are shown in the drawing. The numbers indicate the order in which the parts were assembled. The insert shows the completed crane in operation.

jib. Transformers and other heavy articles had to be moved some little distance by hand to storage space. On this account the cost of handling several transformers and other material each day was quite an item. In addition, the time lost during the manual operation became of prime importance when it was necessary to take out transformers in case of emergency. Transformer bushings were quite often broken while the transformer was being shifted by hand.

The new crane has a capacity of 3 tons, has a travel of 20 ft. along the jib arm and can be swung around in a complete circle. A differential block is suspended from the traveler of the jib, permitting the traveler to be moved the full length of the jib arm by means of a block and endless rope operated from the foot of the mast. The mast is set in a cast-iron thrust bearing mounted on concrete foundation. A steel pin is set at the top of the mast, and by means of a loose collar on the pin the mast is guyed in three different directions to anchored stubs.

This equipment enables one man easily to handle transformers to and from the truck and storage space. The cost of the crane complete was approximately $425. It was designed and erected by the company.

E. F. Pearson,
Electrical Engineer.
Northwestern Electric Company,
Portland, Ore.

## Periodic-Test Schedules

A NUMBER of the more important rules and regulations relating to meters issued or revised during the past year by state and municipal authorities are given herewith.

The principal changes in the Illinois rulings are that induction-type meters not exceeding 25-amp. rated capacity, which meet the requirements of the Meter Code, are to be tested every forty-eight months instead, as under the previous rule, every thirty months. With respect to installation tests the period within which the test is to be made has been extended from sixty days up to one year, provided that the meter is inspected for connections and mechanical condition within sixty days.

The Michigan Public Utilities Commission has issued an order that includes some regulations governing metering and service methods. Definite rules on meter switches and trims have been issued by Detroit for that city.

The rules and regulations of the Public Service Commission of New York governing the testing of watt-hour meters and the reporting of such tests to the commission have been made to apply to the entire state, whereas the former rules applied to only part of the state.

The Public Service Commission of Montana has adopted rules and regulations prescribing standards for electric service. The rules relative to meters and meter testing are incorporated in this order.

A comparative tabulation of periodic test schedules as prescribed by four commissions is given below.

Field Editor Electrical World.
New York, N. Y.

COMPARATIVE TABULATION OF PERIODIC METER TEST SCHEDULES

| New York | Illinois | Michigan | Montana |
|---|---|---|---|
| D. C. meters, periodic tests:<br>Up to 25 amp., 30 mos.<br>25 to 200 amp., 18 mos.<br>200 to 400 amp., 12 mos.<br>Over 400 amp., 6 mos.<br>Installation tests within 60 days.<br>A. C. meters periodic tests:<br>Up to 25 amp., single-phase, 42 mos.<br>Over 25 amp., single-phase, 24 mos.<br>Up to 150 amp., polyphase, 24 mos.<br>Over 150 amp., polyphase, 12 mos.<br>Single and polyphase, not over 100 kw., 2,000 volts, 12 mos.<br>Single and polyphase, over 100 kw., 2,000 volts, 6 mos.<br>Test before or within 60 days of installation. | D. C. meters, periodic tests:<br>Up to 50 amp., 18 mos.<br>Over 50 amp., 12 mos.<br>Installation tests within 60 days.<br>A. C. meters, periodic tests:<br>Up to 25 amp., single-phase, meters meeting code requirements, 48 mos.<br>All others, 30 mos.<br>Over 25 amp., single-phase, 24 mos.<br>Self-contained polyphase, not over 50 kva., 12 mos.<br>Self-contained polyphase, over 50 kva., 24 mos.<br>Transformer meters not over 50 kva., 24 mos.<br>Transformer meters over 50 kva., 18 mos.<br>Installation test within 12 mos. and inspection within 60 days. | D. C. meters, periodic tests:<br>Up to 50 amp., 18 mos.<br>Over 50 amp., 12 mos.<br>Installation inspection within 30 days<br>A. C. meters, periodic tests:<br>Up to 25 amp., single-phase, 36 mos.<br>Over 25 amp., single-phase, 24 mos.<br>Polyphase up to 150 amp., 24 mos.<br>Polyphase over 150 amp., 12 mos.<br>Installation inspection within 30 days. | D. C. meters, periodic tests:<br>Up to 25 amp., 24 mos.<br>Over 25 amp., 18 mos.<br>Installation tests immediately before or within 60 days of installation.<br>A. C. meters, periodic tests:<br>Up to 25 amp., single-phase, 36 mos.<br>Over 25 amp., single-phase, 24 mos.<br>Self-contained polyphase up to 50 kw., 18 mos.<br>Over 50 kw., 12 mos.<br>Polyphase meters with current or current and potential transformers, 24 mos.<br>Test before or within 60 days of installation. |

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## Electrical League Co-operation

**Better Business Methods Have Resulted from the Organization of Local Leagues in Eleven Districts Served by the Public Service Company of Northern Illinois**

BASED on the theory that the better business man the contractor-dealer is the better it will be for the central station, the Public Service Company of Northern Illinois during 1922 was instrumental in the organization of electrical leagues comprising the contractor-dealers in the territory served by the company. Each local league, of which there are eleven, is under the direction of officers elected by the members and the contractor-dealers are represented 100 per cent. The Public Service Company of Northern Illinois also is a member and an active force in the work of each league.

Meetings of the leagues are held monthly, and among the important subjects which have been studied at these meetings has been that of cost keeping. Methods of handling cost records, the costs of material, overhead and profit, the effect of cut-throat competition without considering the cost of doing business, the organization of working forces, shop forces, analysis of actual costs on the job and the proper methods of estimating and bidding on jobs have been under consideration in the meetings.

Efforts have been directed toward better advertising and better window displays. Special work to improve the appearance of show-window cards has been done, and signs for the use of the contractors on their wagons or cars are also being prepared.

Methods of carrying deferred payments on appliances have been considered and financing plans provided. The installation of adequate electrical equipment, including convenience outlets, to take care of the future needs of the home owners and to pave the way for future merchandise sales, has been studied.

In the early days of the organization of the leagues it was discovered at the dinners held that many of the contractor-dealers did not know each other and that the central-station men and the contractor-dealers were in many cases unacquainted with each other. The leagues have remedied this, and in addition it has been possible to bring about a better understanding on the part of both the central station and the contractor-dealer of each other's difficulties.

A most gratifying accomplishment has been to give the contractor a true conception of the work that must be done by the central station in connecting up customers. This has brought about a co-operation between the contractor and the central station that has avoided many of the delays and troubles encountered in making new connections and has developed better service to the customer from both the contractor and the utility. Another subject has been the education of employees of the members of the league to appreciate that they have a vital interest in the business—in other words, they have been convinced that they are more than wage drawers.

### Electrical Shows and Exhibits

One activity of the past few months is the construction of electrical homes. These projects have been handled by a building committee of the electrical league. The homes have been widely advertised, the names of the contractors responsible for the project being connected with the advertising. Electrical shows have been held under the direction of the leagues, and during this winter at least one of these shows will be held in each district.

For organization purposes the territory has been divided into arbitrary districts, usually by counties, though in the territory immediately adjacent to Chicago smaller divisions have been used. This has been a case of fitting the district to the organization desired by arranging it so that the men who would naturally be grouped together are brought into the same body.

Not only have the members of the leagues been provided with valuable educational material, but the central station has benefited from the co-operation. Among other things a substantial number of new stockholders have been obtained, and the better understanding brought about in the league association has made friends for the Public Service Company of Northern Illinois. In some cases where it has not been possible for the company to maintain convenient trouble organizations the contractors handle trouble calls.

While the work of the leagues has been under way only a year, the results in better service and better business relations make the members very enthusiastic over future possibilities. The work has been carried out as far as the Public Service Company of Northern Illinois is concerned by the company's district superintendents, who are: Theo. Blech, Waukegan; J. S. Reesman, Evanston; H. L. Judd, Oak Park; G. E. McCollum, Crystal Lake; O. L. Hyatt, Chicago Heights; L. C. Stephens, Joliet; B. G. Smith, Kankakee; J. A. Schabeck, Lacon; W. J. Brown, Ottawa; V. V. Parshall, Pontiac; W. C. Dowdy, Streator, and T. J. Mulvey of the contract department, under the direction of John C. Learned, assistant to vice-president.

## New York Edison Schedules Seven Special Exhibits

THE recently organized Bureau of Exhibitions of the New York Edison Company, under whose auspices all future specialized electrical exhibits by the company are to be held, has announced a schedule of seven shows to be held between January and June. These seven shows will cover electric signs, electric heating, household equipment, electro-therapeutics, ventilation and refrigeration and electric trucks. All the

displays will be in the Irving Place showroom of the New York Edison Company and will be free to the public. As with previous shows of this sort, the exhibits will be by invitation and there will be no sale of space to exhibitors.

The electric sign show will be the first of the series. It will be held during the week of Jan. 29 to Feb. 3. The other shows scheduled are as follows: Heating, Feb. 19 to 24; washing machines, ironing machines, and dishwashers, March 12 to 17; power, ventilation, and refrigeration, April 2 to 7; electro-therapeutics, April 23 to 28; vacuum cleaners and floor machines, May 14 to 19; electric trucks, cars and accessories, June 4 to 9.

The general management of all the shows will be under the direction of Lincoln Bancroft, manager of the bureau of exhibitions, but in each show he will be associated with the manager of the department of the Eidison company specializing in that particular field.

## Comparison of Utility Rates with Commodity Prices

THE relation of gas and electric rates to commodity prices and the cost of oil is shown graphically in the accompanying chart prepared by the Railroad Commission of California. It includes the years 1914 to 1922, covering the pre-war, war, reconstruction and "return-to-normalcy" periods. In its annual report the commission states that there was a downward trend in the cost of several important classes of public utility service in the fiscal year ended June 30, 1922, and that a corresponding reduction was concurrently reflected in public utility rates. Regulation, the commission adds, has demonstrated its flexibility and its responsiveness to general economic conditions. It is shown that the maximum increase in electric rates over 1914 levels was 36 per cent and the present excess is approximately 16 per cent, while commodity prices soared to 173 per cent over normal at the 1920 peak and are still between 60 and 70 per cent above pre-war prices.

The information compiled by the United States Department of Labor showing the variation of the wholesale price index over the period from 1914 to April 1922, has been used to plot the curve of commodity prices in the chart. A study of this index curve will show that the average price has increased from a basis of 100 per cent in 1914 to a peak of 273 per cent during the early part of 1920. Just after this peak was reached there was a very sudden decrease to 150 per cent during June of 1921. From that time to the present the index price has slightly increased.

In comparison with the variation of this wholesale index price it is interesting to compare the variation of electric rates of utilities operating in California. Considering the rates of the Pacific Gas & Electric Company, it will be noted that the maximum increase in electric rates of this utility occurred during the middle of 1920, and on the basis of the rates during 1914, assuming them to be 100 per cent, the maximum increase amounted to 34 per cent. This maximum increase remained in effect for a period somewhat less than a year, when during the early part of 1921 rates were lowered to the present charges, which are approximately 23 per cent above those in effect in 1914. In the same way the increase in the rates of the Southern California Edison Company made these 43 per cent in excess of 1914 rates. The maximum increase lasted for only nine months, and on Jan. 1, 1921, rates were reduced by about 6 per cent and again in April by 5 per cent. A further reduction in May, 1922, of 10 per cent brought about the present rates, which are now approximately 16 per cent above the rates in effect during 1914.

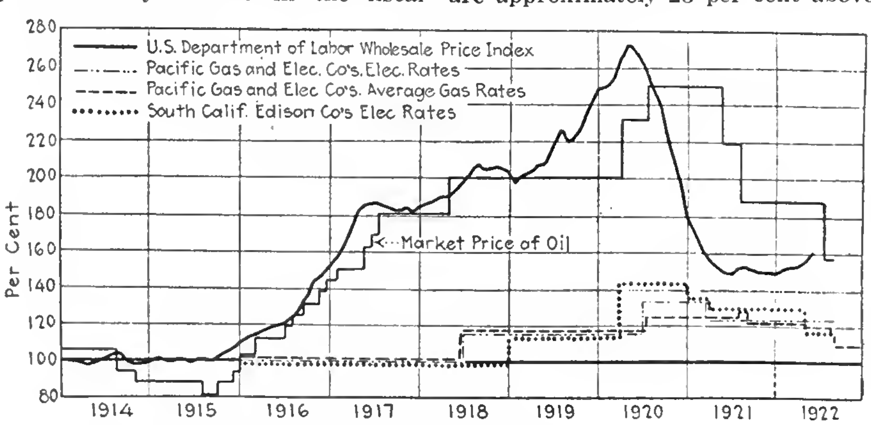



CHART SHOWING COMPARATIVE FLUCTUATIONS OF UTILITY RATES AND COMMODITY PRICES

The rates of other utilities varied in a similar manner to those of these two companies. The average maximum increase of rates for all electric utilities in the state did not exceed 35 per cent over the 1914 rates. The increase of 173 per cent in the price of commodities was over five times the increase in electric rates during this period.

## Electric Ranges Serviced by Dealers

BY W. M. CRAWFORD
General Agent California-Oregon Power Company, Medford, Ore.

AFTER trying out and discarding a number of plans for servicing electric ranges, the California-Oregon Power Company has adopted a very satisfactory arrangement whereby the electrical dealers service the electric ranges they sell. The company replaces fuses and renders only such service as it would to a power customer or any other consumer on its lines.

This company actively entered the range field in 1912, when the electric range was not so reliable a piece of electrical apparatus as it is today. At that time it was necessary for the power company not only to adopt a very liberal servicing policy but to sell and in many cases install the range as well.

About 1916, at the request of the dealers in this territory, the company increased the prices of ranges to a point where the dealers could make a legitimate profit on their sales, and the company maintained prices so that the dealers could go after the business. Before that time the company had been selling ranges at only a small percentage above cost. The company still continued to sell ranges and also to service them, making charges for the servicing at prices which the dealers maintained were unprofitable.

The contractor-dealers also serviced ranges and the company used its influence to throw this business of maintenance to the dealers where it could be done without losing the good will of the customers. In 1918 the company discontinued the sale of ranges, throwing this business

entirely to the dealers, who by this time had become quite active. It also discontinued servicing ranges at the same time, and this practice has been continued ever since. The company's activity in connection with range sales since that date has been confined to efforts through the dealers. All sales are made through the dealer — the dealer installing the range and thereafter servicing it.

We believe that we have been reasonably successful in this procedure, inasmuch as 23 per cent of all of our residential customers in this district have electric ranges installed and we have eliminated a great deal of work and expense.

# "The Public Servant"*

## Application of Some Ancient Laws Which Give a Refreshing Slant to Present-Day Public Relations Problems of the Utility

BY DONALD MCDONALD
Vice-President and General Manager
Louisville Gas & Electric Company

WHOEVER coined the expression "public servant" to describe the utilities performed a real service both to the companies and to the public. No relation of life is older or better understood than that of master and servant. The oldest code of written law is that of Hammurapi, an ancient king of Babylon, which provides among other things for the relation between master and servant. The law of Moses enjoins on the servant diligence, honesty and efficiency; it enjoins on the master justice, kindness and intelligence.

Among the other wise statements contained in the Bible is the one which says "No man can serve two masters." People are prone to forget this. National laws commanded the railroads to obey the Interstate Commerce Commission, whose jurisdiction covered the whole of the United States. State laws commanded the same railroads, within the limit of the state, to obey the rulings of the State Railroad Commission. In some cases these rulings conflicted, and endless confusion resulted.

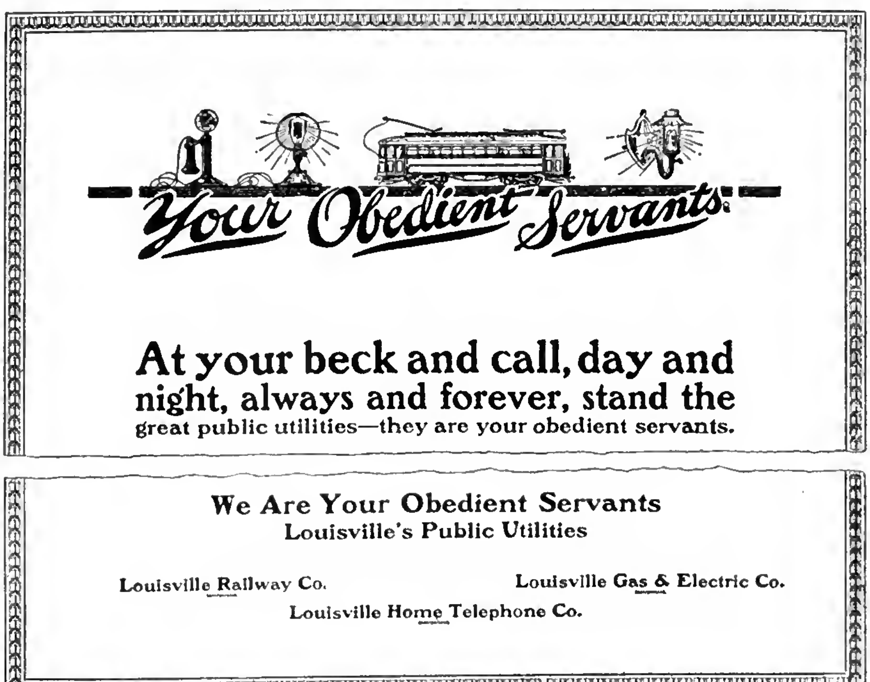
### CONFLICT OF AUTHORITY OVER SERVANTS

Other public utilities were placed under state commissions, while at the same time certain cities claimed and exercised the right to regulate these same utilities. Recent enactments have wiped out most of these conflicts, but the fact is just as true as it was four thousand years ago that no servant can serve two masters.

The relation of master and servant imposes on the servant the exercise of a certain deference to the wishes of the master, even when the master is somewhat unreasonable. A wise public servant will remember this. People will neglect to apply for gas until the weather is actually cold, and then forget that a hundred others have done the same thing and each one feels that he should be served first. A certain amount of good temper in picking out the hardest cases and a large amount of hustling, so that two days' work may be done in one, in this way relieving people from the consequences of their own carelessness, will help the company.

We also learn from Holy Writ that "the laborer is worthy of his hire," and no man promotes his own comfort or interest by beating down that hire to a point which is below the cost of decent living. People are proud of the fact that their servants are well housed, well fed, well paid and contented. I have heard them boast of how cheaply they bought goods, but I never heard a man boast of the fact that his servants were underpaid or underfed. I have, however, heard men boast that in their city the street-car fare was five cents, although they knew that the actual cost of carrying them was more than that. On the whole, communities have reached a saner and more just attitude toward the public utilities.

The relation of master and servant implies not only diligence and respect on the one hand and justice and consideration on the other, but it also implies mutual knowledge of the difficulties and perplexities which each side is compelled to face. Service that would be adequate on ordinary days becomes inadequate when sickness or death invade the house, or when a wedding or a funeral brings a large number of people to the master's house and to his table. At such times the servant must make unusual effort and do his very best to see that the emergency is adequately met. Fires and floods and fairs impose similar duties upon the public utilities. The demand upon them increases suddenly and the importance of their service to their pa-




PREACHING THE GOSPEL OF SERVICE

Mr. McDonald's paper has been very favorably commented on by the press throughout Kentucky, and, following up the public-servant idea, three of the Louisville utilities combined to issue the accompanying advertisement on New Year's Day.

*From an address at the annual meeting of the Kentucky Association of Public Utilities at Lexington, Ky., Dec. 12, 1922.

trons becomes even greater than usual.

The wise manager is prepared for such emergencies, but in order to be prepared he must have such a revenue as will enable him to pay all of his bills promptly and to pay a fair return upon the investment which has been made by his stockholders. Without this he cannot enlist the additional capital which is necessary to provide far in advance the machinery which will be needed to meet the emergencies when they come.

### The Dignity of Service

The rôle of public servant is an honorable rôle. Again we can quote scripture in saying, "He that would be greatest among you, let him be your servant." Every man who is neither a thief nor an idler nor a beggar serves some one. He has at least one master. If he is highly placed, he is apt to have many masters. The President of the United States serves more people than any other man I know. The head of a great corporation appears at a glance to be almost an autocrat. "He sayeth unto this man, 'Come,' and he cometh, and to another, 'Go,' and he goeth," but he cannot with impunity violate the sense of fairness which is in the minds of all those that look to him for orders, he cannot be arbitrary and he cannot be unreasonable. More than this, he must himself take orders from his stockholders and from the representatives of the public.

All that the public utilities have a right to ask is that in public matters the public speak with one voice, that they speak through an authority which is recognized by both sides, and that that authority informs itself of the facts before it issues orders.

### Consideration of the Master for the Servant

The most momentous event in human history came through the failure of a master to inform himself as to the needs of his servants and to adopt a sympathetic attitude toward those needs. Pharaoh said to the children of Israel, "Make bricks without straw, and the tale of the bricks shall not be diminished." In other words, these overburdened slaves must go into the fields and gather stubble, and in spite of the time lost in this way they must make as many brick as they made before, when the straw was delivered to them. Of course, there was great discontent and great wailing. There followed hail and storm, plague and pestilence, and eventually Pharaoh yielded and allowed them to go. He not only allowed them to go, but he speeded their parting in every way—in fact, he thrust them out.

It frequently happens that "the wrath of man is made to praise God"; that the mistakes and stupidities and stubbornness of a utility on the one side or of a municipality on the other finally result in a better day for both sides. But the better day comes after plagues and storms. It is much better that each side should recognize the rights and the interest of the other. It is much better that the utility take care to be a good servant and that the municipality take care that it shall be a good master.

## Oklahoma's Municipal-Plant Shutdowns

In 1922 a large number of individual electric light plants were sold or abandoned in Oklahoma. Ten of these were municipally owned. These towns decided to dispose of their plants and take energy from the high-tension lines of privately owned companies.

Among the towns are: Okemah, which has signed a contract with the Oklahoma Power Company; Heavener, which sold its plant to the Oklahoma Gas & Electric Company; Hunter, Billings, Watonga, and Geary, which gave up municipal plants to take service from the Oklahoma Gas & Electric Company; Boswell and Soper, which signed a contract with the Public Service Company of Oklahoma; Ramona, which voted to abandon its municipal plant to receive service from the Sand Springs Power, Light & Water Company; Wapanuck, which sold its plant to the Public Service Company of Oklahoma; Pawhuska, which was connected with the high-tension line of the Sand Springs Power, Light & Water Company. Norman and Lawton abandoned their municipal electric lighting projects and are buying energy from the Oklahoma Gas & Electric Company. Eldorado a few weeks ago completed a high-tension line to the plant of the Quana Light & Ice Company at Quana, Tex., and Purcell is now negotiating for electricity over a line which is to be extended south from the town of Norman and through Noble to Purcell.

## What Other Companies Are Doing

**Boston, Mass.**—Seventy-one percolators were sold in one day recently by the Edison Electric Illuminating Company of Boston in the Davis Square district of Somerville in a co-operative movement with the local Chamber of Commerce designed to encourage popular buying in particular neighborhoods.

**Illinois.**—Electrical homes built in the Chicago territory during 1922 have not fallen behind the pace set in other districts. In River Forest, a Chicago suburb, a twelve-room house costing $60,000 was constructed during the summer. It contained a total of 200 outlets connected to thirty-two standard appliances and drew an attendance of 30,000 with an average daily number of visitors of 1,200. This house was planned by an organization of electrical contractors and the Public Service Company of Northern Illinois. During the fall a smaller house was built in Wilmette which combined the use of gas and electricity. Then in December, at Hammond, Ind., a house costing $20,000 was opened, also built through the efforts of the local contractors and the utility company.

**Altoona, Pa.**—Thirty new electric display and advertising signs were erected in Altoona during the twelve months of 1922, according to the annual report of Building Inspector M. W. Craine. The total is the largest for any year in the city's history and followed the adoption by the city of a favorable ordinance regulating the use of overhanging electric designs.

**Berlin, Wis.**—To create interest in water-power development the employees of the Wisconsin Power, Light & Heat Company have constructed a miniature hydro-electric plant which is being displayed in the various cities which the company furnishes with power. The model is an exact reproduction of the power plant at Prairie du Sac and represents the dam and power house on the Wisconsin River there.

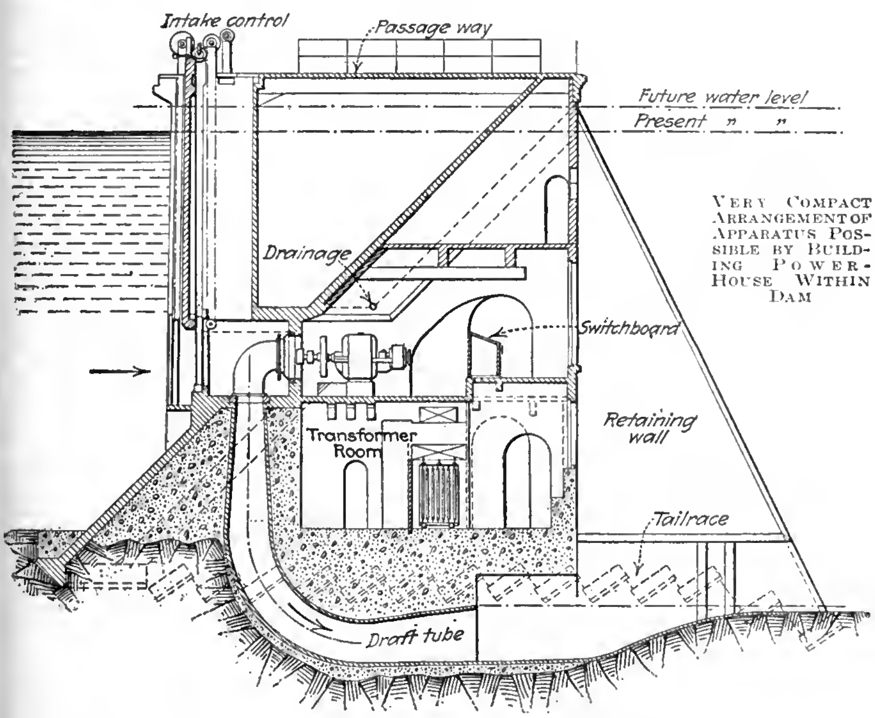
**Worcester, Mass.**—The New England Power Company plans to erect a new 110,000-volt transmission line from Davis Bridge, Vt., to Millbury, Mass., enabling energy to be obtained from the new development on the Deerfield River now under construction to be utilized in the central Massachusetts district.

# Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Hydro-Electric Station Built Into a Dam.*—A power house built compactly into a dam is described in this paper, the first of its kind in France and probably in Europe. Across the river Léguer, near the British Channel, at Belle-Isle-en-Terre, a reinforced-concrete dam inclined at 45 deg. and consisting of fourteen semi-circular vaults has been erected. The three middle compartments serve as engine room and have each three stories. On the lowest level are placed the transformers, the middle tier carries the turbines, alternators and bench-type switchboards, and the upper story contains the buses and protective apparatus. The three turbine sets, each of which is inclosed in an individual vault, are of different sizes, 175 hp., 300 hp. and 600 hp. The third unit has not as yet been installed. A hydraulic head of 10.8 m. is available for these horizontal-shaft Francis turbines, to which the generators are directly connected. About one-third of the head is utilized in draft tubes from the turbines. The transformers transform the machine voltage of 220 to the transmission voltage of 15,000, supplying a paper mill 4 km. away. The limited height of the power-house vaults did not permit the installation of a crane. The hydraulic part of this station is of a design very unusual in France, and the bulk of the article is devoted to detailed description of this, including also a general description of the entire plant.—*Génie Civil*, Dec. 9, 1922.




VERY COMPACT ARRANGEMENT OF APPARATUS POSSIBLE BY BUILDING POWER-HOUSE WITHIN DAM

*Economic Design of Power Plants.*—H. MIDGLEY.—The author presents certain elementary facts which are rarely put before young engineers in training and gives such information on cost as affects design and concerns the preparation of estimates. In the comparison of plants an attempt should be made to estimate the relative cost of repairs. Even though the estimate may not be quite accurate, such a procedure will lead to a much closer comparison of the relative importance of various factors than would otherwise be obtained. For power producers on a high load factor using fuel at an average price it is worth while paying the extra sum required by highly economical plants. For power producers on a low load factor and for standby plants the cheapest possible plant should be installed consistent with reliability, but almost regardless of fuel consumption. —*Beama*, December, 1922.

## Transmission, Substations and Distribution

*Experiences with Aluminum Wires.* —A. G. ERFTWERK.—The data contained in this short article, describing a practically copperless substation for smelting works, are of interest. The station receives its power over four three-phase lines of steel-aluminum, each with a total cross-section of 105 sq.mm., of which 25 sq.mm. is steel, at a voltage of 110,000. Joints in these cables, which were manufactured in 2,000-m. lengths, are made with galvanized-iron clamps with inlaid sheets of aluminum. These lines have been in operation for four and one-half years. The three main transformers, each rated at 30,000 kva., 110,000/5,000 volts, have aluminum windings and have given uninterrupted service. Fifteen rotaries of 4,000 kva. each have aluminum high-voltage windings with welded joints. Between these rotaries and the switchboards aluminum cables of the underground type are used. All buses and connecting lines of the 5,000-volt system are of aluminum. Owing to the high expansion coefficient of aluminum some of these connections on the disconnecting switches worked loose, heated and finally melted off. This was found to be due to too small a contact surface, and after enlarging the contacts 100 per cent no further trouble was experienced. All bars between the rotaries and the smelting furnaces, carrying 12,000 amp. at a density of 0.7 amp. per sq.mm., have given satisfactory service. A large number of rubber-insulated aluminum wires are used for the distribution of light, all joints being made on brass terminals in the junction boxes. Up to the present no electrolytic trouble of any kind has arisen.—*Elektrotechnische Zeitschrift*, Dec. 7, 1922.

## Units, Measurements and Instruments

*Use of Condenser Bushings for Measuring Purposes.*—G. KEINATH.—Bushings built upon the condenser principle, such as are used extensively on high-voltage oil switches, transformers or wall-entrance leads, may be easily arranged to measure voltage, frequency, charging current or insulation, or to synchronize machines, whenever a moderate accuracy is sufficient. Atmospheric conditions may introduce an error of up to 5 per cent. Between the last and next to last condenser layers of such a bushing a static voltmeter may be connected to measure, after proper calibration, the voltage against ground. To measure the insulation against ground of very high-voltage lines during their operation, the author suggests connecting the two last condenser layers to the primary of a specially designed but inexpensive current transformer, insulated for only about 6,000 volts, with a winding ratio of 1 to 170, transforming the primary current of 3 milliamperes to 510 milliamperes, and energizing with the latter current a standard soft-iron instrument calibrated in volts. In a similar way, frequency meters of the resonating comb-type system, or synchronizing meters, may be connected over a small transformer to a condenser bushing. A considerable saving may further be realized in watt measurements by combining an ordinary current transformer with the above transformer connected in "V" to two con-

denser bushings. The charging current of these two bushings for a three-phase line is in phase with the Y-voltage and is fed over the small transformer to the moving coil of the watt-meter, while the stationary current coil is energized from the secondary of the standard current transformer. All of the new high-voltage condenser bushings of one German concern are now equipped with bands connected to the last two metallic layers to enable the customer to take advantage of the simple measuring methods mentioned in the description above.—*Siemens Zeitschrift*, November, 1922.

## Illumination

*Development, Present Status and Problems of Electrical Illuminants.*—H. LUX.—The author outlines the historic development of arc and incandescent lamps. It is shown that it is economically wrong to try to increase the amount of light from a filament by an increase of its temperature, because a visual efficiency of only 14½ per cent can be reached theoretically. With increasing temperature the maximum of radiation is gradually shifted from the long-wave end of the spectrum into the short-wave end. At 3,600 deg. the radiation enters into the just visible red end at 800$\mu\mu$ and leaves the visible end at 7,200 deg. at the violet end, at 400$\mu\mu$. The highest visible efficiency is reached at 5,200 deg. at a wave length of 556$\mu\mu$. If we should succeed in developing a radiator emitting only visible rays, the highest possible light energy would be reached at 4,250 deg. with 248 lumens per watt. A light source with 100 per cent efficiency could be obtained from a radiator giving off rays near the 556$\mu\mu$ maximum. Such a light would give the highest possible output—about 650 lumens for each watt input. But we are far from having reached the ideal light emission of 247.5 lumens per watt. The flaming arc gives 40 lumens per watt, and the mercury vapor lamp in a quartz tube 54 lumens per watt, but their light is quite disagreeable. Another matter of great importance is the light density. It rises enormously with the temperature. With a black body radiating at 6,500 deg. a density of 73,000 cp. to 150,000 cp. per square centimeter is obtained for a bright body or other selective radiator. Such a terrific density would cause instant blinding. A flaming arc gives a density up to 1,000 cp. per square centimeter, which is so high that artificial means have to be employed to lessen the glare. New and more promising ways of obtaining the ideal source of light are shown by the modern electronic theories. If electrons are emitted from a hot cathode and allowed to hit the atoms of a vapor or gas at low pressure, they will be reflected until the reflection potential is reached, when the entire energy of the impulse is absorbed and the radiation of a spectral line is generated without ionization. If now the pressure is increased to the ionization value, all electrons will be driven out of the atom and will unite to form a new atom, forming a complete spectrum. Assuming, for example, a tungsten cathode heated to 2,800 deg., an electron stream of 8.4 amp. per square centimeter is available, producing in the ideal gas a light at 2.2 volts, resulting in 12,300 lumens. To heat the cathode 126 watts will be required, resulting in 2,300 lumens, which would give a total of 12,300 + 2,300 ÷ (18.5 + 126), or 101 lumens per watt. — *Elektrotechnische Zeitschrift*, Nov. 23 and Dec. 7, 1922.

## Motors and Control

*Selection of Electrical Systems for Iron and Steel Works.*—J. MACSHEEHY.—The author describes the demands that iron and steel works make on the electricity supply and discusses the system which he considers most suitable for meeting these demands. Stress is laid on the necessity for thermal efficiency, reliability, adaptability and standardization. The three possible systems of generation, transmission and distribution are considered. The direct-current motor is shown to be the most efficient for intermittent duties.—*Electrician*, Nov. 24, 1922.

*Use and Maintenance of Safety Switches.* — R. B. ANDERSON. — The author takes up typical safety-switch applications and discusses some of the factors that enable this type of switch best to carry out the fundamental purposes of its construction and use in the operation of industrial motors. Because a safety switch is inclosed and made as nearly accident-proof as possible, many men responsible for maintenance forget that it is an operating mechanism and should have inspection and attention of the same nature that is paid to the vital parts of any other system.—*Industrial Engineer*, November, 1922.

## Traction

*Methods Used to Lessen the Corrosive Effect of Stray Currents from Street Railways.*—H. F. ZANGGER.—The author assumes an imaginary street-railway network with given currents at all feeding points and calculates the return currents through the rails and the ground for all sections of the system. It is shown how the dangerous stray currents through the ground which corrode metallic pipe lines of gas and water systems can be reduced to an almost negligible amount by a judicious location of feeding points and the use of additional return-current cables of proper cross-section. A graphical representation of the stray currents along the sections shows in a striking way the large improvements which can be realized by such a reconstruction of any existing rail system having excessive stray currents. The author enlarges further upon his example by adding new extension lines to the improved system, and shows that to keep stray losses down additional return cables would have to be installed in the previously perfect system to take care of unbalancing of network introduced by added lines.—*Bulletin de l'Association Suisse des Electriciens*, November, 1922.

## Heat Applications and Material Handling

*Possibilities of Electrical Precipitation in the Chloride Volatilization Process.*—THOMAS VARLEY and H. W. CLARK.—The Cottrell process of electrical precipitation was described in the November, 1921, issue and a number of its applications have been dealt with, particularly those with reference to the precipitation of fumes from furnaces for treating tin drosses (December, 1921), dust from cement mills (February, 1922) and the cleaning of blast furnaces (July, 1922). In this article the authors describe the possibilities of electrical precipitation in the chloride volatilization process. In the event that the electrical precipitator for this service proves a commercial success—and from the tests described this seems probable—the results will be far-reaching and extensive changes from what is now considered standard practice may be looked for within a comparatively short time. — *General Electric Review*, December, 1922.

## Telegraphy, Telephony, Radio and Signals

*Sensitivity and Precision of the Electrostatic Transmitter for Measuring Sound Intensities.*—E. C. WENTE.—By means of a "pistonphone" and a thermophone, for which corrected formulas are available, both the absolute sensitivity and the phase lag were determined for frequencies of from 10 cycles to 12,000 cycles. Eight transmitters similarly constructed give the same curves within 20 per cent. Combined with an amplifier of ordinary design, the instrument has an over-all sensitivity which is practically uniform from 25 cycles to 8,000 cycles. It is therefore remarkably well adapted for the measurement of the intensities of complex tones and tones of changing pitch and for use with an oscillograph for recording sound waves. If sounds of a definite pitch are to be measured, the apparatus can be made highly selective and almost any desired sensitivity can be obtained by using a tuned amplifier in connection with a vibration galvonometer.—*Bulletin B-7-1 of the Engineering Department, Western Electric Company.*

*Secondary Standardizations of Radio Wave Meters.*—A method of standardizing wave meters for both the transmitting and receiving type is described. In the receiving type the standardizing consists in measuring by means of a standard wave meter the frequencies emitted by a generator of continuous waves which is tuned to resonance with the wave meter under test at various settings of the scale of the latter. In the transmitting type the process utilizes the make and break of a buzzer which excites the wave meter by impact and emits waves the frequency of which is regulated by the wave-meter setting. (A limited supply of this letter circular is available to persons who have use for such information.) *Letter Circular No. 75, Bureau of Standards.*

# New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

## Year Book of Wireless Telegraphy and Telephony, 1922

London: The Wireless Press, Ltd. 1,472 pages.

In this, the tenth successive issue of the "Year Book of Wireless Telegraphy and Telephony," no change of importance has been made in arrangement or subject matter; in fact, much of the material was taken from the 1921 volume. The standard sections have, however, been revised and brought up to date. If the material included in the sections on "Wireless Developments (1827-1921)," "The Birth and History of Long-Distance Telegraphy" and "Biographical Notices" were expanded and published in a separate volume, a service would be rendered. There appears to be no reason why this historical matter should be included in a year book already overgrown. Approximately one-third of the book is devoted to the radio laws and regulations of all countries of the world and one-third to a directory of land and ship stations. With a few exceptions, private and experimental stations are not included in the book.

The year book fulfills its function of giving information regarding developments of the preceding twelve months in the sections on "National Résumés of Technical Progress in Radio Communication," "Patents," "New Radio Books" and a résumé of articles published during 1921 which are of particular value. Interesting technical articles on the "Progress of Wireless Telephony in Aircraft," "The Recording of Wireless Signals," "The Rectification Effect in the Reaction to the Composition and Structure of Crystals" and "The Earthing Resistance of Antennæ" are included. The section on standard wireless publications is convenient for reference purposes. In view of the phenomenal growth of interest in amateur activities in this country during the past year, it is rather surprising to find no mention of the development of radio broadcasting or the influence it is exerting upon the general public. H. M. TURNER.

## The Electrometallurgy of Steel

By C. C. Gow. New York: D. Van Nostrand Company. 351 pages.

This book recounts the historical development of the electric furnace and gives considerable information on the electrical characteristics of the various types of furnace. A part of the volume is given up to highly theoretical electrical features of various furnaces. This possibly represents the author's chief interest. The matter relating to the metallurgical side of the problem is a summary of what has been covered in previous literature. The book presents no very striking advance in known facts, but if one wishes an elementary survey of the general field it will be found in this volume in very readable style. E. E. THUM.

## Machines Electriques: Theorie, Essais et Construction

By A. Mauduit, professor in the faculty of sciences at Nancy, France. Third edition. 1,180 pp., illustrated. Paris: Dunod.

In an analytical preface to this work, Prof. A. Blondel gives an estimate of its value which is so comprehensive that an abstract will serve better than anything else to show just where it fits in. Professor Blondel says that he has a high opinion of the achievements of Professor Mauduit, whose career he has followed with a lively interest.

Referring to the book, Professor Blondel says that, avoiding general or theoretical electrotechnique, the author has devoted attention to detailed study of practical means of applying theory in actual machines. He has produced a personal work in which he has presented clearly and directly the essential elements of each theory, that which is directly applicable. In many cases he is the first to combine in a new arrangement elements which thus associated have double value for those who wish to apply them. He has added many remarks and counsels inspired by his own experience.

Among the new subjects treated in the present edition, Professor Blondel draws attention to the important advances in the theory of continuous-current dynamos, in which Professor Mauduit is an expert on commutation. There is no work where the study of commutation is treated so exactly and on such a solid experimental foundation. Noteworthy are the treatment of non-sinusoidal currents, magnetic fields in alternating-current machinery, three-phase transformers and practical calculations of induction motors.

The author has also made a new development in the study of synchronous machines in giving a place to the theory of double reaction. He introduces also questions relative to the short-circuiting of alternators and the coupling of alternators with dampening circuits.

In the study of alternating-current motors with collectors he has unified the theory of the different types, notably in that which concerns the study of resultant flux, commutation and saturation. Space has also been given to mercury-vapor converters, dynamos with three brushes, and so forth.

One sees, says Professor Blondel, that the new edition is almost a new work. Like its predecessors, it constitutes for the electrician-engineer a veritable encyclopedic manual on the construction and utilization of machines in which the reader, young or old, will find the necessary elements for making quick application of recent progress, at the same time that numerous subjects for reflection and study are suggested to him. H. H. NORRIS.

## The Dynamo—Its Theory, Design and Manufacture

By C. C. Hawkins, Vol. I, sixth edition, rewritten and enlarged. Bath, England: Sir Isaac Pitman & Sons, Ltd. 505 pp., illustrated.

The English type of text differs largely from the American and is chiefly meritorious for the accuracy and thoroughness of its treatment. While English books are not making serious encroachments in the schools as classroom textbooks, they are universally respected and consulted by teachers and students.

The present revised volume is an admirable work on the fundamentals of direct-current and alternating-current generators. It discusses these machines from the design viewpoint very largely, but also gives valuable pointers on manufacture and operation. The author uses mathematics and vectors to determine quantitative results and bases his design analysis on the mechanical-force equation instead of the familiar induced-voltage relations. The book is particularly noteworthy in its consideration of mechanical forces associated with machine operation. It is a welcome revision to a well-known text and its technical treatment is greatly improved over past editions.

# Books Received

**Hochfrequenzmesstechnik.** By Dr. Ing. August Hund. Berlin: Julius Springer. 326 pages, illustrated.

**Principles of Electric Spark Ignition in Internal-Combustion Engines.** By J. D. Morgan. London: Crosby, Lockwood & Sons. New York: D. Van Nostrand Company. 92 pages, illustrated.

**Theoretical and Practical Electrical Engineering.** By Louis Denton Bliss. Takoma Park, Washington, D. C.: The Bliss Electrical School. Vols. I and II. 761 and 708 pages respectively, illustrated.

**Depreciation of Public Utility Properties.** By Henry Earle Riggs. New York: McGraw-Hill Book Company. 211 pages.

**Die Wissenschaftlichen Grundlagen der Elektrotechnik.** By Dr. Gustav Benischke. Berlin: Julius Springer. 682 pages, illustrated.

**Ultraviolet Radiation.** By M. Luckiesh. New York: D. Van Nostrand Company. 258 pages, illustrated.

**Radio for All.** By H. Gernsback. Philadelphia and London: J. P. Lippincott Company. 292 pages, illustrated.

**Lehrbuch der Physik.** Vol. II. Magnetismus Elektrizitat. By E. Grimsehl. Leipzig and Berlin: B. G. Teubner. 780 pages, illustrated.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Fire Causes Half-Million Loss at Eagle Rock

The Eagle Rock substation of the Southern California Edison Company was partly destroyed by fire on Monday last, Jan. 8, entailing a loss unofficially estimated at $500,000. The fire, which burned for nearly eight hours, is said to have been caused by the explosion of a 60,000-volt lightning arrester, the flames quickly spreading to a quantity of oil stored in the substation.

## Big Mining Contract Signed in Illinois

To the Central Illinois Public Service Company has just been awarded what is said to be one of the largest, if not the largest, coal-mine electric power contracts in the history of the industry. This took place when a contract was signed between this company and the Old Ben Coal Company, operating several large mines in Franklin and Williamson Counties, Ill. The Old Ben Coal Company mines and ships 6,000,000 tons of coal a year. The contract with the coal company is for a period of ten years and its bill for electrical energy will be $500,000 a year. The Central Illinois Public Service Company will begin to serve the mines on Feb. 1. The coal company plans to electrify the remainder of its properties gradually over the next two years, so that by Jan. 1, 1925, the electricity required will aggregate 750,000 kw. When the mines of the Old Ben Coal Company are connected to the Central Illinois Public Service Company's lines there will be an aggregate of seventy-three mines operated by electricity supplied by this company.

## New York State Commission Pleads Its Case

The annual report of the Public Service Commission of New York State to the Legislature, just made, declares it of great importance to the public welfare and comfort of the people that the public utilities over which the commission has jurisdiction should remain under the close observation of the state government and that ample power of regulation should at all times be vested in some adequate governmental agency, thus taking direct issue with Governor Smith's views.

"The establishment of a single regulatory commission by the Legislature of 1921, in place of two commissions, centered responsibility for regulation of utility operations," says the report. "The centering of responsibility for the regulation of all utilities of a like character was an act of wisdom and has been amply justified by the results of the work of the commission during the year just closed."

The eighty-one Republican Assemblymen, in a secret conference, agreed, to a man, according to Speaker Machold, their leader, to stand together in their action on measures proposed by Governor Smith and the Democrats, who control the Senate and have sixty-nine votes in the Assembly. This pledge is reported to include opposition to the Governor's program of "home rule" and municipal control or ownership of utilities.

## San Francisco Cable Laid at Rate of 3 Miles an Hour

The Great Western Power Company's submarine power cable across San Francisco Bay referred to in last week's ELECTRICAL WORLD, page 56, as one of the largest and longest ever installed, was successfully laid last Monday, Jan. 8. The cable, which is more than 7 miles in length, was laid in one piece and in one continuous operation in the remarkable time of two hours and thirty-seven minutes, or an average speed of more than 3 miles an hour.

## Power to Order Extensions Denied Commission

A decision denying the power of the Wisconsin Railroad Commission to order extensions of water mains has been handed down by Judge George Thompson of the Dane County Circuit Court in a suit growing out of an action of the state against the Washburn Water Works Company. The decision, far-reaching in effect, is thought virtually to nullify the right of the commission to order public utilities of other kinds to make extensions, as has been its custom during a long period of years.

"The jurisdiction of extension of water mains in cities rests with the municipality," Judge Thompson said, and he expressed the opinion that, though the Railroad Commission can review the action, the grant of original jurisdiction to the municipality in such cases is clear and specific under the law.

The court's opinion, it is contended, will have state-wide effect. Heretofore it has been though obligatory for utilities to do the bidding of the commission when extensions of such nature were ordered.

## Bacharach Utilities Bill to Come Up Again

Representative Isaac Bacharach of New Jersey intends to continue to support in Congress his bill to prevent public utility corporations from appealing to the United States courts from rate decisions of state public utility commissions until after they have exhausted all their right of appeal to the courts of the state.

That is the crux of a letter Congressman Bacharach sent this week to Governor-elect George S. Silzer of New Jersey in reply to a letter from the latter urging him to drop his own bill in favor of one prepared by the Governor-elect which is described as "not so broad." Mr. Bacharach intimated that if his own bill is rejected on the claim that it is unconstitutional he will then urge the adoption of the Silzer measure.

## Mergers of Wisconsin Utilities Continue

Control by the Wisconsin Public Service Corporation of Milwaukee of all power plants and service in the northern section of Manitowoc County has resulted from its acquisition of the Oslo Light & Power Company. This purchase followed another under which the Public Service Corporation came into possession of the lighting plant at Mishicot and the plant at Denmark, Brown County, just over the Manitowoc County line. The Reedsville property was acquired some time ago. The Oslo company, with 80 miles of line, serves the city of Kiel and nine villages.

With the acquirement of these plants the Public Service Corporation gains virtual control of the entire northern section of the state, it having also taken over a plant at Oconto, while it is serving the Lake Shore district north from Manitowoc. It maintains a steam plant in Manitowoc as an auxiliary to its High Falls hydro-electric plant and also operates a station at Green Bay.

Coincident with the confirmation of these purchases by the Public Service Corporation came announcement of the sale of the Cleveland (Wis.) municipal electric plant to the Badger Public Service Company, which was later taken over by the Milwaukee Electric Railway & Light Company.

That control of public utilities of the state may soon be vested in one or two big companies is indicated by the reports of transfers and mergers which have taken place in all sections in the past year.

## Wired Radio Broadcasting

### Practicability Is Shown by Recent Tests at New York City and Washington

TESTS of wired radio broadcasting have for several months past been conducted by the North American Company—in New York City in co-operation with the United Electric Light & Power Company, and in Washington, D. C., in co-operation with the Potomac Electric Power Company. The tests formed a practical demonstration of the feasibility of the "wired wireless" method.

In New York communication was established between the Sherman Creek and Hell Gate power stations over the 13,000-volt underground cables. The transmitting apparatus was connected to the high-voltage bus at Sherman Creek through the distributed capacity of a 30-ft. length of lead-covered cable. The receiving apparatus at Hell Gate was connected through the capacity between the primary and secondary windings of a potential transformer, one terminal of each being disconnected, the remaining terminals connected to the high-voltage bus and the receiving apparatus respectively. The wave lengths employed were in the neighborhood of 5,000 m., or 60,000 cycles per second.

In Washington broadcasting was conducted as such over the 2,400-volt, three-phase distribution system from the Georgetown and Tennallytown substations to the Bureau of Standards and to different points in Chevy Chase, D. C., and Maryland. Transmitter connection was effected through mica condensers, and the receiving apparatus was plugged into any convenient light socket. Wave lengths from 3,000 m., 100,000 cycles, to 30,000 m., 10,000 cycles, were employed. On every test reception from an antenna was compared to that over the light wires, and it was consistently found that unless the antenna was in very close proximity to the power lines, the limited radiation which was present at 3,000 m. decreased very rapidly with increasing wave length until it became unobservable at the lower frequencies. At the same time, owing to the decreasing attenuation from other causes with increasing wave length, for the same energy input considerably more energy was available at the receiving terminals.

#### CONDITIONS OF EXPERIMENTS

R. D. Duncan, Jr., radio engineer with the North American Company, was in charge of the tests. Mr. Duncan in the issue of the ELECTRICAL WORLD for Aug. 19 last described certain experiments which had been performed in Cleveland with a view to investigating the practical utility of broadcasting by wired radio over electric lighting and power lines, the results of those experiments indicating, in his opinion, that, though requiring development, this new method of broadcasting not only offered a decided advantage over radio broadcasting but as a means of commercial use—as, for example, communicating over the high-voltage mains between substations and with repair crews, remote control of substations and similar functions—could be made of important service to electric lighting companies in general.

It is to be noted, Mr. Duncan said recently in describing the later experiments in New York and Washington, that the problem of wired radio broadcasting over an interconnected distribution network of a city differs considerably from similar operation over a long-distance, high-voltage transmission line. In the latter case there is a directly connecting, unobstructed path, constituted by the high-voltage conductors, between the transmitting and receiving stations. In the former the distribution network, constituting innumerable paths and to which are connected hundreds of transformers and other forms of power apparatus, besides a multiplicity of receiving sets, forms the interconnecting medium. It is obvious that the attenuating effect of such a network on the high-frequency currents is many times greater than with a high-voltage transmission line.

Furthermore, Mr. Duncan continued, since one of the fundamental objects of this new type of transmission is to suppress or eliminate entirely radiation from the lines, with the consequent interference with radio broadcasting—already in a chaotic condition—the construction of a large outdoor aërial in close proximity to the high-voltage lines and for coupling thereto is, where the latter are overhead, precluded from the start, and of necessity direct connection to the system must be effected in the power house or substation. This is especially true when the distribution system is underground, as is the case in most cities. Connection to the buses in the substation immediately brings up a multitude of problems, such as the effect of attached apparatus, induction voltage regulators and so forth, all of which, it has been found, vitally affect the high-frequency transmission.

#### RESULTS ASCERTAINED

The effect of connecting transformers across the lines has been investigated, and their characteristics at high frequencies have been determined. The same is being done with induction voltage regulators which contain both a shunting and series winding.

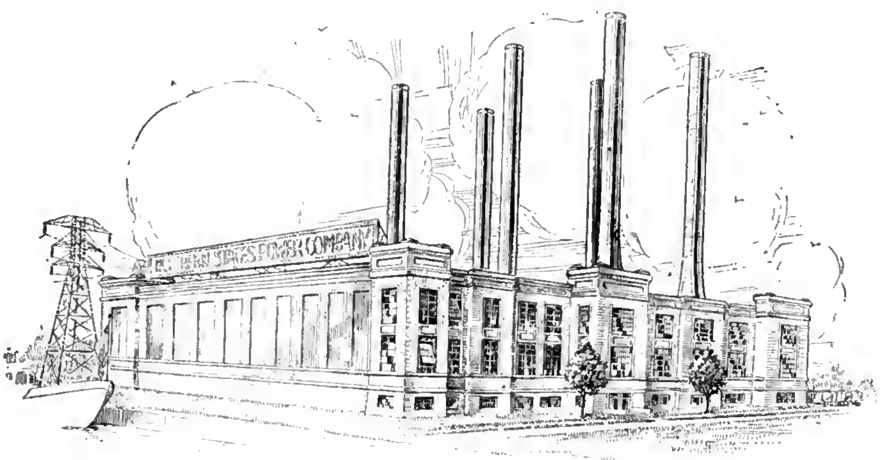
Another interesting line of investigation has been that of relay operation at high frequencies. Remote control of relays has been obtained by voice modulation and whistling at the transmitter, the relay being adjusted to respond to voices at different pitch and to different types of modulation.

Mr. Duncan acknowledges the co-operation of H. R. Searing of the United Electric Light & Power Company and J. H. Ferry of the Potomac Electric Power Company.

## St. Paul's New Power House

### Further Details of the Eighty-Million-Dollar Program for the Twin Cities

AS ALREADY stated in the ELECTRICAL WORLD, the H. M. Byllesby Engineering & Management Corporation has announced a hydro-electric and steam-power construction and development program for the cities of Minneapolis and St. Paul which will involve the expenditure of $80,000,000 in the next ten years. This new construction will increase the generating capacity of the Northern States Power Company is 303,000 hp.



PROPOSED 100,000-HP. ST. PAUL PLANT OF THE NORTHERN STATES POWER COMPANY

Construction work on a 100,000-hp. steam-turbine generating station in St. Paul on the Mississippi River near High Bridge will start immediately. The first generating unit to be installed will have 40,000-hp. capacity, and it is planned to install additional capacity of 60,000 hp. after this unit is completed. During the remainder of the ten-year period an additional steam generating capacity of about 100,000 hp. will be added, divided between the Riverside station in Minneapolis and the new power plant at St. Paul. The present capacity of the Riverside station is 103,000 hp., of which about 28,000 hp. is generated by water power and the rest by steam.

Hydro-electric development on the St. Croix and the Upper Mississippi Rivers has been authorized by the Federal Power Commission. Construction plans call for an increased capacity of 106,000

hp., which will be divided between the existing plant and new construction. A water-storage dam will also be built in the St. Croix River, 8 miles above the Kettle River Rapids.

To facilitate the distribution of this additional power, a new transmission loop will be built around the Twin Cities, with the necessary additions in substations and other equipment. The financing plans contemplate the continuance of customer-ownership methods which have created a shareholders' list of about twenty-five thousand persons, most of whom are customers of the company.

## North Americans Elected to Brazil Technical Club

One of the results most hoped for from the International Engineering Congress in Rio de Janeiro was the establishment of closer relations between the engineers of the Americas. A tangible proof that this has resulted is seen in the election of the following North American engineers to membership in the Club de Engenharia, an organization which would correspond to an amalgamation of the four national societies here in the United States of North America:

Elected corresponding members: Josiah E. Spurr (A. I. M. and M. E.), editor *Engineering and Mining Journal-Press;* Louis J. Hirt (A. S. M. E.), engineer Pearson Engineering Corporation.

Elected honorary members: Verne L. Havens (A. S. C. E.), director *Ingenieria Internacional;* A. W. K. Billings (A. S. C. E.), Canadian & General Finance Company, Ltd. (Toronto); Edward Wegmann (A. S. C. E.), consulting engineer; Samuel M. Vauclain. (A. S. C. E.), president Baldwin Locomotive Works; Calvin W. Rice (A. S. M. E.), secretary A. S. M. E.

## Puget Sound Company Gets Coast Utilities

The Puget Sound Power & Light Company, Seattle, Wash., has purchased the Washington Coast Utilities, furnishing lighting and power service in Wenatchee, Edmonds, Arlington, Stanwood, Vashon Island, Port Townsend and Montesano. The combined properties will be under the management of Stone & Webster, Boston, who have managed the Puget Sound company for more than twenty years. An adequate source of energy for the development of the fruit-raising districts of central and western Washington will result from the completion of a 120-mile transmission line now being built by Stone & Webster, from the White River hydro-electric plant over the Cascades to Wenatchee.

The gross revenue of the acquired company reaches approximately $700,000. The capitalization is about $3,000,000, of which one-third is in common and preferred stock. The Puget Sound company is purchasing $500,000 par value of common stock for cash and securities, offering to exchange its 6 per cent preferred stock share for share for the preferred stock of the Washington Coast Utilities, of which about five thousand shares are outstanding.

## Kentucky Utility Favors Mouth-of-Mine Plants

Officials of the Kentucky Utilities Company are much pleased with the rapid development of the company's high-tension transmission lines in western Kentucky, where it now has nearly 200 miles of lines. The company had a contract whereby it gets the surplus power of two 6,000-kw. coal-mine plants at Greenville and Earlington, amounting to from 5,000 kw. to 5,500 kw. These plants are at the mouth of the mines and furnish power from coal chuted to or directly dumped on the stokers.

In fourteen months the company has developed a total transmission system of 92 miles in western Kentucky and it now furnishes service to a large number of towns, mines and farms in that part of the state. In eastern Kentucky the company has 215 miles of interconnected transmission lines and close to 500 miles in all. In the Harlan County field alone there is about 21,000 kw. connected load.

The company is to a considerable extent following out the plan of producing power at the mouth of the mine. Just how big the development of this method will be is uncertain, but the utility is steadily enlarging its system and there is rapid growth of demand, especially in the eastern Kentucky coal fields.

## Alabama Power Company Completes Mitchell Dam

On the first day of January the Alabama Power Company plugged Mitchell Dam, and the ceremony marked the completion of the eight-million-dollar water-power project. As the impounded waters flow down from Lock 12 they will create a lake 14 miles in length, the entire distance between the two dams.

The first unit of this new project, carrying 25,000 hp., will be placed in operation in February. By April two more units of 25,000 hp. each are expected to be placed in operation, and the total harnessed power of the dam at that time will be 75,000 hp. When the last unit is placed in operation the total horsepower produced will be 120,000.

The Alabama Power Company will begin the construction of its next large water-power project, on the Tallapoosa River, early this year. Four dams will be constructed, and the potential development of power is about 140,000 hp. The project, it is said, will cost between twelve million dollars and twenty million dollars.

## Henry Ford's Water-Power Project at High Dam

According to a press dispatch from St. Paul, representatives of Henry Ford, who, as told in the ELECTRICAL WORLD of Dec. 30, page 1465, is endeavoring to obtain from the Federal Power Commission the right to the power produced by the High Dam erected by the government in the Mississippi River between St. Paul and Minneapolis, have announced the purchase of a site for the proposed factory of the Ford Motor Company immediately adjacent to the dam and have given out the statement that if the water-power rights are granted a ten-million-dollar plant, to employ ultimately between fourteen and fifteen thousand men, will be built; otherwise a plant on a smaller scale to be operated entirely by steam is projected.

Senator Nelson of Minnesota has, it is reported from Washington, aligned himself with those opposed to granting these power rights to the Ford company.

Information from political circles in Minnesota is to the effect that the Legislature will not grant the Municipal Electric Corporation the authority necessary to carry out its plan for the utilization of the High Dam. There is a very general opinion, however, that the Legislature will extend the authority of the Warehouse and Railroad Commission so as to give it regulatory supervision over power matters.

## Competitor Allowed to Enter Indianapolis Field

A certificate of convenience and necessity has been granted by the Indiana Public Service Commission to the Terre Haute, Indianapolis & Eastern Traction Company, which has made plans for an eventual expenditure estimated at between $6,000,000 and $7,000,000 in the development of the West Tenth Street power plant in Indianapolis and in the construction of transmission and distribution lines inside and outside of Indianapolis. As previously reported in the ELECTRICAL WORLD, the application of the railway company was contested by both Indianapolis power companies, the fight being called one of the most bitter in the history of the commission.

The opinion handed down with the order challenges the idea that regulated utility monopoly is best under all contions and asserts that there are situations in which the public will be best served by a certain amount of competition. It denies that a public utility has any vested right in a monopoly and affirms that the basis for regulated monopoly is the public welfare and not the welfare of a utility company.

Although the certificate gives the company authority to supply electrical energy for all purposes authorized by law, a representative of the railway company said that the intention for the present is to sell power in bulk and not to distribute power to small Indianapolis consumers.

## Federal Engineer on Power in Southeast

After a trip along the Coosa and Tallapoosa Rivers and a visit to Muscle Shoals and to the Gorgas steam plant, Col. William Kelly, the chief engineer of the Federal Power Commission, has returned to Washington much impressed with the rapidly growing market for power in the Southeast. Colonel Kelly is interested in the possibility of utilizing storage on the Tallapoosa to advantage. There are several sites on that stream where large storage can be provided at low cost. This would prove an important supplement to the Coosa River plants since it would help the Alabama Power Company to carry its base load on water power.

Further relief could be had, Colonel Kelly reports, if the Alabama Power Company could secure a long lease on the Sheffield plant. As it is, 30,000 kw. of that plant's capacity cannot be used because of transmission-line limitation. It would cost $750,000 to provide the additional transmission line, an expense which the Alabama Power Company naturally would not incur when the contract for the use of the plant is subject to termination on thirty days' notice. Colonel Kelly says that two thousand yards of concrete are going in every day at Muscle Shoals. Construction work has reached the point, he believes, where no slackening of the work will be caused by high water.

## New Rates for Great Western Power Company

Rates reflecting a reduction of approximately 10 per cent on the system as a whole have just been established for the Great Western Power Company by the California Railroad Commission. The rates are almost identical with the new rates of the Pacific Gas & Electric Company, referred to in the ELECTRICAL WORLD for Jan. 6, page 56, and as in the case of the latter are entirely new, taking the place of existing rates and surcharges. The rate structure eliminates various discriminatory rates, and for that reason the percentage reduction is not uniformly applicable to all present charges. Flat rates are effective Feb. 1, meter rates Feb. 20.

Lighting rates in San Francisco and contiguous places will be 90 cents per meter a month for the first 10 kw.-hr., 6 cents for the next 40 kw.-hr., 5 cents for the next 150 kw.-hr., with proportionate reductions as consumption increases. In other incorporated places the rate schedule starts at $1 a month, and outside of incorporated limits it begins at $1.25.

In general the same principles of valuation and rate making were applied to the Great Western as to the Pacific Gas & Electric. The application of these principles eliminated the company's claim of $15,000,000 for water diversion rights and $8,047,185 for development costs. Other reductions were: Intangible capital from $277,359 to $189,500, lands from $4,540,229 to $1,353,022, structures from $40,713,903 to $36,740,957, working capital from $938,049 to $590,000. For additions and betterments operative in 1922 $1,271,000 was allowed.

The rate base found reasonable is $40,144,479. Including items eliminated, the company claimed a rate base of $69,516,725.

## Valuation of Idaho Power Company Cut in Half

After a hard-fought battle of more than two years' duration, the Public Utilities Commission of Idaho has placed a value for rate-making purposes of $11,638,495 upon the property of the Idaho Power Company. The original valuation arrived at by the company's representatives was $22,567,890, but the commission's elimination from the inventory of eighteen Idaho items and one Oregon item on the ground that they are "non-co-operative," the omission of cost involved in borrowing money for development, the discarding of "capitalized deficits," the reduction of alleged inflation in purchase prices, with other "slashes" made by the regulating body, brought the sum total down to the figure already named. Even of this greatly reduced total the commission decided that $1,542,095 is not entitled to full return.

The formal order of the commission which accompanies the opinion sets Monday, Jan. 22, as the date for the opening of the hearing concerning the rates to be based upon the new valuation just arrived at.

# New York Utility Offers Stock to Customers

### Consumers and Employees of Consolidated Gas Company and Its Affiliated Companies May Buy 6 per Cent Preferred Issue at Par, with Privilege of Resale at Premium

DETAILS of the special offer of 6 per cent cumulative participating preferred stock of the Consolidated Gas Company offered at par ($50 a share) to its employees and those of its affiliated companies and to all consumers of gas or electricity distributed by it and its subsidiaries have just been published over the signature of George B. Cortelyou, the president. The authorization of this issue was referred to in the ELECTRICAL WORLD for Dec. 2, but full particulars were not then available. The New York Edison Company, the United Electric Light & Power Company and the New York & Queens Electric Light & Power Company are among the affiliated companies of the Consolidated Gas, and their employees and customers share in the invitation.

This stock will be entitled to receive additional dividends at the rate of 1 per cent for each dollar a share paid on the common stock in excess of the rate of $4 a share per annum. It is designed for those consumers and employees who are seeking an opportunity to invest their savings safely, with the further advantage that it may be acquired by installment payments.

One of the purposes of this issue is to obtain the widest possible range of ownership of this company's stock by consumers and employees, the hope being that eventually every consumer and every employee will become a stockholder, thus assuring a sympathetic relationship between the company and its affiliated companies and the public which they serve. For the purpose of assuring the permanency of this plan of widely distributed ownership, the company has established a means through which any holder desiring to sell his shares may find a constantly available market at a premium above the price paid. This redemption provision is in part as follows:

"In case any holder of preferred stock shall at any time desire to sell or otherwise dispose of any of such preferred stock, he shall give written notice thereof to the company at its main office; and the company shall have the right, within thirty days after the receipt by it of such written notice, to purchase the preferred stock described in such notice upon the payment of an amount equivalent to the par value thereof and the amount of any unpaid dividends accumulated thereon to the date of purchase, plus a premium equivalent to 5 per cent of such par value if dividends of not exceeding 6 per cent in the aggregate shall have been paid on the preferred stock during the period of twelve consecutive calendar months next preceding the purchase thereof; a premium equivalent to 10 per cent of such par value if dividends exceeding 6 per cent but less than 8 per cent in the aggregate shall have been paid thereon during such period, or a premium equivalent to 15 per cent of such par value if dividends of 8 per cent or more in the aggregate shall have been paid thereon during such period. . . . No preferred stock shall at any time be transferable by any stockholder unless he shall first have given the said written notice to the company nor unless the company shall have either consented in writing to such transfer or shall have failed to exercise its right to purchase the said stock within thirty days after the receipt by it of the said written notice."

The new issue may either be paid for in full upon allotment or payments may be spread over a period of ten months, interest being credited on the payments at the rate of 5 per cent. Consumers so desiring may make such payments with their monthly bills.

An over-subscription is anticipated, and the company therefore reserves the right to decline subscriptions in whole or in part and to make individual allotments in such manner as may seem best.

# Engineering Education Is a Fruitful Theme in Many Quarters

## Prof. C. F. Scott Pleads for Fuller Comprehension and Support

A BETTER understanding of the purposes of engineering schools, financial support for their work, more intelligent guiding of potential engineering students in secondary schools and a clear recognition of the complex tasks of technical education were urged by President Charles F. Scott of the Society for the Promotion of Engineering Education in a paper upon "Engineering Training and Modern Life" presented at the recent Boston meeting of that society and of the American Association for the Advancement of Science. Reviewing the development of applied science in the past century, Professor Scott pointed out that the engineering type of mind is destined to assume general leadership in governmental and public affairs as well as in private industry. The stability of our civilization depends on our ability to produce the man power for successful and technical leadership. In concluding his address Professor Scott, who holds the chair of electrical engineering at Yale University, said:

"Broader fields of service call for broader training. Suggestions come to the schools from all quarters proposing supplemental subjects which would make the college curriculum cover a lifetime. What is the best training for the young engineer which will best fit him for leadership? Are the present facilities in our engineering schools, their curricula, their equipment, their faculties, their environment, those which will best train young men for the needs of the future? Are boys in sufficient number and of the right type entering those courses?

### THE COMMON FACTOR

"If engineering education is to provide men for such divergent activities as technical research and design, construction, salesmanship, finance, management and advertising, one may well question what is the common factor in all these things which constitutes the real engineer. Is the product of the engineering school to be a definite, simple thing, or is there to be an indefinite list of engineering courses varying from sanitary and automobile engineering to commercial and human engineering? Is the engineering course to be one thing or an indefinite number? Is there some class or type of boys who will make good engineers or is the engineer himself so varied that any sort of a boy ought to make some sort of an engineer?

"In general we recognize that the common factor in the varied type of engineer is a common method; this may be applied to different kinds of problems in accord with personal tastes and abilities and with opportunities and needs.

"Broadly the purpose of the engineering schools is to produce men who will do their part in the world's work. But in order to produce a definite product there should be a definite ideal. Should these matters lie only with the engineering school, with the authorities who select the faculties and with the faculties who make schedules of studies and impart ideas?

### CLEAR OBJECTIVE NEEDED

"Surely we need to know more clearly the ideals and objective in engineering education. The prime task will presumably fall to the engineering school. It must survey the situation and take counsel from others as to the real needs of the future and then set about to determine what training and what learning and what influences will best contribute to the desired results. But as the problem in its larger sense is one which vitally concerns the industries and the public utilities and, broadly speaking, the public welfare it is fitting that there should be a wider interest in the problem. There are other things besides advice which the schools need. There should be a better understanding of what engineering means. High schools and preparatory schools now have teachers with a decidedly academic influence. These should take a new attitude toward the engineering school and the selection and direction of boys of better quality to it. Financial support should be forthcoming. A better understanding is needed of what the graduate is and what he can do. He has potential ability, he has fundamental training, he is a good beginner, but he must have opportunity for experience and training and growth in the particular fields which he enters. These are matters in which those outside the engineering school can contribute directly toward the production of the engineer of the future."

## Stratton Tells of Need of Trained Men

Informally addressing the student body of the Massachusetts Institute of Technology in taking office as president at Cambridge last week, Dr. S. W. Stratton declared that there never was a greater shortage of well-trained men than today and emphasized the growing bond between American manufacturers and institutions of learning, saying that it marks a trend toward closer co-operation in future on behalf of scientific and commercial progress. Dr. Elihu Thomson, acting president, occupied the chair. Prof. H. P. Talbot greeted the new president on behalf of the faculty and Robert Payne Shaw spoke on behalf of the undergraduates. Dr. Stratton said that a few years ago an ordinary manufacturer would not come near a university, but that that time has fortunately passed away and the universities are now besought to aid in solving the problems of industry.

## President Butler Says High Standard at Columbia Will Be Kept

PRESIDENT NICHOLAS M. BUTLER of Columbia University, New York, in his annual report to the trustees, says that opinion is moving in the direction of a policy of higher standards of admission and instruction in engineering schools. The time has come, in Dr. Butler's opinion, to give more special and concentrated attention to the advanced and research work of the university in the whole field of engineering. "The line of separation between pure and applied science is increasingly difficult to discern and maintain." Dr. Butler says, "The real distinction would appear to lie not so much in the subject matter as in the spirit with which the work of research is carried on."

The policy of Columbia University in accepting eight years ago the recommendation of the faculty of applied science to elevate the standard of admission to the Schools of Mines, Engineering and Chemistry, and to turn those schools definitely to the task of training leaders of the engineering profession and research workers, has resulted, Dr. Butler asserts, in greatly reducing the enrollment of students and has left several departments of instruction overequipped for the work which they have to do, at least during the period when the new policy is establishing itself; but he thinks that no one would counsel going back to the former policy of accepting students for the Schools of Mines, Engineering and Chemistry direct from the secondary schools.

### PRINCIPLES ARE DETERMINED

"That," he says, "would be to abandon a fixed principle of our university organization and development and to turn aside from a task which but few institutions, among them Columbia, can do at all, to resume the task which almost any institution of higher learning can accomplish if it chooses. The real question under discussion would appear to relate to the details of the existing plan of admission and instruction, and not to the principles upon which that plan is based. There are signs that opinion is moving in the direction of the policy that was adopted eight years ago."

Pointing out that a group of representatives of the most important engineering schools in the Middle Western States have unanimously approved a five-year program of study for engineering students, with a view to giving the time gained to the study of the humanities and fundamental scientific subjects, Dr. Butler says that whether the program of engineering study be one of five years or six years is probably of less importance than its content and the possibility of the funda-

mental instruction being given by a large number of colleges and scientific schools.

## Industrial Lectureship at Princeton Succeeds

An attempt to bring students into direct contact with the activities of the engineering world and to acquaint them with the leading personalities in industry has been very successful at Princeton University.

In 1921 the Princeton Engineering Association established the Cyrus Brackett Fogg lectureship in memory of Dr. Fogg, formerly professor of physics and electrical engineering at Princeton. A series of lectures is given during the college year by eminent engineers and scientists. These lectures are chosen by an alumni committee in co-operation with Dean Arthur M. Greene, Jr.

Last year the speakers were Samuel Insull, Joseph B. McCall, John W. Liéb, Charles L. Edgar, John A. Britton, Dr. N. E. Loomis and Col. William C. Spruance. Lecturers for this year are Charles E. Adams, Dr. Ralph Modjeski, Henry I. Harriman, Dana D. Barnum, R. G. Porter, Henry O. Loebell, Alexander S. Lyman, August Belmont and General J. J. Carty.

Dean Greene reports that large numbers have attended the lectures and that the students have shown great interest. The plan marks a trend in development which should, it is held, have a marked influence upon educational co-operation with industry.

## No Successor Found for Dr. Stratton at Washington

No progress has been made in the search for a director for the Bureau of Standards to succeed Dr. S. W. Stratton, who retired from the government service to accept the presidency of the Massachusetts Institute of Technology. Because industry is making much more extensive use of research laboratories, physicists are, according to Commerce Secretary Hoover, very scarce and as a result the level of salaries has risen greatly. This, he declares, makes it very difficult for the government to find an ideal man for this place, when it requires a physicist in the front rank of his profession who will be willing to work for $6.000 a year.

## Wiring Committee Makes Recommendations

In an interim report the wiring committee of the Joint Committee on Business Development has made the following recommendations as a "standard or measure at which commercial departments, wiring contractors, etc., should aim." The committee labels its recommendations "the minimum American house-wiring standard of wiring outlets." They are:

"An average of three outlets (lighting and convenience) per room [that is, parlor, sitting room, dining room, kitchen, bedroom, etc., as based on the ordinary real estate rating], computed as follows:

"There should be at least one lighting outlet and one convenience outlet in any one room, and the outlets (whether lighting or convenience outlets) in the bathrooms, hallways, stairways, closets, unfinished attics, cellars, etc., and any additional outlets in the main rooms (over and above the minimum of one lighting and one convenience outlet) should be enough to bring the average per room up to three as a minimum.

"For the purpose of this standard a switch is not an outlet. An outlet (omitting switches) is considered the point where the wires come to an end at the wall. A convenience outlet is considered as one outlet. A twin convenience outlet permanently connected to the wall is considered as two outlets. A bracket light is considered as one outlet even if there are two or more sockets in the bracket. A chandelier is considered as one outlet even if there are two or more sockets in the chandelier."

## Interstate Merger Approved

The application of the Interstate Public Service Company of Indianapolis for permission to absorb seven public utilities owned by it or under the same control has been approved by the Indiana Public Service Commission. The consolidation is based on a $6,071,029 valuation, and the commission has authorized the company to issue $2,000,000 common stock, $600,000 of 7 per cent preferred stock and $500,000 of 5 per cent bonds to finance the deal and to assume $2,119,600 of debts against the absorbed properties. The seven companies are the Hydro-Electric Light & Power Company, Connersville; Hawks Electric Company, Goshen; Middlebury Electric Company, Winona Electric Light & Water Company, Electrical Transmission Company of Northern Indiana, Southern Indiana Power Company and Indianapolis & Louisville Railway Company.

The enlarged Interstate Public Service Company serves more than 46,000 customers with electricity and has an annual gross revenue from all sources of approximately $6,000,000.

## December Financing Less Active

ALTHOUGH the demand for bonds during the month of December was not so heavy as it had been for several months previously, bond dealers report that the issues offered were well absorbed by investors. New issues of electric light and power public utility securities equaled $18,048,000. The issues were small in number and also in volume. Only nine issues of this type of security were offered in the month, and the largest single offering was the five-million-dollar stock issue of the Electric Bond & Share Company. The average rate of return yielded the investor advanced to 6.59 from 5.82 in November and 5.85 in October. The fact that most investment bankers decided to stand aloof from the market until the first week of the new year tended to slow up business, but the outlook for new issues is now pending.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN DECEMBER

| Name of Company | Amount of Issue | Period | Class of Security | Purpose of Issue | Rate of Interest | Offered at | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Central Indiana Power Co. | $4,248,000 | Twenty-five-year | First mortgage collateral and refunding gold bonds, series A. | To acquire securities of subsidiary companies and for other purposes | 6 | 95 | 6.40 |
| Central Arizona Light & Power Co. | 500,000 | Twenty-year | First and refunding mortgage gold bonds, series B. | To retire outstanding bonds | 6 | 97 | 6.25 |
| Great Northern Power Co., Ltd. (Ontario) | 850,000 | Fifteen-year | First mortgage sinking-fund gold bonds. | To construct plant | 7 | 95* | 7.50 |
| Adirondack Power & Light Corp. | 2,500,000 | Twenty-eight-year | First and refunding gold bonds | | 5½ | 96⅝ | 5.75 |
| | 3,800,000 | | Cumulative preferred stock | For acquisitions and construction | 7 | 90 | 7.78 |
| Detroit Edison Co. | | Ten-year | Convertible gold debenture bonds. | | 6 | 102 | 5.73 |
| Northern Ohio Traction & Light Co. | 1,000,000 | Twenty-five-year | General and refunding mortgage gold bonds, series A | To retire underlying bonds and reimburse for construction expenditures. | 6 | 94 | 6.50 |
| Coast Power Co. (Oregon) | 150,000 | Twenty-year | First mortgage bonds, series A | To retire outstanding bonds and for additions | 6 | 98 | 6.20 |
| Electric Bond & Share Co. | 5,000,000 | | Cumulative preferred stock | General corporate purposes | 6 | 97 | 6.20 |
| Total | $18,048,000 | | | | | | |

* With a bonus of 50 per cent in common stock.

## Farm Engineers Form Rural Lines Committee

The use of electrical energy on the farm was discussed at the annual meeting of the American Society of Agricultural Engineers at St. Louis at a session of the college section on Dec. 27. The matter was presented by J. C. Martin of the ELECTRICAL WORLD as one in which the electrical and agricultural industries must co-operate. Methods and equipment through which the farmer can employ electrical energy profitably to reduce the cost of production must be developed, Mr. Martin said.

Men engaged in farm engineering work at the agricultural experiment stations and who make up the college section of the society discussed the problem, dwelling on the important part these stations should take in its solution. A committee to study rural electric service from central stations was formed to supplement the work already under way by a committee studying the individual-plant problem. C. A. Atherton, National Lamp Works, Cleveland, is the chairman of the new committee.

## Coal Commission May Take Hand in Wage Dispute

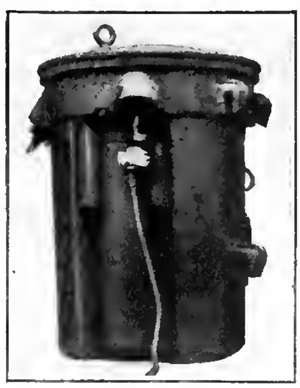
The action of the President's fact-finding coal commission last week in telegraphing the officials of the coal operators' and miners' joint wage conference at Chicago asking for a continuance of the present wage scales for one year in case efforts to reach an agreement should fail is thought by some to indicate a disposition on the part of the commission to mediate in the wage dispute. The commissioners have asserted the probability of an agreement of some kind that will prevent a strike on April 1. The replies from Chicago afford basis for a moderate degree of optimism, both sides, while maintaining that the agreement proposed could not be made at the conference then in session, expressing the opinion that a subsequent conference would be held at which it could be acted upon.

## Accounting Service Given by Wisconsin Association

The Wisconsin Utilities Association has instituted an accounting service bureau for the purpose of assisting the smaller member companies in the association to keep better accounts. Karl F. McMurry will head the bureau. By going to Madison to have reports made out, errors in accounting detected or general instruction given to new bookkeepers, companies can obtain this service without extra charge. The smaller companies can send in their records and federal and state income tax reports will be made out. In cases where more extensive services are required the member companies are expected to pay the actual cost.

## Brief News Notes

**A New Experiment in Electrical Homes.**—Just as the electrical interests in Cleveland were opening their fifth "electrical home" with the latest electrical fixtures and appliances, a sixth electrical home, not quite so modern, but in the class of experiments, was discovered by linemen working on a 55-ft. pole in one of the districts where trees are not plentiful. A bushing in a transformer case, which insulated the primary tap from the casing, had in some way been ejected, leaving a 1½-in. opening through which the birds entered the case. Within it, over the coils,



five nests, built one on top of the other, were found, possibly used by the same birds for as many years. There was one egg in the top nest. The transformer had been in service for eleven years and was being replaced by a larger one. It was rated at 7½ kw. and was connected to a 4,600-volt primary line. This plan of partial electrical incubation seemed to have been successful, as there were no signs of fatalities to birds in the transformer case. The photograph was taken by W. C. Saker of Cleveland.

**Cheboygan (Mich.) Company Sold.**—The General Engineering & Management Corporation, New York City, has recently taken over the Cheboygan (Mich.) Electric Light & Power Company, serving twelve communities, and is completing negotiations for the acquisition of some properties in New Jersey.

**A Consolidation in Maryland.**—The plant of the Havre de Grace Electric Company has been purchased by the Northern Maryland Electric Company, and connections will be made at Perryville with the latter company's transmission line, which will be extended from Port Deposit, the end of its present line. Steel poles will be used.

**Maine Companies May Unite.**—The Cumberland County Power & Light Company, Portland, Me., has petitioned the Maine Public Utilities Commission for authority to purchase the properties of the York County Power Company and the Westbrook Electric Company. The Cumberland County company owns the common stock of these utilities, which form with it a single interconnected system.

**New Turbine for Iowa Utility.**—The Tri-City Railway & Light Company is contemplating the addition of a 26,000-kw. turbo-generator to its Moline station, at a cost of about $1,250,000. The present capacity of the station is adequate to take care of existing needs, but a careful survey has shown that the proposed new unit will be required in the next few years. The Moline station serves Davenport, Rock Island, Moline and Muscatine.

**Permanent Electric Exhibit at San Diego.**—In connection with a permanent materials exhibit now being installed in the basement of the Spreckels Building in San Diego, Cal., electrical men plan to take part of the space and make a co-operative display. Building permits for San Diego totaled $10,000,000 in 1922, and the prospects are for a still more active program in 1923. The exhibit will bring builders into contact with those who manufacture, job and retail materials and appliances.

**Fort Smith Transmission Line Completed.**—The transmission line of the Oklahoma Gas & Electric Company from Muskogee, Okla, to Forth Smith, Ark., has been completed. This line furnishes power to Fallis, Gore, Vian, Sallisaw, Hanson and other towns along the line which heretofore have been dependent upon small individual plants. The construction of this 60-mile transmission line through a wooded and mountainous country was completed in sixty-two days. A distribution system at Gore and Webbers Falls is now being constructed. The main construction force has been transferred to the southern extension, which will run south from Sallisaw through Cowlington, Poteau and Heavener. This line will extend into the coal fields of eastern Oklahoma.

**Nevada Valleys to Lease Lahontan Plant.**—It is reported that the Secretary of the Interior and the Director of the Reclamation Service have approved the contract entered into by the Nevada Valleys Power Company and the United States government for a lease on the Lahontan power plant. The lease is to extend from 1924 to 1934, and in return the company abandons all claims to power rights on the Truckee River near Vista. The contract provides for certain improvements to the Lahontan power plant, increased power efficiency and broadening of the power service. Approval of the contract settles for ten years the friction that has

developed over power rights on the Truckee River, involving as participants the Reclamation Service, the Nevada Valleys Power Company and promoters of the Newlands Project.

**Electrification of Railroads in France.**—Electrification of the section of the Midi Railroad from Pau to Tardes in France has been about completed. The Midi Railroad is committed to the electrification of 1,864 miles of track at an early date, and the Orléans and Paris-Lyons-Mediterranean lines have similar progress in view. The director of the Midi Railroad says that the electrified system will be extended to Montrejeau by March and that during the summer of 1923 the Dax-Toulouse line will be electrified.

**Springfield (Ohio) Company to Serve Five Electrically Abandoned Towns.**—Five Ohio communities that lost electric power and light service when the Springfield, Troy & Piqua traction line was abandoned will receive service in the future from the Springfield Light, Heat & Power Company, negotiations having been about completed. These communities are North Hampton, Dialton, Bushnell, Lawrenceville and Thackery. Under the tentative plan, the Springfield company will take over the transmission lines of the abandoned traction line, transmitting energy at 66,000 volts, to be reduced to 110 volts for consumption. The Springfield company is also supplying Urbana with light and power and contemplates extension to other communities in the vicinity.

**Wakefield to Save Money by Buying High-Tension Central-Station Service.**—By expending $50,000 for a new substation and for an underground line about 6,000 ft. long to connect with the system of the Edison Electric Illuminating Company of Boston, the town of Wakefield, Mass., will save about $7,000 a year over the present costs of operation. The town has a municipal distribution system and already purchases energy from the Edison company, but by the new arrangement electricity will be supplied to the town at the regular high-tension rate. The Edison company will expend $135,000 to build an underground line from its Woburn substation to the Wakefield town line, the distance being about 5 miles. The introduction of the high-tension service will also enable the town to expand its local service. The citizens have appropriated $50,000 for the foregoing purpose.

**Court to Decide Utility Basis.**—An order issued by the Corporation Commission of Oklahoma holding that the Southern Oklahoma Power Company, which manufactures electricity at Byng, is a public utility under the laws of Oklahoma is to be tested in the State Supreme Court. The question involved is whether or not the company is required to report to the Corporation Commission and file all the reports required under the commission's orders. The commission holds that the ownership of the Southern Oklahoma Power Company is the same as that of the Oklahoma Light & Power Company, which distributes electricity from the Byng plant in several cities and towns of southern Oklahoma, and that in order to fix rates for the latter company intelligently it is necessary to have possession of monthly reports of the Southern Oklahoma Power Company.

**United States Navy Airplane Carriers to Have Electric Drive.**—Two airplane carriers now under way for the United States Navy under plans altered from others originally drawn for battle cruisers which, under the limitation program, will not be built are to be electrically equipped throughout by the General Electric Company. Powerful turbo-generators will drive the propellers through huge electric motors, two for each of the four propeller shafts. Rear Admiral Griffin, former chief of the Bureau of Engineering, says that these boats will represent "the greatest horsepower per shaft that has ever been projected in any marine installation, irrespective of the type of motive power." The propulsion apparatus is the same, barring minor alterations, as was planned for the original battle cruisers. The generators will be operated by steam from sixteen oil-fired boilers and each will have a rating of 40,000 kva., 5,000 volts, three-phase, 1,770 r.p.m.

# Associations and Societies

**Rocky Mountain Electrical Co-operative League.** — The second annual meeting of this association was held at Salt Lake City on Dec. 4, when the sixteen members of the board of trustees were chosen, four each from the central-station industry, the manufacturers, the jobbers and the contractor-dealers. W. A. Moser was made chairman of the league for the ensuing year, A. J. Calloway vice-chairman and R. M. Bleak secretary and treasurer.

**Southwestern Electrical and Gas Association.**—Announcement is made of change of name of the Southwestern Electrical and Gas Association to the Southwestern Public Service Association. There will be no change in the purposes or activities of the association, and the office will be as heretofore at 403-4 Slaughter Building, Dallas, Tex. The spring convention will be held at Fort Worth, Tex., May 15 to May 17. E. N. Willis is secretary.

**American Society of Civil Engineers.**—Engineering education and engineering research figure prominently in the program of the civil engineers' seventieth annual meeting, to be held in the Engineering Societies Building, New York City, on Wednesday, Thursday and Friday next, Jan. 17 to 19. On Wednesday afternoon there will be a joint session with the Society for the Promotion of Engineering Education, when Prof. Charles F. Scott of Yale, president of the latter society; Dean William G. Raymond of the College of Applied Sciences, Iowa State University; Magnus W. Alexander, consulting engineer, General Electric Company, and John L. Harrington, president A. S. M. E., will speak. Research activities will be discussed on Friday morning by prominent engineers.

**Empire State Gas and Electric Association.**—The electric meter section of this association will meet at the Onondaga Hotel, Syracuse, N. Y., on Monday and Tuesday, Jan. 22 and 23. On Monday "Demand-Meter Maintenance" will be discussed by E. A. Le Fever, Buffalo General Electric Company; "Electric Demand Rates" by W. M. Carpenter; "Metering Problems in Changing Distribution" by W. Davies, Public Service Corporation of New Jersey; "Instrument Transformers" by J. B. Gibbs, Westinghouse Electric & Manufacturing Company, and "Potentiometers" by I. Melville, Stein, Leeds & Northrup Company. On Tuesday C. L. Casler, Syracuse Lighting Company, will discuss "Maintaining Meters Under Public Service Commission Order"; F. C. Holtz, Sangamo Electric Manufactur-Company, "Measurement of Electric Energy and Power," and B. W. St. Clair, General Electric Company, "Jewels and Pivots."

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

National Council Lighting Fixture Manufacturers—Cleveland, Jan. 15-20. C. H. Hofrichter, 231 Gordon Square Bldg., Cleveland.

Lighting Fixture Dealers' Society of America—Cleveland, Jan. 15-20. J. L. Wolf, Electrical League, Hotel Statler, Cleveland.

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Iowa Engineering Society — Des Moines, Jan. 23-26.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26. H. M. Northrup, 23 Erie St., Milwaukee.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14; executive committee, Atlantic City, Feb. 15-16. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mining and Metallurgical Engineers — New York, Feb. 19-21.

American Physical Society—New York, Feb. 24; Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

# Recent Court Decisions

**Nebraska Commission Sustained.**—Affirming a decision of the Nebraska Railway Commission in Rawlings vs. Chicago, Burlington & Quincy Railroad Company, the Supreme Court of Nebraska declared that on any appeal from a commission order the finding of the commission would receive the same weight as the verdict of a jury and would not be reversed unless clearly wrong. (190 N. W. 569.)*

**Six Thousand Dollars for Death of Electric Helper Not Excessive.**—The Supreme Court of Appeals of West Virginia, in Halley vs. Ohio Valley Electric Railway Company, has declared not excessive a verdict for $6,000 for the death of an electric helper from injuries received while installing a transformer in an electric substation. He was put to work on a ladder which stood only a few inches from an exposed and energized bushing, the dangerous character of which was unknown to the youth, who was inexperienced. (114 S. E. 572.)

**United States May Maintain Storage Pond at Maximum Height for Power Purposes.**—Suits brought by Phillips et al. against Waters et al. and Wheeler et al., and in which the Sterling Hydraulic Company and the Rock River Light & Power Company sought to intervene as defendants, asked for an injunction against the agent of the United States having charge of a federal dam in the Rock River to compel him to open the sluicegates in the winter months, thus stopping the operation of the power plant to which the government's hydraulic system was leased. A decree granted by the lower court has been reversed by the United States Circuit Court in Illinois, which holds as follows: (1) When the United States in lawful exercise of its authority builds a dam for purposes of navigation, the water power thus developed may be lawfully used by it or leased to any concern engaged in the development and distribution of power or electrical energy. (2) Where the United States government acquires the right to erect a dam to a certain height for the purpose of improving navigation, it also acquires as an incident thereto the right to use the pond for power purposes. (3) Injunction is not a proper remedy when the damage caused by the thing sought to be enjoined is relatively very slight compared with that which would be caused by its issuance. (4) Where the United States at large expense built a dam in aid of navigation and for seven years maintained it at a certain height without objection from owners of the land which was overflowed, and in the meantime a power company had built a plant at large cost to use the water from the pond made, such landowners are not entitled to an injunction which would stop operation of the power plant, but will be held to their remedy at law, especially in absence of showing that they would suffer substantial injury. (5) Condemnation decrees giving the United States the right to maintain a dam in aid of navigation at a stated height, on which basis landowners were compensated for flowage, entitles the government in its discretion to maintain the dam at such height during all times of the year. (284 Fed. 237.)

**Electric Truck Not Attractive Nuisance.**—An electric delivery truck by which a child was injured after he and other children had started it going was held not to have been an attractive nuisance by the Supreme Court of Michigan, in Jackson vs. Mills-Fox Baking Company. In this case the driver of the truck shut off the power and set the brakes while he carried purchases to a private house, but did not remove the switch plug. The court, reversing the lower tribunal, found no negligence and said that the starting of the car by the trespassing children was the proximate cause of the accident. (190 N. W. 740.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**Capitalizing Non-Utility Property.**—A public utility may capitalize all the property it owns although it may not include property not devoted to public service in its rate base, according to a decision of the New Hampshire Public Service Commission *in re* Exeter & Hampton Electric Company. The commission therefore included in a valuation for the purpose of issuing securities an office building a part of which was rented for other than utility purposes, stating that rates and capitalization rested upon different bases.

**Capitalization of Savings.**—The annual savings of the Kootenai Power Company under a favorable contract were capitalized at the rate of 8 per cent, and half of this amount was added to the rate base by the Idaho Public Utilities Commission. The question, the commission said, was "whether or not the Kootenai Power Company is entitled to receive any of the benefits which may accrue by reason of its diligence in taking advantages of opportunities which make for economy in the furnishing of electrical energy to its consumers. This utility is one which is and has been managed efficiently and economically. . . . A public utility should be encouraged to practice economy in its management, and the utility that practices economy should not be placed on a par with the utility which is extravagant in its operation. A utility should not have the full benefit accruing by reason of such arrangements, but it is entitled to a portion thereof. . . . In case the present conditions change from any cause whatever, the amount herein allowed shall be deducted from the valuation hereinafter determined."

**Rural Service Charges.**—In authorizing the Leopolis Electric Light & Power Company to make adequate charges to meet the additional expense from excessive transformer losses in supplying rural consumers the Wisconsin Railroad Commission said: "Data furnished by the company indicate that over one-half of the energy purchased is dissipated before reaching the customer. In order that those consumers who cause the unusual expenditures shall contribute more materially to the revenues, the commission has in nearly all cases involving rural rates authorized a line or transformer charge in addition to the regular rates. This charge is dependent partly on the size of the transformer required by the customer. In this particular case we believe that a transformer charge is necessary for all consumers not located in groups having the saturation density of villages."

**Revenue Derived from Other States May Be Considered in Fixing Rates.**—Although a state commission has no jurisdiction over rates in a neighboring state, it may, according to a decision of the North Dakota Board of Railroad Commissioners in fixing rates for the Pembina Light & Power Company, take into consideration the total revenues and expenses of the utility and the amount of the utility's product sold in towns out of the state. The commission said it would expect the utility to look to other towns than the one in question for a portion of the increased revenue necessary to meet operating expenses, depreciation and return. The commission added: "If the utility, in view of the facts disclosed by this investigation, desires to furnish electricity to towns outside our jurisdiction at cost or less, it cannot expect to make up losses by excessive rates elsewhere."

**Adjusting Expense of Inductive Co-ordination.**—The Public Service Commission of Missouri has ordered the Clifton Hill Light & Power Company, which, it was alleged, had made the service of a telephone company of no effect on the two possible routes between two towns, to stand the first cost of one additional telephone wire so as to provide a metallic circuit, and it was required to build its stub lines according to standard specifications, and where the stub lines overbuilt or paralleled in close proximity the rural grounded lines of the telephone company the electric company was required to stand the expense of separating the grounded telephone lines from the transmission line for a distance equal to the width of the country roads in that territory. In view of the fact that better telephone service would be obtained by the metallicized lines, the telephone company was required to pay for the maintenance, depreciation and pole rental of the lines.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

**Worth Bates**, treasurer of the Missouri Gas & Electric Service Company, has been appointed a member of the city advisory committee of Lexington, Mo.

**Francis C. Shenehon** has been appointed vice-president and general manager of construction and engineering of the Byllesby Engineering & Management Corporation, with headquarters at Chicago.

**Major-General George W. Goethals** was appointed State Fuel Administrator on Tuesday, Jan. 9, by Governor Smith, to succeed William H. Woodin, who resigned because of the pressure of private business.

**Charles H. Brown** assumed the duties of superintendent of the North Birmingham (Ala.) light and water plant last week, succeeding Henry S. Hill, who tendered his resignation about a month ago to become chief clerk in the office of Sheriff T. J. Shirley.

**Douglas Betts**, chief engineer of Messrs. Debenhams, Ltd., electrical engineers of London, England, recently visited the Pacific Coast. Mr. Betts, who is a member of the American Institute of Electrical Engineers, is touring the United States for the purpose of investigating recent hydro-electric developments.

**John J. Hubbard**, assistant secretary of the Public Service Commission of New York, resigned last month to enter private practice as an expert accountant and financial adviser to public utilities. He will maintain an office in New York City. Mr. Hubbard has been connected with the Public Service Commission for ten years in various positions, including examiner of accounts, expert accountant and chief of the division of capitalization.

**Edward J. Nally**, who was elected to the new office of managing director of international relations of the Radio Corporation of America, as was announced in the Nov. 25 issue of the ELECTRICAL WORLD, assumed his duties on Jan. 1, when he was succeeded in the presidency of the corporation by Major-General James G. Harbord, who retired from the army.

**August H. Meyer** has been elected president of the Langstadt-Meyer Company, Appleton, Wis., replacing A. C. Langstadt, who is no longer connected with the organization. R. S. Saxton, formerly manager of the Milwaukee branch of the Westinghouse Lamp Company, will be associated with the company as vice-president and sales manager, and **J. G. Harvey**, formerly sales manager of the Luxam Electric Company, Fort Wayne, Ind., will be manager of the company's Oshkosh (Wis.) branch.

### W. A. Moser Elected Chairman of Rocky Mountain League

Walter A. Moser, manager of the Westinghouse Electric & Manufacturing Company at Salt Lake City, was elected chairman of the Rocky Mountain Electrical Co-operative League at the second annual meeting of the league, held in December. Mr. Moser completed two years' apprenticeship with the Westinghouse company at East Pittsburgh, Pa., in 1911. He entered the sales department of the Salt Lake City office of that company in August, 1911, and was made manager in 1920, which position he now holds. Mr. Moser was born in Union Hill, N. J., in 1886 and was graduated from the University of Nebraska with the degree of bachelor of science in electrical engineering in 1907.

W. A. MOSER

**Verne L. Havens**, director of the *Ingeniería Internacional*, has been made permanent secretary of the International Engineering Congress, composed of engineers of North America and the Latin-American republics.

**John M. C. Horn**, who was comptroller of the Illinois Traction System, Peoria, Ill., with headquarters at Champaign, Ill., resigned that position on Jan. 1. Mr. Horn had been with the Illinois Traction System and its component companies for fourteen years, having served in the general offices at Champaign during that time. He has made no plans for the immediate future. The position vacated by Mr. Horn will be filled by T. A. Smith, supervisor of capital expenditures for the same company, who for the present will conduct the work of both offices.

**F. S. Mills** has been appointed representative of the Illuminating Engineering Society in Los Angeles. Mr. Mills has recently been made director of the activities of the National X-Ray Reflector Company in the territory from Denver west, including the Hawaiian Islands.

**W. C. Chappell**, noted English hydro-electric engineer, recently visited San Francisco en route from Australia. Mr. Chappell is known in Australasia as the man who gave Tasmania its first electric lights and street cars. He supervised the construction of a 57,000-hp. hydro-electric plant near Hobart, Tasmania, and later, as chief electrical engineer of the State Electrical Commission of Victoria, was in charge of the erection of a steam plant at Melbourne.

**Harry L. Brown**, who was for some time Western editor of the *Electric Railway Journal* at Chicago and has more recently been managing editor at New York, has been appointed co-editor of the paper with Henry W. Blake. Mr. Brown joined the *Electric Railway Journal* staff at the Chicago office in 1916, having become connected with the McGraw-Hill Company a year before as assistant editor of the ELECTRICAL WORLD. He is a graduate of the University of Michigan and is well known in the railway field, particularly in the central territory.

**J. E. Yorkston** has recently been promoted from the position of engineer in charge of the drafting department of the General Electric Company to that of consulting mechanical engineer. In his new capacity Mr. Yorkston will assist the designing engineers of the company in connection with important mechanical problems and will also serve as a consulting authority in all matters pertaining to drafting practice. He was first employed by the General Electric Company in 1894 as a designing draftsman. Three months later he was put in charge of the alternating-current drafting department, and in 1902 he was made assistant engineer of the works drafting department. In 1907 he was again promoted to be engineer in charge of drafting, which position he held continuously until his present promotion. He is also chairman of the committee on drafting practice and a member of the committee on mechanical design.

# Obituary

**Mabel Hubbard Bell**, widow of Alexander Graham Bell, inventor of the telephone, died on Tuesday evening, Jan. 2, in Chevy Chase, Md., at the home of her daughter. Mrs. Bell never recovered fully from the shock of her husband's death last summer. Mrs. Bell lived under an affliction of total deafness that followed a severe attack of scarlet fever in her childhood. It is said that Dr. Bell's hope that he might find a means of enabling her to hear led to experiments in the realm of phonetics which resulted in his great discovery.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Waste in Advertising

**The Bad Influence of "Free Literature"—The Dealer Should Share in the Cost to Make Him Careful—Manufacturer and Seller Should Unite for Efficient Publicity**


By J. C. McQuiston

Manager Department of Publicity, Westinghouse Electric & Manufacturing Company


NO ONE can deny that there is waste—much waste, large waste—in advertising. Somehow we have come to accept it as a condition, much like that of waste in fuel. Take a ton of coal and burn it in your furnace. Will you get all of the heat units out of it? Even if your furnace is the most efficient you know, you will lose far more than you will get. That is why the battle is ever on for more efficient grates and burners, boilers, etc. And so it is in advertising. Our fight to reduce waste in advertising must be courageously continued.

Let us consider the advertising that we ourselves control—our direct mail and our literature for consumers. Do we know what our waste is? No doubt all of us sleep better because we do not know the facts in the case. Enough is known, however, about this waste to stir every user of direct advertising to eliminate much of it.

J. C. MC QUISTON

### "Free Literature" an Evil

One of the causes of flagrant waste is "free literature." This is a disease in advertising. It is cancerous, because it draws the very lifeblood from this kind of advertising. We all know how much a "free" thing is appreciated. Make a concert free and you prepare the way for either an empty house or a "cheap crowd." The manufacturer who gives without charge all advertising "helps," including folders, "trims," cards and so on, will get rid of large quantities. That is just what he will do, but no more—he will "get rid of them." But, of course, he intended to do more; he expected the "helps" to be mailed to prospective customers. He desired every copy to find a lodgment in the home or business of such a person. But the "life" of the scheme was lost when the plan was cheapened by being "free." The dealer thought he was interested, and you, the manufacturer, thought the dealer was interested, but the facts are that the interest was only on the surface.

When the manufacturer offers the dealer all of some three-color folders he wants, and the dealer says, "Better let me have two thousand," does the dealer say to himself, "I can make good use of two thousand by addressing eighteen hundred from my up-to-date mailing list and two hundred can be used on my counter. I will use them very carefully because two thousand copies of this beautiful folder must be worth $200." On the contrary, you know he knows little, and cares less as a rule, what they cost. Any manufacturer who does not know this to be so can find out by following up some of those free and easy requisitions that come in from his dealers. He might even visit some of those dealers and ask where their last folders went. Is it not his duty to inquire into this?

Printed sales helps represent so much money. When you send them to your dealer you are sending just so much cash, for you have paid cash for writing, planning, printing and shipping them to the dealer. The dealer should be made to appreciate this, so that when he sees a pile of printed folders in his stockroom, out of date, dust-covered and obsolete, he will realize that it represents waste—waste in advertising, which represents waste of real American money.

### Dealer Should Share Costs

I recall returning from an advertising conference at Bedford Springs, Pa., where waste in advertising had been made one of the chief topics. Our party of five were motoring along the Lincoln Highway at Stoyestown, when immediately in front of a garage at this place a tire blew out. While repairs were under way the party, strolling about the garage, beheld stacks of automobile and accessory folders which had, conservatively speaking, a value of $1,000. Think of it! How many manufacturers in good faith had sent this man supplies of literature, and here it was ready to be burned. I would regard it as a safe guess that one-half of the auto literature given to the dealer "free" is wasted.

For economical and other reasons it would not be practical for the dealer to prepare and print his selling "helps." In many ways, if he could do it, however, the work would be better done. For if the dealer *did* do it, you could rely on his knowing the cost and realizing the value of it, and he would therefore, with certainty, see to it that such matter was properly used—not wasted.

Even as things are, with manufacturers for the most part printing and paying for the dealer helps, the dealer would be in a more sound position if he paid a portion—say one-half of the cost of all dealer helps requisitioned by him. If he realized in every case that when he asks his manufacturer for helps he is obli-

gating himself to pay some of the cost of producing such helps, he would be prompted to consider ways and means of using the literature. His demands would be tempered by consideration of investment, and thus this costly waste would be greatly reduced.

Free literature, advertising "helps," etc., are conducive to careless practices and waste. The sooner this problem of the efficient promotion of advertising as between the one who makes and the one who sells is brought to a point where the cost is shared by both, the sooner will millions of dollars be saved to many industries, to say nothing of greater effectiveness resulting from such joint efforts.

# Our Largest Potential Foreign Customer

**Importance of Great Britain as a Market and as a Source of Education in Foreign Trade—Some of the Difficulties Encountered in Promoting Business with Her**

BY CAXTON BROWN

Secretary Weston Electrical Instrument Company, Newark, N. J.

A RATHER careful reading of numerous articles dealing with foreign trade opportunities that have appeared recently reveals the fact that it is very seldom that writers give any attention to our potential market in the British Isles. Yet Great Britain is this country's largest foreign customer.

I do not minimize the trade possibilities that exist in the Latin-American countries, the Far East or other export markets. They are all worthy of close attention, but sometimes it seems to me that there is more theory and less common sense applied to the development of foreign markets than should be the case.

### OFFERS FAVORABLE CONDITIONS

Great Britain has shown the most powerful recuperative possibilities of all markets. It is an English-speaking country. Its methods of doing business are most similar to our own, and, generally speaking, its electrical products do not equal our own either in design or workmanship. Surely these are conditions that warrant a careful study of the best method of securing a fair share of that market. For were we considering the matter from a domestic viewpoint, I believe that any intelligent manufacturer would lay most stress on an effort to secure the good will and trade of his largest potential customer.

All foreign trade is beset with difficulties at the present time. There are troubles of exchange and finance and tariff difficulties which are largely reciprocal; there are passport visas with ridiculous fees, also of a reciprocal nature, and depression in business, all to combat. But these obstacles will not endure forever, and those who endeavor to overcome them in a sane manner can establish connections that will yield attractive returns later on. It is worth consideration that it is easier to obtain a firm foothold now than it will be later on when business is better and more American companies make the effort.

But the intending American exporter should by all means go after this market in an earnest, determined manner and be ready to back his opinions. Haphazard efforts will produce no satisfactory results. His first step should be to analyze all available data, including our own consular reports and British statistics, upon the amount of imports of his particular article. He should secure catalogs of all British competitors and, if feasible, samples of their product. With such information available it will be possible to establish laid-down costs in England for his own product, and should these costs be higher than the price of British-made articles, he may determine whether the price disadvantage may be offset by superior quality or superior serviceability. If neither of these latter advantages exist, the market had better be left alone.

However, should it be deemed possible to export advantageously, then the best procedure would be to make a trip to England to obtain exact information as to the preferable methods of sale—whether through dealers, jobbers or through an exclusive agency. Likewise, careful study should be made of the volume or extent of the sale of the British-made articles which are offered in competition and of the best advertising mediums.

The American Chamber of Commerce in London and our own consular force and commercial attachés will cheerfully assist in such research work and indeed will, I am sure, be glad to furnish much valuable information by mail.

It is difficult for me to try to say specifically just which type of electrical products at this time will be apt to find the greatest opportunity in the British market. I have not investigated or studied the problem from this point of view, our attention being pretty fully occupied with our own line and the affairs of our own British company. In general, I may say that I do not believe that lamps or large motors or generators could profitably be exploited in England; but were I manufacturing any other electrical contrivances or devices and were I interested in exporting them, I would at once start my research work in this market as previously indicated.

### TARIFF DIFFICULTIES

Of course, the prospective importer to the British Isles must not overlook the fact that Great Britain is no longer a strictly free-trade country, for within the past two years laws have been passed which impose an import duty of 33⅓ per cent on many articles and commodities. However, we in this country are hardly in a position to throw stones on that score, because it is a well-known fact that many of the tariffs encountered in conducting foreign trade are to a great extent of a retaliatory nature. Indeed, one of the greatest impediments to world trade today is the vicious circle of retaliatory tariff barriers.

Notwithstanding that it is largely in our own power to reduce these barriers, we seem to make very little, if any, progress in that direction, and by many our latest tariff law is believed to increase these difficulties rather than diminish them. So that if one is inclined to demur at Britain's change from a free-trade to an import-tariff country, he should first study the question from all angles.

Another obstacle that appears somewhat insignificant at first glance and yet which has its importance for United States companies employing foreign travelers is the ridiculous charge made for visas of passports. Visa charges were quite moderate until the United States decided to charge citizens of other countries a ten-dollar fee for a passport visa. It naturally required very little time for other nations to reciprocate in kind, and now the citizen of the United States pays a ten-dollar

equivalent every time he obtains a visa to visit another country, while a citizen of any other country pays only a moderate sum for the same kind of visa. This visa expense is not at all insignificant when viewed in the light of a commercial traveler from the United States, as many American companies will cheerfully testify, and the matter is referred to merely to indicate that import duties and visas should not be neglected as factors to be considered.

Dr. Julius Klein, chief of the Bureau of Foreign and Domestic Commerce of the United States, recently said in an address: "We must be familiar with the situation in Great Britain for two reasons, that we may be able to appraise possible foreign competition and that we may be able to appraise foreign buying power. England has long been and will for years probably continue to be our best foreign customer and our best rival in foreign trade. She can also be our best teacher, and we need education and need it badly."

Great Britain should, therefore, not be disregarded as a market by the American manufacturer who wishes to sell his goods abroad. Yet it must be expected that real success can be accomplished only by building slowly, sanely and surely. That sort of business endures, whereas it is true of export business as of money that that which is easily obtained is easily lost.

Finally, it should be understood by those intending to enter into the exporting field for the first time that European business has been at its lowest ebb for approximately two years. There are now quite distinct signs of improvement, yet one must be a prophet of extraordinary foresight to attempt to forecast how soon and how rapidly business will approach normal. That matter is largely in the hands of the politicians and bankers, and they have yet to solve many problems essential to permanent business stability.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Battery Stocks Spotty in New England

Stocks of dry cells in New England reflect uneven delivery conditions as the year gets under way. Prices are holding firm, and the demand is active for radio uses as the public becomes better informed about the possibilities of operating certain tube sets with this sort of equipment. Fairly good buying of dry cells is reported by jobbers on the part of contractor-dealers, and flashlamp business is always reasonably active at this season.

A healthy absorption of such batteries into new residences for bell-ringing service is also in progress. In the storage-battery field some sales are being made for automobile service, notwithstanding the heavy winter weather and great reduction in car usage. Stocks are none too large, but are meeting current requirements well. Prices are firm. The outlook for better battery sales for industrial and road truck service in this territory this year is excellent.

## Heater Sales Quieter

The demand for radiant heaters since the holidays has shown a considerable recession, and unless scarcity of coal for domestic use makes itself felt more seriously, it is not expected that any immediate marked increase in sales will be recorded. Stocks in the hands of distributors and retailers were substantially lowered before Cristmas, but buying since 1923 began has been on a hand-to-mouth scale. While prices are firm, difficulties in obtaining steel are a factor in production which is causing no little consideration, and anticipation of requirements has to be very carefully planned in order to insure an even flow of sheets for cutting and assembly.

Factory stocks are of moderate size, and these are relied upon by a good many distributors within fairly easy reach of the manufacturers to meet current demands outside of local stock facilities. It is the opinion in some circles that intensive sales effort combined with fair local stocks would improve trade materially in this apparatus, which in many communities has almost reached the staple class in the public mind.

## Raw-Material Advances Push Tape Prices Upward

Recent advances in the cost of rubber and sheeting, amounting to about 100 per cent since the last schedule of a representative manufacturer went into effect, have forced the price of tape upward lately, and the outlook seems to be for a so-called "high market" for the coming half year. This advance in tape was not unexpected in the trade, but in many quarters the disposition to look upon it as a temporary condition resulted in the placing of relatively few orders by distributors.

The moderate supply on hand has led to a flood of orders upon manufacturers, and in some instances production is under way for full-time days and also for part of the nights. So far there seems to be little shortage of labor in this branch of the industry. Manufacturers are buying material on a short-term basis in view of the price situation, which has some uncertainties that well-informed opinion heeds in refusing to make large commitments.

## Generator Figures in Error

The 1922 production figures for generators, both waterwheel and turbo, were: Waterwheel, 1,200,000 kw., and turbo, 1,575,000. These figures erroneously appeared in the ELECTRICAL WORLD for Jan. 6, page 70, as 200,000 kw. for waterwheel, 575,000 kw. for turbo.

## Estimates 1923 Construction at $6,000,000,000

Based upon a survey which it has just completed, the Copper and Brass Research Association estimates the total building construction for the year 1923 at $6,000,000,000. The potential market for copper in building construction in this country next year (including sheet copper for roofing, leaders and gutters, etc., as well as the copper content of the brass used in plumbing pipe, hardware and lighting fixtures) is approximately 780,000,000 lb.

In 1922, statistics for eleven months of which are now available, the total expenditure for building construction is placed at $4,910,000,000. In addition, there were projected, but not built, other buildings of a total estimated cost of $2,480,000,000.

In estimating the amount of building construction in 1923, the carry-over from 1922 has been reduced to $1,240,000,000, because experience indicates that in making preliminary estimates the cost is usually placed on the safe side, and allowance is also necessary for the percentage of such projects that has been indefinitely postponed or will not come up in 1923.

Taking the known accumulated shortage as a basis, after deducting work completed during 1922, and adding the normal increment of building for the year 1923, the actual building requirements of the nation are estimated at $7,830,000,000. Details of the 1923 estimates and the expenditures for the same classes in 1922, follow:

| | 1923 Estimates | 1922 Expenditures |
|---|---|---|
| Apartment houses | $1,253,000,000 | $950,000,000 |
| Churches | 530,000,000 | 205,000,000 |
| Dwellings | 940,000,000 | 680,000,000 |
| Hospitals | 595,000,000 | 230,000,000 |
| Hotels | 851,000,000 | 640,000,000 |
| Industrial buildings | 827,000,000 | 655,000,000 |
| Office buildings | 804,000,000 | 645,000,000 |
| Public buildings | 328,000,000 | 260,000,000 |
| Public garages | 162,000,000 | 125,000,000 |
| Schools | 1,540,000,000 | 610,000,000 |
| Total | $7,830,000,000 | $5,000,000,000 |

To predict such a vast amount of building during the year 1923 presupposes that the entire shortage plus the normal increment for the year will be carried out in 1923 and that we shall enter 1924 with a clean building slate. It is believed by the association, however, that neither the financial nor the material and labor resources of the country are in a position to carry out this program in twelve months.

The association's reports indicate that there still exists over the major part of the country a housing shortage of considerable proportions, despite the huge construction of 1922.

There are, of course, no definite data to go on in estimating how far the present resources of the country and the labor and materials situation will enable it to go in the 1923 building program, but careful consideration of the various factors involved leads to the estimate of $6,000,000,000 as the amount which can be completed in 1923.

Of this amount about $3,030,000,000 will be devoted to housing, about $2,025,000,000 to office, business and industrial buildings, and $2,675,000,000 to churches, hospitals and schools.

ENGLISH ELECTRICAL EXPORTS, IMPORTS AND RE-EXPORTS FOR NOVEMBER, 1922

| | Exports | Imports | Re-exports |
|---|---|---|---|
| Electrical goods and apparatus | £123,273 | £52,794 | £2,612 |
| Insulated wires and cables | 179,447 | 17,182 | ...... |
| Glow lamps | 28,235 | 28,690 | 416 |
| Arc lamps and parts | 1,320 | 1,255 | ...... |
| Batteries and accumulators | 32,950 | 17,799 | 2,070 |
| Meters and instruments | 32,937 | 6,337 | 107 |
| Carbons | 2,967 | 7,030 | 205 |
| Electrical Macninery: | | | |
| Railway and tramway motors | 14,593 | ...... | ...... |
| Other motors and generators | 144,232 | ...... | ...... |
| Switchboards (not telegraph or telephone) | 10,690 | 4 | ...... |
| Electrical machinery, unenumerated | 137,596 | 72,539 | 6,183 |
| Telegraph and telephone cable and material: | | | |
| Telegraph and telephone wires and cable (not submarine) | 27,325 | 4,673 | ...... |
| Submarine telegraph and telephone cable | 51,255 | ...... | ...... |
| Telegraph and telephone instruments and apparatus | 157,254 | 41,879 | 762 |
| Totals | £944,074 | £250,182 | £12,355 |

## November Electrical Exports Show Gain of $939,646

Total exports of electrical machinery, apparatus and appurtenances for the month of November were $5,817,349, a gain of $939,646 over November, 1921, when the total amounted to $4,877,703, and of $693,878 over October, 1922, when they were $5,123,471. The following figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR NOVEMBER, 1922, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

| Articles | Value November, 1921 | Value November, 1922 |
|---|---|---|
| Turbines | | $245,596 |
| Generators | $437,057 | ........ |
| Direct-current— | | |
| Under 500 kw. | ........ | 41,633 |
| Over 500 kw. | ........ | 6,096 |
| Alternating-current— | | |
| Under 2,000 kw. | ........ | 100,161 |
| Over 2,000 kw. | ........ | 288,323 |
| Accessories nnd parts for generators | ........ | 35,077 |
| Self-contained lighting outfits | | 31,293 |
| Batteries | 175,674 | ........ |
| Primary— | | |
| Dry | ........ | 83,267 |
| Wet | ........ | 4,982 |
| Storage | ........ | 149,114 |
| Transforming and converting apparatus: | | |
| Transformers | 285,581 | ........ |
| Power | ........ | 315,121 |
| Other | ........ | 32,482 |
| Rectifiers | ........ | 5,764 |
| Condensers, double-current and motor generators, dynamotors, synchronous and other convertera | ........ | 37,150 |
| Transmission and distribution apparatus: | | |
| Switches and accessories | 81,193 | ........ |
| Switches and panelboards, except telephones | ........ | 323,788 |
| Switches and circuitbreakers | ........ | 97,553 |
| Fuses and fuse plugs | ........ | 29,525 |
| Meters and measuring instruments | $95,254 | ........ |
| Watt-hour and other measuring instruments | ........ | 31,324 |
| Volt, watt and ampere meters and other recording, indicating and testing apparatus | ........ | 68,019 |
| Lightning arresters, choke coils, reactors and other protective devicea | ........ | 43,366 |
| Motors, starters and controllers: | | |
| Motors under 1 hp. | ..... | 66,831 |
| Stationary motors— | | |
| 1 to 200 hp. | ....... | 120,181 |
| Over 200 hp. | ....... | 48,156 |
| Railway motors | ....... | 134,940 |
| Electric locomotives | 376,990 | ....... |
| Railway | ....... | 548,000 |
| Mining and industrial | ....... | 12,109 |
| Other motors | 495,966 | 14,887 |
| Rheostats, coatrollers and other starting and controlling equipment | 46,381 | 76,611 |
| Accessories and parts of motors | ....... | 85,147 |
| Electrical appliances: | | |
| Electric fans | $43,479 | $34,441 |
| Electric lamps: | | |
| Arc | 2,070 | 2,402 |
| Incandescent— | | |
| Carbon filament | 2,599 | 5,942 |
| Metal filament | 83,046 | 96,047 |
| Other electric lamps | ....... | 22,206 |
| Flashlights | ....... | 19,815 |
| Searchlights and projectors | ....... | 19,521 |
| Motor-driven household devices | ....... | 78,756 |
| Domestic heating and cooking apparatus | 70,155 | 73,860 |
| Industrial electric furnaces and ovens | ....... | 6,894 |
| Therapeutic apparatus, x-ray machines, galvanic and faradic batteries | ....... | 64,917 |
| Signal and communication devices: | | |
| Radio and wireless apparatus | ....... | 223,180 |
| Telegraph apparatus | 20,660 | 34,615 |
| Telephone apparatus, including switchboards | 242,603 | 318,336 |
| Police, fire and burglar alarm apparatus | ....... | 1,665 |
| Railway signals, switches and appurtenances | ....... | 129,212 |
| Bells, buzzers and annunciators | ....... | 5,014 |
| Other electrical apparatus: | | |
| Spark plugs, magnetos and other ignition apparatus | 70,384 | 58,388 |
| Insulating material | ....... | 65,149 |
| Metal conduit, outlet and switch boxes | ....... | 18,125 |
| Sockets, outlets and receptacles | ....... | 56,138 |
| Other wiring devices | 85,624 | 127,926 |
| Other electrical apparatus, not elsewhere specified | 1,599,629 | 478,337 |
| Globes and shades for lighting fixtures | ....... | 41,065 |
| Electrical glassware, except for lighting | ....... | 7,828 |
| Electrical porcelain | ....... | 47,346 |
| Carbons for electric lighting, electrodes and batteries | 30,607 | 163,385 |
| Insulated wire and cables (iron and steel) | ..... | 44,750 |
| Other manufactures of aluminum, including wire | 154,672 | 52,799 |
| Copper: | | |
| Bare wire | 66,690 | 265,159 |
| Insulated wire and cable | 411,389 | 177,625 |
| Total electrical machinery, apparatus and appurtenances | $4,877,703 | $5,817,349 |

## English Exports and Imports for November, 1922

The British Board of Trade records of electrical business for the month of November show a decrease in values of £64,207 on last month's totals and £296,736 as compared with November last year. The figures for the month were £944,074; for October, £1,008,281 and for November, 1921, £1,240,810. The principal decreases occurred in the items for batteries, £36,000, and telegraph and telephone exports, £22,000; lower values were also recorded in the sections for electrical goods and apparatus, lamps, carbons and electrical machinery, while slightly increased values are shown in the items for insulated wires and cables and meters. Electrical imports at £250,182 for the month under review show an increase of £30,000 on the total for October, 1922, and £70,000 as compared with November, 1921. An addition of £28,000 in the electrical machinery import section accounts for the enhanced values for the month. The electrical re-export figures for November were £12,355, an increase of £1,300 in October, but a decrease of £2,400 in November, 1921.

## The Metal Market

**Copper Sales Not Heavy—Foreign Demand Quiet—Lead at 7.25—Zinc Active**

Copper sales have not been heavy during the last week, but producers are not concerned, for they did such an excellent business in December that they are well sold up and expect a quiet January. Foreign demand is quiet, with a resumption of Chinese buying an encouraging feature.

A slightly increased activity is noticeable in zinc, but prices show only a small change.

NEW YORK METAL MARKET PRICES

| | Jan. 3, 1923 Cents per Pound | Jan. 10, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 14.75-14.87½ | 14.75 |
| Lead, Am. S. & R. price | 7.25 | 7.25 |
| Antimony | 6.35 | 6.35 |
| Nickel, ingot | 36.00 | 36.00 |
| Zinc, spot | 7.05 | 7.05 |
| Tin Straits | 38.87½ | 38.87½ |
| Aluminum, 98 to 99 per cent | 23.00 | 23.00 |

## Brisk High-Tension Equipment Business in Chicago

Chicago manufacturers of high-tension equipment are unanimous in stating that their business volume in 1922 was above that obtained in 1921. One firm during the week sold three 44,000-volt outdoor substations with capacities of 300 kw. to 900 kw. to a Middle Western utility and six 13,000-volt substations of from 75 kva. to 300 kva. for other Middle West concerns.

Another firm reports that the money value of its 1922 business was 56 per cent greater than that in 1921. This concern received an order during the week for a 33,000-volt, 1,000-kva. substation for a Minnesota utility and shipped a 110,000-volt air-break switch to a utility in Georgia.

Foreign shipments of 25,000-volt fuses were made by another organization.

# The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

LOWER stocks are reported in most of the market centers of the United States, and the price trend in all parts of the country is upward. In the West there is slightly increased activity in porcelain and hardware for central stations, following recent storms and heavy snows which have seriously damaged some lines. Materials entering into new construction are selling as well as they did in the autumn months, and increased demand by the textile and metal-working industries is noted.

New York.—Business is settling down to a more normal stride, and sales show healthy conditions throughout the industry. Orders for lamps are coming in at an unusual rate, and the outlook for the next three months is most optimistic for this line. Stocks generally are low and prices have an upward tendency.

Chicago.—The aftermath of the holiday trade in heaters was rather slow because few jobbers had any stocks worthy of notice left over from the rush of the preceding two weeks. But by combing the local market a sufficient number of heaters were found to supply the past week's trade. Prices

## Demand, Supply and Price Trend of Eighteen Commodities as Sold in Fourteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Flatirons, Rectifiers and Instruments

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Heaters | Tape | Batteries |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **New York** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Sdy. | Slo. | Slo. | Slo. | Slo. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act | Sdy. | Sdy. | Slo. | Sdy. | Sdy. |
| Supply | Nml. | Hi. | Low | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Inc. | Frm. | Inc. | Frm. | Inc. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm | Dec. | Frm. | Frm. | Frm. | Frm. |
| **Chicago** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Act. | Sdy | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Slo. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **Boston** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slo. | Slo. | Slo. | Slo. | Slo. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Slo. | Act. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Low | Low | Low |
| Price trend | Inc. | Inc. | Frm. | Frm. | Inc. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Dec. | Frm. | Frm. | Inc. | Frm. |
| **Atlanta** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slo. | Act. | Sdy. | Slo. | Act. | Slo. | Slo. | Act. | Slo. | Act. | Act. | Act. | Act. | Slo. | Act. | Act. | Sdy. |
| Supply | Low | Low | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **Cleveland** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Act. | Act. | Act. | Slo. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Frm. | Inc. | Inc. | Frm. | Frm. | Dec. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **St. Louis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Slo. | Slo. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy | Sdy. | Act. | Sdy. | Slo. | Sdy. | Inc. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **New Orleans** | | | | | | | | | | | | | | | | | | |
| Demand | Slo. | Sdy. | Act. | Act. | Act. | Act. | Slo. | Slo. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Slo. | Sdy. | Inc. |
| Supply | Low | Nml. | Low | Low | Low | Low | Low | Low | Nml. | Nml. | Hi. | Low | Nml. | Nml. | Low | Nml. | Nlm. | Nml. |
| Price trend | Inc. | Frm. | Inc. | Frm. | Inc. | Inc. | Inc. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **St. Paul-Minneapolis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Slo. | Sdy. | Sdy. | Slo. | Slo. | Slo. | Slo. | Sdy. | Act. | Slo. | Act. | Act. | Act. | Slo. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Frm. | Inc. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slo. | Act. | Sdy. | Slo. | Sdy. | Sdy. | Sdy. | Act. | Act. | Slo. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Hi. | Nml. | Nml. | Low | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Frm. | Inc. | Frm. | Inc. | Inc. | Inc. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. |
| **Denver** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slo. | Slo. | Slo. | Act. | Slo. | Sdy. | Slo. | Sdy. | Sdy. | Act. | Act. | Slo. | Slo. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Low | Nml. | Nml. | Low | Low | Hi. | Nml. | Low | Nml. | Hi. | Hi. | Nml. | Low | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |
| **San Francisco** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Inc | Inc. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Slo. | Act. | Act. | Act. | Sdy. | Slo. | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Inc. | Frm. | Inc. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. | Inc. | Frm. | Frm. | Frm. | Frm. | Frm. | Frm. |

remain firm and jobbers are rapidly replenishing their stocks according to their scheduled contracts.

**Boston.**—Business in New England reflects widespread confidence. Inventories were satisfactorily low on Jan. 1 in many electrical establishments, and buying has set in for current requirements. Lengthening deliveries are causing jobbers to stock up more than for some time. Prices trend upward, with advances in washing machines and tape and firmness in quotations for wire and steel products. The peak of the lamp business seems likely to be reached about Feb. 1, instead of the maximum having been scored in December as usual. Building operations are well sustained and the textile and metal-working industries are very active.

**Atlanta.**—This year has started off according to best expectations. Jobbers report satisfactory orders in all lines, although because of stock taking the majority of dealers have not had an opportunity to place their orders. These orders should be received within the next few days. The prosperity of the year just passed is reflected in the issuing of a 50 per cent stock dividend by the Carter Electric Company. This is in addition to a 12 per cent cash dividend. The cotton-oil industry has been held up by the shortage of cotton, and it has been necessary to close down several mills in this section. Bank clearings are in excess of any previous period, and the credit situation is easier than it has been for a great many months.

**Cleveland.**—Stocks are low, but completed inventories in some instances have allowed substantial orders. Batteries are in fair demand and tape is selling in fair volume. Dealers report heaters active, owing to the colder weather, but have been able to meet the demand without difficulty. Collections show improvement.

**St. Louis.**—Jobbers report business to be increasingly active to an unexpectedly large degree, one of the larger houses stating that January business will be fully 50 per cent better than that of a year ago. Another reported that December was the best month in its history. This condition exists in virtually all lines of goods handled, with the fundamental line of wiring supplies obtaining its share of the progress. The increased demand for radio equipment of the higher grades is producing good markets for batteries and for small battery chargers. The demand for automobile purposes is steadily increasing. The railroads and other regular purchasers of dry batteries are buying in normal quantities, and the sale of flashlight batteries is good. Stocks are conservatively maintained, with liberal turnovers, and business generally is sound.

**St. Paul-Minneapolis.**—Jobbers and dealers declare radio more active than before Christmas. Wire prices are stronger, but consumers are lying low. Power construction is dead. Tape demand is probably a little inclined to be active on account of activity in wiring. The heater trade is steady, compared with a very active market last fall.

**Salt Lake City.**—Central-station companies are buying well for extensions and new development, surplus stocks of copper being rapidly absorbed by the market, and production is steadily increasing. Collections are reported better than for months past. Jobbers are confident of steady improvement in electrical trade.

**Denver.**—Business during the first two weeks of the new year has been unusual. All jobbers report a good volume in excess of the similar period a year previous, while one has equaled the entire month of January last year. New business developing and the number of inquiries received support predictions that the year will be a good one. Collections in outside territory are slow, but few losses are being experienced. Heavy orders are being placed for pole-line hardware, transmission equipment and construction specialties in anticipation of new extensions and overhauling of country lines. One project alone in northern Colorado, not officially announced, will require considerable of this material and extensive generating equipment. High winds during the past week have played havoc with transmission lines and city distribution. Business in heaters has suffered.

**Portland-Seattle.**—Electrical jobbers report business active for the first week in January. There is an optimistic feeling regarding the prospects for the coming year. On the other hand, the retailers in the large cities report little activity on appliances and an appreciable slackness in the demand for fixtures. The falling off, however, does not seem to have been greater than the usual drop following the holidays. The Christmas trade this year was principally on lower-priced articles than formerly, which had the effect of lowering the gross volume of business.

# Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Approves Wagner Refinancing

The Circuit Court has denied the recent application for a receiver made by a small minority of stockholders to prevent the transfer of assets of the Wagner Electric Manufacturing Company to the new company, Wagner Electric Corporation, and has simultaneously refused to cancel the transfer which has been made. The complete refinancing plan will consequently be carried out in the manner authorized by the stockholders. The operations of the company are now being conducted under the name of Wagner Electric Corporation.

## General Insulate Sales Doubled

The General Insulate Company, 1008 Atlantic Avenue, Brooklyn, N. Y., manufacturer of electrical insulating specialties, reports that its volume of business during 1922 was more than 100 per cent over the year 1921. The year 1922 was the second largest year in volume of sales since the company was established nearly twenty years ago.

## Milmow Opens Sales Office

Albert Milmow has opened an office in Charlotte, N. C., where he will conduct a business as a sales engineer in electrical and mechanical lines. At present he is handling the accounts of the Packard Electric Company and the Electrical Engineers' Equipment Company. He will also do some electrical consulting work.

Mr. Milmow is a pioneer in the electrical business in the South. He opened the sales office of the General Electric Company in Charlotte and was with the Southern Power Company as engineer of the mill-power department for some time, later joining the Westingbouse Company. He has been most active in the development of hydro-electric applications to industry.

## Burdick Cabinet Expanding

The Burdick Cabinet Company, Milton, Wis., expects to occupy its new manufacturing plant, with 40,000 sq.ft. of floor space, about Feb. 1 and is now inquiring for additional equipment. Its principal product is a patented electrical bath cabinet and other therapeutic equipment and electric hospital appliances. It is increasing its capital stock by an issue of $100,000 preferred stock to cover the expansion.

## Connecticut Electric Completes Warehouse

The Connecticut Electric Manufacturing Company, Bridgeport, Conn., has just completed the erection of a warehouse, 50 ft. x 140 ft., in which stocks of raw materials will be stored. This new building will allow a great deal of additional space in the main factory building for manufacturing operations. The amount of business booked by this company during the last few months has necessitated larger manufacturing operations than it has heretofore conducted, and every effort is being exerted to increase production to take care of this larger business.

## Betts & Betts Announces Changes in Sales Organization

The Betts & Betts Corporation, 645 West Forty-third Street, New York City, manufacturer of refillable fuse plugs, bell-ringing transformers, radio apparatus and motor-driven controllers, announces the following changes in its sales organization: H. O. Klug has taken over the territory formerly covered by F. Maples, consisting of western Pennsylvania, Ohio, Michigan, eastern Indiana, northern Kentucky and West Virginia. Mr. Klug will probably make his headquarters in Cleveland. John Gilmore, formerly with the Barber Manufacturing Company, replaces J. E. Eldredge. His territory will consist of the New England States, the Hudson River towns and New York State.

## E. W. Ham Electric Company Moves Into New Quarters

The E. W. Ham Electric Company, Worcester, Mass., has moved into a three-story newly constructed reinforced-concrete warehouse and office at 3 Burnside Court, Worcester. The new quarters have a total floor area of about 17,000 sq.ft. and are designed to facilitate rapid service, convenient handling of supplies and improved control of stock volume.

The business of this jobbing house has grown so rapidly of late that a lease for five more years has been signed for the old quarters of the company on Barton Place, covering about 18,000 sq.ft., which will be utilized for storage purposes. The company has recently taken the New England agency for the Aerobell washer, manufactured by the Foote-Burt Company, Cleveland.

## Fairbanks, Morse & Company to Expand Indianapolis Plant

Plans are being made by Fairbanks, Morse & Company, manufacturers of generators and other electrical equipment, for the expansion of the Indianapolis plant, according to Linton A. Cox, Indianapolis, attorney for the company. The attorney is asking that the county commissioners of Marion county call a special meeting at an early date and that a public auction sale of county property be conducted by the commissioners.

The company, an Illinois corporation, has operated in Indianapolis several years. The present factory site has 500 ft. frontage at Northwestern Avenue and Twenty-first Street. The property sought is directly across the street from the present plant. A. W. Thompson, general manager of the Indianapolis plant, says it may require a year to complete surveys and plans before actual construction can be started. Engineers for the company say the electrical business has grown in the last five or six years to such a point that the present plant of the company is inadequate.

It has been suggested that the electrical plant of the company be moved and consolidated with either the factory at Beloit, Wis., or that at Three Rivers, Mich. However, Mr. Thompson and others connected with the Indianapolis branch have been assured that the electrical business will be continued in Indianapolis if the additional space for new buildings can be acquired. The Hoosier plant now is valued at slightly below $1,000,000 and employs nearly 800 persons. If the company's expansion project is carried through, more than 3,000 persons will be employed.

## To Make and Sell Appliances

The Electrical Utilities Company, Jeffersonville, Ind., recently organized with capital stock of $25,000, announces that it will manufacture and sell electrical devices and appliances. The company is located at 332 Missouri Avenue. Officials of the company are Charles F. Schnatterer, C. J. Fackler, M. D. Phillips, George Reiss, R. L. McGinnis and E. A. Drake.

## Kuhlman Sales Appointment

E. N. Hyde, Philadelphia, Eastern district representative of the Kuhlman Electric Company, reports the appointment of Harry W. Motter of York, Pa., as distributor for Kuhlman transformers in several counties of central and southeastern Pennsylvania.

With the addition of Mr. Motter to the field force, prospective buyers will no doubt be able more promptly to get detailed information regarding Kuhlman products, covering as they do high-tension transmission and power distribution transformers for general central-station service and street-lighting transformers which operate without moving coils and without low-power-factor disturbances.

Transformers fit in with the other representations assigned to Mr. Motter by the Howell Electric Motor Company, Marble-Card Electric Company, Electric Machinery Manufacturing Company, Cutler-Hammer Manufacturing Company, Westinghouse Lamp Company and Automatic Fuel Saving Company.

## Ledox Storage Battery Firm Opens Brooklyn Branch

The Ledox Storage Company, Inc., 314 Bergen Street, Brooklyn, N. Y., which was recently incorporated with capital stock of $25,000, is manufacturing two makes of storage batteries. This company makes its own plates and castings, but the remainder of the work is let out through contracts. A new place has been opened at 76 Fourth Avenue, Brooklyn, as the main office, salesroom and repair department. Further expansion is contemplated by the company. The officers of the company are: J. Donald Moulton, president; R. B. Stackpole, vice-president, and O. W. Larson, secretary and treasurer.

## Elliott-Lewis Company Adds to Sales Force

The Elliott-Lewis Electrical Company, Inc., 1017 Race Street, Philadelphia, distributor for the Trumbull Electric Manufacturing Company, Ansonia Electrical Company and Landers, Frary & Clark, has recently added several new salesmen to take care of its increasing number of orders and to assure better distribution. The company has recently leased 15,000 sq.ft. of additional warehouse space to provide for enlargement in its stock. Frank R. Elliott is president of the firm.

## Kubec Electric in New Location

By moving from 506 West Van Buren Street to 628-30 West Jackson Boulevard, Chicago, the Kubec Electric Company has increased its floor capacity 250 per cent. This change went into effect Jan. 1. August Kubec, president, says this expansion affords him better facilities to improve his jobbing lines, especially in the electric industrial tool, industrial fixtures and radio field. He also states that his total business for 1922 was 30 per cent greater than that obtained in 1921. Plans for the incorporation of the company for $75,000 have been made.

## Hurley Company Manufacturing 12,000 Washing Machines Monthly

The decrease in the number of domestic servants, as shown by the last census, is not due to the shortage of persons willing to accept this sort of employment, according to Edward N. Hurley, Jr., vice-president of the Hurley Machine Company, Chicago.

"While the census shows that there has been a decrease in the number of persons listing themselves in the domestic service classification," said Mr. Hurley, "a recent survey by the field force of our company shows that more women than ever before are doing their own household work by preference. This is largely due to the increased use of electrical conveniences.

"There are now approximately 2,500,000 washing machines of all makes and types in use in the United States. While the washing machine has been on the market for many years, the full appreciation of this labor-saving device did not come until the period of the war, when thousands of women left domestic employment to go into munition factories.

"Back in 1909 there were only about three thousand electrical washing machines in the United States. Today the Hurley Machine Company alone is manufacturing twelve thousand a month.

"The future possibilities of the industry are shown by the fact that there will be at the end of this year nine and a half million wired homes in the United States."

## Bright Outlook for Bosch Firm

The 1923 business outlook for the American Bosch Magneto Corporation is exceedingly bright, announcement having just been made that the Rickenbacker car will hereafter be equipped with Bosch starting, lighting and battery ignition and that Hudson and Essex cars will continue during 1923 to use electrical equipment of the same make.

The Rickenbacker will be equipped with the standard 4-in. Bosch generator, the 4-in. Bosch starting motor and the compensating battery ignition system, which has automatic spark control. Compensating ignition is also used on both Hudson and Essex cars, and each is equipped with the standard Bosch 5-in. generator and 4-in. starting motor.

The supplying of electrical equipment for Hudson and Essex cars during 1922 helped greatly to increase the Bosch corporation's business, and the prospects of a substantial increase in production of these two cars during 1923 holds a promise of still greater business for the American Bosch Magneto Corporation.

The Rickenbacker corporation is also rapidly enlarging its selling organization, and its requirements of Bosch equipment during 1923 will undoubtedly assume substantial proportions.

## Pettingell-Andrews Sales Meeting Has Optimistic Tone

Anticipations of an excellent business during 1923 based upon hard work and a growing demand for electrical products on the part of the general public was the feature of the annual sales convention of the Pettingell-Andrews Company, Boston, which was held Jan. 8-10 inclusive. At the opening session Monday the program included addresses by H. S. Schott,, National Carbon Company, Long Island City, N. Y., on "Columbia Batteries," and A. H. Jaeger, Edison Electric Appliance Company, Chicago, on "Appliances." J. E. Livor, sales manager, then threw the meeting open to a general discussion of co-operation by department heads and assistants, and this was continued during the evening.

On Tuesday Messrs. Kennedy and Bowe of the General Electric Company were scheduled to speak on "Insulating Material" and "Tungar Rectifiers," respectively, followed by a talk by J. E. Livor on "Possibilities of G. E. Co-operation." E. N. Hurley, Jr., vice-president, and Messrs. Blye and Root of the Hurley Machine Company, Chicago, were scheduled for addresses upon "Hurley Products." H. F. Wallace, New England manager Edison Lamp Works, and R. B. Parker, assistant sales manager, Edison Lamp Works, Harrison, N. J., on "Lamps." R. S. Yates, Bridgeport, Conn., was scheduled to speak on "Wiring Devices;" R. P. Heaney, Schenectady, on "Fans," and A. L. Atkinson, Bridgeport, was also to speak.

The closing event scheduled was a dinner at the Exchange Club, Boston, on Wednesday evening, the program including talks by F. S. Price, president of the company; George Baldwin, merchandising manager General Electric Company, and David Saranoff of the Radio Corporation of America. A feature was a "radio sketch" of the Pettingell-Andrews and General Electric company a decade ago and today.

## Worcester Sales Agency Opened by McGrail Interests

Interests identified with the McGrail Electric Company, Worcester, Mass., have opened a new fixture and supply house at 442 Main Street, Worcester, under the name of the Sunset Light & Power Company. The establishment is under the management of John E. McGrail. The company plans to retail and to distribute Hotpoint appliances, Hamilton-Beach vacuum cleaners, "Easy" washers, "American Beauty" irons, Simplex heaters and pads, Riddle fixtures and "Lightoliers."

**The Re-New Lamp Company**, Malden, Mass., manufacturer of carbon and tungsten lamps, has changed its corporate name to the Economic Lamp Company. Officials state there has been no change in the management or policy of this company, and that the change seemed desirable to them because, as manufacturers of new lamps, the name Re-New Lamp Company gave a wrong impression as to their product.

**N. A. Strand & Company**, manufacturers of electric vibrators and other machinery, 631 West Jackson Boulevard, Chicago, are taking bids on a two-story factory, 79 ft. x 80 ft., at Argyle and Lincoln Streets, to cost $50,000.

**The Battery Products Company**, 5425 South State Street, Chicago, recently incorporated with $100,000 capital stock, is a continuation of the former Battery Parts Company, same address. It manufactures storage-battery-charging clips, battery terminals, connections and cable leads, and recently completed an addition which is being used as a foundry.

**Electric Appliances, Inc.**, Muncie, Ind., an outgrowth of a purchase recently made of the Sterolectric Company, through a receiver, has been incorporated with a capital stock of $50,000, to manufacture electrical heating and cooking devices.

**The Standard Underground Cable Company**, Westinghouse Building, Pittsburgh, Pa., announces that it moved the Boston sales office of the company from its former location in the Delta Building to 609 Unity Building, 185 Devonshire Street, Boston, on Jan. 1.

**The Mueller Electric Company**, Cleveland, manufacturer of electric specialties, has recently moved into its new building at 1583 East Thirty-first Street, where production will be carried on in greater volume.

**The Federal Lighting Fixture Manufacturing Corporation**, 35 North Ninth Street, Philadelphia, has leased property at 33 North Eleventh Street, Comprising two complete floors, for expansion.

**The National Electric Service Corporation**, organized in Denver, Colo., in the spring of 1922 and manufacturing the Nesco radio equipment, has declared a 5 per cent cash dividend, payable Dec. 20 to stockholders of record of Dec. 15.

**The Wisconsin Cabinet & Panel Company**, a subsidiary of Thomas A Edison, Inc., West Orange, N. J., has plans for a two-story addition to its plant at New London, Wis., to be 72 ft. x 100 ft. and estimated to cost $60,000.

**The Safety Car Heating & Lighting Company**, Dixwell Avenue, New Haven, Conn., manufacturer of electric heating and lighting equipment for railroad cars, will build a one-story addition, 106 ft. x 115 ft.

**Wood & Weber**, Denver, Col., engineers, have recently moved their office to 507 Tramway Building, where additional space is provided for their activities.

**The Bead Chain Manufacturing Company**, Bridgeport, Conn., manufacturer of brass chain for electric lighting service, has announced that it has increased its capital stock from $50,000 to $300,000.

**The Western Electric Company** branch at Portland, Ore., is now occupying its new three-story office and warehouse building at West Park and Flanders Streets, Portland.

**A. B. Faulkner**, 720 Fifth Avenue, Williamsport, Pa., is planning for the establishment of a factory to manufacture electric outdoor operating displays.

**O. H. Sebring**, who recently began the erection of a plant in Sebring, Ohio, for the manufacture of aluminum ware, has decided to make instead a line of electrical supplies. A building 70 ft. x 140 ft. will be occupied by this business.

**The Electrical Dealers' Supply Company**, 162 West Randolph Street, Chicago, will erect a three-story factory, to contain 45,000 sq.ft. of floor space, in Diversey Boulevard near Oakley Avenue. This building, it is estimated, will cost $150,000.

**Guy Dillon**, Indianapolis, has arranged for the establishment of a one-story factory for the manufacture of wireless and equipment at 150 Virginia Avenue.

**The Electric Machinery Manufacturing Company**, Thirteenth and Tyler Streets, N. E., Minneapolis, Minn., will soon take new bids on revised plans for the construction of a two-story plant. Bids recently received have been rejected. Silas McClure is president.

**The Modern Electric & Machine Company**, Indianapolis, Ind., has arranged for an increase in capital from $35,000 to $110,000 for proposed expansion.

**The B-R Electric Company**, Fifteenth and Walnut Streets, Kansas City, Mo., has commenced the erection of a new five-story and basement building at 1411 Walnut Street for general distributing and operating service. It is expected to be ready for occupancy early in the Spring.

## Foreign Trade Notes

FUNDS PROVIDED FOR AN ELECTRIC PLANT IN JAMAICA.—Under a law which became effective on Aug. 11, 1922, *Commerce Reports* states, public improvements, including an electric plant to supply electricity for power purposes and for lighting streets, roads, government buildings and institutions in the cities of Kingston and St. Andrew, Jamaica, were authorized. A loan of £428,000, to be raised by the Kingston General Commissioners, will cover the cost of these improvements.

PROPOSED RADIO SYSTEM IN ARABIA.—Plans are under consideration by local promoters, according to *Commerce Reports*, for connecting Aden, Khokha, Mocha and Hodeidah by wireless. The maximum distance is about 250 miles, and the promoters desire to secure estimates of cost of construction and other information. The same parties desire catalogs covering lighting sets using kerosene engines.

ASH AND DUST EXTRACTION PLANT FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until March 7 for an ash and dust extraction plant for the Morwell power scheme (Specification No. 23/6). R. Liddelow is secretary of the commission.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Cuba (No. 4,926) of ornamental interior electric lighting fixtures.

Purchase is desired in Chile (No. 4,934) of transmitting and receiving radiophone apparatus. Descriptive literature and prices of apparatus easy to install and operate are required.

Purchase and agency is desired in Australia (No. 4,953) for refrigerating machines for household and hotels.

Purchase is desired in Cuba (No. 4,961) of storage batteries, parts and accessories, and machinery and apparatus for the manufacture of storage batteries.

Purchase is desired in Switzerland (No. 4,965) of electric machine to solder fine silver wires onto tinplated brass heads of fusible lamelles.

Purchase is desired in Italy (No. 4,970) of both hand-driven and motor-driven knitting machines for the manufacture of hosiery.

THE EASTERN ELECTRIC & TRADING COMPANY, P. O. Box 459, Hornby Road, Fort Bombay, India, is in the market for individual radio transmitting and receiving sets, also commercial duplex wireless telephone sets, capable of working from 26 miles to about 300 miles, and also for automatic telephone switchboards.

## New Apparatus and Publications

LAMP-MAKING MACHINE. — A unit lamp-making machine for producing miniature, vacuum and nitrogen lamps, tipped or tipless, has been brought out by the General Engineering & Supply Company, 160 Fifth Avenue, New York City.

AUTOMATIC ELECTRIC STOVE.—The Toledo Cooker Company, Toledo, Ohio, has placed on the market an automatic electric stove, known as the "To-Lectric."

ELECTRIC TEST UNIT.—An improved model of testing unit for making tests on starting, lighting and ignition systems has been developed by the Service Products Company, Springfield, Ohio.

ELECTRIC LAUNDRY STOVES.—The George D. Roper Construction Company, Rockford, Ill., has brought out a line of electric laundry stoves with two or three burners.

PORTABLE DESK LAMP.—A portable desk or table lamp of solid brass ("Verdelite") furnished with a pen rack and inkwell has been brought out by the Faries Manufacturing Company, Decatur, Ill.

OUTDOOR LIGHTING CONTROL.—The South Bend Current Controller Company, South Bend, Ind., has issued a new and revised edition of its "Engineer's Reference Book," which deals with the remote control of all phases of outdoor lighting from a power house by means of the "R-C-O-C" system of remote control. It contains typical plans, data for solving problems connected with control of constant-current transformers, multiple or series ornamental lighting systems, etc.

TELEPHONICS.—The Western Electric Company, Inc., Engineering Department, New York City, is distributing reprints B-13-1, B-15-1, B-19-1 and B-20-1, entitled "Voltage-Current Relation in Central Anode Photo-Electric Cells," "The Crystal Structures of Potassium and Beryllium," "The Relative Sensitivity of the Ear" and "Thermionic Work Function of Tungsten" respectively.

STEAM TURBINES, PUMPS, BLOWERS, ETC.—"Plant and Products" is the title of a twenty-four-page booklet issued by the De Laval Steam Turbine Company, Trenton, N. J., covering its single-stage and multi-stage turbines, centrifugal pumps, blowers and other products.

SAWMILL EQUIPMENT.—"Electrically Driven Sawmills" is the title of bulletin No. 140 issued by the Allis-Chalmers Manufacturing Company, Milwaukee, covering its equipment for electrically driven machinery for sawmills. Illustrations are also given of various sawmills equipped with "Allis-Chalmers" machinery.

PORTABLE AMMETERS AND VOLTMETERS. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a folder entitled "Handy Instruments for Everyday Use," giving information for instrument users about its line of portable ammeters and voltmeters.

FEED-WATER HEATERS.—"Feed Water Heaters in Their Relation to Steam-Plant Efficiency" is the title of a sixty-page booklet distributed by the H. S. B. W. Cochrane Corporation, Philadelphia, which is a presentation of the theory and practice of heating boiler-feed water.

OIL ENGINE.—The Ingersoll-Rand Drill Company, 11 Broadway, New York City, has recently placed on the market a horizontal direct-injection oil engine.

FLEXIBLE SHAFTING.—The Stow Manufacturing Company, Binghamton, N. Y., is manufacturing a flexible shafting which can be used with any portable electric drill.

PORTABLE CORD.—"Okocord" is the name of a new flexible, unbraided, portable cord, recently placed on the market by the Okonite Company, Passaic, N. J.

RADIO APPARATUS. — The Coto-Coil Company, 87 Willard Avenue, Providence, R. I., has recently developed a new vacuum-tube socket, known as type 7,000.

SOLDERING MACHINE. — The P. E. Chapman Electric Works, Tenth and Walnut Streets, Philadelphia, have recently developed the "Allatonce" commutator soldering machine, which is described in bulletin No. 120.

WATER HEATER.—The Automatic Electric Heater Company, Warren, Pa., has brought out an improved-type "Sepco" automatic circulation water heater. This heater differs from previous models in that the heating units are inserted from the top. Another feature is the use of separate 1,000-watt units instead of placing 3,000 watts all on one unit-head assembly, and still another is the telltale of glow fuse.

RADIO APPARATUS.—The Dayton Fan & Motor Company, Dayton, Ohio, has brought out a line of molded variometers and vario-couplers.

VARIABLE CONDENSER.—The Mignon Electric Manufacturing Corporation, 25 South Water Street, Rochester, N. Y., has developed a variable condenser.

## New Incorporations

THE WEST TEXAS UTILITIES COMPANY, Abilene, Tex., has been chartered with a capital stock of $1,500,000 to furnish gas and electricity in thirty-four counties in western Texas. The incorporators are G. W. Fry, Taylor County; E. W. Campbell, Eastland County, and M. J. Insull, Chicago.

THE GREAT NORTHERN UTILITIES COMPANY, Great Falls, Mont., has been incorporated with a capital stock of $3,000,000 to supply electricity for lamps and motors in this part of the state. The directors are F. D. Fletcher, J. F. Mooney and O. C. Allan, all of Great Falls.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

PORTLAND, ME.—The Maine Central Railway Company contemplates powerhouse extensions in connection with its proposed car and locomotive shops at its South Portland terminal, to cost about $1,200,000.

WATERVILLE, ME. — The industrial concerns and water-power companies which utilize the waters of the Kennebec River are reported to have united on a project to double the available water power of that stream by establishing storage basins. The proposed plan contemplates the establishment of a large basin along the Dead River in the Flagstaff district. Should the Dead River project be delayed, the other site which is contiguous to Brassau Lake in the Moosehead region, would be devoloped first.

NEW HAVEN, CONN.—Plans are being prepared by Day & Klauder, Architects, 416 Chestnut Street, Philadelphia, for a one-story power house at the building now in course of erection at 19 Rose Street.

STAMFORD, CONN.—Contract has been awarded by the Stamford Gas & Electric Company for the construction of a switch house, to cost about $50,000.

## Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Corporation, it is reported, will build a new plant on East Canada Creek, below Canada Lake, to cost about $750,000. This plant will be connected with the present transmission system near St. Johnsville.

BINGHAMTON, N. Y.—Extensive improvements are contemplated by the Binghamton Light, Heat & Power Company, involving an expenditure of about $1,000,000, during the coming year. The work will include the installation of a 10,000-kw. turbine and three 600-hp. boilers with auxiliary equipment at the main power station at Johnson City, to cost about $850,000. The power station will be doubled in size, and another brick stack, 150 ft. high, will be erected.

BROOKLYN, N. Y.—The Rubel Coal & Ice Corporation, Glenmore Avenue, will install electric power equipment at its proposed ice-manufacturing plant on Eighteenth Avenue, to cost about $500,000. Edward M. Adelsohn, 1778 Pitkin Avenue, is architect.

BUFFALO, N. Y. — The International Railway Company contemplates rebuilding its Cold Spring car shops and barns, recently destroyed by fire.

BUFFALO, N. Y.—Bids will be received by the Board of Education until Jan. 18 for electrical and machine equipment for the vocational and technical schools. D. J. Sweeney is deputy superintendent of business and accounts.

CALCIUM, N. Y.—Steps have been taken by the Citizens' Protective Association to secure electrical service in Calcium from the Northern New York Utilities, Inc., Watertown. Madison Cooper is president of the association.

DUNKIRK, N. Y.—Plans are under consideration for the installation of electrically operated pumping machinery at the waterworks station.

GENEVA, N. Y.—The Empire Gas & Electric Company has acquired the right-of-way for a new high-tension electric transmission line between this city and Lyons, where it will connect with the system of the Niagara, Lockport & Ontario Power Company. The new line will also supply electricity to communities and farms along the route, including Junius, Alloway, Thompson's and other towns.

MAPLETON, N. Y.—Arrangements have been made with the Tonawanda Power Company, North Tonawanda, to furnish electricity in Mapleton. The transmission line will be extended a distance of 4 miles in the spring to furnish the service.

NEW YORK, N. Y.—The Arctic Hygeia Ice Manufacturing Company, 300 East One Hundred and Thirty-third Street, will

install electric power equipment in connection with extensions to its plant, to cost about $450,000. Ophuls & Hill, 112 West Forty-second Street, New York, are engineers.

NEW YORK, N. Y. — Electric power equipment will be installed at the confectionary plant to be erected by Henry Heide, 313 Greenwich Street, on Van Dam Street, to cost about $500,000. Maynicke & Frank, 25 East Twenty-sixth Street, are architects.

UTICA, N. Y.—The Utica Gas & Electric Company contemplates placing its wires on Bleecker Street underground.

GLOUCESTER CITY, N. J.—Electrically operated pumping machinery will be installed in connection with proposed waterworks extensions, to cost about $250,000.

NEWARK, N. J.—The Board of Education contemplates the installation of additional equipment in the electrical department and shop at the Seymour vocational school.

ALTOONA, PA.—Officials of the Penn Central Power Company have organized the Central Transmission Company, to take over eleven of its subsidiary companies operating in central Pennsylvania. The new company will build a transmission system from the power plant of the Penn Central Company at Saxton, now in course of construction.

COATESVILLE, PA.—Improvements are contemplated by the Chester Valley Electric Company, including the erection of a new boiler house and installation of new boilers, to cost about $125,000. The erection of additional high-tension lines is also under consideration by the company.

MOUNT HOLLY SPRINGS, PA. — The Cumberland Valley Light & Power Company has secured contracts for light and power service in York Springs, East Berlin, Abbottstown and Bendersville.

PHILADELPHIA, PA.—Electric power equipment will be installed at the proposed paper manufacturing plant to be erected on South Street, by S. Kardon, Second and Vine Streets, to cost $500,000. Clarence E. Wunder, 1415 Locust Street, is architect.

PHILADELPHIA, PA. — The Schlorer Delicatessen Company, 1909 South Front Street, will install electric equipment at its proposed factory at Water and Mifflin Streets, to cost about $200,000. Clarence E. Wunder, 1415 Locust Street, is architect.

SHENANDOAH, PA.—The Pennsylvania Power & Light Company is making surveys for a transmission line to Shenandoah via Hometown and Delano. Service will be furnished from the Hauto power plant.

STRASBURG, PA.—The Edison Electric Company, Lancaster, has acquired the Strasburg Electric Light Company and will merge the property with its system. Extensions and improvements are planned.

BALTIMORE, MD. — The Washington, Baltimore & Annapolis Railway plan to extend its transmission line to Laurel for light and power service. A distributing system will also be installed at Harmans.

BALTIMORE, MD. — Electric power equipment will be installed in the printing plant to be erected by the Baltimore American, Courtland and Centre Streets, to cost about $450,000. McKim, Mead & White, 101 Park Avenue, New York, are architects.

BLUEFIELD, W. VA.—The Coal River Collieries Company plans to install electrically operated machinery and power equipment at its properties.

BLACKSBURG, VA.—Bids will be called early in February for an addition to the power house at the Virginia Polytechnic Institute, to cost about $55,000. Wiley & Wiley, People's Bank Building, Lynchburg, are engineers.

MARTINSVILLE, VA. — The Lester Lumber Company plans to build a power house in connection with the rebuilding of its local plant, recently destroyed by fire, causing a loss of about $250,000.

WASHINGTON, D. C. — Bids will be received by the Chief Signal Officer, United States Army, until Jan. 22, for telephone supplies. (Circular PR 13360-43 CP.)

## North Central States

CHEBOYGAN, MICH.—The property of the Cheboygan Light & Power Company has been acquired by the Commonwealth Light & Power Company, 141 Broadway, New York. Extensions and improvements are planned.

DETROIT, MICH.—The Board of Education contemplates the construction of a central power house on the Roosevelt Field for service at a number of schools, to cost $150,000.

DETROIT, MICH.—Plans are being prepared by Edward Gray, engineer, foot of Continental Avenue, for the construction of a central power plant, in Detroit.

BELLAIRE, OHIO — The Central Coal Mining Company, Charleston, W. Va., plans to equip its local properties for electrical operation.

DAYTON, OHIO—Plans are being prepared by the A. C. Bishop Company, architect and engineer, Guardian Building, Cleveland, for a plant for the Miami Ice & Fuel Company, Ludlow Building, to cost about $250,000.

DOVER, OHIO.—The American Gas & Electric Company has acquired the plant and property of the Ohio Service Company and plans extensions and improvements.

LIMA, OHIO—An agreement has been reached between the City Council and the Ohio Power Company, which has recently acquired the local system, whereby 200 additional street lamps will be installed in various parts of the city.

GEORGETOWN, KY.—The power house of the Georgetown Water, Gas, Electric & Power Company was recently damaged by fire, causing a loss of about $50,000.

LAWTON, KY.—The Enterprise Chemical Company, P. O. box 545, Huntington, W. Va., recently organized, will build a power plant in connection with its proposed local lime-manufacturing plant. William Lewis is construction engineer.

EVANSVILLE, IND. — The Southern Indiana Gas & Electric Company plans extensions and improvements during the present year, to cost about $500,000.

CHICAGO, ILL. — Extensions will be made to the power house at the Michael Reese Hospital, Twenty-ninth Street and Ellis Avenue, in connection with a new nurses' home. Schmidt, Garden & Martin, 104 South Michigan Avenue, are architects.

JOLIET, ILL.—The Public Service Company of Northern Illinois will begin work at once on the proposed addition to its power plant.

OTTAWA, ILL.—Plans are being prepared by the Waterway Division, of the State of Illinois, 304 South Wabash Avenue, Chicago, for a new power house at Ottawa in connection with locks and dam on the state waterway. W. L. Sashett is superintendent.

HARTFORD, WIS.—The Westphal Milk Products Company has purchased the Denison millpond which it proposes to utilize for the development of hydro-electric power.

HUDSON, WIS. — The Stanton-Star Prairie Power Company, recently organized, plans to erect a transmission line to furnish electricity for lamps and motors to the farming sections north and east of the city. Energy for distribution will be purchased from the New Richmond Roller Mills Company of Hudson.

PORT EDWARDS, WIS.—The Nekoosa-Edwards Paper Company is planning to install a new 1200-hp. hydro-electric unit at the Nekoosa mill to furnish power for the new paper mill now under construction. Two steam turbines of about 3,000 hp. capacity, will also be installed by the company, one at Nekoosa and the other at Port Edwards, as auxiliaries. Other electrical equipment will also be required at the Nekoosa mill.

PORT WASHINGTON, WIS.—The town officials have applied to the Railroad Commissioners for permission to extend the municipal electric light and power lines to the town of Holland to supply electricity in the latter place.

RACINE, WIS.—The Board of Aldermen has decided to replace the arc lamps (416) now in use with 600-cp. nitrogen electric lamps. The Wisconsin Gas & Electric Company furnishes the street-lighting service.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company has applied to the State Railroad Commission for permission to issue $239,000 in capital stock and $3,099,000 in bonds, the proceeds to be used for retiring underlying bonds and proposed extensions and improvements.

MAPLETON, IOWA.—Bonds for $50,000 have been approved for improvements to the municipal electric plant.

MOUNT VERNON, IOWA. — Electric equipment will be installed in connection with improvements at the municipal waterworks pumping plant.

GALENA, MO. — Application has been made to the Federal Power Commission by B. J. Diemer and John Meyer, Springfield, and John A. Williams, Aurora, for permission to construct a hydro-electric plant, in Galena, to cost about $100,000.

LAMAR, MO.—Bids will be received at the office of the Lamar water and electric plant until Jan. 15 for furnishing additional power equipment, consisting of an engine or engines with direct-connected generators, for the municipal electric light plant. J. M. Earp, is Mayor and chairman of utilities committee.

PURDY, MO.—Bonds to the amount of $12,000 have been voted for extensions and improvements to the municipal electric plant and system.

SPICKARD, MO.—Bonds to the amount of $15,000 have been sold for the erection of a transmission line from Trenton to supply electricity in Spickard.

McLAUGHLIN, S. D.—Application has been made to the Council by E. M. Young for the installation of an electric light plant in McLaughlin.

PICKRELL, NEB.—Plans are under way for the erection of a transmission line to Beatrice to supply electricity in Pickrell.

BONNER SPRINGS, KAN.—The International Cement Corporation, 342 Madison Avenue, New York, contemplates an addition to the power plant at its local mills, in connection with extensions, to cost about $500,000.

WICHITA, KAN. — Electric equipment will be installed in the printing plant to be erected by the McCormick-Armstrong Press on Ellis Street, to cost about $100,000. Lorentz Schmidt & Company, Fourth National Bank Building, are architects.

## Southern States

BOSTIC, N. C.—Bonds to the amount of $4,000 have been authorized for the installation of an electric lighting and power system. A transmission line will be erected to Forest City to connect with the lines of the Southern Power Company at that place.

DENMARK, S. C.—The Edisto Public Service Company plans to double the capacity of its electric and ice plants.

HARBOR POINT (P. O. ALLANDALE), FLA.—The Harbor Point Development Company has acquired three partially developed tracts of land about 5 miles south of Daytona, comprising Norwood, Allandale and Rose Bay, aggregating 1,400 acres, which it will develop for homesites. Lighting, water and sewer systems will be installed. Charles D. Thompson is local manager in charge with offices in Nelson Building, Daytona.

TAMPA, FLA.—R. W. Pillsbury, president, Woodmont Orchards Company, New Hampshire has purchased the holdings of the Anna Maria Beach, including pier, dance hall and equipment for maintenance of an amusement resort, and contemplates improvements including an electric lighting system, etc. Bouton & Cermak, St. Petersburg, are representing agents.

MEMPHIS, TENN.—The Memphis Light & Power Company is negotiating for the purchase of the properties of the Memphis Street Railway Company. As soon as the receivership is cleared up it will enlarge the power house of the street railway and make other extensive improvements.

UNION, TENN.—The proposal to issue $125,000 in bonds will be submitted to the voters on Jan. 27. Of the proceeds $75,000 will be used for extensions to the municipal light and water plant and sewer system.

CHICKASHA, OKLA. — The Chichasha Gas & Electric Company has submitted proposals and has asked for franchises to serve electricity to the towns of Cement, Cyril, Tuttle, Minco, Pocasset, Ambler and Alex.

PAWNEE, OKLA.—The Oklahoma Gas & Electric Company plans to extend its 22,000-volt transmission line to Pawnee for commercial service. A line will also be erected to Cushing.

WEST TULSA, OKLA.—The Oklahoma Power Company, Tulsa, will soon break ground for the construction of a new 10,000-kw. unit at its local power plant, duplicating the unit now in course of erection.

DALLAS, TEX. — The Dallas Railway Company will construct two substations in connection with the electrification of the line of the Missouri, Kansas & Texas Railway Company from Dallas to Denton.

ELECTRA, TEX. — The Griswold Oil Company, Henrietta, contemplates the construction of a substation at its proposed oil refinery here, to cost about $500,000.

JACKSONVILLE, TEX.—The Jacksonville Electric & Ice Company has increased its capital stock to $135,000.

PORT ARTHUR, TEX.—The Gulf Refining Company, Dallas, contemplates the installation of additional power equipment in connection with extensions to its local refinery, to cost about $500,000.

## Pacific and Mountain States

CENTRALIA, WASH.—The H. H. Martin Lumber Company will install a substation in connection with a new mill, to cost about $100,000.

COLVILLE, WASH.—The Stevens County Power & Light Company contemplates extending its transmission lines 3 miles south of Kettle Falls.

SEATTLE, WASH.—A preliminary permit has been granted by the Federal Power Commission to Maurice D. Leehy, Seattle, involving a power development at Lake Mahoney and Beaver Lake, 10 miles northeast of Katchikan, Alaska.

FRESNO, CAL.—The installation of a 6,000-hp. generator in power house No. 3 of the Crane Valley system is under consideration by the San Joaquin Light & Power Corporation. An extension, 36 ft. x 85 ft., will be erected at the power house to provide space for the proposed new unit.

HAYWARD, CAL.—Plans are being prepared for the installation of an ornamental lighting system on Castro, B and Main Streets, to be maintained by an underground wire.

LIVERMORE, CAL.—Bids for the construction of twenty-nine buildings at Livermore, including electrical work, refrigerating machinery, etc., for the United States Veterans' Bureau, Arlington Building, Washington, D. C., have been rejected. The work will be readvertised.

LOS ANGELES, CAL.—Ordinances have been approved for the installation of a street-lighting system on North Main Street and on Vermont Avenue.

OAKLAND, CAL.—Steps have been taken by property owners on Webster Street from Fourteenth to Twenty-second Street to secure the installation of electroliers on that thoroughfare.

REDLANDS, CAL. — An ordinance is being prepared for the installation of an ornamental lighting system on Eureka and Grant Streets and Brookside Avenue.

RIVERSIDE, CAL. — Steps have been taken by the officials of the Gage Canal Company for the incorporation of a mutual company for the purchase of power used in pumping water from the Gage Canal to the foothill citrus orchards.

SACRAMENTO, CAL.—The installation of an ornamental lighting system on I Street, to include octagonal electroliers, is under consideration by the City Council.

SAN RAFAEL, CAL.—Negotiations are under way with the Pacific Gas & Electric Company for the installation of an ornamental lighting system in the residential districts.

WATSONVILLE, CAL. — The Watsonville Water & Light Company has petitioned the State Railroad Commission for permission to sell its property to the city of Watsonville, at $200,000. Bonds have been voted to acquire the plant.

PEACH SPRINGS, ARIZ.—A permit has been granted to James B. Girard, engineer, Phœnix, by the State Water Commissioner to build a hydro-electric plant on the Colorado River, at the mouth of Diamond Creek, about 25 miles from Peach Springs. The plans call for a total development of 200,000 hp. Authority from the Federal Power Commission will be necessary before the plant can be erected.

## Canada

ANYOX, B. C.—The Granby Consolidated Mining, Smelting & Power Company is building an addition to its local power plant and will install a 5,000-hp. vertical reaction turbine, for which orders have been placed.

VANCOUVER, B. C.—The British Columbia Electric Company is planning to erect a new 34,000-volt transmission line from its Lake Buntzen plant to Port Moody, tying in with an existing line at that point. This line and the reconstruction of other lines will cost about $170,000.

CAMPBELLVILLE, ONT.—The question of issuing $35,000 in bonds for the installation of an electric lighting and power distribution system is under consideration.

LANSING, ONT.—Surveys are being made for the installation of a street-lighting system in North York Township. A. Stocking, Hydro Building, University Avenue, Toronto, is engineer.

# Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 19, 1922)

1,439,524. ELECTRIC HEATER; T. A. Lewis and A. L. Dunham, New York, N. Y. App. filed March 20, 1920. Radiant room heater with element inclosed in glass bulb.

1,439,525. EXCITATION OF ELECTROLYTIC CONDENSERS; R. D. Mershon, New York, N. Y. App. filed Sept. 14, 1920. Excitation of condensers that are to be employed in polyphase circuits.

1,439,526. EXCITATION OF ELECTROLYTIC CONDENSERS; R. D. Mershon, New York, N. Y. App. filed July 18, 1917. Single source of excitation current.

1,439,543. ELECTROMAGNETIC DEVICE; H. E. Frost, Cleveland, Ohio. App. filed July 9, 1920. Switch for alternating current.

1,439,562. AMPLIFYING SYSTEM; P. F. Lowell, Washington, D. C. App. filed Sept. 9, 1921. Radio-frequency amplifier transformer.

1,439,563. RADIO-FREQUENCY TRANSFORMER; P. D. Lowell, Washington, D. C. App. filed Sept. 9, 1921. Amplifies efficiently at short wave lengths.

1,439,577. ELECTRIC WATER HEATER; G. Pominville, St. Hyacinthe, Quebec, Can. App. filed Sept. 1, 1920. Adaptable to any type of domestic water tanks.

1,439,633. METHOD OF AND APPARATUS FOR TELEGRAPHIC TRANSMISSION; J. W. Milnor, New York, N. Y. App. filed Sept. 17, 1918. Duplex telegraphic transmission through long submarine cables.

1,439,639. ELECTRIC REGULATOR; T. M. Pusey, Kennett Square, Pa. App. filed Nov. 4, 1920. Voltage regulator for generators.

1,439,648. TROLLEY-WHEEL GUARD; W. Stasiak, Detroit, Mich. App. filed April 12, 1922. Star-shaped guard at each side of wheel.

1,439,657. CONNECTION TERMINAL; R. Zollner, Dresden, Germany. App. filed April 6, 1921.

(Issued Dec. 26, 1922)

1,439,686. MAGNETIC FISHING TOOL FOR WELLS; A. H. Brandon, Toledo, Ohio. App. filed May 10, 1919. Relates to electromagnetic fishing operations.

1,439,687. FISHING TOOL; A. H. Brandon, Self-energizing unit attached to drilling stem.

1,439,723. NUMBERING SYSTEM FOR AUTOMATIC TELEPHONE EXCHANGES; W. G. Blauvelt, New York, N. Y. App. filed Sept. 17, 1918. Automatic switching machinery.

1,439,729. TELEPHONE HAND SET; G. Deakin, Antwerp, Belgium. App. filed Sept. 7, 1922. Impulse sender easily attached or removed.

1,439,735. TELEPHONE EXCHANGE SYSTEM; E. W. Hancock, New York, N. Y. App. filed Oct. 20, 1920. Automatic switching.

1,439,740. TROLLEY-POLE BASE; E. S. Lincoln and Ernest Larsson, Mansfield, Ohio. App. filed March 25, 1922.

1,439,761. SIGNAL AND ALARM SYSTEM; C. J. Rohland, Worcester, Mass., and J. H. Wheelock, Fitzwilliam, N. H. App. filed Feb. 5, 1915. Fire-alarm system.

1,439,771. SIGNAL-CONTROLLING SYSTEM; C. A. Sprague, East Orange, N. J. App. filed Feb. 27, 1920. Correcting defective or false response of receiver systems.

1,439,772. SIGNALING APPARATUS AND CIRCUITS; J. F. Toomey, New York, N. Y. App. filed April 24, 1919. Indicates that portion of long telephone line is in use.

1,439,785. TELEPHONE RECEIVER OF THE WATCHCASE TYPE; F. W. Andrew, Brooklyn, N. Y. App. filed April 20, 1922.

1,439,797. GENERATOR DRIVING; W. L. Conwell, Montclair, and W. I. Thomson, Newark, N. J. App. filed Dec. 5, 1918. Railway car-lighting generator belt supplied with sand to prevent slipping.

1,439,817. ANNUNCIATOR DROP; C. Herrmann, New York, N. Y. App. field Oct. 24, 1919.

1,439,871. MOTOR CONTROLLER; L. P. Coulter, Milwaukee, Wis. App. filed Feb. 13, 1922. For machines having several tool-operating motors and a motor-operated feeding mechanism.

1,439,892. MOTOR CONTROLLER; A. J. Horton, White Plains, N. Y. App. filed Nov. 24, 1917. Automatically accelerates to a number of predetermined speeds.

1,439,893. BATTERY-CHARGING APPARATUS; A. J. Horton, White Plains, N. Y. App. filed Jan. 17, 1920. Prevents improper connection to charging circuit.

1,439,947. ELECTRICAL SIGNALING; L. Cohen, Washington, D. C. App. filed June 29, 1921. Static in radio receiving balanced out by Wheatstone bridge.

1,439,955. CATHODE; M. E. Fuld, Baltimore, Md. App. filed Sept. 21, 1920. Dry-cell cathode of wire with depolarizing material.

1,439,956. BATTERY CELL; M. E. Fuld, Baltimore, Md. App. filed June 23, 1919. Cap-shaped anode for dry cell.

1,439,962. TUBE-WELDING MACHINE; E. Kamper, Toledo, Ohio. App. filed June 21, 1917. Preheating the parts of tube to be welded.

1,439,965. ELECTRICALLY HEATED UTENSIL; J. F. Lamb, New Britain, Conn. App. filed July 20, 1917. Waffle iron.

1,439,972. ELECTRIC ARC WELDING; P. O. Noble, Schenectady, N. Y. App. filed Dec. 20, 1920. Flux-covered electrode welding performed with automatic machine.

1,439,979. ELECTRICALLY HEATED DEVICE; E. H. Richardson, Ontario, Cal. App. filed Feb. 21, 1921. Automatic cut-out for flatirons.

1,439,990. VENTILATION FOR DYNAMO-ELECTRIC MACHINES; H. S. Baldwin, Lynn, Mass. App. filed March 5, 1921. Fan attached to one end of machine forces air through windings.

1,439,994. PROCESS OF STABILIZING STORAGE-BATTERY ELECTRODES; R. C. Benner, Bayside, N. Y. App. filed April 29, 1922. Method for washing and drying formed negative plates.

1,439,995. INDUCTANCE; L. F. Bird, Seattle, Wash. App. filed Jan. 5, 1921. For radio circuits.

1,439,997. INSULATION MOUNTING; L. F. Bird, Seattle, Wash. App. filed Feb. 25, 1921. For low-capacity and low-inductance resistances.

1,440,005. PORTABLE BURGLAR ALARM; F. Crossman, San Francisco, Cal. App. filed Aug. 16, 1921.

1,440,021. ELECTRIC POCKET LAMP; A. Luzy, Paris, France. App. filed July 29, 1920. Self-contained generator.

1,440,023. STORAGE BATTERY; S. M. Meyer and W. James, Brooklyn, N. Y. App. filed Oct. 29, 1921. Positive electrode in form of box with perforated sides.

1,440,024. STORAGE BATTERY; S. M. Meyer and W. James, Brooklyn, N. Y. App. filed April 7, 1922. Cylindrical container inclosing cylindrical electrodes.

1,440,036. METHOD OF RECEIVING TELEGRAPH SIGNALS; C. H. Teegarden, Washington, D. C. App. filed Sept. 19, 1918. Supplementary receiving set which may be attached to duplex telegraph system without interference.

1,440,044. COIL-WINDING MACHINE; S. R. Wright, Rawdon, England. App. filed Aug. 22, 1921. Used for winding conical coils.

1,440,051. STARTING GENERATOR FOR INTERNAL-COMBUSTION ENGINES; S. G. Baits, Detroit, Mich. App. filed Nov. 12, 1920.

1,440,078. TELEPHONE LOCK; W. F. Hemstreet, Brooklyn, N. Y. App. filed Feb. 16, 1921. Prevents unauthorized use of automatic telephone.

1,440,091. ELECTRODE; R. A. Long, Tamaqua, Pa. App. filed March 1, 1922. Platinum faced on lead for electrolytic solution.

1,440,093. TROLLEY SHOE; J. Miller, Amesbury, Mass. App. filed Nov. 13, 1915. Self-adjusting, spring-held trolley harp.

1,440,106. PROCESS AND APPARATUS FOR ELECTRIC SMELTING OF ORES; E. H. Rothert, Seattle, Wash. App. filed June 14, 1921. Refining done in same furnace in which ore has been reduced.

1,440,110. TRUNK CIRCUITS; C. Sparks, Chicago, Ill. App. filed April 4, 1918. Provided with double supervision.

1,440,111. TELEPHONE SYSTEM; C. Sparks, Oak Park, Ill. App. filed May 23, 1918. Balanced operator's telephone circuit reduces side tone in the operator's head receiver.

1,440,112. TELEPHONE SYSTEM; C. Sparks, Oak Park, Ill. App. filed July 1, 1918. Multiple-line lamp system in which instantaneous "disconnect" and recall are provided.

1,440,113. TELEPHONE SYSTEM; C. Sparks, Chicago, Ill. App. filed May 15, 1916. Busy test for multiple-line jack and line lamp system.

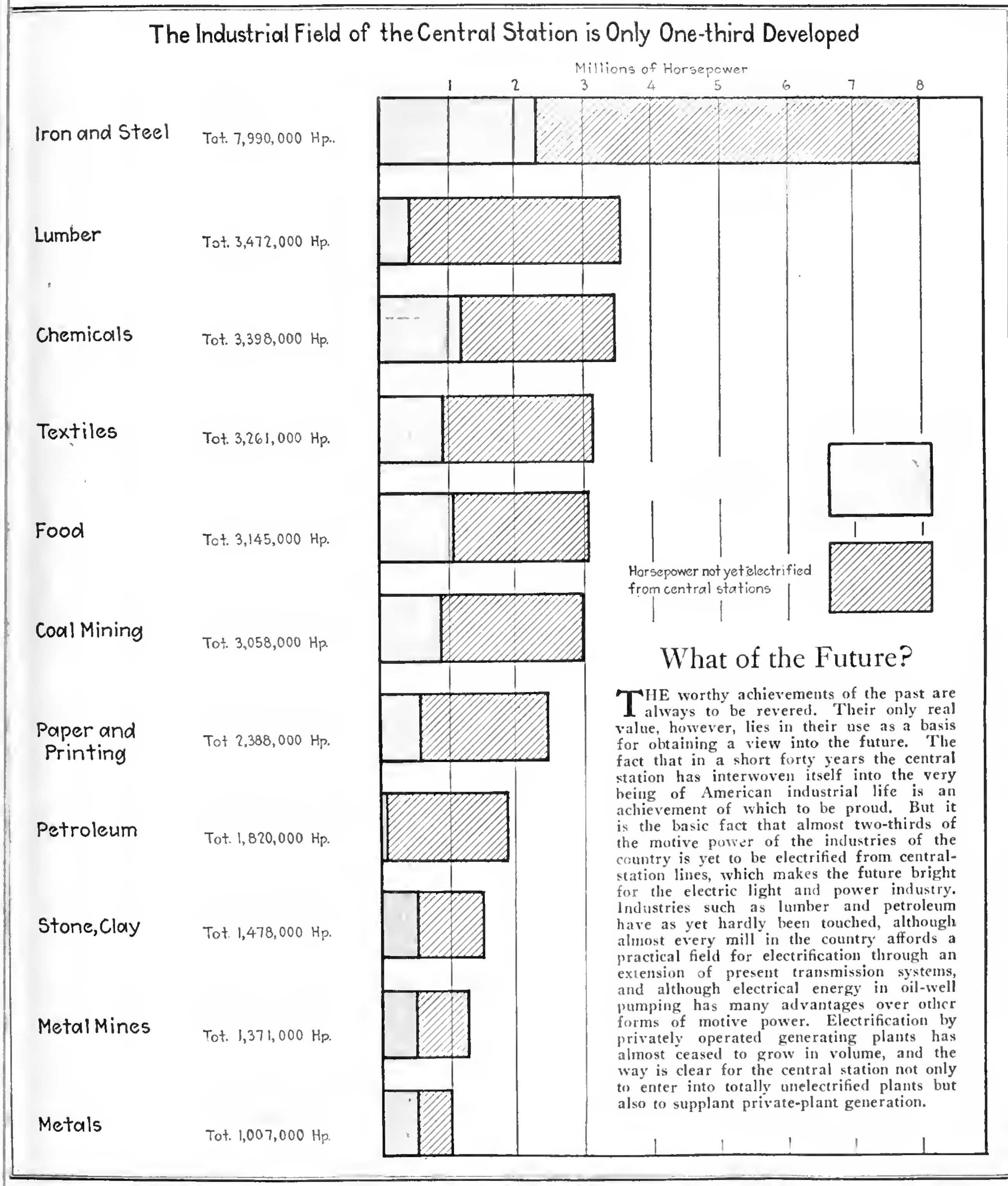
1,440,114. TELEPHONE SYSTEM; C. Sparks, Oak Park, Ill. App. filed Aug. 5, 1918. Interconnection of common-battery and local-battery lines.

1,440,171. ELECTRIC HEATER; A. Papini, Philadelphia, Pa. App. filed April 21, 1920. Expansion and contraction of thermostatic element employed to oscillate reflector.

1,440,202. ELECTRICAL HEATING UNIT; J. S. Yoast, Cincinnati, Ohio. App. filed April 21, 1921. Loosely packed resistance-element refractory container.

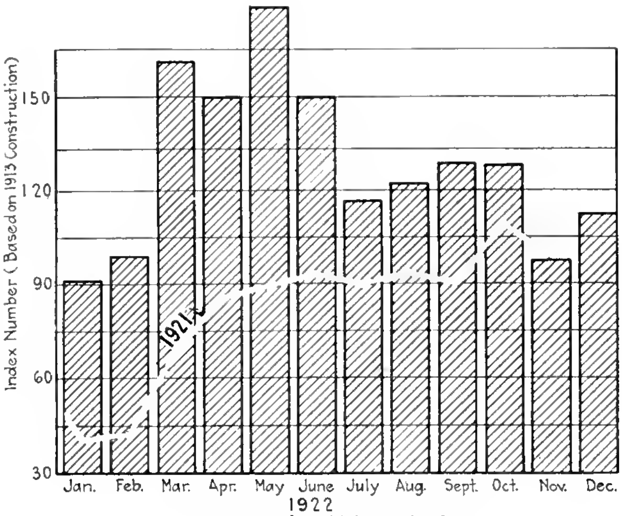
# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

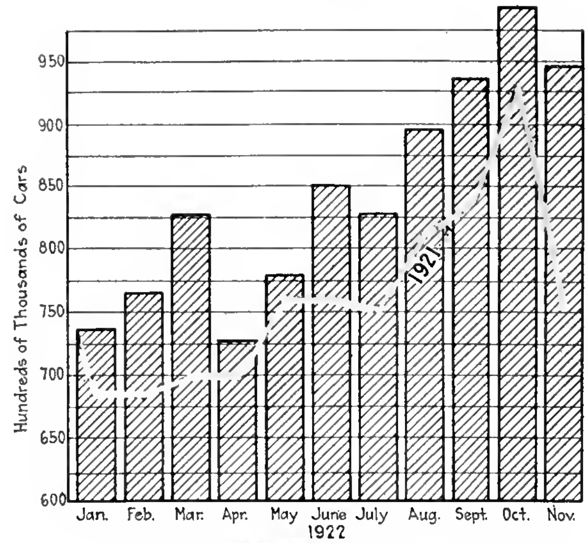



## What of the Future?

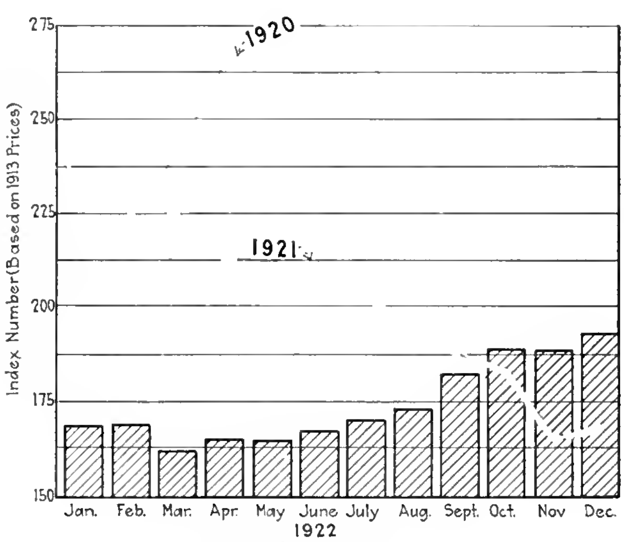
THE worthy achievements of the past are always to be revered. Their only real value, however, lies in their use as a basis for obtaining a view into the future. The fact that in a short forty years the central station has interwoven itself into the very being of American industrial life is an achievement of which to be proud. But it is the basic fact that almost two-thirds of the motive power of the industries of the country is yet to be electrified from central-station lines, which makes the future bright for the electric light and power industry. Industries such as lumber and petroleum have as yet hardly been touched, although almost every mill in the country affords a practical field for electrification through an extension of present transmission systems, and although electrical energy in oil-well pumping has many advantages over other forms of motive power. Electrification by privately operated generating plants has almost ceased to grow in volume, and the way is clear for the central station not only to enter into totally unelectrified plants but also to supplant private-plant generation.



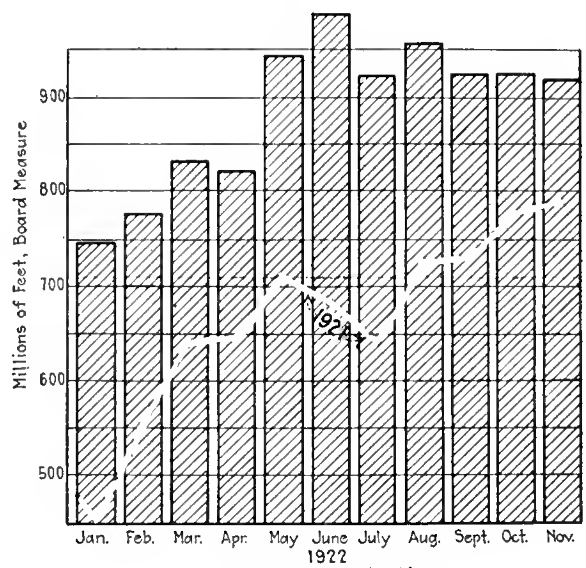

Construction Volume Index
(Engineering-News Record)



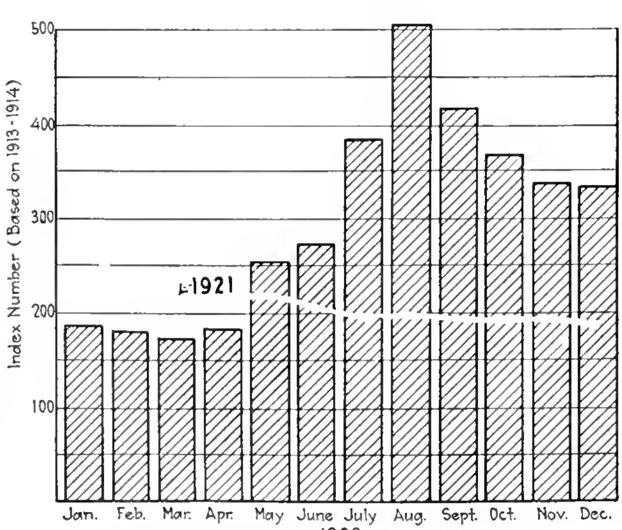

Total Average Weekly Freight-car Loadings




Construction Cost Index
(Engineering-News Record)




Lumber Production
(Yellow Pine and Douglas Fir)




Price of Bituminous Coal at Mines
(Coal Age)

## A Year of Inconsistencies

THE year which has just closed has witnessed many extremely encouraging tendencies and a few extremely discouraging tendencies. The cost of construction during the first half of the year was materially under that of 1920 and 1921, but in September, prices of construction materials exhibited an upward swing which carried them above the prices of 1921 during the last quarter of the year, though they remained still many points below the prices of 1920. Actual construction, however, was far above that during 1921 with the exception of November. The rapid rise in the price of coal with the opening of the coal strike in the middle of spring applied the brakes to industrial development and the rapid return to normal. The year closed with coal prices about 90 per cent above those of 1921.

Electrical World

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# Stop the Negative Guesswork

WEST of the Rockies a new drive is on to extend and intensify the use of electrical appliances in the home. There are a million and a half electrically connected residences in that region. Already certain central-station companies—notably the California Oregon Power Company, the Idaho Power Company and the Washington Water Power Company—have succeeded in introducing electric ranges and water heaters to the extent of one to every five of their residential consumers. The forward movement, which looks to building up electrical household appliance loads to the same degree of saturation in every district, is worthy of the electrical industry, and it should receive similar impetus in every nook and corner of the country.

But there is one great obstacle. As a prominent manufacturer recently expressed it in a line: "Our most difficult and persistent enemies are the electrical men themselves."

An "old fogy," according to William James, is a man who has ceased to accept new thoughts, and he confessed having known some men who showed symptoms of old-fogyism at the age of twenty-five. The question is important, because the disease is a prevalent one and the old fogy is a menace to any industry in which he engages. He is the man who ties his industry down to inefficient methods and hampering limitations.

In the electrical field he is not sufficiently convinced of the value of electricity for cooking, dishwashing, water heating and refrigerating to use it for these purposes himself. He will doubtless put up a very good sales argument if confronted with a prospective customer, but he will tell his friends, as his private opinion, that, aside from electric flat-irons and perhaps vacuum cleaners and possibly clothes washers, there is not one electric appliance which has really proved itself.

This man, and he is surprisingly common in the ranks of the electrical industry, is the greatest hindrance to the advancement of the electrical idea today. It is a common statement among electrical men that they must "sell themselves" before they sell the public. But apparently most of them mean by this that they must somehow acquire an inpouring of enthusiasm on things electrical which will descend from heaven in the form of religious inspiration.

This skepticism and apathy are a tremendous handicap under which our pioneers must struggle. The public naturally considers all members of the electrical industry experts in this field and takes their word, especially if it be derogatory, as final. The man who by snap judgment condemns any new device or method therefore does a tremendous injustice and he is hampering his own work.

# Frederick Gardner Cottrell

*A notable contributor to electrochemical progress through the development of the electrical precipitation process.*

ONE of the leaders in the field of electrochemical research is F. G. Cottrell, research chemist and chairman of the division of chemistry and chemical technology of the National Research Council. The Cottrell process which bears his name and by which he is best known is a simple electrical process by which foreign substances in an admixture with gases or liquid are deflected when made to pass through an electrical field and caused to be deposited in chambers especially prepared for that purpose. So simple is the system that it has usually paid for itself within the first few months of operation by the value of the by-products saved, and so important is it that it may be said to have saved more than one smelting and cement industry from being put out of business as a public nuisance.

Mr. Cottrell is a native of California and a graduate of the University of California, class of 1896. Following graduation, for three years he served as a teacher of chemistry in the Oakland High School. He then went to Europe for further study, receiving a degree from the University of Berlin in 1901 and a Ph.D. from the University of Leipzig in 1902. On his return to California in the latter year he became associated with the chemical department of his Alma Mater, rising to the rank of assistant professor in 1906. About this time he conducted numerous experiments in electrical precipitation on the principles laid down by Walker and Lodge. He was more successful than they in establishing the commercial feasibility of the system, and as early as 1906 an installation was made at the Hercules works of the E. I. du Pont de Nemours Powder Company at Pinole, Cal. Since that time the principle has been applied to the removal of fumes from smelter stacks, the recovery of potash from cement plants, the dehydration of oil and numerous other processes.

In 1911 Mr. Cottrell's services were asked for by the Bureau of Mines and he became consulting chemist with that organization, rising to be director of the bureau in 1920. His interest has always, however, lain primarily with research, and in 1921 he resigned to accept his present post with the National Research Council.

Mr. Cottrell is deeply interested in public service in the broadest sense of the word. Typical of the man is his action, while still dependent on the modest income of an assistant professor, in transferring to the Smithsonian Institution substantially all his rights to his inventions and patents in the field of electrical precipitation, in order that the profits might be applied to the advancement of scientific research.

# Editorial Comment

Electrical World, January 20, 1923

Volume 81 Number 3

### Do Our Associations Function?

THIS question has often been asked by those who contribute as well as by those who have been asked to contribute to the support of the various societies of the electrical industry. Needless to say, organizations which measure up to expectations seldom have to worry greatly about the wherewithal to "carry on." Nevertheless none is ever immune from the necessity of hustling for funds. Though they be as chaste as ice and as pure as snow, they shall not escape calumny, and though the benefits they confer on those who support them be as manifest as the nasal organ of a Roman senator, yet for one who gladly proffers his assistance there are three who wait to be coaxed or who demand superfluous proof.

In the case of the National Electric Light Association at least this necessary work of supererogation has been done well enough to convince even him "who complies against his will." President Frank W. Smith has prepared a report reviewing the affairs of that organization for the first half of the year. In reading his narrative no one can help being impressed with the tremendous scope of the work in which the association is engaged. Mr. Smith and his staff are to be congratulated on such an excellent account of their stewardship. It should silence the carpers and cynics as well as the honestly doubting Thomases, if such there be, and will deprive the reluctant contributor even of the chance to pose as a benefactor, so clearly is he shown to be an investor for his private good as well as for the good of the industry on which he depends.

### Notable Achievement in Radio Telephony

THE speeches delivered in New York last Sunday night and transmitted by radio telephone to New Southgate, England, unquestionably establish a record of development noteworthy in the art. As long ago as 1915 successful radio telephony had been carried on between the naval radio station at Arlington and such distant points as San Francisco, Honolulu and Paris; but these were mere demonstrations indicating the practicability of wireless speech over long distance as soon as improvements in transmitting and receiving apparatus, particularly the former, could be brought about. With the development of continuous-oscillation systems, detectors and amplifiers, and more especially water-cooled vacuum tubes, long-distance radio telephony became a commercial possibility. Although still imperfect, it is nearer perfection than either the telegraph or the telephone was twenty years after its introduction. Ever since Marconi's first experiment scientific interest all over the world has been aroused in radio communication, and that interest has continued unabated until this day.

Meanwhile the aspect of mystery which covers the working of radio grips the mind of the general public, and countless persons, not understanding the physics of what they are attempting, nevertheless, thanks to a great variety of commercial apparatus, have been able to gratify a passion for wireless experimentation. Amateur interest was increased a thousandfold when broadcasting stations were established in every section of the country. It is interesting to observe that telegraphy and telephony, wired or wireless, are not competitors, but co-operators. Each has its particular field and function, and it is particularly gratifying to note the vigorous development of radio despite the limitations imposed on it. It is a matter for congratulation that the art has reached such a point that transatlantic radio telephony is now virtually assured.

### An Engineer Ambassador

WITH a sincerity and an unassuming convincingness that captured his audience, Prince Caetani, the recently appointed Ambassador from "the new Italy" to the United States, established a high standard for future engineer ambassadors to maintain in his address at the dinner given in his honor by the Federated American Engineering Societies at Washington. It is not too much to say that the dinner marked an epoch in visualizing the opportunity for bringing about through the engineer a new basis for international relations. Preceded by Calvin Rice, who presented the opportunity for establishing common purposes between the engineers of North and South America, and by Elmer Sperry, who also was recently an ambassador of engineering good will through his message to the engineers of Japan, the address of Prince Caetani came as a fitting climax to an international evening.

Between the lines of the addresses of all three one common truth was evident, that the engineer who has been and is so definitely responsible for the material advance of our civilization is now viewing himself as one having a responsibility, not alone as an engineer, but also as a citizen, for helping to solve some of the complex problems that this civilization has brought. The Italian Ambassador alluded to this in his address, when he said that he had returned from the war with a great engineering task in view, the draining of the Pontine marshes, but that when the call came to him to serve his country at Washington he felt that the problems of industrial and commercial relations between Italy and the United States could be approached in the spirit of finding the facts and adjusting these international questions on the basis of an understanding of these facts, and in that spirit he had undertaken his new mission.

The addresses of all the speakers emphasized the fact that international relations are not essentially based on mysterious communings between national spokesmen meeting in secret, but on the bringing about

of practical results by discussing with intelligent understanding and in the spirit of mutual respect the industrial and commercial problems between the nations. To this sort of diplomacy the engineer brings an intimate knowledge of the industrial life of his country and the special ability needed in deciding whether a solution proposed will work in practice. With facts expressed for facts' sake in the new diplomacy, is it too much to hope that there will come a mutual respect and tolerance for national motives and ideals that will bring order out of chaos in our world? Certainly this is not a vain hope if truth, common sense, purpose and vision shine in our diplomatic interchanges as they will if men like Caetani are chosen for ambassadors.

### Electrification Proves Economical Factor in Port Development

THE revival of shipping following the post-war depression has turned the attention of port engineers to a consideration of those factors which make for increased speed and economy in port operations and are demanded by the keen competition for water-borne commerce between rival ports and terminals. The most restricted step in the cycle of a ship's operations is the handling of the cargo at the port. It is therefore important that human ingenuity devise ways to facilitate cargo handling, and as a result much study is being given to the electrification of port terminals. Electrical material-handling equipment not only speeds up operations and reduces the unit handling costs, but permits a degree of flexibility in handling large volumes of commerce in commodities of all varieties, both in bulk and in package, not obtainable in any other way.

In an article appearing elsewhere in this issue O. P. Seim, mechanical engineer of the port of Seattle, discusses the factors which have entered into the electrification of the Port of Seattle's terminals, the selection and application of motive-power equipment and control, and the layout of the lighting and power circuits. An interesting point which the author brings out is that if the cargo must be moved more than 120 ft. from the side of the ship, then it is more economical to handle it by conveyors, tractors with trailers or other forms of material-handling equipment. There is a vast field of development in the application of electricity to material handling at ports, and a more complete knowledge of the economies derived from the use of electricity would doubtless encourage those concerned with such work.

### Talk Plainly to the Stockholder in This Year's Statement

THE season of financial reports has again arrived and the annual statements of the public utilities will be laid before their stockholders for inspection. We wonder how many of these public service corporations will follow the lead of the Commonwealth Edison Company's "Year Book" of 1922 (see ELECTRICAL WORLD, July 1, 1922, pages 1 and 29, and put its story in terms of popular understanding. How many will follow the ancient form of the traditional balance sheet?

The average investor regards an annual report as a sort of mathematical puzzle which he has neither the time nor the energy to solve. He reads the president's message, notes its optimism and its statement of growth, looks at a few totals in the columns of assets and liabilities, and lets it go at that. And yet it is of the greatest importance that the stockholder of any corporation shall understand his company's business and feel not a passive but an active confidence in it.

As a matter of fact, the annual report of the average American corporation is, as a rule, a singularly frank statement of the results of the year's activities. The trouble lies in that the form in which this statement is expressed is highly technical. It is couched in financial jargon, adequate and full of meaning to the trained financial mind, but ambiguous, abstruse and almost unintelligible to the ordinary men and women whose money is invested in the enterprise and who are expected to read it and approve. The steward of their property writes to tell them what he has been doing, but he uses a language that is not clearly understood.

It is a simple matter, as the Commonwealth Edison Company demonstrated so cleverly last year, to make the financial statement of a public utility corporation "talk United States." It is to be hoped that many of the other companies who read this year book saw the point and have remembered, and that this season will see a new type of statement that will speak plainly to the stockholder.

### "In Language Understanded of the People"

IN TECHNICAL and scientific circles there is often lamentation over the lack of popular interest in research and of general appreciation of scientific work and attainment. It is in fact true that unless a discovery can be directly coined into dollars, which the most illiterate can fully comprehend, it passes almost unnoticed. Yet this does not really indicate that the man on the street is dull-witted or uninterested in the achievements that lead to a closer knowledge of the mysteries of life and the universe. On the contrary, he is by no means void of intellectual curiosity or unmindful of how far the torch has been borne within a few brief generations. It is chiefly the fault of the highbrow that his works are so often taken at a paper-ruble value. For the highbrow speaks and writes dialects that to the common man are as meaningless as is the superscription on that same worthless spawn of the printing press; and if he looks for real enlightenment, it is generally not to be found unless through translation into another tongue scarcely more intelligible.

At the recent meeting of the American Association for the Advancement of Science, a cub reporter was sent to the scene of action with instructions to summarize what might be of general interest. He was probably, like most of his profession, far above the average in education and intelligence, but all that he brought back was his sense of humor and a collection of titles of papers which looked like printer's "pi" reassembled by a plain drunk. The fact is that technical and scientific men have fallen into the use of language which their fellow mortals can ill comprehend. The jargon of the physicist, the patois of the psychologist, the polysyllabic lingo of the chemist, the pseudo-Hellenic patter of the biologist and the curious argot of the radio fan make a mixture that is enough to drive the common citizen into the arms of the nearest bootlegger. In all seriousness there never was greater need for men who can think straight science and talk straight English. Such there have been in the past —Michael Faraday and John Tyndall, Huxley and Lub-

bock, Sir Robert Ball and the lamented Kingdon Clifford—who in their generation made clear the way. Such interpreters are keenly needed now, for the confusion of tongues has grown steadily worse. Unmasked by fame is the professor who has not, from sheer laziness, devised a new and needless name for an old thing or idea to save himself a casual touch of chalk to blackboard, and lucky is the world if he has not foisted it upon some society to standardize. Our English tongue has thus been cursed by enrichment as Midas by the golden touch, and it has come about that to intricacies of fact have been added those of expression until science repels those who would gladly learn and profit. The situation is a grave one and without good excuse. No modern language surpasses the French in the clarity of its scientific expression, and none is less burdened with the verbiage of the specialist. An ancient English statute prescribed the reading of the Scriptures "in language understanded of the people." We greatly need today the same rational precept applied to the growing body of human learning, so that by many interpreters the truth may be brought to all who are willing to receive it.

## Engineering Necessary in Design of Wooden-Pole Lines

TOO little engineering and an excess of rule-of-thumb methods are still applied in the construction of wooden-pole transmission lines in the United States. Starting with the low-voltage distribution line more than twenty-five years ago, when there was little knowledge of the structural features available and attention was concentrated on more vital development problems, wooden-pole construction was developed largely by the cut-and-try method, and eventually the job of designing new lines was left to the line foreman. As the cross-country transmission line developed the wooden-pole line construction in this field followed the distribution methods. If some one guessed wrong, the error could be corrected without much expense. The nature of the steel-tower line precluded going at the problem in this way, with the result that better engineering methods have been developed for use with this type of construction. These methods ought to be extended as a matter of course to the wooden-pole line.

Climatic, topographical and right-of-way conditions are the three principal factors governing the physical features of a cross-country line. The first largely determines the loading to which the structures will be subjected and warrants a careful study of sags and a careful control of the sags determined on during construction. Topographical conditions must be determined by a survey, including in addition to the transit line a carefully run level line. Stadia methods will not suffice for this. Moreover, where the line is erected on side slopes these slopes must be taken to a point beyond the location of the outside conductor on the high side so that conductor clearances can be maintained by proper design. A careful location of all obstructions, lines of other companies and similar factors should be made in the survey. Using these data, a careful pole layout should be made on the drafting board, particular attention being paid to the location of structures to insure the least possible strain under maximum loading conditions. Particular attention should be paid to the elimination of unbalanced strains of any sort. Frequently when lines are constructed on steep slopes a careful study of different pole locations on the slopes will make for a much more desirable loading on the structures. Particular attention should be paid to the elimination of dead ends and the modification of angles to reduce strains. Such studies mean a better line with longer life, less maintenance expense and in the end much better service.

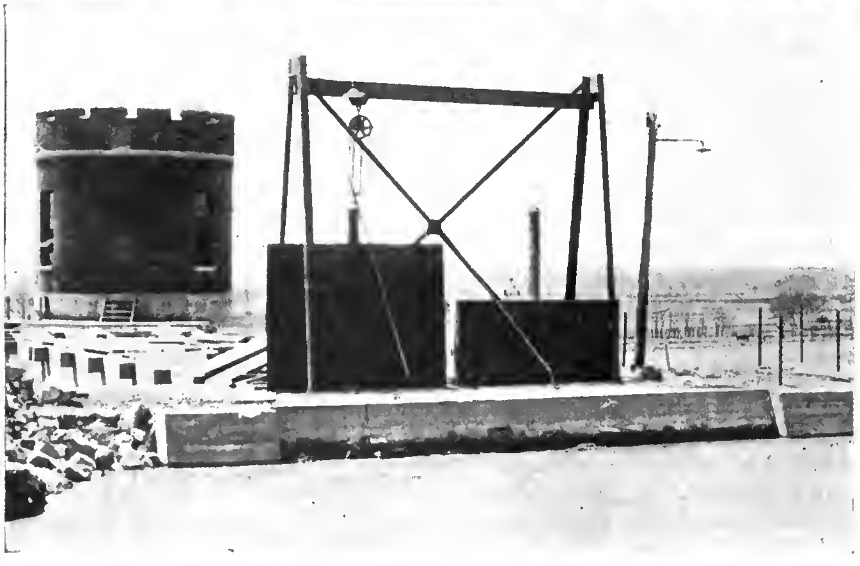
In acquiring a right-of-way it is usually necessary to steer a course founded by economical considerations on one side and by public policy on the other, but the vital effect of the right-of-way on the physical character of the line must not be overlooked. A right-of-way that is easy to obtain may make it almost impossible to construct a physically good line and in many cases may raise the cost of the line itself to a high figure because of the special construction required. No right-of-way should be purchased until the engineers have been called upon to determine its feasibility and its effect on the physical characteristics of the line.

Elsewhere in this issue H. P. Crawford tells of a wooden-pole transmission line constructed in Oregon in which this character of careful engineering has been applied. The stubbing of poles to reduce the cost of construction and to solve a future problem received careful study, and the course indicated to meet a special condition was intelligently carried out. The use of semi-tension insulators in place of dead-end assemblies to reduce strains and meet the demands of service is another piece of intelligent application of engineering facts. The consideration given right-of-way in this instance is well worth the study of engineers who must deal with wooden-pole line design and construction.

## Stray Magnetic Fields and Lead Cable Sheaths

A RELATIVELY inconspicuous, though often serious enough, result of the stray magnetic field is the setting up of circulating currents in neighboring conductors. This case obviously is confined to alternating-current circuits. In generators, and especially in transformers, these currents, unless prevented, lead to greatly increased losses and therefore entail expensive modifications in design. A neglect of suitable precautions in these cases immediately leads to trouble, but there is still a third instance in which, in most cases, the disturbance is too small to notice, namely, the losses in the lead sheath of the three-phase cable caused by the rotating stray magnetic field. This phenomenon has never led to serious trouble either in the heating or the limiting of the capacity of the cable. The exact analysis of the problem and the predetermination of the losses is a matter of some difficulty owing to the unsymmetrical geometry of the cable cross-section. However, various approximate computations have been given from time to time, as, for example, that of N. A. Allen in a recent number of the *Electrician*. He concludes that ordinarily the worst result to be expected is equivalent to an increase in the copper loss of about 5 or 6 per cent, which is usually not a serious matter. He points out, however, the importance of even this small increase in extra-high-voltage cables in which the dielectric losses raise the internal temperatures to the neighborhood of the unstable condition of the insulation. It would appear that, outside of such exceptional cases as this, no serious trouble is to be apprehended from the losses caused by the stray fields of linear conductors.

# Unusual Design for Kearney Hydro-electric Station



**Features of the Kearney Station**

A canal conveys the water 16 miles for irrigation and power purposes. The power plant develops 1,500 kw. with a 54-ft. head.

The upper view shows the open concrete flume, concrete standpipe and brick generator house.

The center view shows the combined standpipe and station foundation.

The lower view shows the forebay and headgates.

# Design Reduces Cost of Small Hydro Plant

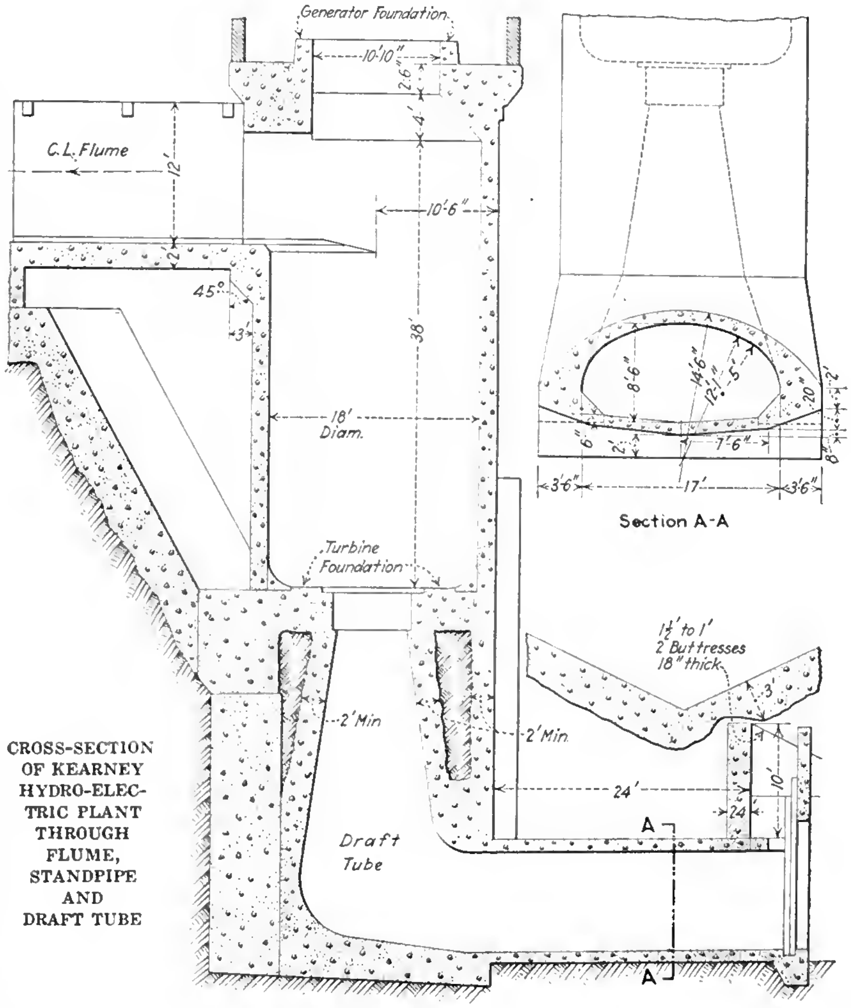
## Unusual Ground Conditions Make Conventional Designs Difficult of Application to Kearney (Neb.) Plant and Hence Unique Plan Is Adopted —Output More than Double that of Old Plant from the Same Canal

A HYDRO-ELECTRIC station with some unique features which were adopted largely to fit unusual local conditions was built by the Central Power Company at Kearney, Neb., a subsidiary of the Middle West Utilities Company, during the summer season of 1921. Water for this project is diverted by a low wing dam across the north channel of the Platte River near Elm Creek, Neb., and is carried by a canal for a distance of 16 miles (25.7 km.) to its terminus at Kearney. Water is used for irrigation along the course of the canal during the irrigation season as well as for power development under 54 ft. (16.5 m.) head at the terminus of the canal. At the power station at Kearney is a spillway, the water from this and the draft tubes returning to the Platte River through a tailrace canal about 2 miles (3.2 km.) long. This canal has been in use for many years for irrigation and for supplying the old Kearney power station. The old station was very inefficient and its situation and type of structures did not permit of substantial improvement in economy by reconstruction. It could develop only 600 kw. from the full capacity of the canal.

The new station was completed and put in operation on Jan. 15, 1922, when the flow of water in the canal was restricted by freezing, and yet the new unit yielded somewhat over 1,000 kw. continuously under these conditions. Moreover this increased capacity was obtained at low gate opening since the new unit is rated as a 2,350-hp., 1,875-kva. unit. The plant is now developing 1,500 kw. with virtually the same canal.

The canal at the site of the development is on ground sloping gently southward toward the Platte River and the 54-ft. (16.5-m.) fall is realized, not by the height of the dam or by the height of the canal above surrounding territory, but by a depressed tailrace channel flowing in a deep cut some 50 ft. (15 m.) below the elevation of the surrounding ground surface at the power station. This tailrace cut has been formed by erosion in clay, and the banks stand nearly vertical to the full height except for a small talus accumulation at the bottom—a type of stream channel familiar in the semi-arid districts of the West, where the flow of a stream rapidly deepens the channel but where the rainfall is insufficient to wear the banks back on a flat slope as in older streams and in more humid regions.

As a result, the problem was to design a power plant which would be adapted to the most effective utilization of a canal only 6 ft. (1.8 m.) deep at ground level and carrying 460 cu.ft. (17 cu.m.) per second, the head being obtained by the depth of the tailrace. The tailrace begins about 100 ft. (30.5 m.) away from the foot




CROSS-SECTION OF KEARNEY HYDRO-ELECTRIC PLANT THROUGH FLUME, STANDPIPE AND DRAFT TUBE

of the spillway, which is only a sloping surface of the native clay deeply paved to resist the scouring action and absorb the energy of the surplus water in its fall.

The conventional type of station now being built most extensively would call for an intake structure in the bank of the canal and a wood-stave or steel-pipe line about 100 ft. (30.5 m.) long leading to a vertical turbine installed in a steel plate or concrete scroll case about 16 ft. (5 m.) above the tailwater level. The amount of water to be carried would have required a pipe about 10 ft. 6 in. (3.2 m.) in diameter and would have necessitated a somewhat large and elaborate intake structure of sufficient depth to depress the top of the pipe at least 2 ft. (0.6 m.) below canal level, or a total depth of the bottom of the pipe of some 13 ft. (4 m.) below water level; still, this would be required to draw water from a canal only 6 ft. (1.8 m.) deep. A deep

cut in the clay bench would have been required to carry the pipe line down to the elevation of the scroll case at the tailrace, 100 ft. away, and this pipe line would have involved considerable maintenance and depreciation. The scroll case itself would occupy a considerable ground area which would need to be provided by excavating back into the nearly vertical wall of the tailrace channel as no space existed in this narrow, deep channel for any structures. With this arrangement it would have been necessary to slope the clay banks outward in three directions from the power house below to avoid possible caving of banks onto the power house in the deep, narrow cut. Furthermore, the generator would have required a flywheel effect adapted to the 100-ft. inclosed column of water in the penstock and scroll case. In addition the power station at the foot of the spillway would have required sheet piling to protect it from scour, and possibly bearing piles.

### Unusual Design Selected

For these reasons, and also because of smaller estimated cost, a unique type of development was decided upon, consisting of an open rectangular flume 12 ft. (3.7 m.) deep by 18 ft. (5.5 m.) wide inside, built of reinforced concrete, carrying 9 ft. (2.7 m.) of water, normally, widening at the intake to 33 ft. 4 in. (10 m.) with the same depth. This concrete flume was carried along the ground surface to the edge of the bench, overlooking the deep tailrace cut, where it enters a concrete standpipe, 18 ft. (5.5 m.) in internal diameter, at the bottom of which is a single-runner, vertical-shaft, open-flume turbine. This discharges downward into a concrete draft tube formed in a downward continuation of the standpipe structure of the same external diameter. The draft tube discharges through a short passage under the talus material to the tailrace canal.

The standpipe extends 3 ft. 6 in. (1 m.) above the top of the flume, expanding in diameter to about 25 ft. (7.6 m.). On top of this is a brick superstructure housing the generator. The floor of the flume is monolithic from the intake to the standpipe, this construction being adapted on the assumption that it will have sufficient flexibility to adjust itself to any unequal settlements. However, the side walls are provided with expansion joints at the standpipe and at the pier at the top of the clay slope, between which points the ground slopes off abruptly. The purpose of the joints is to accommodate any unequal settlement of the flume and of the concrete standpipe, which has a total height from foundation to generator floor of 78 ft. (23.7 m.) in addition to the height of the superstructure of 22 ft. (6.7 m.).

The excavation in which the combined standpipe and station foundation was built was carried 4 ft. (1.2 m.) below the bottom of the discharge tunnel, and a test was made to determine the bearing resistance of the clay bottom at this point. A load of 8 tons per square foot produced a compression of the soil of only 0.16 in. (4 mm.). This clay had been subjected to a compression load of 3 tons per square foot (0.25 t. per sq.m.) in its natural state because of the height of the clay bank in which the pit was dug. The load imposed by the standpipe structures was about 4 tons per square foot (0.33 t. per sq.m.), and no measurable movement whatever of the expansion joints has occurred since completion to indicate any settlement in this structure.

The turbine deck in the standpipe is 41 ft. (12.5 m.) below the top of the flume, 38 ft. (11.6 m.) below normal water level in the flume, and 44 ft. 6 in. (13.5 m.) below the generator-floor level. As mentioned before, the turbine is a single-runner, vertical-shaft, open-flume unit rated at 2,350 hp. at 54-ft. (16.5-m.) head. Two sections of extension shaft connect it with the generator above. In view of the unusually large head for an open-flume turbine, the crown plate is especially well braced against distortion by two tangential struts to the standpipe walls. All bearings are separately lubricated by a grease compressor on the generator floor. The unit is controlled by a governor on the same floor.

The generator is a 1,875-kva. machine, operating at 225 r.p.m., 60 cycles, three-phase, with a direct-connected exciter. All leads from the generator are carried through conduit to the existing steam station of the company about 200 ft. (61 m.) to the eastward, from which point the unit is controlled.

The installation of the turbine in the standpipe structure serves to reduce the required flywheel effect of the generator and allows the turbine to be assembled or dismantled through the flume entrance without disturbing the generator. The velocities through the trash racks, in the flume and in the standpipe are very low. The draft tube is designed as a straight diverging cone of the maximum possible length permissible without danger of vacuum and is provided with an elbow which spreads the water from a circle of 11 ft. (3.4 m.) diameter at the upper end of the elbow to a width of 17 ft. (5.2 m.) and height of 8 ft. 6 in. (2.4 m.) in the discharge tunnel. From the results obtained and from analysis of hydraulic losses it is believed that the efficiency is higher than could have been obtained with the relatively high velocities in the intake, pipe line and scroll case had the conventional setting been adopted.

The total cost of the installation was about $119,000, amounting to about $50.60 per horsepower of turbine installation, or about $63.50 per kilovolt-ampere of generator capacity.

This project was engineered by L. F. Harza, consulting engineer of Chicago, with the approval of George W. Hamilton, engineer of the Middle West Utilities Company of Chicago, the holding company, and was executed by D. D. McNabb as construction superintendent.

## Curious Case of Electrocution

In the *Revue Générale de l'Electricité* A. Turpain tells of an unusual fatal accident from electric shock. Wires used for radio-telephonic communication between two stations on a distribution network ran parallel to the high-tension lines at a distance of 1.80 m. from the latter. On cutting one of these wires a workman received a fatal shock notwithstanding the fact that the wire was isolated from any source of current and did not touch the high-tension line either before or after being cut. The author attributes the mishap to a capacity effect, current being induced in the circuit (containing the capacity and including the workman) by the 15,000-volt current in the adjacent lines. He maintained that workmen should not be allowed on structures carrying high-tension lines until the latter have been disconnected, even though work is not to be done on those lines themselves. This precaution is particularly necessary when work is to be done on lines running parallel to the high-tension lines for some distance.

# Ash Handling for Central Stations*

## High Maintenance Costs of Mechanical Carrier Systems Outbalance Charges on Hopper Car and Air Systems—Practice in Some Stations Tending Toward Water Sluicing of Ashes

THE primary object of a modern central-station system of ash handling is to reduce both labor and depreciation charges to a minimum. To accomplish this any method adopted for a given plant will be governed by the way the ashes are delivered from the fire and also by the facilities for final disposition. With the development of large power boilers yielding ashes at a rate of over a ton per hour, modern ash-handling equipment has been required to keep pace with the boiler development rate. As a result four distinct types of ash-handling equipment have appeared, namely, hopper ash pits dumping direct into freight cars, mechanical conveyors, air conveyors, and conveyors using water as a means of motion.

The design of hopper ash pits, which are used most extensively in modern plants, depends upon the method of ash removal and the draft system. With underfeed and chain-grate stokers dumping ashes at the rear of the furnace, the top of the hopper will be the width of the fire but of small dimension from front to rear. This reduces the capacity for storage. In some instances very little capacity may be sufficient owing to storage facilities outside the ash pit, but twenty-four-hour capacity should usually be provided for in case of breakdown in the conveyors. The largest ash-pit capacity will be required with conveying systems which are operated intermittently; for example, where ashes are dumped into standard railway cars or into conveyors which might be choked by the direct dumping of an accumulation containing large clinkers and therefore need manual attention.

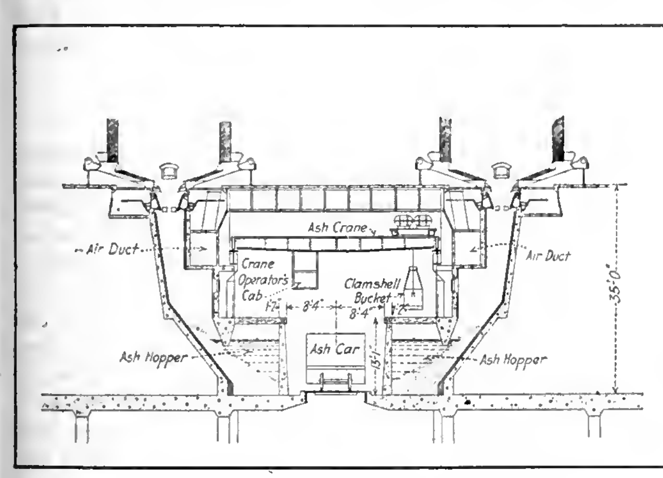



FIG. 1—WATER-SEALED ASH PIT FOR THE SPRINGDALE STATION OF THE WEST PENN POWER COMPANY

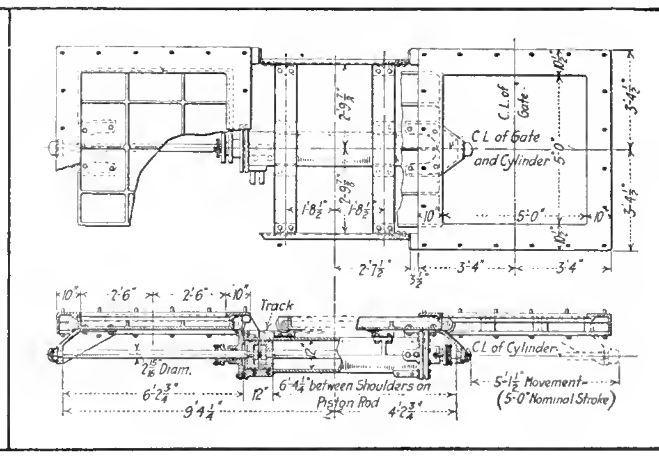



FIG. 2—THIS POWER-OPERATED ASH DOOR HAS A WATER SEAL WHEN CLOSED

Installation of the type shown in Fig. 1 requires a head room of 35 ft. (10.66 m.), but has a capacity of three days' operation at 200 per cent continuous rating of the boilers. Removal of ashes from the ash pits is by traveling crane and clamshell bucket. One crane operator handles the ash output of the station in two hours per day. A further advantage of this method is that no combustible or corrosive gas escapes into the basement to cause trouble to the operating force.

In the design of the hopper ash pit the sides should slope not less than 45 deg. in any case, but if one side is vertical, the opposite side may have the minimum slope. If the slope is too small, arching of the ash is likely to occur. This will increase operating costs owing to the frequent necessity of poking bars up through the discharge doors to start a flow of ash. Where the width of the hopper would necessitate too great a height to get these required slopes, the ash pit may be divided into a number of discharge openings. Modern practice requires discharge openings of about 30 in. to 36 in. (76.2 cm. to 91.4 cm.) as a minimum, although their size depends upon the method of firing. When small anthracite is burned with sufficient steam in the combustion air, no clinkers are formed; but modern intensive firing of bituminous coal tends to cause the formation of large clinkers. Therefore the discharge opening should be large enough to pass these without having to break them into smaller pieces.

The height of the bottom of the hopper above the basement floor depends upon the system of conveyors adopted. With a locomotive and standard railway cars about 17 ft. to 18 ft. (5.18 m. to 5.48 m.) is required; but with industrial cars 5 ft. to 6 ft. (1.52 m. to 1.82 m.) is sufficient, although a clear head room of 7 ft. (2.13 m.) is preferable. Many designers prefer to make the hopper sufficiently large to allow the ashes to remain long enough to cool naturally. By allowing some ash to remain (when dumping) for the new hot ash to fall on the doors and linings are protected.

Although shells with reinforced concrete about 6 in. (15.2 cm.) thick have been found satisfactory, the most modern construction is to use a structural steel skeleton and a shell of substantial cast-iron flanged plates bolted together. Corrosion is not troublesome because cast

*An abstract of the paper presented before the American Society of Mechanical Engineers, Dec. 4, 1922, by John Hunter and Alfred Cotton, St. Louis.

iron suffers much less than steel. By properly quenching the hot ashes with water sprays a lining of well-burned hard paving brick proves satisfactory.

Hopper ash pits will usually be provided with doors to retain the ash, to prevent the passage of air and also to allow the ashes to be dumped. With chain grates and with closed-ash-pit forced draft the doors should be tight to avoid a loss of air pressure and waste of blower power. There are several ways in which dump openings may be sealed. Doors and faces may be machined, flanges may be provided around the edge to maintain a water seal, or the frame may be provided with a groove packed with asbestos rope, while the door has a rib or tongue which is squeezed into the asbestos packing by a cross bar and screw spanning the door. One type of dumping gate which retains a water seal when closed is shown in Fig. 2.

The method of conveying ash by emptying ash pits into small dumping cars has a great deal to recommend it since the cars are usually so inexpensive that one or two spare idle cars are not objectionable; also because the cars can be repaired without interrupting the ash conveyance. The cars can be moved by men, animals, tractors or locomotives; they can be run about the premises and dumped to fill depressions, lifted on elevators to dump into an elevated ash bunker, or they can be dumped into the bucket of a whip hoist.

A hopper ash pit arranged for dumping directly into standard gondola railway cars is shown in Fig. 3. The coal consumption of the particular station in which this system is used is 413,000 tons (374,665 t.) per year, yielding 52,800 tons (47,800 t.) of ashes. Careful time studies have shown that, using the electric locomotive and crane (also in service for coal handling), only 25 per cent of the total time of operation is devoted to ash handling.

The estimated cost of the increased height of the building necessitated by this method of ash handling is liable to arouse comparison with other systems. About 45 lb. (20.4 kg.) of compressed air is required daily to operate the hopper ash-pit dumping doors. From recent tests it was found that 1,030 gal. (3,398.4 l.) of water is used in spraying one ton of ashes. This amounts to about 4 per cent of the total general service water used by the station.

### Mechanical Conveyors

By installing a skip-hoist system at the Ashley Street station of the Union Electric Light & Power Company, St. Louis, in 1916, operation and maintenance expenditures were appreciably reduced. This system is shown in Fig. 4. The old installation, built in 1905, required sixteen men to operate the ash-removal system. This was mainly due to the fact that the men were not allowed to travel on the elevators, which were inspected for freight only. In the old system two men were required to load the cars and drive the mules, two men to run the full cars onto the elevators and to remove the empties, and two men were needed at the top to run the cars off the elevator and dump them into the ash bunker—making a total of six men for each of the two day shifts and four men during the midnight shaft.

The new installation consists of a bucket worked by a skip hoist and a storage-battery locomotive to haul the ash cars. Operation of this system is satisfactory and has given good service. It has reduced the ash-handling labor cost one-third and the cost of maintenance one-half. Experience with storage-battery locomotives shows, however, that in the heat of the basement the electrolyte evaporates rapidly, resulting in battery trouble. A gasoline locomotive is now employed and gives entire satisfaction.

With the chain and bucket forming a ring system (illustrated in Fig. 5) a conveyor may be used for coal in the daytime and for ash at night. The coal is received from crushers at one end of the building and elevated to a point above the bunkers into which the buckets are discharged. The ashes are dumped into buckets during the lower run under the ash pits, elevated and dumped into an ash bin which can be discharged into railway cars or motor trucks. The building of this installation occupies the entire site and no projections of any kind were possible. Since the basement floor was 12 ft. (3.65 m.) below the alley level and as the alley was only 15 ft. (4.75 m.) wide, it was found necessary to build a recess into which the trucks could drive, dump coal and then load up with ashes. Since the ash-bunker discharge is directly above this recess, a truck can be filled with ashes as soon as it has delivered the coal to the receiving bunkers. This makes for quick unloading and reloading, which materially increases the road time of the trucks.

### Conveyor Maintenance

Owing to the abrasive nature of ash, the maintenance cost of mechanical conveyors is high. The ashes grind away the connecting pins, and even with regular renewals the pins sometimes wear excessively and cause breakdowns. With a ring-bucket system breakdowns are sometimes quite serious as the ashes may have to remain in the basement for some days before the conveyor can be placed in operation again. When handling coal and ashes in the same conveyor there is difficulty from the fine coal and wet ashes packing in the buckets, so that there is a needless continuous load on the equipment and a corresponding reduction in the carrying capacity. The water which leaches from the ashes is exceedingly corrosive and helps to carry the fine abrasive ash into the wearing parts.

The life of these conveyors is considered to be about seven or eight years, with extensive repairs necessary every two or three years. The excessive cost of maintenance of ash conveyors of this kind has led to their replacement in some installations with electrically operated cars carrying the ashes to outside pits from which they are loaded into railway cars with a bridge crane. This has resulted in lowering handling costs about 50 per cent.

Both the Fisk Street and the Quarry Street stations of the Commonwealth Edison Company, Chicago, are equipped with bucket conveyors which handle both coal and ashes. It was the intention to install four such conveyors at the Fisk Street station, but only three were installed since the cost of operation and maintenance proved too high. The parts of the fourth were used to repair the three others. An electrically operated ash car is now used in place of the fourth conveyor, and the three other conveyors are being replaced with similar ash cars. These cars are dumped into a pit outside of the building and a bridge crane takes the ashes from the pit with a grab bucket and loads them into railway cars. The cost of maintenance is almost negligible compared with that for the apron conveyors.

At the Northwest and Calumet stations, Chicago, the ash is dumped from hopper ash pits directly into rail-

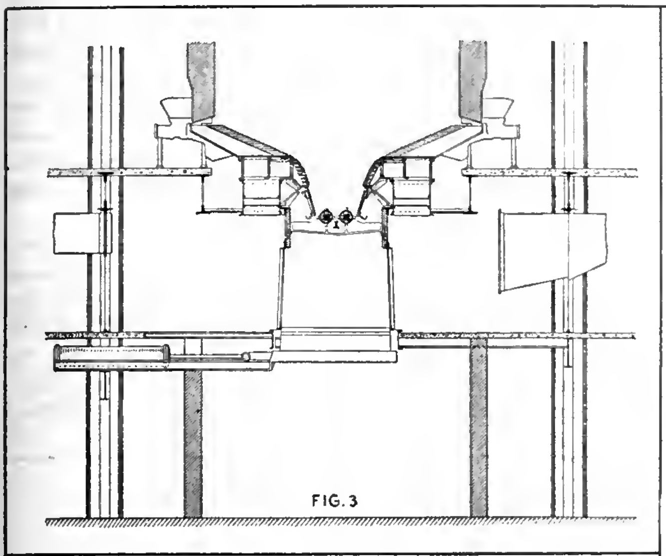


FIG. 3

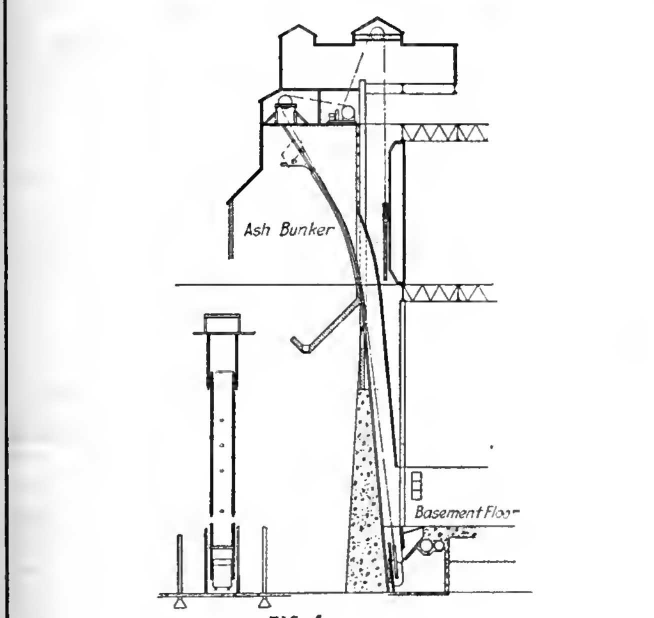



FIG. 4

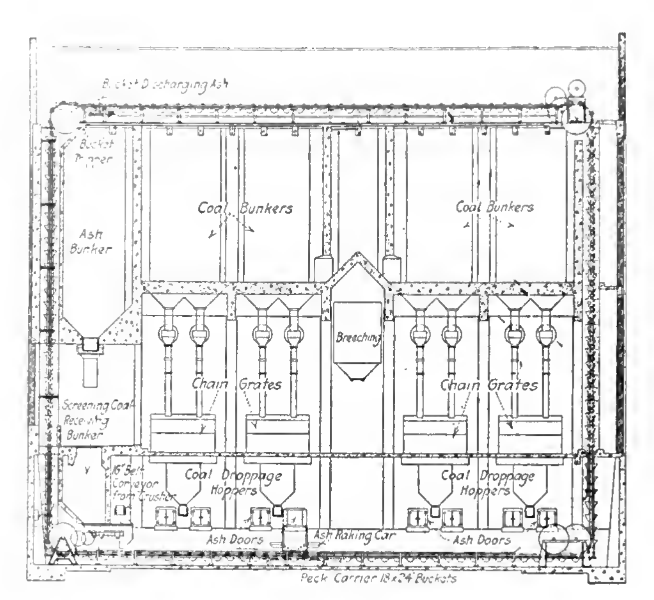



FIG. 5

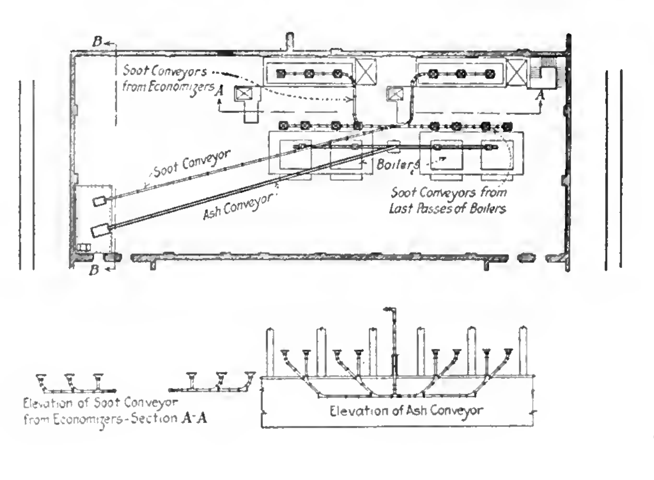



FIG. 6

ASH-HANDLING EQUIPMENT IN USE IN MODERN CENTRAL STATION PLANTS

**Fig. 3**—Hopper ash pit for dumping into standard gondola railroad cars. The hoppers are lined with brick (not shown) and have a capacity of 2,500 lb. (1,134 kg.) of ash. The stokers are equipped with clinker grinders and the ash gates are of the sliding type and are operated by compressed-air cylinders.

**Fig. 4**—Automatic skip hoist at Ashley Street Station of Union company, St. Louis. When an ash car has been dumped into the bucket a switch is pressed which starts the hoisting motor raising the bucket to the top of the travel, where it turns over and discharges into the elevator bucket. A trip switch at this point reverses the motor, thus lowering the bucket to the starting point, where another trip switch stops the motor. One pressure of the button therefore results in hoisting and dumping the bucket and returning it to the starting point, ready for another load.

**Fig. 5**—Typical example of the continuous conveying systems which can be used for both coal and ash handling.

**Fig. 6**—Air conveyor at Milwaukee Power plant conveys a minimum of 12 tons (10.88 t.) per hour at a steam consumption not exceeding 325 lb. (147.4 kg.) of steam per ton of ashes. Feed pipes with a bore of 9 in. (22.8 cm.) are run from the four 734-hp. boilers equipped with underfeed stokers to the storage bunkers inside the boiler house. This storage bunker has a single slope bottom and is emptied through a movable chute into railway cars below. The conveyor for soot and fly ash is connected to the ash conveyor and has a bore of 6 in. (15.2 cm.).

way cars, so that the only maintenance required is the upkeep of ash-pit linings and dumping doors. The cost of the ash-handling equipment at these stations cannot well be estimated since they are recent installations. Owing to the fact that the buildings must necessarily be higher in order to afford head room under the ash pits, the increased cost of the greater height must obviously be chargeable to the ash-handling system.

The salient advantage of fluid conveyors is that there is no mechanism to wear out. The two classes now in common use are the air and water conveyors. As the velocity in air conveyors is high, the abrasive effect is also large and the wear is especially heavy at the elbows.

With the air-conveyor system there are two methods of generating the air current. In one the pipe outlet is connected to the ash-storage tank, in which a vacuum is caused by means of a steam jet, and in the other the air current is induced by a steam jet between the ash intake and the outlet. It is customary to locate the motor jet at an elbow as it is then convenient to aim the jet in the new direction. Ash openings may be arranged in any position desired, such as in the firing floor in front of hand-cleaned ashpits, near the bottom of hopper ash pits, or connected to pipes to draw soot and fly ash from the later boiler passes. They can serve several lines of boilers as easily as one. The maximum capacity of a 6-in. (15.2-cm.) conveyor is about 4 tons

(3.62 t.) of ash per hour; that of the 8-in. (20.3-cm.) conveyor 6 tons to 9 tons (5.44 t. to 8.16 t.), and that of the 9-in. (22.8-cm.) conveyor from 10 tons to 15 tons (9.07 t. to 13.6 t.) per hour. This capacity depends largely upon the size of the pieces. A typical installation is shown in Fig. 6.

The steam consumption of air conveyors depends upon the length of the conveyor, the height to which the ash is lifted, the number of bends and the care used to economize steam during operation. With coal containing 12 per cent ash two tons (1.81 t.) of steam would be used for 100 tons (90.7 t.) of coal. Taking an average evaporation of 9 lb. (4.08 kg.) water per pound of coal, the conveyor will use two tons (1.81 t.) of steam out of every 900 tons (816.46 t.) generated, or approximately 0.2 per cent. To allow for careless operation it

The system of dumping ash directly into an open flume is best illustrated by the installation at the Hell Gate station of the United Electric Light & Power Company, New York, Fig. 8. It has not been sufficiently long in operation to determine the maintenance costs, but the only operating charges are the wages of the ash-crane operator and the cost of energy for driving the pumps, which are running only according to the load and quality of coal.

In the Lacombe station of the Denver Gas & Electric Light Company the same arrangement for ash disposal has been adopted as in the Hell Gate station, with the exception that there are no clinker grinders. Consequently, instead of the ground ash dropping into the flume continuously, the stokers are dumped at intervals, sending down a considerable bulk of ash containing

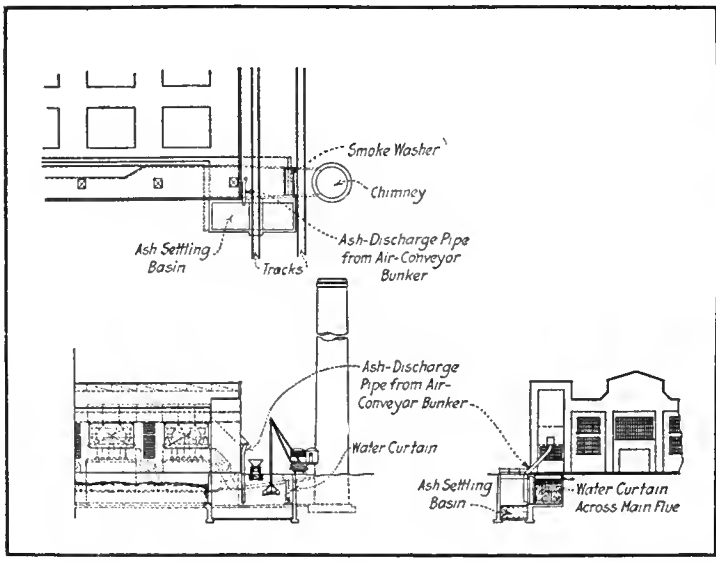



FIG. 7—AIR CONVEYOR AND SMOKE WASHER AT LAKESIDE PLANT, MILWAUKEE

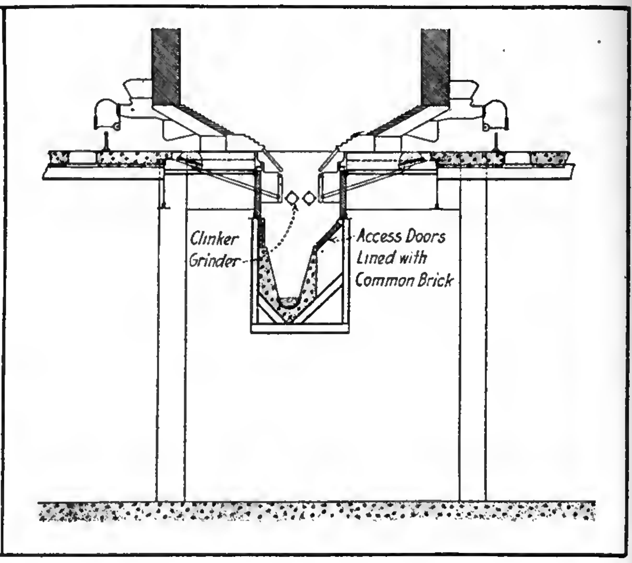



FIG. 8—WATER CONVEYOR AT HELL GATE STATION, NEW YORK

The conveyors discharge into ash bunkers, there being one bunker for each side of the boiler room containing eight boilers arranged in two rows of four each. The ash from one bunker is discharged into cars, while the other is emptied down a closed chute into the ash-settling chamber of the smoke washer. The latter is installed in the main flue about 20 ft. (6 m.) before it enters the base of the stack. The water from the smoke washer runs into a trough formed at the bottom of the flue and then runs off into a concrete settling basin carrying the ashes it collects. This basin is 45 ft. (13.71 m.) long, 16 ft. (4.87 m.) wide and 25 ft. (7.61 m.) deep, which allows the water to settle. When the ash subsides it is removed by a clamshell bucket operated by a locomotive crane.

Open flumes (Fig. 8) run under each row of boilers and connect with a closed cross pipe leading to the ash-settling tank. The ashes are recovered from this settling tank by a grab bucket operated by a locomotive crane and discharged into scows which are towed out to sea. The flumes within the boiler room are of concrete with a bottom lining of vitrified earthen drain tiles or half pipes. There are two nozzles in each flume, one at the head and the other an undercurrent nozzle at the beginning of each succeeding ash pit. These undercurrent nozzles are at the bottom of the flume and are arranged to discharge horizontally downstream to avoid contamination of the circulating water.

is advisable to allow from 0.3 to 0.4 per cent in arranging for extra distillation for make-up water. If the make-up water for the station is 2 per cent, then the distilling capacity should be increased by 20 per cent.

To prevent waste of steam in air-conveyor systems there is on the market an electrically controlled steam valve which consists of a foot-operated switch placed in a convenient position near each ash intake so that steam is actually blowing only when the attendant is actually at work at any particular intake.

The Lakeside plant of the Milwaukee Electric Railway & Light Company in using the air-conveyor system (Fig. 7) has all the conveyor lines constructed of 8-in. (20.3-cm.) cast-iron pipe with a running length of two main lines of approximately 200 ft. (60.96 m.) and a vertical rise of 65 ft. (19.81 m.). In two years of operation the only maintenance required has been the replacement of one nozzle. Since this station uses pulverized fuel, the ash from the combustion chamber is a fine powder which is easily handled by the air conveyor.

large clinkers. The flumes are therefore protected by a "grizzly" composed of heavy bars set 6 in. (15.2 cm.) center to center to withstand breaking up the large clinkers until they can drop between the bars into the flume.

This system handles about 33 tons (29.93 t.) of ashes every twenty-four hours. Stokers are dumped at intervals of two to two and a half hours. The water does not flow continuously, but when the fireman is about to dump ashes the pump is started and when the sluiceway is filled with water, the ashes are dumped from one boiler at a time into the swiftly moving water. A whistle signal is in use between the fireman and the ash tender. The ashes are then recovered from a settling tank by a grab bucket and given to the city for suburban road making. Three combination men, one on each shift, are required to handle the ashes and attend to the feed pumps. Two men, one on each of the two shifts, operate the crane and clamshell bucket to remove the ash from the settling tank.

# Design of Wooden Pole Transmission Line

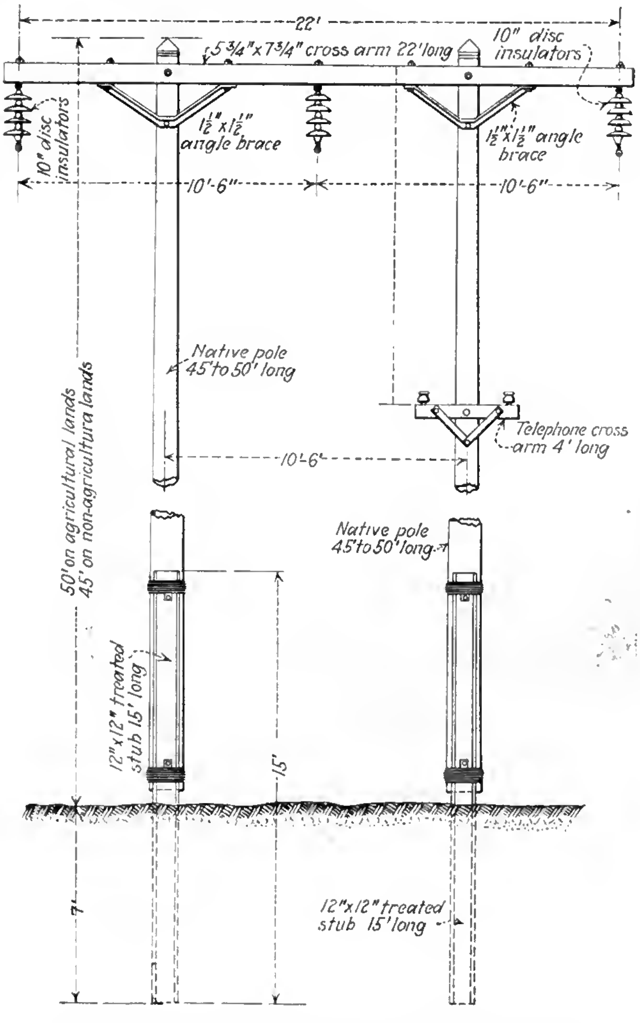
## Tests Made to Determine the Most Suitable Material for Stubs Prove of Much Value—General Features of Design Adopted by Central Station Company in the Pacific Northwest

By PERRY O. CRAWFORD
*Chief Engineer The California Oregon Power Company, Medford, Ore.*

THE construction of a transmission line through rough and mountainous country presents unusual problems in the transportation of materials and in the design of the line to keep down construction costs to the minimum consistent with durability and good engineering practice. The California Oregon Power Company had such a problem in the construction of a 123-mile, 110,000-volt transmission line recently built between its Prospect hydroelectric plant in southern Oregon and the town of Springfield, Ore., in the upper Willamette Valley. A contract was entered into on Dec. 30, 1921, between the Mountain States Power Company and The California Oregon Power Company whereby the latter was to deliver power to the system of the former beginning not later than Jan. 1, 1923, and sooner if the construction of the line should be completed before that date.

The country lying between the systems of these two companies includes two main divides, one between the Rogue River Valley and the Umpqua Valley and the other between the Umpqua and the Willamette River valleys, and in addition a number of steep divides between the minor drainage systems. The southern portion of the intervening territory, particularly on the Umpqua-Rogue divide, is very heavily timbered. In selecting the general route for the line the factors considered were: (1) Accessibility from roads and trails, as affecting construction, patrolling and maintenance, particular attention being given to maintenance; (2) directness of route; (3) avoiding, as far as possible, broken terrain, by following ridges and valleys; (4) avoiding heavy timber as far as practicable; (5) keeping in as low an altitude as possible in order to avoid regions of heavy snowfall. Accessibility and avoidance of heavy clearing were very important from the standpoint of patrolling and maintenance as well as from the standpoint of first cost and time required for construction, as it was essential that the entire line be completed in the one season.

The route as finally selected parallels county roads and highways for a considerable portion of its length, and




IMPORTANT DETAILS OF TWO-POLE WOOD TOWER USED ON TRANSMISSION LINE OF THE CALIFORNIA OREGON POWER COMPANY

no point on the line is more than 7 miles from an existing road. From Springfield south the first 32 miles of the line closely parallels the highway and county roads. South of this there is a timbered ridge not accessible from any road. For the next 50 miles the line is at no place more than 5 or 6 miles from a crossroad, with closely paralleling roads for about 20 miles. Throughout the mountain section, a distance of 27 miles, there is only about 8 miles of paralleling road and only one crossroad, these being rough mountain roads. For the last 14 miles there is practically no road, and the shortest point from the line to the railway is approximately 45 miles. This portion of the line passes through rough mountainous country and crosses the Umpqua-Rogue divide at an elevation of 4,400 ft. Another divide is crossed at an elevation of 3,500 ft

TABLE I—COMPARATIVE COSTS OF TWO KINDS OF CONSTRUCTION FOR MOUNTAIN SECTION

| | |
|---|---|
| Cost of Stubbed Pole at the Hole: | |
| Price of stub, f.o.b., point of railroad delivery | $10.50 |
| Cost of bolts and lashing material | 1.50 |
| Maximum stub haul to line at 25 cents per ton-mile (600 lb., 45 miles) | 3.35 |
| Haul along line, 3 miles, on road | 1.00 |
| Dragging stub with team, 5½ miles to summit | 7.50 |
| Cost of native 45-ft. fir pole at the hole | 5.00 |
| Labor lashing to stub | 1.25 |
| Total | $30.10 |
| Cost of Treated Cedar Pole at the Hole: | |
| Idaho cedar pole, "pentrex"-treated, 50 ft. long, 8-in. top | $21.00 |
| Haul to line, 45 miles | 7.30 |
| Haul along line, 3 miles, on road | 1.95 |
| Dragging 5 miles along line to summit | 15.00 |
| Total | $45.25 |

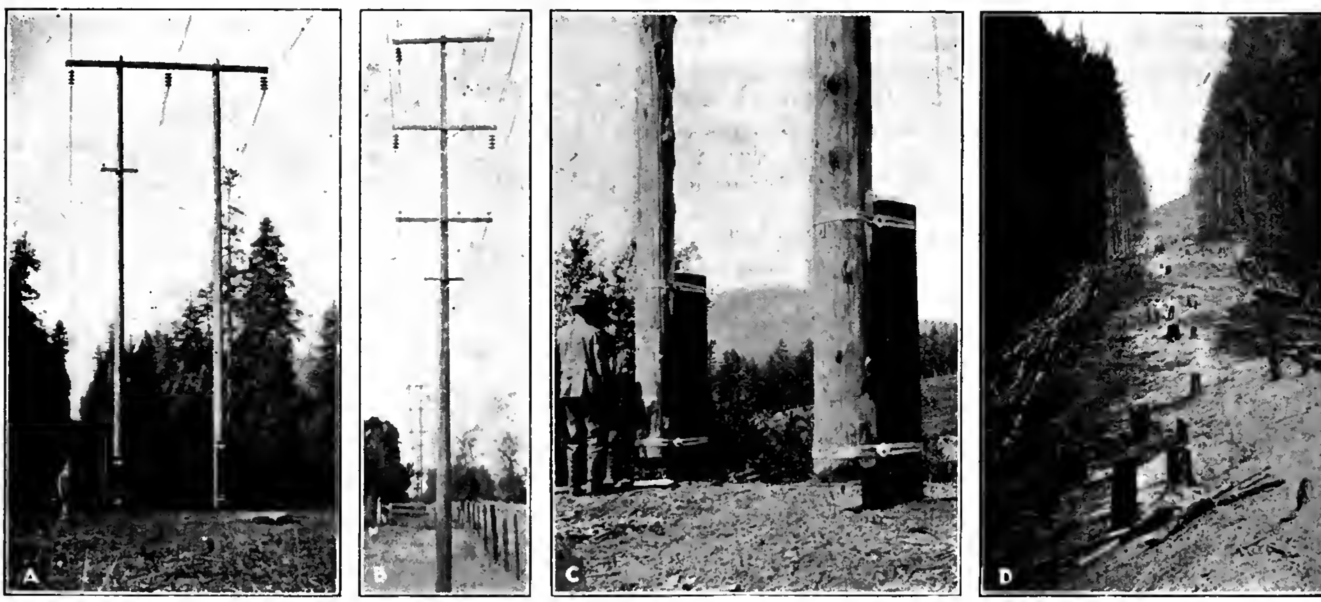
Single-pole construction with 350-ft. spans was used for the first 28 miles because this section of the line lies along roads and highways. For the remaining distance of 95 miles two pole towers were used, the standard span over level ground being 500 ft. The wire throughout is seven-strand, No. 00 medium-hard-drawn copper. Suspension construction was used with 10-in. ball-and-socket disk insulator units. The two-pole tower construction was not used at the north end on account of being too wide to be placed along the highways. On farming and orchard lands a single pole is less objectionable for the reason that there are fewer poles though more structures per mile. The single-pole line averages fifteen and one-half poles per mile and the two-pole line twenty poles, or ten towers per mile. The general specifications for the line were:

*Single-Pole Construction.* — Length of line, 28 miles; standard span, 350 ft.; average span, 342 ft.; standard pole, 8-in. top, 60 ft. long; minimum pole, 55 ft.; maximum pole, 70 ft.; poles, Idaho cedar, "pentrex"-treated; cross-arms, 4½ in. x 6½ in. x 11 ft.; conductor spacing, 10-ft. horizontal and vertical, right-triangle configuration.

*Two-Pole Tower Construction.*—Length of line, 95 miles; standard span, 500 ft.; average span, 550 ft.; longest span, 1,702 ft.; standard pole, 45 ft., lashed and bolted to stub; poles, native fir, native cedar and seasoned fir; stubs, 12 in. x 12 in. x 15 ft., treated fir; spacing of poles, 10 ft. 6 in.; cross-arms, 5¾ in. x 7¾ in. x 22 ft.; conductor spacing, 10 ft. 6 in., flat.

The two-pole construction is unusual in that the poles were attached to stubs at the time the line was built. On account of the high cost and difficulties of transportation and the presence of native timber close to the holes, it was found more economical to haul in a treated stub and bolt the pole to it than to haul in treated cedar poles. The comparative cost of the two types of construction is shown in Table I. It will be seen that the additional cost of a treated cedar pole over that of a native fir pole bolted to a treated fir stub is $15.15. Hence the additional cost per mile for the cedar-pole construction at the summit of the highest divide or the most inaccessible point on the line would be, for twenty poles or ten towers to the mile, $303. In addition, the construction problem was simplified and the labor cost of erecting the towers reduced by the use of stubs, because it was possible to install and line up the stubs with ordinary labor and then for the erecting crew to frame the tower, attach the cross-arm and braces and raise it as a unit. Had cedar poles without stubs been used, it would have been necessary to set the poles separately and frame them and attach the cross-arms after the poles were in place, thus increasing the labor cost.

The native fir which was largely used has such a short life when set in the ground (three to five years) that it was thought preferable to stub the poles at the start rather than later, thus taking advantage of the line organization and equipment to do the work. If the stubs were to be hauled in after a few years instead of at the time of building the line, the cost of transportation would be greater, a new hole would have to be dug, and the rotten butt would still be in the ground to weaken the setting. The creosote-treated stub used is also a better fire risk than the untreated native pole, as has been shown by the tests and experience of many telephone and power companies. In attaching the pole to the stub a clearance of 6 in. to 8 in. was left between the ground and the butt of the pole to prevent butt rot. It is estimated that the life of these stubs will be longer than that of the best treated cedar poles on account of the greater penetration obtained by the closed-tank treating process commonly used for ties and piling. It is conservatively estimated that these stubs will have a life of from thirty to forty years.




GENERAL VIEWS OF POLE-LINE CONSTRUCTION

A—Typical two-pole transmission-line tower used in the mountainous sections.
B—Typical single-pole construction used in the farming sections and along highways.
C—Standard stub structure as finally decided upon for the two-pole towers. Stubs are 12-in.-square fir timbers, 15 ft. long and set in the ground 7 ft. There is a minimum penetration of half an inch and an absorption of 6 lb. of creosote per cubic foot. The estimated life of the stubs is from thirty to forty years.
D—Typical right-of-way.

A series of tests was made to determine the proper size and kind of stub and type of lashing required to develop a strength equivalent to that of the pole. The stubs tested included fir and cedar of various sizes as well as fabricated steel. The results of the several tests are given in Table II. From the results of these tests it was decided to use a sawed Douglas

fir stub 12 in. square and 15 ft. long. These were bought from a lumber company and put through the Rueping tank pressure-vacuum creosoting process, giving a minimum penetration of ½ in. and leaving in the wood 6 lb. or more of creosote per cubic foot. The method of attachment decided upon consisted of bolting the pole to the stub by ¾-in. x 30-in. galvanized bolts, spaced 6 ft. apart, and a lashing near the bolts of ten turns of No. 6 galvanized-iron wire drawn together to form a figure eight by a bolt passing between the stub and the pole, bent washers being used over the wires to prevent them from separating. The bolted and lashed attachment to the pole was found to give a strength equal to that of a treated pole in a direction parallel to the line, and greater than the required strength at right angles to the line for "heavy loading," i.e., wind velocity 57 miles per hour, or a pressure of 8 lb. per square foot on No. 00 conductors loaded with ½ in. of ice.

After the tests on the stubs were made the choice lay between a 12-in. x 12-in. x 15-ft. fir timber, a cedar stub 15 in. in diameter and 15 ft. long, and a fabricated galvanized-steel stub, all being of approximately equal strength. On a comparative cost basis the treated fir stub was found to cost only about one-half as much as the treated cedar stub and only about one-fifth as much as the steel stub. The comparative costs, f.o.b. point of railway delivery, follow:

| | |
|---|---|
| 12-in. x 12-in. x 15-ft. tank-treated fir stub | $10.50 |
| 15-in. "pentrex"-treated cedar stub | 19.20 |
| Fabricated steel stub of equal strength (estimated) | 50.00 |

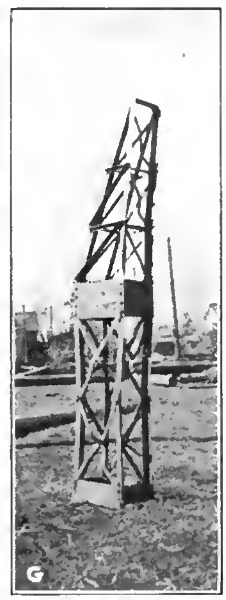
The choice obviously lay between the fir and cedar stubs. The fir stub was chosen for the following reasons: (1) Fir is the stronger of the two timbers, (2) its cost when treated is less than that of a cedar stub of equivalent strength with butt treatment, (3) the pressure-tank treatment gives better penetration than the open-tank pole treatment and hence should give the stub a considerably longer life than that of the best treated cedar pole.

In regard to the probable life, A. F. Robinson, bridge engineer of the Santa Fé system, stated before a meeting of the Western Society of Engineers at Chicago in January, 1922, that "creosoted pine piling was in good condition after sixteen to twenty years of service and was probably good for twenty years more." In deciding on the stub a number of strength tests were made on various sized timbers of fir and cedar and on fabricated-steel stubs. Each was tested individually, and then a two-pole tower structure, the same as used on the line, was set up on stubs and tested to destruction. The steel stubs tested weighed about 400 lb. each and were shown to be much inferior in strength to the wooden stubs under consideration. It was estimated that a steel stub would have to weigh from 550 lb. to 600 lb. to have the required strength.

The line voltage chosen was 110 kv., principally on account of the load requirements. A higher voltage than 110 kv. was not deemed necessary, as it was thought probable that considerable time would elapse before the capacity of the line at this voltage would be exceeded, and when that time came another paralleling line might be built. The line at a voltage lower than 110 kv. would have too short a life in terms of capacity, and the cost per kilowatt would have been greater than for the higher voltage. The line at the present time is being operated at 66 kv., because at this voltage 8,000 kw. can be transmitted, and it is not likely that the demand on the line will exceed this for several years.

Suspension insulators were used for the present line voltage of 66 kv., instead of pin-type insulators, because it was definitely known at the start that a transmission voltage of 110 kv. would be necessary ultimately, and for this voltage pin-type insulators were out of the question. Furthermore, with the use of suspension insulators the additional cost of insulating the line for 110-kv. operation will be a minimum. The increased cost of building a line insulated for 66 kv., with suspension units spaced for 110-kv. oper-







TYPE OF LINE CONSTRUCTION DETERMINED BY TESTS

E—Tower with 2,250 lb. pull on end of cross-arm in test No. 5.
F—Test No. 3 was made on this fir stub, which broke at strain of 1,950 lb. at the top of a 50-ft. pole.
G—Fabricated-steel stub buckled in test No. 7.
H—Steel stub after being subjected to strain of 675 lb. at a radius of 50 ft. in test No. 8.

ation, was estimated to be 7 per cent more for the single construction and 10 per cent more for the two-pole tower construction than for 66-kv. pin-type construction. At the time the line is changed over to 110-kv. operation two more suspension insulator units will be added at the line end and it is estimated that at 110 kv. the line will have a normal capacity of 21,000 kilowatts.

### General Features of Design

The line is sectionalized on an average every 12 miles with a three-pole, 110-kv. sectionalizing switch. The transmission line and the telephone line are transposed throughout the length of the line. Semi-strain anchor towers were placed approximately every mile in level country and oftener in the mountainous sections. Special semi-strain clamps were developed for this purpose, consisting of a standard heavy-body suspension clamp with special features to increase the holding power and 10-in. links to maintain clearance between insulators and conductors.

Semi-strain construction was used to stiffen the line in place of dead-ends for the following principal reasons:

(1) The insulator string is relieved of the continuous strain of the line.

(2) The attachment is much more flexible or elastic in regard to sudden application of longitudinal stresses.

These stresses may be caused by unequal sleet loading, failure of a part of the line, or a tree falling on the wires. Since the structure is head-guyed and back-guyed, dead-ends will allow the full force of the blow to build up suddenly against the tower and guys, while the semi-strain construction greatly relieves the shock by passing a part of it on to the next span and introduces a time element which reduces the peak of the strain. The inclined position of the insulator string also gives better weather protection to the disks.

In the semi-strain construction the same number of disks were used as for dead-ends. Dead-ends were used at the upper end of long steep spans and at both ends of the longest spans. All tower guying was done with ½-in. S. M. galvanized-steel guy wire attached to anchor logs. For the single-pole construction ⅜-in. guys were used. For anchor logs burnt seasoned cedar, yew logs, and in some cases short sections of 12-in. x 12-in. treated stubs, were used. In stringing the wire it first received an initial stretch, then sagged on the single-pole line to medium loading requirements and on the tower line to a tension about 12 per cent in excess of heavy loading requirements. All stringing was done with a dynamometer.

TABLE III—MATERIAL USED ON LINE

| | |
|---|---|
| Length, miles | 123 |
| Wire, No. 00, copper, tons | 410 |
| Telephone wire, No. 6, "copperweld," tons | 50 |
| Insulators, 10-in. disks | 23,000 |
| Number of poles | 2,250 |
| Number of structures | 1,331 |
| Number of stubs | 1,600 |
| Number of dead-ends and semi-strains | 266 |
| Average span, single pole, ft. | 342 |
| Average span, two-pole towers, ft. | 555 |
| Longest span, ft. | 1,702 |
| Shortest span, ft. | 120 |
| Time of active construction, months | 6 |
| Maximum miles per day | 2 |
| Average miles per day | ¾ |
| Total number man-days | 53,220 |
| Man-days, per mile of line | 433 |
| Maximum number of men on the job | 417 |
| Maximum number of camps | 9 |
| Maximum number of survey parties | 6 |
| Number of men clearing, five crews | 177 |
| Number of men digging holes | 48 |
| Number of men stringing wire | 58 |
| Approximate number of ton-miles line material, railroad to line | 40,000 |
| Longest haul, railroad to line, miles | 48 |

TABLE II—RESULTS OF TESTS ON STUBBED POLES

| Test No. | Material and Size | Position of Stub | Fastening | Size and Pole Butt, In. | Distance Between Fastenings, In. | Pull (in Lb.) at Top of 50 Ft. Pole | Deflection Ft. | Deflection In. | Results |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Round cedar, 12 in. dia., 15 ft. long. Single stub tested. | In line with pull | 10 wraps No. 8BB iron wire. | 18 | 41 | 1,000<br>1,300 | 7<br>11 | 7<br>6 | Stub failed at slightly over 1,300 lb. pull by shearing lengthwise through center. |
| 2 | Square fir, 12 in. x 12 in. x 12 ft. Single stub tested. | In line with pull | 12 wraps No. 8BB iron wire. | 18 | 41 | 1,100<br>1,525<br>2,000<br>2,450 | 5<br>6<br>8 | 5<br>0<br>10 | Top lashing broke. |
| 3 | Same as test No. 2. | Right angles to pull. | 10 wraps No. 6BB iron wire. | 18 | 46 | 500<br>1,000<br>1,950 | 10<br>17<br>31 | 10<br>9<br>0 | Stub broke at bottom lashing. |
| 4 | Same as test No. 2, except that complete tower with two stubs was tested. | Pull from end of arm and at right angles to stubs. | 10 wraps No. 6BB iron wire. | 18 | 46 | 500<br>1,000<br>1,250 | 1<br>7<br>11 | 11<br>10<br>7 | Cross-arm was placed on opposite side of poles from stubs and twisting was very noticeable, causing top lashing to loosen. |
| 5 | Same as test No. 4, except that cross-arm was placed on same side of poles as stubs. | Same as test No. 4 | ¾-in. through bolts, and 6 wraps No. 6 BB iron wire. | 18 | 41 | 500<br>1,000<br>1,500<br>2,000<br>2,500 | 0<br>2<br>4<br>6<br>10 | 6<br>2<br>2<br>10<br>5 | Test indicated that a wind pressure less than maximum would move pole tops too far out of line. |
| 6 | Round cedar stub, 15 in. in dia. and 15 ft. long. | Same as test No. 4 | Same as test No. 5 | 17 | 41 | 1,000<br>2,500<br>3,500<br>3,700 | 1<br>6<br>9<br>10 | 5<br>1*<br>7<br>5 | Could not hold 3,700 lb.; pull fell off to 3,100 lb. with increasing deflection. Pull of 3,400 lb. was then applied and one pole and one stub broke. |
| 7 | Single steel stub, 2½ in. x 2 in. x $\frac{3}{16}$ in. corner angles. Horizontal girths, 1 in. x 1 in. angles. Side braces, 1¼ in. x 1¼ in. angles. Flat braces, $\frac{3}{16}$ in. x 1¼ in. Length of stub 11 ft. Set in ground 6 ft. Size base to ground line, 12 in. x 24 in. Weight, 400 lb. | In line with pull | 10 wraps No. 6 BB iron wire. | 15 | 41 | 550<br>625<br>750<br>975 | Stub raked when set<br>Stub plumb<br>5<br>11 | <br><br>10<br>0† | The tests on the two steel stubs indicated that considerably heavier stubs, probably equal to the weight of the wood stubs, or 550 lb. to 600 lb., would be required. |
| 8 | Single steel stub 12 in. square, with bearing plates. Same size material as test No. 7. Weight, 380 lb. | In line with pull | 10 wraps No. 6 BB iron wire. | 15 | 41 | 500<br>640<br>675 | 2‡<br>4<br>7 | <br>5<br>7‖ | |

* No sign of failure. † All angles buckled. ‡ Flat braces bending. ‖ Could not hold over 675 lb., corner angles bending.

Drop-angle cross-arm braces were employed on all construction except where green fir poles were used. The fir in seasoning has a tendency to twist. On this account the braces were omitted wherever green fir poles were used, the arms in these cases being attached to the pole with galvanized U-bolts. On double-arm construction a through bolt was placed on each side of the pole, thus giving the pole freedom to twist.

In all, 44 miles of right-of-way through timbered areas was cleared to a width of 50 ft., and all dangerous trees, including those which were leaning or partly decayed, beyond this width which could reach the line were removed.

The amounts of material given in the following tabulation include spare material left every mile for the greater portion of the line for emergency repairs. This material included 200 ft. No. 00 copper wire, 200 ft. No. 6 telephone wire, one high-tension arm, one telephone arm and one stub.

The survey was started on March 9, 1922, and completed on July 7, 1922. The first holes were dug on April 10, 1922, and the last on Oct. 2, 1922. The first wire was strung on May 9, 1922, and completed on Oct. 12, 1922. The surveying started with two crews, and later others were added until there were six separate surveying parties at different points in the field. Following the surveyors came the clearing gangs, then the hole diggers, then the distributors of material, later the tower erecting crews, and the wire stringing crew last. Powder was used in digging all holes. The towers were framed on the ground and erected with line and shears. Much of the material had to be hauled along the right-of-way, some of it for distances up to 5 miles. During the busiest season nine camps were maintained. There were on the average twenty auto trucks in use on the job. The line was completed on Oct. 15 and placed in operation on Oct. 23; over half a mile of line was completed per day over the entire period of time on an average.

# Electrification of Seattle Port Terminals

## Factors Influencing the Undertaking and Requirements of Electrical Equipment to Meet Port Needs—Essential Features of Lighting and Power Distribution

By O. P. SEIM*

*Superintendent of Distribution Puget Sound Power & Light Company*

THE SMITH'S COVE TERMINAL OF THE PORT OF SEATTLE IS AN EXCELLENT EXAMPLE OF UP-TO-DATE TERMINAL ELECTRIFICATION

ELECTRIFICATION of a port terminal is dependent upon such factors as lower handling charges, flexibility of operation and the speed attained in handling cargoes. The port of Seattle in adopting a policy of electrification of its terminals was primarily actuated by these factors as well as by the necessity for providing facilities for handling great volumes of commerce in commodities of all varieties, both in bulk and in packages. The coordination of railway and marine transportation lines near available industrial sites, in order that these areas might become centers of industry, entering into the original studies of the electrification of the port terminals, exerted a determining influence upon the selection of the terminal sites. Additional factors were the uncertain degree to which the commerce of the port would expand, the character of the cargo-handling equipment of the ships likely to use the terminals, and the nature of the cargo of these ships.

The Smith's Cove Terminal, the most recent and modern in the port of Seattle, has been laid out according to the best practice in port electrification and may be said to be a model terminal of its kind. In designing the electrical installation for this terminal it was found that power requirements fell into two major classifications, as follows:

*Formerly mechanical engineer port of Seattle.

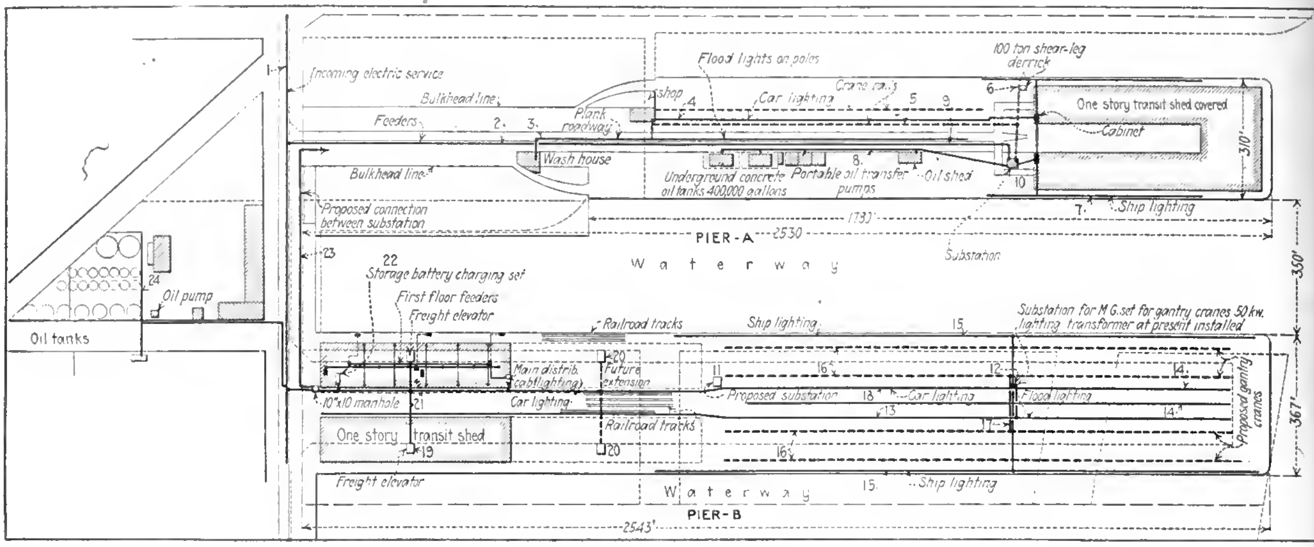



FIG. 1—GENERAL LAYOUT OF PIERS, WITH LOCATION OF EQUIPMENT AND SHEDS

A. Power for driving machines, either in groups or individually, at constant speed. This applies most commonly to conveyors, pumps, elevators and motor-generator sets.

B. Power for driving machinery where it is desirable to obtain speed variation between less than 50 to 100 per cent of maximum. All power in this class is obtained from motor-generator sets. The use of motor-generators instead of rotary converters for this class of service is favored by the port engineers because it is desirable to correct for low power factor on the alternating-current distribution system, and in their judgment a rotary converter, although it has higher efficiency, is not so well suited to this purpose as a motor-generator set. Direct current is used for the gantry crane, the 100-ton shear-leg derrick, the 25-ton stiff-leg derrick, the electric lifting magnets and for charging of tractor storage batteries.

For the requirements of motors under class A, voltages of 440 and 2,200 are used, 440 volts being the most extensively employed. Equipment rated at 220 volts is not desirable owing to the larger size of conductors and conduit required. A 2,200-volt circuit is used only in the case of driving a 300-kw. motor-generator set.

The table gives the electrical and mechanical data for the electrical equipment at the Smith's Cove Terminal, piers A and B. In case it should prove necessary or desirable to generate alternating current, especially for terminal requirements, it is the opinion of the port engineers that load factors ranging from 70 to 75 per cent should be employed, rather from 80 to 85 per cent, which is considered good practice in the design of central stations. This is because of the large proportion of induction-motor load and the consequent low power factor. For equipment operating at constant speed, where conditions would permit, induction motors are used and controlled by standard forms of starting switches, equipped with low-voltage and overload protection. Slip-ring motors with drum-type controllers having sufficient resistance for starting only are used where squirrel-cage induction motors would not supply the necessary starting torque. Where slip-ring motors are used an oil switch is provided in the primary or starter circuit of the motor. If the requirements of a machine are such that motor speeds varying from 50 per cent of maximum to maximum are necessary, a slip-ring induction motor is used with drum-type controller and resistance banks in the secondary or rotor circuit of sufficient capacity to permit of continuous operation at any point of the controller. In those cases where speed variation between less than 50 per cent of maximum and maximum speed are required for driving a machine direct current is used. No standard has been adopted for the control of such

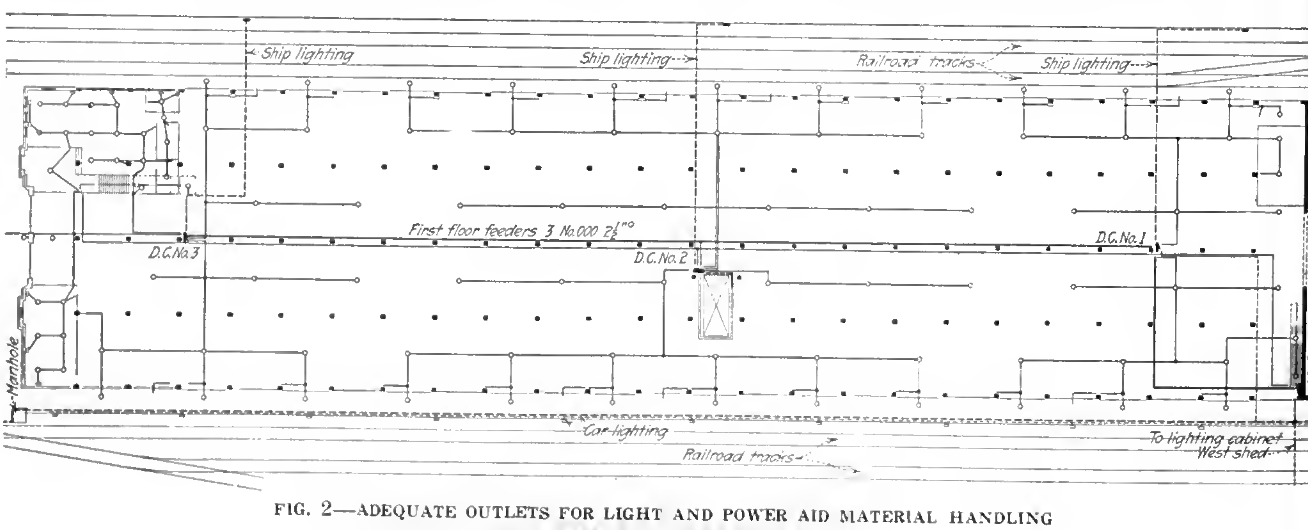



FIG. 2—ADEQUATE OUTLETS FOR LIGHT AND POWER AID MATERIAL HANDLING

motors. Instead, the control is designed to fit the needs of the particular case, and it may vary from a standard plate-field rheostat to the more complex contactor panels.

Service is supplied by the city of Seattle over two circuits, one of 7,500 volts and one of 15,000 volts, to the substations on the terminal property. Fig. 1 shows the location of electrical equipment and substations on piers A and B and the general arrangement of lighting and power circuits. In the case of pier B, which is the latest to be constructed, a 440-volt, three-phase power circuit runs the full length of the pier and is fed from a transformer station situated about the center of the pier. This arrangement has resulted in a more economical installation owing to the reduction in the size of the feeder and conduit made possible in the 2,600-ft. run as compared with that which would have been required had the transformers been installed at one end of the circuit. The three 50-kva. transformers supplying this feeder are operated from a 2,300-volt circuit.

Fig. 2 shows the lighting circuits in the warehouse and transit shed on pier B, as well as the power-plug receptacles for portable motors. The lighting circuits consist of a main and a night circuit. The main circuit is used when cargoes are being handled or when illumination of high intensity is required. The night circuit is used at all times when only enough illumination to allow a clear view of the contents of the warehouse and transit shed is necessary. The tendency toward the use of conveyors, stackers, tractors and other material-handling equipment makes this arrangement of lighting circuits most economical.

Lighting circuits on the open dock consist of a car-lighting circuit, a ship-lighting circuit and a floodlighting circuit. The car-lighting circuit is a plug circuit installed on the side of the transit shed and is used for illuminating box cars or refrigerator cars while they are being loaded or unloaded. The ship-lighting circuit is a plug circuit installed near and parallel to the bull-rail of the dock. The lighting circuit of the ship is connected to this circuit with portable cord, in order that the ship may shut down its boilers and engines for cleaning and repairs. The floodlighting circuit is used to illuminate the dock in the proximity of the ships that are moored there.

CRANES DO THE HEAVY WORK

Owing to the extremely limited field of choice in conveyor equipment applicable to the broad field of use embraced in handling the numerous and varied cargoes that come to the port of Seattle, the design of special equipment has been undertaken to meet the demands


SPECIAL CARE WAS GIVEN TO SECURE RAPID LOADING AND UNLOADING OF VESSELS

imposed by commerce. The equipment developed so far, including that already in use, consists of the following: Derricks, (a) shear leg, (b) stiff leg; cranes, (a) gantry, straight-line and horizontal boom, (b) locomotive; winches, portable conveyors, storage-battery vehicles (tractors with trailers) and piling and tiering machines, (a) inclined, (b) vertical.

As a further step in the development of port facilities the port has under consideration at the present time the installation of an electrically driven air compressor of sufficient capacity to allow certain repairs to be contracted for and executed at the pier while a ship is handling its cargo, rather than having it laid up at a repair yard for several days in addition to the time spent in discharging and loading.

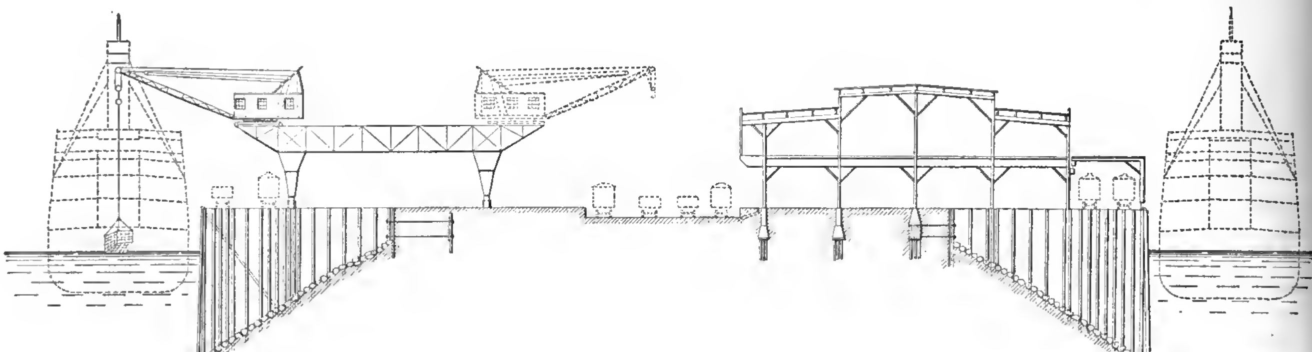
The port of Seattle has three principal industrial terminals, all of which are completely electrified. They are the Hanford Street terminal, at which is constructed and in operation a 1,200,000-bushel grain elevator; the Spokane Street terminal, at which is a 900-carload fruit-storage plant, a 100-ton ice plant, a fish-freezing plant of 300,000 lb. capacity per day, a fish storage plant of 3,000,000 lb. capacity and ice storage for 5,000 tons, and the Bell Street terminal, at which there is a 90-carload miscellaneous cold-storage space.

The grain elevator has 900 hp. connected load, the Spokane Street cold-storage and ice plant 600 hp. and the Bell Street cold-storage plant 250 hp. In the grain elevator and the Bell Street cold-storage plant all the principal driving motors are remotely controlled from the main switchboard. In the case of the Spokane Street plant all motors are controlled at the motor. In the warehouses and transit sheds power circuits are provided as follows:

A. A 440-volt, three-phase plug circuit, usually No. 4 wire. Plugs are placed every 100 ft. along the center line of each floor of the warehouse or transit shed, within reach of the machine operator. This circuit is intended for the use of conveyors, stackers and other portable equipment.

B. Freight-elevator circuit.

C. A 440-volt, three-phase circuit to take care of the motor-generator set for a constant-potential charging set used for charging tractor storage batteries. A typical 30-kw. set consists of a 75-volt, 400 amp. commutating-pole, shunt-wound, direct-current generator, direct connected to a 50-hp., three-phase, 440-volt, 60-cycle, 1,200-r.p.m. induction motor, with starting compensator. On a switchboard are mounted a voltmeter, a shunt ammeter, an overload circuit breaker, a shunt-field rheostat, a voltage regulator and a 600-amp. main switch. This set has capacity for charging at the same time six tractors having twenty-four "Exide" cells each.



VERTICAL SECTION, SHOWING DETAILS OF PIER

On the open dock great care has been taken in making the distribution system flexible. Although the equipment of a pier may be fairly well predetermined and the circuits provided, new business may require alterations or additional equipment, thereby necessitating changes in the distribution system.

The paramount function of a port terminal is to allow a ship to enter, discharge and load cargo and get away with as little confusion and delay as possible. To this end human ingenuity must devise ways to facilitate cargo handling. A ship earns only while it is moving with cargo. Every day it must lie in port means a loss to the operators. The most restricted step in the entire cycle of a ship's operation is the handling of the cargo at the port. If the cargo must be moved over 120 ft. from the side of the ship, then it is more economical to handle it by conveyors, tractors with trailers or other forms of material-handling equipment. This fact establishes the manifold importance of the cargo-handling problem in the development of a port.

ELECTRICAL AND MECHANICAL DATA ON MOTIVE EQUIPMENT AT SMITH'S COVE TERMINAL OF THE PORT OF SEATTLE

| Type of Equipment | Hp. | Voltage | Speed, R.P.M. | A.C. or D.C. | Type of Motor | Type of Drive | Type of Control |
|---|---|---|---|---|---|---|---|
| Gantry crane: | | | | | | | |
| Hoist | 25 | 220 | 510 | D.C. | Series, crane type | ..... | Remote control from cab |
| Travel | 125 | 250 | 490 | D.C. | Series, crane type | ..... | Remote control from cab |
| Crane apron | 40 | 220 | 450 | D.C. | Series, crane type | ..... | Remote control from cab |
| Trolley motor | 18 | 220 | 510 | D.C. | Series, crane type | ..... | Remote control from cab |
| 100-ton Shear-leg derrick | 85 | 230 | 430 | D.C. | Series | Gear coupled to hoist drum | Railway type reversiog drum controller |
| Portable oil transfer pumps | 10 | 440 | 1,200 | A.C. | Induction, constant speed | Gear coupled | Standard control |
| Substation motor generator set | 450 | 2,500 | ..... | A.C. | Synchronous | Direct-connected | Standard control |
| Freight elevators, capacity 20,000 lb.; 60 cycles per minute | 50 | 440 | 720 | A.C. | Wound rotor | Worm-driven gear | Standard elevator control |
| Oil booster pump | 10 | 440 | 1,200 | A.C. | Induction, constant speed | Geared | Standard control |
| Portable motive equipment | 5 | 440 | ..... | A.C. | Induction, constant speed | ..... | Standard control |
| Tractor battery charging set: | | | | | | | |
| Motor | 50 | 440 | 1,200 | A.C. | Induction, constant speed | Direct-connected to generator | Standard control |
| Generator | K.W. 35 | 75 | 1,200 | D.C. | Shunt-wound, commutating pole | Direct-connected to motor | ..... |

# Another Word to Utility Stock Salesmen

## Ancient and Accepted Methods of Investing Money and the Peculiar Advantages of Public Utility Securities, Being Some Reflections and Observations, but Containing, However, No Advice or Recommendation

By WARREN R. VOORHIS

THERE are three orthodox methods of selecting an investment for your money.

Named in the order of their popularity, they are:

1. You may trust your money to a stranger, a gentleman from foreign parts, who has the quick intelligence to recognize at a glance your great capacity to grasp an opportunity before it is too late, and who, also, by reason of your well-known standing and dominating influence in the community, is frequently able to make very attractive promises of really remarkable returns.

2. You may select from your acquaintances that man in whose judgment and financial ability you have the most confidence, give your money to him to invest for you, and thus be done with the whole tiresome business.

3. By observation and study you may acquaint yourself with the simple rules governing the investment of money and then select your investment after such study and observation.

In my time I have employed each of these methods and found that each possesses distinct advantages.

Now, I will here set forth my reflections concerning these three ways of choosing an investment for savings.

The loose, superficial thinker might argue that since 90 per cent of all money invested according to the first method is forever lost to the investor, this method is to be condemned.

A moment of serious reflection exposes the fallacy of this gloomy view.

It is based upon the assumption that the only compensations in life are financial.

One must admit that the rewards to be received from the use of this first method must be expressed other than in terms of money, but it by no means follows that rewards do not exist.

### TRUSTING THE STRANGER

For example: It is always a distinct and gratifying pleasure to me to meet an intelligent stranger, especially one who is able instantly to discern my own intelligence and capacity, particularly in financial matters.

We all feel ourselves to be surrounded by rather dull people, especially relatives, who do not justly appreciate our talents.

To have our true worth appraised by a stranger, who is, of course, wholly disinterested, is one compensation for the use of the first method of investing money.

Then there is a world of romance and imagination in this method, and what sort of a world would this be without romance and imagination?

To feel that you are really a part owner in, say, a cocoanut plantation, located somewhere on an island in the South Seas, where the cocoanuts drop to the ground from the trees, or brushes, or vines, or whatever it is they drop from, and where happy skin-clad natives pitch them into my ships which have anchors and "bo'suns" and "mains'ls" and everything, all this gives an uplift to my spirit and I do not know how to say what it is worth in money.

The picture is always so interesting and attractive to me that it hardly needs the statement of the agent that the stock will be doubled in price within the next thirty days to make me come in.

So that, while I have always lost all the money I ever invested according to this first method of choosing an investment, I am by no means prepared to say that the method possesses no advantages whatever.

I only mean to say that now that I am older and colder I am a little more inclined to separate my romance and imagination from my pocketbook and a little less inclined to estrange myself permanently from my money.

Now, when a fascinating stranger tells me, with his hand on my knee, that I have a great head for finance, I at once admit this and offer it as a reason why I am able to attend to my own financial business, and I point out to him how wrong it would be for me to detain him when so many less able gentlemen are doubtless eager to take his counsel.

### LEANING ON A FRIEND

The second method of choosing an investment has one tremendous advantage.

It makes a minimum demand upon the brain of the investor.

You turn your money over to an honest friend for him to invest according to his judgment, and go your way.

Probably nothing could be more simple than this.

The profound antipathy of the human mind to any form of connected thought is our richest heritage from the arboreal period of civilization.

This method has a further advantage.

Your friend is frequently honest and capable and a good deal of money so invested is well and safely placed.

When it turns out otherwise, you have had the great comfort of having been free from responsibility, and you have also the privilege of calling upon high heaven to witness the perfidy of your friend.

I myself have tried the second method quite often.

Maybe I will again turn over my money to a friend for investment.

But never, never so long as I live, will I take from a friend his money for investment.

When the investment turns out well, my friend proclaims abroad the soundness of his judgment in choosing his investment.

When it turns out badly, my former friend ever afterward regards me with a gloomy and accusing eye.

He wonders what he ever saw in me to warrant his confidence.

This is the reason that I am giving no advice in this article.

I suppose it might be suggested as an objection to this method that one who always relies upon the judgment of others will never become very self-reliant and will never learn to think for himself.

It is only fair to reserve judgment upon this objection until it is demonstrated that the people who think are happier than those who do not think.

I have many friends among both classes, and I am not prepared to give a final opinion.

### A Three-Question Analyses

The third method of choosing an investment is only popular with those persons who have formed a deep attachment for their money and a firm intention not to be separated from it.

I observe that nearly every sound competence and provision for old age has been invested and accumulated according to this method.

Some very able gentlemen make fortunes by keeping alive the hoary tradition that the investment of money is a subject too deep and difficult for people who have only brains enough to make and save money.

But if any man with a little money to invest will first ask three pointed questions, and if he will keep his money in his fist until he gets a satisfactory answer, he will save himself some grief, and the executor of his estate will be required to give a larger bond. These three questions are:

"Will my money be safe?"

"Will my return be as high as is consistent with safety?"

"Can I get my money back when I want it?"

Of course, it would be unsportsmanlike to ask such questions of the picturesque blue-sky salesmen, where, as I have pointed out, romance and adventure rather than stability and safety are the rewards to be expected.

But try these questions upon some of the standard forms of investment and you get interesting results:

### Applying the Test

*Real Estate.*—If you use good judgment in the choice of location, your money ought to be safe. If you can keep the property occupied, if your tenants pay their rent, if taxes and assessments and insurance and repairs don't eat you up, and if you did not pay too much for the property, you ought to make a fair return.

If you can find some one who wishes to invest in real estate, and if he likes your property, and if he will pay you as much as or more than you paid, you should have no trouble in getting back your capital.

It will pay to ask these three questions before you buy any real estate.

*Business.*—You can easily put your money in business. If you select a good business, one which gives a service or makes a product which people want badly enough to be willing to pay more than the cost, your money should be reasonably safe. If you have sense and experience enough to run the business, or if you can find and keep a man with sufficient brains and honesty to do it for you; if times are good; if you are not too much bedeviled by strikes, storm, fire, earthquake or bad debts, you should get a fair return. And when you want to quit, as you may, if you can find some man who wants to go into business, and who likes your line of business and who will pay you as much as or more than you paid for it, you should have no trouble in getting out whole.

These three questions will help you to decide about going into business.

*Government Securities.*—They are safe. The faith and credit of the richest country on earth are behind them. They are safe.

Because they are safe as minted gold held in your hand, the return is low, lower than any other form of investment. The entire absence of risk is paid for by a very low return. The market for these securities always exists. If you want your money, you can get it.

*Public Utility Securities.*—They are very safe. These utility companies furnishing light, water, power, heat, communication, transportation, give to all the people, all the time, a service so necessary that we cannot think of modern life without them. In peace or in war, in good times and bad times, we must have this service.

They earn moderately, but constantly. By the law of the land they are permitted under public regulation to earn a fair, reasonable return upon their fair value.

Because the service of utilities is essential to the very life of the country, because they grow as the country grows in population and wealth, because the return is constant and reasonable, because economy and efficiency are assisted by public observation and supervision, the sound securities of these corporations have become a form of investment favored by an increasing number of investors. This makes a wide market.

The three questions should be of service in selecting a public utility security for investment.

But really there is nothing new about the form or substance of these questions.

They are invariably asked by every investor, no matter what method of selection he employs.

My point is that they will be found to be more useful if they are asked and answered before, rather than after, the investment is made.

### When Winter Comes

Too late, after I have taken the trouble to set down these reflections, it occurs to me that, after all, there are very few people interested in the subject of investment according to any method.

Perhaps it is part of the privilege of the salesman who is endeavoring to sell utility securities to men and women of the community that the company serves to bring these questions to the attention of investors.

For most of us travel gayly through life, considering every dollar saved as so much excess baggage.

We lean heavily on that beautiful Biblical text: "Consider the lilies of the field, how they grow; they toil not, neither do they spin, yet Solomon in all his glory was not arrayed like one of these."

This argument appeals most forcibly to me in June when the lily proudly bends her lovely head to the soft summer wind.

In October, when the early frosts have turned her petals brown, and in December, when she stands stripped and shivering in the bitter winter wind, I am inclined to doubt whether this text was even intended as a guide to thrift and investment.

And as for King Solomon, I think the record is fairly clear that one of his acts of wisdom was to collect and keep enough gold and gear by him to last through the winter of his years.

These are my reflections upon the ancient and accepted methods of investing money.

# Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

## Compound Migration Inappreciable in Modern Cables

*To the Editors of the* ELECTRICAL WORLD:

Impregnated paper cables were formerly made with thick compounds and loose paper. When the compound melted under the influence of load in the cable it ran down in the large spaces between the paper tapes wherever there was a vertical run. This resulted in leaving voids which ionized at high voltages and caused failures. Modern cables are made with tight paper and comparatively thin compounds. When the compound melts most of it is held between the tapes by surface tension.

Tests which were made in 1922 on a cable of modern type consisted in suspending a 15-in. length at an angle of 45 deg. in an oven, both ends of the cable being open. The oven temperature was 220 deg. F., and the cable was kept at this temperature for ninety-six hours. Upon cooling, the cable was subjected to a high-voltage test. It withstood 150-kv. alternating current for one hour without showing any signs of distress. The cable was of 350,000-circ.mil cross-section and had $\frac{12}{64}$-in. insulation on each conductor and a belt of $\frac{7}{64}$-in. thickness.

WILLIAM A. DEL MAR,
Habirshaw Electric Cable Company, Inc., Chief Engineer.
Yonkers, N. Y.

## Meshed Networks for Alternating-Current Distribution

[The editors of the ELECTRICAL WORLD requested Mr. Torchio to submit comments on M. T. Crawford's paper, "Merits of Alternating-Current Underground Distribution," published in the issue of Dec. 23, and he sent in the following.]

*To the Editors of the* ELECTRICAL WORLD:

The low-tension alternating-current systems of distribution are at present generally founded on the fundamental principle of subdividing the territory to be served into separate districts and feeding each district from an independent feeder. Within each feeder district the secondary mains fed by step-down transformers are sometimes connected in a meshed network, but more often they cover only isolated portions of streets in the district, each fed from an individual step-down transformer. Gradually, as the primary feeders become fully loaded, the original districts are subdivided and additional districts created to be fed by corresponding new primary feeders. This fundamental method of growth of low-tension alternating-current systems of distribution, while eminently satisfactory in scattered districts, entails many handicaps when applied in congested and heavily loaded city districts. For such conditions some arrangement of a single meshed network of mains fed from all feeders in the same manner followed in direct-current three-wire systems would afford very great advantages. This has prompted engineers to make efforts to build up low-tension alternating-current meshed networks of distribution.

M. T. Crawford's paper gives a description of one such development. One prominent feature is the fact that Mr. Crawford has solved the difficult problem by the combination of standard apparatus, each unit being already fully developed and obtainable from the standard production of manufacturers. As the district served by the Edison system in Seattle furnishes less than 10 per cent of the total company's service, the advantages that a direct-current system might have would be relatively insignificant as affecting the total business. The adoption of this new system to provide for the growth within the district, still retaining the direct-current system for special customers requiring such service, is probably a compromise prompted by the desire on the one hand to retain the existing investment and on the other hand to obtain a unification of the system, which would offer obvious economical advantages.

PHILIP TORCHIO,
New York Edison Company, Chief Electrical Engineer.
New York.

## Pyro-Electric Theory of Insulation Failure

*To the Editors of the* ELECTRICAL WORLD:

I have read with great interest the discussion by Dr. Whitehead and Mr. Fechheimer in the Nov. 11 issue of the ELECTRICAL WORLD, and by Mr. Del Mar in the Dec. 9 issue. of the article of Oct. 21 contributed by me in collaboration with Dr. Steinmetz on "The Pyro-Electric Theory of the Breakdown of Solid Insulation." We stated in this article that our theory had been gradually developed as the result of our investigation of insulating materials for some years, and we were very much pleased during Dr. Wagner's visit to our country, when comparing notes with him, to find that he had independently come to the same conclusions.

The results of the work since the publication of the article have given further evidence in favor of the theory.

We do not mean to claim that with alternating voltages the pyro-electric effect is caused entirely by the ohmic resistance of the insulation, but the effective resistance of dielectric hysteresis (whatever that may be) may play a large part. Indeed, in a number of our tests the amount of energy loss produced by the ohmic resistance of the dielectric, as measured by high-voltage direct current, was only a very small part of the total energy loss observed under alternating voltage.

In our article we used widely different materials to illustrate the wide extent over which we observed this pyro-electric effect, but no special conclusions can be drawn from the particular nature of the material used in each case, whether Nernst lamp glower or paper, etc. For instance, the black varnished cloth commonly used as machine insulation gave us the same characteristic as the Nernst lamp glower, and mica the same characteristic as unimpregnated paper, so that the described characteristics are not special to the Nernst lamp glower or the paper, but are more general. We are preparing a more extensive paper on the subject for the American Institute of Electrical Engineers.

The difference between our conclusions and those of Dr. Wagner on the variations of the disruptive voltage with the thickness of the insulation is only apparent. Dr. Wagner shows mathematically that if a hot spot in the insulation conducts heat only tangentially into the insulation, then the disruptive voltage should be proportional to the thickness of the dielectric. In his experiment he used wooden blocks as terminals, which were poor heat conductors, and so his assumption was justified. If, however, a sheet of insulation is tested

between metal terminals, which are good heat conductors, then a considerable part of the heat of a hot spot is conducted transversely to the terminals. Indeed, with a thin laminated dielectric practically all the heat may have to be conducted to the metal terminals. It can be shown that in this case the disruptive voltage is not proportional to the thickness of the dielectric, but to the square root of the thickness of the dielectric. In general, therefore, the breakdown voltage of sheet insulation should increase somewhere between proportionality with the thickness and proportionality with the square root of the thickness of the insulation, depending on the proportion of the heat conducted tangentially and radially. The law of variation of breakdown voltage with the thickness, therefore, cannot decide the question whether the effect is pyro-electric or not.

J. L. R. HAYDEN.

Schenectady, N. Y.

### Dielectric Loss and Breakdown

*To the Editors of the* ELECTRICAL WORLD:

In his discussion in the Nov. 11 issue of the ELECTRICAL WORLD of the article by Mr. Hayden and myself in the Oct. 21 issue Dr. Whitehead refers to the characteristic of many insulators, that when a constant voltage is impressed upon them the charging current does not die out rapidly, as required in a circuit with fixed constants, but decreases slowly, sometimes over a period of minutes.

None of the various ingenious explanations given for this characteristic—the motion of water in capillary fibers, progressive ionization, etc.—is satisfactory, when it is remembered that this phenomenon is shown to a marked degree by glass, mica and other materials. I have therefore attacked the question mathematically, in studying the transients in a condenser of non-homogeneous dielectric, such as a cable, but with fixed constants.

Suppose the dielectric of a condenser is laminated—that is, consists of alternating layers of different specific capacities and different resistivities—and a constant voltage $e_0$ is impressed upon it over a supply circuit of resistance and inductance. The charging transient then consists of three terms—not two terms, as in a condenser with homogeneous dielectric.

Two of these terms are of very short duration and may combine to form an oscillation. They are due to the constants of the external or supply circuit and usually have passed in a fraction of a second, leaving the condenser charged to terminal voltage $e_0$, but with the voltage distributed between the two materials in proportion to their elastances (reciprocals of capacity). The third transient, however, is of very long duration, commonly many thousand times slower, and has not yet apparently started when the other two have vanished. By the third transient, which I may call the "internal transient" in distinction from the "external" double transient, the internal voltage distribution between the two materials changes from that corresponding to their respective elastances to that corresponding to their respective resistances. Considerable energy is supplied by the external circuit during this transient—which lasts for minutes—to the interior of the dielectric, and of this energy half is dissipated as heat in the resistance of the dielectric, the other half stored as internal electric charges between the layers.

If, then, the supply voltage is withdrawn and the condenser terminals discharged by a momentary short circuit, the terminal voltage of the condenser gradually builds up again from zero to a maximum value of "residual charge" and then gradually dies down.

In this no variation of constants is assumed, no mechanical changes or local oscillation, but the results are derived for the circuit system of entirely fixed constants.

As illustration, a high-voltage cable of 1,300 ft. of about 0.74 mf. capacity, charged with 20,000 volts direct, over a kenotron rectifier from a 2.5-kw. transformer, gives the charging transient:

$$i = 0.108 \times 10^{-3} + 0.264 \times 10^{-3}\ \epsilon^{-0.0091t} + \epsilon^{-62.5} \cdot (3.2 \sin 196t - 0.372 \times 10^{-3} \cos 196t)$$

One hundred and fifty-four watts is stored as condenser charge during the first quarter second by the external transient, and an additional 288 watts is stored during the next half hour, as internal charge between laminations, by the internal transient.

Discharging the cable by a momentary short circuit, its voltage gradually builds up again from zero to 9,250 volts residual after one and one-half minutes, and then gradually vanishes.

I have specifically considered the case where the lack of homogeneity is due to laminated structure, partly because this is the most important case in cables and condensers, and partly because it is mathematically the simplest. Obviously, similar very slow transients must appear for the same reason, the formation of internal charges between materials of different characteristics in structure with other forms of heterogeneity.

I am preparing an Institute paper on this subject.

CHARLES P. STEINMETZ.

Schenectady, N. Y.

### Proper Methods of Fusing

*To the Editors of the* ELECTRICAL WORLD:

Here are a few suggestions on the much-discussed subject of fusing the grounded side of branch circuits. My judgment is that the neutral or grounded wire should be continuous from transformers to lamp sockets or apparatus, except where provision is made for opening simultaneously every wire of the circuit, as at switches or attachment plugs. The wire should taper in size as it does in wiring where fuses are used, but all fuses on the grounded wire should be eliminated.

The greatest objection to this practice that seems to have been offered is that there would be but one fuse protecting the circuit, while under the present practice there are two. This objection may be simply and completely met by inserting two fuses in series at the branching point in the hot wire. It would be inexpensive compared with the safety gained to add even more than one fuse in series. The fuses, if placed in series on the hot wire, may include only one of the proper size, the others being slightly larger, so that all will not easily blow when ordinary trouble occurs, while at the same time a measure of safety will exist in case the right-sized fuse is bridged.

The most prevalent method of bridging fuses is with coins. This practice can easily be overcome in the design of the block. Overfusing should be prevented by designing the block so that plugs of different sizes are not interchangeable, and there should be fewer sizes made.

FRED CLAYTON,
Chief Electrician.

Gulf Lumber Company,
Fullerton, La.

# Central Station and Industrial Practice

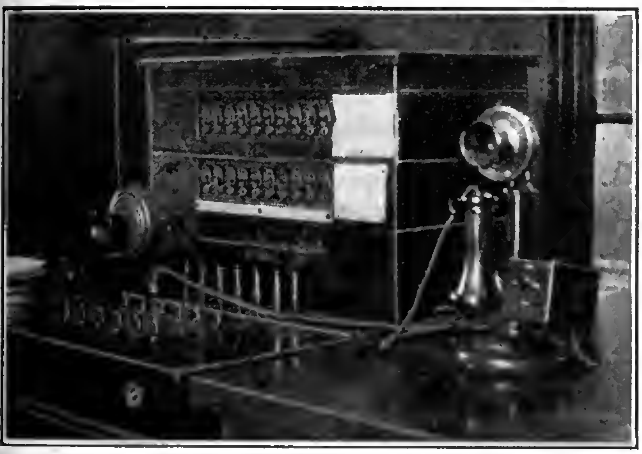
**Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants**

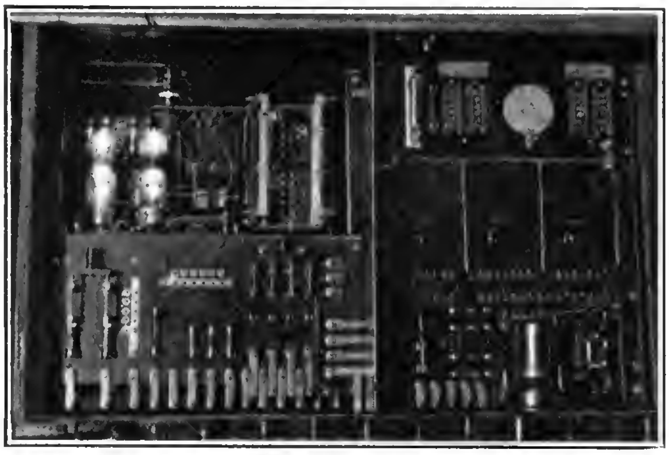
## Carrier Current Being Used Successfully

AS SOON as the development of the carrier-current telephone system had reached the point where apparatus was available the Utica (N. Y.) Gas & Electric Company obtained two sets which were placed in regular service and from which very satisfactory results have been obtained. The apparatus was tuned in, tested out and turned over to this company for regular service on Dec. 8, 1922. During the first two or three days of operation a very few minor troubles were experienced. These were immediately corrected by engineers of the General Electric Company, and since that time the carrier-current telephones have been in regular and continuous use without any further trouble. The two sets now in service are rated at 50 watts and transmit 12½ miles over a 44,000-volt transmission line.

The operation of the sets is almost as simple as with the ordinary telephone. Taking the receiver off the hook starts the motor-generator set and puts the apparatus into condition for either talking or receiving. There is a small key, similar to the key on a telephone switchboard, mounted on the telephone transmitter stand. When this key is pushed up a calling signal is sent to the other station. The key is then released, leaving the telephone in condition for receiving. When the operator desires to talk he pushes the key to the talking position, then releases it for listening.

The voice volume with these sets is at least as good as on the ordinary commercial telephone system. In fact, one of the amplifiers in the receiving circuit is not in operation in our sets, because with the additional amplifier the receiving volume was so great that it was unpleasant to listen to. The quality of the speech received is practically the same as that over the ordinary commercial telephone system.





CARRIER-CURRENT SETS OPERATING SATISFACTORILY OVER 12½-MILE, 44,000-VOLT LINE

One of the very noticeable points in the use of this telephone system to any one who has used the more common dispatching system, in which the telephone lines are run on the same towers with transmission lines, is the very noticeable absence of hum and extraneous noises. There is absolutely no noise discernible from the regular power current in transmission lines, and there has been no interference from any radio signals.

An additional carrier-current telephone set of 250-watt capacity has been ordered to be used in connection with the transmission line now being constructed between the Utica Gas & Electric system and the Northern New York Utilities system. The speech in this case will be transmitted over a 66,000-volt transmission line for a distance of approximately 60 miles, then over a lower-voltage line for a distance of approximately 30 miles, the link between the two transmission lines being closed by means of electrostatic coupling or some equivalent means.

There is one very interesting development being carried out in connection with the new set which has been ordered to provide for talking with several different systems without any system being able to receive conversations or calls directed to another. Where a company is interconnected with two or more companies it is essential that communication between the central company and the various other companies be carried on without interferences with carrier-current systems operating in any of the other companies and without the conversation being receivable by any of the other companies. It appears that this company was the first to call this to the attention of the manufacturers and to ask for sets capable of talking on several different systems without interference between systems. The manufacturers were quick to see the need of this further development, and there is promise of its being carried to a successful conclusion in the near future.

E. P. PECK,
General Superintendent,
Utica Gas & Electric Company,
Utica, N. Y.

## Single-Phase Transformer Ratings Standardized

ADDITIONAL standard ratings for single-phase power transformers have been recently adopted by the Electric Power Club and became effective Jan. 1, 1923. The ratings include transformers to take power from standard circuit voltages, namely, 44,000, 66,000, 88,000, 110,000, 132,400, 154,000 and 220,000, and to supply secondary distribution at voltages above 4,000. The standard sizes, voltage ratings and taps of step-down transformers for supplying lighting and power service as they now stand are given in the accompanying table.

The standard types of transformers are self-cooled oil-immersed, water-cooled oil-immersed and air-blast. The application of air-blast transformers is confined to systems where the voltage does not exceed 25,000. Standard frequencies are 25 cycles and 60 cycles. Standard sizes for oil-immersed self-cooled transformers in kilovolt-amperes continuous rating at 55 deg. C. rise are 250, 333, 400, 500, 667, 833, 1,000 1,250, 1,667, 2,000, 2,500, 3,333, 5,000, 6,667, 8,333 and 10,000. For water-cooled oil-immersed or air-blast transformers the lowest rating is 500 kva., the sizes above this being the same as for the self-cooled type.

Transformers given in the table having a low-voltage rating of 230/115 are arranged for series or three-wire service only. Transformers having low-voltage rating of 230/460 are suitable for series or multiple service only.

Standard single-phase step-down power transformers for supplying secondary distribution and having voltage ratings listed in the table will be designed for successful operation when excited on full winding at 5 per cent above their rated voltage.

Where a standard transformer is suitable for normal application at two voltage ratings, this flexibility will be definitely indicated on the nameplate, on the connection diagram or on a paster inside the transformer cover.

This additional information will be incorporated in the next edition of the handbook of electrical apparatus standards, published by the Electric Power Club.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

STANDARD RATINGS FOR SINGLE-PHASE POWER TRANSFORMERS FOR SUPPLYING LIGHTING AND POWER SERVICE

Voltage ratings shown in bold type are the normal voltage ratings of these lines and, unless otherwise specifically requested, manufacturers will offer guarantees covering electrical characteristics such as efficiency, regulation, etc., on these normal ratings only.

**For Supplying Service Voltages 600 and Below**

| Standard System Voltages | Standard Sizes for Each Voltage Class: Oil-Immersed Self-Cooled | Transformer High-Voltage Ratings for Operation from Various Standard System Voltages: On Full Winding | Approximately on Taps: 2½% | 5% | 7½% | 10% | Transformer Low-Voltage Ratings for Supplying Service Voltages 600 and Below | | |
|---|---|---|---|---|---|---|---|---|---|
| 2,300 | 250 to 500 | 2,200 | 2,145 | 2,090 | 2,035 | 1,980 | to 220/110 (3-wire) | or to 220/440 | or to 550 |
| | | **2,300** | 2,245 | 2,185 | 2,130 | **2,070** | to **230/115** (3-wire) | or to **230/460** | or to **575** |
| 4,600 | 250 to 500 | 2,200/4,400 | 4,290 | 2,090/4,180 | 4,070 | 1,980/3,960 | to 220/110 (3-wire) | or to 220/440 | or to 550 |
| | | 2,300/4,600 | 4,485 | 2,185/4,370 | 4,255 | 2,070/4,140 | to **230/115** (3-wire) | or to **230/460** | or to **575** |
| 6,600 | 250 to 500 | 6,600 | 6,435 | 6,270 | 6,105 | 5,940 | .................. | to 220/440 | or to 550 |
| | | **6,900** | 6,730 | 6,555 | 6,385 | 6,210 | .................. | to **230/460** | or to **575** |
| 11,000 | 250 to 500 | 11,000 | 10,725 | 10,450 | 10,175 | 9,900 | .................. | to 220/440 | or to 550 |
| | | **11,500** | 11,215 | 10,925 | 10,640 | 10,350 | .................. | to **230/460** | or to **575** |
| 13,200 | 250 to 500 | 13,200 | 12,870 | 12,540 | 12,210 | 11,880 | .................. | to 220/440 | or to 550 |
| | | **13,800** | 13,455 | 13,110 | 12,765 | 12,420 | .................. | to **230/460** | or to **575** |
| 22,000 | 250 to 500 | 22,000 | 21,450 | 20,900 | 20,350 | 19,800 | .................. | to 220/440 | or to 550 |
| | | **23,000** | 22,425 | 21,850 | 21,275 | 20,700 | .................. | to **230/460** | or to **575** |
| 33,000 | 250 to 500 | 33,000 | 32,175 | 31,350 | 30,525 | 29,700 | .................. | to 220/440 | or to 550 |
| | | **34,500** | 33,640 | 32,775 | 31,915 | 31,050 | .................. | to **230/460** | or to **575** |

**For Supplying Distribution Voltages Above 600**

| Standard System Voltages | Standard Sizes for Each Voltage Class: Oil-Immersed Self-Cooled | Oil-Immersed Water-Cooled or Air-Blast | Transformer High-Voltage Ratings for Operation from Various Standard-System Voltages: On Full Winding | Approximately on Taps: 2½% | 5% | 7½% | 10% | Transformer Low-Voltage Ratings Supplying Secondary Distribution: To | Or to | Or to | Or to |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 6,600 | 250 to 2,500 | 500 to 5,000 | **6,600** | 6,435 | 6,270 | 6,105 | 5,940 | **2,300/4,000Y** | | | |
| 11,000 | 250 to 2,500 | 500 to 5,000 | **11,000** | 10,725 | 10,450 | 10,175 | 9,900 | **2,300/4,000Y** | | | |
| 13,200 | 250 to 2,500 | 500 to 5,000 | **13,200** | 12,870 | 12,540 | 12,210 | 11,880 | **2,300/4,000Y** | | | |
| 22,000 | 250 to 10,000 | 500 to 10,000 | **22,000** | 21,450 | 20,900 | 20,350 | 19,800 | **2,300/4,000Y** | 6,900 | | |
| 33,000 | 250 to 10,000 | 500 to 10,000 | **33,000** | 32,175 | 31,350 | 30,525 | 29,700 | **2,300/4,000Y** | 6,900 | 11,500 | 13,800 |
| 44,000 | 250 to 10,000 | 500 to 10,000 | **44,000** | 42,900 | 41,800 | 40,700 | 39,600 | **2,300/4,000Y** | 6,900 | 11,500 | 13,800 |
| 66,000 | 250 to 10,000 | 500 to 10,000 | **66,000** | 64,350 | 62,700 | 61,050 | 59,400 | **2,300/4,000Y** | 6,900 | 11,500 | 13,800 |
| 88,000 | 500 to 10,000 | 667 to 10,000 | 88,000 | 85,800 | 83,600 | 81,400 | 79,200 | **2,300/4,000Y** | 6,900 | 11,500 | 13,800 |
| 110,000 | 1,000 to 10,000 | 1,250 to 10,000 | **110,000** | 107,250 | 104,500 | 101,750 | 99,000 | **2,300/4,000Y** | 6,900 | 11,500 | 13,800 |
| 132,000 | 1,250 to 10,000 | 1,667 to 10,000 | **132,000** | 128,700 | 125,400 | 122,100 | 118,800 | **2,300/4,000Y** | 6,900 | 11,500 | 13,800 |
| 154,000 | 1,667 to 10,000 | 2,000 to 10,000 | **154,000** | 150,150 | 146,300 | 142,450 | 138,600 | **2,300/4,000Y** | 6,900 | 11,500 | 13,800 |
| 220,000 | 2,000 to 10,000 | 2,500 to 10,000 | **220,000** | 214,500 | 209,000 | 203,500 | 198,000 | **2,300/4,000Y** | 6,900 | 11,500 | 13,800 |

## Signposts to Economies in Small Stations

BETTERMENT work in the operation of small central-station companies is receiving widespread attention at present, and various lines of attack on waste are being followed with good results in many parts of the country. The following representative "leads" were noted recently in visiting stations which were trying to make the most of existing equipment as well as to install new and economical generating units and auxiliaries:

Substitution of two Klaxon horns and an individual forge blower for an air whistle and compressor service in station forge shop. This secured a marked reduction in the hours of daily operation of an air compressor.

Measurement of the foot-candles of illumination in various parts of the plant, from the coal pocket to the operating gallery, with a tabulation of desirable intensities and lighting unit sizes.

Check-up of station lighting circuits and switching arrangements to permit reduction of energy consumption in maintaining illumination in sections of the plant periodically but not continuously under close operating observation.

Installation of industrial ash car operated by storage battery to reduce labor of ash disposal.

Provision of plane mirror at proper angle outside boiler room to reflect image of chimney top for convenience of boiler-room force in checking smoke

emission and maintaining rules of smoke density laid down by state authorities.

Removal of 6,600-volt knife switches from location within 3 ft. of flow line to height of 12 ft., for safeguarding switchboard operator's work at rear of panels.

Concentration of indicating and recording instruments for boiler-room service in inclosed office at central point in boiler house to facilitate control of boiler units, draft, feed water, etc., and more quickly effect changes in handling when inefficient conditions appear.

Analysis of economical load points or range of efficient service by auxiliaries to insure better handling of such apparatus in connection with fluctuations of station output.

Preparation of special log sheet to record interconnection data, routine and emergency service conditions, to insure more accurate permanent records of operation and provide a basis for deeper economic studies of interplant handling.

Provision of glass-inclosed office in old transformer station serving industrial area to reduce amount of heating required in winter as compared with former practice of steam-heating entire building. Group assembly of all transformer-cooling water-supply valves in recess in switch house, with visual indication of rate of flow and massed thermometric facilities under immediate observation of load dispatchers.

Relocation of transformer bank for city substation next to outer wall facing alleyway and provision of rolling steel doors and screens in place of former brick wall to increase supply of outside air drawn in by motor-driven ventilating fans under peak loads and thereby gain transformer capacity.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

# Slotting Improves Commutator Operation

### Operating Conditions Determine Best Method of Undercutting for Any Particular Machine—Proper Selection and Application of Brushes Important

COMMUTATOR slotting, or undercutting, has been fast gaining in popularity among operating engineers during the past few years. Slotting is cutting or grooving the mica lying between the commutator segments below the surface of the copper so as to allow only copper to come into contact with the brushes. Formerly methods were more or less haphazard, and in many cases the results hoped for were negative and troubles that were intended to be eliminated were multiplied. This, in many instances, resulted in turning the operator against the whole idea of slotting, and it is still dwelt upon by some as an indictment against all slotting.

Later experience and practice have proved that the operation of any commutating-type machine can be improved by using a method of undercutting applicable to the type of the individual machine and its operating conditions, together with the selection of the correct grade of brush material and the correct application of the brushes to the commutator. Some of the many benefits to be derived from proper slotting and brush selection may be enumerated as follows:

*Decreased Commutator Wear.* — On slotted commutators brushes with no abrasive characteristics can be used, while on flush mica commutators it is necessary to use a brush material having a degree of abrasive action sufficient to keep the harder mica flush with the copper.

*Increased Brush Life.*—As it is not necessary to use abrasive brushes on undercut commutators, it is possible to obtain a much better polish both on the surface of the commutator and on the face of the brushes.

*Decrease (if Not Elimination of) Glowing of Brushes, Sparking, Ring Fire and Commutator Surface Burns.*—The most common cause of these conditions is high mica, which slotting abolishes.

*Reduction of Frictional Losses.*—Frictional and abrasive characteristics of brush material are closely related, and the use of a brush having no abrasive characteristics means also a material of minimum friction. Reduction of this loss from friction has in many cases amounted to 1½ per cent to 2 per cent of the total output of the machine, and it is directly reflected in the coal bill.

*Decrease in Operating Temperature Under Set Load Conditions.*—All brush friction is transformed into heat energy at the brush face; therefore, by reducing the friction to a minimum the heat due to friction is also reduced to a minimum.

*Increase in Allowable Load.*—Two factors contribute to this result, (1) reduction in heat due to friction, and (2) the fact that non-abrasive brush materials almost always have a lower specific resistance, which reduces the heat due to current flow.

*Decreased Tendency to Develop Flat Spots.*—Sparking and burning are reduced, and these are the most common causes of the development of flat spots.

There are several methods of undercutting in general use, some of which are excellent and others of questionable value. Machines and tools of various kinds for undercutting are on the market, and all have their advantages for certain classes of work. Machine tools for this work are usually circular-milling saws operated by some convenient power method. Hand tools are of various types, including holders for pieces of hack-saw blades, shaped raking cutters, files and other implements. Of the hand tools, the curved file with the offset handle has proved to give best results under average industrial operating conditions.

In all cases where the job of slotting is to be done the following general rules apply:

Be sure that the commutator is round and free from flat spots, that there is no eccentricity, and that there are no grooves around the commutators. If any of these conditions exist, the commutator should first be trued up by grinding or turning.

After the slotting job is completed a careful inspection should be made to make sure that no particle of mica has been left flush with the bars, as this always defeats the purpose of undercutting. After this the commutator surface should be polished. This can best be done by a very fine grit commutator stone. If a commutator stone is not available, very fine sandpaper can be used. Before using sandpaper, the coarser grit should be worn off by drawing over a piece of steel a few times. Best results from sandpaper can be obtained by backing up with a wooden block cut to the curvature of the commutator. A satisfactory method of anchoring sandpaper to such a block is shown in Fig. 1.

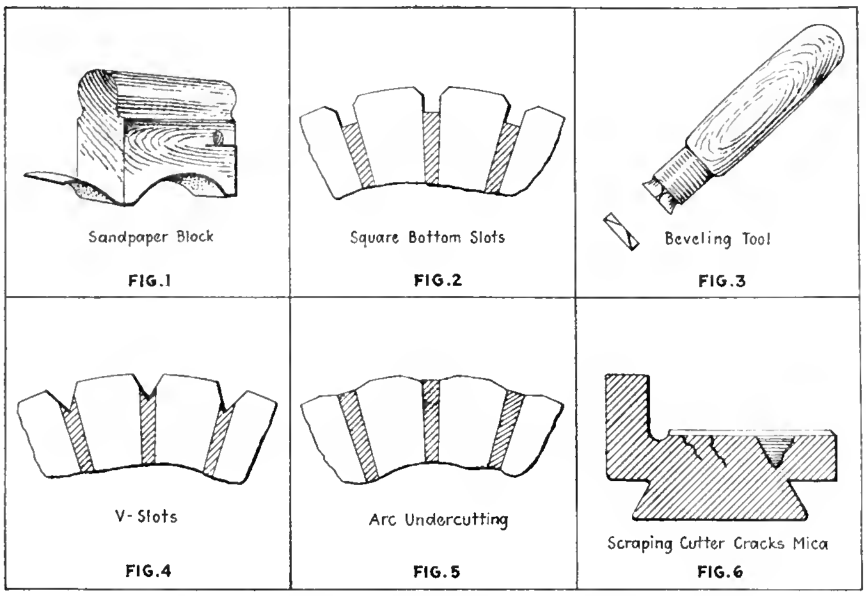
As there are various methods of slotting, conditions of operation determine the best method for any particular job. These methods are divided into three general classifications—square-bottom slotting, "V" slotting and arc slotting, of which the "V" type has the widest range of application.

In the following paragraphs the poorest of operating conditions have been assumed, and under good operating conditions figures for minimum peripheral speeds at which slots will clear will be considerably reduced. Commutator diameters have not been taken into consideration, figures being based on the average diameter of commutators found in the average industrial equipment. Small-diameter commutators will clear at somewhat lower peripheral speeds than those of larger size. However, if figures given are followed in practice, satisfactory results will be obtained, as errors are on the side of safety.

*Square-Bottom Slots.*—The square-bottom type of slot is adapted to high speeds only. This slot is usually put in by the use of power-driven milling saws or hack-saw

blades. It has been found that the maximum depth of this style of slot that will positively clear itself is $\frac{3}{64}$ in., and it is then positive in its action only at peripheral speeds of 5,000 ft. per minute or greater. This practically limits the use of the $\frac{3}{64}$-in.-deep square-bottom slot to turbine-driven commutating machines and some 60-cycle rotary converters. The square-bottom slot of $\frac{1}{32}$-in. depth is positive in its clearing action at peripheral speeds of 3,500 ft. per minute or greater and can be used to advantage on many larger generators and rotary converters having a commutator speed above this figure.

In the machining of the square-bottom slot there are several details which may seem of minor importance, but careful attention to them is absolutely essential if best results are to be obtained, and they cannot be emphasized too much. Where the power-driven milling saw is used it is impossible to prevent it from coming in contact with the sides of the bars, and wherever this occurs some of the copper is cut or dragged off. Usually the dragging or tearing action is pronounced. This has the effect of cold-drawing on the side of the bar, which causes a hardening of the copper at the side of the slot, and no matter how carefully the surface of the commutator may be smoothed or polished after slotting, there is a knife edge of hardened copper at the edges of each bar. This hardened knife edge will not wear down uniformly with the softer center of the bar and after a time will have a tendency to start flat spots in the center of the bars. This causes the bar edges to run high and act as scrapers against the brush face, shortens the brush life and causes an excess of carbon dust which, in the end, may result in flashovers and the breakdown of the machine. With such possibilities it is, therefore, advisable always to bevel the edge of the commutator bars as indicated in Fig. 2. A bevel surface of approximately $\frac{1}{64}$ in. is sufficient for this purpose. Beveling can be accomplished by the use of an ordinary three-corner slim-taper file or with a sharp cutting edge such as a strong pocket knife or a special tool like that shown in Fig. 3.




METHODS OF COMMUTATOR SLOTTING THAT IMPROVE THE OPERATION OF MACHINE

It is a proved fact that the number of car-miles per motor failure obtained on one interurban railway line in the Southwest was increased more than 30 per cent by beveling the edges of the bars where square-bottom slots were used.

*V Slots.*—As has been previously stated, the V slot (Fig. 4.) has a wider range of application than any of the other types and in time is bound to be accepted as the standard method of slotting for all machines operating under average industrial conditions. At the present time there are no power-driven tools on the market for slotting in this manner, and this makes necessary the use of hand tools to get the results desired. Hand tools are comparatively slow, and many operators, while admitting the advisability of using the V slot, continue to use a square-bottom type solely because of the time saving of power machinery. It is, however, a fact that the improvement to be gained in operation will often pay many times over for the difference in labor cost of putting in the V slot. A V slot of 60-deg. angle, the bottom being slightly rounded, cut to a depth that will bevel the copper to about $\frac{1}{64}$ in. at the sides of the slots, will clear itself at peripheral speeds of 1,200 ft. per minute or greater. A careful check of surveys made covering thousands of motors and generators in many industrial and central-station plants shows approximately 76 per cent of the machines operating with a commutator speed in feet per minute greater than 1,200 and less than 3,500, which is the minimum limit for square-bottom slots.

*Arc Undercutting.*—While entirely satisfactory on any machine and under all conditions on account of the cost of properly machining, arc undercutting (Fig. 5) is limited in application to those machines that will not operate satisfactorily when slotted by any other method. When properly machined there is no minimum speed limit at which arc undercutting will not clean, even when the machine is operating under the most adverse of conditions such as engine exhaust, steam, water or oil splash. To get these results, however, it is absolutely necessary that slot machining be held within very close limits. Careful observation of several cases where this method has been used to overcome commutation faults has established 0.010 in. as a maximum depth of undercutting at which cleaning action is positive at very slow speeds. Moreover, the total width of the slot at the top should not be less than two and one-half times nor more than three and one-half times the thickness of the mica.

There is one method of machining slots occasionally used which very often is the primary cause of serious machine trouble. This is the use of raking-type cutters, whether used by hand or in the tool rest of a lathe. Mica is hard and brittle, and the use of any raking or scraping cutter having a single cutting point is almost sure to cause small cracks or checks in the mica at the bottom of the slots, as indicated in Fig 6. Where any oil or moisture is present it finds its way into these small cracks and breaks down the insulation between bars, often causing the mica to char and burn all the way to the spider or shaft, thus bringing about complete machine failure.

The different methods of slotting recommended above will always prove satisfactory when properly applied to machines in continuous operation. Very often, however, on machines used intermittently, where oil creeps from the bearings, or the atmosphere is moist, oily or dirty, or corrosive fumes are present, failures directly traceable to the slotting develop. Where conditions such as those described occur this trouble can be eliminated by coating or filling the slots with a good grade of shellac, certain air-drying insulating varnishes or some of the commutator cements sold for that purpose. Care should be used in the selection of this material. It must have good adhesive properties. It must dry hard and not gum, but it must not become harder than the copper commutator bars. It must not be affected by oil or moisture and it must be free from abrasive qualities.

With a slotting job properly done, the selection of the grade of brush material to be used on the commutator is of the utmost importance. The brush that gave satisfactory service on the machine while operating with flush mica will not operate correctly after undercutting. Brush material on flush mica commutators must have a degree of abrasive action, which on undercut commutators would be expended entirely in cutting out the softer copper, resulting in greater commutator wear than before undercutting. This would mean more copper dust and a correspondingly greater possibility of failure in insulation, with the consequent breakdown of the machine.

With the proper grade of brush material selected, the application of that grade to the machine becomes of prime importance. Brush angle, brush pressure, brush staggering and fitting of brushes to the commutator should all receive consideration. Brushes with low friction should be more nearly radial than those having high abrasive characteristics. Brush pressure on slotted commutators should usually be somewhat less than where abrasive brushes are used on flush mica. Staggering should be by pairs of studs instead of by single studs. New brushes never exactly fit the commutator, and in order to get the proper contact they should be sandpapered in by pulling the sandpaper in the direction of rotation of the commutator.

With correct slotting, the correct brush applied in the proper way, the machine should operate quietly, without chatter, spark, squeal or burn. No lubricant should ever be used on slotted commutators, and if everything is correct it will not be needed.

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## Damage from Oxygen in Boiler-Feed Water

WATER containing oxygen in solution actively corrodes the tubes of steel-tube economizers and boilers. The serious harm due to such corrosion can be inferred from Fig. 1, showing the amounts of iron converted into rust in a year by an hourly supply of 1,000 lb. of water containing different amounts of oxygen in solution. Where economizers have been put in without suitable de-aërating means they have in several instances been destroyed by pitting within a year or less.

Open heaters receiving sufficient exhaust steam at all times to bring the water up to 212 deg. F. or above greatly reduce the corrosion, but since the amount of heat recovered by the economizer depends upon the difference between the temperature of the flue gases and the temperature of the water, it is generally desirable in the interests of over-all plant economy to supply water to economizers at the lower temperatures. Ordinarily the flue gases enter the economizer at a temperature between 550 deg. and 650 deg. F. and leave at a temperature between 250 deg. and 350 deg. F., having therefore a mean temperature of about 450 deg. F. If the feed water enters the economizer at 200 deg. F. and leaves at, say, 300 deg. F., giving a mean temperature of 250 deg. F., the average temperature difference will be in the neighborhood of 200 deg. F. If, on the other hand, the water enters at 140 deg. or 150 deg. F., the temperature difference, and therefore the fuel saving and money return upon the economizers, will be increased by about 20 per cent.

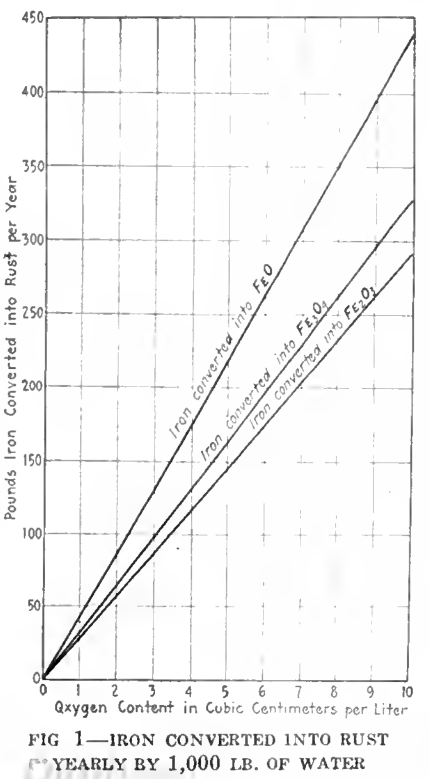


FIG 1—IRON CONVERTED INTO RUST YEARLY BY 1,000 LB. OF WATER PER HOUR

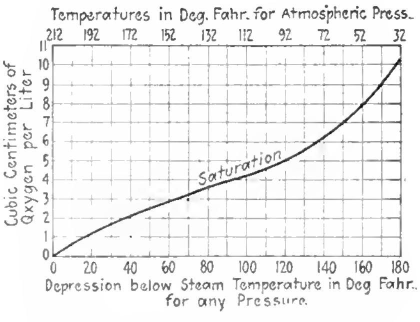


FIG. 2—OXYGEN CONTENT OF WATER HEATED TO VARIOUS TEMPERATURES

The extent to which oxygen can be driven out of solution by heating water to the boiling point under atmospheric pressure is shown in Fig. 2. The problem of heating water to the full temperature of the steam in an open heater resolves itself into that of removing non-condensible gases from the steam space. If the venting is done directly from the steam space, large quantities of steam must be vented in order to keep down the concentration of air.

If the amount of steam supplied is insufficient to heat the water to atmospheric boiling point, the temperature of the feed water will vary according to the relative amounts of steam and water, and in order to secure de-aëration at the lower temperatures, means must be provided for maintaining a vacuum in the heater corresponding to the pressure of water vapor at the temperature to which the water is heated. This condition will be fulfilled if the accumulation of non-condensible gases in the heater is prevented, as by withdrawing a portion of the heater atmosphere continuously by means of a steam-jet air pump or ejector. For operation under vacuum conditions special apparatus has been developed.

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# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## The Present Status of Rural Service*

**Eventual Modification of Agricultural Processes and Equipment Will Increase Use of Energy to a Point Profitable to Both the Central Station and the Farmer**


BY J. C. MARTIN
Western Editor ELECTRICAL WORLD, Chicago


SEEING the advantages of electric service in cities and towns and sensing its economic possibilities in agricultural operations, the farmer has not been able fully to understand why an electric power supply cannot be as readily taken to his door as it has been to that of the city man. He has made attempts, with more or less success, to get his power supply by building lines to the central-station system and buying power on a wholesale basis, doing his own distributing and thereby in many cases entering, legally at least, into the utility business and assuming without realizing it responsibilities that have later proved a severe burden. All sorts of errors, some ludicrous and some tragic, have been committed in such projects.

Some success has been attained, but it is not of the character that indicates the lines along which practice will finally stabilize. After four or five years of work both the seller and the consumer are still groping very much in the dark and the solution seems as far off as ever. As a matter of fact I believe that the difficulty lies largely in the old human failing of refusing to look a problem over and analyze it to see what is involved.

### Nature of the Problem

Two facts are thoroughly proved in economic experience. One is that the seller must make a profit if he is to continue in the business of selling a product. The other is that the buyer must make a profit from the use of the thing he buys. In the case of the buyer the profit does not always come in the form of a money balance. It may come in the form of better living conditions or better health, or in numerous other ways. However, if he is using the things he buys in a producing business from which he derives an income, then he must be able to turn those things into more cash than he pays for them, including the labor and process costs through which he must put his raw materials.

There are two sides to this question, and, to dispose first of the one which seems to be simplest, the seller's problem will be discussed briefly. The central-station man called upon to give service anywhere has certain total cost limits below which he cannot go in establishing the service. The costs per consumer are controlled in certain items by the number of consumers he can serve with a given amount of material in the form of service plant. In certain other items the cost is independent of the number of consumers. When called upon to build a city line he can figure eventually on from approximately twenty to one hundred consumers per mile of line. Probably the general average is around fifty per mile or slightly less. Called upon to serve the same class of consumers in rural territory, he cannot expect in the Middle West and Far West more than three per mile, and the general average in service so far established is less. The expense per consumer which is affected most by the number served by a given line is the biggest expense.

When he has figured out the entire problem he finds that for a line costing a given sum in city service he will serve say forty to fifty consumers and in the country a line costing approximately one-half the amount will serve only about three consumers. This is because there is a minimum amount of material that can be used in building a line that will stand up under the climatic and other physical conditions it must meet. This amount of material has no relation to the number of consumers. It must be used to secure physical strength. He also has to face the fact that in maintaining his rural lines he must arrange to travel miles for service and maintenance purposes where in his city or town service the travel is measured in blocks. Good pavements in city work and poor roads in many country districts serve to widen the difference in expense. The difference in expense is inherent in the method of giving service, and unfortunately it is the only method we know. This is the heart of the central-station side of the problem, and it is a wall which prevents placing the service cost to the individual farmer on the same basis as the city dweller.

### The User's Problem

The user's problem is divided into two parts. The buyer must distinguish between the uses to which he puts the things he buys. We have heard a great deal of the need of improving farm living conditions in the past few years. Much of this has had to do with the farm home. If he can make the other part of his activities pay him a fair return on his investment, the farmer can afford to spend money on improvements in living conditions in the home. In fact, he is doing this in many directions. In using electrical energy the question is how can he make it relieve the home conditions. The way to the solution of this problem is well paved by the developments in city homes, so far as light, the sewing machine, the washing and ironing machine and the ordinary items of home use are concerned. Such items of equipment as the electric range and the refrigerator require educational development. Merely placing them in the farm kitchen will not solve the problem. That they have great possibilities is certain, and a considerable amount of study can be devoted to their use on the farm.

The other and by far the biggest

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*From a paper presented before a meeting of the American Society of Agricultural Engineers at St. Louis, Dec. 27, 1922.

possibilities, however, lie in the field of farm work that corresponds to the business activities of the city business or industrial man. It seems that the time has come when the farmer must view his producing problems in exactly the same light as the factory owner or executive views his production problems. In other words, the farm as a producing agency is a factory.

The farmer uses power. For centuries that power has been human or animal because such power has been cheap. In America cheapness is no longer a certain feature of human labor unaided by machinery. I think it is fair to question whether animal labor is not also reaching that point in many places. I understand from farm sources that it requires the products from several acres of ground each year to sustain a single horse.

### Possibilities for Increased Production

If by means of machine equipment the products of that ground can be turned to other uses, what is the gain to the farmer? If it is possible to increase the production per man from this acreage and the remaining acreage now devoted to other purposes, what is the value of such a gain to the farmer? If it is possible, for example, to reduce the number of horses used on a 600-acre farm to two, as one English investigator claimed recently could be done, by the use of some form of power other than animal, what is such a gain worth to the farmer in the solution of his production-cost problems?

In a recent discussion it was pointed out that forced curing of hay had been resorted to in an experimental way in England, and the results seemed to show that the food qualities of the product are better than where the hay is cured in the ordinary way. The process is simple, and outside of an ordinary fan and motor the only equipment involved was some sort of a tunnel under the stack into which the air is forced and then allowed to escape through the green hay, carrying the moisture with it and curing the hay before destructive processes can set in. There are other crops on which the same process might make for an improvement in product.

This is but one instance of a saving effected by the application of electric power. There are many other benefits, including water supply, haulage and small power applications in the daily routine of farm work, which will minimize or eliminate hand labor.

Many, including men in both the agricultural and electrical fields, believe that the future development of farm equipment must follow in a general way the broad lines of progress that have been followed in the industrial field in the past twenty-five years, namely, the development of equipment of the highest possible mechanical efficiency which requires the least human labor to keep in operation and which places the production possibilities on a plane that hand labor can never approach. If electric power is to be used profitably on the farm, there will probably be as great modifications in farm processes and equipment as have taken place in the industrial field. The problem is neither wholly electrical nor wholly agricultural in its aspect, but it is an economic problem that must be solved by both industries working together in order that the viewpoint of each may be properly considered. It involves a vast amount of research, and the extensive government experiment stations have the facilities to undertake the work. The nub of the problem in reducing the cost of energy delivered at the farm is to increase the use so that the costs of getting service will be absorbed, and leave the farmer with a profit as the result of his expenditure.

## Power-Factor Table Lessens Billing Computations

By George B. Leland
General Manager Stamford Gas & Electric Company, Stamford, Conn.

Many central stations are using the two-meter method of determining the average power factor of their power customers, one meter registering the kilowatt-hours and the other meter registering the reactive volt-amperes.

Our company started using this method of metering with a few of our larger customers about four

TABLE FOR COMPUTING POWER FACTOR

Divide reading of wattless component meter by reading of kilowatt-hour meter. This gives the ratio of the wattless and the true current. Find in table below nearest constant to the ratio above determined and in the column at the left-hand side of table read power factor. Add to this the decimal shown over the top of the column which contains the constant. This will give the power factor to the nearest tenth.

| Power Factor | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 95 | 0.3288 | 0.3252 | 0.3214 | 0.3179 | 0.3143 | 0.3105 | 0.3067 | 0.3032 | 0.2994 | 0.2956 |
| 94 | 0.3630 | 0.3597 | 0.3564 | 0.3528 | 0.3495 | 0.3460 | 0.3427 | 0.3391 | 0.3356 | 0.3323 |
| 93 | 0.3953 | 0.3921 | 0.3889 | 0.3859 | 0.3825 | 0.3792 | 0.3762 | 0.3729 | 0.3696 | 0.3663 |
| 92 | 0.4258 | 0.4231 | 0.4200 | 0.4169 | 0.4139 | 0.4108 | 0.4078 | 0.4047 | 0.4015 | 0.3983 |
| 91 | 0.4557 | 0.4526 | 0.4498 | 0.4470 | 0.4438 | 0.4411 | 0.4379 | 0.4350 | 0.4320 | 0.4289 |
| 90 | 0.4843 | 0.4816 | 0.4788 | 0.4759 | 0.4731 | 0.4702 | 0.4672 | 0.4642 | 0.4614 | 0.4585 |
| 89 | 0.5123 | 0.5095 | 0.5068 | 0.5040 | 0.5011 | 0.4984 | 0.4957 | 0.4928 | 0.4899 | 0.4870 |
| 88 | 0.5398 | 0.5369 | 0.5343 | 0.5315 | 0.5287 | 0.5261 | 0.5233 | 0.5206 | 0.5178 | 0.5150 |
| 87 | 0.5667 | 0.5641 | 0.5614 | 0.5587 | 0.5560 | 0.5532 | 0.5505 | 0.5479 | 0.5452 | 0.5426 |
| 86 | 0.5934 | 0.5906 | 0.5881 | 0.5855 | 0.5828 | 0.5801 | 0.5774 | 0.5746 | 0.5721 | 0.5694 |
| 85 | 0.6196 | 0.6172 | 0.6144 | 0.6118 | 0.6092 | 0.6066 | 0.6040 | 0.6013 | 0.5987 | 0.5961 |
| 84 | 0.6459 | 0.6432 | 0.6408 | 0.6381 | 0.6354 | 0.6330 | 0.6301 | 0.6277 | 0.6249 | 0.6224 |
| 83 | 0.6720 | 0.6694 | 0.6669 | 0.6642 | 0.6615 | 0.6590 | 0.6565 | 0.6538 | 0.6511 | 0.6486 |
| 82 | 0.6980 | 0.6954 | 0.6929 | 0.6903 | 0.6877 | 0.6849 | 0.6824 | 0.6798 | 0.6773 | 0.6745 |
| 81 | 0.7239 | 0.7214 | 0.7188 | 0.7163 | 0.7135 | 0.7111 | 0.7085 | 0.7059 | 0.7032 | 0.7006 |
| 80 | 0.7499 | 0.7474 | 0.7447 | 0.7422 | 0.7395 | 0.7371 | 0.7344 | 0.7319 | 0.7292 | 0.7265 |
| 79 | 0.7761 | 0.7734 | 0.7708 | 0.7683 | 0.7657 | 0.7632 | 0.7604 | 0.7579 | 0.7552 | 0.7526 |
| 78 | 0.8023 | 0.7997 | 0.7971 | 0.7945 | 0.7919 | 0.7893 | 0.7865 | 0.7839 | 0.7813 | 0.7787 |
| 77 | 0.8287 | 0.8261 | 0.8234 | 0.8206 | 0.8180 | 0.8154 | 0.8127 | 0.8103 | 0.8077 | 0.8050 |
| 76 | 0.8551 | 0.8526 | 0.8498 | 0.8471 | 0.8446 | 0.8418 | 0.8391 | 0.8366 | 0.8339 | 0.8312 |
| 75 | 0.8819 | 0.8793 | 0.8765 | 0.8739 | 0.8711 | 0.8685 | 0.8657 | 0.8632 | 0.8603 | 0.8578 |
| 74 | 0.9089 | 0.9062 | 0.9036 | 0.9009 | 0.8980 | 0.8955 | 0.8928 | 0.8899 | 0.8873 | 0.8847 |
| 73 | 0.9363 | 0.9336 | 0.9306 | 0.9279 | 0.9252 | 0.9225 | 0.9198 | 0.9172 | 0.9145 | 0.9115 |
| 72 | 0.9637 | 0.9612 | 0.9584 | 0.9556 | 0.9528 | 0.9501 | 0.9473 | 0.9446 | 0.9418 | 0.9391 |
| 71 | 0.9919 | 0.9890 | 0.9861 | 0.9833 | 0.9807 | 0.9779 | 0.9750 | 0.9722 | 0.9694 | 0.9666 |
| 70 | 1.0203 | 1.0170 | 1.0144 | 1.0117 | 1.0088 | 1.0058 | 1.0032 | 1.0003 | 0.9974 | 0.9948 |
| 69 | 1.0489 | 1.0461 | 1.0431 | 1.0404 | 1.0373 | 1.0346 | 1.0316 | 1.0289 | 1.0259 | 1.0230 |
| 68 | 1.0783 | 1.0752 | 1.0724 | 1.0694 | 1.0664 | 1.0637 | 1.0606 | 1.0578 | 1.0547 | 1.0519 |
| 67 | 1.1080 | 1.1051 | 1.1020 | 1.0990 | 1.0961 | 1.0930 | 1.0900 | 1.0872 | 1.0840 | 1.0812 |
| 66 | 1.1383 | 1.1352 | 1.1323 | 1.1293 | 1.1260 | 1.1230 | 1.1200 | 1.1171 | 1.1139 | 1.1111 |
| 65 | 1.1692 | 1.1660 | 1.1629 | 1.1599 | 1.1568 | 1.1538 | 1.1506 | 1.1474 | 1.1443 | 1.1413 |
| 64 | 1.2005 | 1.1974 | 1.1943 | 1.1910 | 1.1878 | 1.1847 | 1.1816 | 1.1785 | 1.1754 | 1.1722 |
| 63 | 1.2327 | 1.2294 | 1.2261 | 1.2229 | 1.2198 | 1.2167 | 1.2135 | 1.2102 | 1.2070 | 1.2038 |
| 62 | 1.2655 | 1.2621 | 1.2589 | 1.2557 | 1.2523 | 1.2489 | 1.2458 | 1.2426 | 1.2393 | 1.2360 |
| 61 | 1.2989 | 1.2957 | 1.2923 | 1.2888 | 1.2857 | 1.2822 | 1.2788 | 1.2753 | 1.2723 | 1.2689 |
| 60 | 1.3335 | 1.3299 | 1.3262 | 1.3230 | 1.3194 | 1.3162 | 1.3127 | 1.3091 | 1.3059 | 1.3024 |
| 59 | 1.3684 | 1.3650 | 1.3613 | 1.3580 | 1.3543 | 1.3511 | 1.3473 | 1.3438 | 1.3404 | 1.3367 |
| 58 | 1.4045 | 1.4008 | 1.3972 | 1.3937 | 1.3899 | 1.3865 | 1.3827 | 1.3792 | 1.3755 | 1.3722 |
| 57 | 1.4415 | 1.4379 | 1.4340 | 1.4304 | 1.4266 | 1.4229 | 1.4193 | 1.4154 | 1.4120 | 1.4080 |
| 56 | 1.4792 | 1.4756 | 1.4718 | 1.4678 | 1.4641 | 1.4605 | 1.4565 | 1.4527 | 1.4490 | 1.4451 |
| 55 | 1.5185 | 1.5147 | 1.5105 | 1.5066 | 1.5027 | 1.4988 | 1.4951 | 1.4910 | 1.4872 | 1.4835 |
| 54 | 1.5587 | 1.5547 | 1.5507 | 1.5465 | 1.5425 | 1.5384 | 1.5345 | 1.5304 | 1.5262 | 1.5224 |
| 53 | 1.6000 | 1.5958 | 1.5916 | 1.5875 | 1.5834 | 1.5792 | 1.5751 | 1.5711 | 1.5667 | 1.5627 |
| 52 | 1.6426 | 1.6383 | 1.6340 | 1.6297 | 1.6255 | 1.6212 | 1.6170 | 1.6128 | 1.6083 | 1.6042 |
| 51 | 1.6864 | 1.6820 | 1.6775 | 1.6731 | 1.6687 | 1.6643 | 1.6599 | 1.6555 | 1.6512 | 1.6469 |
| 50 | 1.7321 | 1.7274 | 1.7228 | 1.7182 | 1.7136 | 1.7090 | 1.7045 | 1.6999 | 1.6954 | 1.6909 |

years ago, and one of the first problems we had to solve was that the billing department was unable to determine the power factor of the consumer when it received the readings from the indexers. After trying out various methods and "graphs," the accompanying table (cosines and tangents) was worked out. After two years' use it has fully solved the problem and enables any billing clerk accurately to determine the power factor of the consumer and bill him in accordance with our rate.

## Company Garage Has Model Electrical Installation

SOME power companies are prone to devote too little attention to the type of wiring which goes into their own buildings because the men are so familiar with their work that they can be trusted to handle a rough installation. In consequence temporary wires are often used for months or years in positions where a power man would advise the most permanent type of wiring if the installation were being made on a customer's premises.

In the belief that the public will be impressed by the example set by the electric company, the San Joaquin Light & Power Corporation has installed model electrical equipment in its new garage building. Wiring is in conduit throughout and switchboards are well arranged and of the latest design.

More than one hundred of the company's cars are stored in this building, and from 200 to 225 are cared for here for repairs. In addition to the repair work on the cars, which calls for a paint shop and an upholstery repair shop as well as the main machine shop, any heavy machine work in connection with company construction requirements is handled in the garage.

An average of 4,000 kw.-hr. per month is used for power purposes, with a total motor installation of 117.5 hp. as shown below, the figures indicating horsepower:

*Machine Shop.*—Band saw, 7.5; hack saw, 0.5; grinder, 2; drill press, 2; sensitive drill, 1; shaper, 2; grinder, 0.5; milling machine, 3; cylinder driver, 5; universal driver, 3; 14-in. lathe, 2; 18-in. lathe, 5; 18-in. lathe, 3; 12-in. lathe, 2; threading machine, 3; threading machine, 3; drill press, 3; punch, 5; grinder, 3; air compressor, 30.

*Garage.*—Bearing burning-in, 10; bearing burning-in. 20.

*Filling Station.*—Gasoline pump, 2.

All machines are remote-controlled with push-button operation and are protected with approved safety features. In addition to the motor load, there is a 25.9-kw. lighting and fan load with an average monthly consumption of 3,500 kw.-hr. during the summer and 3,000 kw.-hr. during the winter. Heating is accomplished by 1,800-watt heaters, but this installation is too recent to furnish figures for consumption.

Besides serving as an example of good wiring which may be used in selling adequate illumination and modern installations to garage owners and machine shops, this garage has the added advantage to the company of providing for the grouping of all cars at one place, a feature which permits of their being regularly inspected for repairs at frequent intervals.

The paint and upholstery shops located on the premises facilitate keeping up the appearance of the company's cars, a factor which influences the attitude of the community.

## Customers Oversubscribe Holding Company Stock

CUSTOMER ownership of holding-company stock, which was successfully tried out by the United Light & Railways Company of Davenport, Iowa, as described by H. E. Weeks, manager of the company's securities department, in the ELECTRICAL WORLD of March 18, 1922, has further proved its value. Not only was a second block of $1,000,000 of prior preferred stock sold on this plan, but this quota was oversubscribed by $200,000.

During the latter part of March, 922, the directors of the company authorized the sale of another $1,000,000 of prior preferred stock to the customers of the company. The previous block of stock had been sold almost entirely through the employees, the only exception being that in some of the larger localities a few paid salesmen were employed.

When it was decided to sell the $1,000,000 of stock between April 1 and Dec. 31 a definite quota was assigned to each of the sixteen companies operated by the United Light & Railways Company. During the period between April 1 and Aug. 31 the employees were not urged to sell the stock, but approximately $200,000 was sold during that period.

With the opening of fall, however, the effort was intensified, and during

MAIN MACHINE SHOP, SHOWING CONDUIT WIRING, INDIVIDUAL DRIVE AND PUSH-BUTTON CONTROL


MODERN SWITCHBOARD INSTALLATION CONTROLLING POWER SUPPLY FOR THE BUILDING

The illumination is carefully planned and installed to meet the specific needs of the work.

## Purchasing and Employment Value of a Water-Power Development


WHAT hydro-electric construction work means to a city in the employment it gives to labor and the money spent with merchants for various supplies was graphically depicted in a joint exhibit by the Manitoba Power Company and the Winnipeg Electric Railway Company at a recent industrial show in Winnipeg. As will be seen from the accompanying view of the exhibit, the 170,000-hp. water-power project under construction at Great Falls was the feature of the display. How much this will mean in added business for merchants of the city is emphasized by statements of the amount of money and labor necessary to build the plant. For instance, it will require the employment for nearly two years of 1,500 men, who are paid an aggregate of $7,500 in wages, daily. Furthermore, 200,000 lb. of foodstuffs to feed these men is purchased monthly in Winnipeg.

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the month of September approximately $125,000 of stock was sold, while during October $250,000 in stock was disposed of. The results during the first few days of November were especially gratifying. Announcement had been made about Oct. 15 that the price of the stock would be advanced on Nov. 15 from par to $102 a share. This served as a stimulant to sales and there was sold in the first two weeks of November $625,000 of stock, or at the rate of $16,000,000 a year. The sales for the last six weeks of the campaign totaled $875,000.

The United Light & Railways Company serves 600,000 people, but all of the territory embraced was not opened for sales during the entire period of the campaign. In Chattanooga the sale of stock did not begin until about two weeks before the closing of the campaign. This city was the only one which did not sell its quota. Although the Grand Rapids territory was opened about a month before the close of the campaign the quota was oversold by 140 per cent.

Cadillac, Mich., was also very late in getting started on its sale and had less than a month to sell its quota. Despite this, however, the allotment there was oversold. More than half of the stock was sold in territory known as Tri-City territory, which embraces the cities of Davenport, Rock Island and Moline. It is very significant that the territory where industrial conditions were probably most depressed the greatest sales were made. The Peoples Power Company, which operates in Rock Island and Moline, where the great agricultural implement factories are located, sold approximately $300,000 of stock, although the implement factories are practically closed down. The quota assigned there was exceeded by about 80 per cent.

The splendid work done by the trainmen and other employees of the railway companies owned by the United Light & Railways Company was especially gratifying. During the campaign the percentage of ownership of stock by one railway company's trainmen was increased from 36 to 70. Nearly all of the employees assisted in the sale of the stock. Another of the railway companies included in the system of the United Light & Railways Company had almost 100 per cent of stock ownership.

During the year the company sold stock to 2,100 people, and it has on its books today more than 4,600 stockholders in this issue in the communities in which it operates. These stockholders have all been acquired during the last two years. The figures of the company show an average holding of four and six-tenths shares per stockholder.

The "United Go-Getters' Club," which was organized in the fall of 1921 and was described in the ELECTRICAL WORLD article already referred to as having put on a successful sale of $500,000 of stock, did splendid work in "putting over" this sale. Although the later sale was not handled entirely by the "Go-Getters' Club" on all of the properties, as part of the properties have no organized club, the work of the individual "Go-Getters" was largely responsible for the splendid results which were obtained.

## What Other Companies Are Doing

**Chicago, Ill.**—For the week ended Dec. 23, 1922, the electrical energy output of the Standard Gas & Electric Company increased 12.82 per cent over the corresponding week in 1921. Applications for new electric services totaled 1,623, covering 788 kw. of lighting and 1,125 hp. in motors. New customers' connected load shows a net gain of 579.

**Indianapolis, Ind.**—As Christmas presents to more than nine hundred of his employees, Harry Reid, president of the Interstate Public Service Company, operating interurban and power and light utilities in Indiana, sent life insurance policies ranging in value from $600 to $1,000. A letter of appreciation for services rendered accompanied each policy. The policies are based on the duration of the service of the employees. Those who have been with the company one year and less than two received a policy for $600; two and less than three, $700; three and less than four, $800; four and less than five, $900, and more than five years, $1,000.

**Denver, Col.**—Frank J. McEniry, general field representative of the Electrical Co-operative League of Denver, in going after additional business has chosen for his attack the poor lighting of homes, and particularly the dining table. In Denver, as in every city, there are many houses which have been wired for a number of years, and it is felt that these customers are not aware of the improvement in home illumination which they can have for a very little additional expense.

# Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Surface Condenser.*—C. L. Hubbard.—The choice of a condenser should be based upon a study of individual plant conditions and is governed to a large extent by the degree of vacuum required and the quality and available quantity of cooling water. The author discusses the advantages and types of condensers and the computation of tube and cooling surfaces.—*Southern Engineer*, December, 1922.

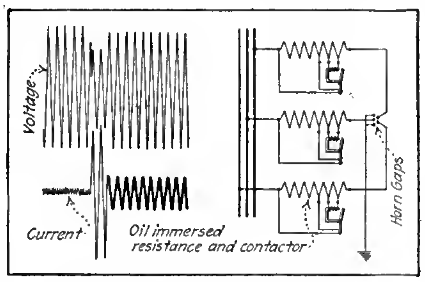
*Aspects of Study and Selection of Water-Power Sites.*—W. T. Taylor.—The author discusses the considerations involved in the selection of power site, stream flow, economical developments, relationship between rainfall and run-off and a survey of natural lakes.—*Canadian Engineer*, Dec. 12, 1922.

*Hydro-Electric Generating Sets for Small Output.*—C. Reindl.—The author has developed a water-turbine-driven generator set which operates at variable speed but maintains constant voltage without a regulator or any manual attention. This has been reached by the use of a specially wound direct-current dynamo the voltage of which will stay constant within a very wide speed range. High-speed water turbines of the Francis, Pelton, Banki or Kaplan type permit direct coupling with the generator. The absence of a turbine regulator, storage battery or electric regulator makes these sets extremely simple and inexpensive, saving as much as 50 per cent on the investment cost as against a non-automatic set. From a few hundred watts up to 25-kw. output these hydraulic generating sets are standardized.—*Elektrotechnische Zeitschrift*, Dec. 7, 1922.

## Generation, Control and Switching

*Neon Glow-Discharge Lamps on Direct-Current Circuits.*—J. T. MacGregor-Morris, M. J. Dowty and B. J. Privett.—The investigation dealt with in this article was carried out to study the behavior and to determine the statical characteristics of two types of neon lamps with a view to further possible applications. The article is illustrated with photographs of the spectra of the two lamps and concludes with a number of suggestions for possible application.—*Electrician*, Dec. 1, 1922.

*Overvoltage Problems.*—F. Schrottke.—The author gives an interesting account of the development of overvoltage protective apparatus. Much thought and energy have been spent on protective apparatus for electric machines, but the author claims that not all of the investigators were qualified for the task and that as a result much so-called protective apparatus was brought on the market which was either of no value or did actual harm. Shortly after the first 100,000-volt lines were put in operation it was realized that an excellent protection against overvoltages could be obtained from a strong internal insulation of generators and transformers. Such reliable results have been obtained in plants with machines of high winding insulation that practically no external protective apparatus is required. Another series of devices has been developed to guard against the dangers of a ground. Specifically, the Petersen and Bauch quenching transformers have proved useful in many cases. For energies of more than 2,000 kva. these coils, however, are far from fully satisfying. The




Ohmic Resistance in Series with Horn Gaps Has Proved Satisfactory for Suppressing Grounds

author mentions, for example, that in the large German Golpa power house the Petersen coils were disconnected from the buses after some major troubles and that the station has been operating satisfactorily for more than a year without these coils. He recommends the more extensive use of ohmic resistance in series with horn gaps, for which arrangement broad protective claims are made, substantiated by several years of good experience. An apparatus of this class is described, comprising an oil-immersed resistance and a contactor, with a horn gap on the cover of the oil tank. The contactor short-circuits the greater part of the resistance during normal operation, but opens this short-circuit and thereby inserts the full resistance in case of overvoltage within two cycles. An oscillographic record showing the operation of this apparatus is reproduced here. A further innovation is a spiral-wound choke coil made of a ribbon of copper and a ribbon of nichrome in parallel. Such a coil, the author claims, will not only reduce the voltage of an incoming traveling wave but will also smooth out its steep wave front. The use of condensers as overvoltage protectors is not recommended. The protective value of a grounded steel cable above a transmission line is still being discussed, but the majority of investigators and plant managers seem to disapprove of its extensive use.—*Elektrotechnische Zeitschrift*, Nov. 30, 1922.

## Transmission, Substations and Distribution

*Possibilities of Transmission by Underground Cables at 100,000 Volts to 150,000 Volts.*—A. M. Taylor.—Until recent years the methods of trial and error figured largely in the evolution of the transmission of power by underground cables and were successful because of the margin of safety which existed. Today the limits are much closer and a failure is a much more serious contingency, making it necessary that for any further step extensive study of the problems involved, both scientific and commercial, shall be made. Apart from a few pages in which certain fundamental principles are dealt with, this paper, presented before the Institution of (British) Electrical Engineers, consists almost entirely of a description of a special scheme developed for transmitting power over single-core cables provided with concentric potential grading sheaths. Six of the triple concentric cables are employed for a three-phase system and each pair has its six conductors connected to a six-phase supply system, which by being grounded on one side instead of in the center, as is usual, permits of the main conductors of the two cables being worked at a high voltage above earth. A comparison is included of the cost of transmitting 50,000 kw. a distance of 30 miles by this six-phase / three-phase system transmitting at 100,000 volts and the same performance by three-core cables working at 30,000 volts. The saving by the first system is, according to the author, quite pronounced.—*Electrician*, Dec. 15, 1922; *Electrical Review*, Dec. 15, 1922, and *Electrical Times*, Dec. 14, 1922.

## Units, Measurements and Instruments

*Electrical Timing Device for Short Intervals.*—D. Robertson and N. F. Frome.—A short description is given of a timing device for the above purpose, consisting of an inductive resistance in a Wheatstone bridge. The theory of the device is given, as well as an example of its application.—*Journal of the Institution of (British) Electrical Engineers*, December, 1922.

*Electric Telemeter.*—During the past two years the Bureau of Standards has been engaged in developing electric telemetric devices based upon the fact that carbon-contact resistances vary with pressures or displacements applied to their terminals. Difficulties in using carbon-contact resistances are that the contact resistances in the past have been erratic, that such apparatus has shown large hysteresis effects and that these devices are inherently non-linear in their characteristics. The bureau

has investigated these troubles and has found means of eliminating all of them to a degree which makes the apparatus well adapted to a great variety of engineering measurements. These include measurements of strains in bridge members and other engineering structures, measurements of accelerations, vibrations and pressures of practically every description. The apparatus can be made either indicating or recording as desired.—*Technical News Bulletin No.* 68 *of the Bureau of Standards.*

### Illumination

*Theory, Construction and Use of the Photometric Integrating Sphere.*—E. B. ROSA and A. H. TAYLOR.—The first part of this paper deals with the materials and construction of various spheres and describes in detail the construction of a reinforced-concrete sphere used at the Bureau of Standards. It gives tests of the accuracy of integration by this sphere, the absorption of light by the sphere coating and by objects in the sphere and effect of the position of the lamps. Proper methods of operation are also outlined. A fairly complete résumé of the general theory of the sphere is given in the second part, with the addition of a considerable amount of new material, showing how to test the accuracy of the sphere and how to improve the accuracy of integration. A complete bibliography of the subject is also given.—*Scientific Paper No.* 447 *of the Bureau of Standards.*

### Motors and Control

*Methods for Correcting Power Factor.*—E. H. HUBERT.—A practical analysis of how the benefits obtained by correcting power factor can be balanced against the cost in any industrial establishment. Where a large number of motors are used and the loads on them may vary from time to time a careful analysis of operating conditions and power requirements and a wise expenditure of money on corrective measures will show increased profits. The fundamentals to consider in such an analysis are dealt with. The article compares the results with the expenditures in practical examples that can be applied to conditions found in almost every plant. The subject is considered from the viewpoint of the industrial-plant operator, demonstrating to him the advantages to be gained by correcting power factor, among which are better voltage regulations, better rates, in some cases less equipment, reduction of power losses, etc.—*Industrial Engineer,* December, 1922.

*Alternating Current and Iron and Steel Works Practice.*—J. P. HODGES.—The author strongly advocates the use of alternating current in the steel industry. He points out how conditions in power production have changed since 1901 and discusses from the practical point of view the advances that have been made in and the precautions that must be taken with modern electrical equipment. He deals especially with distribution, motors and control gear. The two essentials are continuity of service and output.—*Electrician,* Nov. 24, 1922.

### Heat Applications and Material Handling

*Tipping and Guiding of Vertical Skips.*—G. W. SHARP.—The wear and tear and general condition of rope, guides, shaft timbering, winding engine and all that is accessory to the working of the skip, as well as the skip itself, depend so much upon the manner in which it is guided and tipped that practical improvement in this connection must be reflected in no small reduction of working costs. The author indicates the cause of excessive wear and tear and shows by what means improvement can be effected. Two subjects which are closely related—namely, the designing of tipping gear in such a way as to eliminate as far as possible shocks and excess strains and a description of an improved form of guiding slipper on skips—are the main points brought out by the author. He carefully worked out, illustrating his study with numerous diagrams, the static forces existing in the operation of tipping the skips, and, having made certain assumptions, has added to his calculations and drawings the effects of dynamic forces. This is a very comprehensive article, being about twenty-four pages long.—*Journal of the South African Institution of Engineers,* November, 1922.

*Resistance Welding Transformers.*—J. B. BORGADT.—The author discusses how modern designs of welding transformers tend to eliminate breakdowns, low efficiency and retarded production. The requirement of a good efficient welding transformer can be summed up as follows: Strong electrical and mechanical construction, good regulation, high efficiency, good cooling characteristics and low price.—*Welding Engineer,* December, 1922.

### Electrophysics, Electrochemistry and Batteries

*Small Oil-Engine Battery-Charging Sets.*—The second of a series of three articles on this subject that commenced with the November issue. In the first article the author discussed standard non-automatic house-lighting equipment, defects of the old type of plant and improvements in more recent plants, describing the specific functions of the components of lighting sets. The second installment considers the regulation of current during charge, automatic control, the supply of constant voltage, semi-automatic and automatic sets, type of engines manufactured for this purpose and running cost. In the concluding installment examples of the complete apparatus will be described and illustrated in detail.—*Beama,* December, 1922.

*Standard Cells of Concentric Form.*—YUICHI ISHIBASHI.—A concentric standard cell is designed which is convenient for the insertion of materials and also for washing and drying the glass vessel. As for the voltage constancy, temperature coefficient and internal resistance of this form, there is no difference as compared with the H-form standard cell. The characteristics of recovering to the steady state in both forms of cells for the abrupt change of temperature were studied. Less diffusion lag and more rapid attainment to the apparent constant electromotive force were observed in the H-form cells, but the recovery of the initial electromotive force is more rapid in the case of the concentric cell.—*Bulletin* 113 *of Electrotechnical Laboratories,* Tokyo, Japan.

### Telegraphy, Telephony, Radio and Signals

*Radio Vacuum Tube.*—H. M. FREEMAN and A. K. PHILLIPPI.—It is impossible to compare directly crystal and tube detectors because of their widely different characteristics and method of operation. Although they are apparently more complicated, the theory of operation of tubes is susceptible of more complete analysis than is that of crystal rectifiers. Such an analysis is simply and adequately given in an article by Mr. Freeman, while a study of crystal rectifiers is taken up by Mr. Phillippi in another article.—*Electric Journal,* November, 1922.

*Effect of Local Conditions on Radio Direction-Finding Installations.*—R. L. SMITH-ROSE and R. H. BARFIELD.—An account is given of the experiments carried out during the past year by a sub-committee of the Radio Research Board (England) on wireless direction finding. Experiments are described which provide quantitative data as regards the effects of metal work, coils, aërials, overhead wires and trees on a direction-finding set in their vicinity, and definite figures are given which show the extent in certain cases of errors produced by mountains and buildings.—*Electrician,* Dec. 8, 1922.

### Miscellaneous

*Influence of Temperature on Insulating Materials Used in Electrical Machinery.* — ERNESTO VANNOTTI. — Laboratory tests, as well as the condition of machines which have been running a number of years, show that the temperatures that can be withstood without damage to the insulating materials are considerably higher than those prescribed by the international rules. The present values have probably been chosen so as to guard against too high temperatures caused by defective construction of certain parts of the machines. If exploring coils are placed suitably and with care at the points where overheating is most likely to occur, the value of the permissible temperature should be 10 per cent to 20 per cent higher than the rules permit, the author claims, in order to utilize fully the materials of construction used in the machinery.—*Journal of the A. I. E. E.,* December, 1922.

# Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

*Conducted by* PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

## Research Completed

### Batteries, Lead, Rate of Sulphation of.

A new method has been devised, based upon successive weighings of the positive or negative plates while immersed in the solutions to be tested, which are maintained at a constant temperature. The battery plates were immersed in the various electrolytes and any plate could be brought in the arm of a sensitive balance for weighing. The results showed considerable differences in the rates of sulphation (a) of plates made by various manufacturers, (b) produced by different concentrations of the acid solution, and (c) at different temperatures.—*G. W. Vinal, Bureau of Standards, Washington, D. C.*

### Carborundum as Electrical Resistor Material.

Carborundum might be a good resistance material for high-temperature work since its decomposition temperature is around 4,000 deg. F. However, when it carries electric current hot spots of decomposition temperature seem to develop, although the temperature of the furnace itself may be only 2,500 deg. F. The life of such resistors has been found to be very short.—*J. L. McK. Yardley, Pittsburgh, Pa.*

### Controller of Temperature or Pressure, with Pneumatic Switch.

A controller-recorder has been developed to operate a pneumatic switch, which in turn opens or closes an electric circuit. This arrangement may be used to start and to stop a motor-driven fan or blower, to operate the heating circuit in an enameling oven, etc. A time cam may be added to make the controller follow a desired program of temperature or pressure changes. —*Foxboro Company, Foxboro, Mass.*

### Elevators, Multi-Voltage Control of.

Energy of several voltages is supplied to the elevator motors, usually through the medium of a double-armature balancer generator which floats on the line. Where 240-volt service is available, steps of 60, 120, 180 and 240 volts are obtained from the balancer. Power is delivered to the individual motors by five supply lines—the two outside ones from the source of supply and the three intermediate ones from the balancer. The advantages are economy of energy consumption, due to the practical elimination of resistances; smoothness and rapidity of acceleration and retardation; lower power demands, starting inrushes being greatly reduced, and simplified control equipment.—*W. H. Whitton, New York Edison Company.*

### Fuel Metering, Electric, for Engine Tests

An automatic metering device for liquid fuels has been developed for use with the Sprague electric dynamometer. A fuel tank is placed on a platform scale with an electric contact on the beam. When the fuel reaches the value for which the poise is set the beam falls and closes an electric contact. This causes a bell to ring and operates a relay which automatically starts a stopwatch and a speed counter. The poise is then reset to a lower value, etc. From the data obtained the output, the speed and the fuel consumption per horsepower-hour can be computed.—*Sprague Electric Works, New York City.*

### Iron, B-H Curve of, on Short Samples.

A short bar is clamped in a yoke which closes the magnetic circuit, and a distributed mmf. is applied in such a manner that it is used up bit by bit where produced, thus eliminating magnetic leakage. In order to know when this condition has been reached a secondary coil with soft-iron ends is so placed as to form a magnetic shunt around the sample. The mmf. is adjusted until a ballistic discharge through the test coil becomes zero. Tests by this method have been shown to agree quite closely with the results obtained on ring samples.—*Arthur Whitmore Smith, University of Michigan, Ann Arbor.*

### Magneto, Cobalt Steel, Revolving Field.

Cobalt steel is four times as efficient for permanent magnets as the best tungsten steel. Therefore it has been possible to build an ignition magneto with a stationary armature. The only rotating elements are the solid steel magnet and the cam, which operates the stationary contact breaker. The weight of the new magneto is only about one-sixth of that of an ordinary magneto. For further details see the (London) *Electrician*, Vol. 89, page 443, Oct. 20, 1922.

### Poles, Preservation of.

By forcing hot paraffin containing copper or arsenic salts into timbers under pressure the wood can be preserved from damage by shipworms and other destructive forms of life. The method of application is the same as that now used in treating timber with creosote.—*Paul Bartsch, Smithsonian Institution, Washington, D. C.*

[This discovery of a way to seal poison in wood promises complete protection against the ravages of termites, teredos, etc., and may become of great value in many branches of engineering where wood is employed.—EDITOR.]

### Transformers, Spark-Over Tests on Coils in.

Tests were made on transformers of 30, 60 and 6,000 kva. rating connected to a high-tension line. Spark-overs between one of the line phases and the ground were produced at different distances from the transformers, and the resulting stresses in the transformer coils were measured. In the small transformers the maximum stress always was at the end coils, showing that a line spark-over produced a steep-front traveling wave. In the large transformer the location of the maximum stress depended essentially upon the distance of the spark-over from the transformer, thus indicating the presence of oscillations.—*Sigurd Rump, Baden, Switzerland.*

[This seems to indicate that in large transformers it is not sufficient to provide extra insulation on end coils only, as is the present practice.—EDITOR.]

## Research in Progress

### Core Losses.

A committee is at work to reduce the calculation of electrical core losses as well as of eddy-current losses in machines and conductors to a more rational and scientifically exact basis. Four phases of the work are now being conducted by four universities—Harvard, Washington (St. Louis), Missouri and Massachusetts Institute of Technology—and the General Electric Company, under the supervision of five members of the committee. A number of manufacturers are furnishing the services of their engineers and the facilities of their laboratories. The work has already resulted in a slight change in design of the standard induction motor which will decrease the core losses from 3 per cent to about 2½ per cent without increase in cost.—*National Research Council Engineering Division, New York City.*

### Insulators, Effect of Vibration Upon.

We have in view some experiments to determine the effect of vibration upon the mechanical and electrical strength of suspension-type insulators. The apparatus for making the test has been designed and built, but the actual work has not yet been started.—*R. J. C. Wood, Southern California Edison Company, Los Angeles, Cal.*

### Magnetic Analysis.

A committee has been organized by the American Society for Testing Materials to study the magnetic properties of bodies, to correlate such magnetic properties with corresponding mechanical properties, and to develop suitable methods of testing for magnetic properties, with respect to commercial applications.

### Surges on Transmission Line.

We are doing some research on the actual magnitude of high-voltage surges occurring in the Big Creek transmission lines, this being determined by the use of a photographic surge recorder which we have developed.—*R. J. C. Wood, Southern California Edison Company, Los Angeles, Cal.*

## Suggestions for Research

### Electromagnetism, Fundamental Relationships in.

An investigator who has to do with theoretical problems involving moving conductors, alternating fluxes, currents induced by rotation and pulsation, mechanical forces in the electromagnetic field, etc., is often handicapped by the lack of fundamental equations containing energy and work done. Usually the problem is reduced to a system of simultaneous equations involving only factors of energy, such as currents, voltages, fluxes, etc. In rational mechanics there are Lagrangian equations, Hamilton's principle, the law of least action, etc., which permit one to derive the entire system of equations of motion by taking partial derivatives of certain characteristic functions of the system. While Maxwell and others have shown a possibility of such a method in electromagnetism, much remains to be done to bring this method within the reach of those working out engineering problems involving electrical machinery and apparatus.

### Flash-Over Voltage, Effect of Dampness and Dust Upon.

At 60 cycles the flash-over voltage is considerably lowered by the presence of water, dust, etc., on the surface. At very high frequencies the effect of these factors is very small, indicating a different nature of the phenomenon. This difference is of importance in view of the fact that insulators are often tested by high-frequency oscillating voltages. It would be of interest to establish a theory which would explain the difference in the behavior at different frequencies and give a relationship between the flash-over voltage and the frequency.

### Generating Stations.

Research is urged in the following directions: Turbo-driven generators, (a) temperature limitations, (b) temperature detectors, (c) fire-fighting equipment, (d) closed-circuit ventilation; automatic water-power stations, excitation, auxiliaries, grounding of neutrals, maintenance.—*Electrical Apparatus Committee of the N. E. L. A.*

### Illumination by Wires Exploded b Electrical Discharges.

In order to obtain high-temperature spectra, fine wires were instantly melted by electrical discharges. A large condenser, charged at 26 kv., was used, and some 30 gram-calories of energy were dissipated in one-hundred-thousandth of a second. Without losses the temperature of the wire vapor would have been about 300,000 deg. C. Actually the flash had an intrinsic intensity of light corresponding to a temperature of about 20,000 deg. C., or approximately one hundred times the intrinsic brilliancy of the sun. Many new and interesting phenomena were observed. For details see the *Astrophysical Journal*, January, 1920.—*J. A. Anderson, Mount Wilson Observatory, Pasadena, Cal*

[This method may prove to be useful for intermittent lights for lighthouses, for guiding airplanes at night and for long-distance optical signaling in general—EDITOR.]

# News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

## Six Months' N.E.L.A. Work

**President Smith Reviews His First Half Year of Office—Division and Committee Achievements**

ON the first of January the present administration of the National Electric Light Association entered upon the second half of its term of office, and President Frank W. Smith has taken advantage of this fact to pass the first six months of the association year in brief review. In the January *Bulletin* of the organization he refers to the ever-increasing scope of the work and the consequent growth of executive responsibility, summarizing a few of the activities and accomplishments that marked the latter part of 1922.

The public policy committee, under the chairmanship of Martin J. Insull, met twice in New York, on Sept. 21 and Dec. 5. Many of its members, including the chairman, are devoting much time and effort to constructive work besides delivering speeches and visiting conventions in all parts of the country.

The executive committee met in New York on Sept. 20 and Dec. 6, all the geographic divisions of the association being well represented, those attending including all four vice-presidents. At the last meeting thirty-eight men remained in continuous session for six hours.

Five geographic divisions held conventions, as did seven state associations, and in addition there were many group meetings. All the fourteen geographic divisions are either in the full swing of activity or have organization perfected and are getting under way.

The four national sections—Accounting, Commercial, Technical and Public Relations—held conferences in the latter part of June or the first part of July, and their committees have since assembled in different parts of the country. Interest and attendance have been unusually high.

Officers of the association or representatives from headquarters have attended every important meeting, whereever held.

Radio and Fuel

Radio sub-committees of both the public policy and the electrical apparatus committees are making progress in the handling of this important subject from different points of approach.

On inductive co-ordination, water-power development, customer ownership, relations with banks, merchandising policy, good-will advertising, membership and many other matters of primary importance the appropriate committees have all worked hard and their efforts are bearing fruit.

The financial affairs of the association are reported in very satisfactory condition.

With Nicholas F. Brady, president of the New York Edison Company, as chairman of the general convention committee, John W. Lieb as vice-chairman and Arthur Williams as chairman of the entertainment committee, President Smith foresees an excellent working out of details for the forty-sixth annual convention of the association, to be held in New York City next June.

## Representative Bacharach Pushes His Bill

Representative Isaac Bacharach, whose determination to push his bill to limit the jurisdiction of the federal courts over public utility rate cases was referred to in last week's Electrical World, is circulating an appeal to his colleagues in the House to support this measure. In his letter to them he says:

"This bill has been favorably indorsed by the Governors of the following states: Arkansas, Georgia, Illinois, Indiana, Louisiana, Mississippi, Missouri, Nebraska, Rhode Island, South Carolina, Wyoming, Delaware, Maine, Maryland, Vermont and Wisconsin. It has been also indorsed by the state regulatory commissions of the following states: Arizona, Colorado, Florida, Idaho, Kansas, Michigan, Montana, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, South Dakota, Tennessee, Utah, Virginia, West Virginia and Oklahoma.

"You no doubt have heard directly from either your Governor or your regulatory commission asking you to support this bill. Hearings on the bill were completed on June 8, and since that time nothing has been done in the matter.

"I am very anxious to have the bill reported to the House at this session of Congress if possible, and I am therefore writing to ask if you will not communicate with the chairman and members of the sub-committee having the bill in charge, expressing your favorable interest in it and asking them to report it to the full committee at the earliest possible date.

"Anything that you may do to aid in getting the bill reported out of committee so that it may be considered by the House at an early date will be very much appreciated."

## Great Plant for Boulder

**Doherty Interests Plan Huge Development on Artificial Lake in Colorado Mountains**

WHAT is designed to be the largest steam plant for the generation of electricity ever built on an artificial body of water in the United States will, if plans just made public are carried through, be constructed four miles south of Boulder on the Denver-Boulder highway by the Denver Gas & Electric Light Company and the Western Light & Power Company, members of the Cities Service group of companies controlled by Henry L. Doherty & Company.

The project includes the purchase of the Boulder Lake, an artificial reservoir high in the mountains, which covers 128 acres, impounding approximately 78,000,000 cu. ft. of water. This lake will be enlarged to cover 380 acres and impound 280,000,000 cu. ft. of water.

An immediate expenditure of $4,000,000 for plant and equipment is purposed, and when the plant and transmission system are completed it is said that the cost will have reached $12,000,000. Present plans are for a generating capacity of 120,000 hp., the possible ultimate rating being put at 250,000 hp.

When the new plant is completed it will serve the cities of Denver, Boulder, Lafayette, Fort Collins, Greeley and all intermediate cities and surrounding towns, going as far north as Cheyenne, Wyo. The old plant at Lafayette will then be abandoned. Pulverized coal from the mines of the vicinity is to be used. Transmission will be at 100,000 volts. It is said that the plant will be ready to supply the larger cities in its territory early in 1924.

## Commonwealth Edison Buys Parsons Turbine

The purchase of a 40,000-kw. Parsons turbo-generator by the Commonwealth Edison Company for use in the new Crawford Avenue station in Chicago was announced in that city this week. The set, purchased from C. A. Parsons & Company, Newcastle-on-Tyne, England, will operate at a throttle pressure of 550 lb., with a total steam temperature of 725 deg. F., and after passing through the high-pressure end of the turbine the steam will be reheated to the initial temperature. The turbine will be used in the new plant along with others mainly of American manufacture. The station is designed to have an ultimate capacity of 500,000 kw.

This is the second turbo-generator of Parsons manufacture that the Common-

wealth Edison Company has purchased, the first being a 25,000-kw. set bought in 1912 and installed in the Fisk Street station, which has operated satisfactorily. Sargent & Lundy of Chicago are engineers in charge of design, with Merz & McLellan of London acting as advisory engineers.

## Idaho Companies Must Pay Irrigation Rebates

Complying with a special act of the last Legislature, the Idaho Public Utilities Commission has issued an order granting a rebate to all irrigation farmers in the state using electricity for pumping. The law exempts power companies furnishing power for irrigation from the payment of certain taxes, but requires them to rebate the entire amount of this exemption to the individual farmer users. The total rebate ordered by the commission amounts to $47,232.87, divided among four power companies.

## Aftermath of "Loop" Decision in Wisconsin

A temporary injunction has been issued by the United States court in the western district of Wisconsin restraining the State Railroad Commission from changing a set of "emergency" rates put into effect by the Wisconsin-Minnesota Light & Power Company in Eau Claire, Menomonie and Chippewa Falls because of the now famous decision of the Wisconsin Supreme Court last June declaring the municipality the legal unit in fixing rates and forbidding the enforcement of uniform charges for all places on the company's "loop" system regardless of the distance from the source of supply. The commission is directed to show reason on Jan. 20 why the injunction should not be made permanent. The company in adopting these emergency rates contended that the old rates which the commission had ordered restored pending a complete revision are confiscatory.

Meanwhile about forty smaller cities which receive their power from the same source, but which are not involved in the case which went to the Supreme Court, are still paying for electricity at the price ordered by the Railroad Commission by the uniform rate method declared illegal.

Basing its action on the Supreme Court decision in the "loop" case, the city of La Crosse applied last week for an injunction forbidding the Wisconsin-Minnesota Light & Power Company from continuing to charge in that city the rates imposed previous to the decision cited. This plea has been denied in the local court, which holds that under the Supreme Court decision relief is to be extended only to municipalities which have duly taken exception to the commission order setting up the "loop" and have duly appealed for relief. The city of La Crosse was not a party to the original action and therefore, the court holds, is neither bound nor benefited by the vacation of the order.

## Getting Artistic Lighting in Theaters

The methods of attaining artistic color lighting in motion-picture theatres and the production of realistic lighting effects on the legitimate stage were the topics discussed at a well-attended Illuminating Engineering Society meeting in New York on Jan. 11. The meeting was conducted by A. L. Powell of the Edison Lamp Works, and the main speakers were Sam Rothafel, managing director of the Capitol Theater, and Louis Hartman, lighting engineer for the David Belasco productions.

Methods for producing artistic color lighting with little scenery were described by Mr. Rothafel, who explained in detail how the lighting effects at the Capitol Theater are planned and executed. Mr. Hartman discussed the lighting of interior and exterior scenes, stressing the point that very often there is a tendency to use too much light.

## Carolina-Tennessee Charter May Be Repealed

A bill has been introduced in the North Carolina Legislature by Senator Dillard which seeks to repeal the charter of the Carolina-Tennessee Power Company on the ground that the charter provisions are so sweeping that the company would acquire dominion over all the undeveloped water-power interests in North Carolina and other companies be shut out. Simultaneously with this legislative fight, in which politics is said to be involved, the Carolina-Tennessee Power Company has instituted suit against the Hiawassee Power Company over the ownership of 500 acres of land in Cherokee County, N. C., upon the possession of which, according to W. V. N. Powelson of New York, the president of the Carolina-Tennessee Power Company, depends the execution of that company's program of hydro-electric development, said to involve the expenditure of approximately $7,000,000 for dams, power plants and transmission system. The repeal of the company's charter would, of course, automatically end both the litigation and the Carolina-Tennessee Power Company's project; but if that company wins its suit and retains its charter, work, according to Mr. Powelson, will begin in sixty days after the verdict. In this case, however, the Hiawassee Power Company is considered certain to appeal to the Supreme Court of the state.

Both Mr. Powelson and H. F. Vanderventer of Knoxville, Tenn., president of the Hiawassee Power Company, are in Murphy, N. C., where the suit is to be heard. The charter of the Carolina-Tennessee Power Company was granted by the North Carolina Legislature in 1909, and its headquarters were to be in Cherokee County.

## Investment Bankers Oppose Governor Smith

Disapproval of the legislative program recommended by Governor Smith of New York in his message to the Legislature, so far as this program relates to the abolition of the existing public service commission and the institution of municipal "home rule," has just been voiced in a report by the committee on public service securities adopted by the board of governors of the Investment Bankers' Association of America. This report says in part:

"The legislation recommended by Governor Smith will create a lack of confidence on the part of the large and small investor within and without the state, thereby seriously impairing the credit of utility companies, and accordingly, until such time as the policy of state-wide regulation is reaffirmed definitely, the expansion of utility service will be greatly retarded.

"For a great many years the policy of state-wide regulation of public utilities has been the established policy of the State of New York. In fact, New York was one of the first states to recognize this principle. It has been followed, as we know, very generally by other states throughout the country, advantageously in the public interest. Furthermore, recognizing the great advantages of judicial regulation, protection of the public interest and freedom from political influences, especially up-state, investors have freely placed funds in these utilities with all the risks attendant to these investments. When viewed in this light, the good faith and moral credit of the state is involved. Investors would not have continued so freely to support the much-needed expansion of utility services by investment in their securities had they expected these industries to be again subjected to the danger of political control and local regulation."

## Cleveland's Fixture Market Shows Trend of Design

Displays of lighting fixtures and parts by about seventy manufacturers marked the fourth annual lighting equipment market held at the Hotel Winton in Cleveland this week, coincidentally with the annual convention of the Lighting Fixture Dealers' Society of America. Although there was only a small attendance of dealers from outside of the Cleveland territory, the exhibits of the manufacturers showed strikingly this year's tendencies in fixture design.

The "high spots" of the meetings of dealers held at the Hollenden Hotel proved to be the "demonstrations," or playlets, illustrating right and wrong ways to sell fixtures and the summary handling of piracy of designs. The strong economic position of the fixture dealer, the standardization of fixture-outlet boxes, the greater use of glassware in the new designs and carton packing were among the topics.

# Transatlantic Conversation Nearly Here

### Speeches Transmitted by Wireless Telephony from New York to England Are Plainly Heard There—Reciprocal Communication Planned in Near Future

A GREAT stride in intercontinental telephony was made last Sunday evening when officials of the American Telephone & Telegraph Company sent messages and made speeches which, by means of wireless equipment, were plainly heard by Guglielmo Marconi and British engineers at New Southgate, a London suburb. Scattered words and phrases have been heard across the ocean before, but this week hundreds of consecutive syllables were, according to cabled comments, heard with distinctness and little was lost.

The first message, containing about 240 words, was spoken by President H. B. Thayer of the American Telephone & Telegraph Company, at exactly 9 o'clock. Eleven minutes later a cable message was received saying that Mr. Thayer's message had been heard and understood. Vice-president John J. Carty then sent a wireless-telephone message, and at 10:10 o'clock this cablegram from Mr. Marconi arrived:

"I have just listened to your radiotelephonic messages, which I have heard distinctly, and congratulate you and all those connected with the research which has led to this achievement."

#### ROUTE OF THE MESSAGES

Mr. Thayer and Mr. Carty spoke from the offices of their company at 195 Broadway and used a telephone connected to the radio equipment at Rocky Point, Long Island, by a telephone circuit about 70 miles long, half of it being underground cable and half open wire, and containing telephone repeaters and equalizers of a type similar to those used on long-distance telephone lines.

The distance from Rocky Point to New Southgate is about 3,400 miles. Prior to the tests of Sunday evening other tests were made to measure the transparency of the atmosphere to radio messages over such great distances. Measurements were also made on the strength which the signals received in New Southgate must have in order to be clearly heard above the noise of static and interference from other radio stations.

Sending apparatus may be set up in England in the near future to make possible conversations by transoceanic radiophone, but months of research and development must elapse before the method can be brought into commercial use. The demonstration was only incidental to a prolonged series of tests undertaken for the purpose of obtaining the accurate information upon which practicable transoceanic telephony can eventually be founded.

#### TECHNICAL FEATURES

The technical features of the communication involved a departure from previous practice in two respects—the use of 10-kw. power tubes and the elimination of carrier currents in transmission.

In the ordinary transmission the voice current, so to speak, is carried along by a carrier current, which usually contains about two-thirds the energy. The carrier current is used to polarize the receiver devices. If the carrier current is, say, 50,000 cycles, the voice current will fluctuate perhaps between 47,000 and 52,000, which necessitates the use of quite a wide ether transmission band.

In the new method twenty 10-kw. tubes are arranged with modulators and filters to radiate into the the ether about 100 kw., composed entirely of voice current. The modulating system is similar in principle to that used in wire telephony and consists of balancing tubes against each other in such a way as to balance out the carrier frequency and radiate the voice current.

Suppression of the carrier and one side band occurs directly after the speech currents come from the telephone line which brings them to the radio equipment. The line current modulates the output of a high-frequency oscillator by the balanced modulating equipment, which eliminates the carrier frequency. A filter is then used to suppress one side band, the other side band being applied to a multistage amplifier, the output of whose last stage is the 100-kw. power applied to the antenna. Thus the new method is improved so that a very narrow band in the ether is occupied in transmitting speech.

By the suppression of one of the two side bands it also becomes possible to transmit twice as many messages simultaneously as is now effected, a feature which will become increasingly important as the use of radio grows and especially at the longer wave lengths.

At the receiving end a local oscillator is used to replace the carrier current in rendering audible the received signals. The vacuum tubes used in the present test, while not the largest which have successfully withstood laboratory trial, are the largest that have thus far been applied to radio telephony, and are characterized by means for sealing large copper thimbles to glass in such manner as to hold the best obtainable vacuum.

The radio apparatus and system used in the test are the result of research and experimental work in the laboratories of the American Telephone & Telegraph Company and in the laboratories of the Radio Corporation of America and its associated companies.

JOHN J. CARTY
Vice-President American Telephone & Telegraph Company

THE experiments which we are now making represent some of the advances which have been made in the first half century of the telephone art, which is now drawing to a close. They belong to the golden age of communication, which has achieved the extension of the spoken word throughout both space and time. But this golden age has not yet ended, and when we contemplate the possibilities of the future we discover that it has only just begun. It is to the future that we must now turn our minds and direct our endeavors

—*Statement from Mr. Carty.*

## General Electric's Broadcasting Heard Abroad

Vice-president Coolidge has received a letter from W. T. Meehan of the General Electric Company informing him that his Christmas address, which was broadcasted on Dec. 24, was heard in both Liverpool and London, as well as in every state in the Union.

## Valuation of Alabama Power Company

President Thomas W. Martin of the Alabama Power Company has given out a statement at Birmingham saying that his company will welcome further investigation to get at the correct valuation of its property for tax purposes. Because of the public discussion of this matter, Governor Thomas A. Kilby in his message to the Legislature advised that it be gone into thoroughly by that body. The Governor holds to the opinion that the valuation placed upon the property holdings of the company in Alabama is very much under what it should be.

President Martin says: "The truth is the Governor has been imposed upon by men who have a political purpose to serve." He says further that there has been no indication on the part of his company that an application would be made to increase rates, as was asserted by Governor Kilby. On the contrary, the company has made substantial voluntary reductions affecting approximately twenty thousand customers.

## For Radio Standardization

**Forty Societies Unite in Movement—A. I. E. E. and Institute of Radio Engineers to Be Sponsors**

A broad program of radio standardization was agreed upon at a meeting on Jan. 12 of representatives of forty radio trade associations and national engineering and scientific societies. The meeting was held in the Engineering Societies Building, New York City, at the call of the United States Bureau of Standards in co-operation with the American Engineering Standards Committee. Dr. F. C. Brown, acting director of the Bureau of Standards, presided, and about one hundred were present.

After full discussion the conference adopted resolutions providing:

(1) That standards for radio apparatus and service should be formulated.

(2) That a broadly representative national committee on radio standardization should be formed under the leadership of the Institute of Radio Engineers and the American Institute of Electrical Engineers, under the procedure of the American Engineering Standards Committee.

Specifications for quality and performance of receiving apparatus, nomenclature and methods of testing and of rating apparatus are to be included in the program.

Dr. J. H. Dellinger, chief of the Radio Laboratory of the Bureau of Standards, showed how the widespread interest in radio had brought with it an increasing demand for uniformity and dependability in radio service and apparatus. The lack of any such standardization had been brought to the attention of the Bureau of Standards by producer, distributor and consumer. There had not previously been a concerted movement to introduce standardization by joint action of all radio interests.

### Sane Standardization Demanded

Dr. A. N. Goldsmith, secretary of the Institute of Radio Engineers, said:

"As every new field of industry passes out of the childhood stage, the need for standardization becomes evident. The main difficulties which at once arise and which emphasize the necessity for cautious procedure are the dangers of stagnation in an only partly developed art, a possible excessive monotony in the resulting product, and a diversion of the best brains from such a field.

"On the other hand, it is only by a reasonable amount of standardization along wise directions that gross abuses of public confidence can be avoided. As a typical instance, consider the objectionable nature of some of the so-called 'information' appearing on nameplates and in the advertisements of radio apparatus. We have seen 'static eliminators,' 'thousand-mile receivers,' 'twenty-plate condensers' and a score of other vague or misleading designations. The purchaser of radio sets and the dealers who handle them are all entitled to protection against this sort of loose description. Thus we are brought face to face with the necessity for sane standardization."

The following advisory committee was appointed to assist in the organization of the national committee and the necessary technical sub-committees: Major L. B. Bender, Dr. J. H. Dellinger, W. A. Fitzgerald, Dr. A. N. Goldsmith, J. V. L. Hogan, Commander S. C. Cooper, George H. Lewis, Max Lowenthal, Donald McNicol, L. T. Robinson, M. C. Rypinski, E. B. Warner and L. E. Whittemore.

# Engineering Council Hails the Future

**Washington Meeting of Federated Societies' Representatives Sees Great Possibilities Awaiting Technical Men in Public Service—Influence of the Body with Federal Government**

FURTHER crystallization of the belief that engineers can render a real public service and that the Federated American Engineering Societies provides a workable medium through which they may unite in rendering it has resulted from the meeting in Washington on Jan. 11 and 12 of the American Engineering Council. The marked characteristics of this gathering were its desire to further international relationships among engineers, its accentuation of the need for engineering colleges to train their students to assume leadership in public affairs, and its endeavors to promote relief in the Patent Office, adequate personnel for the Federal Power Commission, a more comprehensive policy with respect to topographic maps and a higher salary scale for technical men in the federal service. Strongly worded resolutions on these points were adopted.

GELASIO CAETANI

Co-operation on an important scale is to be undertaken with the Forest Service in the matter of reforestation and with the Department of Commerce in the matter of types of government contracts. It was announced that the societies had all but concluded arrangements to undertake two new surveys which will be entirely comparable with those made on waste in industry and on the twelve-hour shift.

Dean Mortimer E. Cooley was re-elected to the presidency of the federation and J. Parke Channing was re-elected a vice-president. Calvert Townley, Philip N. Moore and Gardner S. Williams were elected as new vice-presidents. Mr. Williams was selected to fill out the unexpired portion of the term of Dean D. S. Kimball. H. E. Howe was re-elected treasurer.

One of the most interesting features of the meeting was the banquet of Jan. 11, which was attended by ninety-one guests. On that occasion the principal address was made by Ambassador Caetani of Italy, who is both a mining and a civil engineer of distinction. Extracts from his speech are printed under a separate heading. At this banquet Calvin W. Rice, secretary of the American Society of Mechanical Engineers, reported on his South American trip and urged an interchange of engineering education between the United States and the countries of South America. Elmer A. Sperry, the inventor of the gyro-compass and ship stabilizers, told of the progress being made by the engineering professions in Japan.

In the course of the business sessions some dissatisfaction was voiced with the conduct of the affairs of the Federated American Engineering Societies. The point was made that member societies had too little voice in what was being done and fear was expressed that an effort might be made to make of the federation a super-society. It was pointed out by President Cooley and by L. W. Wallace, the executive secretary, that every effort had been made to conduct the federation so that it would be a sort of House of Representatives—highly responsible to and in no way dominating constituencies. The difficulties were ironed out, and the general discussion by members of the council indicated a complete sympathy with the broad purposes of the federation, though it also emphasized the need of devising every means possible to acquaint the individual engineer as well as the member societies with the work completed and problems to be undertaken.

President Cooley in his address said:

"I am more than ever convinced, after fifteen months of service in the federation, that the opportunities for the engineering profession to do something remarkable in this world are very great. They are so vast that we cannot comprehend them. We do not think of them, we are so busy in our field, we do not even dream of them, and we do

not dream of what we can do or what the opportunities really are."

### INFLUENCE AT WASHINGTON

In the course of his remarks L. W. Wallace, the executive secretary, said: "The Federated American Engineering Societies has become firmly established in the official mind of Washington as an influential and constructive agency that is working in the interest of the public and without any ulterior motive. I shall name only two facts that support my statement. To date the Federated American Engineering Societies has conducted two major investigations, namely, those on waste in industry and the twelve-hour shift in American industry. The introduction to the former was written by the Secretary of Commerce; the introduction to the latter was drafted by the President of the United States."

Mr. Wallace mentioned many instances of the high esteem in which the federation is held by engineers and citizens both at home and abroad, among them the fact that the government of Czechoslovakia had asked permission to reprint the report on waste in industry. This reprint will be in the German language and will be distributed in Germany and Austria as well as Czechoslovakia.

## Caetani to Engineers

**Italian Ambassador Bears Good Will of His Nation to the Technical Men of America**

A NOTEWORTHY feature of last week's meeting of the American Engineering Council at Washington was the banquet on Thursday evening, at which the new Ambassador from Italy, Gelasio Caetani, was the principal guest. Ambassador Caetani is himself a civil and mining engineer, a graduate of the School of Mines at Columbia University, and spent thirteen years in the practice of his profession in this country. In responding to a toast the Ambassador dwelt on the good relations between Italy and the United States and the way in which in some directions the natural bent of the two countries and the respective characteristics of their peoples could complement each other. He said in part:

"I judge that many of the colleagues present at this banquet have followed in life most disparate occupations which often had little to do with engineering. Such has been my personal experience during the agitated years since the beginning of the war. Well, gentlemen, we can say that in each and every occupation we have felt and thought and acted chiefly as engineers.

"Some have made the remark in criticism that engineers lack political intuition and ability. I would answer that a larger dose of logic and positiveness applied to politics would bring great advantages to public affairs.

Paying a tribute to the qualities of the Italian workman, the Ambassador continued:

"Specialization of Italian labor will bring great advantages to the large engineering, industrial and agricultural enterprises which are still to be achieved in the United States. Much, however, is still to be done in Italy itself; its resources are far from being fully developed, and there are many opportunities for American capital, machinery and technical organization to be usefully applied in Italy.

"The electrical industry in our country has made rapid strides, and as to percentage of utilized water power, Italy ranks, I believe, foremost in the world. Electricity is our 'white coal,' and at the present day its use results in an economy of about two billion lire, otherwise necessarily spent on fuel imports.

### ELECTRICAL DEVELOPMENT IN ITALY

"In 1898 the electrical energy developed in Italy amounted only to 87,000 kw.; it increased to 426,000 kw. in 1908, to 1,240,000 kw. in 1918, and power plants for some other 1,000,000 kw. are planned or under construction. About 800,000 kw. is still to be developed.

"On the Tirso, in Sardegna, a reservoir with 416,000,000 cu.m. of capacity is being constructed. It will be the second largest in the world, ranging immediately after the Assuan Dam, and will develop 50,000,000 kw.-hr. and irrigate 60,000 acres of land.

"The newly redeemed provinces in northern Italy are virgin ground for hydro-electric engineering because Austria, for political reasons, prevented the development of the power plants which could only have an outlet toward Italy.

"In the Trentino a reservoir is to be constructed on the Noce torrent of 180,000,000 cu.m. capacity. The dam, 400 ft. high, will be practically a concrete wedge driven in a mountain gully, measuring less than 60 ft. in width at the base and only 100 ft. wide at 300 ft. above the bottom. In southern Italy the large reservoir in construction on the Sila mountain will develop over 110,000 kw. and irrigate large tracts of fertile land.

"Another interesting plan which is gradually being carried through is to connect the northern power plants, fed by the summer streams of the Alps, with those of central Italy, where water is plentiful in winter and rather poor in summer, by a network of high-tension lines and by standardization of voltage to obtain a better seasonal compensation than could be secured by the use of even very large reservoirs.

"Railroads are to be electrified and telegraphs and telephones are to be reorganized and then gradually handed over to private enterprises. Experience has proved that state administration of industrial concerns ends always in a financial and technical failure.

"There are most remarkable possibilities for increasing the commercial and industrial exchange between Italy and the United States. Each of our countries is especially fit for the production of certain kinds of products. You have the raw materials, you produce wheat cheaper than we can, you have the means and the capacity to build machinery in series. We have arts and products of our own and skilled and intelligent workmen to turn out to better advantage any material in which labor accounts for a large percentage of the cost.

"For each item there exists a difference in cost between Italy and America which, like a difference in hydraulic level, causes merchandise to flow from one country to the other and creates a circulation of products; that is, commercial and economic intercourse. These differences are a vital, indispensable requisite for the prosperity of both countries as they cause motion, and there is no life without motion.

"Intercourse between our young students, who in a few years will be the active men of our countries, will be a powerful factor in reaching the principal and ultimate aim I will have in view in carrying out my duty as Ambassador; that is, to strengthen the bonds of friendship and esteem between Italy and the United States."

## Wider Distribution Planned by Niagara & Lockport

The Niagara, Lockport & Ontario Power Company of Buffalo has purchased the stock of the Bradford (N. Y.) Electric Company, which in turn owns all the outstanding stock of the Olean Electric Light & Power Company, and has started to build a double-circuit 110,000-volt transmission line to Olean for supplying Niagara power in the Olean-Bradford district. By the end of this year the company expects to have 110,000-volt duplicate circuits paralleling its 60,000-volt transmission system, with three transformer stations stepping down the voltage from 110,000 to 60,000. This will permit transmitting the "long-haul" power at the higher tension and distributing it through the existing system—an economical method which leaves the present investment intact and avoids the installation of costly 110,000-volt auxiliary equipment at each point of use.

A new 110,000-volt double-circuit line from Dunkirk to Jamestown is under way to connect with the existing transmission system, and there will be a transformer and frequency-changer station at the boundary between Jamestown and Falconer, with an initial 15,000-kva. transformer capacity and 6,000-kva. frequency-changer capacity, suitable for eventual increase to 30,000 kva. and 16,000 kva., respectively, for the distribution of Niagara power in the Jamestown district. Another new substation will soon be started at Olean with 10,000 kva. frequency-changer capacity and 15,000-kva., 110,000-volt transformer capacity, which can ultimately be raised to 20,000 kva. and 30,000 kva., respectively. This station will distribute Niagara power in Olean-Bradford district at 25 cycles and 60 cycles.

## Next A. I. E. E. Program

**Proceedings at Midwinter Convention Will Be of Varied Nature and Sustained Interest**

FOR the eleventh midwinter convention of the American Institute of Electrical Engineers, to be held in the Engineering Societies Building, New York City, on Feb. 14-17, the meetings and papers committee, in co-operation with the convention committee, has prepared a tentative program including not only a number of papers of special merit but also several instructive and entertaining features.

On Wednesday, the opening day, the morning will be devoted to the registration of members and guests and to meetings of the various A. I. E. E. committees. The first technical session will be held in the afternoon, the program being under the auspices of the transmission and distribution committee. The Wednesday evening session, as already announced in the ELECTRICAL WORLD, will consist of a joint meeting with the Chicago Section by the use of telephone connections and loud speakers. Two papers will be delivered by means of the loud speakers, one being presented at New York and the other at Chicago. Lantern-slide illustrations will be shown at both places and a joint discussion will follow. After the telephone meeting an illustrated lecture will be delivered by William B. Potter, who has recently spent several months investigating the electric railway systems of Europe.

On Thursday the morning session will be devoted to a group of papers on miscellaneous subjects, and in the afternoon a technical session under the auspices of the telephone and telegraph committee will be held. In the evening there will be a smoker under the auspices of the New York Section of the A. I. E. E., at which motion pictures showing a new development in speech transmission will be exhibited.

The session on Friday morning will be under the auspices of the electrophysics committee, and on Friday afternoon the final technical session of the convention will be held under the auspices of the measurements and instruments committee. On Friday evening the annual dinner-dance will be held, and Saturday morning will be devoted to visits of inspection to places of engineering interest in and about New York City.

## Plans for the Pacific Coast Convention of A. I. E. E.

Convention committees have been appointed and plans are well under way for the Pacific Coast convention of the American Institute of Electrical Engineers to be held under the auspices of the San Francisco Section, beginning on Sept. 25. The place of the meeting has been tentatively set as Del Monte, Cal. In the program will be featured the hydro-electric developments of the West and the recent accomplishments in high-voltage transmission, and it will contain papers on other timely subjects designed to stimulate wide interest and attract a large attendance. Professor Harris J. Ryan of Stanford University has been named convention chairman and Robert Sibley vice-chairman.

## Army Bill Carries $7,000,000 More for Muscle Shoals

The War Department appropriation bill just reported out from committee carries an appropriation of $6,998,800 for the Muscle Shoals project. In addition, it gives contract authorization for $10,501,200. These sums are intended to provide for the completion of the dam and the installation of eight power units complete. This authorization makes it possible to let contracts for the lock gates, the gates of the dam and such metal work as requires time to fabricate.

## For 1926 Technical Meet

**International Engineering Congress Planned for Sesqui-Centennial Fair at Philadelphia**

A MOVEMENT to hold a World Congress of Engineers in 1926 at the time of the sesqui-centennial celebration in Philadelphia was initiated by the Engineers' Club of that city in December, 1921, and an invitation at that time was extended to the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society for Testing Materials. Each was requested to appoint two representatives to meet with a committee of the Engineers' Club of Philadelphia to formulate a plan for such a world congress.

Subsequently a board of management was appointed as follows: A. S. C. E., George S. Webster, Richard L. Humphrey; A. I. M. and M. E., J. Vipond Davies, Charles F. Rand; A. S. M. E., James Hartness, D. Robert Yarnall; A. I. E. E., A. E. Kennelly, Charles E. Skinner; Federated American Engineering Societies, J. Parke Channing, L. P. Alford; Engineers' Club of Philadelphia, W. C. L. Eglin, Charles E. Billin. Richard L. Humphrey was made chairman of the committee on plan and scope, of which the other members are Charles F. Rand, James Hartness, A. E. Kennelly, J. Parke Channing and W. C. L. Eglin. This

## Tentative Program of Midwinter Convention, A. I. E. E.

WEDNESDAY, FEB. 14

*Technical Session*, 2.30 *p.m.*—Report of transmission and distribution committee, E. B. Meyer, Public Service Electric Company, Newark, N. J.; "Apparent Dielectric Strength of Cables," R. J. Wiseman, Okonite Company, Passaic, N. J.; "Short-Circuit Currents in Networks," O. R. Schurig, General Electric Company; "Qualitative Analysis of Transmission Lines," H. Goodwin, Jr., Sanderson & Porter, New York; "The Heavisidion," Vladimir Karapetoff, Cornell University; "Cable Testing and Maintenance," H. S. Phelps and E. D. Tanzer, Philadelphia Electric Company.

*New York-Chicago Joint Session*, 8.30 *p.m.*—"Public Address Systems," G. K. Thompson and J. P. Maxfield, American Telephone & Telegraph Company; "Use of Public Address Systems with Telephone Lines," W. H. Martin, American Telephone & Telegraph Company; lecture, "Observations on Electric Railway Practice," William B. Potter, General Electric Company.

THURSDAY, FEB. 15

*Technical Session*, 10.30 *a.m.*—"Automatic Train-Control Problems," E. J. Blake, Gould Coupler Company, Depew, N. Y.; "Application and Economics of Automatic Railway Substations," L. D. Bale, Cleveland Railway Company; "Single-Phase Regeneration for Series Commutator Motors," L. J. Hibbard, Westinghouse Electric & Manufacturing Company; "The Blondelion," Vladimir Karapetoff, Cornell University; "Transients in Electrical Machinery," W. V. Lyon, Massachusetts Institute of Technology; "1922 Developments in Auto-Valve Lightning Arresters," A. L. Atherton, Westinghouse Electric & Manufacturing Company.

*Technical Session*, 2.30 *p.m.* — "Telephone Transmission Over Long Cables," A. B. Clark, American Telephone & Telegraph Company; "Machine Switching," E. B. Craft, Western Electric Company, L. F. Morehouse, American Telephone & Telegraph Company, and H. P. Charlesworth, American Telephone & Telegraph Company; "Wind Shielding Between Conductors," F. J. Howe, Western Union Telegraph Company; "Wave Antennas," Harold H. Beverage, Chester W. Rice and Edward W. Kellogg, General Electric Company; "Theory of Electric Filter Circuits," L. J. Peters, University of Wisconsin; "Diaphragmless Microphone, for Radio Broadcasting," Philips Thomas, Westinghouse Electric & Manufacturing Company.

*Smoker*, 8.30 *p.m.* — Motion pictures showing new method of speech transmission.

FRIDAY, FEB. 16

*Technical Session*, 10.30 *a.m.* — "Dissymmetrical Electrical Networks," A. E. Kennelly, Harvard University; "New Equation for Static Characteristics of Electrical Arcs," W. B. Nottingham, Westfield, N. J.; "Radiation from Transmission Lines," Charles Manneback, Massachusetts Institute of Technology; "Electromagnetic Forces," Carl Hering, Philadelphia; "Physical Interpretation of Complex Angles and Their Functions," A. Boyajian, General Electric Company; "Permeability," T. Spooner, Westinghouse Electric & Manufacturing Company.

*Technical Session*, 2.30 *p.m.*—"Application and Limitation of Thermocouples for Measuring Temperature," I. B. Smith, Leeds & Northrup Company, Philadelphia; "Measurement of Power in Polyphase Circuits," C. Fortescue, Westinghouse Electric & Manufacturing Company; "Kilovolt-Ampere Demand Measurement," H. C. Fryer, Union Gas & Electric Company, Cincinnati; "Expansion of Oscillography by Portable Instrument," J. W. Legg, Westinghouse Electric & Manufacturing Company; "Measurement of Transients," F. Terman, Leland Stanford University; "Balance Methods in Alternating-Current Measurement," P. A. Borden, Hydro-Electric Power Commission, Toronto.

committee prepared for a conference, which was held in New York City on Tuesday of last week.

At this conference twenty-five or thirty leading engineers from the different engineering organizations expressed their ideas on the scope of the congress, the relation of meetings of engineering societies to the sessions of such a congress and cognate topics. It was brought out that the proposed meeting would be another step toward bringing the engineers of the world closer together, taking up the threads of contact broken by the war and fostering a better understanding of the relation of the engineer not only to the technical problems of the world but to the reconstruction of present-day civilization. Emphasis, it was generally agreed, should, in the program prepared, be laid on these broader relations of the engineer to the public rather than on the presentation of a large number of technical papers.

It was asserted by several of the engineers at the conference that an opportunity was afforded to make engineers abroad better acquainted with the actual engineering achievements and accomplishments in this country by a tour of industrial cities. Those contributing especially to the discussion were A. M. Hunt, H. Foster Bain, Henry A. Lardner, Fred Lavis, A. R. Ledoux, John W. Lieb, Elmer A. Sperry, Mortimer E. Cooley, Charles F. Rand, F. M. Feiker, C. O. Mailloux and Clayton H. Sharp.

## Program Adopted by Western Electrical Inspectors

The recodification of the National Electrical Code, the 600-watt rule and the identification of fuses by color will be some of the subjects discussed at the eighteenth annual meeting of the Western Association of Electrical Inspectors, to be held at the Hotel Sherman, Chicago, on Jan. 23, 24 and 25. The tentative program is as follows:

TUESDAY, JAN. 23

*Morning.*—President's address, reports of officers, report of committee on devices and materials (A. R. Small).

*Afternoon.*—Reports of sub-committees on polarization of wires (A. R. Small), identification of fuses by color (C. A. Bates), protection of armored cable through floors (A. R. Small), switchboards (B. H. Glover), 400-600-amp. fuses (A. R. Small), cabinets (A. R. Small), 600-watt sockets (C. A. Bates), isolated lighting plants (A. R. Small) and exposed live parts (Dr. M. G. Lloyd); reports of committees on fixtures, heaters, signs and lamps (J. C. Forsyth), generating stations and substations (K. W. Adkins) and grounding (W. H. Blood, Jr.).

WEDNESDAY, JAN. 24

*Morning.*—Report of committee on industrial applications (G. S. Lawler), reports of sub-committees on protection of motors (G. S. Lawler), equipment in dusty places (F. F. Burroughs), 2,500-volt motors (G. S. Lawler), varnished-cloth insulation for motor leads (R. B. Shepherd) and transformers for electric furnaces (J. C. Forsyth).

*Afternoon.*—Reports of committees on outside wiring, building supply and services (Dr. M. G. Lloyd) and signal systems, wireless and lighting (Thomas H. Day).

THURSDAY, JAN. 25

*Morning.* — Reports of committees on theaters, motion pictures and places of public assembly (Washington Devereaux) and wiring standards (A. P. Denton); report of sub-committee on 660-watt rule (A. P. Denton and A. R. Small).

*Afternoon.*—Reports of sub-committees on lead-covered wires in conduit (A. P. Denton), size and number of wires in conduit (Arthur L. Abbott) and extensions to wiring in fireproof buildings (A. P. Denton); report of committee on recodification of National Electrical Code (Dana Pierce); election of officers.

Friday, Jan. 26, will be devoted to inspection tours, in charge of F. G. Waldenfels.

## F. W. Smith Prize in N.E.L.A. Educational Courses

President Frank W. Smith of the National Electric Light Association has offered an annual prize of $100 in gold, open for competition to Class B, Class E and Class G members of the association who are subscribers to any of its educational courses, who have been in the continuous employ of a company, firm or individual member of the association during their period of study, and who have completed within the specified time and preceding the first day of January of the year in which each national convention is held, with a grade mark of not less than 90 per cent, the merchandise sales course, lighting sales course, power sales course, practical electricity course, commercial engineering course, elementary accounting course or advanced accounting course of the association.

Applicants for the award must submit a statement reciting in detail in what manner and to what extent the course has benefited the individual or company, or both. This statement must include such facts as increased amount of work accomplished, increased responsibilities assumed, promotions received or increase in salary or income resulting from the study of the course and any other facts which, in the judgment of the applicant, may be evidence to the judges of tangible benefits received.

This prize is to be awarded annually at each national convention of the association to the competitor who, in the judgment of a majority of the members of the committees on education of the Commercial and Accounting Sections, has received the most benefit from any one of the courses.

## Montreal's Rates for Lighting One-Third Those of 1908

A new rate for electric lighting just announced by the Montreal Light, Heat & Power Consolidated represents a reduction of 11.4 per cent from the present rate and, according to the company, will mean an annual saving of upward of $300,000 to consumers. The reduction is from 4.8 cents per kilowatt-hour (6 cents with a discount of 20 per cent) to 4.25 cents per kilowatt-hour (5 cents with a discount of 15 per cent). This is one of the cheapest rates on the continent and is exactly one-third the price charged in 1908, fifteen years ago.

To gain the benefit of the new rate consumers must sign five-year contracts, a system now in force. The reduced rate will go into effect immediately after the contract is signed.

# Brief News Notes

**Promoting Widespread Ownership.**—The stockholders of the Northern New York Utilities, Inc., Watertown, N. Y., have voted to increase the number of shares of common stock from 40,000 to 160,000, decreasing the par value of each share from $100 to $25. This change has been made to render the stock more salable and is in line with the company's policy of broadening the field of individual stock ownership.

**Another Iowa Utility Purchase.**—The Iowa Gas & Electric Company, Washington, Iowa, has purchased the Louisa County Power Company, Columbus Junction. The Louisa County Power Company has a capacity of 175 kw. and serves Columbus City, Columbus Junction, Cotter, Letts and Grandview. This will bring the number of towns served by the Iowa Gas & Electric Company up to twenty-one.

**Sand Springs Plant to Double Capacity.**—The Sand Springs Power, Light & Water Company, which supplies electricity to Sand Springs, Tulsa and a number of other towns in Oklahoma, announces that it will almost double its power plant in 1923. The company now operates a plant at Sand Springs rated at 15,000 kva. An order has just been placed for an additional 12,000-kva. steam turbine, to be delivered early in the spring.

**Flood Destroys Dam and Transformers.**—The concrete dam of the Baker County Power Company on Notchaway River, 10 miles from Newton, Ga., was almost totally washed away on the night of Jan. 6, causing a loss of approximately $75,000. This company furnishes energy to the towns of Camilla, Doerun, Newton, Sale City and Moultrie. Two large transformers were lost, though the power house and most of the equipment remain intact. Repair work will start immediately.

**New York-Ontario Power Company Seeks Rights.**—The International Joint Commission will hold a hearing in New York on Feb. 12 at which it will take testimony in regard to the application of the New York-Ontario Power Company for rights covering a certain amount of water to be taken through the South Channel of the St. Lawrence at Waddington, N. Y. The company has applied to the Federal Power Commission for a preliminary permit covering this proposed utilization of water, but, as in the case of similar applications, it is being held to await the settlement of the whole St. Lawrence matter.

**Wadsworth, Ohio, Gives Up Municipal Plant.** — The municipal electric plant operated by the city of Wadsworth, Ohio, for several years is to be superseded by a contract with the Northern Ohio Traction & Light Company to sell to the city all the energy

it needs for lighting purposes. The contract involves the extension to Wadsworth of the company's 22,000-volt line from Barberton, 8 miles distant. Under the agreement made the city will be able to sell energy for 8 or 9 cents per kilowatt-hour. It has been charging 10 cents for the energy generated in its plant, and notwithstanding this figures show a loss of approximately $14,000 in 1921.

**Third Report of Committee on Inductive Co-ordination.**—The third report of the joint general committee of the N. E. L. A. and the Bell Telephone System on the physical relations between electrical supply and signal systems has just been issued. It embodies the detailed practices for the inductive coordination of supply and signal systems, which are based on the principles contained in the second report, printed in the ELECTRICAL WORLD of May 20, 1922. This second report is reprinted in the present edition in order that the principles and practices together may form a working guide in consecutive order. Copies of the reports in addition to those already mailed may be had by member companies on application to N. E. L. A. headquarters.

**De Forest Aids Radio Work at Yale.**—Dr. Lee de Forest has, it is announced by the Yale Engineering Association, undertaken to establish a library on radio telegraphy and telephony at Sheffield Scientific School and has made a first donation of $1,000 toward this end. The Sheffield school is one of the leaders in radio instruction and research work. Dr. de Forest has also donated $1,200 to defray the expense of an advanced course in radio engineering. Lectures will be given this year early in the second term by Commander S. C. Hooper, U. S. A., Gen G. O. Squier, U. S. A., G. A. Campbell and Lloyd Espenschied of the American Telephone & Telegraph Company, Dr. A. W. Hull of the General Electric Company, Prof. John Morecroft of Columbia University and Dr. L. E. Whittemore of the Bureau of Standards.

**A Big Colorado River Scheme.**—A bold engineering scheme on the Colorado River is proposed by the Colorado River Syndicate, said to have the backing of New York and Philadelphia bankers. W. G. Clark is the consulting engineer. The plan is to build a dam 1,100 ft. high at Boulder Canyon or Black Canyon. This will mean the backing up of water into the lower edge of Grand Canyon National Park and the flooding of a number of small towns. An unusual feature of the plan is that the power house is not to be built at the dam but at the end of a 25-mile tunnel which is to be driven through the hard rock of the region and to carry an average flow of 12,500 second-feet. The scheme also involves the construction of a dam at Bull's Head Rock. This smaller development is to provide power for the construction of the larger project. The proposal is regarded with sufficient seriousness by the Federal Power Commission to insure an investigation of its possibilities.

**Eau Claire (Wis.) and Rochester (Minn.) Municipal Plants Face Predicament.**—Representatives of the Wisconsin-Minnesota Light & Power Company of Eau Claire, Wis., have placed a proposal for a hig-tension line before the City Council. That city is faced with the problem of either spending a large sum on its municipal electric light plant for extensions and improvements or purchasing its future supply of light and power from a private corporation, using its present plant for emergency purposes. The city of Rochester, Minn., is reported to be in a similar predicament, having to choose between spending $75,000 for an additional hydro-electric unit and connecting up with the Wisconsin-Minnesota Light & Power Company at Red Wing, Minn.

# Associations and Societies

**Electric Power Club.**—The annual meeting of the Electric Power Club has been set for June 11 to June 14 and will be held at The Homestead, Hot Springs, Va.

**Pacific Coast Electrical Association.**—The annual convention of this association will be held at the Fairmount Hotel, San Francisco, on June 19-22. The program has not been announced.

**Michigan Electric Light Association.**—The place and date for the tenth annual meeting of this body have already been set, and it will be held in the Hotel Pantlind, Grand Rapids, on Aug. 28-30. Among the topics selected for discussion are uniform methods of accounting, safety in radio installation, development of water power and economy in operation.

**Iowa Engineering Society.**—At the mechanical-electrical session of the convention of this society at Des Moines next week John M. Drabelle, Iowa Railway & Light Company, Cedar Rapids, will give a paper on "Arch and Furnace Design for Iowa Fuel," and Milton W. Arrowwood of Chicago one on "Efficient Use of Pulverized Fuel." The session will be held on Wednesday, Jan. 24.

**Great Lakes Division Technical Committees, N. E. L. A., Meet.**—The Technical Section of the Great Lakes Geographic Division of the National Electric Light Association met at the Hotel LaSalle in Chicago on Wednesday, Thursday and Friday of last week for the discussion of technical problems in that territory. Nearly a hundred men from the four states in the division, in which the committee organizations are virtually identical with those of the National Technical Section, were present.

**Pennsylvania Electric Association.**—A meeting of the geographic sections committee of this association will be held at Pittsburgh on Jan. 23. Topics are: "Aërial Cables," by W. C. Hayman, General Electric Company; "Meters," by Orville Buys, Duquesne Light Company; "Transformers," by M. W. De Merit, West Penn Power Company, and "Training Employees," by J. J. Dougherty, Duquesne Light Company. Brief talks on safety and education will also be made, the latter by A. N. Cartwright, West Penn Power Company.

**Illumination Lectures for Chicago Architects.**—A series of lectures on the approved methods of illumination will be given to architects and architectural engineers from Jan. 22 to Jan. 26 under the joint auspices of the Chicago Section of the Illuminating Engineering Society and the Armour Institute of Technology. This is the first series of lectures which will be promoted in New York, Boston and Philadelphia with the view of assisting architects in their illuminating problems. These lectures will be held in the lecture rooms of the Western Society of Engineers. The tuition fee for the course will be $10. The lecturers will be Ward Harrison, A. L. Arenberg, Prof. E. H. Freeman, A. J. Sweet, Prof. H. H. Higbie, S. G. Hibben, A. L. Powell, J. L. Stair, Norman Macbeth, M. Luckiesh, Otis L. Johnson and George Ainsworth.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Western Association of Electrical Inspectors—Chicago, Jan. 23-25. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Iowa Engineering Society—Des Moines, Jan. 23-26.

Wisconsin State Association of Electragists—Milwaukee, Jan. 24-26. H. M. Northrup, 23 Erle St., Milwaukee.

Association Municipal Electrical Utilities of Ontario—Toronto, Jan. 25-26. S. R. A. Clement, 190 University Ave., Toronto.

New Mexico Electrical Association—Albuquerque, Feb. 12-13. C. E. Twogood, Albuquerque, N. M.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14. General meeting, Hot Springs, Va., March 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Electric Railway Association—Washington, D. C., Feb. 15-16. J. W. Welsh, 8 W. 40th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

American Physical Society—New York, Feb. 24; Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago. March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee. March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

American Society of Mechanical Engineers—Montreal, March 28-31. C. W. Rice, 29 W. 39th St., New York.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Wills, 403 Slaughter Bldg., Dallas, Tex.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

# Commission Rulings

**Proper Proportion of Stocks and Bonds.**—The issue of securities which would make the total par value of bonds equal approximately 80 per cent of the securities outstanding and the stock 20 per cent was disapproved by the New Jersey Board of Public Utility Commissioners in passing on applications from the Commonwealth Electric Company of Summit and other companies. Were the proportions changed to 70 per cent and 30 per cent respectively, the commission intimated that approval would be given.

**Common Stock Should Not Be Issued Under Par.**—In granting the Penobscot Power Company permission to capitalize a hydro-electric undertaking by issuing stock and bonds in the proportion of one to two, the Maine Public Utilities Commission said: "It has been the policy of this commission to insist that common stock should be issued at not less than par. The price which the bonds will bring on the market depends primarily upon certain things, among which are the security and the rate of interest and the availability of capital seeking investment at the time such capital issues are offered. Ordinarily it is as well to permit the issue at a discount of bonds carrying a normal rate of interest as to make the rate higher in order to command par for the bonds, but if that is done the sum of the stock and bonds so issued will exceed the total amount of money immediately realized, and the absorption of the difference properly becomes a problem for the stockholders as the corporation proceeds. We believe that the price at which it is proposed to sell these bonds is reasonable under all the circumstances, but we shall provide in our decree that the discount on the bonds be amortized during the life of the bonds."

**Why Federal Income Tax Does Not Belong in Operating Expenses.**—In fixing the rate base for the Pacific Gas & Electric Company the California Railroad Commission excluded the federal income tax from operating expenses, saying: "An income tax has been imposed by the federal government since this commission acquired jurisdiction over power utilities and established what it considered a fair rate of return. This tax is now 12½ per cent of net revenue after bond interest, depreciation and certain other smaller deductions, which in this case is equivalent to approximately four-tenths of 1 per cent on the reasonable rate base found herein. If this tax were allowed as a part of the return to the company, a return of 8.4 per cent at the present time would be approximately equivalent to the 8 per cent allowed in 1913. On the other hand, the company is larger, has a more diversified business and has, by absorption, eliminated the prospect of no small amount of competition. More than ever before the production and distribution of electrical energy is recognized as an essential and basic industry, and the confidence of the investing public in the soundness of state regulation is becoming more firmly established. The benefits to the investor of supervision of financial operations and the encouragement by large utilities of 'customer ownership' have contributed to a wider distribution of securities and a broader market for new issues. Under such conditions a utility should be able to finance itself much more cheaply than before, and we believe that this factor may fairly and safely be considered as offsetting the effect of the federal income tax and of the increase in interest rates during the period of high prices in so far as such interest rates have affected the operations of this company. A return of 8 per cent upon the estimated reasonable investment will therefore be allowed in the present proceeding."

# Recent Court Decisions

**Whether Fatal Accident in Trying to Safeguard Children Involved Contributory Negligence Is for Jury to Decide.**—In attempting to move a fallen electric wire to a safe distance from children playing in the street a citizen of Baltimore was instantly electrocuted. A suit for damages was brought by the State of Maryland (to use of Dove) against the city of Baltimore and the Consolidated Gas, Electric Light & Power Company. The Court of Appeals of Maryland overruled the company's contention of contributory negligence as a matter of law—which had been accepted by the lower court and the case withdrawn from the jury—remanding the case for a new jury trial. (118 At. 753.)*

**Abutting Owner Cannot Enjoin Construction of Duly Authorized and Properly Built High-Tension Line.**—In Smith vs. Central Power Company an owner of abutting land sought to prevent the construction of a high-tension transmission line by the company in fulfillment of its contract to furnish the city of Bucyrus with electrical energy. The Supreme Court of Ohio held that although an owner of abutting property has certain rights peculiar to himself, such special rights do not include the right to prevent the construction in the streets of appliances which have been authorized by the city, and which do not interfere with his access, light, air or view, merely on the ground that they are a menace to life and property, unless such menace is peculiar to the particular abutting owner. High-voltage electric wires, the court averred, though a highly dangerous agency, are not a nuisance unless the manner of erection and maintenance is faulty and not in accordance with the usual custom, and the maintenance of such wire does not constitute the taking of private property without compensation. (137 N. E. 159.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

**Relations Between Companies Properly Considered in Ordering Extensions.**—In People ex rel. Woodhaven Gaslight Company vs. Nixon the Supreme Court of New York, Appellate Division, held that where a company having a franchise to supply gas in certain territory manufactured no gas, but purchased all it distributed from another company which owned all of its stock, had advanced all the money invested, selected its officers from among its own employees, and arbitrarily divided their salaries and expenses, the Public Service Commission in ordering an extension of the gas mains could properly take into consideration the relation between such companies and was not necessarily limited to a consideration of the expense with relation to the capitalization or stated income of the franchise holder. (196 N. Y. S. 623.)

**Different Rates for Contiguous Consumers of Same Class Discriminatory.**—The right of the Dallas (Tex.) Power & Light Company to charge a higher rate for electrical energy furnished in Highland Park, a suburb of Dallas but a separately incorporated place, than is charged to users in Dallas has been denied by the Texas Court of Civil Appeals, which held that, although Dallas cannot fix the rates for Highland Park nor Highland Park delegate this power to Dallas, none the less any difference between rates charged two groups of consumers similarly classed is an unjust discrimination and that for consumers of like amounts of energy the same rate must apply, whether in Dallas or in Highland Park. This decision was given in the application of citizens of Highland Park for an injunction against the company, which had fixed a rate of 10½ cents a kilowatt-hour for Highland Park as against 6 cents a kilowatt-hour for Dallas.

**Enforcement of Contract Not Interrupted on Claim that Bankruptcy of Utility Would Result.**—The Central Power & Light Company won a suit against the town of Pocahontas, Ark., to enjoin contract rates restored by the town after the abolition of the Arkansas Corporation Commission, which had first granted and then set aside a higher rate. The commission had ordered the new rate continued for six months pending a rehearing which its abolition prevented. The trial court granted the suit and ordered an increase, fixing the amount. This judgment the Supreme Court of Arkansas reversed, holding that, in the absence of a statute, the enforcement of a contract between a city and a utility cannot be interrupted on the ground that it will force the utility into bankruptcy, the only remedy for such a condition being a modification of rates by mutual consent. (244 S. W. 712.)

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

## F. C. Shenehon Joins Byllesby Organization

F. C. Shenehon, whose appointment as vice-president and general manager of construction and engineering for the Byllesby Engineering & Management Corporation, Chicago, was recently announced, is widely known as a hydraulic engineer. Mr. Shenehon obtained his engineering education at the University of Minnesota, where he received the degree of B.S. in 1885 and of C.E. in 1895. From 1886 to 1887 he was connected with railroad location and construction in Michigan and in 1888 he became engineer of water power and supplies at Sault Ste. Marie, Mich. In 1891 he became engineer of the ship locks and ship canals on St. Mary's River, Mich., where he stayed until 1902. From 1903 to 1905 he was engineer for the hydraulic investigations of the Niagara-St. Lawrence Rivers. In 1906 he became engineer of hydrography and hydraulics of the Great Lakes and outflow rivers. He then became the head of the College of Engineering at the University of Minnesota in 1909, where he remained until 1917. Since then he has been connected with various water-supply and flood-protection projects, notably at Natchez, Miss., in Minnehaha County, S. D., and on the Big Sioux River in the latter state. He investigated the water-power project of the Northern States Power Company in 1917 and has been constructing engineer for the Minneapolis Gas & Electric Company on the reconstruction of the Coon Rapids dam since 1920. His technical associations include the American Institute of Consulting Engineers and the American Society of Civil Engineers. He also is the past-president of the Detroit Engineering Society.

F. C. SHENEHON

## B. G. Lamme Receives Medal

Benjamin G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to whom was awarded the Joseph Sullivant medal, as announced in the Nov. 11 issue of the ELECTRICAL WORLD, was officially presented with the medal on Jan. 12 at the Ohio State University, his alma mater. The presentation was made in the presence of the trustees and faculties of the university, with appropriate ceremonies, in the chapel. President W. O. Thompson made the presentation address.

## Engineers' Council Re-elects M. E. Cooley

Mortimer E. Cooley, dean of the engineering schools of the University of Michigan, was re-elected president of the American Engineering Council, executive organ of the Federated American Engineering Societies, according to an announcement made at the opening of the two days' meeting of the council in Washington last week. Dean Cooley is the second president of the council, his predecessor having been Herbert Hoover, who resigned soon after he entered President Harding's Cabinet. His re-election comes just as he is rounding out forty years at the University of Michigan, broken only by service in the Spanish-American War, during which he was chief engineer of the Yosemite. For many years Dean Cooley has been associated with engineering investigations and appraisals of utility properties, and he has been in charge of appraisal work at different times for the Wisconsin Railroad Commission and the Michigan commission.

**John H. Trumbull**, president of the Trumbull Electric Manufacturing Company, Plainville, Conn., has been made president pro tem. of the Connecticut State Senate for 1923.

**Edward J. Nally**, who took office as managing director of international relations of the Radio Corporation of America on Jan. 1, left New York on Saturday, Jan. 6, on the Steamship *Majestic* for Europe. Mr. Nally is going abroad to attend conferences at Paris, London, Berlin and other centers where plans to mobilize the interests of American, French, English, German and Italian radio companies will be discussed.

## O. D. Street Becomes Vice-president of the McGraw-Hill Company

O. D. Street, well known for the past ten years as general manager of distribution of the Western Electric Company, has been elected vice-president of the McGraw-Hill Company, in executive charge of the ELECTRICAL WORLD, *Electrical Merchandising, Journal of Electricity and Western Industry, Industrial Engineer, Electric Railway Journal and Bus Transportation.* Mr. Street brings to these publications a broad background of business training and a very extensive contact in the electrical industry.

O. D. STREET

Mr. Street entered the organization of the Western Electric Company in 1901 on his graduation from Williams and has a broad practical training. He was in charge of telephone sales on the Pacific Coast, assistant to the president, Atlanta branch manager, general telephone sales manager and latterly general manager of distribution. During the war he rendered invaluable service in reorganizing the warehousing division of the Quartermaster's Corps and establishing an orderly system of forwarding to Pershing's army where chaos had existed before. Under his administration the Western Electric system was expanded by the creation of twenty-two branch houses until Mr. Street was in executive charge of fifty jobbing houses distributing electrical supplies. This responsibility has entailed a personal contact with all sections of the country and all branches of the industry gained in the service of central stations, telephone systems, industrial plants and contractor-dealers, in co-operation with the manufacturers of practically all classes of electrical products. He has become a recognized authority on the broad problem of distribution, now one of the most pressing issues before the industries of America.

Mr. Street was born in Massachusetts in 1877. He is a resident of Bronxville, N. Y. He belongs to the Bankers', University, and Williams Clubs and the Siwaney and Pittsfield Country Clubs.

## F. A. Ketcham General Manager Western Electric Supply Department

Frank A. Ketcham, who has been general sales manager of the Western Electric Company for the past four years, has been appointed general manager of the supply department, effective Jan. 15. Mr. Ketcham became associated with the Western Electric Company in 1900, starting at the Clinton Street office in Chicago. His early work was in connection with the telephone supply end of the business, and

F. A. KETCHAM

in 1905 he became telephone storekeeper. One promotion followed another until in April, 1911, he was made manager. Two months later he received the additional title of central district manager, with supervision over the Cincinnati, Omaha, Indianapolis and Minneapolis houses. Subsequently the Cleveland, Detroit and Milwaukee offices were opened under his jurisdiction. Mr. Ketcham was born in Saginaw, Mich., and was educated at the University of Michigan.

**William J. Hagenah** of the firm of Hagenah & Erickson, public utility engineers, Chicago, who, with a staff of engineers and accountants, has been engaged on public utility investigation work in South America, has returned to the United States. The work in question, which covered gas, tramway, telephone and electric light and power properties, extended over a period of one year and was undertaken for foreign banking interests.

**W. B. Miser**, manager of the Drumright division of the Oklahoma Gas & Electric Company for five years, resigned on Jan. 1. Mr. Miser has been recognized throughout the central part of the state as one of the civic leaders in Drumright and he has headed the most important organizations of the city. The Drumright division is to be consolidated with the Sapulpa and Bristow divisions. R. C. Coffy of Sapulpa will be the manager of the central division, and C. C. Stewart will be the local division manager at Drumright in connection with his work as commercial manager.

**C. A. Miller**, who has been chief electrical engineer of the Goodyear Tire & Rubber Company, Akron, Ohio, for over two years, resigned Dec. 1 to become electrical engineer in the engineering department of the Adirondack Power & Light Corporation, Schenectady, N. Y. Mr. Miller is a graduate of the University of Illinois in electrical engineering and was with Henry L. Doherty & Company for seven years and with the Goodyear Tire & Rubber Company for three years. During this time Mr. Miller has had charge of several large power house and substation developments as well as being assistant general superintendent of the Trumbull Public Service Company of Warren.

**Kenneth A. McIntyre** of the staff of the Society for Electrical Development started early in January on an extensive trip to about seventeen different cities throughout the United States and Canada. Mr. McIntyre's services will be available to local electrical leagues and clubs for meetings with the executives of governing committees, for the purpose of discussing the best methods of effectively carrying on local co-operative work through the interchange of experiences of the various leagues throughout the country. He will also address the industry where meetings are arranged, for the purpose of stimulating interest in local work.

**Harry L. Garbutt** has been appointed merchandising manager for the San Francisco office of the Westinghouse Electric & Manufacturing Company. He went to San Francisco in 1919 to become district supply manager for the Westinghouse company. Born at Port Huron, Mich., in 1879, Mr. Garbutt entered the electrical field at seventeen and for twelve years was engaged in overhead construction work in various Middle Western states. In 1908 he joined the organization of the Drew Electric & Manufacturing Company of Indianapolis, where he remained as sales manager until he became line-material specialist with the Westinghouse company late in 1909. In 1913 he became manager of the line-material section at East Pittsburgh and six years later supply manager for the San Francisco territory, a position he has since held.

## H. F. T. Erben Vice-Chairman of Manufacturing Committee

H. F. T. Erben, whose appointment as vice-chairman of the manufacturing committee of the General Electric Company was recently announced, has been identified with that company since the early beginnings at Schenectady. In October, 1887, Mr. Erben entered the

H. F. T. ERBEN

employ of the Edison Machine Works. With the growth of the company and the later development of the plant at Schenectady, he became designing engineer of the direct-current department soon after the formation of the General Electric Company in 1892.

In 1914 Mr. Erben was made engineer of the Schenectady works, and in March, 1916, he was appointed assistant manager of the works, which position he held until his appointment as works manager in June, 1920. He held that position until his present appointment as vice-chairman of the manufacturing committee, which was effective Jan. 1, 1923.

## Obituary

**Wallace P. Hurley**, who for the past twelve years has been a member of the sales organization of the Westinghouse Electric & Manufacturing Company, died at New Hope, Pa., on Nov. 28 of sleeping sickness. Mr. Hurley, who was a graduate of Purdue University, became associated with the Westinghouse company in 1910, when he joined the illuminating section of the supply department. In July, 1918, he was made manager of this section and one month later left the company to take a commission in the Signal Corps, U. S. Army. At the end of the war he returned and was assigned to the New York Sales office. Mr. Hurley was a member of the A. I. E. E. and of the I. E. S.

**Alexander Kennedy**, president and treasurer of the Pittsfield (Mass.) Electric Company, died at Pittsfield, Jan. 10, aged eighty-two years. Mr. Kennedy was born in Dumfriesshire, Scotland, and came to the United States in 1865. With three others he established the Pittsfield Electric Company in 1883 and became its head. He was a director of the Pittsfield Electric Street Railway Company until that system was merged with the Berkshire Street Railway and was the head of Pittsfield's first board of trade.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Patience Needed in Solving Our Problems

**An Appeal Against Selfishness and for the Adjustment of Group Controversies as a Preliminary to United Action by Manufacturers, Jobbers and Merchants**

By H. P. Andrae
President, Julius Andrae & Sons Company

THE electrical jobber has been blamed for a good many things. Some of them are properly chargeable to the jobber and others are not. Out of the mass of discussion that has enveloped the electrical industry there seems to be coming, rather slowly but surely, a full recognition that the so-called jobber problem is broader than the jobbing field. It is one of many questions that are incident to the development of the electrical industry as a whole. The basis of its settlement will not be the welfare of the jobber to the exclusion of the rest of the industry. The basis will be the welfare of the whole industry and the best possible development of the service to the public. This is the real foundation on which the entire industry is built.

### Each One of the Branches Must Justify Itself

Broadly, industry may be divided into three parts. The first is the manufacturer, the second the distributing agency between the manufacturer and the retail merchant, and the last the retail merchant himself. Each must justify himself in the performance of a definite service rendered in a way that no other agency can equal.

With the manufacturer, in addition to his routine manufacturing problems, lies the duty of the development of better equipment as the needs of the field he serves may justify. With this is combined a certain class of educational and advertising work that reaches the public in a broad way, keeping the usefulness and service of the product well in the public eye and maintaining a demand for it. Back of his routine manufacturing and development problems lies the bigger duty of keeping the product up to a standard that makes it worth the price paid by the consumer.

The distributing agency, on the other hand, has the obligation of placing the product in the hands of the retailer at a cost and on a basis of service that can be provided in no other way. While this agency does not come into contact with the buying public directly, it has a definite responsibility in educational work in that it must see that the retail dealer is properly equipped to give service. This equipment cannot be insisted on and the dealer forced to equip himself, but it must be done through an indirect educational process. This is more difficult than a direct educational job would be. Distributing agencies, properly equipped and justifying themselves on a service basis, require an investment in plant, brains and energy that reaches enormous figures. The man who merely receives an order and passes it on to the manufacturer, taking his commission and having no further responsibility, will have a hard time to justify himself.

The retailer, coming into immediate contact with the consumer, not only has his merchandising problems to face but the duty of completing the educational and development work undertaken by the manufacturer and carried on by the distributing agency by bringing to the individual consumer the service that the others have developed. Backed by the manufacturer and distributing agency, he must see that the consumer actually gets value received for his money. Unless this chain of operation can be followed through successfully, an industry falls partly or wholly short of justifying itself, because it fails to render the service paid for.

### Nothing Is Gained by Heated Controversy

Nothing can be gained in the long run by the manufacturer, the distributor and the dealer getting on opposite sides of the fence and throwing "rocks" at each other. Each group has individual problems that are of little or no direct interest to the others. Each group has problems that are common to all. The quickest and surest way to the solution is agreement among the individuals of each group on the problems affecting that group only. This means getting together on the basis of the greatest good to the group and not for the advantage of some particular faction that may be powerful for the moment. So long as there are individuals who will seek to turn every move to immediate personal advantage there will be strife and discord in the group and it will be impossible for that group to meet the others and discuss the common problems of the industry. In short, the manufacturers, jobbers and retailers must settle their own individual problems on a broad give-and-take basis before it will be possible for them to make much progress when they meet as an industry to develop co-operatively the service that the public must have.

### An Electrical Manufacturer Raises This Question —

"WHY should a manufacturer whose factory is located, say, in Syracuse carry branch stocks in New York and Boston when there are in the two cities anywhere from two to three hundred jobbing houses selling the class of goods which this manufacturer produces? The principal effect is to keep in business so-called jobbing houses which have not the financial resources to carry the volume of material which it would be necessary for them to have in order to do business if they drew their supplies from the manufacturer's factory stock. Manufacturers' branch stocks thus tend to multiply the number of jobbing houses, of which, as every one knows, there are too many. Is it good for the industry?"

Concretely, much of the controversy in the electrical industry is based on suspicion of motives, trade rivalries and the fears of individuals that they are not getting their just due. These sources of discord must be cleared away before much progress can be made in putting the industry as a whole on the basis of full health. We must cease to view our problems as manufacturers', jobbers' or dealers' problems, to be solved for the selfish advantage of one or the other group, and view them as broad problems of the industry, to be solved for the best interests of the greatest number and for the betterment of service. This may sound altruistic, but as a matter of sober fact it is the one sure method of preventing throat-cutting competition, and also what is still worse, the adoption of policies that mean certain monetary loss, where some one fears that some one else will get an advantage or is going to do something that will create resentment.

A "devil-take-the-hindmost" policy has never failed to wreck those concerned in it. Much of the confusion in the electrical industry right now is traceable to the newness of its development and to temporary causes incident to financial depressions. The biggest influence for clearing up the situation will be clear thinking from an industry and public service viewpoint and above all patience in plugging away at the problem. There is no such thing as a quick settlement. The condition will only be changed by a concerted effort to put the industry as a whole solidly on the next step upward in the progress of development.

# Who Is to Guide the Non-Electric Store

**How This Growing Influence May Be Molded Into Our Scheme of Distribution as a Constructive Help to Electrical Dealers —The Jobbers' Responsibility**

By A Manufacturer

It would be well, it seems to me, if the manufacturers and jobbers of electrical appliances, devices and materials that go into the homes of the people would give more careful thought and planning to directing and controlling the growing distribution of electrical merchandise through non-electric stores. Electrical construction will naturally remain permanently in the hands of men of the electrical i. dustry, and the sale of electrical appliances and accessories will also continue to be an important and growing fe. ture of the business of the central-station company, contractor and dealer. But we know from our own personal observation that a constantly increasing amount of these commodities is going to be sold by men outside of our industry, for the simple reason that the general merchant is an enterprising trader, very much alive to the wants and needs of the people to whom he sells. And as the ordinary householder becomes more and more interested in these goods and buys more of them, he will find more and more electrical merchandise offered to him in the stores which he habitually frequents in sea ch of other miscellaneous household supplies.

The company with which I am connected and the majority of other electrical manufacturers have restricted their distribution largely within the electrical industry. Many manufacturers of domestic appliances who were already established in the hardware, drug and department-store field electrified their lines when electric cooking devices became popular and began to sell percolators and other utensils, until today the hardware and department stores are selling electrical appliances in wide variety and in considerable volume. Accessories such as shades, plugs, fuses and other devices which can be attached to or plugged into approved wiring, however, have continued to be looked upon more as a distinctly electrical line and to be sold mainly thr gh the electrical trade. But even h non-electric distribution is beginnin o edge in. Inquiries are continually received from large mail-order houses, chain-store groups or other large distributors in the general merchandise field, large orders are flashed at manufacturers, and many of them sell. Whether we like it or not, therefore, the non-electric store is becoming a growing factor in the marketing of these goods.

It is clearly time, therefore, for electrical men to realize that their goods are fast progressing toward the staple stage, when the public demand will attract all classes of merchants to the sale of this household electrical merchandise. We must, besides, recognize the fact that, after all, the service of the public is the prime consideration, and if it will facilitate the sale and use of electrical appliances and accessories to have them on display in stores other than those of purely electrical dealers, it is to the interest of us all to have it so. For even the electrical dealer himself will benefit, because the more pressure is put behind the sale of these goods the faster the market will develop and the better the business will be. Consequently, the problem is not how to prevent or retard this growing sale through non-electric stores, but rather how to guide it and develop it along the most constructive lines.

### The Jobber's Responsibility

The opportunity lies in the direction of the electrical jobber, for if he will function as distributor for the non-electric store as well as for the man whom we now call the regular electrical dealer, he will gradually knit the general merchant who sells electrical merchandise into the organized electrical distribution system. He will guide him through the dangers of his inexperience and make surer his prosperity. He will protect the existing electrical dealer against careless or ill-advised competition, with the result that he will profit by this greater pressure of market building and not be hurt by a struggle for the existing business. He will assure a better, fuller merchandising service to the public, which will be for the advancement of all electrical interests. And the jobber can do this by calling on these non-electric merchants who do or could profitably sell the electric line, by interesting them more deeply in the principle and purpose of the electrical industry, by influencing them to feature and support devices that the electrical industry is pushing, and by ultimately lining up the man behind the electrical department in the non-electric store to feel himself not a free-lance outsider but a member of the local electrical community concerned in co-operating in all its constructive plans for market development.

All this the electrical jobber can do to his own good profit, and the manufacturer can assist him greatly by practical co-operation in selling plans. It would surely be to the advantage of the rest of the industry.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Insulating Material Business Is Strengthened by Automotives

Increased production in the automotive industry and heavier buying by radio manufacturers are the major influencing factors in the present active insulating material market. A leading company in the Eastern territory states that his sales for the last six months of 1922 show an increase of over 60 per cent in comparison with the first six months of 1922.

Deliveries for insulating material are for normal periods. There have been no recent price changes, although there is a possibility of a price increase if the present upward trend of prices on raw materials continues. The sales outlook for the next six months is considered good, although one important manufacturer expects a falling off in business for this year as compared with 1922.

## Collections in Atlanta Show Improvement

Taken as a whole, collections have shown some improvement during the past thirty days. Jobbers report municipalities and the larger central stations as paying promptly, with an improvement to be noted in the length of time taken by industrials to liquidate accounts. Payment of accounts by the small contractors, however, continue slow, and it requires continuous efforts to obtain moneys due.

Trade acceptances are being dealt in to a small extent, but there is a disinclination on the part of purchasers to use this form of credit. No likelihood of a tightening up of credit in the next thirty days is expected, and one of the larger houses expresses the opinion that collections will continue to improve for the rest of the year. Increases in the value of agricultural products should enable small-town merchants and industrial companies to improve their financial conditions materially, and the outlook is bright for a continued improvement.

## Purchases for Spring Delivery Are Heavy in Cleveland

Electrical business in Cleveland is quite active in all lines, according to the January *Monthly Business Review* of the Federal Reserve Bank of Cleveland.

"The extensive building program which has been put through this fall has brought additional loads on the power plants," says this periodical, "and is partially responsible for the strength of business in that particular field, although the development in many industrial fields is also requiring additional electric power and equipment. There is an unusually heavy demand for bare and insulated electrical wires and lead-covered cables. A large concern reports that orders booked during recent months in the aggregate are about double those for the corresponding months of last year. The placing of so much business at this time of year is looked upon by manufacturers as rather unusual and is attributed to the fact that copper has shown a rising tendency. It is also true that purchases for spring delivery are heavier than for some years past, and this is looked upon in the trade as an evidence that public service corporations are contemplating considerable extension."

## Crude Platinum Prices Drop

Prices of crude platinum dropped from \$2 to \$3 an ounce within the last week. Crude platinum can be obtained from \$109 to \$112 an ounce, while refined platinum is nominally quoted at \$118. The sudden appearance of 800 ounces of sweepings and reclaimed metal, together with the failure of consuming demand to reach the point refiners expected, brought about lower prices. Imports during the last week were four boxes of about 80 ounces each from South American countries.

## Smelter Production of Copper 475,000,000 Lb. Heavier

Smelter production of copper in 1922, according to the United States Geological Survey, covering actual production for eleven months and estimated production in December, was about 981,000,000 lb., an increase of 475,000,000 lb. over 1921. Production was resumed by practically all large mining companies except the United Verde Copper Company by or during April, 1922, one year from the general shutdown. Smelter production of copper for December, as estimated by the companies, was 103,300,000 lb., or at the rate of about 1,240,000,000 lb. a year.

Total production of new refined copper from domestic sources was about 897,000,000 lb., 288,000,000 lb. more than in 1921. Refinery output of new copper obtained from domestic and foreign sources, including imports of refined copper, was about 1,398,000,000 lb. In addition to output of new refined copper, about 112,000,000 lb. of secondary copper was produced at refineries, making total refinery output 1,510,000,000 lb.

Up to Sept. 21 total imports of copper in ore, concentrates, matte, blister and refined copper were 363,443,226 lb., of which 75,556,317 lb. were refined copper and 192,050,397 lb. blister. Exports for the first ten months were 634,501,851 lb.

## Survey Shows Substantial Rise in Wages of All Labor

A nation-wide survey of wage changes covering four hundred thousand wage earners in twenty-three industries just completed by the National Industrial Conference Board shows a substantial rise in hourly and weekly earnings in all classes of labor from July, 1922, to October, 1922. In only two industries, lumber and rubber, was there a decrease in hourly wages during this period. In automobile manufacturing and book and job printing a slight decline took place in weekly earnings.

The average hourly earnings of all wage earners covered in this investigation were \$0.238 in July, 1914. In July, 1922, they had risen to \$0.484, in August to \$0.486, in September to \$0.495. In September, 1922, therefore, the average hourly earnings of all the wage earners covered were 108 per cent higher than in July, 1914.

The average weekly earnings of all wage earners, which were \$12.27 in July, 1914, had risen to \$23.09 in July, 1922, to \$23.31 in August and to \$23.88 in September. In the latter month they were 95 per cent above the July, 1914, level. The average weekly earnings of unskilled labor appear to have increased more since 1914 and during July, August and September of 1922 than those of skilled labor. Average weekly earnings of unskilled labor in July, 1922, were 87 per cent above 1914 and in September, 1922, 95 per cent above pre-war levels, while those of skilled labor in July, 1922, were 86 per cent above 1914 and in September, 1922, had risen to 92 per cent above the July, 1914, level.

The actual hours worked per week per wage earner also increased from 47.7 in July to 48.2 in September, although this figure is still below that

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | \$0.0296 | \$0.0295 | \$0.0258 |
| Cold finished shafting, per l | 0.0378 | 0.0375 | 0.0337 |
| Brass rods, per lb. | 0.1742 | 0.171 | 0.1516 |
| Solder (half and half), per lb. | 0.2425 | 0.24 | 0.2058 |
| Cotton waste, per lb. | 0.1175 | 0.11 | 0.10 |
| Washers, cast iron (½-in.), per 100 lb. | 4.33 | 4.33 | 4.50 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 3.11 | 3.20 |
| Machine oil, per gal. | 0.36 | 0.36 | 0.40 |
| Belting, leather, medium, off list | 49% | 37% | 44% |
| Machine bolts, up to 1-in. x 30-in., off list | 51½% | 52% | 58% |

for July, 1914. Plant hours and the nominal working week also improved steadily during July, August and September of this year, though these also were still considerably below the pre-war levels.

## December Was Best Month for Chicago Motor Sales

The Chicago motor sales rate maintained during October and November kept advancing steadily upward during December, with the result that five manufacturers report December their best month of the year. Although the year's motor activity did not start to come back until July, the latter half of the year overcame some of the sluggishness of the first six months. Relative comparative figures of the year's business at present are not available in most cases, but one company reports a 20 per cent increase for 1922 over 1921. The other companies declare that their total business is above their 1921 figures. The greatest demand has been for sizes ranging from 1 hp. to 20 hp. Prices are firm and deliveries are slowing up, with a three-month to four-month period for promised shipments. Stocks are in good shape with few exceptions where an accentuated demand has depleted that one size. With the increase in price of the raw materials, cotton, rubber and copper, there is a feeling that the price tendency will be upward.

## Declares Recent Demand for Cleaners Was Phenomenal

"Demand for electrical household cleaners during the last few months of 1922 was phenomenal, to judge by the experience of the P. A. Geier Company." Such was the recent statement of General Manager Frank J. Gottron of this Cleveland concern. He declared that on Dec. 30 his factory, after a month of working a night shift as well as going at full daytime capacity, had on hand only 600 Royal cleaners, 8 per cent of the regular factory minimum.

"December business showed a 25 per cent increase over normal," said Mr. Gottron, "and orders for January shipment are far above the usual volume, which proves that the trade is sold out. Chicago dealers were so hard pressed for machines in the last days before Christmas that one factory representative there, in trying to help a certain dealer fill his orders, could locate only thirty cleaners although he telephoned forty stores.

"The company never before experienced such heavy Christmas buying, even in the war-boom days, and orders were still pouring in after the holiday at such a rate that production was not halted during the yearly inventory taking but was continued at a fair rate of speed."

## Chinese Electrical Imports Show Heavy Gain

In his report to the Department of Overseas Trade on the commercial and economic situation in China, H. H. Fox, commercial counselor to the British Legation at Peking, says of electric light and power that the customs report for 1921 shows that the importation of electrical materials and fittings rose from 6,300,000 taels in 1920 to 13,200,000 in 1921. Adverse trade conditions caused a marked decline in the sale of small lighting plants, which is partly ascribed to the installation of new or improvement of existing plants for public light services. Many contracts for large power and light plants for cities in the interior were settled, and there is an increasing tendency to install larger units of 1,000, 2,000 and 5,000 kw., while only a couple of years ago 200 kw. and 400 kw. were considered sufficient to meet requirements. These installations are bound to have an effect on China's industrial progress. It is interesting to note that a Chino-German company purchased during the past year a large quantity of land near Soochow for the manufacture of motors and electrical appliances, this being the first project of this nature to be mooted in China.

## Anaconda Acquires Chile Copper

The Anaconda Copper Company has acquired control of Chile Copper through purchase of the holdings of the Guggenheim family. This gives Anaconda the source of cheap copper necessary to make it the great manufacturing-producing company in copper that United States Steel is in iron and steel.

This will give Anaconda the leadership in copper that Amalgamated, its precursor, held prior to the advent of the "disseminated coppers," and rounds out the plan conceived when Anaconda acquired American Brass. Tying a current low-cost producer to Anaconda gives the enterprise a financial stability that will probably never be lost.

Anaconda, according to officials, must still develop Andes as well as the zinc-producing ground of the Butte camp acquired last summer by purchase of the Anselmo and other ground. However, from now on its problem will be to round out the manufacturing end with zinc-oxide works, acid-phosphate plants, a brass foundry and fine-wire mill at Great Falls, thus developing a market for its large bodies of phosphate in Idaho and Montana and the sulphuric acid that it can make at Anaconda, as well as utilizing to the utmost the geographic advantage of having copper, zinc and cheap power available in the center of the West, whence Pacific Coast and trans-Mississippi enterprises can be advantageously supplied with copper wire and brass. Acquisition means no change in Anaconda's program for developing its South American Andes property. Anaconda will purchase copper from the Chile company at the market price, and the return on its investment will be in dividends from Chile profits.

## The Metal Market

Producers continue to quote 14.75 cents, delivered, for prompt copper and for deliveries extending over the next two or three months.

Sales have not been so large as they averaged toward the close of 1922, but neither have producers as much copper available. Some have been forced to decline offers at the ruling price. However, there is no scarcity of the metal, for others are able to supply up to 1,000-ton or 2,000-ton lots for any delivery from spot on. Only one producer or consumer reports any tendency to shade the 14.75-cent price where the freight rate is anywhere near normal, and this report was only a rumor.

NEW YORK METAL MARKET PRICES

| Copper | Jan. 10, 1923 Cents per Pound | Jan. 17, 1923 Cents per Pound |
|---|---|---|
| Electrolytic | 14.75 | 14.75 |
| Lead, Am. S. & R. price | 7.25 | 7.40 |
| Antimony | 6.35 | 6.35 |
| Nickel, ingot | 36.00 | 36.00 |
| Zinc, spot | 7.05 | 7.00 |
| Tin Straits | 38.87½ | 38.87½ |
| Aluminum, 98 to 99 per cent | 23.00 | 23.00 |

## Instrument Market Brightened by Growing Interest in Accurate Control

Electrical instruments generally are in good demand, according to manufacturers' representatives, although nothing spectacular marks the current trade. Well-known lines are enjoying a continuing run of orders, the business embracing a great variety of applications. Interest in the relations between power-factor and rates in industrial circles is slowly bearing fruit in the use of more and more curve-drawing apparatus, and the attempt to gain more accurate control of electric heating process work is also a factor in the instrument market.

Radio fans are buying instruments much more freely than formerly, even for lower-priced tube sets, and the demand of automobilists for attractive dashboard equipment is growing. Although many instruments are of long-standardized varieties, there does not seem to be any marked tendency to stock heavily on the part of either agents or jobbers. By maintaining close touch with the factories current needs are being comfortably met, and the outlook for the year's business is excellent.

For additional information regarding present conditions in the instrument market in fifteen important centers of the country turn to "Week in Trade" on page 191.

# The Week in Trade

**Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

BUSINESS in electrical supplies is somewhat slower than last week, a short lull following the heavy buying experienced during the last few weeks of the old year and inventory taking by the jobbers and dealers. Wholesome conditions prevail, and manufacturers expect a large amount of the season's heavy orders to be signed within the next two or three weeks. Construction of residences and commercial buildings continues at a fair rate. Increased production is reported in the iron and steel and textile industries. Orders from the central-station companies are in greater volume.

**New York.**—A stiffening in prices for wire, conduit, armored cable and loom is noted, following a slightly increased demand from the building industry. Prices of some makes of fixtures are lower. Competition in the vacuum cleaner has forced some reductions. Central-station business is somewhat improved. Some manufacturers report raw material shortages and transportation difficulties. Stocks generally are normal.

**Boston.**—The demand for electrical supplies has slightly subsided during the past week, and jobbers are making the most of the opportunity to close gaps in stock. Railroad difficulties are hampering deliveries and heavy snows and rains have retarded highway travel. Building operations in New England continue at good volume and general manufacturing shows improvement. Manufacturers of electrical machinery are seeking more skilled labor. Prices are stiffening in loom, lead-covered cable and non-indicating fuses. Quotations on fixtures are weaker in some cases owing to large stocks. Deliveries on some types of meters are now running on a four to six weeks' basis. Central stations have suffered little from storms thus far. Telephone facilities are far behind installations, and the demand for new electric lighting service is outrunning the immediate satisfaction of many applications.

**Chicago.**—Jobbers report that the start of this year's business exceeded that of 1922. Approximate estimates on the volume of increased business obtained during the year are found to vary between 20 and 30 per cent over 1921. With an increasing price trend on wire, the demand has risen. The conduit supply is still low, requiring close attention to shipments and prices. Pole dealers report a steady demand, but the freight situation is such that deliveries are uncertain. During the week one high-tension manufacturer sold three 33,000-volt substations rated at 450, 600 and 900 kva. to a Middle Western Utility. Foreign purchases have been active for the 110,000-volt air-break switching equipment. Another firm received orders for 2,300-volt indoor switching equipment for a California utility. Fuses rated at 70,000 volts are the main volume of another concern.

The demand for flatirons, according to most jobbers, is featureless. Prices remain unchanged. The call for rectifiers for storage batteries is fairly steady, being stimulated by the radio demand for charging the "A" battery. Only the largest jobbers carry this equipment, but stocks are low at the present time. Dealers declare that while their sales rate on electrical instruments for the past three months has been good, the month of January is starting with the same maintained rate.

**Atlanta.**—General conditions in the Southeast are the best for some time, and electrical jobbers and dealers are most optimistic over the prospects for the year. While prices have been reduced in a few items, the general trend is upward. Now that inventory is over orders will begin to be placed to bring stocks up to normal, and this, together with the sales campaigns that are being launched, will see the movement in all lines stimulated. One of the largest central-station companies in this section has announced an improvement and expansion program for 1923 which will call for the expenditure of $6,500,000 and other central stations are planning similar programs. Building material prices have advanced somewhat, but this is having little effect on building in Atlanta, and this year will doubtless be the biggest in its history. Cotton has reached the new high of 27.39 cents, which is having a stimulating effect throughout the territory. The increasing interest of Eastern industries in the establishment of mills in the South indicates that building materials and electrical equipment lines will receive a considerable boost before the year is over.

Christmas witnessed an unusually good volume of sales in flatirons, and the general outlook for 1923 is very bright. One of the largest jobbers is beginning a sales campaign, and increased sales are anticipated, with adequate stocks on hand to meet the demands. Prices are firm and no changes are expected for some time. Jobbers report good sales of rectifiers, particularly those jobbers concentrating on sales of radio equipment. Jobbers report a slow movement in the electrical instrument line and anticipate little interest to be displayed.

**St. Louis.**—A steady and strong demand for flatirons has existed since last summer, and as a result of a conservative policy in carrying stocks on the part of both jobbers and dealers turnovers have been good and profits very satisfactory. The increased trade before holidays reduced stocks materially below normal, but normal stocks again obtain. While competition continues keen, prices are fairly well stabilized. The increased use of radio tubes requiring storage batteries has greatly stimulated the sale of small low-priced rectifiers. There is some demand for larger machines for electric automobile charging and for moving-picture machines, but neither of these fields may be classed as active. On the whole, stocks are in suitable condition. There is a tendency on the part of industrial plants to consider portable instruments as somewhat of a luxury, and sales during the recent period of business quietude have been dull. Some improvement is found now, due to occasional purchases for the purpose of checking power consumption and factory efficiency. Recording-chart instruments are increasingly popular for this purpose. Switchboard instruments are experiencing fairly good sales because of expansion on the part of central stations and the smaller municipal plants. Slightly better sales are found in the coal districts since the strike settlement.

**Cleveland.**—The week's business has been slow. Firm prices prevail and demand generally is steady. Conservatism has been the predominant note. The most spectacular feature was an active movement in small motors. Poles and high-tension equipment orders were somewhat lower this week, new construction having been retarded by unfavorable weather conditions. The same weather conditions were advantageous to heater sales, however, jobbers reporting their movement as brisk. Demand for conduit continues to prevent overstocks, while the supply of wire is improved.

**New Orleans.**—Because of the demand of radio users, business in rectifiers has increased conspicuously during the last month or six weeks. Business in electrical instruments is slow. There is never much demand, except sporadically, when some institution or school lays in a large supply. The flatiron business is sluggish.

**St. Paul-Minneapolis.**—The market for flatirons is slowing up slightly after the holidays, but the steady undercurrent of demand for this staple article is not materially affected. Dealers report a flood of "bargain" irons and a good deal of price cutting by department stores, mostly on inferior goods. The inclination here is toward a decline in prices. Many dealers are cutting slightly to offset the department-store raid. Small-size rectifiers are keeping pace with the radio sales, being in good demand, while the larger sizes are sluggish. The supply of both, particularly the small sizes, is low. Instruments are steady here, but since central-station work and any other switchboard work is slow, it doesn't seem reasonable that instruments could be anything else.

# Demand, Supply and Price Trend of Eighteen Commodities as Sold in Fifteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Conduit Boxes, Cooking Appliances
and Signal Apparatus

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Flatirons | Rectifiers | Instruments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **New York** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Sdy. | Slow | Slow | Slow | Slow | Slow | Sdy. | Spy. | Sdy. | Sdy. | Act | Sdy. | Sdy. | Slow | Sdy. | Sdy. |
| Supply | Nml. | Hi. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Low | Low | Nml. |
| Price trend | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Firm | Firm | Firm | Firm | Inc. | Firm | Dec. | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml | Low | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Boston** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slow | Slow | Slow | Slow | Slow | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Low | Hi. | Nml. | Nml. | Nml. | Low |
| Price trend | Firm | Inc. | Inc. | Firm | Firm | Firm | Dec. | Firm | Inc. | Firm | Frm. | Firm | Firm | Dec. | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Slow | Act. | Act. | Act. | Act. | Slow | Act. | Act. | Slow |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Nml. | Firm | Inc. | Inc. | Firm | Firm | Dec. | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Inc. | Firm | Firm | Dec. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Slow | Slow | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Slow | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | |
| Demand | Slow | Sdy. | Slow | Act. | Act. | Act. | Slow | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Slow |
| Supply | Low | Nml. | Low | Low | Low | Low | Nml. | Low | Nml. | Nml. | Hi. | Low | Nml. | Nml. | Low | Nml. | Nlm. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc.' | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Paul-Minneapolis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Act. | Slow | Slow | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Low | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Hi. | Nml. | Nml. | Low | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Slow | Act. | Act. | Slow | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Low | Nml. | Low | Low | Low | Hi. | Nml. | Low | Nml. | Hi. | Hi. | Nml. | Nml. | Low | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Inc | Inc. | Firm | Firm | Firm | Firm | Nml. | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Slow | Act. | Act. | Act. | Sdy. | Slow | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm |

San Francisco.—Jobbers' annual inventories disclose far larger stocks than in 1922, but the vastly increased construction business with its larger individual orders and greater rate of turnover demands such increased stocks, and they are not viewed with any apprehension. Collections have steadily lengthened throughout the past year until they now average just beyond sixty days. Credit managers feel that this rate must be improved and are ready to take measures for vigorous handling. All customers are required to better their own collections, to scrutinize carefully their own credit risks and generally to put their own financial houses in order. The number of failures and of seriously overdue accounts has more than doubled since last year and will run to a higher proportion of sales volume, even considering the 1922 increase in business. New accounts are very cautiously handled and personally followed until they have been proved satisfactory. Prices on such wiring staples as rubber-covered wire, tape and lamp cord have increased about 10 per cent.

Denver.—January business continues satisfactory. Local supply of electrical material and equipment is seriously curtailed by a one-hundred-thousand-dollar fire in a large warehouse. Fortunately the annual inventory had reduced stocks to a minimum. Manufacturers with warehouse stock and other jobbers are co-operating with the company suffering the loss in filling orders and caring for business until emergency stock can be obtained. Lack of winter weather has allowed continuance of the building program. Local permits exceed those of last month for same period. Credits have been tightened owing to slow collections. In the house-wiring business contractors in severe competition are allowing work, obtained on unreasonably low bids to remain unsettled.

Portland-Seattle.—Electrical jobbers report reasonably good business for this time of year. Sales are less than before the holidays but better than a year ago. Dealers are experiencing a very marked decrease in sales, as are contractors on certain classes of work. A number of large industrial installations are under construction at present, and the prospects are very good for the coming season. Farm plants are not moving rapidly, but inquiries are becoming active again. An advance of 5 per cent in the price of washing machines is reported and copper wire also has advanced about 5 per cent since the first of the year. Construction for 1922 was the greatest in the history of the Northwest.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

### Bosch Business Increasing

The American Bosch Magneto Corporation's production is running 70 per cent ahead of a year ago and is approaching normal, according to President Arthur T. Murray, who reports an operating force of 1,600 at the opening of the year. Prospects for 1923 he regards as excellent. A production of $10,000,000 to $12,000,000 is forecast at the main factory in Springfield, and $5,000,000 to $6,000,000 at the Gray & Davis plant in Cambridge.

### G. E. Conference at Pittsfield

Members of the newly organized merchandising department of the General Electric Company had a three days' conference in Pittsfield, Mass., recently, at which electric fans formed the chief topic of discussion. Experts on the manufacture and merchandising of fans were present from all parts of the country. J. O. Weathersby was toastmaster at a banquet which concluded the sessions, and R. H. Heaney, head of the merchandising department, and C. C. Chesney, manager of the Pittsfield works, were among the speakers.

### Chicago Branch Improves Store

The Manhattan Electrical Supply Company, 112-114 South Wells Street, Chicago, has changed and regrouped its internal store departmental locations with a view of improving the handling of local business. The offices formerly on the first and fourth floors were placed on the second floor, which gave the first floor more room for merchandise display. The entire first floor has also been redecorated and refinished, with the addition of new showcases and lighting fixtures.

For improving the firm's distribution in the Middle West the following salesmen were added the first of the year: Carl Mack, Oshkosh, Wis.; Charles Stegmaier, Cleveland, Ohio; Vincent Lonergon, Milwaukee, Wis.; Joe Hughes, Kokomo, Ind., and Robert Burns, Indianapolis.

### Northern Engineering Works Changes in Addresses

The Northern Engineering Works, electric crane and hoist builders of Detroit, announce changes in addresses of their local sales offices as follows: New York City, 30 Church Street, room 623, in charge of H. C. Rood; Philadelphia, 51 Estey Building, in charge of John H. Bricker; Chicago, 53 West Jackson Boulevard, room 630 Monadnock Building, in charge of M. H. Haeger of the Abell-Howe Company, and St. Louis, 606 Pontiac Building, in charge of J. S. Davidson.

### Birtman Electric Holds Sales Conference

A ten-day executive sales conference was held at the Edgewater Beach Hotel, Chicago, starting Jan. 2, by the Birtman Electric Company, 640 West Lake Street, Chicago. The purpose of this conference with the ten newly appointed divisional sales managers was to work over and adopt plans for the distribution of the "Magnetic house cleaner," a product of eighteen years of development.

Ten divisional offices will serve as headquarters for 110 branch offices, whence will radiate 3,000 sales engineers. Of these 110 district managers thirty have already been appointed. The ten divisional sales managers are as follows: Boston, F. J. Caldwell; New York, J. K. Tyner; Washington, C. H. Magee; Detroit, B. K. Sheldon; Chicago, W. R. Noxon; Minneapolis, V. V. Corbin; Seattle, Ralph Wilder; San Francisco, H. G. Gute; Dallas, F. C. Roeggl; Kansas City, E. V. Swanstron.

The organization has for fifteen years been engaged in manufacturing housecleaning devices, fractional-horsepower motors and electrotherapeutical equipment. The manufacturing floor space of 55,000 sq. ft. will make possible the production of a thousand cleaners a day. The conference terminated by a banquet at the University Club on Jan. 11.

### Gibb Instrument Company Is to Make and Sell Pabst Products

The Gibb Instrument Company, Bay City, Mich., has taken over, under exclusive license, the manufacture and sale of the automatic and semi-automatic electric arc-welding machines developed and heretofore manufactured by the Fred Pabst Company, Milwaukee, under its various letters patent, and has contracted to act as selling agent for the Pabst line of patented covered electrodes. The Fred Pabst Company has spent more than two years in the development of this line of equipment, and the field of application is said to be very wide, embracing the welding of tanks, range boilers, bells, drums and tubing. The Gibb Instrument Company has announced its intention to encompass the entire range of electric welding equipment, and this contract marks a long step in that direction.

### Westinghouse Secures Extensive New Sales Field

The Westinghouse Electric and Manufacturing Company has concluded an agreement with the Metropolitan-Vickers Electric Company, Ltd., which provides the opening of much foreign territory for independent trade for the Westinghouse company, which can now enter New Zealand, Australia, South Africa and India to book new business directly.

Under the old agreement of 1919, superseded by the present agreement, Westinghouse could not book business in the above territories as the field was opened only to Metropolitan-Vickers, who manufactured all their capacity permitted, turning the overflow over to Westinghouse.

Westinghouse has outlined an extensive selling campaign for the territory newly opened, and some of the best salesmen are now on their way to enter negotiations for available business. Additional men will be sent in a few days.

The significance of the new agreement is that Westinghouse, through its extensive sales organization, will be able to compete more successfully for new business in this territory and at the same time will receive the full manufacturer's profit on all orders booked.

### Kerite Increases Capital

The Kerite Insulated Wire & Cable Company, Seymour, Conn., has filed a certificate with the Secretary of State adding $812,000 to its capital stock. The addition calls for 8,120 shares of "B" stock.

### Piedmont Plans New Building

The Piedmont Electric Company, Asheville, N. C., is having plans made for the erection of a five story building, 44 ft. x 100 ft., for its own use. It will cost about $50,000 and will be designed to house one of the most complete electrical establishments in the South. The firm has been in operation in Asheville since 1902 and has had a branch in Greensboro three years.

### Louis Allis Sales Conference

The Louis Allis Company of Milwaukee, manufacturer of motors, held a general conference of its sales staff at the plant in Milwaukee, Dec. 11 to 14, at which were present the sales engineers and distributors from all the territories in the United States and Canada.

In addition to the discussion of general sales problems, special analysis and study was made of a number of interesting new motor applications which the company has recently been making, and the meeting was addressed by various representatives of manufacturers of control apparatus. The conference concluded with a dinner to the entire staff.

## Ohio Electric and Controller Appoints Alabama Agent

The Ohio Electric and Controller Company, 5900 Maurice Avenue, Cleveland, announces the appointment of the Southern Industrial Engineering Company, Inc., American Trust Building, Birmingham, Ala., as its agent for the sale of "Ohio" magnets in Alabama.

This company also announces the opening of an office in St. Louis. Thomas E. Beasley will be district sales manager in charge of the motor and magnet sales in the St. Louis district.

## New Jobbing Firm Opens in Appleton, Wis.

A new corporation to be called the Langstadt Electrical Company has opened temporary quarters in Appleton, Wis. Organizers of the new company are A. C. Langstadt, E. A. Killoren and A. A. Schneider. Application will be made to the Railroad Commission for permission to incorporate for $100,000, with the three men as part owners. The concern will do a general electrical business, including contracting, jobbing and retailing.

Mr. Langstadt formerly was president of the Langstadt-Meyer Company and one of the founders of that firm thirty years ago. He disposed of his interest recently to August Meyer and will become head of the new company and its general manager. Mr. Killoren formerly was salesman for Lanstadt-Meyer Company, and will be sales manager for the new company. Mr. Schneider, who served the Langstadt-Meyer firm as foreman of construction for twenty-three years, will act in a like capacity for the new firm.

## General Electric Orders Increase 50 per Cent

Orders received by the General Electric Company for the three months ended Dec. 31, 1922, totaled $66,568,333, an increase of 50 per cent over the corresponding three months of 1921. New business booked in twelve months of 1922 totaled $242,739,527 as compared with $179,721,680 for 1921, an increase of 35 per cent.

**The Flexlume Sign Company**, 74 Kail Street, Buffalo, manufacturer of metal electric signs, etc., is planning the erection of a new factory at Military Road and Skillen Street, to cost $45,000.

**The Acheson Graphite Company**, Buffalo Avenue, Niagara Falls, New York, manufacturer of electrodes, electrical products, etc., plans the erection of a new one-story addition.

**The C. J. Litscher Electric Company**, 41 Market Avenue, Grand Rapids, Mich., manufacturer of electrical products, has arranged plans for rebuilding its three-story factory recently destroyed by fire. The new structure is estimated to cost $150,000, with machinery.

**The Trumbull-Vanderpoel Electric Manufacturing Company**, Bantam, Conn., has increased its capital stock from $300,000 to $400,000.

**The Colonial Electrical Division of the National Lamp Works** has opened a branch office at 9 South Clinton Street which is in charge of Charles A. Nash, former president and general manager of the Nash-Odell Company.

**The Perfection Specialties Company**, Elkhart Lake, Wis., has been organized by George C. Trotter, E. C. Trotter and William K. Burk, to manufacture radio condensers and other apparatus and devices for wireless communication. This company will operate in part of the plant of the Lake Laboratories Company, the original enterprise of George C. Trotter, which manufactures electric phonograph motors. Some additional tool-room and floor equipment is being purchased for this company.

**The Federal Lighting Fixture Manufacturing Corporation**, 35 North Ninth Street, Philadelphia, has leased two floors in the building at 33 North Eleventh Street in order to increase its floor space.

**The Combustion Engineering Corporation**, 43 Broad Street, New York City, announces the acquisition of the Quinn Oil Burner & Torch Company. W. R. Quinn, former president of the Quinn Oil Burner & Torch Company, is now associated with the Combustion Engineering Corporation as its manager of the fuel-oil department.

**The Galvin Electric Manufacturing Company**, manufacturers of electric motors and apparatus, announced on Jan. 1 its removal to new and larger quarters at 3314 South Broadway, St. Louis.

**The Gibraltar Battery Manufacturing Company**, Tenth and Lancaster Avenues, Dallas, Tex., has been incorporated to manufacture electric storage batteries and equipment and is in the market for equipment, including small motors and a large potential charging outfit. The company is in the manufacturing end only and will sell to dealers. A. Swanson is president of the company.

**The Wissler Instrument Company**, 601 North Broadway, St. Louis, manufacturer of engineering instruments, has acquired a four-story building, 65 ft. x 100 ft., at 15 Pine Street, for a new plant. A. Wissler is president of the company.

**The Watkins Manufacturing Company**, Wichita, Kan., manufacturer of wireless equipment, has plans for a two-story factory, 50 ft. x 140 ft., at 208 North Waco Street, to cost about $50,000.

**The Uehling Instrument Company**, Paterson, N. J., has appointed the Mine & Smelter Supply Company, El Paso, Tex. as its exclusive representative for $CO_2$ recording equipment and other power plant recording instruments in Arizona, New Mexico and west Texas, as well as in the Republic of Mexico north of Mexico City.

## Western Electric Company Announces Important Sales Appointments

The Western Electric Company announces important organization changes, which were effective Jan. 15, as follows:

F. A. Ketcham has been appointed general manager of the supply department. For the past four years Mr. Ketcham has been general sales manager.

G. E. Cullinan assumes the position of general sales manager. Mr. Cullinan entered the employ of the company upon his graduation from Williams College in 1901 and for several years was connected with the New York house. He went to St. Louis in 1907 and was manager there from 1909 to 1918, when he went to Chicago as central district manager.

L. M. Dunn, who for the past three years has been manager of the Eastern district, which includes the New York and the New England territory, has been appointed general merchandise manager of the general manager's staff.

W. J. Drury has been made manager of the Eastern district to fill the vacancy created by Mr. Dunn. Mr. Drury has been sales manager of the New York house for the past three years and is succeeded in that capacity by J. F. Davis, who has been sales manager of the Boston branch for the same period.

T. E. Burger has been made sales manager at Boston. Mr. Burger was for thirteen years connected with the Los Angeles and San Francisco organizations, being sales manager of the former. More recently he has been on the staff of the Society for Electrical Development.

W. P. Hoagland has been appointed central district manager in charge of the Chicago and Minneapolis branch houses. For the past three years Mr. Hoagland has been sales manager at Chicago.

J. H. Gleason takes the position of Chicago sales manager. Mr. Gleason has been power-apparatus sales manager at Chicago.

H. L. Grant, who for the past three years has been general appliance sales manager, located at New York, has been appointed Erie district manager, a new grouping of the distributing houses at Cleveland, Pittsburgh, Detroit and Cincinnati. Mr. Grant's headquarters will be at Cleveland. A. M. Collins continues as manager of the Cleveland house.

It is interesting to note that all of these organization changes are in the nature of promotions. This is in line with the Western Electric Company's consistent policy of advancing men who have made good in their previous capacities.

## Foreign Trade Notes

PERUVIAN WATER-POWER CONCESSIONS.—The transfer of water rights or water-power concessions in Peru, according to *Commerce Reports*, must obtain approval within sixty days of the Bureau of Waters and Irrigation. Otherwise the transfer will not be recognized or registered.

CHANGES MADE IN SPANISH WATER-POWER LAW.—Certain changes have been made in the hydro-electric law of Spain, *Commerce Reports* states, by a decree of Nov. 10, 1922. The duration of concessions in general shall be seventy-five instead of sixty-five years, counting from the date of the partial or total exploitation of the concession, with exceptions in certain instances. For such exceptions the period of franchise will be ninety-nine years. Upon the expiration of a franchise the whole property will revert without cost or lien of any kind to the state and will become public property. Special exceptions as regards reversion of properties to the state are made in the case of projects of less than 200 hp. used by private industry.

THE YBBS (AUSTRIA) HYDRO-ELECTRIC PROJECT TO BE FINANCED BY TAX.—A municipal tax of 1½ per cent on gas consumption and 4 per cent on electric light, *Commerce Reports* states, was announced recently in the Austrian papers for the purpose of financing the electrification on the Ybbs, undertaken by the commune of Vienna. This tax is expected to yield approximately 1,750,000 crowns a month and to equal the sum expended on the Ybbs project monthly for wages and material.

PROPOSED ELECTRIC RAILWAY FOR JAPAN.—Plans are under way by the Toho Electric Power Company, according to *Commerce Reports*, to organize a subsidiary company, to be known as the Sangu Electric Railway, which will be supplied with hydro-electric power generated in the vicinity of Yokkaichi. The proposed railway is to furnish more adequate transportation between Nagoya and Uji-Yamada and to the grand shrines of Ise at the latter place.

CONCESSION ASKED FOR HYDRO-ELECTRIC PLANT IN ARGENTINA.—Application has been made to the provincial government, *Commerce Reports* states, by Segundo Calderon for a concession covering the construction of a hydro-electric plant to supply electricity in the city of Rio Cuarto, Argentina, and surrounding territory.

ELECTRIFICATION OF THE HORSE-CAR LINE IN MONTEVIDEO PROPOSED.—A bill authorizing the executive to issue mortgage bonds to the amount of 3,500,000 pesos for the electrification of the northern tramway (the government-owned horse-car line) in Montevideo, according to *Commerce Reports*, has been favorably reported upon by the committee of the chamber to which it was referred. Before it becomes a law the bill must come up for a vote in the Chamber.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An exclusive agency is desired in Denmark (No. 5,001) for complete radio sets and parts thereof.

An agency is desired in Norway (No. 5,017) for electric wiring devices such as switches and sockets, all kinds of marine fittings, all kinds of unmounted knife switches, and wireless telephone apparatus.

An agency is desired in Italy (No. 5,026) for electric bulbs and electric irons.

An agency is desired in Switzerland (No. 5,045) for electric conveying trucks for factories.

An agency is desired in Poland (No. 5,058) for alternating-current motors, three-phase, 50-cycle, 120/210 volts and 220/380 volts; direct-current motors, 110/220 volts; installation material, electrical apparatus, ammeters, voltmeters, wattmeters, etc.

DEMAND IN BOLIVIA FOR ELECTRIC HEATERS.—There is a good demand in Bolivia, *Commerce Reports* states, for electric heating apparatus, especially among the foreign colony in La Paz.

TRANSFORMERS FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by State Electricity Commission of Victoria, Melbourne, Australia, until March 31 for transformers for the Morwell power scheme, specification (No. 23/8.)

ELECTRIFICATION OF THE TRANS-PYRENEAN (SPAIN) RAILWAY.—The Ministro de Fomento has been authorized to call for tenders for equipping (for electrical operation) the Ripoll-Puigcerda Railway, which extends across the Pyrenees. Particulars may be obtained from Señor Ingeniero Jefe de la Segunda Division de Ferrocarriles, Calle de Balmes, Barcelona, Spain.

## New Apparatus and Publications

MOTOR FOR TYPESETTING MACHINE.—An offset motor for use with typesetting machines has been brought out by the Cushman Electric Company, Concord, N. H.

TOOL BAG.—A tool bag for electricians, contractors, linemen and others engaged in the electrical industry has been brought out by A. Bruns & Sons, 50 Ralph Avenue, Brooklyn, N. Y.

INSULATED-WIRE STRIPPER.—A device for stripping the insulation from ends of wire and cord has been developed by Wallace G. Grossman, 79 Walker Street, New York City.

ELECTRIC COOKER.—The Excel Electric Company, Muncie, Ind., has developed an electric cooker which operates on 110 volts and 660 watts.

HEADLIGHT FOR MINE SERVICE.—A locomotive incandescent headlight for mine service has been developed by the Jeffrey Manufacturing Company, Columbus, Ohio.

SHADOW SHIELD.—A shadow shield for indirect and semi-direct lighting units has been developed by the Macbeth-Evans Glass Company, Pittsburgh, Pa.

RECORDING INSTRUMENTS.—The Uehling Instrument Company, Paterson, N. J., is distributing a twelve-page folder in which it describes the "Uehling" combined barometer and vacuum recorder for low-pressure turbine and condensing plants.

WELDING AND CUTTING EQUIPMENT.—The Alexander Milburn Company, 1416-1428 West Baltimore Street, Baltimore, is distributing a new catalog covering the "Milburn" line of welding and cutting equipment.

ELECTRIC MOTOR.—Bulletin No. 406 issued by the Louis Allis Company, Milwaukee, describes the "L-A" type H. D. (heavy-duty) motor.

RADIO RECEIVING SET.—The Machen Radio Manufacturing Company, 4639 East Thompson Street, Philadelphia, has brought out a new radio receiving set, known as "Machen Clearad," designed to operate on radio-frequency lines.

RECEPTACLES.—A new line of standard receptacles, made single and duplex, known as the "Gilto" type, has been developed by the Machen Electric Manufacturing Company, 4639 East Thompson Street, Philadelphia. These receptacles are also in its "No-lus-Plug" type.

STEAM TURBINES.—The De Laval Steam Turbine Company, Trenton, N. J., is distributing two leaflets, one describing and illustrating the "De Laval" equipment in the Crown Willamette paper mill at West Linn, Ore., and the other the "De Laval" equipment for the Marquette Cement Manufacturing Company, La Salle, Ill.

## New Incorporations

THE BERTRAM (TEX.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $9,000 by P. M. Rodgers, R. J. Bostic and M. B. Rodgers.

THE TEXAS ELECTRIC & ICE COMPANY, San Antonio, Tex., has been chartered by R. W. Morrison, A. C. Prucha and H. C. Loehr. The company is capitalized at $90,000.

THE ST. ALBANS (W. VA.) ELECTRIC & LIGHT COMPANY has been incorporated with a capital stock of $100,000. The incorporators are J. E. Campbell, W. G. Matthews and G. F. Skidmore.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

WESTBROOK, ME.—The Public Utilities Commission has granted the Mallison Power Company permission to issue $125,000 in bonds. Of the proceeds $45,000 will be used in connection with the construction of a new power station at Mallison. The cost of new construction work contemplated is estimated at between $80,000 and $85,000.

SUNAPEE, N. H.—The Lake Sunapee Power Company has prepared plans for the construction of its proposed power plant at Sunapee Harbor, to cost about $300,000.

WORCESTER, MASS.—The installation of an ornamental lighting system on Southbridge Street from Washburn to Cambridge Street is under consideration.

NORWICH, CONN.—The Uncas Paperboard Company, recently organized with a capital of $1,500,000, to operate at the former mill of the Ironsides Board Corporation, contemplates the installation of electric power equipment in connection with extensions and improvements.

## Middle Atlantic States

ALBANY, N. Y.—Steps have been taken by a committee of property owners for a new lighting system on the Albany-Troy road. A. E. Leu, Albany, is chairman of the committee.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company contemplates the erection of an electric transmission line from here to Sayre, Pa., to cost about $225,000.

JAMESTOWN, N. Y.—The Jamestown Chair Company will build a one-story power house, 25 ft. x 75 ft., at its local plant.

NEW YORK, N. Y.—Bids will be received by the board of purchase of the city of New York, Room 526, Municipal Building, until Jan. 23 for furnishing incandescent lamps to the Department of Water Supply, Gas and Electricity. Grover A. Whalen is chairman of commission.

NEW YORK, N. Y.—The Fulton Ice Company, 18 East Forty-first Street, will install electric power equipment at its proposed ice-manufacturing plant at 138-40 Cherry Street, to cost about $100,000. Ophuls & Hill, 112 West Forty-second Street, are engineers.

OWEGO, N. Y.—The Owego Light & Power Company has contracted with the Binghamton Light, Heat & Power Company, Binghamton, for electricity from the Binghamton plant for a period of ten years. The Binghamton company has also made arrangements with the Binghamton Railway Company for an exchange of power, and transmission lines will be built for this purpose.

SYRACUSE, N. Y.—The erection of a hospital building, power house and laundry building on Prospect Avenue for the St. Joseph's Hospital, to cost about $500,000, is under consideration.

THIELLS, N. Y.—Bids will be received by Mortimer B. Patterson, president of board of managers of Letchworth Village, 7 Wall Street, New York City, until Feb. 1, for construction, including heating, sanitary and electrical work, of attendants' home, assembly hall and industrial building (girls' group) at Letchworth Village, Thiells. L. F. Pilcher, Capitol, Albany, is state architect.

NEWARK, N. J.—Bids will be received by Charles P. Gillen, Director of Parks and Public Property, City Hall, until Jan. 24, for electric and mechanical equipment for the new Center Market, as follows: (a) Electric generating plant; (b) boiler plant and steam piping; (c) market equipment; (d) refrigerating plant; (e) elevator equipment; (f) ventilating apparatus. George B. Hopper and Frank Grad, 116 Market Street, are associated architects.

TRENTON JUNCTION, N. J.—Bids will be received by the board of trustees, New Jersey School for the Deaf, until Jan. 31, for the construction of a transformer house

at the institution and the installation of electrical work in the entire group of buildings now in course of construction. Arnold H. Moses, Temple Building, 415 Market Street, Camden, is architect in charge.

WASHINGTON, N. J.—The New Jersey Power & Light Company has acquired the system of the Washington Electric Company and will extend its transmission lines for local service. The plant will be remodeled for a transformer station and extensions made to the local distributing system.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company is planning to erect a 66,000-volt tower transmission line from Milton to Lockhaven. Electricity will be supplied to cities and towns along the line.

BLOSSBURG, PA. — Gannett, Seeley & Fleming, Inc., engineers, 204 Locust Street, Harrisburg, have organized the Northern Power Company with a capital stock of $500,000, to take over and merge the Blossburg Electric Light & Power Company and sixteen other electric companies operating in this district. The new company will construct a generating plant near Blossburg, to cost about $150,000.

EASTON, PA.—Plans are being prepared by Lockwood, Greene & Company, engineers, 101 Park Avenue, New York City, for a four-story, 80-ft. by 100-ft. factory and a 250-hp. power plant for the Binnery & Smith Company.

EBENSBURG, PA. — The Penn Central Light & Power Company, Altoona, contemplates extensions and improvements to the system of the Ebensburg Light & Power Company, recently acquired.

INDIANA, PA. — The Pine Township Power Company and the Green Township Power Company are being organized to build and operate transmission systems in Pine and Green Townships. James Collins Jones, Bullitt Building, Philadelphia, represents the companies.

JOHNSTOWN, PA. — The Penn Public Service Corporation is planning to erect a number of transmission lines.

JOHNSTOWN, PA. — The Penn Public Service Corporation has acquired the systems of the Warren, DuBois and Jefferson Electric Light & Power companies, operating in Warren, Jefferson, Clearfield and Indiana Counties. The properties will be merged and extended, including the construction of additional substations. The Penn company contemplates the construction of a hydro-electric plant on the Youghiogheny River.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 30, for electric storage batteries for the local naval aircraft factory, in lots of 6, 25, 50, 100 and 200. (Schedule 421.)

PHILADELPHIA, PA.—The Philadelphia & Reading Coal & Iron Company, Reading Terminal, is planning to build a series of steam-driven electric power plants for its coal-mining properties and shops at Pottsville, to replace the present steam and compressed-air service. The plans call for the erection of at least five power stations and the merging of the existing power plants at Good Springs and Locust Point with the system. C. B. Hadesty is general manager.

READING, PA.—The Metropolitan Edison Company will increase the capacity of its power plant at West Reading from 33,000 kw. to 70,000 kw. Plans are also being prepared for the installation of hydro-electric equipment at the station of the York Haven (Pa.) Water & Power Company, recently acquired. New transmission lines will be built.

READING, PA.—The Reading Coal & Iron Company plans to equip all its mining properties in Northumberland and Schuylkill Counties with electrically operated machinery. The project will include the construction of five or six plants, to cost about $500,000.

WILLIAMSPORT, PA.—Extensions and improvements, it is said, will be made to the plant of the Lycoming Edison Company, to cost about $500,000.

SHELBYVILLE, DEL. — The Delaware Light & Ice Company contemplates rebuilding its local electric light and ice-manufacturing plant, recently destroyed by fire, with loss of about $75,000.

BALTIMORE, MD.—The Baltimore Ice Manufacturing Company, Lewis and Lexington Streets, will install electric power equipment at its proposed ice-manufacturing plant, to cost about $125,000.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company contemplates placing its wires underground on the Falls Road, from the old to the new city line. Underground conduits will be laid from the city line to the power house in Mount Washington.

BALTIMORE, MD.—A power house will be built in connection with a new ward building at the Baltimore Children's Hospital, Forty-first Street and Green Spring Avenue. William G. Beecher and Smith & May, Calvert Building, are associated architects.

CLAREMONT, VA.—The H. J. Arrington Company contemplates purchasing a complete electric light and power plant for commercial service in a small community.

WASHINGTON, D. C. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department until Jan. 23 for electric wire and cable for eastern navy yards (Schedule 416).

## North Central States

BATTLE CREEK, MICH.—Bids will be received by the director United States Veterans' Bureau, office of the Quartermaster General, 2306 Munitions Building, Washington, D. C., until Feb. 16 for construction of a 500-bed Neuro-Psychiatric Hospital to be erected at Camp Custer, Battle Creek. The work will include the construction of about thirty buildings complete with sewer, water, heating and lighting systems, etc.

DETROIT, MICH. — The Detroit Edison Company has issued $1,500,000 in bonds, part of the proceeds to be used for extensions and improvements. Plans are being prepared for an addition to the substation at Milan, to cost about $25,000.

NORTH FORUM, MICH. — The State Prison Board, Jackson, contemplates the installation of a power house in connection with a new state prison here, to cost about $3,000,000. Smith, Hinchman & Grylls, Marquette Building, Detroit, are architects.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until Jan. 26 for station transformers.

CLEVELAND, OHIO.—Bids will be received at the commissioner of purchases and supplies, City Hall, until Jan. 26 for furnishing coal and ash handling equipment, radial brick chimney, feed-water-heater shells and equipment for treating boiler make-up water for the Fairmount pumping station, division of water.

INDIANAPOLIS, IND.—The Terre Haute, Indianapolis & Eastern Traction Company has been granted permission to construct an addition to its steam-operated electric generating plant on West Tenth Street, including new transmission and distributing lines, substations, etc., to cost eventually about $6,000,000.

CHICAGO, ILL. — The Commonwealth Edison Company is preparing plans for a 320,000-kw. power plant at Crawford Avenue and Thirty-fifth Street, to cost about $5,000,000. Graham, Anderson, Probst & White, 80 East Jackson Boulevard, are architects.

SHELBYVILLE, ILL. — Bids will be received by the City Council until Feb. 5 for the installation of a municipal electric light and power plant. Plans and specifications may be obtained from the W. A. Fuller Company, Railway Exchange Building, St. Louis.

BEAR CREEK, WIS.—Electricity will be supplied in Bear Creek to farmers along the Bear Creek Road and in the towns of Maple Creek, Lebanon, Deer Creek and a portion of Black by the Star Electric Heat & Power Company, recently organized as a subsidiary of the Wisconsin Traction, Light, Heat & Power Company. Power to operate the system will be purchased from the Wisconsin Traction, Light, Heat & Power Company, Appleton. W. R. Cornwell, New London, will be manager of the new company.

DELAVAN, WIS.—The Southern Wisconsin Electric Company is planning to change its local system from three-wire, three-phase, 2,300 volts, to four wire, three-phase, 2,300 volts. The cost is estimated at about $12,000.

GRANTSBURG, WIS. — The Burnett County Light & Power Company has petitioned the Railroad Commission for authority to issue $20,000 in notes, the proceeds to be used for extensions to its plant and system during the coming year.

LANCASTER, WIS. — The Interstate Power Company will soon begin work on the reconstruction of its transmission line from Postville to Waukon. The voltage will be changed from 13,200 to 33,000.

MANITOWOC, WIS. — Plans are under consideration by the Public Utilities Commission for extensions to the municipal electric lighting and waterworks systems. The installation of a new generator and automatic stokers, etc., at the electric plant is contemplated.

STURGEON BAY, WIS.—The installation of an ornamental lighting system on Cedar Street in the business district, to cost about $9,000, has been approved by the City Council.

ST. PAUL, MINN.—The Ford Motor Company, Highland Park, Mich., has applied to the Federal Power Commission for permission to build a hydro-electric power plant on the Mississippi River, to be used in connection with a proposed assembling works to cost about $2,500,000. In the event of refusal a steam-driven generating plant will be built.

BRANSON, MO. — The Empire District Electric Company, Joplin, has completed plans for the initial unit of its proposed local hydro-electric power plant, to cost about $2,500,000. The entire project will involve an expenditure of about $10,000,000.

OSCEOLA, MO.—Plans are being prepared by Arthur L. Mullergren, Gates Building, Kansas City, consulting engineer, for the construction of a hydro-electric plant in Osceola, to cost about $450,000. It will be operated by a company now being organized by E. E. Peake, Kansas City.

CHESTER, NEB.—Plans are being prepared for the installation of an electric distributing system in Chester. The Prince-Nixon Engineering Company, Peters Trust Building, Omaha, is engineer.

## Southern States

MORGANTON, N. C. — The Drexel (N. C.) Furniture Company will install a power house in connection with its proposed local factory, to consist of four two-story buildings, 75 ft. x 250 ft. each.

RALEIGH, N. C.—The Carolina Power & Light Company contemplates the erection of a 60,000-volt substation near the State Hospital in Raleigh.

TUXEDO, N. C. — The Manufacturers' Power Company is preparing plans for the construction of a local hydro-electric plant, with ultimate capacity of 70,000 hp., to cost about $4,000,000.

VANCEBORO, N. C. — Contract, it is understood, has been placed for the installation of a municipal electric light plant.

WILMINGTON, N. C. — The Tidewater Power Company contemplates erecting a transmission line from Wilmington to Warsaw, and from Warsaw to Clinton to supply electricity in those towns and intermediate points. The Tidewater company will sell power in bulk only, and it is expected that companies will be organized in each town to distribute electricity locally. C. W. Petty of Clinton has entered into a contract with the company for energy to be distributed in that town.

ATLANTA, GA.—The Georgia Railway & Power Company is arranging an expenditure of $6,500,000 for extensions and improvements in 1923, to include a 22,000-kw. hydro-electric plant at Tallulah Lake, to cost $1,000,000; completion of the power plant at Tugalo; transmission line from Atlanta to Tallulah, Commerce, Winde and Noreros, to cost $750,000; substations and line extensions at Atlanta, to cost about $500,000, and extensions and improvements to the traction system and gas plants to cost $2,500,000.

BONIFAY, FLA. — The Council has awarded a contract to the Houston Power Company, Dothan, Ala., to supply electricity for lamps and motors in Bonifay. The service will be supplied from the plant at Newton, Ala.

KNOXVILLE, TENN. — The Tennessee Lumber Manufacturing Company will build a power house at its proposed local plant.

CARSON, LA.—The Delta Land & Timber Company will install a substation in connection with the rebuilding of its local plant, recently destroyed by fire, causing a loss of about $150,000.

HOUMA, LA.—The contract for the construction of a municipal electric plant, waterworks system and filtration plant has been awarded to the Merkel Machinery & Contracting Company, Kansas City, Mo. The cost is estimated at $250,000.

MONROE, LA. — The Southern Carbon Company will build power houses at its proposed plants at Swartz, Spyker and Fowler, La., to cost about $1,500,000.

MONROE, LA.—The Bell Manufacturing Company contemplates the installation of a power house in connection with extensions to its plant.

ARDMORE, OKLA. — The Consumers' Light & Power Company will soon take bids for a power plant, to cost about $100,000. The W. A. Baehr Corporation, People's Gas Building, Chicago, Ill., is consulting engineer.

PAUL'S VALLEY, OKLA.—Bonds to the amount of $53,000 have been voted for the installation of a municipal electric plant. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

CUERO, TEX. — The City Council has granted the Texas Central Power Company permission to erect a new transmission line from its power plant on the Guadalupe River to Cuero.

FORT WORTH, TEX. — Bonds to the amount of $250,000 have been voted for extensions to the municipal electric light and power system.

PORT ARTHUR, TEX.—The Board of Education plans to build a two-story power house in connection with extensions to the local high school.

SAN ANTONIO, TEX. — The tentative budget of the San Antonio Public Service Company provides for extensions and improvements to the electric power plant and street-railway system, to cost about $1,000,000.

## Pacific and Mountain States

KETTLE FALLS, WASH. — Plans are being prepared by the White Pine Sash Company, Spokane, for the erection of a band sawmill, including power plant, dam, logging road, etc., at Kettle Falls, to cost about $150,000. F. W. Horstkotte, Mohawk Building, Spokane, is engineer.

PASCO, WASH.—The Pacific Power & Light Company contemplates extensions and improvements in this section, including additional transmission lines, to cost about $450,000.

PULLMAN, WASH. — The Washington Water Power Company plans to erect a 60,000-volt transmission line to Moscow, Idaho, 11 miles, to replace the 22,500-volt line.

ASTORIA, ORE.—Plans have been prepared by the Hammond Lumber Company for the erection of a new lumber mill, box factory and power house, to replace its plant recently destroyed by fire. The loss is estimated at about $700,000.

ANDERSON, CAL.—The Pacific Gas & Electric Company is planning to remodel the local street-lighting system.

BANNING, CAL. — The San Gorgonia Power Company has been granted permission by the State Railroad Commission to construct two hydro-electric plants near Banning and also authority to issue $100,000 in bonds and $100,000 in capital stock.

LOS ANGELES, CAL. — The Southern California Edison Company has received permission to issue $1,761,000 in bonds, the proceeds to be used for extensions to its system.

OAKDALE, CAL. — The Oakdale and South San Joaquin irrigation districts are arranging a bond issue of $3,750,000, of which $1,516,000 will be used for the construction of a power plant for joint service.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company contemplates building a machine shop, meter shops, transformer shop, warehouse and other miscellaneous structures.

SANTA BARBARA, CAL.—Plans have been approved for the installation of a street-lighting system on Anacapa and Pedregosa Streets, Riviera district.

SCALES, CAL.—Plans are under consideration by Peer & Berkey for the construction of an irrigation project, including hydro-electric plants to develop 36,000 hp., using impulse wheels directly connected to generators. The project includes two diversion dams, several storage dams, steel-pipe line, canals, etc. J. P. Sweeney, Nevada Bank Building, San Francisco, is representative.

SELMA, CAL.—The installation of an ornamental lighting system in the business district is under consideration.

SYLMAR, CAL.—The construction of a power house at the Olive View Sanitarium is under consideration by the Board of Supervisors, Los Angeles.

## Canada

BARNET, B. C.—The erection of a high-tension transmission line crossing over Burrard Inlet to Barnet, to cost about $90,000, is under consideration by the British Columbia Electric Railway Company, Vancouver.

AMHERST, N. S.—The Nova Scotia Electric Commission is considering a hydro-electric development near Amherst, where it is estimated that about 600,000 hp. can be developed.

BROCKVILLE, ONT.—The Town Council has passed a bylaw authorizing an appropriation of $57,645 for improvements to the Hydro-Electric system.

DUNDAS, ONT. — The Hydro-Electric Power Commission of Ontario is planning to rebuild its local substation and transformer station, recently destroyed by fire, to cost about $125,000. F. A. Gaby, Toronto, is chief engineer.

GALT, ONT.—The ratepayers have authorized an issue of $125,000 in debentures for extensions to the Hydro-Electric system.

MEAFORD, ONT.—The ratepayers have approved a bylaw providing for an extension to the Hydro-Electric transmission line. The bylaw for the purchase of the plant of the Georgian Bay Milling & Power Company was defeated.

OTTAWA, ONT.—The ratepayers have approved a bylaw to purchase the street railway owned by the Ottawa Electric Company. Extensions are contemplated, including the construction of 17 miles of single track, the erection of car barns and the purchase of forty-seven new cars, to cost about $1,500,000.

TORONTO, ONT.—The Toronto Hydro-Electric Power Commission of Ontario has decided to carry out plans at once for the complete conjunction of the former Toronto-Niagara system with the Hydro-Electric system.

TORONTO, ONT.—Plans are being considered for equipping the Grand Trunk Railway from Toronto to Hamilton and from Hamilton to Niagara Falls, for electrical operation, also for laying additional tracks for fast radial service, a total distance of 80 miles. A. F. Stewart, 407 Old Union Station, is chief engineer of the Canadian National Railways.

MONTREAL, QUE.—Interests connected with the Shawinigan Water & Power Company have organized the St. Maurice Power Company to operate as a subsidiary in connection with utilizing the Big Gres Falls on the St. Maurice River for development of hydro-electric power. The company will be capitalized at $8,000,000 and will authorize an issue of $12,000,000 in bonds.

## Electrical Patents

**Announced by U. S. Patent Office**

(Issued Dec. 26, 1922)

1,440,225. EMERY WHEEL STAND; J. J. Koukol, Cuba, Kan. App. filed April 6, 1921. One or more stones can be attached and operated on same piece simultaneously.

1,440,305. ELECTRIC HEATER; E. N. Lightfoot, New York, N. Y. App. filed Jan. 9, 1920. Resistance elements represent clusters of logs.

1,440,325. SAFETY RAZOR; R. H. Wilhelm, Chicago, Ill. App. filed Aug. 9, 1921. Flashlight placed in handle.

1,440,354. BATTERY PLATE; J. J. Hanna, Ordway, Col. App. filed April 8, 1922. Allows for expansion and contraction of plates.

(Issued Jan. 2, 1923)

1,440,365. TELEPHONE SYSTEM; R. W. Augustine, Chicago, Ill. App. filed July 31, 1916. Code-ringing system for different stations upon poly-station line.

1,440,389. JUNCTION BOX FOR CONDUIT PIPING; J. W. Jones, Perth, Scotland. App. filed March 3, 1923.

1,440,402. ELECTRIC HEATER; H. Meredith-Jones, New York, N. Y. App. filed Dec. 14, 1921. Room heater provided with racks for drying clothes.

1,440,407. DETECTING CIRCUITS; H. S. Osborne, New York, N. Y. App. filed July 2, 1920. Carrier-current receiving apparatus.

1,440,419. TROLLEY-WIRE GUARD; D. Stitt, Morgantown, W. Va. App. filed May 19, 1922. Guard normally extending below the trolley wire automatically swung out by passage of trolley wheel.

1,440,432. WIRELESS RECEIVING SYSTEM; C. T. Allcutt, Pittsburgh, Pa. App. filed June 25, 1921. Receiving system for undamped signal impulses.

1,440,470. METHOD AND APPARATUS FOR TESTING WELDS; I. F. Kinnard, Wilkinsburg, Pa. App. filed April 21, 1921. By comparing resistance and reluctance of weld with unwelded part.

1,440,490. REGENERATION OF ALTERNATING-CURRENT COMMUTATION MOTORS; L. M. Perkins, Wilkinsburg, Pa. App. filed Jan. 25, 1919. Manual control of phase relation of exciting voltage regulates regenerative torque.

1,440,502. METHOD OF AND APPARATUS FOR MAKING FINE METALLIC POWDERS AND COLLOID SOLUTIONS; J. Slepian, Wilkinsburg, Pa. App. filed Jan. 8, 1920. Electrolytic process.

1,440,511. SECTION BREAK DEVICE; N. J. A. Wahlberg, Pittsburgh, Pa. App. filed Nov. 11, 1919. Section switch for mine trolley.

1,440,515. MELTING FURNACE; H. G. Wellman and C. D. Gilpin, Cleveland, Ohio. App. filed May 17, 1920. Adopted to melt non-ferrous metals for making bronze, brass and similar castings.

1,440,519. ELECTRIC BAKE OVEN; J. C. Woodson, Mansfield, Ohio. App. filed June 3, 1921. Means for equalizing heating effects at both ends of oven.

1,440,551. ELECTRIC POWER PLANT; H. R. Patterson, Toledo, Ohio. App. filed Sept. 10, 1919. Engine-driven storage-battery set.

1,440,651. ATTACHMENT PLUG; R. B. Wolcott, Cleveland Heights, Ohio. App. filed Dec. 23, 1916. Swivel plugs.

1,440,678. METHOD OF PLATING WOODEN ARTICLES; F. Hachmann, St. Louis, Mo. App. filed Dec. 31, 1920. Electrolytic process.

1,440,693. ELECTRICAL WATER HEATER; H. R. Montgomery, Dayton, Ohio. App. filed Jan. 7, 1921. Automatic pipe-line heater.

1,440,711. ARC-WELDING APPARATUS; P. P. Alexander, Lynn, Mass. App. filed July 26, 1921. Automatic or semi-automatic type in which metallic electrode is automatically fed to work.

1,440,724. ELECTRODE FOR ELECTRIC FURNACES AND PROCESS FOR MANUFACTURING THE SAME; C. W. Söderberg, Christiania, Norway. App. filed Sept. 8, 1919. Tamping or pressing an electrode material into metallic mantle.

1,440,729. ELECTRIC STEP-BY-STEP MOTOR OF THE UNWOUND-ARMATURE TYPE; J. W. French, Glasgow, Scotland. App. filed March 30, 1921. Three motor elements, each comprising an electromagnet and an unwound armature.

1,440,750. ELECTRIC RIVET HEATER; E. Schroder, Berlin, Germany. App. filed July 6, 1921. Cooling electrodes by evaporating liquid held in cavity in electrode.

1,440,752. TELEPHONE TEST SET; R. B. Stone, Nashville, Tenn. App. filed Sept. 9, 1919. Hand telephone set for use along railways.

1,440,760. ELECTRICAL COIL; S. R. Wright, Rawdon, near Leeds, England. App. filed Aug. 22, 1921. Method of winding high-voltage coils to prevent initial surges.

1,440,774. ELECTRICAL DEHYDRATOR; W. O. Eddy, Los Angeles, Cal. App. filed Dec. 19, 1921. Adapted to remove water from petroleum emulsions.

1,440,775. DEHYDRATOR; W. O. Eddy, Los Angeles, Cal. App. filed Dec. 19, 1921. For petroleum emulsions operated by electrostatic field.

1,440,776. DEHYDRATOR; W. O. Eddy, Los Angeles, Cal. App. filed Dec. 27, 1921. Upper electrode adjustable.

1,440,778. WATER INDICATOR FOR OIL WELLS; W. L. Foster, Whittier, Cal. App. filed May 21, 1921.

1,440,804. DIRECTION INDICATOR; E. B. Wagner, San José, Cal. App. filed Aug. 6, 1919. Direction indicator for automobiles.

1,440,826. ELECTRICAL HEATING ELEMENT FOR PRESSURE COOKERS; E. G. Hager, Kimberly, Idaho. App. filed July 5, 1921.

1,440,828. DEHYDRATOR; F. W. Harris, Los Angeles, Cal. App. filed Sept. 18, 1919. Process of removing water from petroleum oils.

1,440,834. RADIO COMMUNICATION; C. V. Logwood, Chicago, Ill. App. filed July 2, 1921. Transmitting equipment comprising several vacuum tubes.

1,440,835. PROCESS OF AND APPARATUS FOR DEHYDRATING PETROLEUM EMULSIONS BY OSMOSIS; W. Meredith, Alameda, Cal. App. filed Feb. 14, 1921.

1,440,840. AUTOMOBILE HEADLIGHT; F. A. Reece, Chestnut Hill, Mass. App. filed Sept. 22, 1917. Lamp bulb containing two light centers with an opaque member between them throws all rays downward.

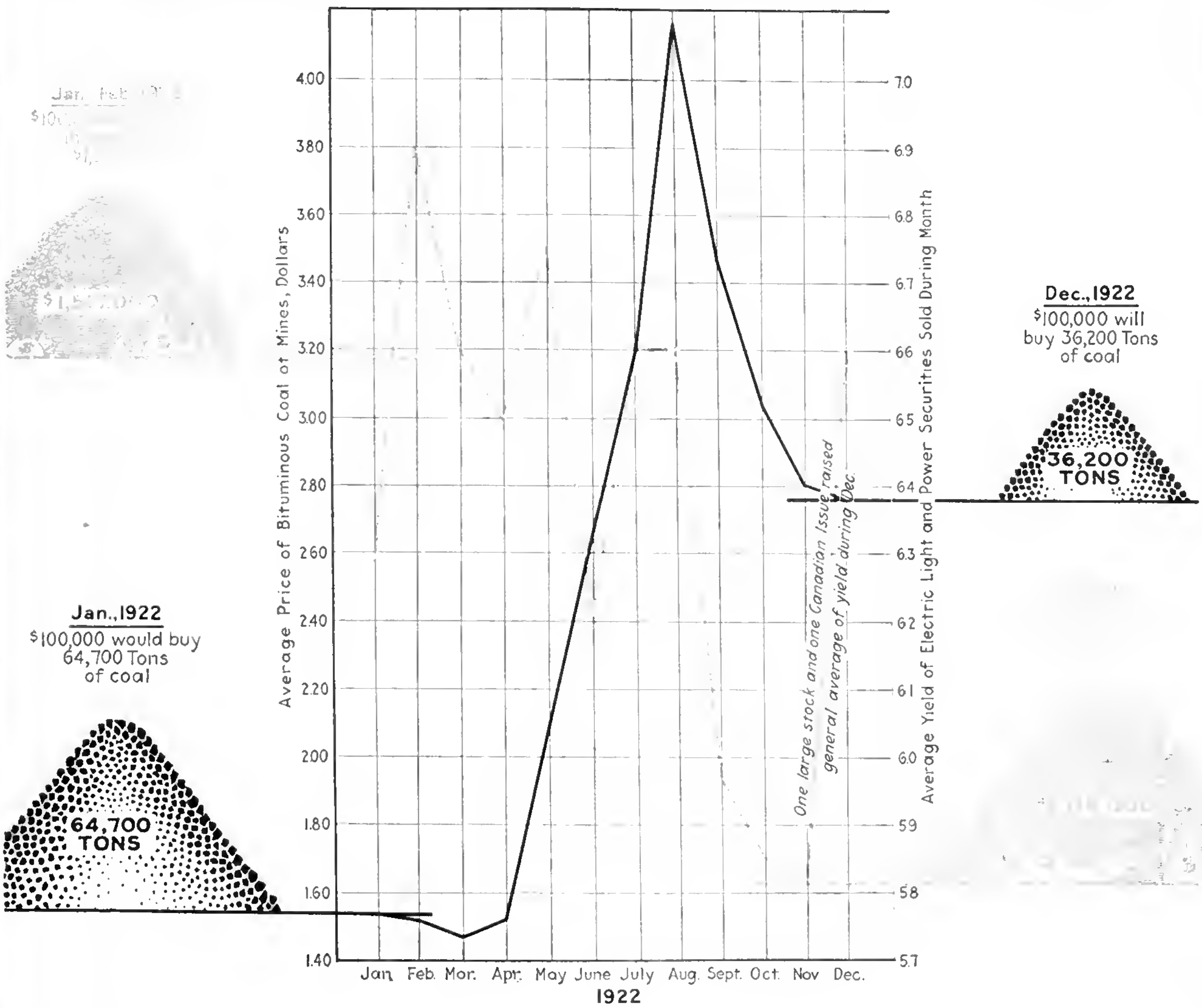
1,440,879. ELECTRIC SYSTEM FOR VEHICLES; T. L. Lee and R. H. Sullivan, Rochester, N. Y. App. filed Jan. 20, 1921. Automatic storage-battery-charging system.

1,440,951. ARMATURE CONSTRUCTION; V. G. Apple, Dayton, Ohio. App. filed April 27, 1918. Insulation and support for armature and commutator.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

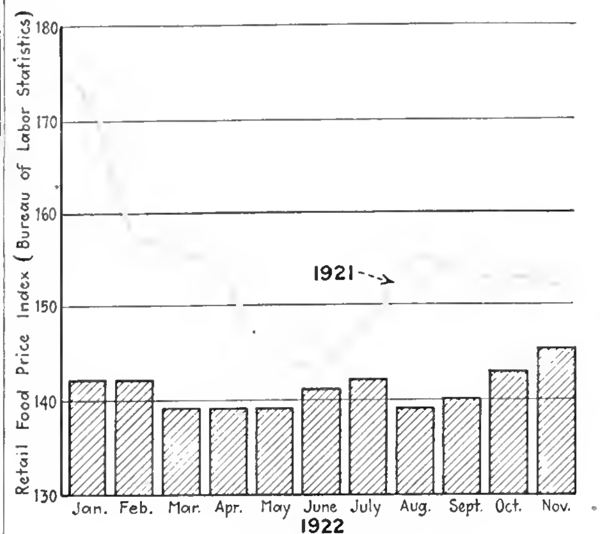
## During 1922 Cost of Money Fell While Cost of Fuel Rose



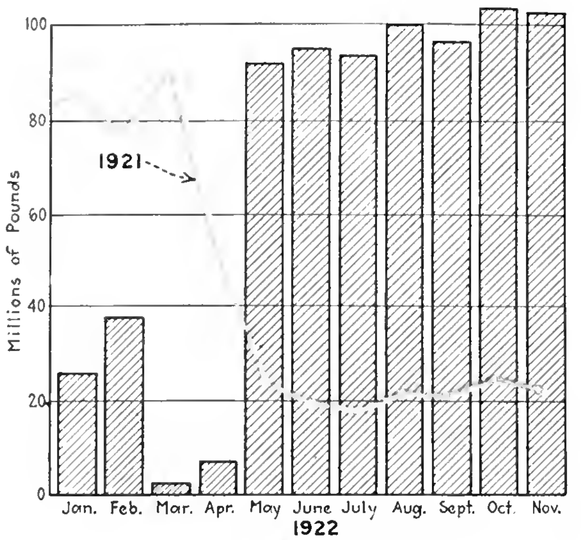

## A Year Calling for Extreme Economy and Large Expenditures

NECESSARY extensions to central-station equipment call for hundreds of millions of dollars during 1923. A very large portion of this amount must be borrowed from the public, and interest on the loans must be paid. The year opens with the possibility for efficiently managed companies to borrow at a cost under 6 per cent, which is significant when it is remembered that at the opening of 1922 the average yield demanded was 6.6 per cent and in August, 1920, it was over 8 per cent. This means that the industry will be much better able to meet the largely increased demands for electrical energy by added equipment and that the profits from the new load will not be eaten up through payments of interest.

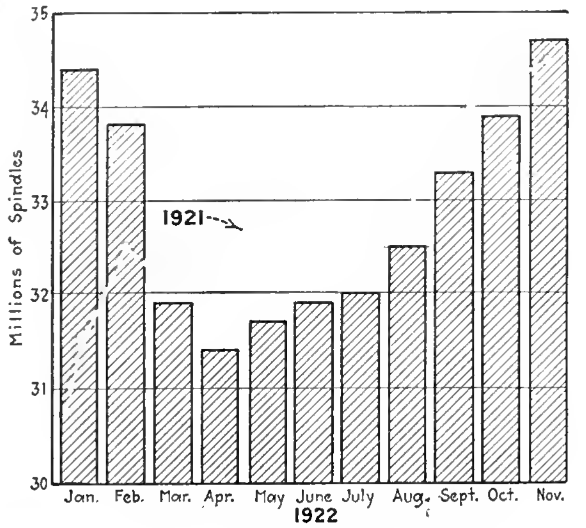
The thorn in the rose is the price of coal. Fuel costs almost twice as much as it did a year ago, and the cost of fuel forms almost 75 per cent of the production expenses of a large generating plant. The encouraging fact is that the cost of coal will undoubtedly decrease as the year advances.



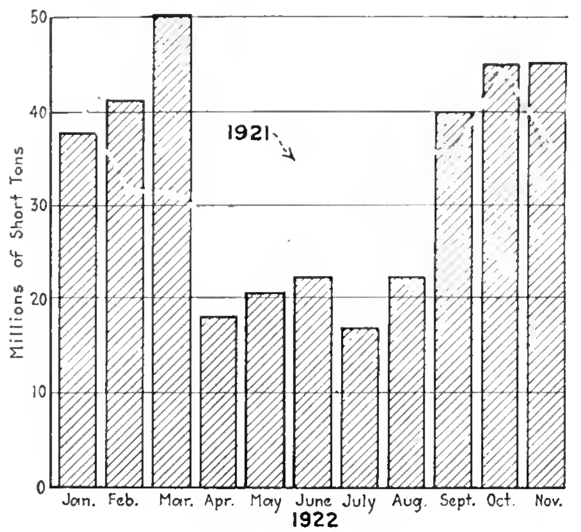

Index of Retail Food Prices



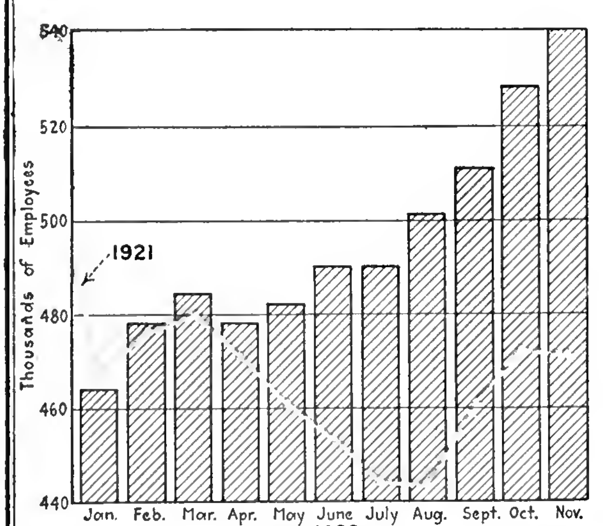

Copper Production




Activity of Spindles in Cotton Mills




Bituminous Coal Production




Employees in Factories of New York State

# A Job for Every Workman

THE transition of the country from a period with much lack of employment to one in which few men are looking for work was one of the most remarkable economic changes witnessed during 1922. The low point in employment, as indicated by the employees in the factories of New York State, was during July and August of 1921. Subsequent to that date employment increased by almost uniform steps until by the end of 1922, a period of sixteen months, the number employed was about 20 per cent greater than in August, 1921. In other words, in New York State alone almost 100,000 more men were employed in the factories on Jan. 1, 1923, than at a period sixteen months previous to that date.

Another skyrocket movement during 1922 was in the production of copper. In one month, from April to May, the production of copper jumped over 1,200 per cent, or from 7,026,000 lb. to 92,048,000 lb. The production for the first eleven months of 1922 showed an increase of 36 per cent over a similar period in 1921, but was almost 30 per cent below the 1920 figures. Exports of copper were 29 per cent greater than in 1921 on the basis of ten-month figures.

Electrical World

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# What to Do

THE world is full of good advice. We are plenteously supplied with theorists and prophets willing and eager to point us all along the paths of progress. There are so many plans and purposes and opportunities before the face of every man interested in the development of the electrical industry that oftentimes there seems to be no sure place to begin.

With the whole wide world spread to his eyes and with the greatest service to render that has ever blessed mankind, the electrical man is often baffled with the question of "what to do." The time is short, the task is great and ambition urges to divergent ends.

Fundamentally there are four things to do, four ways to work that simplify the problem and help to set a course and get the work done. There are four principles around which the development of the electrical industry can well be organized:

1. Use the agencies now in the field. Employ the tools that are at hand. Continue the methods that experience has proved good until the work that they will do has been completed.

2. Follow the line of least resistance. Undertake first those things most possible. Concentrate on getting actually done that which will contribute each time the next advance in the purpose and the progress.

3. Proceed along national lines of thought that will take advantage of the interest and the inclination of the masses of the people. Carry forward step by step in the direction of the popular demand, guiding the industry in its growth, but not attempting to resist its natural trend, rather following and serving it.

4. Apply the actual work as an individual and a local effort. Assume responsibility to do first all that can be done to prosper the next job. Make the little things done each day tie into the upbuilding of the electrical industry in the community as the prime consideration and the basis of all bigger plans.

IN the last forty years thirteen million customers for electric service have been connected to the lines of the central station. Not long ago three dollars income per capita in a community was considered good, but today a revenue of thirteen dollars per inhabitant is not uncommon. New consumers are taken on by the thousand in great selling drives. The project to electrify America is really not so big a job as it appears. It can be done. It has been already started.

But no plan, no policy alone will ever accomplish it. Whatever is achieved will be the product of the daily work of engineers, manufacturers, jobbers, central-station men, dealers and contractors who, supported by the co-operation of the entire industry, look to see what to do, each in his town, and then do it.

# Walter Sherman Moody

*A pioneer in power transformer design and a specialist in insulating and magnetic materials.*

THE transformer and the induction motor are the two machine developments that have created the alternating-current electrical systems. The great networks of high-voltage transmission lines owe their existence to the development of the transformer, and Walter Sherman Moody stands in the same relation to this device that Nikola Tesla does to the induction motor.

Back in 1888, while an instructor at the Massachusetts Institute of Technology, Mr. Moody helped William Stanley demonstrate the Goulard and Gibbs alternating-current system. He was so greatly fascinated by its possibilities that he devoted his energies to this field of research. He was assistant engineer with the Thompson Electric Welding Company from 1888 to 1892 and then became a designing engineer with the Thomson-Houston Company at Lynn and became chief engineer of the transformer department of the General Electric Company when the merger occurred. While with the General Electric Company he has made notable contributions to the art, holding nearly fifty patents, and he was the originator of the circular-coil type of transformer with a core of approximately round cross-section. He also was the designer of the first "air-blast" transformers.

Today he is chief engineer of the transformer department of the Pittsfield works of the General Electric Company and has general supervision of transformer engineering at the Fort Wayne and Lynn plants. He has helped make possible a growth in transformer size and rating from the small figures of the early days to those of today, with ratings of 25,000 kva. and 220,000 volts.

Born in Chelsea, Mass., Sept. 20, 1864, Mr. Moody was graduated in the first electrical engineering class from the Massachusetts Institute of Technology in 1887. He taught in his Alma Mater for one year and then entered upon his career as a transformer engineer. Believing that he should know materials, he got into close touch with Sir Robert Hadfield in the development of silicon-steel alloys and co-operated with the Allegheny Steel Company in the first production of silicon-steel sheets. He also became a specialist on insulating materials and the metallurgy of iron and copper.

In the midst of his technical activity Mr. Moody found time to write many authoritative papers and to co-operate with the activities of other men in the industry. He is a fellow of the A. I. E. E., a member of the N. E. L. A. and the American Electrochemical Society. His social affiliations are with clubs in Schenectady and Pittsfield.

# Editorial Comment

Electrical World, January 27, 1923

Volume 81 Number 4

## Persecution by the News Reporter

WHY should the newspaper reporter prey upon the electrical industry? For instance, recently two persons were found dead in a bathroom. One body lay in the water, the other upon the floor. And this is what the news sleuth wrote—in his final paragraph:

> Coroner Blank thought it was improbable that the deaths were due to electrocution. Occasionally, he admitted, a person taking a bath gets a shock strong enough to kill if, while still in the water, he touches an electric light fixture. Death by electricity, however, generally marks its victim, even though the burn be a small one, and no such scars were to be found on either body.

Now, all were agreed that it was not "death by electrocution." All would have doubtless agreed that neither was it death by forest fire, cyclone, automobile collision or swallowing false teeth. But this the reporter does not speculate upon. By suggestion, however, he spreads abroad the hurtful thought that death by electrocution is not uncommon, though the coroner would not "admit" it in this case. All this is bad for the central-station company. It is bad for all electrical men—which in turn is bad for the newspaper. But the reporter does not think about this, and so he speculates about this tragedy and says, "It might have been electricity, but it wasn't." And the reason that he does not realize how he harms the electrical industry is because no electrical man has ever gone to the trouble to take him out to lunch and explain it all. For friendly personal contact with the men who write this local news will develop understanding.

## Operating Code Makes for Permanent Economies

A PERMANENT operating code is an aid to economy in the operation of a central-station system. It reduces the harmful effect of the frequent changes in personnel that are sometimes unavoidable. Another advantage is that while highly paid engineering and executive talent can be used to formulate the code and to revise it at intervals, yet the operations favored can be carried out by men who, though lacking high technical knowledge, are better suited to handling the operating forces.

In the modern central-station system too frequently an able executive and engineer organizes various methods of procedure as he works his way to the front ranks, only to find later, upon studying his organization in detail, that his rules of operation have been changed by his successor to the detriment of the system. He often finds, too, that a change in a foremanship makes it necessary for him to supervise the new incumbent's work minutely in order to insure efficiency. With the grade of labor used in subordinate positions executive supervision over every detail is required. A written operating code helps greatly in improving these conditions, particularly if along with the code an educational plan is intelligently pursued.

As a practical matter it has been found very difficult to formulate such a code on a national basis, because the changing conditions in the art and the personal opinions of minor executives are difficult obstacles to overcome. None the less, a code offers many opportunities for putting the best methods of the industry into practice, and several companies have formulated codes for their own use and have proved their efficiency through trial. The ELECTRICAL WORLD in this issue starts the publication in the Central Station and Industrial Practice department of such a code. It hopes that a valuable discussion will follow on which a more universally applicable code can be based.

## Advisory Publicity Council Deserves Support

THE announcement that the publicity council which has been serving as an active advisory board to the Society for Electrical Development will from now on function also for the Joint Committee for Business Development is a gratifying evidence of progress. This council is composed of a group of the directors of publicity of the principal electrical manufacturers and central-station companies. Through its association with the joint committee, also, it will become in effect an advisory publicity council for the industry and an instrument for assisting and harmonizing to some degree the many independent influences which the electrical industry is now exerting in various forms of advertising and publicity.

An interesting case, of recent report, offers a good example. A certain group of manufacturers has apparently decided to employ a publicity man to organize a joint campaign of publicity in the form of "human interest" articles written around their particular appliance, which will be broadcasted to the newspapers of the country, with the expectation that many will be printed and thereby advertise the product of the group. But it happens that for several years the Society for Electrical Development has maintained a press service to provide a well-balanced presentation of the story of electricity in the home and industry, written in popular form, and about 450 newspapers are accepting it as legitimate news and using it. Moreover, the state committees for public information, which have been organized through the efforts of the National Electric Light Association and the other national utility associations, are providing the press with an ample amount of current facts on public utilities, and their articles and items are widely accepted. For independent groups of manufacturers, therefore, to enter the arena and begin to deluge the press of the country with a flood of "news stories" which because of their more limited topic would necessarily smack of propaganda might shake the entire confidence of the press. The fact that news of electrical

developments and activities has become recognized as of vital interest to the public is a great achievement. The newspapers must not be provoked to alter their friendly attitude by any attempt to cram selfish "copy" down their throats.

The broader activity of this advisory publicity council should provide a responsible authority that may serve the industry well in guiding all its advertising efforts along constructive, helpful lines and avoiding wasteful duplication or hurtful mistakes. Its work should have the strongest possible support from all branches of the industry, so that their combined publicity may be synchronized as perfectly as possible.

### Inductive Co-ordination and Public Duty

REAFFIRMATION by the Supreme Court of the State of Washington of its findings, rendered last fall, that the prior occupancy of a highway by telephone wires did not obligate a power company which had paralleled these wires by a properly constructed transmission system to bear the cost of metallicizing them again draws attention to the mutual obligations of utilities under such conditions toward each other and toward the public. In this case the power company had done everything that the present development of the art suggests to confine inductive influence to its proper channels, but the physical condition of the telephone system, which was grounded, made it unduly susceptible. The telephone system, the court clearly holds, had an equal duty to perform in putting its plant into a condition that would not place an undue burden on the power company and the public it serves. Despite the court's enunciation, in its second pronouncement—in order, it said, to quiet unnecessary alarm—of the obvious fact that its declaration that priority in time does not give a superior right to occupancy applied only to the case under review, the inference is that such priority has no effect on the obligations toward each other of the two classes of utility. In every case that arises these obligations must be determined by other facts than the mere question of which utility was first in carrying its service to the public over a highway which both have the right to occupy.

### Financing Rural Extensions

FINANCING of rural line extensions has been a vexing problem all over the country because the revenue from most extensions of this character has been so small that they cannot be considered on the same basis as other classes of business. There have been almost as many extension policies in use as there are utilities in the field, and the confusion caused by the contradictory nature of the many policies has almost led many utility men to throw up their hands in despair. In a few cases the problem has been faced on a broad basis and an earnest attempt made to bring all the fundamental factors into consideration. One of these attempts is the study, extending over two years, made by the technical committee of the Northwest Electric Light and Power Association. The annuity plan of financing extensions as evolved by the committee is described elsewhere in this issue by R. M. Boykin, its chairman.

Without so stating, the committee starts with the assumption that commission regulation has put the returns from the operation of any given property on such a basis that the ratio of investment in certain items of property to the annual revenue is such as to provide a proper return to the utility. The utility under the suggested plan is then required to make investments for future consumers on this same ratio basis, and an annuity method of determining the advance payments to cover losses that must be borne by the consumer is applied to cover the remainder of the financing cost. The committee further assumes that the course of business development on any extension will be sufficient to place the extension on a paying basis in a reasonable period of time.

While these two assumptions are probably correct for Pacific Northwest conditions, they do not apply in some other sections of the United States, and for this reason the method suggested is probably not available for application over the whole country. However, it does represent an attempt to cover the fundamentals, and even though it may not cover all situations in its present form, it adds something toward the solution of the question and deserves serious study as one method of meeting the problem of financing not only rural extensions but other classes of extensions as well, particularly those in which the future development to a paying basis in the ordinary growth of a territory is an assured fact or at least as nearly so as anything of this nature can be.

### Dominant Position of Anaconda Copper

AS THE largest user of copper in the world, the electrical industry has more than a passing interest in the purchase of the Chile Copper Company by the Anaconda Copper Mining Company. The combination will make the Anaconda company, which for almost forty years has been the country's greatest producer of red metal, the dominant figure in the copper markets of the world. With 16 per cent of the world's copper output to its credit, the company is in a position to make or break the copper market. If it shall become conscious of its strength as well as deeply sensible of its obligation, it can exercise the same sobering influence over the price of red metal that the United States Steel Corporation exercises over the price of iron and steel. The copper industry has long needed some such stabilizer among the half dozen or more great groups of copper producers.

That the Anaconda combination will have any effect in sending the price of copper downward is greatly to be doubted. Ever since the war the economic position of copper has been greatly unsettled. Overproduction was followed by shutdown and then by distribution of virgin metal and scrap from stock. Prices have been chaotic. If the enlarged Anaconda company shall prove to be nothing more than a stabilizer, it will justify itself. However, those who know John D. Ryan and Cornelius F. Kelley realize that the Anaconda will not be content to lead a passive existence. It has always been numbered among the enterprising companies of the country. It has linked itself with the electrical industry in more ways than one, and as goes that industry so will go the Anaconda. Its wagon is hitched too firmly to our star to lumber or to deviate from the path of progress.

## A Practical Example of a Superpower System

THERE has been no little propaganda for the construction of superpower systems for the distribution of energy on a large scale along the Eastern seaboard. As Mark Twain once suggested with regard to the weather, "A great deal has been said about it but nothing done." Nothing, that is, has been done beyond preliminary studies and estimates for public consumption. As has happened many times before in power transmission matters, the Pacific Coast is on the job. Frank G. Baum's article on the Pit River power transmission system, of which the first part appears in this issue, describes a superpower network stretching more than 200 miles northward from its base load around San Francisco Bay. The operating voltage of 220,000 is now well within reach as a practical working pressure. From an engineering standpoint, therefore, the voltage is not surprising, although still impressive. Of far more interest to engineers at large are Mr. Baum's comments on the necessity which gave rise to this particular form of transmission on a large scale and the economic phase of what otherwise would seem an unusual project.

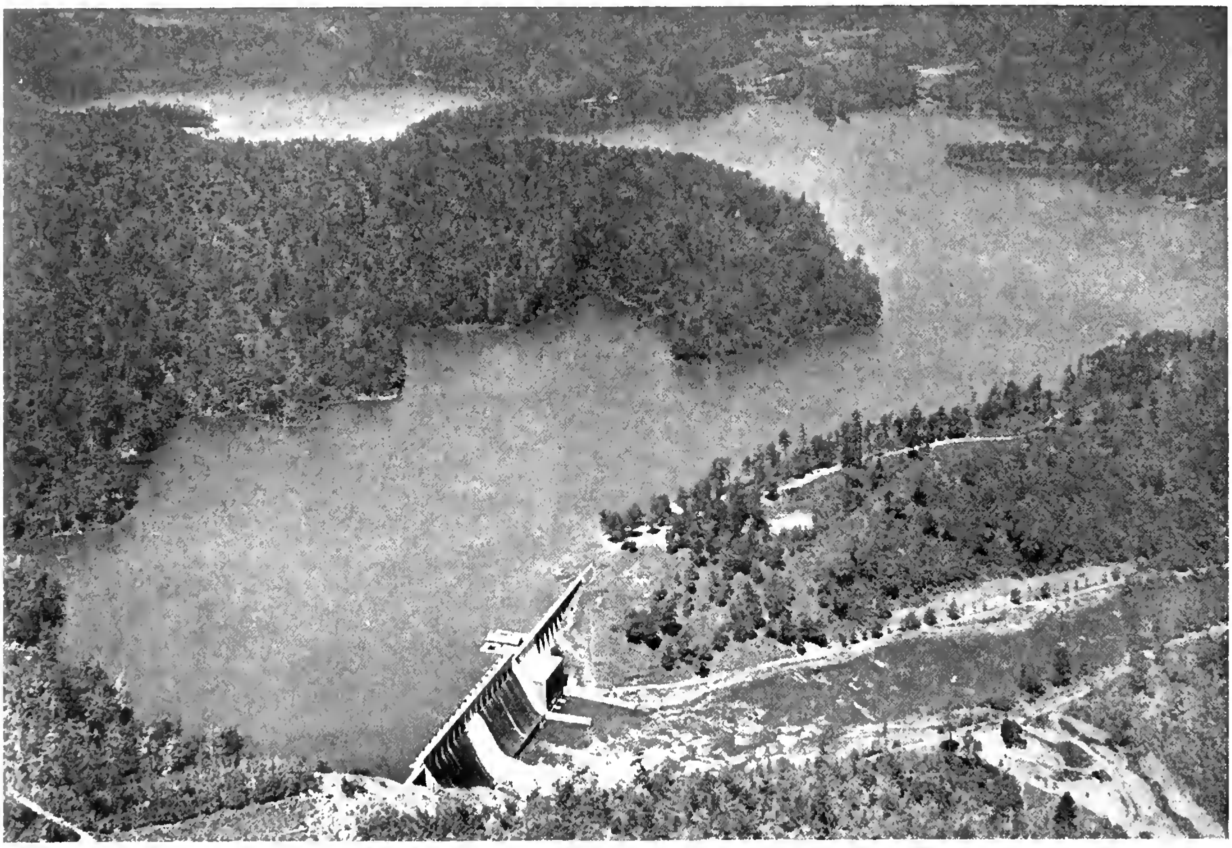
The point of the matter is that California as a whole is wonderfully well served with electrical energy. The networks in the southern, central and northern parts of the state are of remarkable extent and complication, so that more than 80 per cent of the population is actually served, a proportion much larger than that served in any other part of the country, especially the extreme East. The more electricity is used in everyday life the more call for it quickly comes, so that the situation which had to be met by the Pacific Gas & Electric Company was the provision for the San Francisco district of a very large amount of additional power which the existing networks could not supply. The water powers of California grow better and more reliable as one passes northward, and by far the best available source for great additional energy was to be found on the Pit River. The development here means 100,000 kw. at once and two or three times more in the near future. The striking novelty in this great long-distance project was not the addition of the Pit River powers to the existing network; it was rather the plan of boring through this network with a straight-away transmission line aimed to supply the rapidly growing power load around San Francisco Bay and to turn back the power from the widely ramifying networks to build up an intensive service of their own. In Mr. Baum's view, and he is unquestionably right, carrying out the project in this way means a great simplification, especially from the operating standpoint. The Pit River load is thus made independent and can be regulated as a whole without the complication of tying in with an already intricate network. The voltage on the long line can be dealt with by synchronous condensers of no very exaggerated size and held substantially constant at the load and irrespective of variations. Meanwhile it still remains possible to use in an emergency the existing network and the Pit River power to help out each the other's temporary deficiency, although this is not intended to be in the least degree the normal method of operation. Mr. Baum fully appreciates the importance of distributing power to all the communities of the state and criticises with a great deal of justice the timidity which endeavors to draw the load to the power instead of distributing the power to the load.

The transportation of electrical power is the least of the transportation problems which today confront industry. A new manufacturing center means new difficulties in the accumulation and distribution of material vastly more troublesome than any electrical distribution which might serve to place the plants in a better situation with regard to the transportation market as a whole. Further, it is undoubtedly desirable to check the extreme centralization of industry which is now going on. It would be much better to distribute the work over fifty towns and cities than to concentrate it in one of them, where, inevitably, high expense, a difficult labor situation and overcrowding with all its trail of misfortunes will hold sway. To be perfectly frank about it, a great industrial city is usually by no means a pleasant place in which to live, rarely well governed and almost universally overtaxed. In this civic sense the work of the distribution system which brings cheap power to the country in general, instead of confining it, as now too often happens, to a few big centers, is of primary importance, as Mr. Baum very pointedly shows. The interconnection which has gone on in California and elsewhere is, within its limitations, vastly efficient in providing general distribution at moderate expense, but when the time comes for a very large additional amount of power the Pit River plan exemplifies the best way of providing it to simplify the operating conditions. Of some of the other details of the project Mr. Baum will tell more next week. It is sufficient now to point out that the line involves no startling changes in practice, although the graded insulator string, of which the usefulness has been well proved, is a feature which does not appear sufficiently often on American lines. The Pit River system is certainly a most notable addition to the already great development on the Pacific Coast, and Mr. Baum's further studies, especially as regards the operating characteristics of the power plants themselves, will prove of much interest.

## Build Up the Distribution System

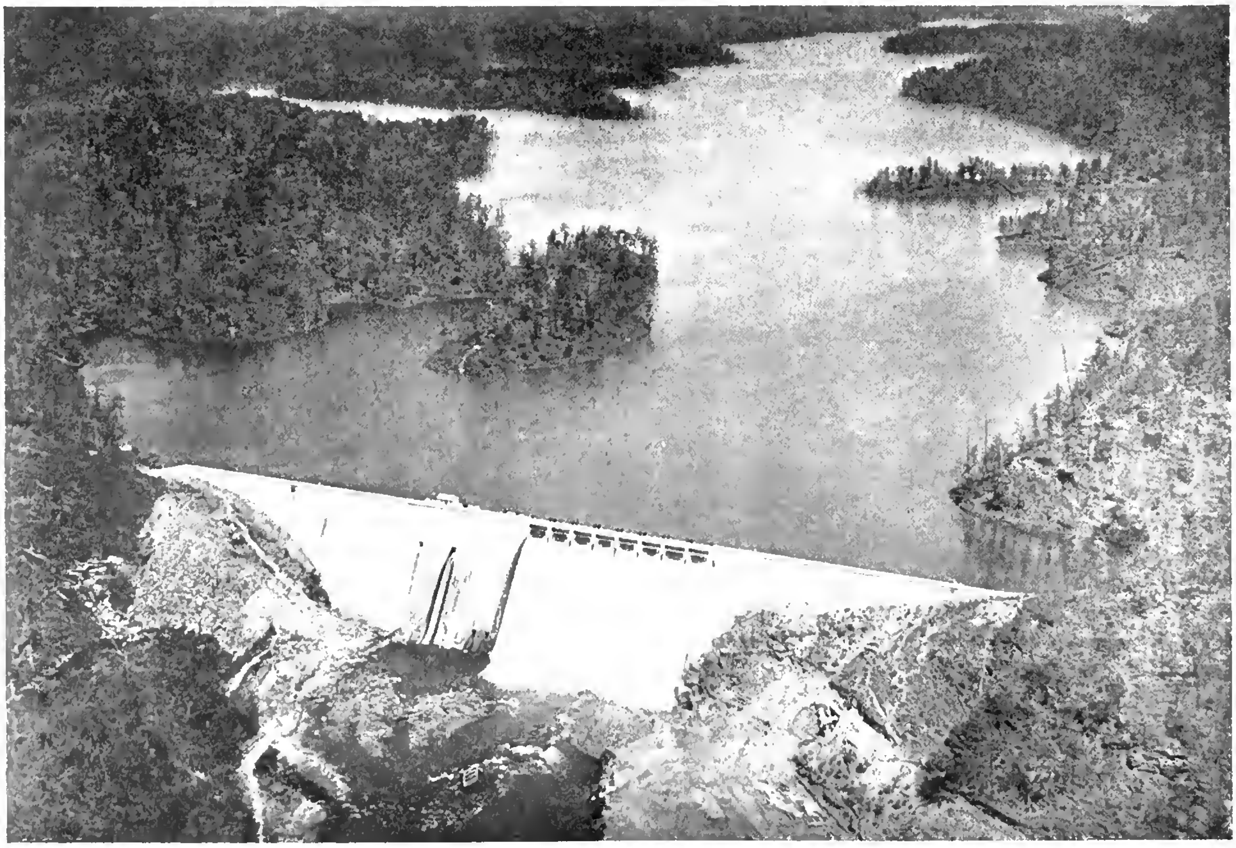
COMPLAINTS come sometimes from the distribution department that central-station executives do not appropriate money to it with the same readiness they show when the power-plant department is concerned. Many things may be to blame for this condition where it exists, but in many cases unfamiliarity with the distribution department's needs is the chief. Perhaps a little human vanity, easily pardonable, also plays its part; for almost every company takes great pride in constructing a fine generating station. Yet when monumental power houses involve, as too frequently they do, an expenditure for decorative and architectural effects out of all proportion to the condition of other parts of the system the error in judgment is manifest.

The distribution system is the one place today where maximum operating economies can be obtained through the application of good engineering and ample funds. In too many cases the existing distribution system represents an accumulation of historic systems many of which are obsolete, but whoever heard of junking a distribution system because of this? Another factor that calls for judicious expenditure is that the distribution system rapidly gets overloaded. Money spent in putting in reserve cable capacity and large ducts will be returned with interest as the system grows. Shoestring financing, on the other hand, is only pennywise. Ungrudging executive support should back the distribution engineers in their plans for development.



## Georgia Railway & Power Company Develops Southern Water Powers

This company has already developed 150,600 hp. and upon completion of the Tugalo plant will have 234,000 hp. available from water power. Upper view, Mathis or Lakemont dam and lake. The reservoir stores 1,369,000,000 cu.ft. of water. Below is Burton lake and dam, which stores 5,280,000,000 cu.ft. of water.



# The Pit River Power and 220,000-Volt Transmission Problem

## PART I

### Analysis of a California Power Problem Which Involved Transmission and Economic Questions of Unprecedented Magnitude and Pioneer Engineering of Noteworthy Character—Interconnection Not the Solution

By FRANK G. BAUM
*Consulting Hydro-Electric Engineer, San Francisco, Cal.*

THE chief merits of hydro-electric developments are that they tend (1) to stabilize rates for power uses and therefore to extend the use for electric power, (2) to equalize the rates for power as between the larger and smaller cities, so that the smaller towns and cities may build up industries, and (3) to conserve coal, oil and labor needed for other industries.

Many of the earlier water-power developments were not a success because they were developed for a lighting business rather than for a power business. It is the power load that has made a financial success of water-power developments and electric transmission, and in California we have many communities which owe their beginning and progress largely to hydro-electric power and transmission. Electric service and rates in California for given classes of service are practically the same in cities of 5,000, 50,000 and 500,000 population. I believe the real solution of the power problem must keep this fundamental of practically universal service throughout in mind. Electric service is too popular now to make it possible to deny the use of this service to a large proportion of the people or to have the cost so high in the smaller cities that the growth of the nation must take place in the larger cities.

I believe the recent overshadowing defeat of the proposed initiative constitutional amendment in California to turn the hydro-electric developments of the future over to the state was primarily due to the fact that electric service in California is almost universal. A secondary reason was the customer ownership, but the service to the customers was first necessary to develop the customer ownership. The problem is political as well as economical, but fortunately the best solution which gives stabilization of rates and wide service is also the best solution for the industry and nation.

## Natural Conditions in California Plus Great Individual Initiative Have Resulted in the Development of Large Power Transmission Systems

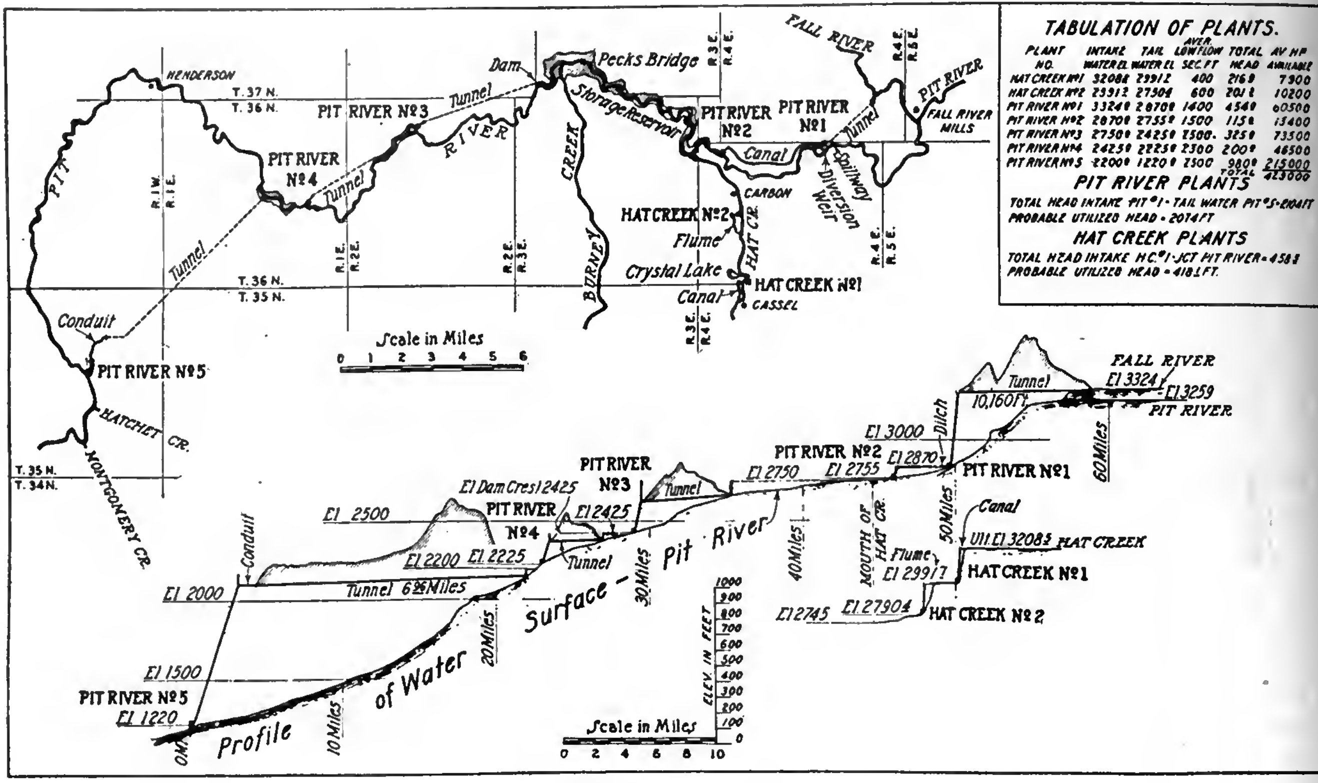
THE writer of this article has been connected with water-power and electric transmission developments in California since 1898 and has devoted his entire time and thought to this industry. He believes that what has taken place in California is a result of natural conditions plus strong individual initiative, which have resulted in a great advantage to the industry. The natural condition in California is that the water power is in the mountains east of the great interior valleys, and in order to bring the power to the large industrial centers near the seacoast the power transmission lines had to cross these valleys. Naturally there was developed along the transmission lines power business for mines, cities, industries, farms, etc., and this has resulted to the great advantage of the state as well as the power industry.

The following analysis of results attained in California was written by the author of this article in 1914 ("The Economic Value of Electric Transmission," Technical Publishing Company, San Francisco). Results today show that the economic value of electric transmission is proving the statements very conservative:

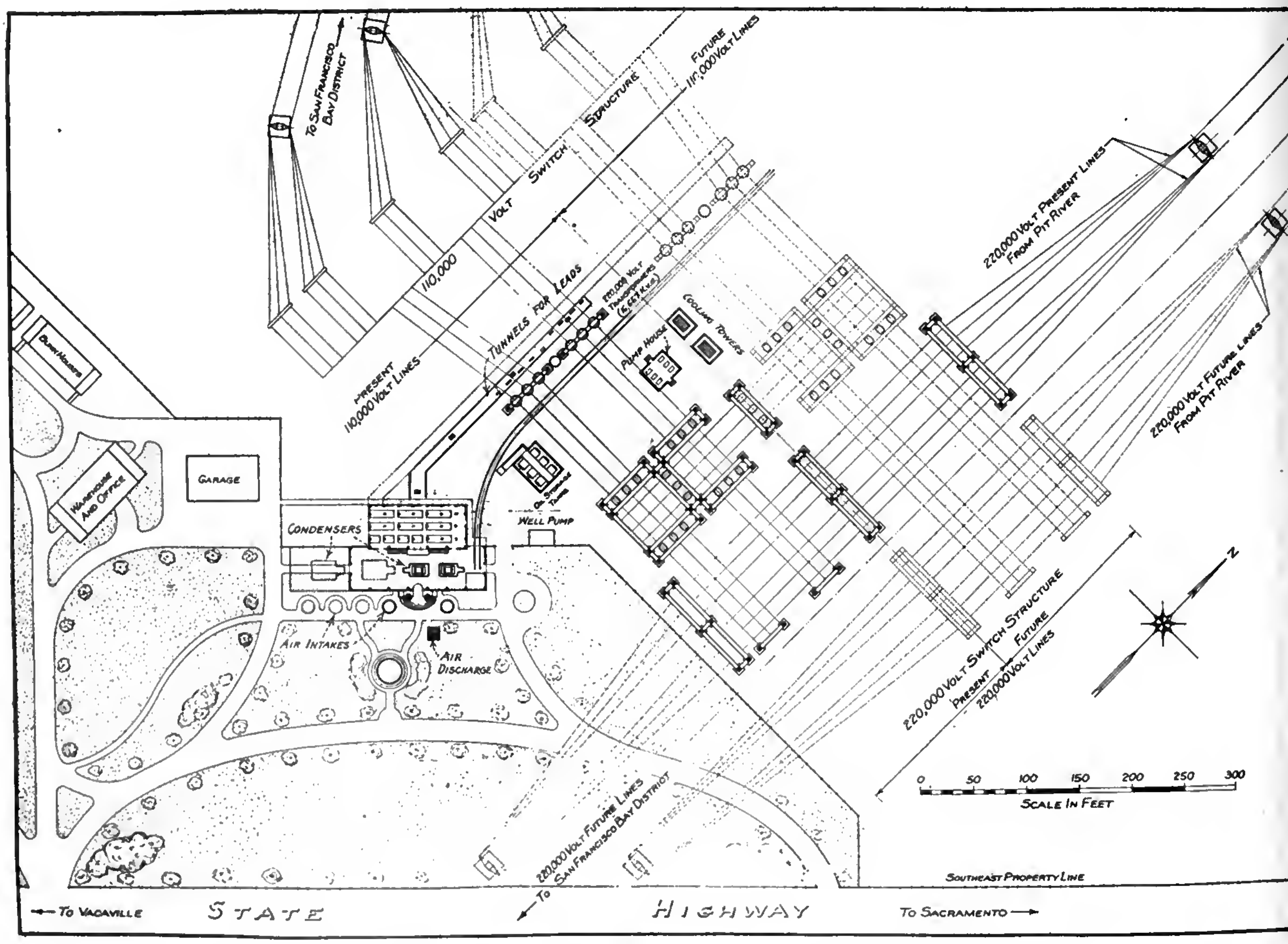
"The men who built the first electric power transmission systems in California did not realize how rapidly and to what magnitude the business would grow; yet, in a general way, they did appreciate the great advantages to be gained by a transmission system furnishing power to operate various industries from large, efficient power plants, instead of each industry supplying its own power from a small, inefficient plant. The economy to the consumer in any particular case could, of course, be determined and the saving to the power user effectively shown, but as the power transmission lines operating as a unit have become larger and made to cover more and more territory, the additional advantages of having large power systems supported by a varied series of industries have added additional economy and stability to the large systems and have also added general benefits to the industries and communities. The total result gives strong reasons for the increase of the electric transmission systems to cover generally a wider territory and more diversified industries.

"The result of such a system covering a wide area is that the same service in electric power is available at the mining camps in the mountains and to the small towns and industries in the central part of California as is supplied to the larger cities. Aside from the economies of such a system resulting from the 'banking' of the facilities, the power conditions throughout this area tend to become equalized, resulting in a distribution of population and industries not otherwise possible, and resulting, also, in adding to the general stability of the country and in great saving in capital and operating expenditures for the industries and cities served. Very often it enables the establishment of an industry—for example, a small factory, a rock quarry, a cement plant, a farm—at a point otherwise prohibited, adding to the economic value of the district.

"In consequence of this electrical development industries are being established in many of the smaller towns and outlying districts where the employees can live more advantageously, and the natural effective result is a healthy growth of all parts of the state, a large saving in operating expenses, capital and resources, a general equalizing of opportunities, and, on the whole, a tremendous economic gain for the communities, increasing in geometric ratio. It is naturally to the interests of the people that the power systems be extended as rapidly as conditions warrant, as the resultant economies from the extension of the business will of necessity redound to their benefit. For this reason, as I said before, California, or any state or nation having available cheap power, need never fear decay."




PLAN AND PROFILE OF THE CONTEMPLATED 400,000-KVA. DEVELOPMENT ON PIT RIVER

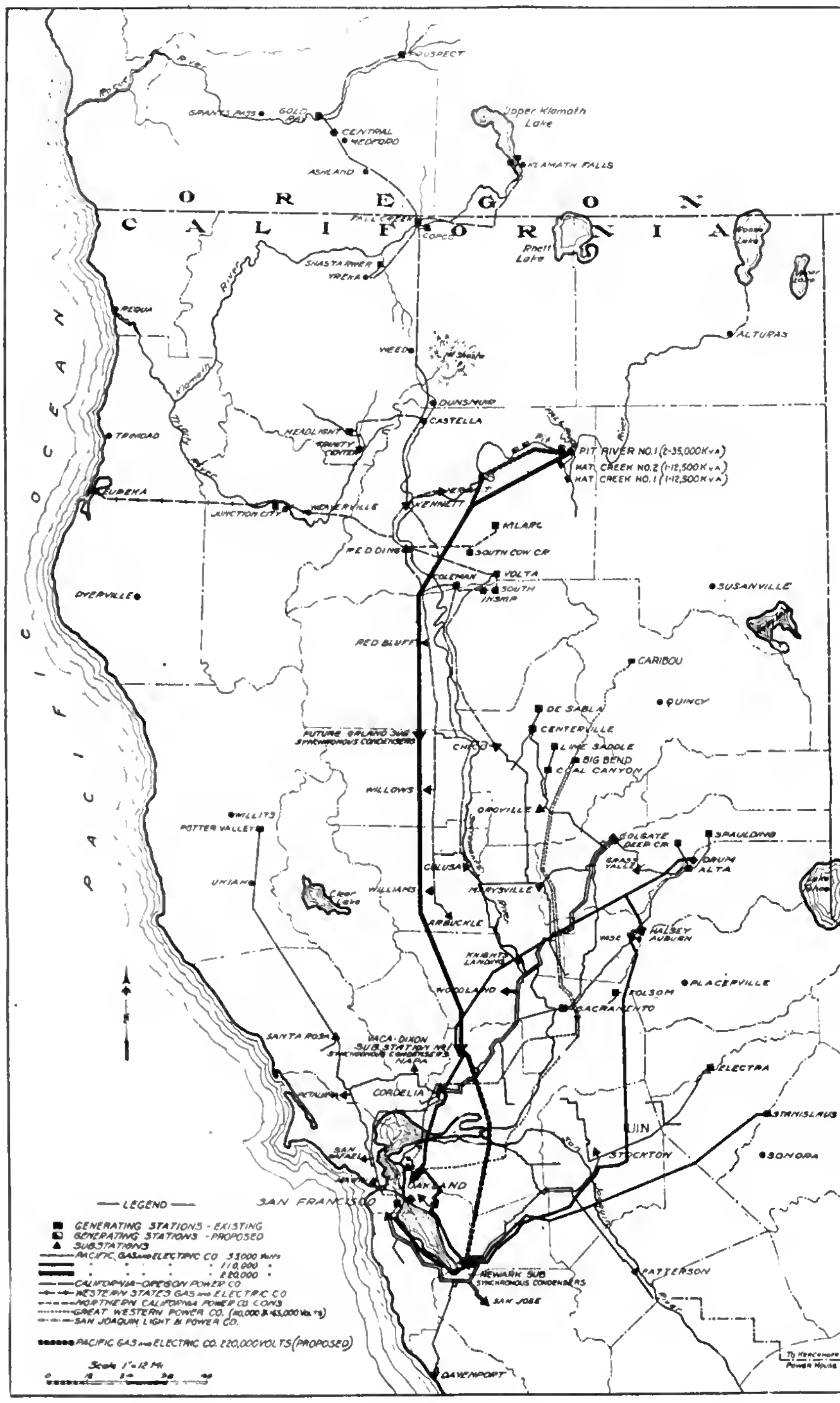



AT THE VACA SUBSTATION THE INCOMING PIT RIVER POWER IS TRANSFORMED, SWITCHED AND DISTRIBUTED TO THE SAN FRANCISCO BAY DISTRICT

With more than 80 per cent of the people of California enjoying electric service, there is little to fear from socialistic ownership schemes; but in many Eastern states less than one-half the people have electric service, and the smaller towns and cities have no real power service to help build up their industries, and I think the danger from this situation is serious. Electric men therefore have a responsible part to play in the future distribution of population of industries, on which depends the stability of the country as a whole as well as the stability of the power industry.

The power streams of California improve generally as one goes north, and gradually, as predicted years ago, the transmission lines have tended to be built from north to south. We required a large, dependable power supply, and Pit River gave us what was necessary, even though an extra hundred miles of transmission line was added. It will be noted that the Pit River power is farthest north, and that this power is taken through to serve the San Francisco Bay district loads, 200 to 300 miles away, without displacing the power step by step from north to south, as might at first glance seem to be the solution of the problem. Before entering into a description of the plants and transmission system the underlying reasons for the design and construction of the system will be given.

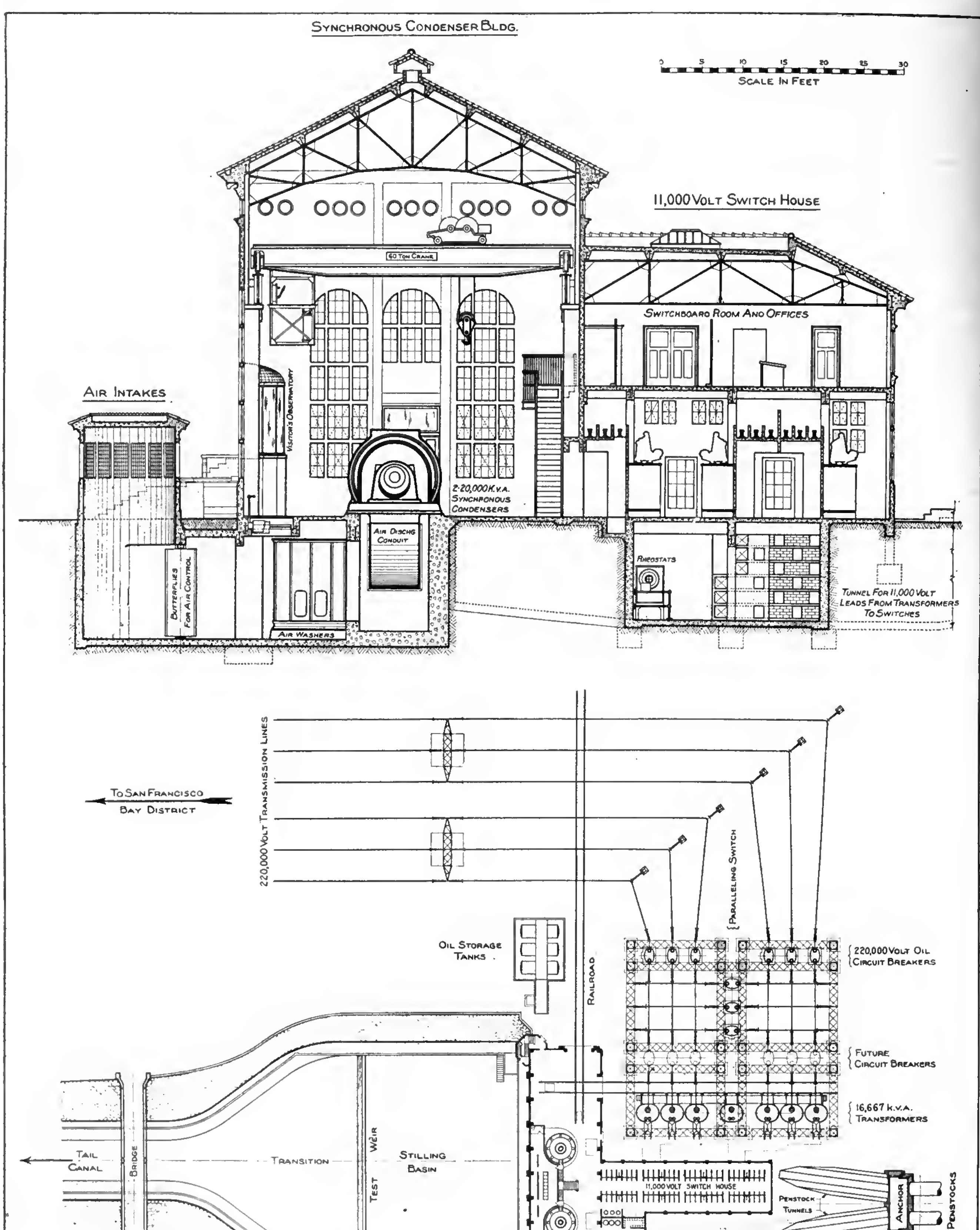
It was necessary to deliver to the bay district about 100,000 kw. at once and another 100,000 kw. within three to five years. Instead, therefore, of using the old and smaller developments and transmission lines to deliver their power into the bay district and have the Pit power displace the valley district loads, we decided to take the Pit River power to the bay district, where the large load is more concentrated and is more nearly of the magnitude of the power supply. In other words, it was thought best to join the big power supply to the large demand by a transmission system proportionately large. Further, we have now a future base power supply that solves our problem for some time. There will be ultimately about 400,000 kva. developed on the Pit River.




A CALIFORNIA SUPERPOWER SYSTEM WITH A 220,000-VOLT LINE

To have solved the problem by having the Pit power displace the valley power and have this power then go to San Francisco Bay would have required the reconstruction of many power stations and transmission lines and substations and would have created a system difficult to operate. By taking the big power supply directly to the large market by a large-capacity transmission system the problem became merely one of building a new large system complete. We thus tie up units of supply and transmission to loads that are commensurate. It required courage on the part of the engineers and the financiers to attack the problem in this big way, for it required the expenditure of approximately $20,000,000 for the power system, transmission lines and substations to deliver the first power to the 110,000-volt and 55,000-volt lines on the west side of San Francisco Bay. Only a large power system can do things on this large scale.

If the problem had been the development and transmission of say 25,000 kw. to 50,000 kw., the old method of displacing the power generated at one place for the power generated in an adjacent district might possibly have been used. For comparison, if we were to raise a few truck loads of potatoes in the Pit River region, we would transport them to Redding or Red Bluff, and




SUBSTATION BUILDING AND LAYOUT OF MAIN PLANT

A large switch house and synchronous condenser building at Vaca substation is shown in the upper view. The lower view gives a plan of the Pit No. 1 development with connections through outdoor transformers to the 220,000-volt lines.

the Redding or Red Bluff potatoes would displace those raised near Chico, and those would replace an equivalent amount near Sacramento, and finally the surplus would reach the large San Francisco market. But if we were to raise 1,000 carloads of potatoes in the Pit River region, then the right disposition is to take the large surplus supply direct to the large market.

It is believed that the solution of this power problem, which required for economy 220,000-volt design and transmission construction, will be followed by many similar enterprises in the United States of America in the next few years. For the power problems have become of such magnitude, owing to the large single power units and stations and the large markets, coupled with the high prices of coal, that the question of the transmission system must be attacked in a proportionately big way, if the electric power industry is to meet the needs of the times.

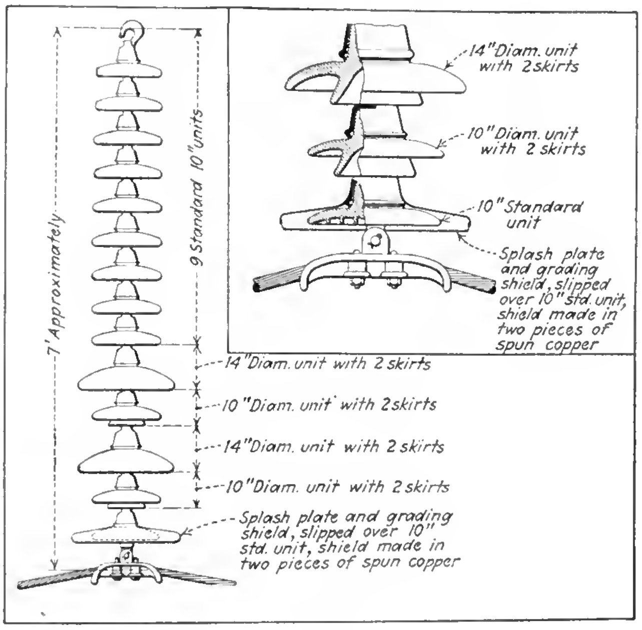
We could not expect the old county and city roads that made possible a speed of about 10 miles an hour and loads of 1 ton or 2 tons to meet the needs of present-day automobile traffic. Roads allowing a speed of 40 miles an hour and loads of 5 tons are required. Connecting up the old-fashioned roads would not have given a national or state highway system that would meet present-day needs. A new system of highways had to be designed and built to meet the new requirements.

### Interconnection Not the Solution

Similarly, interconnecting the small-capacity power lines built out from various points for local uses will not generally give a transmission system to meet the needs of the electric power industry. We need large high-power transmission lines that will carry the power from places where there is little demand, like the St. Lawrence, the Niagara, the Southern Appalachians, the Rocky Mountains, etc., to places of large demand, and the transmission system capacity must be commensurate with the power available at these sources and commensurate with the needs in the large industrial regions.

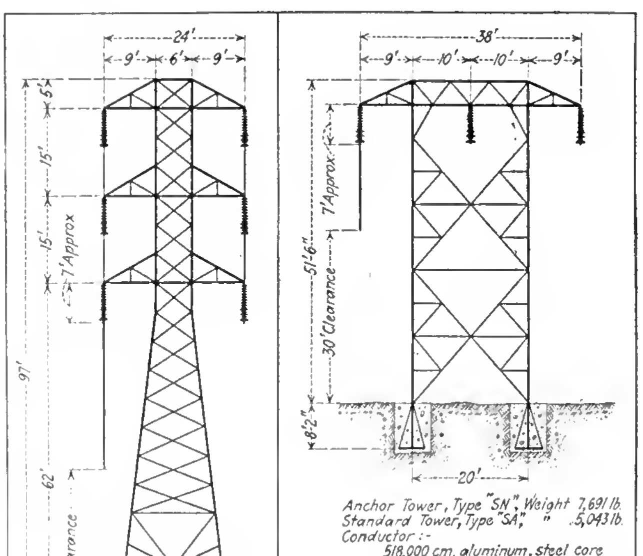
Without the automobile and truck there would be no need of the modern highway system, and similarly without the development of the large steam and hydraulic power units and without the big markets, there would be no need for the high-power transmission systems we must have. Without a feasible power transmission system the problem could not be solved, but with a transmission system laid out on a big scale* so that we may transmit say 100,000 kw. to 150,000 kw. per circuit and 200,000 to 300,000 kw. per tower line, we have a solution of the transmission problem commensurate with the wonderful development of the water-power and steam units in the past few years and commensurate with the needs of the large markets in the Eastern States. Electric power units are now generally of 20,000 kw. to 60,000 kw. capacity and 75,000-kw. units will be in use in a few years. Single power stations of 100,000 kw. to 500,000 kw. are now being constructed. The power-transmission circuits must of course have capacities commensurate.

To attempt to find a local demand for the whole of these large powers, as was done at Niagara, because in the early days of the electrical industry there were no transmission systems developed, is uneconomic and unsound for the industry and from a standpoint of




DETAILS OF INSULATORS USED ON PIT RIVER LINE

national stability. For to be stable we should have the industries of the country diversified and spread out over the country as much as possible, building up the smaller communities as well as the large centers. At present places like Niagara, New York City, Boston, Philadelphia, Chicago and other places have much cheaper power than obtains in the smaller cities and towns. This does not make for a healthy growth of the states and nation. We need a transmission system



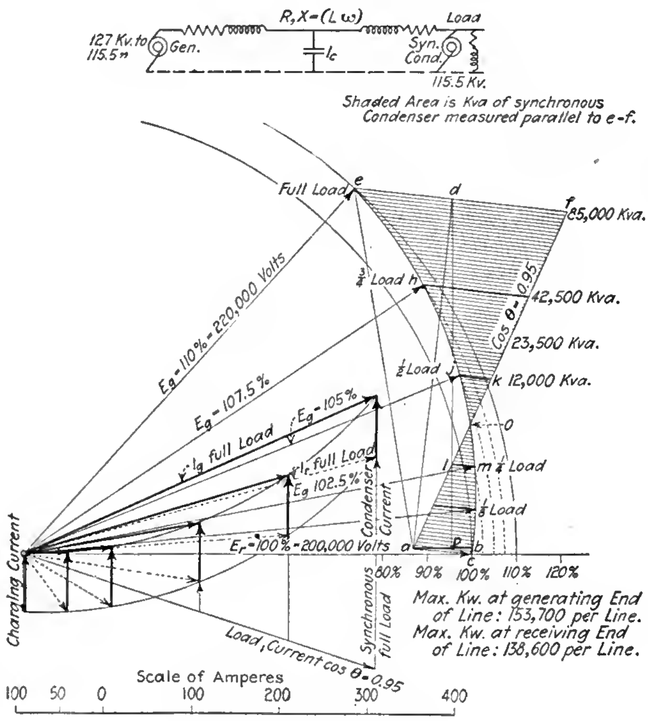

TOWERS USED ON PIT RIVER LINE

Left—Main-line double-circuit towers, used in valleys. Right—Towers used in the mountains, where snow and ice make vertical spacing inadvisable.

*See "Voltage Regulation and Insulation for Large-Power Long-Distance Transmission Systems," by F. G. Baum, *Transactions A. I. E. E.*, June, 1921, pages 643-648.

which will take the power from the large producing centers to the smaller as well as the larger consumption centers and more nearly equalize power conditions in small and large cities. That is the fundamental basis of the electric power problem and on that basis the problem has been successfully handled in California and a few other states.

It is not sound practice to allow all the water powers of Niagara to be used locally to the advantage of a few industries, but part of this power should be required to flow out into the smaller cities to help them prosper. Similarly, the water power of Muscle Shoals and other sites of great potentiality should not all be used locally to the advantage of a few industries, but a very large proportion of this power should find a market through the construction of transmission lines that will take




THE SYNCHRONOUS CONDENSER IS USED TO GET GOOD LINE REGULATION

it to available markets and build up present communities. In that way we will spread out the advantages of water power among more people, and this will in turn create a more favorable public opinion for the logical development of water power and transmission systems to meet the needs of the states and nation. I believe the men in the electrical industry in California will see the logic of the reasoning now that there is available a transmission system with which to back it up.

## Pit River 220,000-Volt Transmission Line

Recently there has been completed in California the first step of what I believe confidently to be the forerunner of many similar systems covering large power producing and consuming regions, and I believe an account of this achievement and the reasons therefor, as above given, will be of interest to the industry as well as to those far-sighted financial men and business men who have ability and vision, energy and courage combined in the proper proportions.

The Mount Shasta Power Corporation (a subsidiary of the Pacific Gas & Electric Company of California) has completed the first step of a series of power developments on the Pit River, which is in the northeastern part of California, and has constructed a transmission line to the San Francisco Bay region. The first power development consists of two stations of 12,500 kva. each and one station containing two units of 35,000 kva. each, making a total of 95,000 kva., with step-up transformers for 220,000-volt delivery to a transmission line 202 miles in length and to the first substation. This substation contains 100,000 kva. in transformers, which lower the voltage to 110,000 for secondary transmission and to 55,000 for primary distribution to the San Francisco Bay district.†

The power load of the bay district first justified (about 1898-1900) the construction of plants of about 10,000 kw. easterly and northeasterly from the bay. The Standard Electric Company's network was first designed for 60,000 volts, 60 cycles, and a grounded system. This system was also adopted by the Bay Counties Power Company. The two systems formed the nucleus for the present network of the Pacific Gas & Electric Company. I have always advocated 60 cycles and a grounded system, believing that this should become standard for the United States. I believe the grounded system necessary for any large high-voltage system.

As already stated, the construction of the transmission lines across the Sacramento Valley developed considerable power business outside the bay districts. At the present time practically all power used in this section is electric power, and this great diversity has resulted in a high load factor for the system and has also greatly stabilized the earnings of the Pacific Gas & Electric Company.

San Francisco and Oakland, the larger cities in the bay district, justify steam plants for local insurance, as well as to give an economical proportion of steam and hydro-electric power as determined by the load curve of the system.

The growth of the system, as is generally known, has been very rapid, and this growth has been in the valley cities as well as the larger cities, owing to the policy of the company and the natural conditions in the territory, as explained above. The Pacific Gas & Electric system now has a daily load of about 200,000 kw. average and a peak load of about 275,000 kw., giving a very high load factor. About forty different power plants supply power to the system, which consists of several thousand miles of transmission lines. This growth has occurred in about twenty years.‡

## Line Regulation

In a second article the Pit River power plants will be described. The transmission line designed for 220,000-volt operation is the only part of this development which is pioneer work.‖ Manufacturers have been ready for some time to furnish transformers and switches for 220-kv. service, as well as generators and turbines of the rating required for this voltage. Therefore our studies were concentrated largely on the problems of line regulation and insulation. The line regulation we consider solved with the help of synchronous condensers, without which operation at this voltage would be

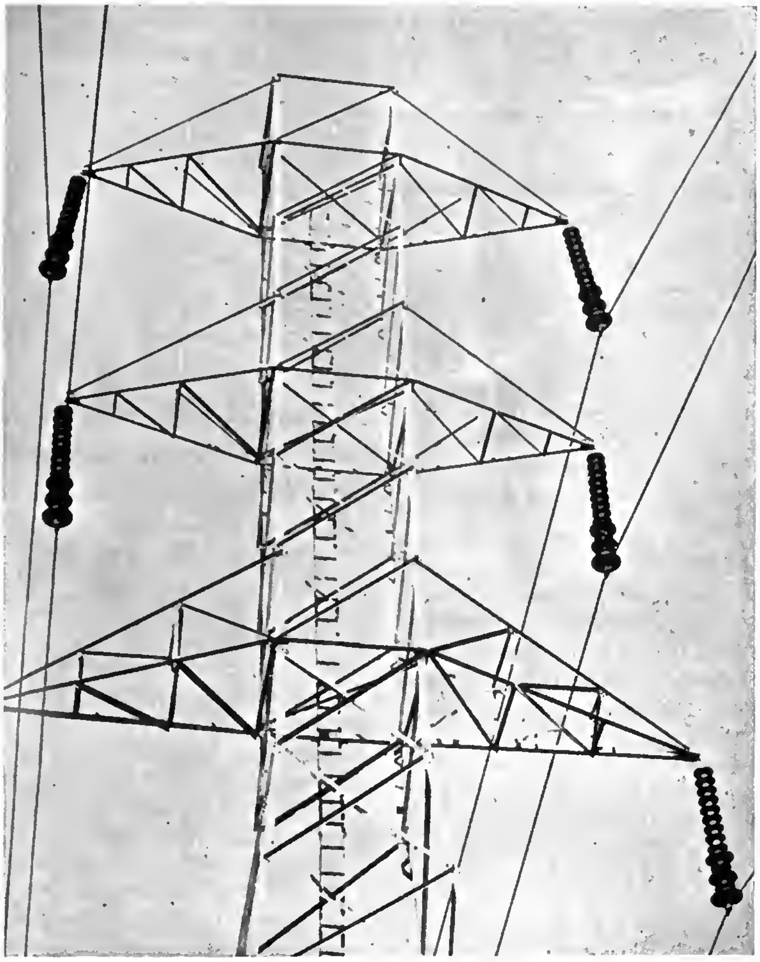
†See "Rebuilding a Transmission System," by J. P. Jellyman, Electrical World, Sept. 16, 1922.

‡See "Progress of Power Industry in Far West," by F. G. Baum Electrical World, May 22, 1920, and "Potential Water Power in California," by F. G. Baum, *Pacific Service Magazine*, July, 1920.

‖See "Voltage Regulation and Insulation for Large-Power Long-Distance Transmission Systems," by F. G. Baum, *Transactions A. I. E. E.*, June, 1921, pages 643-648.

impracticable. A description of the transmission line, which was so designed that we shall get (1) a stable line, (2) a constant-voltage line and (3) a reversible line was contained in the paper above referred to and will be only briefly alluded to here. (Interesting articles on the 220-kv. line, discussing the use of distributed condensers for stabilization and regulation of potential, have been written by F. W. Peek, Jr., *Transactions A. S. C. E.*, November, 1922, and Prof. A. J. Ryan, *Transactions A. S. C. E.*, December, 1922.)

On long lines at high voltages the charging current at no load, being a leading quadrature current, causes a voltage rise over the line when flowing over the reactances found in its circuit. At heavy loads the power current causes a voltage drop flowing over resistances and reactances in the circuit. Thus, by introducing at no load a lagging quadrature current, voltage rises may be compensated for, and by introducing at heavy load a leading quadrature current, voltage drops may be compensated for. This the synchronous condenser will do, so that it becomes in effect a variable reactor at excitation below normal and a variable condenser at excitation above normal. Two condensers each of 20,000 kva. capacity at leading quadrature current, giving 12,000 kva. at lagging quadrature current, are installed at the Vaca substation at the end of the line. This station has room for an additional condenser of 40,000 kva., which will become necessary when the load grows. Condensers will be added at the center of line when required for regulation and stabilization of potential under operation at 220,000 volts.



A GREAT AMOUNT OF RESEARCH WAS REQUIRED TO DEVELOP THE GRADED INSULATORS FOR THE 220,000-VOLT LINE

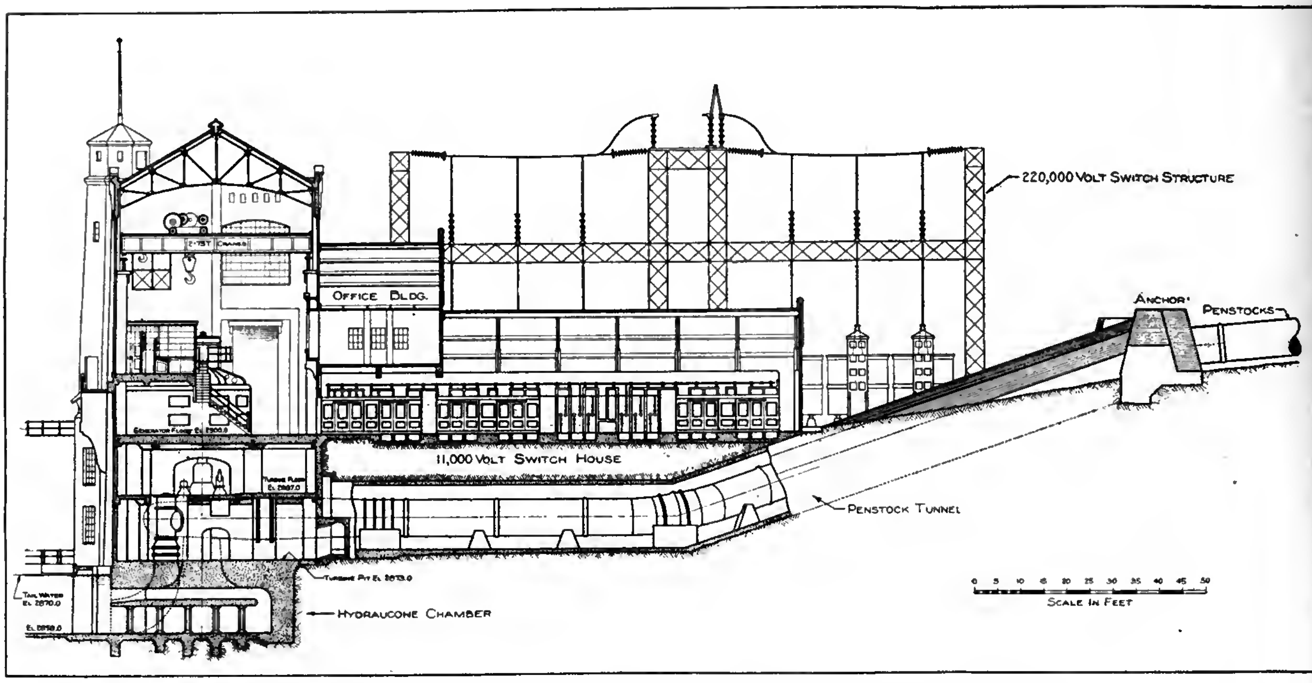
### LINE INSULATION

The line insulation was studied extensively in the various laboratories of the country, as described in the 1921 A. I. E. E. transmission paper referred to. A discussion of the reasons pro and con for the selection of the string of insulator arrangements used would lead too far for the present article. Suffice it to say that the chosen string is not considered the final solution in the insulation for high voltages, although we expect better operation at 220 kv. with the arrangement referred to than is now obtained on 110-kv. lines. It will be necessary to study the problem continuously not alone for 220 kv. but for 100 kv. and upward, so that we shall not fall into a state of self-assurance and neglect the matters, as was done when the suspension insulator first was introduced. All interested parties are now alert as they appreciate the very great importance to the future of the power industry of the highest type of line insulation for all voltages.

A typical string, as shown in Fig. 3, is made up as follows, counting from the tower arm nine standard 10-in. disks, one two-skirted 14-in. disk, one two-skirted 10-in. disk, and then what we call a splash plate and grading shield combined. The latter is made of spun copper in two pieces which are slipped over a standard 10-in. insulator unit, short-circuiting it, and suspended from the string as is any insulator above. Below this is the line clamp. The diameter of the shield is 16 in., and its purpose is twofold. First it serves as a splash plate during a rain with heavy drops and brings about on the unit next above it a surface condition similar to that which exists on all the rest of the units. Without it the undersurface of the last unit would be dryer than that of any other, piling up the voltage on it. Second, it assists in a better voltage distribution between the units by control of the capacity currents. The assembly gives a string length of about 7 ft. Voltages of the order of magnitude of 500,000 are necessary to flash over such a string. Experiments bearing on the problem are still going on, but briefly the writer may say he is convinced that the solution of the insulator problem for 220-kv. operation requires:

1. A long string of insulators, so that birds, etc., will not cause short-circuits.
2. A string containing five to seven units, so as to give good natural potential distribution, reducing the shield to small proportions.
3. The surfaces to be of such design that the maximum discontinuity of water streams caused by rain, dew or fog will result.
4. Each unit to be designed for good potential distribution under wet and dry conditions.

The construction of the second Pit River line was not completed over the mountain section before winter set in. The lines are therefore operating at 125,000 volts. This is to be raised later to 175,000 and then to 220,000.




VERTICAL SECTION OF PLANT AT PIT RIVER, SHOWING LOCATION OF SWITCH HOUSES AND MAIN UNITS

The main-line double-circuit towers shown in the illustration were used in the valley, while double towers were used in the mountains, where heavy snow and ice makes vertical spacing inadvisable. The conductor cables used are shown in tower drawings.

### Vaca Substation

The Vaca substation is designed to receive at the present time all the Pit River power, to regulate the voltage and to distribute at 110,000 volts the power to the San Francisco Bay region. Later other stations will be erected as required. (See plan of station, on page 206.

Two banks of 50,000 kva. each are installed. They are auto-transformers, two-to-one ratio for full voltage. There is a tap at 165,000 volts, and they may be operated at 110,000 volts without auto-transformation.

The synchronous condensers are started and operated from tertiary and quarternary deltas, these windings also transforming and absorbing the triple-frequency exciting current.

To a great extent the layout is similar to that at Pit No. 1, and it is exactly so for the 220,000-volt equipment. There is a large 110,000-volt switch rack in addition, but the 11,000-volt switches are housed in a very similar manner. The control room, being on the second floor, overlooks the extensive high-tension switch and transformer yard. Connection is made at Vaca substation to the 110,000-volt line from the South Yuba River power house at Drum.

The transmission-line towers were furnished by the Pacific Coast Steel Company of San Francisco. The insulators were furnished by the Ohio Brass Company and the Locke Insulator Company. The high-tension switches are Westinghouse. This company also furnished the two 20,000-kva. synchronous condensers with special regulators for voltage control at the receiving end of the line. The step-down transformers were furnished by the General Electric Company.

The system was placed in operation on Sept. 30, 1922, with a clean score for all apparatus.

## Financial Results of Norwegian Hydro-Electric Nitrogen Company

THE Norwegian Hydro-Electric Nitrogen Company, which makes nitric acid directly from air by the arc process, has had a remarkable financial success, according to E. Kilburn Scott. As a manufacturing concern it is a triumph of exact scientific engineering skill, and as a financial proposition it is unique, he declares. Unlike some other companies, this concern has paid handsomely ever since it started, seventeen years ago. It is estimated that the total annual output is worth over £2,000,000. During the last ten years the capitalization of the company has increased enormously until it is now 57,000,000 kroner, or £3,200,000 at normal exchange, and the capital of Rjukanfos, one of the subsidiaries, is 100,000,000 kroner, or £5,500,000. The dividends on common and preferred stock have increased from 5 per cent and 8 per cent respectively to 15 per cent.

FINANCIAL DEVELOPMENT OF THE NORWEGIAN HYDRO-ELECTRIC NITROGEN COMPANY

| | Year 1913 | Year 1917 | Year 1920 |
|---|---|---|---|
| Income from Svaelgfos-Notodden | 8,137,489 | 38,404,474 | 16,751,345 |
| Operating expenses, etc. | 5,042,914 | 27,736,861 | 8,853,161 |
| | 3,094,574 | 10,667,613 | 7,898,184 |
| Interest on advances to subsidiaries | 3,269,098 | 1,410,814 | 766,258 |
| Dividends on stocks of subsidiaries | 2,814,127 | 12,638,755 | 20,763,351 |
| Other income | 4,506 | 79,174 | 7,790 |
| | 9,182,306 | 24,796,356 | 29,435,583 |
| General expenses— Norsk Hydro annuities, loans and written off | 3,967,336 | 4,970,303 | 3,704,920 |
| | 5,214,970 | 19,826,053 | 25,730,663 |
| Amortization | 1,810,276 | 2,471,068 | 875,045 |
| Net profit | 3,404,693 | 17,354,985 | 24,855,617 |
| From last year | 180,432 | 1,473,910 | 2,614,126 |
| Total profit | 3,585,126 | 18,828,895 | 27,469,744 |
| Management fees, reserve fund, taxes, staff employees, workmen | 723,248 | 10,861,003 | 2,439,277 |
| | 2,861,877 | 7,967,891 | 25,030,467 |
| Dividends | 2,468,388 | 5,763,960 | 8,645,940 |
| Surplus | 393,489 | 2,203,931 | 16,384,527 |

# The Physics of Hysteresis Loss

## Attention Directed to the Importance of the Heaviside Formula in Bringing About Co-ordination in the Essentials of This Subject

BY A. PRESS

SO MUCH has been written about hysteresis since the time of Oliver Heaviside's treatment of the subject in his "Electromagnetic Theory" (Vol. 1) that it is surprising greater co-ordination in the fundamentals of the subject has not resulted. Many of the difficulties which Professor Whitehead ably brought together in a letter to the ELECTRICAL WORLD printed on Nov. 11, 1922, can nevertheless be explained if note is taken of some recent work in which no less than two mechanical models of hysteresis have been evolved. (See *Physical Review*, June, 1922; Lees, *Philosophical Magazine*, September, 1922.)

In the writer's view too little attention has been paid to the Heaviside formula:

$$B = \mu_0 H + I = \mu_0 H + \mu_1 H = B_0 + B_1 \qquad (1)$$

Most engineers and physicists have preferred the simpler form of expression

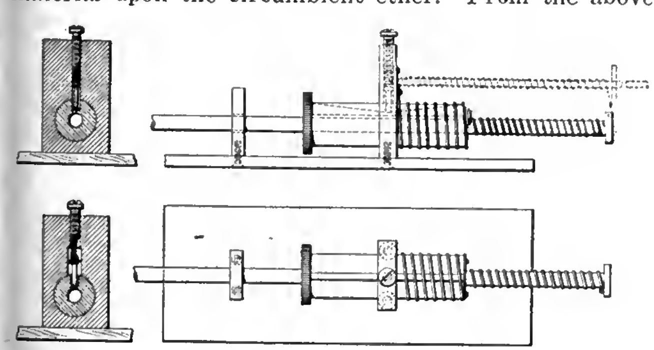
$$B = \mu H = (\mu_0 + \mu_1) H \qquad (2)$$

with consequent loss of proper emphasis. Thus it should be clear that in the ether itself there can be neither magnetic nor electric hysteresis proper. Such hysteretic phenomena as may be present at all, whether viscous or static, must be a property of matter and not the ether.

Indeed, in keeping with formula (1) for the magnetic case we also have for the electrical counterpart the formula:

$$D = D_0 + D_1 = K_0 E + K_1 E \qquad (3)$$

(See Heaviside "Electromagnetic Theory," Vol. III, page 44.) The hysteresis diagram should therefore only strictly involve the co-ordinate $H$ or $E$ (the applied forces respectively), on the one hand, and the magnetic displacement $I$ and electric displacement $D_1 = K_1 E$, due to the effect of the material dielectric and magnetic material upon the circumbient ether. From the above

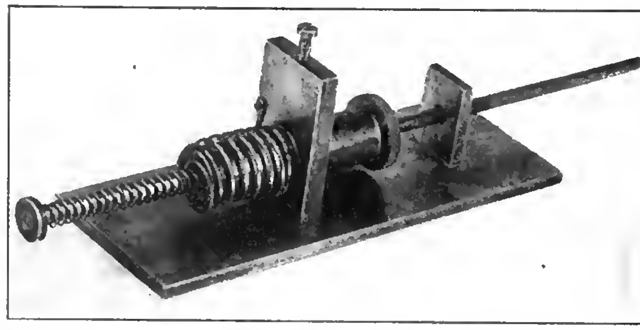


DETAILS OF MODEL APPARATUS WHICH CLARIFIES CONCEPTION OF HYSTERESIS

point of view magnetic and electric coercivities can only have proper reference to the $H$-$I$ and $E$-$D$ diagrams and cannot be employed in the manner hitherto obtaining in nearly all physics textbooks which have been written since the time of Ewing.

Conduction phenomena can never be considered as a pure ether effect. It properly refers to the material medium as contradistinguished from the enveloping ether. The same thing is true of the term dielectric strength. (A recent writer aimed to measure the dielectric strength of the ether!) To speak of the resistance of the ether is equally absurd, for conductance cognates matter, not the ether.

To answer the hysteretic conundrum of Professor Whitehead attention may be invited to the model. The ether has permeability $\mu_0$ ($k_0$ for the electric case) and is simulated as a spring constraint between the rod, giving the displacement $B$ or $D$, and the enveloping barrel giving the displacement $B_1 = I$ or $D_1$, due to the influence of the magnetic material or dielectric matter upon the ether. The ether co-ordinate of displacement is with respect to the frame supporting the rod and barrel.



MODEL FOR EXPLAINING ACTION OF HYSTERESIS

The $I$ and $D_1$ displacements are controlled by the barrel spring between its one end and the above frame. To produce hysteretic lag a frictional constraint is introduced mounted on the frame and engaging with a groove on the outside surface of the barrel in question. A set screw and spring within the vertical support of the frame controls the frictional contact between a lug and the spline mounted hollowed-out to give greater frictional constraint for extreme movements of the barrel.

### LUG ACTS AS A PISTON

To simulate viscous hysteresis it is necessary to have the lug above referred to working as a piston within the leaky confines of the vertical support. This is illustrated in the figure. On the other hand, diamagnetism is indicated by an additional spring control between the further end of the rod (see dotted line) and the supporting frame.

Let us then see to what extent known hysteretic phenomena are explainable by means of the above clarifying model. Professor Whitehead refers to electric soakage. This is explainable by the fact that the frictional constraint has included a leaky piston in the bore of the frame in which the friction spring occurs. On the other hand, it is very clear that at high periodicities the piston chamber, whether under compression or tension, has no time to permit any material leakage to occur, and therefore the apparent dielectric constant varies.

It is true that on a sudden application of direct-current potential only the initial charge should be taken to obtain the true dielectric constant for high frequencies. Needless to say, there is no obvious interconnection between the leakance of the piston chamber or the strength of the spring controlling the friction contact and that true resistance factor of the material which is in the nature of a fluid frictional property of

the conduction current rather than the material dielectric counterpart. For there are in fact two types of dielectric—the ether dielectric with its Maxwellian displacement current $dD_0/dt$ and the less emphasized material dielectric with its displacement current $dD_1/dt$, neither of which constitutes a conduction current in the Maxwellian sense. Loss may, however, occur with respect to $dD_1/dt$ (hysteresis) but not with respect to the former.

It may be noted in passing that the proposed mechanical model for hysteresis can be helpful in understanding mechanical phenomena. Thus the spring constraint on the rod corresponds to the crystalline conservative element of the metal, whereas the barrel constraint and its frictional hysteresis-producing control would have to correspond to the non-conservative filler or amorphous material between the crystals.

# Economics of Rural Line Extensions

## Growing Demand for Service Makes Simple Rules Protecting Both Consumer and Utility Necessary—Annuity Plan as Evolved by Committee of Northwest Electric Light and Power Association

By R. M. BOYKIN*
*Vice-President and General Manager*
*North Coast Power Company, Portland, Ore.*

FOR many years there has been a persistent and growing demand for electric service from farmers and small property owners living adjacent to improved highways and large centers of population. This demand is constantly increasing as highways are improved. The problem of determining upon what basis the rural line extension should be made is largely financial, but there are commercial and practical problems that should be considered, and possible future growth must never be forgotten. These matters have had serious consideration from executives, engineers and commercial men belonging to the utilities of the Northwest and other sections. In some instances well-meaning staffs of state regulatory bodies have attempted to make rules in an endeavor to cover adequately all questions that may arise. The resulting rules have become involved beyond description, are wholly or partly unworkable, and fundamental principles have been buried in a maze of meaningless words.

During the past two years the technical committee of the Northwest Electric Light & Power Association, feeling that line extensions into rural districts should be encouraged, since these districts are the backbone of our national life, has devoted a great deal of time and study to the solution of the problem of financing rural extensions. This study was predicated upon the fact that rules as simple as the facts underlying their making and equitable alike to the utility and the consumer are the only kind that will survive. It was recognized that of necessity all points could not be covered in the rules and that such a task should not be attempted. The purpose of the rules should be to establish a working basis for determining the amount which any electrical utility can afford to invest in an extension, with due regard to the interests of existing consumers, assuming that at the time the utility is in successful operation and reasonably able to finance itself. The rules should also determine under what conditions such an extension may be required when the investment necessary is greater than what is justified by the return.

A line extension is defined as a branch from or a continuation of an existing primary or secondary distribution system, or both, to serve new customers. A line extension includes all labor, material and apparatus used in the line extension up to the customer's service outlets and includes the meter. Reinforcing existing lines or increasing the capacity of transformers to provide additional capacity for existing customers should not be considered as a line extension.

That part of the cost of increasing the capacity of existing lines and apparatus and that part of the cost of overbuilding of secondary lines with primary lines which is made necessary by an extension to serve new customers should be considered a part of the cost of such line extension.

### TRANSMISSION AND DISTRIBUTION SYSTEMS MUST BE SEPARATED

A primary or secondary distribution system should not be confused with a transmission system used primarily for the transmission of electrical energy between generating stations, between substations or between generating stations and substations.

A line extension may consist of poles, wire, transformers and other material and apparatus, or it may consist only of wire on existing poles.

To determine the amount a utility in "successful operation and reasonably able to finance itself" should invest in a rural extension, the following language is suggested: "The minimum amount to be invested by any utility in an extension will bear the same ratio to the estimated annual revenue from the new extension as the total investment in the distribution system of the utility bears to the total annual revenue from the system. That is to say, if the utility's total investment in its distribution system is $100,000 and the annual revenue from this system is $50,000, then the investment ratio is two to one and the utility should invest two dollars in an extension for every dollar of estimated annual revenue to be derived from the extension." No prospective rural customer complains, but rather considers himself fortunate when told he will receive service upon the same ratio of investment to earnings as his urban brother.

The necessary investment in rural lines is frequently several times the ratio above referred to. It is the provision of funds to meet this excess cost and caring

*Chairman technical committee Northwest Electric Light and Power Association.

for the fixed charges thereon that troubles the utility and the customer and is the only real problem that has been a nightmare to regulating authorities and utilities alike. The utility is often more able than the customer to provide the funds to meet this excess cost in the line and facilities, in which case the customer, in addition to the rates, should pay annually certain charges on the excess investment until the rural line extension becomes self-supporting. It should be remembered that the rates paid to a "successfully operated utility" reflect all cost and a reasonable return on "the minimum amount to be invested by any utility." The annual amounts that should be paid by the customer on the excess cost, or investment, until the rural line extension is self-supporting are as follows:

A—Interest (return or cost of money).
B—Taxes.
C—Depreciation.
D—Operation.
E—Risk and contingencies.

These items should be expressed as a percentage of the excess cost in the rural line extension and in many cases have been found to be: A, 8 per cent; B, 1 per cent; C, 5 per cent; D, 6 per cent, and E, 2 per cent.

An inquiring mind would ask: "When does a rural line extension become self-supporting and the customer cease paying the fixed charges on the excess investment in the extension?" The extension may be said to be self-supporting when the ratio of the total investment in the extension to the revenue derived from the extension equals the investment ratio for the specific system under consideration as defined above. There will be in most rural extensions a gradual increase in the business and revenue from the lines as the territory served becomes more settled, so that the annual payments, A to E inclusive, should gradually decrease and become nil when the extension is self-supporting. The annual amounts that should be paid by the customer on the excess cost should, therefore, be for each year one-half of the first year's payment, and this sum should be paid each year until the self-supporting period arrives. This period can be obtained from statistics and fairly closely estimated. The length of time required for an extension to become self-supporting will perhaps vary in many sections of the utility property and will be from a few years in some sections to perhaps twenty years or longer in others.

It is highly desirable to close the transaction with the customer at the time the contract is made, rather than have the average annual payments on account of the excess investment in the line paid in annual instalments up to the beginning of the self-supporting period.

### The Annuity Plan

To enable the transaction to be closed at the time of executing a service contract by a customer the annuity principle of finance is recommended. Such a plan contemplates the payment to the utility by the customer of the principal of an annuity computed at 4 per cent compound interest. The yearly payments earned by the principal of the annuity should be sufficient to return to the utility the average annual payments (one-half of A to E inclusive each year) necessary to defray the charges on the excess investment in the rural extension to the time it becomes self-supporting. At the end of this period the principal is exhausted. The following table shows the payment necessary in order to produce $1 per year for the years shown and at the end of each year, the principal being exhausted. The computation is at 4 per cent compound interest.

| Period of Years | Principal | Period of Years | Principal |
|---|---|---|---|
| 5 | $4.452 | 15 | $11.118 |
| 8 | 6.733 | 18 | 12.65 |
| 10 | 8.111 | 20 | 13.59 |

Since it is proposed that the extension shall be financed by the utility, the title should remain with the utility; also, since the amount paid by any prospective customer is only sufficient on the average to make good the actual deficit resulting from the construction and operation of such extension, no customer is entitled to a refund of any amount paid by him.

### Details of Method

The following example will aid in a clear understanding of the method of financing that is proposed:

| | |
|---|---|
| Applicants—rural lighting residence | 5 |
| Estimated cost of providing service | $510 |
| Annual estimated gross earnings from tariff | $130 |
| Estimated time to become self-supporting | 10 years |
| **FACTS** | |
| Investment in company distributing system | $100,000 |
| Gross earning from company distributing system | $50,000 |
| Investment ratio | $2.00 to $1.00 |
| Payments on excess investment, per cent | 22 |
| **SOLUTION** | |
| Minimum investment that should be made by company, $130 × 2 | $260.00 |
| Excess investment, $510 — $260 | 250.00 |
| Fixed charge on excess investment 22 per cent of $250 | 55.00 |
| Average annual fixed charge, half of $55 | 27.50 |
| Principal of annuity to be paid by customer to company, 8.111 times $27.50 | 223.05 |
| Amount to be advanced by each customer to defray deficits for ten years | 44.61 |

The rates charged should be those prevailing for the same class of service in the nearest urban district, with perhaps higher minimums to compensate for additional losses in longer lines and greater transformer losses. Utility representatives and commission engineering staffs have given much thought to the matter of refunds, a somewhat vexing problem. From the commercial and practical side of the problem refunds are a source of annoyance. The idea of finance expressed above eliminates this problem. It should be borne in mind that the utility must develop its rural business on a basis that will be self-supporting within a reasonable time, but care should be used so as not to reflect a burden on the urban consumers. Whatever scheme of financing rural extensions is evolved it must be one to encourage and develop rural electric service. On this point the Wisconsin commission says: "Not only must the business be permitted to earn the same rate of return as is reasonable for urban business, but the utility must be permitted to make terms as to financing which will make possible the immediate investment of considerable sums of money in rural extensions without taxing the resources of the utility for securing capital."

Many ideas have been expressed as to methods of finance. Some advocate that groups of customers organize and engage in utility business. Such ideas have little or no merit. Encouragement of such organizations by the supplying utility is an effort to evade the responsibility. This plan is discouraged.

After a thorough study of many financial plans taking into consideration the commercial, practical and future aspects of rural line extensions, the natural conclusion drawn is that the subject is so involved that only a few simple rules should be made. To cover every point adequately is impracticable and out of the question.

# The Neon "Glim Lamp"

## A New Signal and Decorative Lamp for Use on Higher Voltage Distribution Circuits Which Uses Electric Discharges in Neon Gas

BY ARTHUR PALME
Pittsfield, Mass.

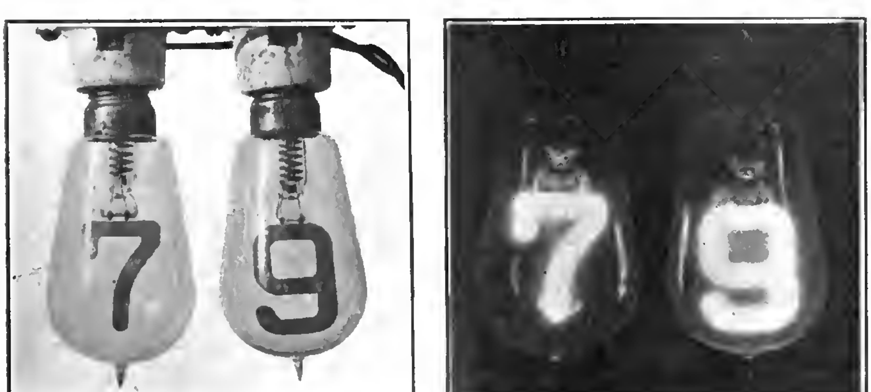
THE glim lamp derives its luminosity from an electric discharge between two electrodes placed together and inclosed in a rarefied atmosphere of neon gas. The lamp operates like an electric valve; that is to say, if a direct-current potential of more than a certain critical minimum is placed upon its two electrodes, the cathode will be luminous, the anode will remain dark. If alternating current is impressed, both electrodes will *appear* to be simultaneously luminous. In fact they are luminous one at a time, but with commercial frequencies of 25 cycles to 60 cycles the alternations of light and dark will occur so rapidly that the eye will see only a permanent glow of both electrodes simultaneously. At 25 cycles, however, the flicker is quite pronounced. The critical or minimum voltage to start any visible discharge is 180 volts for direct current and 130 volts for alternating current. The color of the luminous electrodes is a pleasing pinkish-orange with a blue-violet fringe on the edges. The manufacturer labeled the lamps "5 watts, 210-240 volts." Actual measurements showed a consumption of 11 milliamperes for alternating current and 8.8 milliamperes for direct current at 220 volts in both cases. The difference between the amount of current required by a lamp fed by alternating current and the amount required by the same lamp fed by direct current might permit one to assume the power factor of the lamp to be in the neighborhood of 0.8, but as the lamp is really a small condenser, this figure appears to be much too high.

The shape of the electrodes is governed solely by the use of the lamp. The most obvious use of these lamps is for sign lighting in the form of letters to spell out words or names, etc., or in the form of figures for luminous house numbers. Any word may be spelled out with a number of letter lamps mounted closely side by side; but a limited number of letters or numbers may also be combined in one long glass tube to spell out a complete name or a high house number. For instance, the name of a doctor may be spelled out in one tube and mounted over the entrance to the physician's house, the lamps continuing to burn during the night hours. Assuming a consumption of 2 watts per letter, a sign bearing the name "Dr. Jones" would require only about 15 watts, and its operation at a charge of 10 cents per kilowatt-hour would cost about 1½ cents for ten hours. For general signal lights the electrodes are shaped in the form of a semisphere, radiating the light uniformly downward at all angles. The brightness of the lamps is about 0.7 cp. to 1 cp., but the pinkish light is very conspicuous and can be seen easily even in daylight and for a considerable distance. Such plain signal lamps have a great variety of uses. They make excellent indicator lamps to show the position of a switch in circuits of more than 130 volts alternating current, the lamp being connected parallel to the switch. The lamp will burn at open switch, regardless of the ohmic resistance in the consuming circuit, because the latter is as a rule infinitely smaller than the very high internal resistance of the lamp. Connected in parallel to a fuse, the lamp will indicate the blowing of the fuse. A lamp with one electrode shaped like a plus sign and the other like a minus sign can be used as a very simple polarity tester for all direct-current circuits of 180 or more volts.

ACTUAL SIZE OF LAMP, SHOWING DETAILS OF CONSTRUCTION

All bulbs containing a letter or a figure have fastened to the central contact on the Edison base a short wire spiral, so that proper contact is insured for more than a full turn in the socket. This will permit one to turn the lamp always to the right position, regardless of the depth of the socket thread.

For European conditions, where 220-volt distributing systems outnumber overwhelmingly the 110-volt networks, these lamps become popular in a remarkably short time. For 110-volt direct-current circuits they are obviously useless. On alternating-current 110-volt supplies a small booster transformer is all that is needed. This transformer should be wound preferably as a 110/220-volt auto-transformer and should have a rating according to the number of "glim lamps" to be energized, calculating 2 watts to 5 watts per lamp or per letter. The so-called "toy transformer" has more than ample capacity to supply ten of these lamps. The manufacturers guarantee them a life of several thousand hours.



THESE NEON LAMPS ARE POPULAR IN EUROPE ON THE 220-VOLT CIRCUITS —BEFORE AND AFTER ILLUMINATION

# Some Economic Phases of Engineering

## Methods of Evaluating Increase of Equipment Efficiency in Studies of Plant Design Suggested—Mathematical Formulas that Have Been Developed for Such Studies

By GEORGE F. MARSTELLER

*Electrical Engineering Department, Utica Gas & Electric Company*

ENGINEERS whose duty it is to approve specifications of apparatus, layouts of systems and similar work do not always give sufficient consideration to the underlying economics of their problems. For some cases there is a tendency to get the best quality regardless of cost or to make sure of some quality regardless of value. The mechanical, electrical or thermodynamic efficiency either receives too much attention or not enough. The following article embodies a few reflections along these lines which it is hoped may at least stimulate a more considerate attitude toward this interesting subject.

When the constancy or variation of conditions over a given period of time can be ascertained with a reasonable degree of accuracy or reliability, it is the aim of all true engineering to specify machinery equipments or entire systems which will have an economic efficiency that will ultimately earn the greatest financial returns on a given investment of capital and not necessarily have the greatest physical efficiency at lowest or highest first cost. For example, to obtain the greatest number of kilowatt-hours from the least possible number of B.t.u.'s or pounds of coal does not necessarily imply the most economical operation, since it may require too great an investment. Illustrations could be cited where many an otherwise fine and modern installation incurs at least twice the service cost necessary to perform its economic function properly. Obviously, then, the specification of any apparatus, unit or equipment available for selection does not depend on the first cost or physical efficiency alone, but on their mode of operation, interest charges, useful life and load factors of power and time as well.

As in most practical engineering calculations so also in this domain does the correct solution of a problem depend upon certain premises or constants. Evidently, the accuracy of the most elaborate method of calculation can never exceed the trustworthiness or reliability of these constants. This statement, too, is another mathematical axiom which seems often to be entirely overlooked. Naturally, then, in the correct determination of these constants or suppositions much caution is required, since here experience and research are at a premium and find their greatest value. Hasty conclusions and too close adherence to conventional methods, sometimes established by custom or prestige rather than by practical facts, often lead to unjustifiable errors.

One item which is commonly subject to these propensities is the depreciation rate. For instance if the life of a unit is taken as fifty years, then the depreciation rate is generally taken to be $100 \div 50 = 2$ per cent; i. e., if $R$ is the depreciation rate in per cent and $n$ the number of years, plotted against each other, then $100 = nR$ is thus assumed to follow a curve represented by a rectangular hyperbola. A little examination will readily show that such an assumption is incorrect, since it entirely fails to take into account the steadily growing interest on the depreciation reserve accumulated.

An abbreviated derivation of the following formula, based upon the well-known compound-interest principle, will illuminate this point:

Let $E$ = first cost of the unit or equipment,
$V$ = annual amount to be set aside for depreciation,
$I$ = interest rate on money,
$R$ = depreciation rate.

Provided that the very indefinite scrap value of the unit or equipment to be replaced shall be considered applicable to the new purchase and not be treated as if it were a capital asset, the equation $R = V/E$ will give exact values of the depreciation rate.

The depreciation reserve $M$ at the end of the first year is evidently:

$$M_1 = V \qquad (1)$$

At the end of the second year we have:

$$M_2 = M_1\,(1 + I) + V = V[(1 + I) + 1] \qquad (2)$$

At the end of the third year:

$$M_3 = M_2(1 + I) + V = V[(1 + I) + 1]\,(1 + I) + V = V[(1 + I)^2 + (1 + I) + 1] \qquad (3)$$

Multiplying $M_3$ by $(1 + I)$, we get:

$$M_3(1 + I) = V[(1 + I)^3 + (1 + I)^2 + (1 + I)] \qquad (4)$$

Substracting (3) from (4), we have:

$$M_3[(1 + I) - 1] = V[(1 + I)^3 - 1] \qquad (5)$$

and consequently from (5):

$$M_3 = \frac{V}{I}\Big[(1 + I)^3 - 1\Big]. \qquad (6)$$

Similarly, at the end of the fourth year:

$$M_4 = \frac{V}{I}\Big[(1 + I)^4 - 1\Big]. \qquad (7)$$

And in general, at the end of any number of years, or $n$ years:

$$M_n = \frac{V}{I}\Big[(1 + I)^n - 1\Big]. \qquad (8)$$

But at the end of $n$ years the depreciation reserve must equal the first cost $E$, so that:

$$E = M_n = \frac{V}{I}\Big[(1 + I)^n - 1\Big], \qquad (9)$$

and the depreciation rate being $R = V/E$, substitution gives:

$$R = \frac{V}{E} = \frac{I}{(1 + I)^n - 1}. \qquad (10)$$

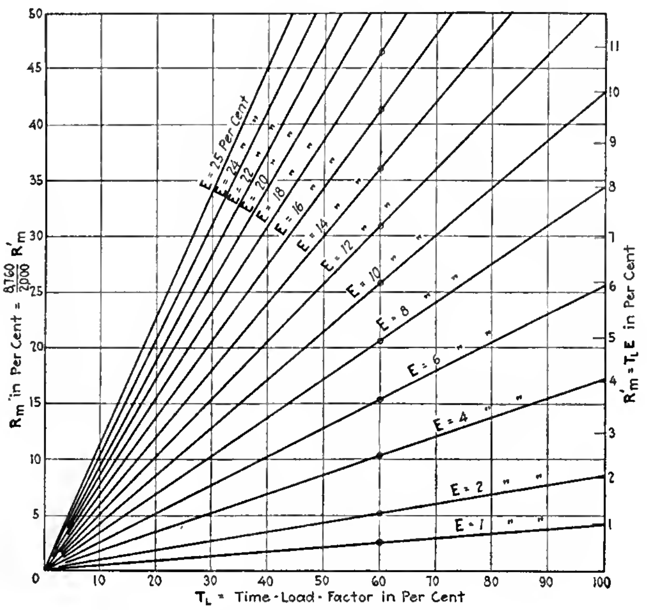
If it be assumed that the useful life of the machine or equipment is say, fifty years, and the interest on money, $I$, is 5 per cent, the formula (10) would give:

$$R = \frac{0.05}{(1 + 0.05)^{50} - 1} = 0.4777 \text{ per cent,}$$

thus showing an error of nearly 315 per cent with

respect to the conventionally acquired depreciation rate of $100 \div 50 = 2$ per cent. For the same interest rate the error decreases as $n$ decreases, but even at $n = 25$ years, the difference would still be 91 per cent. At $I = 10$ per cent and $n = 25$ years, the error would be $(4 - 1.0168) \div 1.0168$, or about 294 per cent. It is, therefore, evident that this subject of depreciation, and appreciation for that matter, cannot be taken lightly.

Sometimes a few calculations will throw light on points which seem uncertain and entirely indefinite, thus arriving at comparative values that fit the special conditions under consideration. As an illustrative example, let it be desired to determine the additional investment we can afford for a new machine of similar capacity and general mechanical features, but having a perceptible increase in efficiency.




A GRAPHIC CHART AIDS IN MAKING EASY THE MATHEMATICAL SOLUTIONS

Let the old machine be a turbo-generator, costing originally, say, \$80,000. Furthermore, let 7,500 = kw. capacity of both old and new machine. Also, let this be the mean load, differing more or less from this constant load for a total time which is negligible in comparison with the time of the total yearly run.

20 = estimated useful life of machine in years,
11 = percentage of interest, taxes, depreciation, etc.
12.8 = pounds of steam per kw.-hr. of old machine,
12.4 = pounds of steam per kw.-hr. of new machine,
8,760 = hours per year,
8 = pounds of steam per pound of coal,
$\frac{3.2}{2{,}000}$ = price per pound of coal in dollars,
$\frac{1}{3}$ = time-load factor; i.e., that factor which, multiplied by 8,760 gives the total number of hours during which the machine was running throughout the year.

Then, from the above, the total annual interest charges will amount to:

$$80{,}000 \times 0.11 = \$8{,}800.$$

Cost of coal per year for old machine:

$$\frac{12.8}{8} \times 7{,}500 \times \tfrac{1}{3} \times 8{,}760 \times \frac{3.2}{2{,}000} = \$56{,}064.$$

Cost of coal per year for new machine:

$$\frac{12.4}{12.8} \times 56{,}064 = \$54{,}312.$$

Saving in coal due to increased efficiency:

$$56{,}064 - 54{,}312 = \$1{,}752.$$

Since the annual interest charges on the old machine amounted to \$8,800, the additional investment on the new machine over the old one can *at the most* be such that the annual interest charges on the difference in cost equal the annual saving in total operating expenses. If we pay more than this without a compensating feature of some sort within the useful life of the apparatus, more money must be paid out on account of additional interest charges than is coming in from a saving in operating expenses in the form of increased efficiency, decreased maintenance, attendance, etc.

Since for simplicity of illustration we have assumed the general structural features of the more efficient machine to be similar to the old one, the items of attendance, maintenance, etc., will also be the same, and therefore cancel each other for the purpose of economic comparison. Where such items cannot be assumed identical within a reasonable degree, they naturally must be taken into consideration also.

The general condition may be represented symbolically as follows. Let:

$O_1$ = operating expenses of old machine,
$O_2$ = operating expenses of new machine,
$M_1$ = investment in the old machine,
$M_2$ = investment in the new machine,
$I_n$ = total interest charges.

Then, for the total annual charges against the two machines to be equal we must have:

$$M_2 I_n + O_2 = M_1 I_n + O_1$$

hence,

$$M_2 - M_1 = (O_1 - O_2)/I_n \qquad \text{(A)}$$

If for any reason the interest charges should not be the same, then evidently:

$$M_2 I_{n_2} + O_2 = M_1 I_{n_1} + O_1$$

and

$$M_2 = \frac{O_1 - O_2}{I_{n_2}} + M_1 \left(\frac{I_{n_1}}{I_{n_2}}\right) \qquad \text{(B)}$$

Returning to the numerical values above and substituting, we have:

$$M_2 - M_1 = 1{,}752/0.11 = \$15{,}927.28.$$

Therefore: $M_2 = (80{,}000 + 15{,}927.28) = \$95{,}927.28$, which represents the greatest total investment that can be allowed for the new machine.

To determine the interdependence between two or more quantities, we can generalize these relations algebraically and may proceed as follows. Let:

$S_1$ = pounds of steam per kw.-hr. of old machine,
$S_2$ = pounds of steam of new machine,
$O_1$ = yearly operating cost of old machine,
$O_2$ = yearly operating cost of new machine,
$M_d$ = initial cost of old machine,
$M_w$ = greatest permissible cost of new machine,
P = pounds of steam per pound of coal,
$T_L$ = time-load factor (as defined previously),
$I_n$ = interest charges, assumed same for both,
Kw. = capacity of both old and new machine, running at a nearly constant mean and rated load,
$C/2{,}000$ = cost per pound of coal in dollars,
8,760 = number of hours per year.

The yearly operating cost in coal for the old apparatus is then:

$$O_1 = \frac{8{,}760 \times T_L \times \text{kw.} \times C \times S_1}{2{,}000 \times P}$$

$$= 4.38 T_L C\text{kw.} \times \left(\frac{S_1}{P}\right) \qquad (1)$$

If $S_2 < S_1$, as it obviously should be, we have:

$$O_2 = S_2/S_1\, O_1 = 4.38 T_L C\text{kw.}(S_2/P) \qquad (2)$$

And

$$O_1 - O_2 = 4.38 T_L C\text{kw.}\ [(S_1 - S_2)/P] \qquad (3)$$

Therefore

$$V = M_w - M_d = 4.38 T_L C\text{kw.}[(S_1 - S_2)/PI_n] \quad (4)$$

where $V$ is the difference in investment cost between the two machines, or the greatest allowable additional investment as the price of increased physical efficiency.

Now, $(S_1 - S_2) = S_1(1 - K')$, where $K'$ is a factor such that $S_2 = S_1K'$ and $K' = S_2/S_1$, and therefore $100S_2/S_1\ (1 - K') = 100(1 - K_1) = E =$ *increase* in per cent in efficiency of the new machine over the old one.

Consequently,

if $K' = 0.98$, $E = 2$ per cent,
if $K' = 0.96$, $E = 4$ per cent,
if $K' = 0.93$, $E = 7$ per cent,
if $K' = 0.90$, $E = 10$ per cent, etc.

However, the actual expenditure will equal:

$M_2$ + cost of removal — depreciation — salvage, etc.

Putting $C = P = I_n = \text{kw.} = S_1 = 1$, equation (4) above reduces to $R_m = M_w - M_d = 4.38T_L\ (1—K^1)$, where $R_m$ will be a coefficient which when plotted against $T_L$ is proportional to $E$, and equation (4) becomes:

$$V = M_2 - M_1 = (C\text{kw.}S_1/P\ I_n)\ R_m \qquad (5)$$

Since $R_m$ is a straight-line function between $E$ and $T_L$, it is only necessary to compute the various values of $R_m$ for one value of $T_L$, say 60 per cent, and connect these with the origin of the rectangular co-ordinates, and for purpose of plotting:

$$R_m = 4.38 \times 0.6 \times E = 2.628\ E. \qquad \text{(See Fig. 1.)}$$

In the foregoing numerical example we have: $K' = S_2/S_1 = 12.4/12.8$; $T_L = \frac{1}{3} = 33.33$ per cent, then:

$$R_m = 4.38/3 \times [1 - (12.4/12.8)] = 0.045625,$$

or since $E = 1 - 12.4/12.8 = 3.12$ per cent, such values as $R_m$ could be read off a diagram directly, and therefore from (5) we get:

$$V = \left[\frac{3.2 \times 7{,}500 \times 12.8}{8 \times 0.11}\right] \times [0.045625] = \$15{,}927.28,$$

which is the same result as attained formerly.

From the diagram it is evident that a time-load factor of, say, 38 per cent and 12 per cent increase in efficiency is economically equivalent to a 57 per cent time-load factor and 8 per cent increase in efficiency, since evidently for the same value of $R_m$ (or more generally $R^1_m$) $38 \times 12 = 57 \times 8$, etc. In general $T_{L_1} E_1 = T_{L_2} E_2 = T_{L_3} E_3 = R^1_m$, and therefore we can readily read off from such a diagram by what percentage we may increase and correspondingly decrease either the time-load factor or the gain in efficiency and still justify the same greatest permissible investment.

In the previous simple problem the comparative values of $S_1$ and $S_2$ alone were considered. In a similar manner any other factor or combination of factors could be studied. By attaching to the values of $E$ in Fig. 1 a broader meaning than the previous example would seem to indicate and using it in connection with $R^1_m$ various useful results may be readily read off.

It must be remembered that until now we have dealt with the cases of loads which were considered practically constant. Since it is rarely the case that, for example, a turbo-generator carries the same load continuously, modifications of the foregoing formulas must be made to allow for the conditions of a constantly variable and fluctuating load.

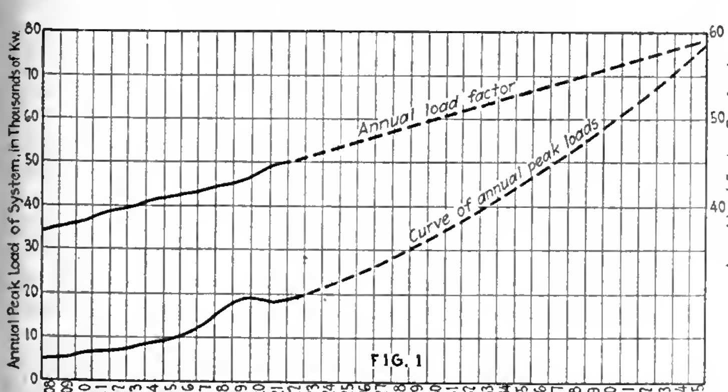
This phase of the subject will be discussed as applied to a specific illustration in an early issue of the ELECTRICAL WORLD.

# Analysis of a Building Program

## Graphs Used to Make Concise and Readable Masses of Figures Needed in Power Company's Building Program

BY CHARLES P. DUNN
Seattle, Wash.

THE detailed study of even a simple central-station building program involves a great many pages of output calculations and cost estimates, and the summary is often a confusing array of figures which are difficult to visualize in their proper relations and to weigh one against the other, unless the results of the study, stripped of all trimmings, are presented in the form of graphs. Often much of the work connected with the calculations can be done graphically with sufficient accuracy and with a small fraction of the labor that would otherwise be required. Excessive refinement of calculations pertaining to future events is futile. The work is fundamentally a guess, a scientific guess to be sure, but figures carried out to the $n$th decimal place do not fool the business men to whom the work



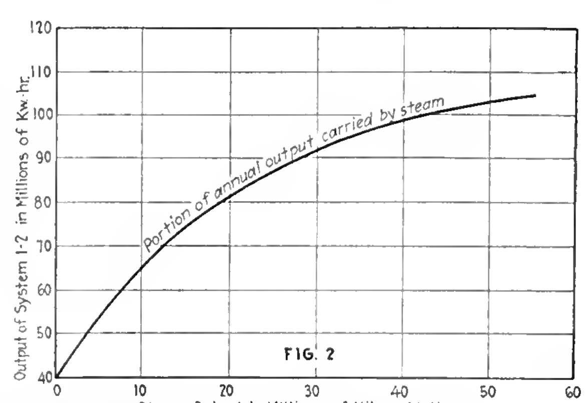




FIG. 1—EXTRAPOLATION OF CURVES SHOWING PAST GROWTH OF SYSTEM PREDICTS THE FUTURE. FIG. 2—GRAPH TO DETERMINE AMOUNT OF LOAD TO BE CARRIED BY STEAM PLANTS

is presented and do not increase their respect for the man who does the guessing.

Almost any industrial enterprise might profitably be visualized in the manner indicated by the following brief outline of a study of a power company's expansion program.

Fig. 1 shows an estimate of future loads and load factors extrapolated from the curve of past performance or calculated from probable local conditions which may influence the growth of the industry.

The present plant is assumed as consisting of:

(1) A 15,000-kw. hydro-electric plant, with daily storage only, with output limited to 10,000 kw. on 50 per cent annual load factor in dry years; cost $2,500,000.

(2) A 15,000-kw. steam plant; cost $1,500,000.

The future possibilities to be considered are:

(3) A hydro-electric plant of 22,000 kw. capacity on 50 per cent annual load factor, with storage ample for complete control of stream flow; plant to cost $3,500,000, of which $2,500,000 is invested in works which will be a part of plant (4).

(4) The extension of (3) to a plant of 80,000 kw. capacity on 55 per cent annual load factor, at an additional cost of $6,000,000.

(5) The construction of the plant described as (4) without the preliminary step (3), at a cost of $8,500,000.

(6) Increase of (1) to 20,000 kw. capacity on 50 per cent annual load factor by additional storage and additional machinery, at a cost of $1,500,000.

(7) Additional steam installation at $90 per kilowatt.

By a study of loads, load factors and hydrographs a series of performance calculations are made covering each possible combination of the present system with the proposed future plants. The portion of the load which must be carried by steam at various system loads is determined for the different combinations and for convenience is recorded in curves, of which Fig. 2 is a sample.

The probable performance having been determined, cost of power curves can be obtained by considering fixed, operating, maintenance and fuel charges. These curves are shown in Fig. 3, the vertical scale being cost per kilowatt-hour, the horizontal scales being time, peak load, annual output and annual load factor.

The curves in Fig. 3 are identified by groups of numbers representing combinations of the possibilities listed above, as: Curve 1-2 represents the cost of power delivered by the present system at various loads; curve 2-6 represents the present system with the present hydro-electric plant expanded as per item 6 in the preceding list; curve 1-2-5 shows the cost of power with the 80,000-kw. plant added to the system at once and forcefully pictures the folly of over-construction.

The object to be attained is to plan the construction so that the costs follow as nearly as possible the lower limit of the group of curves. It is evident that the extension of the present plant as per item (6) would be of immediate advantage if it could be put in operation at once. However, by the time this extension could be built and put in service it would be of no more advantage than group 1-2-3, and from 1925 until 1930 the group 1-2-3 gives the cheapest power of any combination.

Additional power must be ready by the time the load reaches the dry-season capacity of the present system (25,000 kw.) in the fall of 1925. The choice lies between 1-2-3 and 1-2-5 for the first step in the program. If plant No. 5 is built at once, the cost of power will be sharply increased and will be higher than could be obtained in other ways for at least ten years, the advantage of this construction being more than ten years in the future, where curve 1-2-5 is the lowest of the four nearly parallel curves. If plant No. 3 is built, we may follow the curve 1-2-3 to a load of 46,000 kw., then make

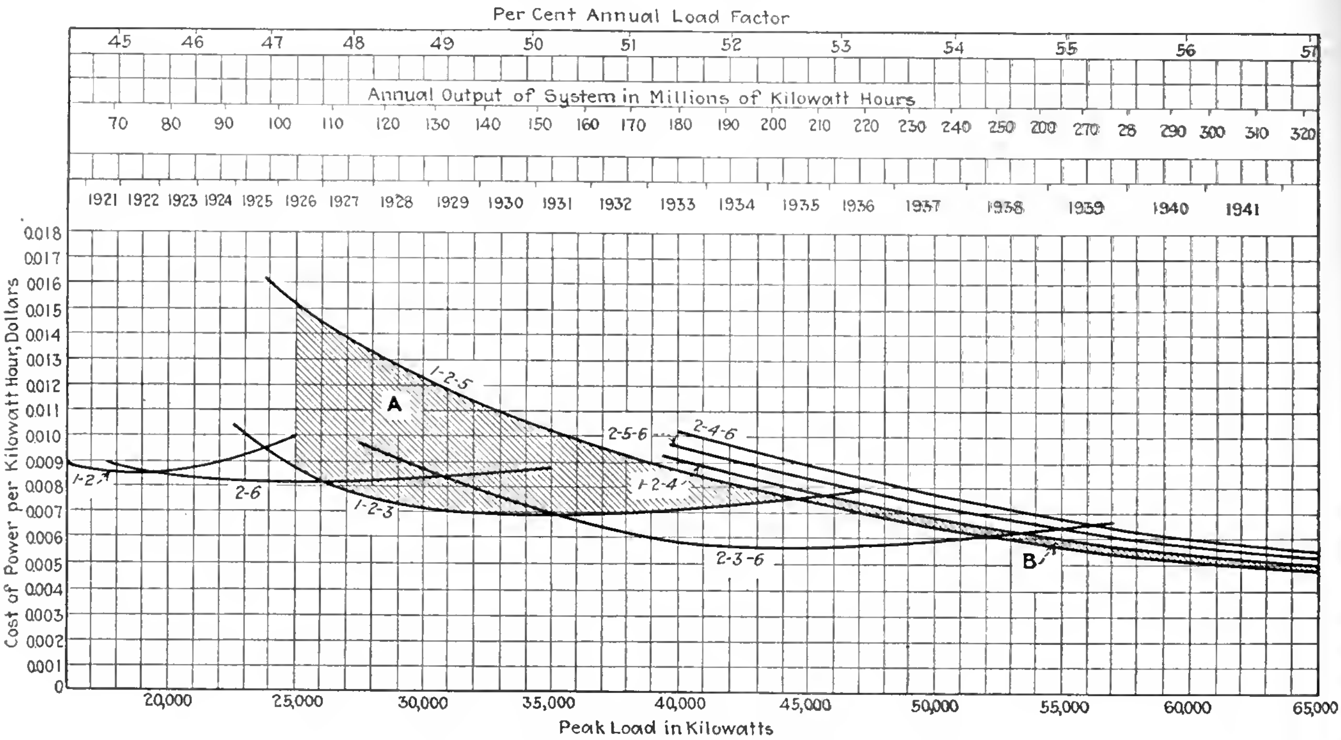



FIG. 3—COST OF POWER CURVES OBTAINED BY CONSIDERING ALL CHARGES

the change to 1-2-4, or we may follow 1-2-3 to 35,000 kw., then 2-3-6 to 56,000 kw., then 2-4-6.

There is little doubt that the first proposition, 1-2-5, is inadvisable because it would cause a loss represented by the shaded area *A* against a gain represented by the shaded area *B*. The second and third propositions appear to be nearly equal in value, and a decision between the two requires careful study. In comparing savings on the chart it must be kept in mind that a dollar saved in 1925 is worth considerably more than one saved in 1935. It would, no doubt, in some cases be advantageous to distort the horizontal scale on the basis of "present worth" of the possible savings, so that areas under the curves would represent dollars at the present time and could be compared directly.

The upward trend of the curves near their ends is due to the cost of fuel as the load approaches the ultimate capacity of the system under consideration and a substantial load is carried by the steam plant. The addition of more steam capacity has not been shown on this chart because there is no opportunity to make a saving thereby. The construction of an additional steam plant would move all the succeeding curves up on the cost scale.

There are usually certain factors in a problem which the engineer does not attempt to express graphically because they are difficult to evaluate, such as legal proceedings, availability of funds, the value of designing the system in such a way as to insure continuity of service, etc. It must also be remembered that the immediate future is more important than the remote future; the forecast of costs and events is more accurate for the near than for the future. This concisely presented best possible approximation is much better than vague, poorly expressed guesses, and if revised from time to time to suit changing conditions, is sure to prove of great value.

# Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

## Proper Ratio of Tooth Width to Slot Width

*To the Editors of the* ELECTRICAL WORLD:

Discussion such as that of F. S. Dellenbaugh, Jr., on page 1158 of the ELECTRICAL WORLD for Nov. 25 are very interesting and instructive and should be a help in the checking of design work. It would seem that instead of reserving the quantities $B$ and $\phi$ as the working variables, $\phi$ and $w$ should be so considered, since in most cases $B$ can be taken as a constant, for, with given conditions of frequency, etc., $B$ is of fixed value, being subject to some manipulation in extreme cases. Of course, with very narrow teeth $B$ can be made greater without much increase of iron loss.

Taking the equation as given and operating on $\phi$ and $w$, the same conclusion is reached: Slot width should equal tooth width for the most economical results, the final value of $\phi$ being $L\psi B\pi D/2p$.

Some time ago the writer attacked this problem from a slightly different angle. The equations were applied to the case of an armature with a comparatively small number of paralleled side slots, giving the tooth considerable angularity and bringing in the matter of tooth depth.

Let $D$ = diameter of armature,
$L$ = active iron length,
$t$ = tooth depth,
$w$ = slot width,
$n$ = number of slots,
$Z$ = number of conductors in series.
$E$ = emf. produced.
$B$ = tooth density,
$\psi$ = polar enclosure.

It is required to make $E$ as large as possible by suitable relation of slot width to tooth width, assuming a given ampere capacity or size of conductor, so that output is proportional to volts.

Neck of tooth then $= \dfrac{(D-2t)\pi}{n} - w.$

$Z = Ktwn$, or the conductors in series are proportioned to total cross-section of the slots, $K$ being a constant.

$E = \int Z\phi$, assuming the speed as fixed, and can be expressed as

$$\int Ktwn\psi BLn\left[\frac{(D-2t)\pi}{n} - w\right], \text{ or}$$

$$K\psi BL(\pi Dtwn - 2\pi t^2wn - tw^2n^2).$$

Now, letting $w$ and $t$ be constant, varying the number of slots $n$:

$$dE/dn = K\psi BL(\pi Dtw - 2\pi t^2w - 2tw^2n)$$

and

$$\pi Dtw - 2\pi t^2w - 2tw^2n = 0$$

whence $\quad n = (\pi Dtw - 2\pi t^2w)/2tw^2,$

or $\quad wn = \pi(D-2t)/2,$

showing that the total neck area should be half of the perimeter at the base of the tooth.

If $w$ and $E$ are the variables with $n$ and $t$ as constant,

$$dE/dw = c(\pi Dtn - 2\pi t^2n - 2twn^2).$$

Where $c$ is a constant,

$w = \pi(D-2t)/2n$, which is a repetition of the above.

Suppose $t$ is the variable, then:

$$dE/dt = C(\pi dwn - 4\pi twn - w^2n^2)$$

and $\quad t = (\pi D - wn)/4\pi;$

but, as above, $\quad wn = \pi(D-2t)/2,$

$$t \text{ becomes } \frac{\pi D - \pi[D-2t]/2}{4\pi} \text{ or } t = D/6.$$

From which it appears that for parallel side slots the neck should equal the slot width and the depth should be one-sixth the diameter.

The last is probably of academic interest only, as other considerations would eliminate this in all but small armatures.

Another feature of particular interest is that of slot space factor. A moment's consideration will show that with decreasing slot width a point is reached where the slot insulation will cut the wire space down to nothing, such a slot having a width of twice the slot insulation plus the cotton taping or other coil insulation. As such insulation is generally greater than 0.100 in., it can readily be seen that the slot width should be substantially greater than the width of the tooth. This can be shown below where $Z$, instead of being equal to $Ktwn$, is now $Ktn(w-k)$, where $k$ is the difference between slot and wire widths.

By differentiating as before, $n$ becomes

$$(\pi D - 2\pi t)/2(w-k)$$

and $\quad w = (\pi D - 2\pi t + 2nk)/2n,$

showing that either the number of slots or their width must be increased to maintain maximum output as the slot insulation increases. This, too, is in accord with practice.

The same line of reasoning can be extended to the value of $t$, because here again we have a certain amount of constant loss of space at top, center and bottom of the slot, which within the limits of the design may be considered constant. The result will show that the greater the proportion of slot section occupied by anything except copper, the larger should be the slot and the thinner the teeth to secure the maximum use of material. JOHN H. HERTNER.

Hertner Electric Company,
Cleveland, Ohio.

*To the Editors of the* ELECTRICAL WORLD:

Mr. Hertner's discussion upon the design of slot and tooth dimensions is very gratifying, and it is interesting to note that he obtains the same results from a slightly different standpoint. I did not intend to imply in my article that $B$, the tooth density, was to be considered a variable in the design. It was merely assumed as a variable temporarily and the conditions necessary for making it a minimum were determined. This obviously implies the minimum material necessary, and the flux density itself may be brought to any desired value by changes in length or diameter without affecting this minimum condition.

Mr. Hertner's further discussion upon the effect of insulation is valuable for a practical application of the results. It would be interesting in this connection to investigate also the effect of varying the size of copper as the total number of armature conductors is changed. It is usually necessary to do this in actual design since more conductors result in more heat loss, and even though there be greater facilities for conduction away from the copper, the total loss within an armature of fixed over-all dimensions must in general be approximately constant. This is a little difficult to handle theoretically since the relation between the number of conductors and the size of each one is somewhat uncertain and would vary with different types of design. F. S. DELLENBAUGH, JR.,

Department of Electrical Engineering,
Massachusetts Institute of Technology,
Cambridge, Mass.

## Laminated-Frame Arc-Welding Generators

*To the Editors of the* ELECTRICAL WORLD:

In your issue of Sept. 16 J. F. Lincoln illustrates the use of a stabilizing reactance in the arc circuit by comparing it to a flywheel in a mechanical system. The illustration is made clearer if this splendid analogy is carried a step further. Obviously the current in the electric system corresponds to velocity or speed in the mechanical system, and the voltage corresponds to force or torque. The purpose of adding flywheel effect is evidently to oppose rapid changes in speed and never to assist in obtaining "almost instantaneous adjustment of speed." Its function is to assist or oppose the torque of the driving mechanism in accordance with the torque requirements of the load so as to maintain nearly uniform velocity. Similarly, in a direct-current circuit, electromagnetic inertia or inductance is inserted for the very purpose of opposing sudden changes in the current by assisting or opposing the generator terminal voltage.

Manifestly, the object sought by laminating the frame is then to make the generator itself adjust its terminal "voltage" rapidly enough to maintain nearly uniform current with less assistance from the reactance. In my letter of Sept. 9 I criticised a statement in a catalog, that lamination of the frame makes it possible for the "electric current" to adjust itself "almost instantly" to any demand. My statement in this connection was: "The idea which it is intended to convey probably is that a rapid change of flux permits a rapid change of terminal voltage, so that a substantially constant current can be maintained when the resistance of the arc circuit varies rapidly." This statement harmonizes perfectly with Mr. Lincoln's mechanical analogy, and had he read my letter carefully, he would probably have arrived at a different conclusion in regard to my missing the point on this subject.

Mr. Lincoln further states that the voltage adjustment of any commercial machine is a gradual process, comparatively. I emphasized this point very strongly in my original letter, indeed insisted that a failure to recognize the relative meaning of the expression "rapidly changing flux" when used in this connection has been responsible for greatly overestimating the benefits received from laminating the frame.

In a paper on design of arc-welding generators (*Transactions A. I. E. E.*, Vol. XXXIX, Part 2) the writer has derived formulas for the transient currents of a separately excited differential generator when the resistance in the external circuit is suddenly changed from one value to another. As stated in the appendix to the paper, the formulas were derived on the assumption that in the sizes under discussion the mutual induction due to eddy currents in the frame is negligible, and yet the calculated values checked very well with values from oscillograms.

However, such analysis is not necessary, for the present at least, as Mr. Lincoln furnishes a good criterion for the usefulness of the laminated frame, namely, the extent to which it makes it possible to reduce the reactance in the external circuit. In the above-mentioned issue of the *Transactions* A. M. Candy of the Westinghouse company describes the operating characteristics of a generator having a solid frame (rolled), but in the design of which were embodied some special features tending to stabilize the arc circuit. The inductance used with this generator was given as 3½ millihenries at 100 amp. and approximately 2 millihenries at 200 amp. Furthermore, it was stated that the generator operated quite satisfactorily over a fairly wide range of current without any external reactance. Will merely laminating the frame permit the use of less inductance as a commercial proposition?

But that is not all. By the disposition of part of the commutating coil in the main pole flanges so as to obtain a large leakage flux interlinking with the coil considerably more inherent stabilizing effect can be obtained than was possible by means of the special features in the machine discussed by Mr. Candy. The writer fully agrees that prevention is better than cure, and inasmuch as the reactor at the best can only be considered a cure, I strongly recommended in my previous letter that designers concentrate their immediate efforts toward the elimination of the reactor. My opinion is that that can be done much more effectively by other means than laminating the frame, and so far the replies to my letters have in no wise tended to alter this opinion. K. L. HANSEN

Milwaukee, Wis.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Advantages of Scheduled Inspection Over Individual Responsibility

TWO methods are commonly employed by general managers and operating executives in checking the upkeep and repair of properties, the degree of efficiency maintained, the relative utility or obsolescence of equipment and the maintenance of said upkeep, efficiency and utility from year to year.

The first method, and the one commonly used by executives of the old school, is to place such responsibility once for all upon some appropriate individual, as, for instance, the plant superintendent, and consider the matter closed. The plant superintendent has several alternatives in handling this assignment. He may delegate the task to his assistant or immediate inferior in rank, who will in turn redelegate it on down the line, where it will eventually receive, perhaps, the thought and diligence of that employee least fitted by perspective, attitude or training to accept it. Each head from the chief executive down will be occasionally inspired to note some oversight, failure in effectiveness or dereliction of duty and will straightway prod his immediate delegates into activity and so on down the line. This is the so-called military type of management.

### Proper Inspection Impossible by Disinterested Persons

We can say little for the disinterested and indifferent custodian who not only fails to delegate this duty to an individual whose characteristics fit him for such responsibility, but also fails to keep alert to the conditions himself. If his habit of mind continues, upon being confronted with conditions resulting from the absence of remedial and modernizing upkeep, his tenure of office is apt to be short-lived.

The "exceptional superintendent" to whom this assignment holds an especial appeal may pursue other tactics. His interest and sense of pride in the property may be reflected in his mental attitude to the extent of refusing to intrust this function of custodian to any one, least of all an inferior officer or employee. This type of executive pursues a similar course in other capacities and will usually be found overworked, harassed and burdened by each added duty or assignment. Each responsibility will doubtless receive honest, dependable treatment to the extent of his ability. In any event, assuming normal conditions, his plant and equipment will acquire the aspect of an efficient, well-maintained property.

### Specific Instructions Necessary for New Employees

There comes a time eventually when the exigencies of industrial unrest (resulting in increased labor turnover), plant additions or other material changes or developments occur to add to previous burdens and necessitate a complete shifting of former adjustments. The new apprentices must find their places in uncharted ways, and there is a serious breakdown in the plan of operation that formerly functioned smoothly. Specific instructions to new employees must be stated and restated and followed up at high expense of time and energy, and even then the results of unexpected omissions constantly arise. Should the "exceptional executive" be absent at such a time, the result may be chaotic.

There is, however, another method in very general use but representing an entirely new school in executive thought and practice. It will not be adopted by the old "military type" executive or the "exceptional type" who aims to drive all the nails in his plant or property himself. It may be called scheduled inspection functionally maintained. A clearly defined task is set before each operating custodian. The schedule will state nothing that is in the least degree vague or indefinite, but on the contrary each task will be carefully and completely circumscribed. It will conform to Gilbreth's definition of a standard: "A standard is simply a carefully thought-out method of performing a function or a carefully drawn-out specification. The idea of perfection is not involved; it is simply the best that can be devised at the time the standard is drawn. Improvements in standards are wanted and adopted whenever and wherever they are found. There is nothing to preclude innovation. A proposed change is scrutinized as carefully as the original standard by as competent counsel. They are a constant invitation to experiment and improvement."

It is the recognition and acceptance of the above premises and the logical conclusions so afforded that we believe justify our confidence and persistent effort in attempting to render scheduled inspection increasingly effective in the operation of the Central Hudson Gas & Electric Company's system.

Few managers purposely neglect or postpone work essential to efficient maintenance of properties. There is a failure in bringing to attention needed changes and repairs, a lack of system in directing the inquiry, and an absence of follow-up treatment in pursuing the subject through to completion.

### Inspection May Be Supplemented by Outside Forces

Schedule inspection is a resultant of two viewpoints—staff and line. In application it may be supplemented by expert "outside inspection" services in addition to the occasional managerial survey and regular insurance inspection. In relation to upkeep a man exclusively detailed to handle minor plant repairs and construction orders may often be used to advantage.

A schedule is impersonal and consequently more amenable to criticism and review than the best-intentioned custodian; it is insistent upon comprehensive treatment regarding each item of its check list; it may not be unduly postponed, since it is sub-

ject to immediate and imperative "follow-up."

The scheduled method is, in our opinion, strong in precisely those elements where the method of responsibility minus adequate written instructions, report and follow-up is weak. It is regular and prompt where the older method is at best occasionally delayed through pressure of seemingly more important duties. It is independent of personnel where change in the latter may prove disastrous. It may well be, however, that susceptibility to improvement is its main attribute and that even where present schedules may prove inadequate they will at least afford a basis upon which more consistent practices may be subsequently established and from which better results will accordingly ensue.

E. W. BAKER.

Central Hudson Gas & Electric Company, Poughkeepsie, N. Y.

## Spacers Aid Storage of Parts in Stockroom

MATERIAL in the stockroom of the Stamford (Conn.) Gas & Electric Company is stacked in unusually compact order by the use of corrugated-board spacing sheets, as shown in the accompanying photograph. By careful attention to the proper labeling of bins as to kind of material and size, with the orderly packing illustrated, the company finds it easy to keep track of supplies and to maintain what virtually amounts to a continuous inventory of material on hand in the bins themselves. The amounts on hand can be

INVENTORY OF STOCK FACILITATED BY CORRUGATED SPACERS

verified with the utmost rapidity by multiplying the numbers of units in each row by the number of rows and this product by the number of tiers. The entire stockroom presents the appearance of the small section photographed.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Roller Bearings Reduce Mill Motor Maintenance

MARKED reductions in mill motor-bearing troubles have resulted from the use of roller bearings in this type of equipment, according to a paper recently presented before the Philadelphia section of the Association of Iron and Steel Electrical Engineers by L. J. Hess, chief electrician Youngstown (Ohio) Sheet & Tube Company. Mr. Hess has done much original work along the line of roller-bearing design for mill motors. His first installation of roller bearings was made on a Westinghouse series crane motor on hoist service about six years ago. The bearings were of the spring-roller type, but the design was unsuccessful, owing probably to lack of study of the problem and to the transition through which bearing design was passing in this establishment.

### ROLLER BEARINGS USED TO ADVANTAGE ON HOT-METAL CRANE

About four years ago another installation was made of a solid roller-type bearing on a Crocker-Wheeler size EW series motor driving, in tandem with a similar motor, the bridge of a 100-ton hot-metal crane in a mixer building. Previous to this application, a four-month run on babbitt bearings on this drive was considered good, while frequent armature changes, broken bands and flat spots were the rule. At the time of the application the commutator was badly worn, had an estimated life of three months with babbitt bearings, and rewinding was close at hand. After the roller bearings were installed the motor ran about nine months before the commutator began to throw bars. Electrical repairs were then made, and the bearings have since been running without trouble either in armature or bearings. No grease or oil has leaked into the windings or upon the commutator, and a recent inspection shows a bearing wear of only about 0.004 in., which is the ordinary tolerance for a new babbitt bearing.

By making a new motor head Mr. Hess developed a roller bearing which has given excellent results in the Westinghouse type K motor. This involved a comparatively small casting and eliminated difficulties formerly experienced with the bronze sleeve-type bearing. At present roller bearings have been developed for the Crocker-Wheeler type SM, sizes CW, DW, EW and FW, and the Westinghouse type K, Nos. 3, 4, 6 and 8 frame motors. These bearings the Youngstown company carries in stock, and as fast as the repairs to armatures necessitate new shafts and the repair record of the motor indicates the necessity of roller bearings they are put on. Besides careful design of shafts and bearings, heat treatment of shafts is also desirable in order that the surface may be harder and tougher to withstand the action of the race. Using a steel with 0.50 per cent carbon, quenched in oil at 1,500 deg. and drawn back to 850 deg., a shaft is obtained which is tough and moderately hard, with the added refinement of grain and improvement of the breaking strength.

From experience with about sixty sets of bearings, Mr. Hess has found the following advantages:

1. Electrical repairs to commutators and windings are greatly reduced because at least 50 per cent of these troubles arise from oil and grease working upon the commutator and front V-ring.

2. Commutator wear is materially reduced because there is no jumping due to loose bearings with resultant flashing and flat spots.

3. Equalizer connections are relieved of abnormal duty because the armature is held constantly in the center of the magnetic field.

4. Broken bands due to rubbing are unknown.

5. Pinions are kept accurately in mesh and crowding of teeth is obviated.

6. Inspection cost is reduced through improved commutation and less attention to lubrication.

7. The cost of lubricants is reduced almost to nil, as the bearings consume practically no grease.

8. Labor and lost time during armature changes and charges against electricians in mills are reduced.

The writer stated that in ordering a considerable number of mill motors he would specify roller bearings.

In the discussion the desirability of permitting further time for standardization of bearings to be effected in designing circles was brought out.

D. M. Petty, superintendent electrical department, Bethlehem Steel Company, Bethlehem, Pa., predicted that in the near future either ball bearings or roller bearings for motors will be the rule rather than the exception. Ball bearings on a 20-hp. shear motor with pinion drive have been running over two years, against a sleeve-bearing life of three months. The importance of adequate size in ball bearings was also brought out in the discussion.

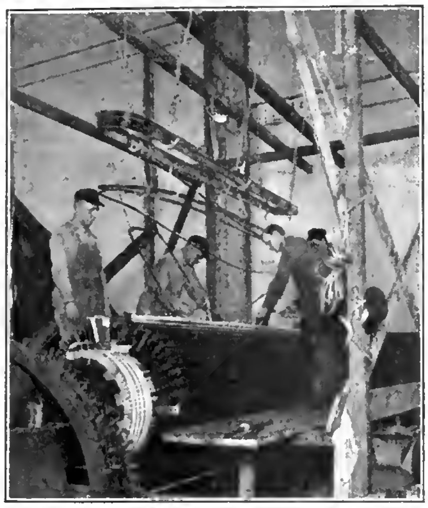
FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## A 30,000-Kw. Rotor Rewound in 74 Days

WITHIN seventy-four days after an opened field coil was found on a 30,000-kw. generator in the Connors Creek plant of the Detroit Edison Company the entire field was rewound and the machine back in service. This 1,800-r.p.m., 12,200-volt unit had been in operation since June 11, 1920. Trouble was first experienced on Aug. 18, 1922, when it was found that after the unit was brought up to speed there was no voltage on the stator.

After removing the end bells it was found that the field connections between poles had broken. When the machine had been shut down in cooling off, the ends of a coil had separated, causing an open circuit. Since the installation of the coils and the wooden spacers showed excessive heating, it was decided to rewind the entire field. The first work was to sledge out 480 brass and iron wedges, which was accomplished in about a week's time with very little damage to the wedges.

In lifting out the coils they were twisted and bent out of shape very badly, as the slot insulation was baked hard and had stuck to the coils and slots. The coils were then annealed before they could be straightened. As there was no convenient means of obtaining more than 900 amp. at low voltage, a blowtorch was used which annealed only the ends. It was then necessary to make a press to straighten the coils and flexible connections were connected to the ends.



RELAYING-COIL METHOD FOR REINSERTION IN ROTOR

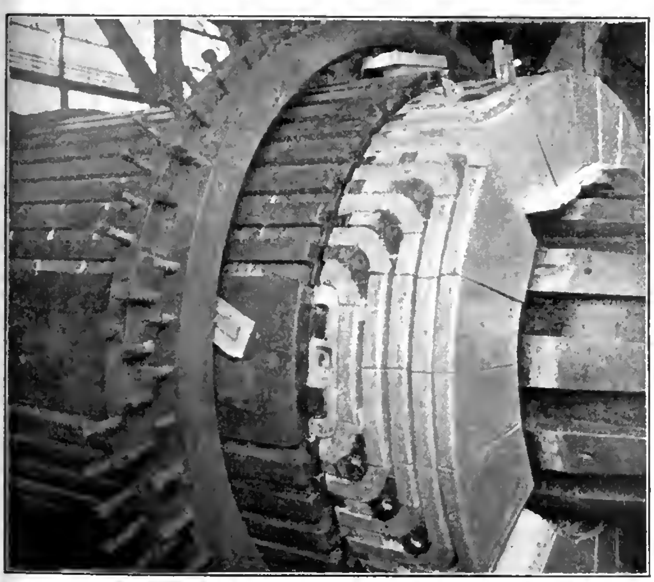
The coils were then insulated with mica tape wound by hand, and each turn was varnished as it was wound. The method of relaying a coil when being replaced in the rotor is shown in one of the accompanying illustrations. A new cell was placed in the iron slot and each turn of copper dropped in place and then driven in with fiber boards and rawhide mallets. The inner coil, being the hardest to place owing to the short radius of the end turns, required a 90-deg. twist in each end to slip it over the core, but when in place this twist was hammered out.

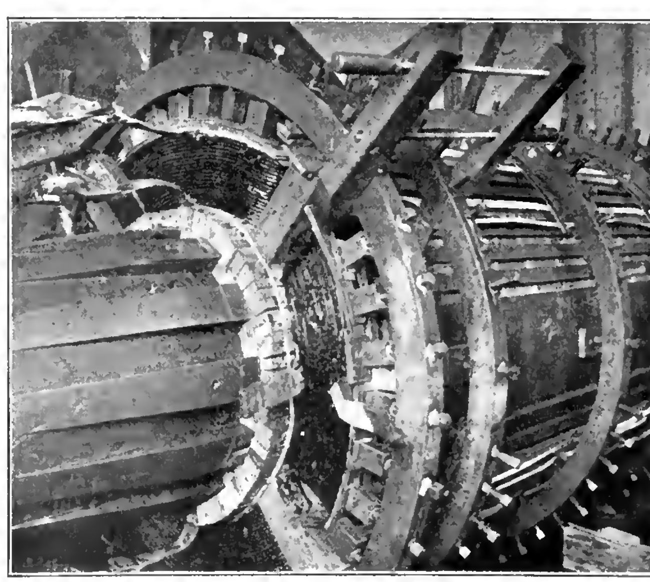
Pressure rings were used in forcing the upper coil into place, and current was applied to warm the insulation to make it more pliable. The twenty coils had each to be heated and pressed separately, then the entire field was baked for five days. Aluminum pins were used in securing the end turns instead of wooden blocks because, besides holding the insulation in place and preventing its mushrooming from centrifugal force, they carry the heat to the retaining bells, where it is dissipated. After the retaining bells were replaced the field was again baked for a period of four days and then placed back in the armature. The repaired unit started to generate electricity again on Oct. 31, 1922. The total time required to complete the work was equivalent to 11,855 man-hours.

A. N. SIMMONS.
Detroit Edison Company,
Detroit, Mich.

## Control of Direct-Current Generator Fields

RECOMMENDED practice for the control of direct-current generator fields as adopted by the Electric Power Club shall be to omit field switches from direct-current generator panels, it being understood that





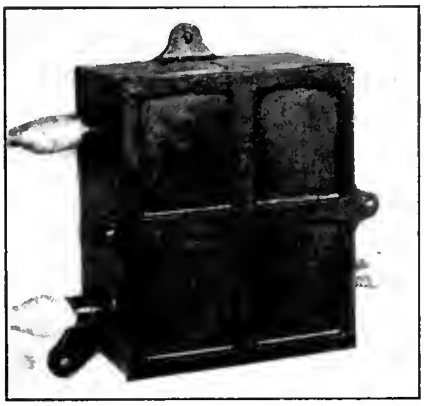
LEFT—FIELD ALUMINUM SADDLE AND WEDGES ON END TURNS OF 30,000-KW. ROTOR AT CONNORS CREEK BEING DISMANTLED. RIGHT—PRESSURE RINGS AND CURRENT AID IN FINAL ASSEMBLY

when no field switch is used the field rheostat will be designed to reduce the field current to a point which will not allow the building up of voltage on the generator.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Reliable Operation Insured by Solenoid Switch

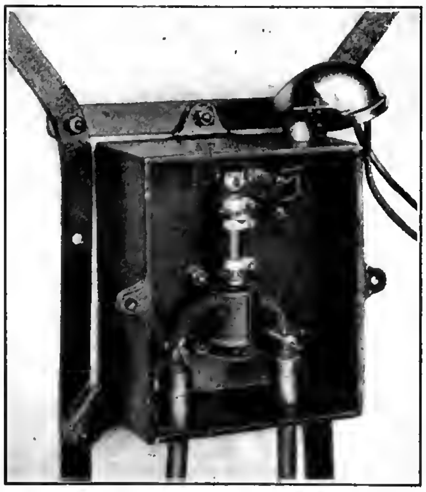
A SWITCH that has proved very useful in connection with the operation of illuminated traffic signals at street intersections has been developed by the United Electric Light Company of Springfield, Mass.



MOISTURE-PROOF BOX USED WITH OR WITHOUT HANGERS

These signals contain two 50-watt mill-type "Mazda C" lamps, operated from 110-volt alternating-current circuits. The switch is installed in a manhole and connected to the series street-lighting circuit, which insures regular operation of traffic signals.

This switch consists of a stationary contact and a movable contact, the latter being brought into contact with the former when the solenoid is energized by the high-voltage circuit. The contact is thus held until such time as the high-voltage circuit is cut off, when the contact is broken by gravity. The magnetic circuit of the solenoid contains a large leakage path, so that a quick break follows the cutting off of the current from the series coil.



SOLENOID SWITCH ADAPTABLE TO UNDERGROUND AND OVERHEAD SERVICE

The contacts and solenoid are mounted on an insulated panel of non-hydroscopic material and inclosed in a cast-iron box, such as is shown in the accompanying illustrations. The cover of the box is fitted with a lead gasket, and the cables are brought in through brass sleeves wiped on, making the box moisture-proof, so that it may be installed in any desired location. The switch box is 8 in. long by 10 in. wide and 4 in. deep, fitted with three lugs for attaching to the wall of the manhole. The box may also be fitted with hangers for installation on cross-arms when used with overhead construction.

L. O. INGALLS,
Electrical Engineer.
United Electric Light Company,
Springfield, Mass.

# Extracts from Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## General Switching Recommendations

IN SWITCHING operations speed is desirable, especially in cases of emergency, but unless an operator is absolutely sure of every move he makes rapid manipulation of switches may serve only to increase rather than diminish the trouble. The best indication of the correct performance of switching operations is obtained by intelligently observing the ammeters during the switching. For example, when one transformer bank is carrying a certain load its ammeter indicates the amount of current. If another transformer bank is connected in parallel with the first one, the two banks should divide the load in proportion to their capacities and their ammeters should indicate this division of the current.

In order that switching operations may be facilitated the Philadelphia Electric Company employs the following rules:

1. The operator should always know with certainty the proper steps to take in switching of any kind, and his moves should always be made with his attention fixed upon what he is about to do.
2. Ammeters and pilot lights must always be observed when performing any switching operations.
3. In case of trouble proceed as rapidly as accuracy permits and carry out a definite plan thought out in advance.
4. Consult the load dispatcher before carrying out any switching operations on the system under his control, except where delay will result in danger to life or property. In this emergency the operator may proceed with such operations as he thinks necessary and report to the load dispatcher immediately afterward.
5. All switching, when possible, should be checked by another person in company with the one performing the switching operations.

## Rules for Changing Shifts in Boiler Room

WHEN changing shifts in a stoker-fired boiler room it is necessary for the incoming shift to report before the outgoing shift leaves in order to determine existing conditions so that the water tender or boiler operator may assume full responsibility for immediate operation even under the most unusual conditions.

Special attention should be paid to the report on the automatic feed-water regulators since the sticking of these valves will either flood the boiler or let it run dry. The specific rules in regard to changing shifts followed by the Philadelphia Electric Company are given below:

At the beginning of each shift, before taking over the shift, the water tender or boiler operator must proceed as follows:

1. Blow down the working column and gage glass on each boiler and test the gages by opening the gage cocks to determine the water level.
This should be done by the water tender or boiler operator, but any one else detailed may blow down duplicate columns under supervision of the water tender or boiler operator.
2. Examine the fires and see that the stoker speeds and drafts are adjusted properly for the ratings developed. Note the position of wind box extensions, clinker-crusher doors and clinker-crusher speed.
3. Examine the gage board to see that all instruments are in operation.
4. The water tender or boiler operator leaving the shift must report to his relief any unusual or special conditions pertaining to the apparatus and fires. Special attention must be given in this report to the condition of the automatic feed-water regulators and hand-operated feed-water valves.
5. On taking over the shift the water tender or boiler operator assumes full responsibility for further operation.

# "Fool-proof" Disconnecting Switch

**Electrical Interlock in 66,000-Volt Outdoor Switching Station Prevents Opening Under Load, While 45-Deg. Mounting Maintains Safety Factor of the Insulators**

SIMPLICITY in bus structure, with lack of complicated wiring, has been insured in the 66,000-volt outdoor switching stations of the Duquesne Light Company by the use of the specially designed, gang-operated disconnecting switch shown in the accompanying illustrations. Other advantages gained by use of this switch are:

(a) It may be electrically or mechanically interlocked with the accompanying oil switch to prevent opening under load.

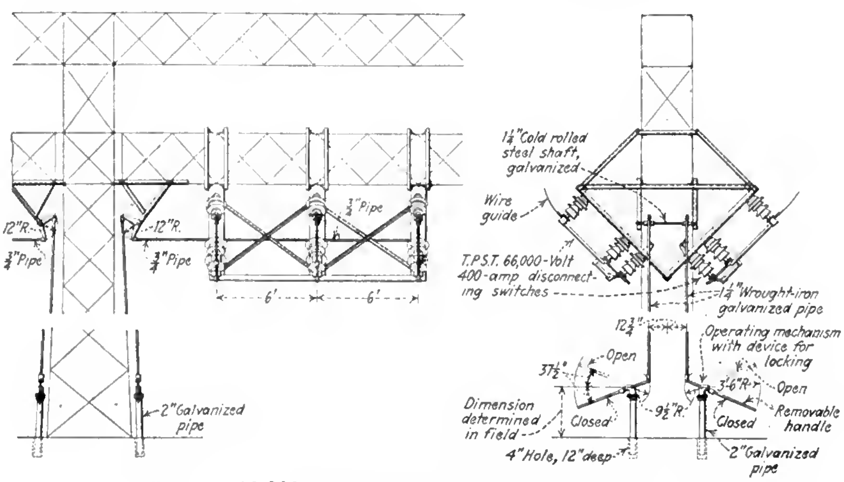
(b) It may be mounted high up on the structure when structural features of substation design make this desirable.

(c) Complete isolation of an oil switch may be effected in a few seconds, whereas the operation of six single-pole units with a long hook stick may take several minutes when time is very valuable during an emergency.

(d) The operating handle may be grounded and thus eliminate the danger from a switch hook stick becoming a partial conductor.

(e) The operating handle may be locked in either the open or closed position.

The interlock between oil circuit breaker and disconnecting switch is obtained by the following sequence of operations: Under normal conditions a key remains continuously inserted in a lock on the switchboard, permitting operation of the oil circuit breaker by means of the controller or by relay action. When the oil circuit breaker is to be inspected or repaired the key is removed, tripping the breaker (if this has not already been done) and opening the closing circuit to prevent reclosing. The key is then used to unlock the disconnecting switches, which are then opened manually, the padlock being replaced in such a way that they are also locked open. Upon completion of repairs the disconnecting switches are closed and the key is again inserted in the lock at the switchboard, permitting normal operation of the oil circuit breakers. Instead of installing the lock on the switchboard, it may be installed in the oil circuit breaker control housing, which would have certain advantages in a large outdoor station.

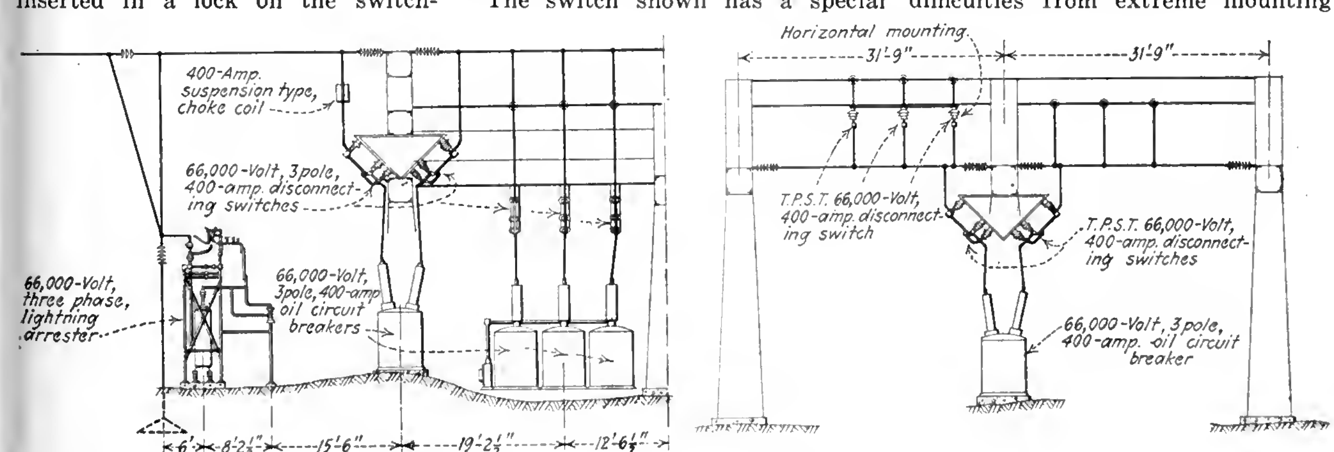



DETAILS OF 66,000-VOLT DISCONNECTING SWITCH, SHOWING OPERATING MECHANISM

The switch shown has a special rotating mechanism which permits mounting at any angle desired. With the base mounted at 45 deg. to the vertical, taps to the bus can be made short and direct, and the absence of turns and bends in the switch and transformer wiring permits the use of ordinary stranded conductors and standard suspension insulators and hardware. To secure the angular mounting the base is framed into the steel structure, thus eliminating castings in the insulator supports. By slightly modifying the steel structure horizontal or vertical mounting can be obtained.

The switch has been adapted for use with 22,000-volt and 66,000-volt lines, and in the substation shown the same design of switch, with various ratings, has been used on both the high-tension and the low-tension sides of the transformers.

Similar switches for 22,000-volt structures have been employed in one of the substations of the West Penn Power Company. These switches also bring out the advantage that gang operation eliminates difficulties from extreme mounting heights and at the same time facilitate the construction of buses from standard line material.




TYPICAL APPLICATIONS OF INTERLOCKED SWITCH TO 66,000-VOLT SUBSTATION CONSTRUCTION

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# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## Development of Electrical Advertising

**Data from 143 Cities Show Wide Variation in Use, but a Uniformly Large Opportunity Exists for More Business If Energetic Efforts Are Made**

By H. H. Magdsick
Chairman Sign, Display and Billboard Committee, Commercial Section, N.E.L.A.

THE rate of increase in the use of electrical advertising through more and larger displays and the substitution of higher-wattage lamps in existing signs was previous to the last year about 15 per cent annually. A much faster growth was evidenced during 1922. This has been attributed to two major influences: First, publicity managers are appreciating more fully the many advantages and the comparative efficiency of this medium and are appropriating a constantly growing part of their advertising budget to it; second, central station commercial managers are realizing more generally the desirable and profitable nature of the electrical advertising load and are joining in organized stimulation of the field.

Surveys conducted by the Lighting Sales Bureau of the National Electric Light Association have brought out clearly the opportunity for increasing central-station revenue by the promotion of electrical advertising. One hundred and thirteen central stations assisted in a recent survey by furnishing detailed information from their cities, and sign manufacturers supplemented this with data from thirty other cities. These surveys reveal some interesting facts regarding the development of electrical advertising in the 143 cities, which have an aggregate population of 6,300,000.

In Table I, showing the number of different types of displays, it is interesting to note that of the 250,000 listed 112,000 were exposed lamp signs and 81,000 were inclosed lamp signs. That is, 77.2 per cent of the total was purely electric advertising. Illuminated bulletin and poster boards accounted for 50,000, or 20 per cent, and 7,000 displays, or 2.8 per cent, were for building outline lighting.

These 250,000 electrical displays, as shown in Table II, have a total of 15,000,500 sockets, in which lamps varying in size from 5 watts to 250 watts and even larger are used. The average wattage per socket is 13.2. The largest sign has a connected load of 300 kw. and 20,000 sockets, the average connected load is 800 watts with sixty sockets, and the smallest is 25 watts in one socket.

In addition to the tabulated information shown here, the surveys have emphasized some fundamental facts with regard to increasing the use of electrical advertising:

1. The opportunities for development are relatively the same in cities of all sizes. In large cities and small cities organized sales effort has succeeded equally well in promoting a high per capita use, and it is also true that lack of stimulation has everywhere resulted in a lower use of this medium.

2. The opportunities exist in all

TABLE I—TYPES OF ELECTRICAL DISPLAYS

| | |
|---|---|
| Exposed lamp signs | 112,000 |
| Inclosed lamp signs | 81,000 |
| Bulletin and poster boards | 50,000 |
| Building outline and marquise lighting | 7,000 |
| Total | 250,000 |

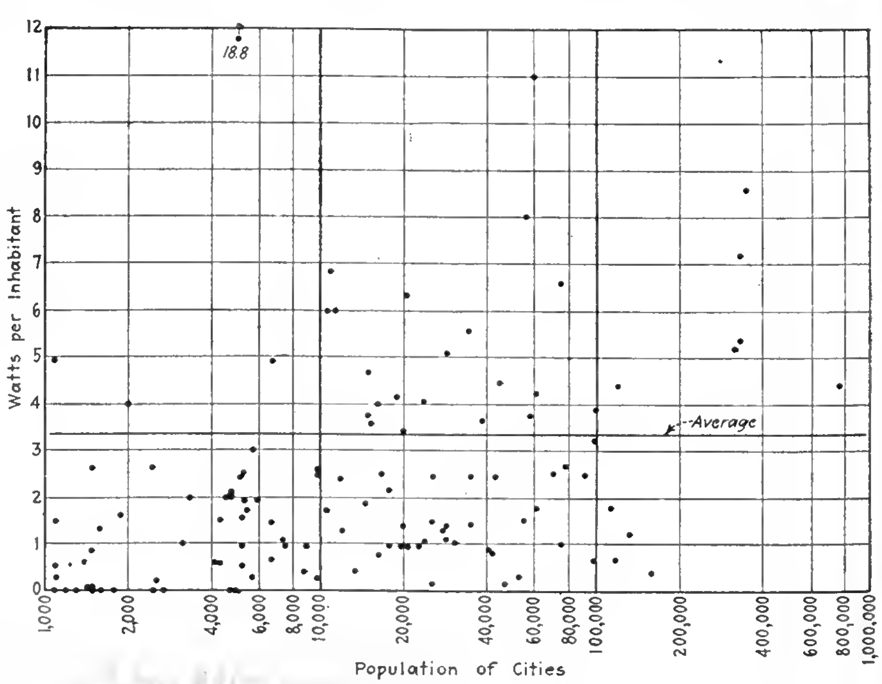
TABLE II—LAMP SIZES AND CONNECTED LOAD OF SIGNS AND DISPLAYS

| Lamp Size, Watts | Per Cent of Total Lamps | No. of Lamps | Kw. Connected | Per Cent of Total Wattage |
|---|---|---|---|---|
| 5 | 39.2 | 5,860,000 | 29,300 | 14.8 |
| 10 | 43.8 | 6,680,000 | 66,800 | 33.2 |
| 15 | 3.0 | 448,000 | 6,700 | 3.4 |
| 25 | 7.4 | 1,108,000 | 27,600 | 14.0 |
| 40 | 0.5 | 81,000 | 3,240 | 1.6 |
| 50 | 3.2 | 471,000 | 23,500 | 11.9 |
| 60 | 0.3 | 38,000 | 2,280 | 1.1 |
| 75 | 0.6 | 89,000 | 6,700 | 3.4 |
| 100 | 1.5 | 160,000 | 16,000 | 8.0 |
| 150 | 0.2 | 34,000 | 5,100 | 2.6 |
| 200 | 0.3 | 52,000 | 10,400 | 5.2 |
| 250 and larger | 0.2 | 24,000 | 1,200 | 3.0 |
| Total | . | 15,005,000 | 198,820 | .... |

Average 13.2 watts per socket

Largest display has a connected load of 300 kw. and ........ 20,000 sockets
Average display has a connected load of 800 watts and ........ 60 sockets
Smallest display has a connected load of 25 watts and ........ 1 sockets

Note—Use of 5-watt lamps is decreasing rapidly, while use of the 15, 25 and 50-watt sizes is increasing.




ELECTRICAL ADVERTISING IN WATTS PER INHABITANT IN 143 CITIES

sections of the country. Again, it is found that North, East, South and West respond enthusiastically wherever organized effort is made.

3. In industrial and commercial cities, trading centers and agricultural districts, summer and winter resorts, and cities of all types, this medium is effective and has been used extensively whenever vigorously offered.

TABLE III—CLASSIFICATION OF CHIEF USERS OF ELECTRICAL ADVERTISING

| | No. of Sockets |
|---|---|
| 1. Theaters (motion-picture and legitimate) | 2,680,000 |
| 2. Automotive (sales offices, garages, oil stations) | 1,500,000 |
| 3. Restaurants (cafés, lunch rooms, etc.) | 1,290,000 |
| 4. Clothing (stores, tailors, cleaners, etc.) | 1,280,000 |
| 5. Hotels (rooming houses, etc.) | 1,260,000 |
| 6. Banks (investment houses, etc.) | 780,000 |
| 7. Drugs | 700,000 |
| 8. Shoes (stores, repair, etc.) | 385,000 |
| All others | 5,000,000 |

4. The actual development in specific cities of all sizes and districts, however, does vary directly with the efforts at promotion put forth. The average development as shown in the accompanying chart is equivalent to $3\frac{1}{3}$ watts per inhabitant, corresponding to an energy consumption of about 5 kw.-hr. annually.

It is usually assumed that the greatest development of the sign and display load is found in the larger cities. This is true only to the extent that selling effort has been better organized. In the small cities the development may be as high or higher when proportional effort is made. The average of $3\frac{1}{3}$ watts per inhabitant is weighted according to population and not according to number of cities. Some cities report only 0.1 watt per inhabitant, while other cities show 10 watts per inhabitant or more. If the development is brought up to that already obtaining in the best 10 per cent of the cities, the central-station revenue from electrical advertising will be increased from its present figure of $15,000,000 to $35,000,00.

## Three Exclusively Electric Garages for New York

IN ANTICIPATION of a great increase in the use of electric trucks in New York during the next two years garage managers are making substantial enlargements in their service facilities and at least one stable, recognizing that the days of the horse-drawn vehicle are numbered, is being converted to a garage. In the stable of the Wendall & Evans Company, which had room for two hundred horses, the stalls are being removed, new floors laid, and when the alteration is completed there will be facilities for garaging 175 electric vehicles. This garage will handle electric vehicles exclusively.

The Commercial Truck Company also has leased a large building on Nineteenth Street, and when alterations are completed it will operate a service station and garage with accommodations for 150 trucks. The Walker Vehicle Company has outgrown its present quarters in Long Island City and has just given contracts for the erection of a new building. The garage will occupy a plot 100 ft. x 100 ft., will be three stories high, with 30,000 sq.ft. of floor space, and will be able to care for 350 electric trucks.

## Chicago Electric Shops Break Sales Records

TOTAL appliance sales by the Commonwealth Edison Company for the last year smashed all former records established in the company's branch stores. Not only did the total sales for 1922 far exceed those of any other year, but in December they were greater than during any previous month in the history of the company, and on one day during the month the previous high day's record was passed by more than $10,000.

Perhaps the most remarkable fact about this last feat was that the day on which the record was made was selected in advance, so that the record breaking was no chance happening, but the result of an efficiently planned campaign.

E. A. Edkins, general manager of electric shops, selected Thursday, Dec. 21, as the day. Careful preparations were made a week in advance. Mr. Edkins held a meeting of all the salespeople in the electric shops, explaining to them the purpose of the plan, and asking them to work at more than top speed on that day. He also interviewed the branch store managers, the outside salesmen, the supervisors, the cashiers and the credit department, enlisting their co-operation.

The result of this excellent planning was that on the day chosen a total of $51,700 worth of merchandise was sold. The previous high record, made in December, 1920, was about $40,000. Mr. Edkins is enthusiastic over the manner in which the employees in his department and those working with that department responded to his request.

"Credit for the accomplishment," he said, "must go to all the people who are concerned in the drive. It was only by the co-operation of the salespeople in all of the stores, the outside salesmen and the cashiers that we were able to do it."

Although the figures are not yet complete, indications are that the sales for December reached the high mark of $540,000, and that the total gross sales for the year 1922 were more than $3.500,000, about $300,000 more than the previous high year, 1920.

## Customers Have Choice of Rates in New Schedule

STEPS have been taken by the British Columbia Electric Railway Company, Vancouver, B. C., to differentiate between domestic and commercial customers under a new lighting schedule put into effect on Jan. 1. Under an agreement with the City Council of Vancouver by which the street-railway franchise was altered to allow the company a 6-cent fare and other adjustments, the company agreed to reduce the domestic lighting rate from 6 cents to 5 cents a kilowatt-hour.

There are about five thousand commercial lighting customers in the city, including a large number of small offices, small stores or combination stores and residences. The company has offered to its commercial customers the 5-cent lighting rate, but with a minimum charge of $1 per month per kilowatt-hour connected. Schedules have been mailed to every customer to be filled in, and these will be checked by the company during the year. The domestic minimum charge is 50 cents per month.

On the other hand, if any commercial customer, such as the small office or store, does not wish to pay the minimum charge of $1, he may continue to pay 50 cents a month minimum, but his rate for energy will be 6 cents a kilowatt-hour. Most of these small customers have an extremely low load factor, using light only for an hour or two a day and only in winter. This is the company's reason for making a higher charge to such customers than to residences.

Another feature of the Vancouver rates is the differentiation between the center of the city and the suburbs. Vancouver proper covers a small area, whereas one-third of the

population of the greater city resides in self-governing municipalities. These municipalities must make separate agreements covering utility services. Several years ago the company made a greater reduction in the city than in the suburbs, and today the domestic rate in the latter is 7 cents a kilowatt-hour, with possibility of a reduction if agreements are negotiated with the respective municipalities.

## Analysis of Residential Load Conditions

BY J. A. ROCKWOOD
Valuation Engineer Portland (Ore.) Railway, Light & Power Company

INCREASES in the use of electrical energy in the home have been one of the interesting features of electrical progress since the war, and a recent analysis by the Portland Railway, Light & Power Company reveals conditions which are typical in many companies.

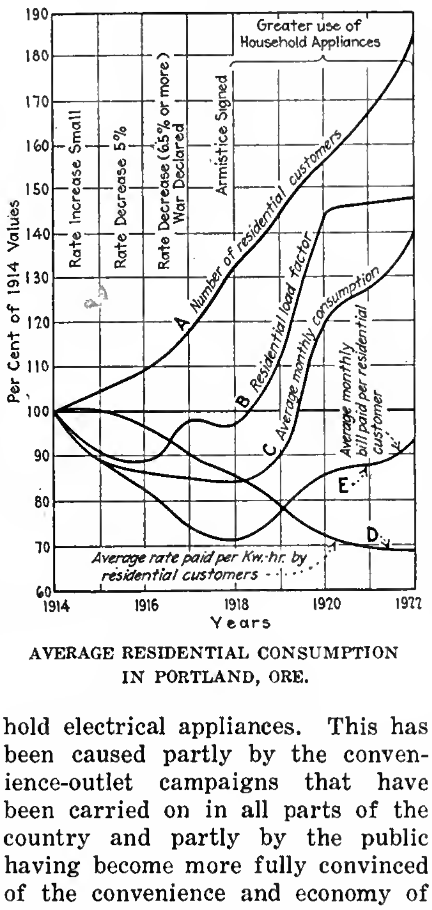
Up to November, 1918, there had been relatively little change in the amount of energy used by the householder, but in December, 1918, there was a marked increase in the average residential consumption in comparison with the same month of the preceding year. In January, 1919, there was an even greater increase per customer when compared with January, 1918. It was first thought that there must be some unusual cause back of such a noticeable increase, but it is now evident that this is a permanent condition. The consumption per customer has mounted steadily until now it is about 65 per cent greater than in 1918.

The earnings per customer also have increased, but not in the same proportion as the kilowatt-hour consumption. The increases in revenue have averaged about 30 per cent between 1918 and 1922. Owing to a sliding scale the average rate per kilowatt-hour has decreased about 20 per cent. These changes in unit figures make it plain that there has been a decided increase in the use of electrical energy by the average residence consumer, and the accompanying curves express these changes graphically. It will be noted from the chart that no changes in rates have occurred since the middle of 1916.

A part of the increase is due to the growing popularity of the electric range. There are now about 1,600 electric ranges on the company's system, but it is significant to note that very few of these were being added during the period that the greatest increase occurred. It is therefore evident that a large proportion of it is due to the use of other electrical appliances, especially small portable heaters used to supplement the regular house-heating system.

The sale of these heaters has been very active during the past few years, and many people have turned to their use when only a small amount of heat is required in order that they may save on their fuel bills.

Then, too, there has been a general increase in the use of all house-




AVERAGE RESIDENTIAL CONSUMPTION IN PORTLAND, ORE.

hold electrical appliances. This has been caused partly by the convenience-outlet campaigns that have been carried on in all parts of the country and partly by the public having become more fully convinced of the convenience and economy of electric service. Another factor has been the tendency toward better illumination in the home, which is reflected in greater consumption and has more than offset the expected decrease because of the more efficient "Mazda" lamp. The sudden increase noted in December, 1918, was no doubt the result of a relaxation from the economies practiced during the war, although, as will be noted from the curves, these economies did not result in any serious decrease in the average consumption during the war.

## What Other Companies Are Doing

**Worcester, Mass.**—In one month a single representative of the Worcester Electric Light Company, covering on foot the outlying districts of the city, sold 446 lamps from a portable supply to small storekeepers, distribution being by hand. Of these, 217 were sold to increase the illumination of existing installations, the increase in connected load being from 10,220 watts to 16,850 watts. Many of the remaining sales were to fill empty sockets or to replace burned-out units. Edwin Mandeville is in charge of the commercial lighting department.

**Salt Lake City, Utah.** — In the year ended Nov. 30, 1922, the employees' mutual aid association of the Utah Power & Light Company paid death claims amounting to $3,700 and sickness, accident and refund claims to members totaling $2,550. A surplus of $7,967 was divided among 826 members of the association, prorated according to the length of membership. Employees who were members throughout the year each received $10.25, the largest dividend ever paid by the association.

**Hartford, Conn.**—A compact calendar for the new year has been prepared by the Hartford Electric Light Company, carrying each month a practical message to the customer about the convenience and economical use of electric service. The calendars are mounted on cards only 3⅜ in. x 6¼ in. in size, and, instead of featuring the company's name, emphasis is placed upon the value of electricity as a servant. Suggestions are given monthly on cleaning lamps, fuses, metering, extra switches, wages of the electrical servant, repair service, the porch light, hot-weather comforts, electric heaters, lamp renewals, glare and lamp selection.

**Poteau, Okla.**—The first of a series of employees' meetings of the Oklahoma Gas & Electric Company was held at the Poteau office on Jan. 4. These meetings are planned to be held every two weeks and will alternate between this town and Heavener. Their avowed object is to discuss ways and means of improving service rendered the company's customers. Entertainment features are planned in order that they may be made as attractive as possible.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Hydraulic Turbines for Very Low Falls.*—F. JOHNSTONE-TAYLOR.—Owing to the attention being bestowed on the development of even quite small water powers and the necessity of developing water-power resources to the utmost, irrespective of the available fall, considerable attention is being paid to the low head turbine. The result is that these water turbines have now reached a high state of efficiency and are being built of a type which is suitable for driving all kinds of electric generators. —*Electrical Times*, Nov. 23, 1922.

*The Hydro-Electric Power Station at Fully, Switzerland.*—The working of hydro-electric power stations in the Alps, which are operated by water courses fed by glaciers, is entirely dependent upon the quantity of water available. Low water occurs in the winter, and tl. periods of high water are in the summer months. At low water the flow is generally much below the average, and when the equipment of the stations does not include steam reserves as a standby power the output may fall to very low limits during the winter. A means for overcoming this difficulty is the provision of water reservoirs at a high level, and one of the most interesting examples of a power station under such conditions is the one at Fully, Valais, Switzerland, which operates under a head of 1,650 m., this probably being by far the highest working head ever utilized. The building of this installation, including the power house, turbine foundation, pipe lines, etc., was surrounded by very many difficult problems, and a detailed description of the manner in which these were overcome is given. The pipe line connecting the reservoir with the plant is 4,625.5 m. long and is made of welded pipes varying in thickness from 6 mm. to 20 mm. It is operated at pressures up to 60 atmospheres. Four turbo-generators are used. These are designed for a flow of 200 liters per second at minimum head and for a normal power of 3,000 hp. each. The turbines operate at a normal speed of 500 r.p.m. — *Engineering*, Nov. 24, Dec. 1 and Dec. 15, 1922.

## Generation, Control and Switching

*Improvements of Power Factor.*—GISBERT KAPP.—This posthumous paper, presented before the Institution of (British) Electrical Engineers on Nov. 16, 1922, deals with the use of such consuming devices, or such addition to existing consuming devices or apparatus, as will improve the operating power factor of a plant. The paper is divided into three parts. The first part deals with the economical limit of power-factor improvement in relation to capital outlay. The concluding pages deal with meters and tariffs which allow the effect of a consumers' power factor to be assessed in money. Various methods of indicating kilowatt maximum demand and wattless kilovolt-amperes are described, and particulars of the tariffs employed by companies in England are given. The middle section of the paper, which is by far the longest, describes the equipment which can be used for power-factor improvements and brings together a useful amount of critical information on rotary and static condensers, synchronous induction motors, rotary converters and phase advances in their application to the correction of power factor.—*Electrician*, Dec. 1, 1922, and *Engineering*, Nov. 24, Dec. 1 and Dec. 8, 1922.

## Transmission, Substations and Distribution

*Factors Affecting Bulk Underground Transmission.*—P. DUNSHEATH. — Two possible methods of transmitting large amounts of power underground are discussed. These are (1) direct-current systems and (2) alternating-current systems using a multi-core cable or single-core cables. Some of the problems encountered are common to each of the systems, but each system has its own peculiar points, and the recognition of these without arriving at adequate methods of handling them has resulted in a curious state of affairs in which different engineers select totally different systems for practically identical conditions. Some of the systems described are the 110,000-volt line of the Metropolitan Electric Supply Company (England), using single-core cables; the 60,000-volt single-phase transmission line used in connection with the electrification of the St. Gothard system between Switzerland and Italy, in which single-core cables are used, and the 50,000-volt line of the Union d'Electricité, Paris. The author considers sheath losses, longitudinal current losses, the effect of armoring, dielectric losses, thermal characteristics, etc., of the types of cables now in use in Europe.—*Electrician*, Dec. 1, 1922.

*Japanese High-Voltage Power-Transmission Systems.*—S. W. HAYES.—Super-power systems in the United States have been thoroughly discussed in the American technical press within the last few years, but little has been published about similar developments in other countries. Japan's progress in high-voltage transmission is of interest. In this article, the first of a series, the author takes up some of the more general features in connection with the larger power transmission systems and then goes into further details relative to interesting features of the generators, transformers, synchronous condensers, switching equipment and other important devices. — *Electric Journal*, December, 1922.

## Units, Measurements and Instruments

*Thermionic Voltmeter.*—The vacuum tube forms a convenient method of measuring alternating electromotive forces of any frequency, because, owing to its asymmetric conductivity, an alternating electromotive force of which the mean value is zero produces an alternating current the mean value of which is not zero and which is readily measured by an ordinary milliammeter or microammeter. Two methods of using the triode valve as a rectifier are described. One method employs the curvature of the anode current/grid potential characteristic, while the other employs the curvature of the grid current/grid potential characteristics.—*Engineer*, Dec. 15, 1922.

*Testing of Materials Used in the Manufacture of Electrical Equipment.* —C. DAWSON.—The tests on metals that are described are tensile, compression, shearing, bending, torsion, impact, hardness and magnetic. For sheet and molded insulation the following tests are described: Mechanical strength, plastic yield, electric strength and insulation resistance; for oils, electric strength, insulation resistance, viscosity, flash point, chemical reaction and sludge, while for varnishes the tests described include electric strength, flexibility, acidity and time necessary for drying.—*Journal of the Institution of (British) Electrical Engineers*, December, 1922.

## Illumination

*Lighting in Factories and Workshops.*—The third report of the Home Office departmental committee (England) marks a new stage in the treatment of the above subject. The two previous reports are first summarized. The primary recommendation contained in the first report stated that there should be a statutory provision in general terms requiring adequate and suitable lighting in every part of a factory or workshop and giving power to the Secretary of State to define such lighting. In the second report general requirements in regard to avoidance of glare, elimination of inconvenient shadows and absence of flicker were made. In the report recently issued the requirements in regard to glare are supplemented by an indication that when a brilliant source is covered by a small shade the brightness may considerably exceed 15 cp. to 20 cp. per square inch and should be treated as a source and its position with regard to the worker limited accordingly. The chief question

considered in the third report is the degree of illumination needed for the actual carrying on of work. The committee presents a comprehensive schedule of industrial operation, divided into two classes described respectively as "fine work" and "very fine work," the former requiring 3 foot-candles and the latter about 5 foot-candles.—*Illuminating Engineer (London)*, Vol. 15, No. 7.

## Motors and Control

*Flour-Mill Electrification.* — The power employed in the flour industry in Canada is shown by kinds and classes in the statistical table reproduced herewith. This table is divided according to the number of units of each class, the total horsepower installed and the horsepower actually developed. A comparison of the figures shows that there is still a large field for electrification.—*Electrical News*, Dec. 15, 1922.

EXTENT OF ELECTRIFICATION OF FLOUR MILLS IN CANADA

| Kinds of Power Used | No. of Units | Mfrs' Rating, Hp. | Actual Hp. |
|---|---|---|---|
| Boilers | 231 | 17,828 | 12,706 |
| Engines, steam | 227 | 17,871 | 14,921 |
| Engines, gas | 47 | 3,134 | 2,696 |
| Engines, gasoline and oil | 181 | 3,331 | 3,202 |
| Waterwheels or turbines | 1,134 | 44,106 | 37,029 |
| Water motors | 8 | 321 | 295 |
| Electric motors | 1,135 | 50,812 | 38,220 |
| Other power supplies | 4 | 270 | 100 |
| Total | 2,736 | 119,845 | 96,463 |

*Electrical Equipment for Cotton Mills.*—G. W. ROBERTSON.—The electrical equipment of Mill No. 8 of the Riverside Division of the Riverside and Dan River Cotton Mills is described. As the equipment of these cotton mills is mostly standard apparatus, the author tells the greater part of the story by means of illustrations.—*General Electric Review*, December, 1922.

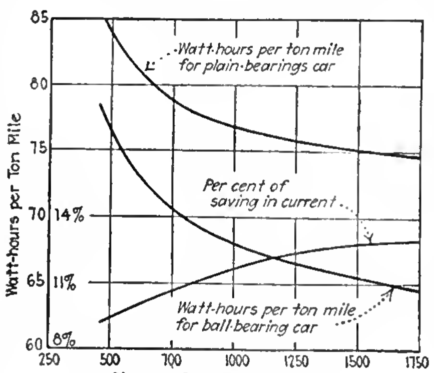
## Heat Applications and Material Handling

*Electric Arc-Welding Apparatus and Equipment.* — J. CALDWELL. — General information regarding the power requirements of welding processes and descriptions of generators and other electrical machines used in welding were given by the author in a paper presented before the Institution of (British) Electrical Engineers on Dec. 14, 1922. In an appendix to the paper a description of an apparatus is given by means of which, for the purpose of experimental investigation, an ordinary electrode may be set to do the work by the use of gears driven by an electric motor. Observations were made of the nature of the deposit through a magnified view on an image screen as well as of the arc. Oscillograms show the alternating current used for the arc to have a curve which is in form a triangular peak with a base of about two-thirds of the duration of each alternation. Claims are made in the paper that flux coated electrodes are essential for alternating-current work and are preferable to bare wires when direct current is used.—*Electrician*, Dec. 22, 1922.

*Electric Furnaces for Heat Treatment of Steel.*—A. W. LAMONT.—The special features of design and operation of electric furnaces are discussed with particular reference to the furnace installation of the Transcona shop of the Canadian National Railways. The furnace which is used at the Transcona plant is designed to heat 5,000 lb. of locomotive side rods and main rods from room temperature up to a temperature of 1,500 deg. F.—*Engineering Journal* (Canada), January, 1923.

## Traction

*Anti-Friction Bearings for Electric Cars.*—O. R. WIKANDER.—A review is made of the results obtained from the use of anti-friction bearings in the United States and abroad, together




POWER CONSUMPTION FOR CAR WITH BALL AND PLAIN BEARINGS

with a description of some of the principal types now in use. The main advantage claimed for the use of ball bearings is the decrease in starting torque due to the smaller starting friction of ball bearings as compared with plain types. The power consumption for a motor car equipped first with ball bearings and then with plain bearings is shown in the accompanying illustration.—*Electric Railway Journal*, Dec. 16, 1922.

## Electrophysics, Electrochemistry and Batteries

*Electrical Resistivity and Temperature Coefficient of Manganin.*—SKEZUG KIMURA and KIKUJI SAKAMAKI. — The resistivity and temperature coefficient of copper manganese alloys and the effects of other elements are investigated. From their experimental results the authors have found that a straight copper-manganese alloy can furnish the best manganin and that there is no need of adding other elements for the purpose of improving its resistivity and temperature coefficient. The straight copper-manganese alloys of about 13 per cent manganese made in the authors' laboratory have a specific resistance of 45 microhms and a temperature coefficient at 22.5 deg. C. of 0.00000348. — *Researches of the Electrotechnical Laboratory, Tokyo, Japan.*

*Dry-Cell Specifications.*—The Bureau of Standards has issued specifications for the standard sizes of dry cells and flashlight batteries. These specifications are a revision of similar specifications prepared several years ago and published in the first edition of Circular No. 79, on the electrical characteristics and testing of dry cells. A limited number of copies of the new specifications are available for distribution prior to publication of the second edition of the dry-cell circular.—*Technical News Bulletin No. 68 of the Bureau of Standards.*

## Telegraphy, Telephony, Radio and Signals

*Use of Telephones in Moving Trains.*—B. ROSENBAUM.—The article describes a method of communication from a stationary telephone to a subscriber traveling on a train which was tried on a 275-km. stretch of track between Berlin and Hamburg. All previously tried methods required either a very large amount of energy in the sending station or else a high antenna somewhere upon the train. The former was too costly; the latter was impossible owing to the limited overhead room in cuts and tunnels. The tests described were made by the use of high-frequency currents with wave lengths of between 3,000 m. and 4,000 m. emitted from a station near the main line and carried in a wire along the tracks. The author goes into full details as to the best arrangement of the high-frequency current-carrying wire which carries the speech to the train. It is claimed that energies of only 5 watts to 50 watts were required to establish perfect speech transmission.—*Jahrbuch der Drahtlosen Telegrafie und Telephonie*, November, 1922.

*Theory of the Telephone Receiver.*—L. C. POCOCK.—Some of the simpler electromechanical properties of the telephone receiver that can be derived from the well-known receiver equations first formulated by Poincaré and the experimental researches of Kennelly and his collaborators are described. The equations of a telephone receiver in a generalized form, taking cognizance of some second-order effects, have been given more recently by Wegel and are reviewed in this article.—*Electrician*, Dec. 22, 1922.

*Comparison of Condensers at Radio Frequencies.*—This pamphlet describes the method of comparison of the capacity and effective resistance or phase difference of two condensers one of which has already been standardized. The method used is that of comparison by substitution; that is, tested and untested condensers are compared by inserting them in turn in a circuit which is brought to resonance with a source of undamped waves.—*Letter Circular No. 77 of the Bureau of Standards.*

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## City Vs. Power Company

**Louisville and Byllesby Interests Fight Before Federal Commission for Falls of Ohio**

JUDGING from the arguments presented at a hearing before the Federal Power Commission and by the apparent attitude of Secretary Weeks, its chairman, the probabilities favor an ultimate decision for the Louisville Hydro-Electric Company in the conflict which has arisen with the city of Louisville for power rights at the Falls of the Ohio. The Louisville Hydro-Electric Company is a subsidiary of the Louisville Gas & Electric Company—a Byllesby interest.

The arguments for the Louisville Hydro-Electric Company hinged on the fact that it already has a development of 60,000 hp. provided by an existing steam plant and has in construction a new unit which will furnish an additional 30,000 hp. of steam power. With this installation it is in a position to make excellent use of the variable power which will be developed at the government dam. Moreover, it was pointed out that the company has a complete distributing system serving not only Louisville but the entire surrounding region, power lines radiating as far as 60 miles from the city.

### Louisville's Broad Project

The city was represented by former Governor Thatcher and by Gen. William L. Seibert, the constructor of the Gatun Dam. In their arguments it was brought out that Louisville proposes to develop this power through its water company, a private corporation all of whose stock is owned by the city. It is the desire of the city's company to supply power to the entire tributary region, including that which lies adjacent to Louisville in Indiana. Letters from the Mayors of Jeffersonville and New Albany were presented to show that Indiana authorities would not oppose such a plan. It is the ambition of the city to secure a supply of cheap power with which to attract industries, and its plan is to develop 75,000 hp. to 100,000 hp. by developing steam auxiliaries or erecting an auxiliary power plant on either the Green or the Cumberland River. The point was made that the city is anxious not to interfere with the existing business of the Louisville Gas & Electric Company.

Col. William Kelly, the chief engineer of the Federal Power Commission, pointed out that the maximum demand in Louisville and in the cities of Jeffersonville and New Albany during 1920 was 61,000 kw. and that the average load was 25,000 kw. For that reason he is inclined to regard it as questionable whether Louisville could market 100,000 hp. in addition to the 90,000 hp. furnished by the Louisville Gas & Electric Company.

## Potomac Company's Rates Before Supreme Court

Arguments were heard before the United States Supreme Court on Wednesday of this week in the appeal of the Public Utilities Commission of the District of Columbia from the decision of a lower court setting aside the valuation placed by the commission upon the properties of the Potomac Electric Power Company as the basis for rates. This case is being followed with particular interest by consumers of electricity within the District of Columbia and by stockholders of the corporation not only because the rate for energy is involved but because of the impounding of the difference between the rates sought by the commission and those charged by the corporation. This difference amounted to approximately $3,200,000 on Jan. 1, and the sum will be distributed among the consumers or among the stockholders according to the decision of the Supreme Court.

The main point of dissension is reproduction value. The company also alleges that the commission made improper deductions for depreciation, it being alleged that, because of constant replacements, no actual depreciation existed. The company further asserts that the commission improperly excluded three properties owned by the company. These three properties are valued by the company at more than $1,000,000.

When the commission began valuation of the properties of the Potomac company, in 1915, it took reproduction values as of July 1, 1914. In deciding the case in May, 1917, it added the actual cost of replacements made from July 1, 1914 to July 1, 1916. The commission declared the value to be $11,231,170 and ordered a 20 per cent reduction in electric rates.

The company contended that reproduction values should have been taken as of July 1, 1916, the year in which actual hearings in the case began. It asserted that the enhanced value of its structural property between July 1, 1914, and July 1, 1916, was $2,521,000 on account of rising costs due to the war. The president of the corporation contended that the value as of July 1, 1916, should have been $15,642,431.

## Deschutes Power Case Up

**Federal Commission Thought Likely to Decide the Contest in Favor of Columbia Valley Company**

AFTER an exhaustive hearing granted to representatives of the Bend Water, Light & Power Company of Bend, Ore., and of the Columbia Valley Power Company, it seems probable that the Federal Power Commission will reject the proposition of the Bend company and will execute the preliminary permit requested by the Columbia Valley Power Company.

The Columbia Valley Power Company, which is financed by Iowa, Philadelphia and New York interests, was an early applicant for a preliminary permit for the Metolius site on the Deschutes River. The preliminary permit was authorized by the commission on Oct. 10, 1922, but its execution was withheld when the Bend company, backed by an unusual volume of local sentiment, filed a belated application.

At the hearing the Columbia Valley company's representatives stated that they would make no argument as they are entirely willing that the question be settled on its merits. The Bend company devoted practically all of its two hours to an attack on the conclusions of the engineers of the Federal Power Commission. These engineers hold that the Bend project is of doubtful economic feasibility. The reflection on the commission's engineers became so pointed that Secretary Weeks declared he would tolerate no further aspersions on their motives or fairmindedness.

### An Unparalleled Pumping Scheme

The proposition is to irrigate 83,000 acres of land in central Oregon by pumping water an average lift of 771 ft. It is admitted that the project is without parallel in the development of irrigation farming in the United States. Engineers of the Reclamation Service joined with those of the power commission in declaring the project not feasible. It was contended that experience in Idaho, where conditions are similar, has shown that land cannot be irrigated profitably where it is necessary to lift the water more than 100 ft.

Col. William Kelly, the chief engineer of the Federal Power Commission, estimated that, making every possible allowance for the cheap power which the Deschutes will furnish, it would be impossible to bring power costs below $3 a horsepower-year. The engineers of the Bend company have arrived at a much lower figure and before a decision is made they will try to justify it.

Mathis and Burton Lakes, Which Together Store 6,649,000,000 Cu.Ft. of Water for Tallulah River Developments

# Georgia Company's Expansion Program

## More than $6,500,000 to Be Expended on the Mathis Development, on the Completion of the Tugaloo Plant, for Transmission Lines and in the Atlanta Zone

EXTENSIVE additions to and improvements of the Georgia Railway & Power Company's systems have been started which will constitute the largest program ever undertaken by the company in a single year, more than $6,500,000 being appropriated for the work. The plans provide for new power plants, substations and transmission lines in various parts of the state, in addition to improved gas and street-railway service in Atlanta. The chief additions which will be made to the electric service facilities are indicated on the accompanying map. More than $1,350,000 will be spent during 1923 for transmission lines outside the 7-mile zone centered at Atlanta, $1,000,000 for the Mathis hydro-electric development, and about $700,000 to complete the Tugaloo development, which was started in 1917 but suspended during the war. The remainder of the $6,500,000 will be spent inside the Atlanta 7-mile zone. It is expected that the Mathis development will be completed by the fall of 1924 and the Tugaloo development in the fall of this year.

The Mathis-Tallulah development will involve a 1-mile tunnel from Lakemont dam, which will feed water into the power house under a 190-ft. head and develop 12,000 kw., or 63,000,000 kw.-hr. annually. This station, which will be several miles from the existing Tallulah Falls plant, will be remotely controlled from there. Water from the Mathis station will then pass through the Tallulah Falls plant and join the flow from the Chattooga River to feed the Tugaloo plant.

The Tugaloo development, which will have a generating capacity of 50,000 kw. at 152-ft. head, will provide more than twice the annual output of Mathis, or 129,790,000 kw.-hr.

A modernization of the Morgan Falls, or Bull Sluice, station will also be completed this year, increasing the capacity 35 per cent. This work is already well under way.

Already leading from Tallulah to Atlanta is a double-circuit, 100,000-volt transmission line. An additional line of the same voltage will be completed to Atlanta by way of Toccoa, Commerce, Winder and Norcross, where step-down substations will be installed. This line will not only improve the reliability of service to Atlanta but also that to the east and southeast of the line. Power from Tugaloo, Mathis and Tallulah will be controlled at a switching station at Tallulah.

Next year a 110,000-volt line will be built from Lindale substation, which will be increased in capacity from 3,000 kw. to 10,000 kw., through Summerville, Lafayette and Chickamauga to Chattanooga, where it will connect with the Tennessee Power Company's system. At the same time a 38,000-volt line will be run from Marietta to Tate.

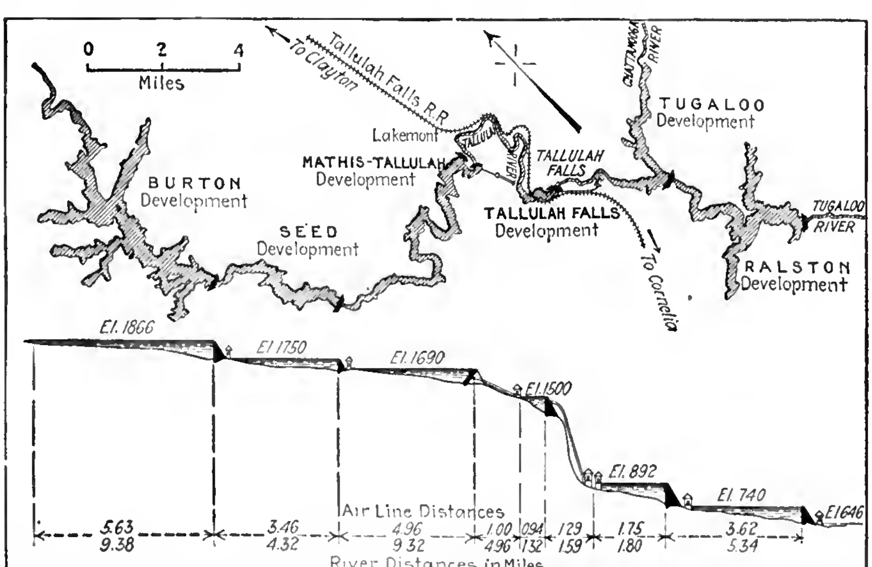
Inside Atlanta this year a 19,000-volt loop will be completed to increase the reliability and quality of service. In addition to this, extensive improvements will be made in the city's substations, and the Butler and Davis Street steam plants will be enlarged.

All of the foregoing improvements will be made with the next five or ten years' load growth in mind. The present total developed water power on the Georgia Railway & Power Company's system is 150,600 hp. Upon completion of the Tugaloo plant it will be 234,000 hp. In addition to this, however, the entire generating capacity will be backed by six other power companies in Alabama, Tennessee, Georgia and North and South Carolina. The interconnected companies have a total rated capacity of 1,010,355 hp. and are on three separate and distinct watersheds. From extreme tip to tip of the interconnected systems is 900 miles. Notwithstanding this great distance, they have all exchanged energy in emergencies during the past three years very successfully and advantageously.

The need of the development work undertaken by the Georgia Railway & Power Company is indicated by the fact that 46,000,000 kw.-hr. additional consumption may be expected on the company's system by the end of 1923 owing to the natural growth of existing loads and to new business which may be obtained exclusive of the increase in consumption resulting from growth of street-railway and interurban business. The foregoing consumption will represent an increase of 17 to 18 per cent over the corresponding amount for 1922.

### How Interconnection Has Helped

Some indication of the mutual benefits received from the superpower system, of which the Georgia Railway & Power Company is a part is afforded by last year's record of exchange of energy




Relative Positions of Existing and Proposed Hydro-electric Development on the Tallulah and Tugaloo Rivers, Georgia

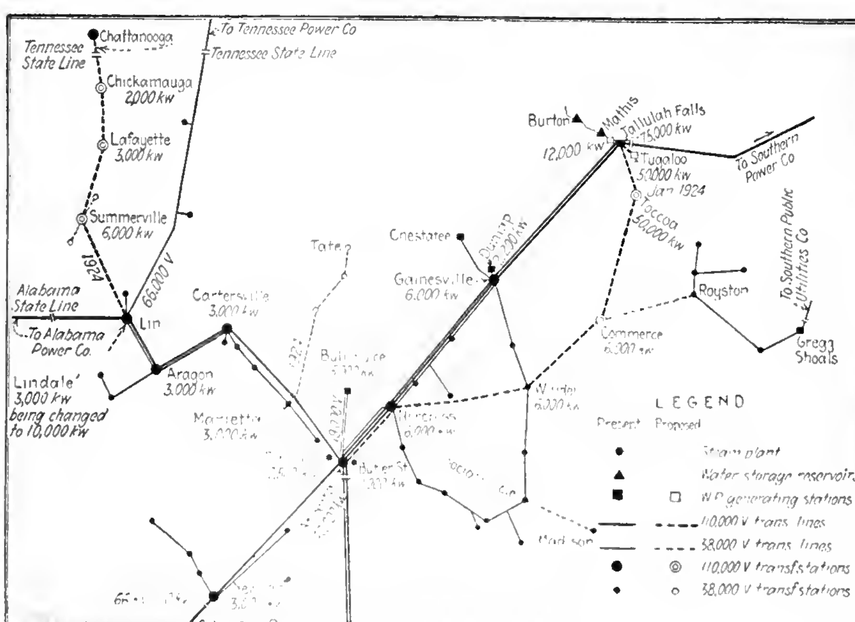
between this system and the six systems with which it is interconnected. The amount of energy received from and delivered to the connected systems was approximately as follows: Tennessee Power Company, 15,000,000 kw.-hr. and zero respectively; Alabama Power Company, 18,000,000 kw.-hr, and 1,500,000 kw.-hr.; Columbus Power Company, 5,000,000 kw.-hr. and 3,250,000 kw.-hr.; Central of Georgia Power Company, 6,000,000 kw.-hr. and 6,000,000 kw.-hr.; Southern Public Utilities Company, 1,500,000 kw.-hr. and zero; Southern Power Company, zero and 27,000,000 kw.-hr. Most of the energy purchased by the Georgia Railway & Power Company was received during October, November, December and January, the dry season. It should be observed that the foregoing receipts and deliveries of energy merely indicate the system from or to which energy was delivered and do not necessarily indicate its ultimate destination. Many times the energy was relayed to some other system. In general, the Georgia Railway & Power Company requires the delivering company to deliver 5 per cent more energy than is to be relayed to the distant company to compensate for line losses. In some cases standing contracts are held for receiving or delivering a definite amount of energy each year, but in general the exchange of energy is only for emergency purposes. By agreement of the interconnected companies, the system operator of the Georgia Railway & Power Company has supervision over the interchange of energy and the operating methods involved in making the interchange. The chief problem is to maintain the proper frequency and voltage to facilitate interchange and division of the wattless current as well as voltage regulation. The contracts, in general, cover only the amount which shall be paid for the energy, there being a fairly uniform

WATER POWERS ON THE TALLULAH AND TUGALOO RIVERS

| | |
|---|---|
| **Burton Development:** | |
| Height of dam, ft. | 116 |
| Drainage area above dam, sq.miles | 136 |
| Area of reservoir, acres | 2,775 |
| Capacity of reservoir, cu.ft. | 5,280,000,000 |
| Capacity of reservoir in equivalent kilowatt-hours: | |
| At Seed power house | 5,540,000 |
| At Mathis-Tallulah power house | 17,300,000 |
| At Tallulah Falls power house | 55,000,000 |
| At Tugaloo power house | 13,850,000 |
| At Ralston power house | 8,600,000 |
| Total capacity of reservoir | 100,290,000 |
| Generating capacity, kw. | 6,000 |
| Head, ft. | 84-116 |
| Average annual output, kw.-hr. | 32,200,000 |
| **Seed Development:** | |
| Height of dam, ft. | 60 |
| Drainage area above dam, sq.miles | 144 |
| Area of reservoir, acres | 560 |
| Available capacity of reservoir, cu.ft. | 350,000,000 |
| Generating capacity, kw. | 5,000 |
| Head, ft. | 60 |
| Average annual output, kw.-hr. | 20,000,000 |
| **Mathis-Tallulah Development:** | |
| Height of dam, ft. | 90 |
| Drainage area above dam, sq.miles | 153 |
| Area of reservoir, acres | 834 |
| Capacity of reservoir, cu.ft. | 1,369,000,000 |
| Capacity of reservoir in equivalent kilowatt-hours: | |
| At Mathis-Tallulah power house | 2,210,000 |
| At Tallulah Falls power house | 15,000,000 |
| At Tugaloo power house | 3,940,000 |
| At Ralston power house | 2,450,000 |
| Total capacity of reservoir | 23,600,000 |
| Generating capacity, kw. | 12,000 |
| Head, ft. | 190 |
| Average annual output, kw.-hr. | 63,800,000 |
| **Tallulah Falls Development:** | |
| Height of dam, ft. | 116 |
| Drainage area above dam, sq.miles | 190 |
| Area of reservoir, acres | 63 |
| Available capacity of reservoir, cu.ft. | 63,000,000 |
| Generating capacity, kw. | 72,000 |
| Head, ft. | 608 |
| Average annual output, kw.-hr. | 200,000,000 |
| **Tugaloo Development:** | |
| Height of dam, ft. | 140 |
| Drainage area above dam, sq.miles | 481 |
| Area of reservoir, acres | 557 |
| Available capacity of reservoir, cu.ft. | 725,000,000 |
| Generating capacity, kw. | 50,000 |
| Head, ft. | 152 |
| Average annual output, kw.-hr. | 129,790,000 |
| **Ralston Development:** | |
| Height of dam, ft. | 90 |
| Drainage area above dam, sq.miles | 540 |
| Area of reservoir, acres | 1,040 |
| Available capacity of reservoir, cu.ft. | 900,000,000 |
| Generating capacity, kw. | 30,000 |
| Head, ft. | 94 |
| Average annual output, kw.-hr. | 88,850,000 |
| SUMMARY | |
| Total storage capacity, cu.ft. | 8,687,000,000 |
| Total head, ft. | 1,220 |
| Total generating capacity, kw. | 175,000 |
| Total average annual output, kw.-hr. | 534,640,000 |
| Average annual rainfall over entire watershed, in. | 65 |
| Average annual run-off, in. | 40 |

SITE OF 50,000-KW. TUGALOO DEVELOPMENT, WHICH UTILIZES COMBINED FLOW FROM TALLULAH AND CHATTOOGA RIVERS

This dam and power house which will be completed before Jan. 1, 1924, will add approximately 50 per cent to the company's waterpower output. The dam will be 140 ft. high and will form a lake covering 557 acres.




GEORGIA RAILWAY & POWER COMPANY'S SYSTEM, SHOWING DEVELOPMENT PROPOSED

rate for hydro-electric energy but a sliding rate for steam power depending on the price of coal.

Except where standing contracts exist for a fixed amount of energy each year, no company is compelled to deliver or accept any energy. If one company desires energy, it endeavors to see who will furnish it and no company is compelled to give it unless it has surplus power available.

This development is in charge of Charles G. Adsit, vice-president and executive engineer of the Georgia Railway & Power Company. A special construction force of about 1,500 men will be employed.

## International Paper Company Has New 25,000-Kw. Plant

Water will, it is announced, be turned into the International Paper Company's new storage basin at Sherman Island, N. Y., within a few weeks, and the plant is expected to be in operation about June 1 with an installed capacity of 25,000 kw. Contracts are already in hand whereby industries and consumers in the surrounding territory will purchase the full output.

This plant is on the Hudson River within a few miles of the company's Glens Falls mill. The International has three other plants in the vicinity, but none of the power generated will be consumed by these mills.

## Tax-Free Bonds Disapproved by Lower House

The resolution to submit to the states an amendment to the United States Constitution to prevent the exemption of securities from taxation was adopted by the House of Representatives this week by a vote of 293 to 101. The resolution thus commanded five more than the two-thirds vote required to pass a constitutional amendment resolution.

Twenty-four Republicans opposed the resolution, while twenty-three Democrats supported it.

## Chicago Electric Club Has Ambitious Program

Three concrete plans for promoting the electrical industry were sponsored by the Electric Club of Chicago at its "inspiration day" luncheon on Jan. 23 as part of a progressive program to be carried out during 1923. President Paul W. Koch said that the first thing was to start sectional technical groups among club members for the purpose of studying one particular subject. The second was to "tie in" with the "more and better business" campaign of the N. E. L. A. by starting a bureau to lay definite plans for developing each section of the industry from the central station to the contractor. The "electric home" idea was the third plan, and it was forcefully championed by Walter Collins, secretary of the Electrical Contractors' Association of Chicago, who declared that the Cleveland Electric Club had been instrumental in causing sixty-five "electric homes" to be built in 1922.

## Commercial Side of N. E. L. A. Promoted at Denver

Seventy-five leading central-station commercial executives from all parts of the country, East as well as West, met at Denver this week for the midwinter session of the N. E. L. A. Commercial Section committees. The purpose of holding the meetings so far west was to encourage a large attendance of central-station commercial men from that part of the country and make them feel that Eastern men are interested in their problems.

Discussing plans for the New York convention in June, Oliver R. Hogue, chairman of the Commercial Section, said: "The electrical industry is now getting into its commercial stride, and the national convention of 1923 will be of the greatest commercial significance in the history of the central-station business. Much important information on selling methods will be presented at the convention and many surprises are in store in the presentation of this material. Not only will every central-station executive want to be present himself, but he should see that his commercial manager and the principal members of his selling staff are also on hand for the important general and commercial sessions. The 1923 meeting is going to be a shirtsleeve convention, by which I mean that the commercial men are going to take off their coats and go after the business."

G. Bertram Regar, chairman of the Lighting Sales Bureau, pointed out some of the commercial possibilities in the field of lighting sales. It is possible, for example, he said, with benefit to the customer in general, to double the intensity of existing lighting installations, and since lighting makes up 58 per cent of the total central-station income today, tremendous increases can thus be achieved in central-station gross business. The Lighting Bureau's program for 1923 will be concentrated on the two important subjects of residence lighting and store lighting. Papers and reports will be prepared and circulated well in advance. Novel means are being planned for the dramatic visualization at the convention of business-getting ideas.

The Power Sales Bureau, C. K. Nichols chairman, expressed a desire to learn of the problems of the West and to make the work of the committee of more value to Western commercial men. Particular attention will be devoted to new types of drives and control which will increase production and lower operating costs. Plans for carrying on the industrial heating school will be carried forward. Western men emphasized the necessity for holding such courses in the West. The Power Sales Bureau fully appreciates this need, and next year the work will be started through the various geographic divisions.

## Joint Committee for Business Hard at Work

At a meeting of the executive committee of the Joint Committee for Business Development held in New York on Jan. 9, P. R. Labelle, power sales manager of the Shawinigan Water & Power Company, Montreal, was elected a member of the executive committee, and J. S. Tritle, merchandising manager of the Westinghouse Electric & Manufacturing Company, was included in the membership of the general committee. Director Lane announced that the committee now had 749 correspondents.

It was decided to make a list of available electrical publications prepared by the national associations co-operating with the committee and distribute it to the trade. C. E. Greenwood, chairman of the appliance department, announced that he was preparing a booklet on vacuum cleaners and another on commercial cooking; P. B. Zimmerman, chairman of the lighting department, is at work on a domestic lighting prospectus, and A. K. Baylor, chairman of the wiring department, reported progress.

A newly created electrical transportation department has Charles R. Skinner, Jr., of the New York Edison Company, as chairman. The electrification of textile mills is to be taken up by the electric power department, of which H. H. Holding is chairman. C. K. Nichols, chairman of the department of electric heating and melting, reported that he had gathered material for a series of booklets.

The original plans for the joint committee prize contest have been somewhat changed, and the committee will announce on Feb. 10 the rules governing the award of a cup to the electrical club, league, local association or local company which reports the most effective and interesting local activity. Five other prizes in the form of plaques will be awarded for meritorious local activities.

A motion was passed to consolidate the advertising committee of the joint committee and the publicity advertising council of the Society for Electrical Development into one body. It was decided that the first publication to be sent out to the committee's correspondents would be one on store and show-window lighting.

## Fitkin Properties Report Year of Records

Representatives of the properties operated by the General Engineering & Management Corporation of New York, known as the "Fitkin group," held their annual convention last week at the offices of A. E. Fitkin & Company. They consisted of the local operating heads of the Tidewater Power Company, Commonwealth Light & Power Company, Interstate Electric Corporation and the Morris & Somerset Electric Company and their subsidiaries, numbering twenty-six electric light and power, gas, water, ice and street-railway companies serving more than a hundred communi-

ties in New Jersey, Pennsylvania, North Carolina, Florida, Texas, Missouri, Kansas and Michigan. This organization has just completed the most successful year in its history as owner and operator of public utilities. As of Nov. 30 last, the number of customers served by these combined properties in the twelve months previous increased by development and acquisition of new properties from 29,151 to 48,961 and the capacity of their central stations from 8,315 kva. to 40,595 kva.

Meetings were held throughout the week and the keynote was distinctly optimistic. Plans for commercial expansion and development were the chief consideration. In addition to the organization program, the convention was addressed by F. W. Smith, president National Electric Light Association; M. R. Bump of Henry L. Doherty & Company, A. K. Baylor of the General Electric Company and Earl E. Whitehorne, commercial editor ELECTRICAL WORLD.

## Carolina-Tennessee Company Wins—Appeal Taken

The Carolina-Tennessee Power Company won a victory in the hearing at Murphy, N. C., of its suit against the Hiawassee Power Company over the right to power sites, referred to in the ELECTRICAL WORLD for Jan. 20, page 176, before Judge P. A. McElroy. The Hiawassee company will, however, as predicted, appeal to the State Supreme Court. Officials of the Carolina-Tennessee company are confident that the Legislature will not repeal its charter.

## Indiana Legislature Acting on Commission Bills

One of three measures affecting the administration of the Indiana Public Service Commission which were introduced in the State Legislature has been killed in the Senate, another is coming up as a special order of business, and the third, a House bill, is still in committee.

The bill killed provided that utility bond issues should not exceed the taxable valuation of the company. It was reported for indefinite postponement by the committee on finance, and the report was adopted by a viva voce vote. The bill before the Senate would require the taxable valuation of a utility to be the basis on which rates are made. This bill came out of committee with a divided report, a majority favoring indefinite postponement. It is possible that a public hearing may be held on the measure. The House bill would authorize the holding of a referendum to decide whether a municipally owned public utility shall be exempt from operating under the Public Service Commission. A majority of the committee is expected to favor it.

## Code Changes Discussed by Electrical Inspectors

In the first two days of the eighteenth annual meeting of the Western Association of Electrical Inspectors at Chicago this week twenty-three proposed changes of the National Electrical Code were considered in view of the revision to be made this year. These changes, contained in the report of the electrical committee of the National Fire Protection Association, were explained by Chairman Dana Pierce, as being the outcome of three years of investigation into troubles reported by and protests made by electrical inspectors. Unless further protests are made the new changes will go into effect after a public hearing at New York on March 12.

Among the most prominent changes are those which require color identification of fuses. Fuses for 600 volts will still remain red, 250-volt cartridge fuses of 15 amp. capacity and less are to be yellow or orange, and fuses over 15 amp. are to be green. To aid in distinguishing plug fuses, those of 15 amp. and under are to have a hexagonal opening in the brass cap through which a mica window will appear. To insure rigidity flush-switch and receptacle metal plates are to have a thickness of 0.04 in.

C. A. Bates, reporting on the 600-watt sockets, declared that some manufacturers were now in a position to furnish this class of equipment.The new rules require their use wherever flexible cords are used.

George Ainsworth, New York, opened the Wednesday discussion by favoring the adoption in new buildings of outlet boxes having a depth of at least ½ in. for all side-wall outlets. By such a uniform regulation designers could be certain that their fixtures would be properly installed.

A 3-in. minimum diameter for side-wall outlet boxes flush with the plaster was favored by Edwin L. Kopp, Louisville. Such construction would be in line with the development trend of fixtures and would aid in competing with foreign fixtures which, while artistic, do not pass inspection tests.

Regarding motor protection, A. R. Small, Chicago, felt that the new Rule 8C should be reworded. Too much leeway by special permission should not be given, he thought, since it would only confuse inspectors.

The question of proper wiring for cold-storage plants was raised by R. E. Moran, Memphis, who said that his experience with conduit had forced him to go back to weatherproof wiring and porcelain insulators. J. C. Forsyth, New York, gave his experience on this class of wiring. By paying proper attention to joints and repainting them twice a year, he had had little trouble.

Although no report on 2,500-volt motors was presented, W. J. Canada, New York, voiced the opinion that when properly installed the fire risk was no greater than with motors operating at lower voltages. With the increasing growth of industrial voltages he urged that attention be given to this class of equipment.

## Another Utility Information Bureau Started

The Louisiana and Mississippi Public Service Information Bureau was organized Jan. 19 at the New Orleans meeting of the committees of the Southwestern Geographic Division of the National Electric Light Association. W. J. Aicklen, Jr., general manager of the Consumers' Light & Power Company of New Orleans, was elected chairman of the committee to organize the bureau. Its work will include distinctive bulletins and news services for the two states, according to the plans adopted. H. C. Abell, chairman of the committee on organization of state information bureaus, and M. H. Aylesworth, executive manager N. E. L. A., were at the meeting and aided in the organization.

The completion of this plan means that there will be a public service information bureau for every state in the Southwestern Geographic Division. This is one of the objectives that President E. H. Kifer of the division had set for his administration.

DELEGATES FROM IOWA, MISSOURI, KANSAS AND NEBRASKA AT THE MIDDLE WEST DIVISION CONFERENCE, KANSAS CITY, JAN. 10

## Power Versus Irrigation

### Flathead Lake Project, Now Before Power Commission, Involves Important Principle

ACTIVE consideration of the Flathead Lake power project is being begun by the Federal Power Commission. The development of the 275,000 hp. which can be harnessed at that point has a bearing on the development of the Columbia Basin project of the State of Washington, and officials of that state are urging that no power rights be given unless the interests of irrigation have priority. The Federal Power Commission probably will be influenced in this case by the relatively greater importance of the power possibilities of the project, and there is reason to think that the commission will not be inclined to accept all of the conditions which the Washington State officials would impose.

The Rocky Mountain Power Company, which is a subsidiary of the Montana Power Company and of the Anaconda Copper Mining Company, was one of the first to apply for a preliminary permit following the passage of the water-power act. The commission, having in mind that a conflict would take place between those who would develop the power and those interested in irrigation on the Upper Columbia, appointed a board to report on the project. This board found that Priest Lake and Pend d'Oreille Lake have all the storage capacity necessary for the Columbia Basin project provided that the natural flow from Flathead Lake is not interfered with during the critical months of the irrigation season. For that reason the board recommended that Flathead Lake be reserved for power users and the two lower lakes for irrigation storage.

#### Power Versus Irrigation

The case is of unusual interest not alone because of the large amount of power involved but because of the principle concerned in deciding just how far water for agricultural purposes may take precedence over that to be used for power purposes. In this instance the logical development of Flathead Lake for power purposes would affect adversely a small portion of the territory which it is planned to irrigate. It is typical of numerous cases where the logical development is to use the upper storage for power purposes, providing for the restoration of the water lower down after it has served the former end.

## Federal Power Commission Proceedings

A license covering two small projects on the San Gorgonia River in California has been granted by the Federal Power Commission to the San Gorgonia Power Company. The company has a long-term lease to sell the output of the plants to the Southern Sierras Power Company. A license also has been granted to the Idaho Power Company for a transmission line from Caldwell, Idaho, to Ontario, Ore. The requirement in the license of the Snow Mountain Power Company of San Francisco that additional machinery be installed in its power house before Dec. 31, 1922, was extended for one year. The project may be sold to the municipalities adjacent to San Francisco Bay.

Preliminary permits were granted to the Eureka (Mont.) Hydro-Electric Company, covering a small project on Graves Creek in the Blackfeet National Forest; to Thebo, Starr & Anderton, Inc., covering two projects on the McCloud River, in the Shasta National Forest, and a project on the American River near Placerville involving 25,000 hp.; to the Clarion River Power Company for two dams in connection with its licensed project near Foxburg, Pa.; to the Alabama Interstate Power Company, a subsidiary of the Alabama Power Company, covering a comprehensive development on the Tallapoosa River involving four dams and power houses, and to Anna P. Gray for three small projects on South Colony Creek in Custer County, Col. An extension of one year was granted R. W. Hawley to carry out the conditions of the preliminary permit issued to him on Aug. 24, 1921, for a project on Silver Creek in California.

## Helena (Ark.) Gas & Electric Company Sold

Possession of the Helena Gas & Electric Company of Helena, Ark., passed on Jan. 15 to the Arkansas Utilities Company, which now owns and operates electric plants at Clarendon, Cotton Plant, Kingsland, Brinkley, Fordyce and Rison. The Arkansas Utility Company is a subsidiary of the Community Power & Light Company. The Helena property will be consolidated with the other holdings of the company in Arkansas, and J. M. Wharton, who was secretary-treasurer and manager of the Helena utility, is to be general manager of all the plants, with headquarters at Helena.

## Danger of New Coal-Mining Strike Thought Past

The conference of bituminous coal operators and union miners of Illinois, Indiana and Ohio has unanimously adopted a basic wage scale agreement to become effective April 1, 1923, and remain operative for one year. This agreement continues the present basic wage scale which became effective after the strike in August, 1922, and was originally drafted in 1920. This action, it is thought, gives definite assurance that there will be no national coal strike in the soft-coal fields for one year.

The fundamental cause of the instability of the bituminous coal-mining industry that has its effects in unreasonably high prices, labor troubles and transportation difficulties is a surplus of mines and miners, according to the preliminary report of the United States Coal Commission sent to President Harding and Congress on Monday of last week.

"There can be no permanent peace in the industry until this underlying cause of instability is removed," says the report of the fact-finding commission established to study the coal industry.

## Standards Committee Has 122 Projects Under Way

Speaking recently before the Boston Section of the American Institute of Electrical Engineers, Dr. P. G. Agnew, secretary of the American Engineering Standards Committee, said that 122 projects are being worked upon by the committee at present, that thirty organizations are represented on the committee today and that twenty-eight standards have already been adopted as a result of its work. About a thousand individuals are at work in different organizations upon the problems of duplication, and more than two hundred national bodies are co-operating with the committee in its service. There are now fourteen national standardizing bodies affiliated with the committee. Last year the work of the committee increased more than 50 per cent. The United States, Great Britain and Germany have led the world in standardization brought about by firms engaged in industry.

In a discussion following Dr. Agnew's address Dr. A. E. Kennelly defined standardization as "the selective adoption of instrumentalities used in co-operative work for aiding joint effort and eliminating waste." Prof. D. C. Jackson pointed out that standardization should lead in the long run to the greater development of individual effort.

## Natural Gas for Generating Electricity

Utilization of the natural gas of the Amarillo field in Texas for generating electricity on a scale of great magnitude is being considered by large financial interests, according to S. J. Keese, an engineer of Los Angeles, Cal., who has been investigating the available gas supply of the existing wells and the cost of the proposed electric project. It is stated that there is now a production of 1,000,000,000 cu.ft. of gas a day from twenty-seven wells that are scattered over the proved territory of 1,200 square miles in the Panhandle of Texas. Mr. Keese's surveys have had in view the feasibility of using natural gas for generating sufficient electric power to operate the trains of the Atchison, Topeka & Santa Fé between Kansas City and Albuquerque, N. M.

It is thought that the Santa Fé is favorably inclined to the proposition provided the power cost is not too great. While Mr. Keese's figures are not as yet available, it is predicted that the initial cost of electric power pro-

duced with natural gas will not be much in excess of that generated from water power.

The project of laying a pipe line from the natural-gas field to Denver, Col., is still in abeyance. The estimated cost of such a line and the necessary equipment is $16,000,000, which is believed by some engineers to be prohibitive. The wells of the Amarillo field are of enormous production, the largest one gaging 180,000,000 cu.ft. a day, and the underground reservoir of the fuel is thought to have been barely touched.

## Texas Bureau's Figures on Natural Gas as Fuel

Compilations made by the Texas Public Service Information Bureau at Dallas, Tex., show that the use of natural gas as fuel in electric power plants has increased steadily throughout the states having this fuel available, according to George McQuaid, in charge of the bureau. Mr. McQuaid's investigations disclose that in September, 1922, the volume of gas consumed in electric power plants exceeded 100,000,000 cu.ft. a day for the first time. The figures for the month showed an average of 103,500,000 cu.ft. daily. Texas was sixth in this list, having used a total of 238,041,000 cu.ft. during the month. California used 624,056,000 cu.ft. and Oklahoma 444,008,000 cu.ft.

Mr. McQuaid goes on to say that only fifteen states have natural gas available for fuel for power plants. Fuel oil is used to some extent by power plants in all the states except ten, while coal is used by them in all states except California, Idaho, Nevada and Utah. Utah alone produces all its electric energy by water power.

## Power Company Sues Utilities Commission

The Colorado Power Company, which has made several ineffectual efforts to secure an increase in rates, has brought suit in the United States District Court against the three members of the Colorado Public Utilities Commission. The company asks that the commission be restrained from enforcing the schedule of rates authorized by it in 1920, asserting that the central system of the corporation earned a gross revenue in 1922 of only $682,663, netting $55,156, exclusive of government taxes, and that this is a return on the valuation of only 0.51 per cent.

A 40 per cent increase was sought in 1920 on average rates and 20 per cent on special contract rates. This is again prayed for. If the rates sought had been allowed during 1922, it is claimed, the gross revenue would have been $837,769 and the net revenue $176,251, or 1.60 per cent on the valuation.

The "central system" comprises the Shoshone development, the Boulder development, the Georgetown development and the Leadville system, all hydro-electric. The company's valuation is $11,000,000. It is set forth that it operates its systems over sections of the state sparsely populated, high mountain ranges and territories unprotected from fierce storms, and that the rates now in effect are unfair, unreasonable and confiscatory.

## Underwriters Review Year

### More Work Was Accomplished in the Electrical Laboratories in 1922 than Ever Before

THE volume of work in the electrical department of the Underwriters' Laboratories during 1922 exceeded that of any preceding year, according to the official report, recently issued, and necessitated the employment of more engineers and laboratory assistants. The development of a multitude of special appliances for the utilization of electricity in home, office and factory continued steadily and was reflected in the increase of applications to the department for examinations and tests, the engineers having been constantly called upon to devise new test methods to bring out the characteristics and essential features of installations and of devices so new that standards based upon service records are incomplete or wholly lacking.

Vending machines, advertising and display devices, electrical toys, "permanent-wave" hair-dressing appliances, devices for waxing motion-picture films, anchors for screws in walls, surgical and dental appliances and so forth lent variety to the routine work on wires, wiring devices and the more standardized things.

The extraordinary spread of "radio" threw a large amount of work on the department. Grounding switches, lightning arresters and other small fittings were most numerous, but reports were also made on elaborate and expensive outfits for the complete power equipment of amateur or professional transmitting stations.

During the year a standard was developed on a form of rubber-sheathed cord, known as "type SJ" cord, which is for use on portables where the conditions are less severe than for the "type S" cord developed in 1921. In co-operation with the committee on new developments of the National Fire Protection Association's electrical committee, investigations of three new special forms of wiring were made. Of these one was later withdrawn by the submitter, one was passed by the Laboratories and one is still being studied.

Several new automatically regulating electric flatirons have been tested and label service is now in prospect on such irons to distinguish them sharply from irons which lack this protective feature.

In the Laboratories' new quarters in New York there is to be a much larger and better equipped electrical testing station, laid out with special attention to present-day standards of safety and with many more facilities for expeditious work.

## Illinois Utility Plans Issues of $20,000,000

The Public Service Company of Northern Illinois has filed an application to the Illinois Commerce Commission for permission to issue $20,000,000 in new bonds and stocks. This increase in capital is to finance a large program of expansion of generating facilities and also to retire some securities falling due in the near future. The application covers the issuance of $5,000,000 of 5½ per cent first lien and refunding bonds, an increase of 100,000 shares in no-par-value common stock and $5,000,000 additional 6 per cent preferred stock. The proceeds of this bond issue will go in part to retire $1,750,000 collateral notes which mature Feb. 1 and in part toward the erection of the new Waukegan generating plant now under construction, which will start operation about Sept. 1, and to increase the capacity of the Joliet generating station by the addition of 30,000 kw. The two projects last named will require about $9,000,000.

Stockholders will be asked at the annual meeting on Feb. 26 to increase the common stock by 100,000 shares of no par value and the preferred stock by $5,000,000. If approval is obtained, the company will later ask permission for the issuance of 52,980 shares of additional no-par-value stock.

## Last Year's Work of Joint Fuel Committee

A report on the work done by the Washington office of the joint fuel committee of the National Electric Light Association, the American Gas Association and the American Electric Railway Association has been made by John Price Jackson, the managing director, to John W. Lieb, the chairman of the committee.

The character of the work that has been done for individual utilities is outlined as follows: Giving information as to procedure, government regulations, etc.; obtaining priorities where needed, increasing car supply, accelerating car movements, preventing confiscation of cars, relieving stress caused by embargoes, endeavoring to prevent the necessity for paying excessive prices, advising as to where coal of the right quality is purchasable, aiding the shipment of plant supplies, providing cars for coke and carrying on other work which develops in particular instances.

At the close of the year, the report says, the emergency situation had largely relaxed and the government methods were reasonably well established. Emergency cases of specific utilities requiring aid had declined greatly in number.

The fuel situation in the country, however, is still upon an unsettled basis, and should a long period of genuine blizzard weather occur many utilities would again be thrown into the emergency class.

## New Code of Ethics

**Committee of Four Major Engineering Bodies and Heating Society Formulates Principles**

A NEW code of ethics drawn up by a joint committee of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society of Heating and Ventilating Engineers, under the chairmanship of Prof. A. C. Christie of Johns Hopkins University, has been made public. Its text follows:

"Engineering work has become an increasingly important factor in the progress of civilization and in the welfare of the community. The engineering profession is held responsible for the planning, construction and operation of such work and is entitled to the position and authority which will enable it to discharge this responsibility and to render effective service to humanity.

"That the dignity of their chosen profession may be maintained, it is the duty of all engineers to conduct themselves according to the principles of the following code of ethics:

"1. The engineer will carry on his professional work in a spirit of fairness to employees and contractors, fidelity to clients and employers, loyalty to his country and devotion to high ideals of courtesy and personal honor.

"2. He will refrain from associating himself with or allowing the use of his name by an enterprise of questionable character.

"3. He will advertise only in a dignified manner, being careful to avoid misleading statements.

"4. He will regard as confidential any information obtained by him as to the business affairs and technical methods or processes of a client or employer.

"5. He will inform a client or employer of any business connections, interests or affiliations which might influence his judgment or impair the disinterested quality of his services.

"6. He will refrain from using any improper or questionable methods of soliciting professional work and will decline to pay or to accept commissions for securing such work.

"7. He will accept compensation, financial or otherwise, for a particular service from one source only, except with the full knowledge and consent of all interested parties.

"8. He will not use unfair means to win professional advancement or to injure the chances of another engineer to secure and hold employment.

"9. He will co-operate in upbuilding the engineering profession by exchanging general information and experience with his fellow engineers and students of engineering and also by contributing to work of engineering societies, schools of applied science and the technical press.

"10. He will interest himself in the public welfare in behalf of which he will be ready to apply his special knowledge, skill and training for the use and benefit of mankind."

The representatives of the A. I. E. E. on the joint committee were Prof. Comfort A. Adams, Giuseppi Faccioli, George F. Sever and L. B. Stillwell. The code has already been adopted by the A. S. M. E.

## Brief News Notes

**American Power & Light Acquires Minnesota Utilities.**—The stock of the Minnesota Utilities Company, an electric light and power concern owned by Wausau (Wis.) investors and supplying a number of small cities in Minnesota, has been purchased by the American Power & Light Company of New York.

**Alabama Legislature Backs Ford.**—Henry Ford's proposal to lease and purchase government power sites and property at Muscle Shoals has been indorsed in a joint resolution of the Alabama Legislature. A committee will be named by the Senate and House to draft "suitable resolutions" to forward to Congress through Alabama Representatives and Senators.

**Trunk-Line Electrification Project in Ontario.**—Sir Henry Thornton, the new president of the Canadian National Railways, announced recently that electrification of the Grand Trunk Railway from Toronto to Niagara Falls via Hamilton and St. Catharines is the only means of providing for the increased traffic. He added that there were no serious obstacles to electrification.

**Indiana Commercial Men for Commission.**—The result of the referendum vote taken by the Indiana State Chamber of Commerce in the local chambers of the state on the question of retaining or abolishing the Public Service Commission was overwhelmingly for its retention, though many believed there should be changes made in the law.

**Oconto and Peshtigo Companies Become Northeastern Power Company.**—Two small Wisconsin electric light and power companies, the Oconto Service Company and the Peshtigo Electric Company, have been merged in the Northeastern Power Company, a subsidiary of the Wisconsin Public Service Corporation of Milwaukee, and Charles M. Haffeler will manage the two plants from Oconto. At Peshtigo an attempt to bring about municipal ownership failed signally.

**New Indiana Transmission Lines.**—Construction work on a 33,000-volt transmission line from Newcastle to Cambridge City, Ind., is now under way. The 13,200-volt line from Cambridge City to Connersville will be changed to 33,000 volts. This includes the installation of 33,000-volt substations at Connersville, Milton, Cambridge City and Newcastle. The construction of a high-tension transmission line from the Norway plant of the Indiana Hydro-Electric Power Company to Logansport has been authorized and construction will start immediately.

**Wisconsin Hydro-Electric Company Takes Over Chetek Plant.**—On Jan. 4 the Wisconsin Hydro-Electric Company, whose headquarters are at Amery, Wis., not Apple River, as stated in "Brief News Notes" on Dec. 30, took over the Chetek Light & Power Company, and it will supply the customers of the latter from its 25,000-volt line. This line is to be extended in the spring to Sand Creek and Colfax, a distance of about 25 miles, where it will connect with the company's existing line and complete a loop system.

**Badger Public Service Company Wins Right to Enter Calumet, Wis.**—The Circuit Court at Madison, Wis., has reversed the decision of the State Railroad Commission which granted the Eastern Wisconsin Electric Company permission to extend its lines into the town of Calumet and barred out the Badger Public Service Company. The long-drawn-out contest over the exclusive right to serve Calumet with light and power has now been appealed to the Wisconsin Supreme Court.

**Dynamos on the Dead Sea.**—Plans for the electrification of Palestine by raising the level of the Sea of Galilee and harnessing the historic River Jordan, involving an initial expenditure of $10,000,000, are described in "Palestine—Its Commercial Resources, with Particular Reference to American Trade," by Addison E. Southard, American Consul at Jerusalem, just published by the Department of Commerce. The scheme calls for the canalization of the Jordan Valley from the Sea of Galilee to the Dead Sea, where, under irrigation, it is expected that copious crops can be produced.

**Negotiations of Alabama Power Company for Montgomery Utilities Completed.**—With negotiations for the purchase of the Montgomery Light & Water Power Company and the Montgomery Light & Traction Company from Henry L. Doherty & Company completed and the sale ordered by a federal judge, as necessitated by the companies being in the hands of receivers, only the formal approval of the Alabama Power Service Commission is needed to consummate the transfer. The petition will be heard by that body on Feb. 12.

**French Government to Assist Rural Electric Service.**—A bill adopted by the Council of Ministers in France authorizes 4 per cent loans to communes, agricultural societies and approved syndicates through the National Office of Agricultural Credit for the extension of electric service in certain country districts. The loans will be guaranteed under conditions similar to those under which loans for cheap dwellings are obtainable. The total of the government loans is limited to 600,000,000 francs and an amount equal to the loan must in every case be raised by the community or society applying for it.

**Shawinigan Water & Power to Develop St. Maurice River.**—The Shawinigan Water & Power Company has formed a subsidiary company under the name of the St. Maurice Power Company, Ltd., to develop Gres Falls and Gabelle Rapids on the St. Maurice River, Quebec. The new company has common-stock capital of $8,000,000 and an authorized bond issue of $12,000,000, of which $10,000,000 is now being issued by a New York syndicate.

**Stanley Library Given to Pittsfield Works.**—The entire technical library of the late William Stanley, electrical inventor and founder of the Stanley Electric Company of Pittsfield, Mass., which became part of the General Electric Company, has been given by his widow, Mrs. Lila Stanley, for the permanent use of employees of the General Electric Company in Pittsfield. In the library are about a thousand volumes on scientific subjects, including a set covering the researches of the Royal Society of London from 1665 to 1800.

**North American Company Buys General Squier's Patent.**—The North American Company has, it is reported, purchased the patent rights of the "wired-wireless" system of transmission and receiving radio apparatus invented by Major-General George O. Squier, Chief Signal Officer, U. S. Army, which facilitates the broadcasting of news, entertainment and music over the entire wire systems of power and light companies in connection with regulation sending and receiving sets. It is said that the North American Company will supply a radio service to its power consumers in Cleveland, Milwaukee, St. Louis and other cities where it operates.

**Colorado Colleges Learn About the Utilities.**—A movement enlisting the co-operation of colleges and universities has been started by the Rocky Mountain Committee on Public Utility Information. The plan includes lectures before students and faculties and also classroom study. Where provision could be made actual utility courses have been added to the curriculm. The work began on Jan. 8, when Carl D. Jackson of Madison, Wis., formerly president of the National Asociation of Railway and Utilities Commissioners and former chairman of the Wisconsin Railroad Commission, began a series of lectures that were to include every university in Colorado.

**Johnstown (Pa.) Company Seeks to Expand.**—The Penn Public Service Corporation of Johnstown, Pa., is seeking from the state commission the right to acquire for $3,500,000 the Warren Light & Power Company, the Jefferson Electric Company and the DuBois Electric and Traction companies, all in western Pennsylvania. When this merger shall have been completed the field of the new company will spread out over nearly a fourth of the state. The main source of power for the system is to be the Clarion River dams, the first of which is now under way. From these dams a network of high-power transmission lines is, according to published plans, to be spread over more than 150 townships in the territory of the Penn Public Service Corporation.

**Investment Bankers Take Hand in New Brunswick Power Situation.**—Representatives of the Investment Bankers' Association of the United States and the Bond Dealers' Association of Canada waited recently on the Premier of the Province of New Brunswick respecting their request that arbitration be resorted to between the city of St. John and the New Brunswick Power Company for the purchase of the power company's plant. The Premier insisted, however, that the city had a perfect right to erect a civic distribution system in competition with that of the power company and said that "the investors in the New Brunswick Power Company when they purchased their stock or bonds did not acquire with such securities the exclusive right to distribute light and power in the city." It is not thought the government will interfere.

# Associations and Societies

**Electric Club of Louisville, Ky.**—This club has elected the following officers: President, W. W. Crooker; vice-president, Will A. Link; secretary-treasurer, David Schneider; directors, James Clark, Jr., Frank A. Hamel, George M. Miller, A. G. Renau and Samuel B. Storm.

**Tri-State Water and Light Association.**—The thirteenth annual convention of the Tri-State Water and Light Association, embracing the Carolinas and Georgia, will be held at Birmingham, Ala., on April 17 to April 20, according to an announcement by the secretary, who said that the executive committee had selected the Alabama city because it is proposed to amend the constitution of the association at the approaching meeting to include Florida, Alabama and Tennessee.

**Ohio Metermen Convene at Cleveland.**—The second conference of the year for metermen of the Ohio Electric Light Association was held Jan. 18 at the Hotel Statler, Cleveland. R. H. Wolford of the Ohio Power Company dealt with "Meter Laboratory Equipment and Maintenance," and W. A. Holliday, Cleveland, with "Field Testing Equipment and Its Maintenance." An exhibit of laboratory and field testing instruments was made by J. L. Wright, chairman of the meter committee.

**February Section Meetings of the A. I. E. E.**—The following Institute section meetings have been scheduled for February, 1923: Boston, Feb. 13, "Caribou Hydro-Electric Development," A. A. Northrop; Detroit-Ann Arbor, Feb. 9, "Electricity in a Tire-Making Plant," D. H. Baer; New York, Feb. 2, "The Gaseous Conductor Lamp," D. McFarlan Moore; Pittsfield, Feb. 1, annual dinner; Toronto, Feb. 9, "Carrier Current," Mr. Vennes; Providence, Feb. 2, "Seeing but Not Observing," William H. Blood, Jr.; Worcester, Feb. 15, "Interior Wiring," Prof. A. L. Cook.

**New Executive Board for American Council.**—The executive board of the American Engineering Council for 1923 will, in addition to the officers of the Federated American Engineering Societies, whose names were published last week (page 178), be constituted as follows: American Institute of Electrical Engineers, C. G. Adsit, F. B. Jewett, William McClellan, L. F. Morehouse and C. F. Scott; American Institute of Mining and Metallurgical Engineers, Galen H. Clevenger, Charles H. McDowell and Allen H. Rogers; American Society of Mechanical Engineers, L. P. Alford, A. M. Greene, Jr., John L. Harrington, Fred J. Miller and P. F. Walker; jointly representing American Society of Safety Engineers, American Society of Agricultural Engineers, Society of Industrial Engineers and American Institute of Chemical Engineers, M. G. Lloyd, S. H. McCrory and J. W. Roe; regional directors, A. E. Lindau of Buffalo, W. H. Hoyt of Duluth, Charles H. Gow of Boston, W. J. Fisher of York, Erskine Ramsay of Birmingham, L. A. Canfield of Des Moines, O. H. Koch of Dallas and J. C. Ralston of Spokane.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

New Mexico Electrical Association—Albuquerque, Feb. 12-13. C. E. Twogood, Albuquerque, N. M.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division New York, Feb. 14; general meeting, Hot Springs, Va., March 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Electric Railway Association—Washington, D. C., Feb. 15-16. J. W. Welsh, 8 W. 40th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb 19-21.

American Physical Society—New York, Feb 24; Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

American Society of Mechanical Engineers—Montreal, March 28-31. C. W. Rice, 29 W. 39th St., New York.

Tri-State Water and Light Association—Birmingham, April 17-20.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Wills, 403 Slaughter Bldg., Dallas, Tex.

American Society of Mechanical Engineers—Montreal, May 28-31.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

# Recent Court Decisions

**"Danger" Signs Not Sufficient to Absolve Maintainer of Defectively Insulated High-Voltage Wires.**—Sustaining a verdict of $30,000 damages awarded in Clumfoot vs. St. Clair Tunnel Company to the plaintiff, an expressman who while engaged in his ordinary work slipped and came into contact with an imperfectly insulated 3,300-volt wire in the St. Clair Tunnel, the Supreme Court of Michigan held that the case rightly went to the jury and that "danger" signs and the victim's knowledge of the nature of his surroundings did not absolve the company from liability in the maintenance of a dangerous instrumentality. (190 N. W. 759.)*

**Power of Court Over California Commission's Orders.**—In Brewer et al. vs. Railroad Commission of California the Supreme Court of California, deciding that the plaintiff (a water company) was a public utility, declared that, in view of the court's limited power of review, an order of the commission fixing rates cannot be set aside on certiorari because of an error in rulings on evidence, unless this constitutes an entire exclusion of admissible evidence on one side touching the essential issue, amounting to a denial of due process of law, and so ousting the commission from jurisdiction. Such, the court held, cannot be said to be the case where the main substance of that evidence was before the commission in the form of a record of evidence presented in earlier proceedings involving the same issues. (210 Pac. 511.)

**Powers of Maryland Commission.**—In Benson vs. Maloy an injunction was sought to prevent the abandonment of a street railway line on the authorization of the Maryland Public Service Commission. The Court of Appeals of Maryland, denying the appeal, thus construed the law covering the power of the commission: "It is true that the Public Service Commission, acting under a specially conferred grant of power by the Legislature, exercises only a limited jurisdiction, and where a jurisdiction is so limited it will be strictly construed. The construction to be given, however, must be as far as possible such as to carry out the legislative intent, not to thwart it nor to render its exercise or inability to exercise meaningless and absurd. The argument of the appellant is that an abandonment of a franchise once exercised can only be brought about by a repeal by the Legislature, but how would the Legislature be able to act intelligently in a case like the present? The suggestion is that the allegations of the petition must first go before the Public Service Commission in order that the facts upon which it is based may be found by that body, that such findings shall then be certified to the Legislature, and the franchise, or at least some part of it, repealed, and then such repeal go back to the Public Service Commission. The enumeration of these steps will show the absurdity of any such construction, because if the franchise, or any part of it, is repealed, there is nothing for the commission to act upon. On the other hand, if an effect can be given to the act of 1914 which will plainly carry out the legislative intent without involving any absurdity, that should manifestly be done." (118 At. 852.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

**Negligence of Manufacturing Company in Leaving Packing Blocks in Transformer and of Central-Station Company in Not Removing Them Questions for Jury.**—Sider vs. General Electric Company and Niagara Falls Power Company was one of the suits for damages growing out of the death of thirteen men in a tower of the Niagara Falls company at Tonawanda, N. Y., on Oct. 31, 1920. The Appellate Division of the New York Supreme Court has confirmed an order of the trial term setting aside a jury verdict of $21,200 as excessive, because of the death of the plaintiff, the sole statutory beneficiary of the victim of the accident, but sustaining the jury in finding for the plaintiff. From this order both the plaintiff and the two defendant companies had appealed, the latter claiming that the verdict should have been set aside on other grounds. The claim for damages was based on the allegations that the manufacturing company had negligently, without proper notice to the central-station company, left packing blocks in transformers which it had sold to the latter, thus making the transformers liable to short circuit, and that the purchaser was also negligent in not making a proper inspection and test of the transformers before putting them into use. The General Electric Company contended that there was no evidence that the presence of the packing blocks caused the circuit and that, even if there had been, the accident was due to the negligence of the power company in failing to remove them. The Supreme Court held that the issue of negligence in both these regards was properly submitted to the jury, declaring that a manufacturer of electric current transformers, knowing that they were to be used to measure a powerful current of electricity, and that to use them with packing blocks left therein would create a very dangerous situation, was called on to exercise care commensurate with the danger, and that where an electric power company purchasing new transformers to measure a powerful current could have turned on a small current at first and increased it gradually, thereby testing the transformers, as was its custom in certain cases, but did not do so, and a short circuit resulted, it was a question of fact for the determination of the jury whether it used care in inspecting and testing them before turning on the full power. (197 N. Y. S. 98.)

# Commission Rulings

**Special Contracts—Cost of Service.**—While asserting that three industrial companies which applied for lower rates from the Southern Sierras Power Company were entitled to a modification of the tariff now charged, the California Railroad Commission reiterated its view that rates set forth in special contracts cannot be upheld by the commission without permitting discrimination, which the law prohibits. It denied the petitioners' contention that rates should be based on cost of service, holding that, however important, this is not the only determining factor. The consumers' own testimony, the commission asserted, showed that in their case the value and not the cost of service is in reality the dominating consideration.

**Protest from Telephone Company Against Radiophone Service Overruled.**—The Midland Telephone Company protested to the Utah Public Utilities Commission against an application made to that body for permission to operate a radio-telephonic system to provide mutual means of communication for a number of towns and cities which were not interconnected by wire. In granting the application the commission said that the only question to be considered was the necessity of such a service and whether it would serve the convenience of the public. Objections that the enterprise could not be made a success and that such a service would cause damage and inconvenience to a proposed telephone line were held not to be well taken.

**Valuation Based on Historic Cost.**—In support of the historical reproduction-cost basis as the controlling factor in rate proceedings, the California Railroad Commission said, in the course of its finding in the Pacific Gas & Electric valuation (ELECTRICAL WORLD, Jan. 6, p. 56): "Estimated reasonable historical cost is not the only factor that should be considered in arriving at a proper basis of rates, but we believe it must be the controlling factor, provided resulting rates are within the constitutional limitations. For ten years this commission has followed such a policy, and under that policy utility companies have prospered and are now on a sounder financial basis than they were ten years ago. At the same time, many of the rates they charge are lower today than ten years ago, and considering the state as a whole, but few commodities are as close to pre-war prices as electricity. Careful consideration and reconsideration of the question by succeeding members of the commission has uniformly resulted in the conclusion that this policy is sound, and, what is perhaps more convincing, it has satisfactorily stood the test of time and the extreme conditions that have prevailed in the past few years."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## J. T. Whittlesey Appointed to California Commission

James T. Whittlesey, prominent consulting engineer of San Francisco, has been appointed to a two-year term as commissioner on the California State Railroad Commission. After his graduation from Yale he was with the Thomson-Houston Electric Company from 1889 to 1890. He then went to New York as consulting engineer, and

J. T. WHITTLESEY

in 1892 he entered the service of the Brooklyn street railroad, where he spent four years in the motor department. During the succeeding two years he was chief engineer of the Brooklyn Rapid Transit Company. In 1898 he became superintendent of the Stephenson Car Company of New Jersey. For three years following 1900 he was chief engineer of the United Electric Company of New Jersey and following this held the same position with the Public Service Corporation of New Jersey. In 1912 he removed to California and was retained by the Spreckels interests of San Francisco to advise them on utility matters. During the past five years he has been director of the Pacific Coast branch of the Engineering Business Exchange, with offices in San Francisco. He is a member of the A. I. E. E., A. S. M. E. and American Electrochemical Society.

**Philip Harrington** has been appointed chief electrical engineer of the Sanitary District of Chicago. After graduation from the Armour Institute of Technology in 1906 Mr. Harrington joined the engineering department of the Sanitary District. He advanced to the post of assistant chief engineer and has had charge of the electrical and of the hydraulic, canal and other departments. His new appointment is part of a plan for the reorganization of the engineering department being carried out by E. J. Kelly, recently elected chief engineer.

**Eugene A. Yates**, chief engineer of the Alabama Power Company in the construction of Lock 12 and in all projects since the completion of the locks, was last week appointed general manager of the company, according to an announcement made by Thomas W. Martin, president. He succeeds W. N. Walmsley, who has retired owing to ill health. Mr. Walmsley is at present in South America, but on his return will continue to be a vice-president.

## J. M. Graves General Manager of Duquesne Company

James M. Graves, assistant general manager of the Duquesne Light Company for more than two years, has been appointed general manager of the company to succeed C. S. Cook, recently made vice-president. Mr. Graves was born at Lexington, Ky., in 1878 and was graduated as mechanical engineer from the University of Kentucky in 1900. In 1903 he became assistant to W. A. Shoreman, chief engineer of the Allegheny County Light Company, and later assistant superintendent of the power stations of the Duquesne Light Company. In 1906 he was made superintendent of power plants, a position he occupied until July 1, 1920, when he was made assistant general manager.

## M. F. Riley Heads Potomac Public Service Company

M. F. Riley, who resigned the presidency of the Birmingham Water Works Company to become president of the Potomac Public Service Company of Maryland, as was announced in the Jan. 6 issue of the ELECTRICAL WORLD, is an experienced public utility executive, having been actively connected with the American Water Works & Electric Company's properties for more than twenty-five years. Mr. Riley was educated in Pittsburgh and began his thirty-five years' experience in public utility operation with the Braddock Gas & Light Company of that city. Thereafter for several years Mr. Riley was associated with the American Water Works & Guarantee Company in the general inspection of its waterworks properties. For a period of ten years he had charge of the waterworks property at Little Rock, Ark. For several years prior to 1919 he was associated with the American Water Works & Electric Company in the management and operation of its water properties, and in 1919 he was elected president and manager of the largest properties of that group, among others those of Birmingham and Chattanooga.

Mr. Riley's success as a utility officer and operator is due not only to his long experience and knowledge of business but also to his sense of fairness and his constant purpose to have the public utilities in his charge make the largest possible contribution to the welfare and prosperity of the communities which they serve.

## Dr. Fuller Joins General Electric

Dr. Leonard F. Fuller, one of the most prominent radio engineers in the country, has accepted a radio engineering appointment with the General Electric Company at Schenectady, N. Y., and will take up his duties there as soon as work in California under his

L. F. FULLER

direction shall have been completed. He was for seven years with the Federal Telegraph Company, and particularly as chief engineer of that company during the war did important development work on the high-power magnetic arc transmitters which the United States Navy now uses for all transoceanic work. In this capacity he was also charged with executive duties and personally represented the company in negotiations on technical matters with the Navy Department at Washington. Stations designed and built under his direction are used for transmission over some of the longest distances spanned by radio communication.

With C. B. Kennedy, he formed a partnership under the name of the Colin B. Kennedy Company and has been active in the development of the line of radio receiving instruments bearing that name. For several years he has done radio consultation work in the East as well as on the Pacific Coast, and recently he was retained by some of the large power companies of the West to develop and install complete radio telephone transmitting and receiving systems, using 200-mile, high-voltage power lines as carriers. In recognition of his research and development work in radio he received the Morris Liebmann prize for 1919.

## G. E. Cullinan Appointed General Sales Manager

George E. Cullinan, who has recently been appointed general sales manager of the Western Electric Company, brings to his new office a background of very broad experience. He entered the employ of the Western Electric Company in 1901 on his graduation from Williams College, and for several years he was in the New York office. In 1907 he was sent to St. Louis and was manager there from 1909 to 1918, going then to Chicago as the central district manager with supervision over and responsibility for the Chicago, Detroit, Minneapolis, St. Paul, Duluth, Omaha, Indianapolis, Louisville, Cincinnati, Columbus and Cleveland branch houses.

G. E. CULLINAN

Mr. Cullinan brings to his new work a particular fitness because of his broad contact with the national problems of sales and distribution. He is gifted with a genial personality and the ability to make and hold friends.

Mr. Cullinan was born in Geneseo, N. Y., 1878. He is a member of the executive committee of the Chicago Chamber of Commerce and a director of one of the Chicago banks.

## Society for Electrical Development Increases Staff

Albert Kapteyn joined the staff of the Society for Electrical Development at the close of 1922. His work with the Westinghouse Machine and Air-Brake companies, supplemented by considerable experience in export work, especially fits him for the making of original studies and the preparation of booklets. W. W. Ayre, another new appointee, has been with the McGraw-Hill Company, the advertising department of the Western Electric Company and the Tucker Advertising Agency and was more recently managing editor of the Publishers' Autocaster Service in New York. Mrs. Harriett C. Emmons has been added to the staff to assist in organizing and fostering home economics work. W. S. Sands has also allied himself with the society.

**Norman Perry** of the Indianapolis Light & Heat Company has been elected president of the Electric Appliance League of Indianapolis.

**R. U. Mussley**, formerly superintendent at Bellingham for the Puget Sound Light & Power Company, has been made manager of the properties which were purchased by that company from the Washington Coast Utilities Company.

**Clarence T. Ward**, office attorney and secretary of the Idaho Power Company and the Boise Valley Traction Company for four and a half years, has resigned, and will open offices in Boise for the general practice of law. A. J. Priest, graduate of the University of Idaho law school, has succeeded Mr. Ward.

**F. R. Wadleigh** has been designated by the President to succeed Conrad E. Spens as federal Fuel Distributor. Mr. Wadleigh has been chief lieutenant to Mr. Spens throughout the latter's administration. He also is continuing to fill the position of chief of the coal commodity division of the Department of Commerce.

## Dr. F. C. Brown Made Acting Director of Bureau of Standards

Dr. Fay C. Brown, assistant director of the Bureau of Standards, was recently designated by Secretary of Commerce Hoover as the acting director of the bureau to conduct its work until a director shall have been chosen. In addition to his administrative duties in connection with the Bureau of Standards, Dr. Brown has done a great deal of research work, including special studies in thermionics and optical work, and he has made an intensive study of the electrical and mechanical properties of selenium and selenium crystals. Dr. Brown was born in Washington, Ohio, in 1881 and was graduated from the University of Indiana in 1903. He did graduate work at the University of Illinois, the University of Chicago and at Princeton. He became an instructor in physics and engineering at the University of Illinois and later joined the faculty of the University of Iowa. When the United States entered the war he was assigned to the Ordnance Department of the army and placed in charge of

F. C. BROWN

the testing and ballistic work on airplane bombs. While in the military service he attained the rank of major. At the end of the war Dr. Brown had the opportunity to choose between the professorship of physics at the University of Iowa and the position of assistant director of the Bureau of Standards. He accepted the latter post, where he has been engaged continuously since.

# Obituary

**Walter F. Brown**, general traffic manager of the Mountain States Telephone & Telegraph Company, Denver, died of pneumonia on Jan. 17, after a few days' illness. Mr. Brown, who was elected president of the Colorado Public Service Association last fall, became identified with the Bell Telephone System in New York City in 1893, and several years afterward he was transferred to Colorado.

**Jacob S. McFerren**, prominent banker and manufacturer of Hoopeston, Ill., died Jan. 7, at Chandler, Ariz., where he had gone to spend the winter months. Mr. McFerren was prominently identified with the canning industries of Hoopeston and also with the lumber interests of the South. He, with A. H. Trego, installed the electric lighting plant in Hoopeston, since absorbed into the Central Illinois Public Service Company. He also introduced the telephone business into Hoopeston.

**H. G. McConnaughty**, who had recently been associated with the Edison Electric Illuminating Company of Boston, died of heart failure on Sunday, Jan. 21, after a long illness. During the war Mr. McConnaughty acted as an assistant on the national fuel board. He was at one time exhibit director of the American Electric Railway Association and subsequently of the National Electric Light Association.

**Arthur M. Beveridge**, for the past four and one-half years New England district manager of the Eureka Vacuum Cleaner Company, with headquarters at Boston, died Jan. 10 after a short illness. Mr. Beveridge was one of the ablest men in the appliance sales field in the East and had a host of friends in New England central-station and retailing circles. He was a member of the Merchandising Bureau of the New England Division, National Electric Light Association.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Pros and Cons of Buying Spare Parts*

### What the Local Foundry Has to Offer as Compared with the Distant Manufacturer of the Equipment

By C. E. Harrison
Manager Service Department
American Engineering Company, Philadelphia

AN IMPORTANT part of a manufacturer's service to the industries which he supplies with equipment is the provision for prompt shipment of spare parts upon receipt of orders from users. The practice sometimes adopted of ordering parts from local sources other than the original manufacturer is susceptible to objections from the manufacturer's standpoint, although arguments in favor of local buying are also available. Let us analyze this matter from the point of view of the mechanical-stoker user and manufacturer in relation to the supply of spare parts.

There are five points in favor of the local foundry:

1. *Local Relations.*—Business, political and personal relations can only be offset by good service and salesmanship.

2. *Lower Price per Pound.*—This will as a rule only apply to some of the easily made and weighty parts and usually those parts that do not require machine work.

3. *Saving in Freight.*—This is a direct saving and presents an unanswerable argument.

4. *Quicker Delivery on Small Orders.*—We must grant the fact that in an emergency, a local foundry can make a small part in less time than a duplicate can be received from a service station, provided that a mold can be made from the piece itself or that a pattern is at hand.

5. *Opportunity to Make Changes.*—Almost every stoker operator has at some time the desire to change a part and can very readily do this when having his parts made locally.

Against these there are nine points in favor of purchase from the original manufacturer:

1. *Incentive.* — Aside from the monetary remuneration, the manufacturer's continued success depends to a great extent on the field reports on his equipment. It is therefore necessary that these reports be as favorable as possible, and to this end the very best value and service must go with his sales of spare parts.

2. *Service.*—It is so self-evident that the manufacturer is in a far better position to render service than is the local foundry that further comment is unnecessary.

3. *Better Material.*—The manufacturer is in a position to determine the best material for the requirements of stoker service. He also is in a position to use this material, for he pours a sufficient quantity. The local foundry, on the contrary, must run a general all-around mixture, and as it is competing on a price basis without a constant demand, this means spot iron with its high sulphur or phosphorus content and larger portion of scrap than is advisable.

4. *Interchangeability.* — This best can be assured when replacement parts are made from the same patterns as the original. Even then it requires constant inspection and numerous changes and adjustment to keep the product uniform. Only those who have followed quantity production can realize the difficulty of maintaining a constantly uniform and interchangeable part. Machine molding by eliminating the personal equation materially assists in securing the desired result. Gages, jigs, fixtures and all other aids to uniform production can be afforded only by the manufacturer.

5. *Improvements.*—Only the constant user of parts service secures the benefit of improvements. The man making his own parts remains in ignorance of the advances that have been made. Even if these are called to his attention, he may be unable to change over owing to large stocks on hand or the prohibitive cost of pattern or method changes.

6. *Stock-keeping Costs.* — These will vary between 10 and 20 per cent. This difference is made up of factors such as interest on investment, labor, hauling, light, heat, power, stationery, space charges, depreciation of market value, depreciation due to age and depreciation due to advancement of the art rendering stock parts obsolete. When the original manufacturer renders good service by shipping promptly and by the establishing of local service stations, this cost can be kept down materially—in some cases to one-fourth the cost experienced when purchasing parts locally, for the foundry making parts must regard the work as temporary and used only to fill in during slack times. It, therefore, invariably requires a great deal of time to fill the average order and seldom, if ever, maintains a stock. The original manufacturer can maintain a stock to protect amply five hundred plants at a much lower cost than those five hundred plants could carry an individual stock affording the same protection.

7. *Benefit of Experiments.*—The original manufacturer with the resources at his command and data from hundreds of plants has the ability and competition provides the motive to be constantly striving to better his product.

8. *Quantity Manufacture.* — A phrase to conjure with—the basis of American business. It means not only lower costs, but a uniform and better product, for on this basis only can the maker warrant the expenditure to insure a uniform and better product. It permits the purchase of quantities of materials on rigid specifications and makes it possible to see that these specifications

*From a paper on "Service," presented at the convention of the Stoker Manufacturers' Association at New London.

have been met, to employ manufacturing methods and special tools that turn out a product within a tolerance impossible to attain by job-shop methods, and to afford the purchase and use of limit gages and inspections that insure the shipment of a product in absolute accordance with the original design.

9. *Most Value for Dollar.*—The cheapest is practically never the best. It is built down to a price rather than up to a standard. Cast iron is not cast iron any more than coal is coal or oil is oil.

Why not consider the cost of lost production due to shutdown, extra boiler hours off the line, extra installation costs and the multitude of extra cost items occasioned by the failure of locally made parts? One such failure will cost more than can be saved in a year's purchases.

The original manufacturer has every reason to encourage such analysis and can rest assured that, if fairly made, it will demonstrate the purchase of original parts to return to the purchaser the most value per dollar spent.

# Radio—A Pacific Coast Analysis

**How the Jobber Has Come Into the Picture—The Problem of the Department Store—The Present Inadequacy of Broadcasting in the Far West**

ALMOST every electrical dealer in each community now carries radio equipment. Down Main Street is a barber shop which handles it as a side line; the music stores all feature it, and at least two department stores have special sections devoted to it. Then, of course, there are seven or eight radio specialty shops, all the hardware stores, two cigar stores and a grocery shop.

This is the retail side of the story. Following it back a little further, one finds something like fifteen jobbing houses in various lines distributing the goods wholesale, four or five of them in the electrical field, an equal number of hardware jobbers, automotive jobbers, music jobbers, one or two radio jobbers, some of whom have retail departments, one or two dealers who have jobbing departments, several manufacturers who have every variety of department, and, as always, the department store.

As for manufacturers, if there is an idle machine shop, sewing-machine factory, garage or shipyard in the country which is not manufacturing some radio part, it is not on this section of the coast. Aside from the "bootleggers," there are also the legitimate manufacturers who are not infringing on anybody's patent and who have some measure of financial responsibility.

### The Advent of the Jobber

Until six months ago there were comparatively few wholesale channels for radio equipment in this Far Western country. Much of the business was by mail order. The few large retail concerns which were first in the field took practically the entire manufacturer's output, and it was a simple matter for him to deal direct with them and either to pass by other business which sought to enter the field or to accept it upon due financial investigation. But the business has been in the process of growing overnight from a laboratory experiment to a national sport. The popular demand enticed everybody into it, and the manufacturer, who started to deal with all alike upon a one-price, small-discount basis, was forced to realize that he needed a jobber's service. In the unforeseen hurry of the emergency he took what was at hand, and the radio dealer-jobber and jobber-dealer came into existence.

More recently the electric jobbing houses and hardware jobbing houses of established reputation have taken over these lines, and the tendency is more and more for the manufacturer to take advantage of these standard channels of distribution. The jobber's service is a financial one as well as a local merchandising and warehousing one, and it is a great advantage to the manufacturer to have the wholesaling of his product in the hands of financially well-established concerns.

Discounts are no longer the sore point that they were and the tendency is for the manufacturer, under the pressure of a slower market, to allow for a reasonable wholesale margin. Fixed policies are probably not to be expected until the market has worked itself into something like stability.

Within the wholesale group itself are policies still awaiting settlement. Some have accepted one manufacturer's line only, on the theory that they handle only one line of other types of electrical equipment. Other firms have departed from this principle in handling radio goods and are prepared to furnish almost every make of equipment which is on the market.

One aspect of the situation which is a thorn in the side of all concerned is the participation of the department store in the game under present conditions. It means the ruin of the market for the small dealer, who often pays more for his goods to the wholesaler than the sale price at which they are offered over the department-store counter.

### Department Store Problem

There are seemingly two methods of escape from this predicament—one the hope that the department store can be persuaded to play the game along the lines which have been shown to be sane merchandising practice, the other that the standard manufacturers will look upon these channels as outlawed and, by allowing no special margins, leave the department store exclusive rights to such lines as it is able to acquire upon other terms. The more hopeful effort, however, is directed toward the possibility of bringing the department store into co-operation with all other interests in the field. The tentative program outlined at the recent meeting of the advisory committee of the California Electrical Co-operative Campaign by which membership in that body will be open to all in the electrical merchandising business who subscribe to its tenets offers an opportunity of interesting the department store in the general "betterment-of-the-industry" movement, which perhaps promises more than any other existing tendency.

The greatest difficulty with the radio business on the Pacific Coast at the present time is the broadcasting situation. In the major Eastern cities and in certain other localities in the Middle West and in the South adequate broadcasting centers have been established where the power back of the station insures clear-cut signals and the character of the entertainment is maintained at a high level. There is no such satisfactory situation on the Pacific Coast. The publicity advantages of broadcasting have attracted many, and there are some sixty-odd centers

established, many of them with capacities so small that they cannot be heard clearly even in their own communities. A victrola and a selection of jazz records complete the equipment, with results which offer little attraction to any one but the amateur experimenter interested in the scientific novelty.

The Western industry is fully alive to the need for immediate improvement, and local interests are endeavoring to bring it about. The answer to all of these problems lies in the adoption of sound merchandising principles in every department of radio merchandising and the clearing up of the distribution situation. The present troubles of the radio business lie not with radio but with business, and the sooner this is realized and policies determined, not by the exigencies of the moment but by careful consideration of the future, the sooner will they cease to be a thing to worry about.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Demand for Signal Apparatus Is Improving

Without any spectacular features, the demand for signal apparatus is improving decidedly as compared with a year ago, and distributors of this class of equipment are busy with sales to owners of new buildings in many parts of the country. Schoolhouse construction is responsible for a healthy portion of this trade, but new apartment houses, residences and changes in manufacturing and mercantile establishments in the interest of greater efficiency are reflected in recent orders. Manufacturers are able to make good deliveries in this line, as a result of long-established coordination of raw material supply and plant facilities, but a good deal of effort has to be expended upon securing steel products which enter into signal apparatus, as in many other lines utilizing this class of raw material. In a representative manufacturing plant deliveries of signal equipment can be made in three weeks from receipt of order. Prices are firm and have shown no tendency to change for some months.

## Conduit Boxes in Easy Supply

Despite the difficulties reported in some sections of the country in securing rigid conduit for jobbers' stocks, the supply of conduit boxes on hand at the beginning of this week was reported as highly satisfactory. The relatively small number of these outfits used in connection with any particular wiring job as compared with the length of pipe required has long been a factor permitting the maintenance of adequate stocks in distributors' hands. The fluctuations in the demand for pipe which have been noted during the past year or two have been correspondingly "dampened" by the time they have reached the conduit-box bins. At present the increase in building trade activities in different parts of the country is stimulating a healthy demand for boxes. Prices are firm and tend to follow the general movement of steel-product quotations, with more or less lag behind the active changes on account of the relatively staple stocks noted above.

## Electric Furnace Business Showing Activity

Considerable increased activity is reported for the electric furnace field.

The Electric Furnace Company, Salem, Ohio, announces that it has recently sold to the Columbia Tool Steel Company, Chicago Heights, two 100-kw. annealing furnaces. These furnaces are especially adapted to handle long bars of tool steel in boxes, with the temperature under automatic control. Other recent installations of interest are as follows: One for the Auto Strop Safety Razor Company, New York City, which consists of two furnaces adapted for heating lead baths through which razor-blade steel is drawn for treatment.

Hadfields, Ltd., of Sheffield, England, are installing a 360-kw. car-type electric furnace for the heat treatment of manganese steel castings.

The Metal & Thermit Company has purchased another furnace for its East Chicago plant, a duplicate of one made over a year ago, excepting as to size, the new unit being of 250 kw. capacity. This furnace will be used for special treatment of oxides, which are supported on a double firebrick hearth.

Besides the above-listed heating furnaces there have been additional installations made for the Buick Motor Company of Flint, Mich., of a third furnace for melting brass; for the Ohio Injector Company, Wadsworth, Ohio, of a 105-kw. brass-melting furnace; a 75-kw. furnace for melting brass for the Hammond Brass Works, Hammond, Ind.; a 75-kw. brass-melting furnace for the American Stove Company at Bedford, Ohio, and another furnace with special automatic control has just been shipped to the American Stove Company's Cleveland plant for the calorizing of stove chimneys.

## Switch Sales Are Reported 50 per Cent Heavier

Present sales of inclosed switches are running approximately 50 per cent greater than they were twelve months ago. According to one manufacturer in the Middle West deliveries are not very good and the outlook for the coming three months is not encouraging.

In giving his opinion of the business in switches for the next six months of the year, another manufacturer, also in the Middle West, says: "We feel that business for the next six months will be better than it was for the first six months of last year, but we do not anticipate any great increase. Our opinion is based on the fact that there is going to be a great deal more industrial building during the first half of 1923 than there was during the first half of 1922 and a great increase in the use of the standardized service switch.

The switch business in Canada has also increased greatly during the last six months, but conditions are not healthy. According to a manufacturer of Toronto, Ontario, manufacturers apparently are fighting for business to keep their factories going. It has resulted in a great decrease in price with little prospect of early betterment. There are really more manufacturers in the business than there is business to be had. The outlook for the next six months is fairly good. This assumption is based on the number of building permits that have been taken out since the first of the year, and the program as a whole seems to be fairly extensive compared with the two former years.

## The Metal Market

**Copper at 14.62½ Cents—European Sales Are Quiet—Lead Supply Continues Low**

Copper prices have been shaded so that now the quotation of 14.62½ cents, delivered, prevails. Although the tense European situation has not yet had any direct influence on the market, it is evident that producers are somewhat worried over the outlook for German purchases of copper as an important factor in the export trade. European sales of copper have been quiet, England remaining practically out of the market. The consolidation of Anaconda and Chile Copper, as last officially announced, has not had any stimulating results on prices, probably because the amalgamation had been known and discounted by the trade for several weeks. The new arrangement does not alter the copper situation, as it neither adds to nor subtracts from the amount of metal that is available for consumption. A sale of a good-sized lot of copper for delivery through the second half of the year at 14.75 cents, delivered, was an interesting feature of the week. This is said to be one of the largest sales of copper since the war, estimated to be more than 36,500,000 lb.

The official contract price of the American Smelting & Refining Company for lead continues at 7.50 cents per

pound, New York. The shortage in lead continues. A measure of its acuteness is to be found in the great variation to be observed in the prices quoted for lead not only in the New York market but in that at St. Louis. In New York by far the greatest amount of lead was sold at 7.50 cents, although quotations have been as high as 8 cents. One large producer sold merely a handful of lead during the week as his stocks are exhausted and he has made all the commitments he cares to for the time being.

NEW YORK METAL MARKET PRICES

| | Jan. 17, 1923 Cents per Pound | Jan. 24, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 14.75 | 14.62½ |
| Lead, Am. S. & R. price | 7.40 | 7.50 |
| Antimony | 6.35 | 6.75 |
| Nickel, ingot | 36.00 | 36.00 |
| Zinc, spot | 7.00 | 7.00 |
| Tin Straits | 38.87½ | 38.62½ |
| Aluminum, 98 to 99 per cent | 23.00 | 23.00 |

## Collections in St. Paul and Minneapolis Very Slow

Collections in the St. Paul and Minneapolis territory are very poor, according to several manufacturers and jobbers. Minneapolis reports that the amount of its cash business generally has grown to large proportions, while St. Paul credit men say that a very large percentage of retail business is also for cash. The whole territory suffered heavily last fall from the car shortage. Large crops of perishable products, mostly potatoes, rotted away for lack of cars. This condition had a deadening effect on collections, and accordingly extensions were not granted. Outstanding obligations were covered by notes and other forms of security, and rural business was put on a cash basis.

## Sales of Canadian Fixtures Active, with Firm Prices

Prices of Canadian fixtures during last year remained quite steady. There were no changes of any consequence, although there were of course a few fluctuations. Canadian manufacturers do not look for any great change in prices during the coming year, and, if any, they believe the trend will be slightly to increase prices.

During 1922 deliveries of Canadian fixtures were a little slower on the whole when compared to the deliveries during 1921 and 1920. It is the opinion of a fixture manufacturer in Hamilton, Ont., that supplies will be able to keep up with the demand of 1923 owing to improved conditions in transportation of raw materials.

A leading manufacturer of fixtures in Canada states that his sales during the last half of 1922 were considerably better than during the first period of that year.

Indications are that business will be fairly brisk during the next six months because of large construction programs.

# The Week in Trade

**Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

CONSTRUCTION programs throughout the United States indicate an unusually heavy amount of business for manufacturers of all electrical material entering into new buildings both residential and industrial. Brief summaries of activities in leading cities of the country report greater activity by central-station companies in the purchase of material for line extension and repair work. High-tension business in Chicago remains brisk and manufacturers are kept busy supplying certain large orders. Because of continued winter construction conduit boxes are in steady demand, with firm prices and normal stocks. A slight falling off in the demand for meters is noted. Radio buying is said to be on a firmer basis because purchasers are now showing a growing tendency to buy complete sets rather than scattered parts. Among other general features of the week are a change to lower stocks of wire, firmer conduit prices, a steady call for fuses and a slight falling off in the demand for motors.

**New York** Manufacturers and jobbers report an improvement in business. All wire and other materials entering into new construction are moving in satisfactory volume. Inventories generally are completed and orders from retailers are reported to be conservative and of wholesome character. Demand for motors is slower, stocks are normal and the price trend is firm. Meters continue slow. Central-station purchasing shows a little improvement. The appliance market is without feature and is not expected to take on any growth until spring. A turn in the radio market is for complete sets built by skilled engineers in preference to many parts, which when assembled by the average amateur, guided by inadequate instructions, are inefficient and bulky. Prices generally are firm.

**Chicago** Jobbers report business steadily climbing with increase in number of January building permits. New construction requires a steady volume of wiring materials, and wire prices have an upward tendency. Conduit supplies, especially in the smaller cities, are still low. High-tension manufacturers are busy. One company sold one 1,500-kva., 14,000-volt substation for the Middle West and two 600-kva., 33,000-volt substations for the Southwest. Another firm handled an order for 4,000-volt substation equipment for a Middle Western utility. A steady volume of high-tension fuses is flowing out from another concern.

**Boston** Business is less brisk, but the underlying tone is excellent. Deliveries are giving considerable trouble, and a severe shortage of rigid conduit was reported Monday, with tendencies toward stiffer pricing on filling orders. Manufacturing is progressing well in New England, and jobbers are buying appliances to overcome the shortage experienced at the end of the year. Building operations are well sustained, and favorable rates for money are encouraging the consideration of many new projects. Cotton and rubber prices rose to new peaks last week and copper tended toward weaker quotations. Central-station business continues to gain, as do traction earnings, and the demand for telephone service is remarkably active.

**Atlanta** The spirit of optimism which ushered in the new year becomes more evident every day, and one hears that 1923 will be a record year. Municipal improvements in Atlanta under the bond issue of last spring have finally got well under way, and this has resulted in a high percentage of employment among the artisan class as well as in the ranks of common labor. This is reflected in the improvement of retail sales in this city. Good sales are reported by electrical jobbers and dealers, despite the usual after-Christmas lull.

**Pittsburgh** Jobbers are finishing inventories and again are placing orders for stock. Jobbers and their salemen generally are optimistic as to future business. The steel industry is steady, although production could be increased to a great extent if the car shortage were eliminated. Weather-proof wire advanced slightly last week. Rubber-covered is firm. One manufacturer of armored cable has made an advance and others are expected to do likewise in the near future. Low stocks of pole-line hardware have been somewhat relieved by the opening of another plant in this territory by one of the largest manufacturers. The demand for radio shows a slight increase and seems to be settling down to a merchandising position. Among the features of the week is the change to lower stocks of wire, firmer prices for conduit, steady call for fuses with increasing prices, and a falling off in the demand for motors.

**St. Louis** Records of building permits for last year indicate that construction work in St. Louis exceeded that done in the year 1921 by approximately $10,000,000, which is an increase of more than 50 per cent. The construction work for manufacturers and other shops during this period shows an increase of about $1,000,000, more

# Demand, Supply and Price Trend of Eighteen Commodities as Sold in Fifteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Storage Batteries, Farm Lighting Plants and Tools

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Conduit Boxes | Cooking Appliances | Signal Apparatus |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **New York** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Sdy. | Slow | Slow | Slow | Slow | Slow | Sdy. | Spy. | Sdy. | Sdy. | Act | Sdy. | Sdy. | Sdy. | Sdy. | Sdy |
| Supply | Nml. | Hi. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml |
| Price trend | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Firm | Inc. | Firm | Firm | Inc. | Firm | Dec. | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy | Sdy. | Slow | Slow | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Boston** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slow | Slow | Slow | Slow | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Sdy. | Slow | Act. |
| Supply | Nml. | Nml. | Low | Low | Nml. | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Low | Hi. | Nml. | Nml. | Nml. | Nml |
| Price trend | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Firm | Inc. | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Slow | Act. | Act. | Act. | Act. | Slow | Act. | Act. | Slow |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slow | Slow | Slow | Slow | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Slow | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Nml. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act | Sdy. | Sdy. | Slow | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Slow | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Slow | Sdy. | Act. | Act. | Slow | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Sdy. | Slow | Act. |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. |
| **St. Paul-Minneapolis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Slow | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Hi. | Nml | Nml. | Low | Hi. | Nml. | Nml. | Nml. | Low | Low |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Slow | Act. | Act. | Slow | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Slow | Act. | Slow | Sdy. |
| Supply | Nml. | Nml. | Low | Low | Nml. | Low | Low | Low | Hi. | Nml. | Low | Nml. | Hi. | Hi. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Inc. | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Slow |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Slow | Act. | Act. | Act. | Sdy. | Slow | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Slow | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml | Nml. | Nml. | Nml | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Inc. | Firm | Firm |

**than 85 per cent higher than during the previous year. The first three weeks of 1923 have been marked by great enthusiasm among the electrical wholesalers and retailers. The better business experienced in the latter part of 1922 is continuing, and prospects for the year are very bright. There is an absence of speculative purchasing by retailers, and continued replenishing of depleted stocks indicates a healthy business condition.**

## Cleveland

Orders of the week were of the nature to indicate that dealers were rounding out stocks in anticipation of an active spring. Dealers are "shopping around," and while prices are firm in the main, no advances are evident. Manufacturers report only a mediocre week in sales, but jobbers review it as satisfactory. Credits are easier, but deliveries are lengthened somewhat by shipping difficulties. Industrial equipment was more active, with particular strength in motors. Conduit boxes are in good demand, but orders are promptly filled and firm prices prevail. Appliances generally are suffering a post-holiday depression, although washers are selling in fair volume.

## New Orleans

Business during the week has shown a noticeable improvement. A feature of the week has been the change in demand for wire from slow to active. Prices of armored cable are said to be increasing. Demand for transformers has changed to a steady gait, and stocks generally are normal with firm prices. Porcelain stocks are again normal and firm prices prevail. Business in switches is somewhat slower than last week as demand has changed from active to steady, stocks are normal and prices generally are firm. Motor stocks also are improved.

## St. Paul-Minneapolis

Twin Cities business changed little from the even strides of last week, although orders are slightly smaller in St. Paul. A greater demand by the central stations for equipment to be used in extensions and repairs is reported. Radio buying continues active. Appliance business is slow, and some dealers expect price declines. House wiring is noticeably slower. Fixture demand remains active. Jobbers plan large spring campaigns. Fixtures are more active than last week. The price of conduit is more firm, although stocks are low. Demand for meters has changed from an active condition to a steady one.

**Salt Lake City** A four-million-dollar bond issue has been sold by the Columbia Steel Company for erection of plants in Utah. This is believed to be the beginning of extensive coal and iron developments in this section of the Intermountain West. The National Wool Growers' Association has just finished a convention here, and the wool and mutton industries were reported to be in excellent condition. Most growers are said to be well on the way toward recuperation. Statistics just compiled show a million-dollar increase in building in Salt Lake City in 1922 over 1921. A larger gain is forecast for 1923. Jobbers and retailers report business rather slow for this time of the year. Collections are improving steadily.

**Denver** A program of continued building indicates an early demand for a wage increase by all building trades. It is stated the electrical union will ask for an increase of one dollar a day above the present rate of \$8 for eight hours. No action has been taken by any of the master contractors. Some jobbers believe that if an increase in wages is granted, along with the increasing costs of other materials, prosperity in this section will be somewhat affected. Most inventories are over and stocks are being added to. Central-station buying is active.

**San Francisco** Business in building industry continues at a high rate, but store sales have fallen off. Electrical orders from the railroads are excellent and will increase considerably when large constructive programs of various lines commence within the next few months. Southern Pacific has authorized the expenditure of \$12,000,000 for new equipment alone. The year's combination of bumper crops and car shortages when transportation facilities were needed most caused considerable loss to fruit growers. Radio sales have gained considerably since the opening here of a large new station, which is said to have cost over \$20,000. Conduit box prices have recently increased about 10 per cent. Five thousand electric ranges will be sold during the present year, it is estimated.

**Portland-Seattle** Jobbing business is active for this time of year. Conduit, safety switches and wiring devices apparently are moving more freely than other lines. General opinion is that prospects for a good business year are excellent. Inquiries at present are most active from lumber mills and railroads. Many buildings are planned for early construction in cities throughout this section. Conduit boxes are in steady demand, with orders averaging from 100 to 200 boxes each. Cooking appliances are moving more slowly since the holidays, but a recovery is expected by early spring. There is little demand for signal apparatus in this section and heavy orders are few.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Rauch & Lang Receive Order for More Electric Taxis

The Rauch & Lang Company, Chicopee Falls, Mass., reports an increased demand for taxicabs, a line undertaken by this concern last year in addition to the manufacture of electric vehicles for ordinary passenger use. The Electrotaxi Company of New York, which has a fleet of eight Rauch & Lang electric taxis, has ordered ten more for early delivery. Aside from taxicabs, the company reports that its business is 25 per cent better than a year ago.

## Results of Geier Sales Contest

The idea of the electric cleaner as a holiday gift was the keynote of the successful Royal sales contest, results of which have just been announced by the P. A. Geier Company. The thirty-three winners were widely distributed throughout the country. The first prize of \$500 went to Alexander Mueller of Los Angeles, and second prize, \$450, to Raymond M. Uber, Philadelphia.

## Record-Size Frequency-Changer Set Ordered from Westinghouse

The Brooklyn Edison Company has recently purchased from the Westinghouse Electric & Manufacturing Company a frequency changer set of 35,000 kva. capacity for installation in its Gold Street station. The set is larger than any frequency-changer set now in service in the United States and has over-all dimensions, including the direct-connected exciter, of approximately 47½ ft. length, 22 ft. width and 15 ft. height. It is expected that the set will be in operation by November, 1923.

The set, which operates at 300 r.p.m., will connect the company's 25-cycle and 60-cycle systems, transforming energy from 13,800 volts, three-phase, 60-cycle, to either 6,600 volts or 11,400 volts, three-phase, 25-cycle. The 60-cycle end of the set is connected directly to an auto-transformer, through which the voltage is stepped up from 13,800 to 27,600. At this latter end a tie line, running underground in three-phase lead-covered cables, will connect the set with the power house which the Brooklyn Edison Company is erecting at Hudson Avenue.

The set is arranged for starting from either end. For the 60-cycle end starting taps are provided on the auto-transformer, and for the 25-cycle end it is proposed to connect the set directly to a generator in the station while the latter is at rest and to bring both the generator and the frequency-changer set up to speed together. No starting motor is provided. Excitation for both ends of the set is obtained from a common exciter of 300 kw. capacity. Hand regulation will be used for both ends of the changer.

## Pacific Coast Jobber Announces Largest "Ad" Campaign in West

The Pacific States Electric Company, one of the largest electrical jobbers on the Pacific Coast, with branches in all large Western cities, has announced an advertising program for 1923 to promote its "Check Seal" campaign, which will be the largest advertising campaign ever put on by a concern of any kind in the West. The "Check Seal" slogan, standing for higher standards in electrical contracting, had its inception in Los Angeles in September, 1921, and proved so successful there that it was carried to all of the large cities of the West.

The plans for 1923 call for extensive newspaper advertising and billboards throughout California, Oregon and Washington. The program consists of two full-page and eight 1,000-line newspaper advertisements, to be alternated with the billboard displays throughout the year. The two full-page advertisements feature the "Check Seal" standards of installation in relation to power development. The other eight advertisements feature the "Check Seal" as a guide to standard electrical materials and qualified electrical contracting service in both industrial and domestic installations. In addition to 415 poster panels in full color, nine de luxe illuminated billboards will broadcast the story and direct public attention to "Check Seal" contractors.

## Sprague to Campaign Against Misuse of Its Trademark

In order to correct the misuse of the trademark "BX," the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York City, manufacturers of steel-armored conductors, will soon start a campaign to curb this practice. In a statement to trade publications this company states:

"Steel-armored conductors were first introduced to the trade by the Sprague Electric Works under the trademark 'BX' more than twenty-five years ago. In a short time this trademark had become universally known, and by the time the first competitive make of armored conductor appeared on the market 'BX' had become synonymous with armored conductor or cable. The title 'BX' was loosely applied to any

make of armored conductor, and the misuse of the Sprague trademark gradually became general.

"In an endeavor to correct this condition, the Sprague Electric Works are carrying on a campaign of education. One measure adopted is the use of an orange and blue tag which will be attached to every coil and will distinguish 'BX' from other makes.

"'BX' is the registered trademark of the Sprague Electric Works and cannot be legally applied to armored conductors of any other make."

# What Anaconda-Chile Copper Merger Means

A special meeting of the stockholders of the Anaconda Copper Mining Company has been called to meet at Anaconda, Mont., Feb. 26, for the purpose chiefly of completing the acquisition of the Chile Copper Company, notice of which appeared in last week's issue. So extensive is the field of the activities of the Anaconda Copper Mining Company that it possesses not only the greatest capacity in the production of copper, but through its rolling-mills department and the American Brass Company it is the premier manufacturer of copper and brass products in the world. The company's reduction works at Anaconda have a normal output amounting to 13 per cent of the copper produced in the United States and about 9 per cent of the world's total production. A modern refinery at Great Falls, Mont., has an average annual capacity of 216,000,000 lb., while a refinery at Perth Amboy, N. J., has an annual capacity of 450,000,000 lb. The rod and wire mill at Great Falls turns out annually 90,000,000 lb. of manufactured copper, while its electrolytic-zinc plant at Great Falls is the largest of its kind in the world.

A year ago the Anaconda Copper Mining Company acquired the stock of the American Brass Company, which gave the Anaconda Copper Mining Company a definite outlet through which its metals found their way directly to the various industries. The American Brass Company now produces at the rate of 450,000,000 lb. per annum, and its consumption of copper, together with the requirements of the Anaconda Company's own fabricating plants, is in excess of the present copper production of the Anaconda Copper Mining Company and the Chile Copper Company. The Chile Copper Company, the control of which has just been acquired by the Anaconda Copper Mining Company, possesses the most extensive and one of the most valuable of the known bodies of copper ore in the world. The mines of the company are in the Province of Antofagasta in Chile and enjoy many natural advantages, including proximity to ocean transportation, adequate supply of labor and immense tonnage near the surface. The mines are equipped with electric and steam shovels capable of moving 43,000 tons or more a day. A modern power plant is established at Tocopilla, from which a 100,000-volt, three-phase, 50-cycle, 87-mile transmission line runs to a plant at Chuquicamata. The Chile Copper Company is the lowest-cost large-scale producer of copper in the world. Its present production is at the rate of 180,000,000 lb. of copper per annum, and extensions now under way provide for increasing that production to a rate of 225,000,000 lb. per annum by spring.

The purposes of the consolidation were explained to a representative of the ELECTRICAL WORLD by Cornelius F. Kelley, president of the Anaconda company, at its office in New York. It was stated that electrical manufacture and transmission and telegraphic and telephonic communication absorb nearly 60 per cent of the copper output and that the Anaconda Copper Mining Company does not sell any of its production except in manufactured form in this country.

### INFLUENCE OF THE WAR

"Copper production has been very greatly affected by the war and its aftermath," said Mr. Kelley. "In 1913 the world's production of copper was 2,188,000,000 lb., and in 1917 the world's production had increased to 3,138,000,000 lb., owing to the artificial demands created by the war. On Jan. 1, 1919, the producers held stocks of 839,000,000 lb., and there was held by the allied governments at least another billion pounds of virgin metal and two billion pounds of available scrap accumulated during the intensive manufacture of war plants, all of which was dumped on the market during the past three years at prices below the cost of current production. The beginning of 1922 found the industry still carrying burdensome stocks, the accumulation of which had compelled the suspension of nearly all American mines in the spring of 1921. In the eleven months of 1922, for which accurate data are available, war stocks had been reduced 496,872,000 lb., or at the average rate of 45,170,000 lb. a month. Production during that time has increased to an average of 156,000,000 lb. a month, bringing the average consumption of primary copper to over 200,000,000 lb. a month, which, while it does not indicate the full measure of consumption in 1922, indicates the exhaustion of the large volume of secondary copper and a return of normal consumption, particularly in the United States. A comparison of the percentages in the price of copper with that of other basic mineral production shows that from the year 1917 to 1923, with the single exception of pig iron, all were selling at a higher level during 1921, as compared with their respective pre-war prices, than copper reached at any time excepting the year 1917. Pig iron in 1921 was selling at approximately the same increase over the pre-war price that copper reached in 1918, while copper on the contrary was selling for 20 per cent below its pre-war price.

"As a result the Anaconda Copper Mining Company, despite all the improvements made to increase the efficiency in economy and production, was obliged during the past two years to pass the payment of dividends to stockholders. In 1921 the company showed a large loss due to shutdown and the reduction of its inventories to market prices. Not only was the cost of copper during 1921 and 1922 below the pre-war level, but the cost of labor, transportation, fuel, taxes and supplies had greatly increased, and these items constitute approximately 80 per cent of the total cost of producing copper. By reason of a long-term contract with the Montana Power Company electricity was the only item of cost which remained unchanged. The rapid growth of the brass and copper manufacturing business, coupled with the continued high level of production cost in the United States, caused the Anaconda Copper Mining Company to seek an immediate supply of cheaper copper than it is possible to obtain in the United States today. Hence the purchase of the Chile Copper Company. That company, because of the character of its copper ore and other favorable circumstances, can deliver copper at a less cost than can the Anaconda Copper Mining Company, and in addition the freight rate to New York is less than one-third of the rail rate from Butte to New York, which is $16.50 a ton."

There was no indication that the consolidation would have any effect on the present price of copper, although the thought was very freely expressed that the Anaconda Copper Mining Company is now in a better position to stabilize the market. It was pointed out that the present price of copper is less than the average for the twenty-year period prior to the war.

## Sign Manufacturers' Exhibit in New York City Next Week

Electrical sign and electrical advertising device manufacturers will hold an exhibition of their products in the Irving Place showroom of the New York Edison Company during the week beginning Jan. 29, it is announced by that company. In the showroom will be large signs in operation, smaller signs of the type used for window and counter display, directional signs, advertising novelties, and interesting mechanical exhibits showing the controlling apparatus which regulates the sign.

The American Brass Products Company, with general offices at 2302 Woolworth Building, New York City, announces change in its name to the United States Brass Products Company. The management and business will be continued in the same manner as in the past.

## Foreign Trade Notes

PROPOSED ELECTRICAL DEVELOPMENTS IN MORAVIA, CZECHOSLOVAKIA.—Four companies, it is reported, have been organized in Moravia for the purpose of a systematic electrification of the country. A special section has been allotted to each company. The plans include utilizing the water power of the river Dyje, between Freinstyn and Znojme. To provide the necessary funds for the project the Moravian government has decided to issue a 4½ per cent loan of 30,000,000 kronen in communal bonds of the Moravian Mortgage and Agrarian Bank.

PROPOSED WATER-POWER DEVELOPMENTS IN CZECHOSLOVAKIA. — In an effort to improve the employment situation in Czechoslovakia the Ministry of Public Works, according to *Commerce Reports*, has decided to start preliminary work on several public undertakings, including five hydraulic stations in Bohemia, one in Moravia and one in Slovakia, at an expense of 72,000,000 Czechoslovakian crowns ($2,333,000 at present exchange). In addition, seven new dams have been planned, involving a total expenditure of 609,000,000 crowns ($18,879,000), and nineteen other hydraulic stations have been proposed.

"ANNALES DES POSTES, TELEGRAPHES ET TELEPHONES" TO BE ISSUED MONTHLY.—This technical bulletin, which the French government has published for several years and which has been so far appearing bimonthly, will in the future be issued monthly, with no change in subscription price. The publication is edited by the Librairie de l'Enseignement Technique, 3 Rue Thénard, Paris.

HYDRO-ELECTRIC DEVELOPMENTS PLANNED IN IRELAND.—Following investigations into the water-power resources of the country by the Irish Commission of Inquiry, *Commerce Reports* states, the Irish Power Syndicate, Ltd., has been organized with headquarters at 28 Molesworth Street, Dublin. The company, which plans to utilize a portion of the water power of the Liffey River, has applied to the Ministry of Industry and Commerce of the Irish government for a special order to enable it to take necessary steps to acquire sites for power stations and rights of way for transmission lines. It is estimated that 8,300 hp. can be developed on the six available sites on the Liffey River.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase or agency is desired in Italy (No. 5,066) for surveying instruments and accessories and medical and surgical instruments, including the latest electrical accessories and novelties for household use.

Purchase and agency is desired in the Netherlands (No. 5,097) for wireless-telephone supplies.

An agency is desired in Sweden (No. 5,131) for all kinds of electrical articles, measuring instruments, cables and wires, electric lamps, current breakers, heating and cooking apparatus, motors, electrical apparatus for medical purposes, etc.

Purchase is desired in Spain (No. 5,149) for refrigerating machinery for small ice plants.

POSSIBLE DEMAND FOR ELECTRIC SIGNS IN SWITZERLAND.—While considerable electrical apparatus and equipment is manufactured in Switzerland there has been little local development of electric signs, according to *Commerce Reports*. The larger cities, it would seem, would offer opportunities for the installation of electric signs.

POSSIBLE DEMAND FOR PORTABLE ELECTRIC PLANTS IN BLUEFIELDS, NICARAGUA.—According to Consul William W. Heard, Bluefields, Nicaragua, Central America, there is a possible demand for portable electric plants driven by gasoline engines. The principal lighting system used in most of the stores and dwellings is the acetylene generator, which owing to climatic conditions is subject to considerable deterioration. Some of the gas plants now in use will soon have to be replaced, and it is probable that electric plants will be used.

POSSIBLE MARKET FOR ELECTRIC WATER HEATERS IN SWITZERLAND. —As electricity is plentiful and comparatively cheap, Consul Thornwell Haynes, Berne, Switzerland, states that there is seemingly in that district and throughout Switzerland a market for electric heaters which will quickly produce hot or boiling water, especially heaters that can be attached to any water faucet whereby hot or cold water can be obtained immediately, operated either on direct or alternating current.

## New Apparatus and Publications

SAFETY SWITCHES. — The Mutual Electric & Machine Company, Detroit, has placed on the market a new "Bull Dog" safety meter-starting switch.

LABORATORY POTENTIOMETER. — The Queen-Gray Company, 70 West Johnson Street, Philadelphia, has brought out a laboratory potentiometer, combining the advantages of the high-resistance and low-resistance types.

ELECTRIC WASHING MACHINE.—An electric clothes washer designed particularly for use in apartment houses has been brought out by the Gillespie-Eden Corporation, Paterson, N. J.

ELECTRIC FAN.—A small fan "Aero," operated by a fractional-horsepower motor for supplying a positive circulation of air to a hot-air furnace, has been developed by the Buffalo Forge Company, 490 Broadway, Buffalo, N. Y.

ELECTRIC FAN.—A 10-in. fan finished in ivory-tinted enamel with nickel-plated trimmings has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. An illustrated booklet entitled "What Fans Are For," which shows the many ways in which a fan can be used, has been issued by the company.

MAGNETOS.—The American Bosch Magneto Corporation, Springfield, Mass., has developed a new type of "Bosch" magneto, known as type "AT." This instrument is waterproof and made for use with large four-cylinder and six-cylinder engines.

BRUSH EQUIPMENT. — The National Carbon Company, Inc., Thompson Avenue and Orten Street, Long Island City, N. Y., has issued a supplement to its catalog No. 37, describing its electrographitic brush—259—for the direct-current side of synchronous converters, and the Ringsdorff ET-10 metal graphite brush for the alternating-current side.

VARIABLE-SPEED TRANSMISSION.— "The Driscoll Variable Speed Transmission" is the title of a booklet distributed by the Driscoll Transmission Corporation, 416 West Thirty-third Street, New York City, describing the "Driscoll" device for control and transmission of mechanical energy.

CONDENSERS. — The Elliott Company, Jeannette, Pa., has published a new catalog, C-1, covering the Elliott-Ehrhart condensers, in jet, barometric and surface types. It also describes the Elliott-Ehrhart air ejectors, types "A," "B" and "C," and other products of the company.

## New Incorporations

THE SOUTH MISSOURI POWER COMPANY, Greenfield, Mo., has been incorporated with a capital stock of $100,000 by C. L. Ward, Buford Adams and E. Nelson. The company proposes to construct and operate electric light, water, power and heating plants and distributing systems, etc.

THE MARSHFIELD (MO.) ELECTRIC LIGHT & POWER COMPANY has been incorporated by T. F. Bowdern, L. A. Reynolds and others. The company is capitalized at $25,000 and proposes to operate an electric light plant.

THE VALLEY ELECTRIC & ICE COMPANY, San Antonio, Tex., has been chartered with a capital stock of $200,000 by R. W. Morrison, A. C. Prucha and H. C. Leohr.

THE GRAFTON (VT.) LIGHT & POWER COMPANY has been incorporated by Justin C. Tay, Grafton; Edward L. Walker, Bellows Falls, and Fred M. Prouty, Grafton. The company is capitalized at $10,000 and proposes to erect a transmission line from Saxtons River to Grafton and to distribute electricity, and also to deal in electrical supplies.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

BOSTON, MASS. — The Supply Officer, Boston Navy Yard, will purchase 1,100 hand flashlights. (N.S.A.F.Req. 212.)

HOLYOKE, MASS. — Extensions to the municipal electric plant, involving an expenditure of about $400,000, are under consideration by the Municipal Gas and Electric Department. John J. Kirkpatrick is manager.

WORCESTER, MASS.—The New England Power Company plans to erect a high-tension transmission line from Sherman, Vt., through Greenfield to Millbury, a distance of 75 miles, where a station will be erected. It is also proposed to build a transmission line from Sherman to Pittsfield. The New England company is building a large hydro-electric plant on the Deerfield River, near Whitingham, Vt.

NEW MILFORD, CONN. — Work has started on the foundation for the initial units of the proposed new local electric generating plant of the Connecticut Light & Power Company, Waterbury, to cost about $750,000.

SEYMOUR, CONN. — Preparations are being made by the Connecticut Light & Power Company, Waterbury, for improvements in the Seymour district, to include the rebuilding of the local substation, installation of new switching equipment and rearrangement of the distribution lines in Seymour, and also the erection of an additional transmission line between Naugatuck and Seymour and reconstruction of the existing line. The cost of the entire work is estimated at about $30,000. W. T. Pratt, Naugatuck, is district manager.

## Middle Atlantic States

BUFFALO, N. Y.—Plans are being prepared for the installation of electric lighting fixtures at the Broadway Auditorium, to cost about $30,000. The work will be done by the municipality, with Commissioner Meahl in charge.

CHENANGO BRIDGE, N. Y.—An electrically operated pumping plant will be installed in connection with local waterworks to be built by the County Board of Supervisors, Binghamton, to cost about $115,000.

COEYMANS, N. Y.—The Atlantic Light & Power Company has petitioned the Public Service Commission for permission to extend its system to the town of Bethlehem for the purpose of supplying electricity to the railroad yards of the New York Central system.

DEFERIET, N. Y.—The St. Regis Paper Company is planning to erect a wood-grinding plant at Deferiet, which will be equipped with electrically driven machinery. Power requirements, it is stated, will be about 15,000 hp.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company until Feb. 2 for railway motors and multiple-unit control equipment (Serial contract No. 3-1923). C. S. White, 466 Lexington Avenue, is purchasing agent.

PHILADELPHIA, N. Y.—At a recent election it was voted to install meters throughout the entire municipal electric lighting system in the town and surrounding territory. Warner Hubbard is manager of the municipal plant.

ROCHESTER, N. Y.—Extensions will be made to power station No. 3 of the Rochester Gas & Electric Corporation to provide space for switching apparatus and a new electric boiler. The cost is estimated at about $400,000.

TROY, N. Y.—The Rensselaer Polytechnic Institute will soon ask for bids for the erection of a three-story addition to the electrical laboratory, 50 ft. x 70 ft. Lawlor & Haase, 15 West Thirty-eighth Street, New York, are architects.

WATERTOWN, N. Y.—The Power Corporation of New York, Inc., has issued $1,000,000 in capital stock, part of the proceeds to be used for extensions and improve-

ments. The company is affiliated with the Northern New York Utilities, Inc.

WEST HENRIETTA, N. Y.—The Rochester (N. Y.) Gas & Electric Company has petitioned the Public Service Commission for permission to extend its lighting and power system into this town.

BRANCHVILLE, N. J.—The Branchville Electric Power, Water & Lighting Company has been ordered by the Board of Public Utility Commissioners to make improvements to its system. Electric meters will be installed for all consumers, replacing the present flat-rate system. Charles H. Crismah is owner.

BURLINGTON, N. J.—The Public Service Corporation plans to increase the output of its plant to 37,500 kw.

CAMDEN, N. J. — The Public Service Electric Company has contracted with the Philadelphia Electric Company for power for its South Jersey system. Three submarine cables will be laid under the Delaware River, with line connection at Camden. The Public Service company has plans for a generating plant addition, to cost about $1,000,000, to be carried out in connection with an improvement program estimated at $25,000,000.

MORRISTOWN, N. J.—The property of the Morris & Somerset Electric Company has been acquired by A. E. Fitkin & Company, 141 Broadway, New York. Extensions and improvements are contemplated.

STEWARTSVILLE, N. J. — The Greenwich Township Committee is preparing plans for the installation of a local lighting system.

WOODBURY, N. J.—The Woodbury Ice & Power Company plans to build a one-story power plant and an ice factory.

CHAMBERSBURG, PA.—D. P. Minick will build a power house in connection with proposed ice and cold-storage plant at 147 East Queen Street. John Crowe, Hartman Building, York, Pa., is architect and engineer.

DELTA, PA.—The properties of the Delta Electric Light Company and the Delta Water Power Company have been acquired by the Susquehanna Power Company, which proposes to build a dam across the Susquehanna River at Conowingo, Md., to furnish power for a large electric plant. J. A. Schriever, Bel Air, Md., is interested in the Susquehanna company.

HYNDMAN, PA.—The property of the Hyndman Electric Light, Heat & Power Company has been acquired by the American Water Works & Electric Company, 50 Broad Street, New York. It has also purchased the Deal Power Company, Cooks Mills, near Hyndman. Extensions and improvements will be made in the system.

PITTSBURGH, PA. — Bids will be received by the Board of Education, 1326 Fulton Building, until Feb. 1 for the installation of electrical equipment at the Peabody high school addition, including motors, mechanical fans, etc. George W. Gerwig is secretary.

PITTSBURGH, PA.—Receivers for the Pittsburgh Railways Company have been authorized to make improvements, including the installation of new equipment at substations, feeder lines, and cables, etc., to cost $211,300. W. D. George, S. L. Tone and C. A. Fagan are receivers.

SALISBURY, MD. — Plans are being arranged for the installation of an ornamental street-lighting system on Division and Main Streets, in the business district. F. H. Dryden, city engineer.

NEW WINDSOR, MD. — Improvements will be made in the local municipal power plant and system, including the installation of additional equipment.

BLUEFIELD, W. VA.—The Appalachian Power Company contemplates the installation of an additional generating unit at its steam-power station at Glenlyn, Va., to cost about $1,800,000. The work will include an addition to power house and installation of one 20,000-kw. steam turbine and four boilers with auxiliary equipment, etc. Viele, Blackwell & Buck, 49 Wall Street, New York City, are engineers and contractors.

KENOVA, W. VA. — The Consolidated Light, Heat & Power Company, Huntington, will make extensions in its local power plant, increasing the capacity by about 15,000 kw.

NORFOLK, VA.—Bids will be received by the Bureau of Supplies and Accounts, Washington, D. C., until Feb. 6 for busbar supports, cable terminals and cable racks (Schedule 444); also for 1,200 ft. telephone cable and miscellaneous single copper cable (Schedule 445).

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until Jan. 29 for 50 switch panels (Circular 23-111).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Feb. 8 for 350 telephone transmitters and mouthpieces (Circular P.R. 13145-B-99 CP).

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon call for bids for the installation of electric traveling cranes at the Puget Sound Navy Yard under Specification 4,755.

WASHINGTON, D. C. — Arrangements are being made by the United States Shipping Board, Washington, for an appropriation of from $5,000,000 to $6,000,000 for remodeling twenty-three post-war American passenger vessels and a number of merchant steamers. The work will include the installation of new electric generators, electric lighting sets, engine and pumping machinery, condensers, etc.

## North Central States

DETROIT, MICH.—The Père Marquette Railroad Company, Union Station, contemplates building a power house in connection with its proposed engine terminal at West Jefferson and Twenty-first Streets, to cost about $1,000,000.

CLEVELAND, OHIO.—The installation of two additional 1,400-hp. boilers in the municipal electric light plant this year is under consideration. The cost is estimated at about $250,000. C. G. Beckwith is superintendent of the lighting department.

COVINGTON, OHIO. — The Buckeye Light & Power Company is negotiating for the purchase of the property of the Stillwater Valley Electric Company, West Milton. Extensions and improvements will be made.

MARTINS FERRY, OHIO. — Plans are being prepared for construction of a pumping station to be equipped with two 4,000,000-gal. pumps, ash-handling equipment and electric generating station, to cost about $450,000. The J. N. Chester Engineering Company, Union Building, Pittsburgh, is engineer.

PHILO, OHIO.—The Ohio Power Company will soon commence work on its proposed local generating plant. Two generating units each of 35,000 kw. will be installed.

TIFFIN, OHIO.—An ordinance has been passed authorizing the present overhead wires to be placed in underground conduits.

CROWN POINT, IND.—A power house will be built in connection with the proposed County Tuberculosis Sanitarium, about 2 miles from the city, to cost about $350,000. Karl D. Norris, Calumet Building, East Chicago, Ind., is architect.

FORT WAYNE, IND.—Bids will be received by the Board of Public Works until Feb. 12 for one 3,000-kw. turbo-generator, switchboard apparatus and one surface condenser.

LOGANSPORT, IND. — The Northern Indiana Power Company, Kokomo, which recently acquired the property of the Logansport Utilities Company, has started work on the erection of a new power plant, to cost about $500,000. The equipment will include two 1,000-kw. turbines, three 565-hp. boilers, pump house and filter plant, etc.

PENDLETON, IND.—A power plant will be installed at the new Indiana Reformatory to be built here, to cost, with equipment, $175,000. A distributing system will be erected at a cost of $75,000. The committee, composed of Joseph E. Henning, John O'Neil and J. W. Nash, Indianapolis, has applied for an appropriation for this work.

CHICAGO, ILL. — A one-story power plant will be erected at the new home to be built on Ridge Avenue by the Guardian Angel, German Catholic Orphan Society, 2001 Devon Avenue, at a cost of $250,000. Herman J. Gaul, 111 West Washington Street, is architect.

NEW BADEN, ILL. — The Southern Illinois Light & Power Company, Hillsboro, has acquired the local municipal plant and will furnish service in the future from its 33,000-volt transmission line. The local power plant will be discontinued.

WAUKEGAN, ILL. — Plans have been completed by the Public Service Company of Northern Illinois, 72 Adams Street, Chicago, for the initial unit of its proposed new local power plant, to cost about $3,000,000.

ALGOMA, WIS. — The City Council is considering the question of equipping the waterworks pumping station with electrically driven pumps.

GREEN BAY, WIS. — The Wisconsin Public Service Commission contemplates extending its transmission line from High Falls to Wausaukee, Amberg and Middle Inlet, a distance of about 25 miles. The cost is estimated at about $42,000.

GREEN BAY, WIS. — Plans are being prepared by the Wisconsin Public Service Corporation for extensions to its plants in Oshkosh, Sheboygan and Marinette, Wis., and in Michigan. It has recently acquired a power site at Chaldron Falls on the Peshtigo River where an 11,000-hp. plant will be erected, at a cost of $1,000,000.

STEVENS POINT, WIS.—The Consolidated Water Power & Paper Company, Wisconsin Rapids, is considering an additional water-power development in Stevens Point.

OSKALOOSA, IOWA.—The City Council is preparing plans for a municipal hydro-electric plant at Harvey, to cost about $375,000. Burns & McDonald, Interstate Building, Kansas City, Mo., are engineers.

JASPER, MO. — The proposal to issue $32,000 in bonds for the construction of a municipal electric light and power plant will be submitted to the voters.

SPICKARDSVILLE, MO. — The Trenton (Mo.) Gas & Electric Company has been granted a franchise to erect a transmission line from Trenton to Spickardsville and install a distributing system here. A loan of $15,000, it is said, is available.

TRENTON, MO.—The proposed extensions and improvements to the municipal waterworks include the installation of electrically operated pumps. The cost is estimated at about $175,000. The Burns & McDonnell Engineering Company, Interstate Building, Kansas City, Mo., is engineer.

## Southern States

HICKORY, N. C.—Water rights on the Catawba River below Horseford Shoals have been acquired by Joseph B. Elliott, which will be utilized for a hydro-electric development.

MORGANTOWN, N. C. — Improvements will be made to the street-lighting system, to cost about $9,000.

SPARTANBURG, S. C. — The Pacific Mills Company, Lawrence, Mass., will build a power house in connection with its proposed local textile plant, to cost about $1,500,000.

MILLTOWN, GA. — The Lanier County Power Company, recently organized, plans to build a power plant at the foot of Lake Irma, to cost about $300 000. The company is headed by F. E. Hatch.

ANNA MARIA, FLA.—H. W. Ralston contemplates the installation of an electric plant on Anna Maria Beach.

ARCADIA, FLA.—Plans are under way for the construction of a municipal light and power plant in Arcadia.

McINTOSH, FLA.—The McIntosh Utilities Company is planning to establish an electric light plant in McIntosh. S. H. Gaitskill is president.

BIRMINGHAM, ALA. — The Alabama Power Company plans to erect a substation in Leeds at a cost of $1,500,000 to distribute energy generated at the Mitchell Dam and Lock 12 to the Birmingham district. A 50-mile, 110,000-volt transmission line will be erected from Lock 12 to the Leeds station. Another transmission line will connect Mitchell Dam with Lock 12 and the Leeds substation with Birmingham.

FLORENCE, ALA.—Bids will be received by the United States Engineer Office until Feb. 12 for one electric 937-kva. generator, 937.5 kva., with exciter, for use at Sheffield, Ala.

MOBILE, ALA. — The Great Southern Roofing Corporation, recently organized, will build a power house in connection with its proposed local factory. William D. Martin is secretary and treasurer.

CHATTANOOGA, TENN.—The Tennessee Electric Power Company contemplates extensions and improvements during 1923, including the construction of a 120,000-volt steel-tower transmission line to Lindale, connecting with the system of the Georgia Railway & Power Company. The cost of the work is estimated at about $2,450,000.

GULFPORT, MISS. — The Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon take bids for the installation of electric lighting systems in the buildings to be erected at the veterans' hospital, with power circuits and telephone conduit, power-house equipment, piping, etc. (Specification 4774).

PARAGOULD, ARK.—The City Council has granted a franchise to R. W. Meriwether and H. W. Woosley to construct and operate an electric light and power system.

SMACKOVER, ARK.—The Pan-American Petroleum & Transport Company, 120 Broadway, New York City, has acquired 120 acres in the new Smackover (Ark.) oil field and plans to build at once a storage and distributing plant, consisting of twenty-two steel tanks of 80,000 barrels each, power house, pumping plant, machine shop and other buildings. Edward L. Doheny is chairman of the board.

BOGALUSA, LA.—The Bogalusa Power Company will build an electric power plant in connection with extensions to its mill, to cost about $1,000,000. James L. Carey, 208 North Laramie Avenue, Chicago, is engineer.

RAYNE, LA.—Bonds to the amount of $125,000 have been voted by Acadia Parish for extensions to lighting and water systems. J. B. McCrary & Company, Third National Bank Building, Atlanta, Ga., are engineers.

LAHOMA, OKLA.—An electric transmission line will be erected from Drummond to Lahoma, about 8 miles, for local service, to cost about $12,000.

AMARILLO, TEX.—The installation of electrically operating pumping machinery at the municipal waterworks is under consideration.

BRECKENRIDGE, TEX. — The Great Texas Oil & Refining Company will install electric power equipment in connection with a local refinery, now in course of construction, to cost about $1,200,000.

HOUSTON, TEX.—The South Texas Cold Storage & Warehouse Company will install electric power equipment in its proposed ice and cold-storage plant near the Main Street viaduct, to cost about $1,000,000.

## Pacific and Mountain States

EVERETT, WASH.—The Delta Electric & Water Company contemplates erecting transmission and distributing lines in different parts of Snobomish County. A franchise has been asked.

KETTLE FALLS, WASH.—The Washington Water Power Company, Spokane, contemplates building a hydro-electric plant at Kettle Falls, to cost about $3,000,000.

LOS ANGELES, CAL.—An ordinance has been passed authorizing the installation of ornamental lamps on Sixth Street and on Palos Verdes Street in the San Pedro Harbor district.

PASADENA, CAL.—Bids will be received by the City Clerk until Feb. 9 for one 10,000-kw., 2,400-volt, steam turbo-generator unit, one jet condenser and one surface condenser and circulating pump for the Municipal Light Department.

REDLANDS, CAL.—The Southern California Edison Company will install an ornamental lighting system to replace present lamps on all city streets.

SACRAMENTO, CAL.—Plans are being prepared for a municipal hydro-electric plant at Silver Creek. Albert Givan is city engineer.

SAN PEDRO, CAL.—The installation of new street lamps on Pacific Avenue is under consideration.

SAN YSIDRO, CAL.—Plans are being considered for the establishment of a new lighting district in this section. J. M. McLees, clerk San Diego County, San Diego, is in charge.

TAFT, CAL. — Plans for the proposed ornamental system in the business district provide for seventy-one lamp standards. Bids will soon be called.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company has secured a site at Bruce's Eddy, where it proposes to build a hydro-electric plant.

PEACH SPRINGS, ARIZ.—The Colorado River Engineering & Development Company has been granted permission by the State Water Commission to build a hydro-electric plant on the Colorado River on Diamond Creek, near Peach Springs. The plant will have an ultimate capacity of 200,000 hp. and will cost about $25,000,000. James B. Girard, Phoenix, is engineer.

PHOENIX, ARIZ.—Bids will be received by the Salt River Valley Water Users' Association, Phoenix, until Feb. 5 for one 10,000-hp. turbine, one 7,500,-kva. generator, 25 cycles, 2,300 volts, for installation in power house at the Roosevelt dam. The cost is estimated at from $130,000 to $140,000. H. Lawson is superintendent of power.

DENVER, COL.—Arrangements are being made by the Denver Gas & Electric Company and the Western Light & Power Company, Boulder, both controlled by the Cities Service Company, for the construction of a large steam-driven electric generating plant about 4 miles south of Boulder. Four million dollars will be spent at once on a development, the initial installation in which will generate 12,000 hp. The present plans provide for a development of 120,000 hp., to cost with transmission system about $12,000,000.

DOVE CREEK, COL.—An electric lighting plant, it is said, will be installed in the new hotel to be erected by George E. Haney. It will be of sufficient size to furnish service for the entire community.

LAMAR, COL.—Plans for the proposed ornamental lighting system call for eighty standards. Contract for cable and regulators have been awarded. Bids for standards, tops and other equipment will soon be called for. J. E. Todd is superintendent of the municipal electric plant.

FARMINGTON, N. M. — The Western Colorado Power Company, Durango, it is understood, contemplates erecting a new high-tension transmission line from Denver to Farmington.

LOVELAND, N. M.—A movement has been started by the city officials for rebuilding the local electric light plant. Service has been discontinued for several months.

## Canada

BURQUITLAM, B. C.—The Council has asked the British Columbia Electric Railway Company, Vancouver, to submit an estimate of cost for the installation of a lighting service in Burquitlam.

BRANDON, MAN.—The Rennie Engineering Company, Winnipeg, has submitted a proposition to the City Council for the installation of a municipal electric power plant, to cost about $850,000. The proposal calls for gas-engine-driven generators.

ST. JOHN, N. B.—Preliminary plans have been completed for the proposed municipal Hydro substation. Tenders for construction of same, it is understood, will soon be called for.

PORT CREDIT, ONT.—Improvements to the municipal electric lighting system are under consideration by the Town Council.

# Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 2, 1923)

1,440,952. DYNAMO-ELECTRIC MACHINE; V. G. Apple, Dayton, Ohio. App. filed June 11, 1920. Windings impregnated with phenolic condensation product while in liquid state.

1,441,002. MEANS OF GROUNDING ELECTRICAL PILOTING CABLES; H. W. Kitchin, Washington, D. C. App. filed Jan. 29, 1921. By turning back on cable and electrically connecting conductor with armor.

1,441,025. CONDUCTOR-BAR HOLDER; H. F. Raab, Johnstown, Pa. App. filed Sept. 20, 1922. Means for holding conductors for electric cranes.

1,441,029. TRANSMITTER FOR TELEPHONY; H. J. Round, London, England. App. filed March 31, 1920. Transmitter used with thermionic generators in which direct current causes continuous waves to be generated while alternating current causes amplitude of these waves to be varied.

1,441,037. PROCESS OF BAKING CARBON ELECTRODES; C. W. Söderberg, Christiania, Norway. App. filed Dec. 4, 1917.

1,441,054. OUTLET BOX; J. Barry, Brooklyn, N. Y. App. filed Oct. 12, 1920.

1,441,087. WIRING SYSTEM; J. W. Hill, Salt Lake City, Utah. App. filed April 6, 1921. Transmitting circuit of wireless telegraphy.

1,441,131. ELECTRICALLY HEATED KETTLE AND THE LIKE; W. W. Soutter, Birmingham, England. App. filed Dec. 22, 1921.

1,441,150. INCANDESCENT ELECTRIC LAMP; W. D. Hawley, Syracuse, N. Y. App. filed June 10, 1920.

1,441,160. DENTAL X-RAY PACKAGE; Rochester, N. Y. App. filed May 15, 1920. Wrapper for film.

1,441,193. ELECTRIC CIRCUIT MAKING AND BREAKING DEVICE; C. W. Wyman, Claremont, N. H. App. filed Sept. 1, 1916. To prevent explosions where circuit is broken in gaseous regions.

(Issued Jan. 9, 1923)

15,524 and 15,525 (reissue). SYSTEM OF CONTROL; N. W. Storer, Pittsburgh, Pa. App. filed April 12, 1921. Successive groupings of railway motors form a non-geometrical series to provide several speed ranges.

1,441,200. COUPLING; W. G. Allan, Toronto, Ontario, Can. App. filed Feb. 3, 1920. Insulated coupling for metal tubes entering electrolytic cells.

1,441,233. LOW-VOLTAGE ATTACHMENT; M. McCright, Cincinnati, Ohio. App. filed Oct. 30, 1919. Pilot brush on direct-current commutator for charging batteries direct.

1,441,247. COMBINED LAMP AND BELL; C. Shiono, Los Angeles, Cal. App. filed Sept. 20, 1921. For bicycles and motorcycles.

1,441,270. TRANSMISSION SYSTEM; L. Espenschied, Hollis, N. Y. App. filed Sept. 26, 1919. Several messages sent over telephone wires by using different carrier frequencies.

1,441,289. CURRENT-COLLECTING HEAD; E. S. Lincoln, Mansfield, Ohio. App. filed Jan. 7, 1922. Means for conducting a heavy current from one to the other of two relatively moving parts.

1,441,310. MOTOR CONTROL; W. G. Thomas, New York, N. Y. App. filed April 21, 1920. Method of electrically locking rotors of two alternating-current motors.

1,441,398. ELECTRIC SWITCH; W. A. Chryst, Dayton, Ohio. App. filed May 22, 1920. Controls automobile ignition apparatus and lighting system.

1,441,399. ELECTRICAL RESISTANCE; W. Clark, London, England. App. filed April 3, 1921. Wheatstone bridge with visual indication of resistance in each branch.

1,441,408. METHOD OF AND APPARATUS FOR ELECTROLYZING LIQUID; H. H. Dow, T. Griswold, Jr., and E. O. Barstow, Midland, Mich. App. filed Aug. 12, 1915. Method for equalizing height of liquid in cells.

1,441,421. SEWING-MACHINE-MOTOR CONTROL; F. F. Hillix, Cleveland, Ohio. App. filed Sept. 14, 1921. Operated by lateral movement of foot or knee.

1,441,422. SEWING-MACHINE-MOTOR CONTROL; F. F. Hillix, Cleveland, Ohio. App. filed March 30, 1922. Controlled by lateral movement of foot or knee.

1,441,426. ELECTRICAL RECTIFIER AND POLE CHANGER; W. Kaisling, Chicago, Ill. App. filed April 12, 1918. Automatic auxiliary telephone-ringing equipment operated from batteries.

1,441,427. POLARITY INDICATOR; W. Kaisling, Chicago, Ill. App. filed Aug. 7, 1918. To show whether storage battery is charging or discharging.

1,441,429. ALTERNATING-CURRENT INDUCTION MOTOR; J. F. Kelly, Troy, N. Y. App. filed July 21, 1916. Two-phase motor can also operate as single-phase split-type motor.

1,441,436. JIG FOR USE IN ASSEMBLING AND ELECTRICALLY WELDING TOGETHER THE PARTS OF AUTOMOBILE BODIES AND OTHER STRUCTURES; J. Ledwinka, Philadelphia, Pa. App. filed March 15, 1921.

1,441,443. ELECTRODE CLAMPING DEVICE FOR ELECTRIC WELDING MACHINES; J. W. Meadowcroft, Philadelphia, Pa. App. filed Aug. 16, 1921. Device for releasably locking or clamping electrodes in machine.

1,441,451. IGNITION SYSTEM; W. W. Riedel, Dayton, Ohio. App. filed Jan. 8, 1921. Electrically ignited fuel burner for combustion engines.

1,441,460. SELF-COOLED ELECTRIC MOTOR; A. G. Sutcliffe, Chicago, Ill. App. filed Jan. 21, 1922. For motors used on direct-driven fans and blowers.

1,441,479. PROCESS FOR MAKING AN ALLOY-ING ALLOY; W. Bennett, Wellington, N. Z. App. filed Sept. 8, 1922. Made directly from the ores.

1,441,482. SPEED CONTROL OF DIRECT-CURRENT MOTORS; F. A. Byles, Schenectady, N. Y. App. filed Aug. 30, 1920. Vibratory regulator holds speed of motor constant.

1,441,500. TROLLEY RETRIEVER; G. E. Harpham, Los Angeles, Cal. App. filed May 16, 1918. Mechanism for lowering pole when connducting wheel leaves feed wire.

1,441,532. ELECTRICAL APPARATUS; P. R. Fortin, Schenectady, N. Y. App. filed July 1, 1920. Devices for varying the inductance of radio circuits.

1,441,546. REGULATION OF ELECTRIC CIRCUITS; L. W. Thompson, Schenectady, N. Y. App. filed Aug. 27, 1919. Voltage regulator for electric machine.

1,441,567. ELECTRODE; C. G. Fink, Yonkers, N. Y. App. filed Feb. 18, 1921. Insoluble anode for electrodeposition of copper from electrolytes containing chlorides and nitrates.

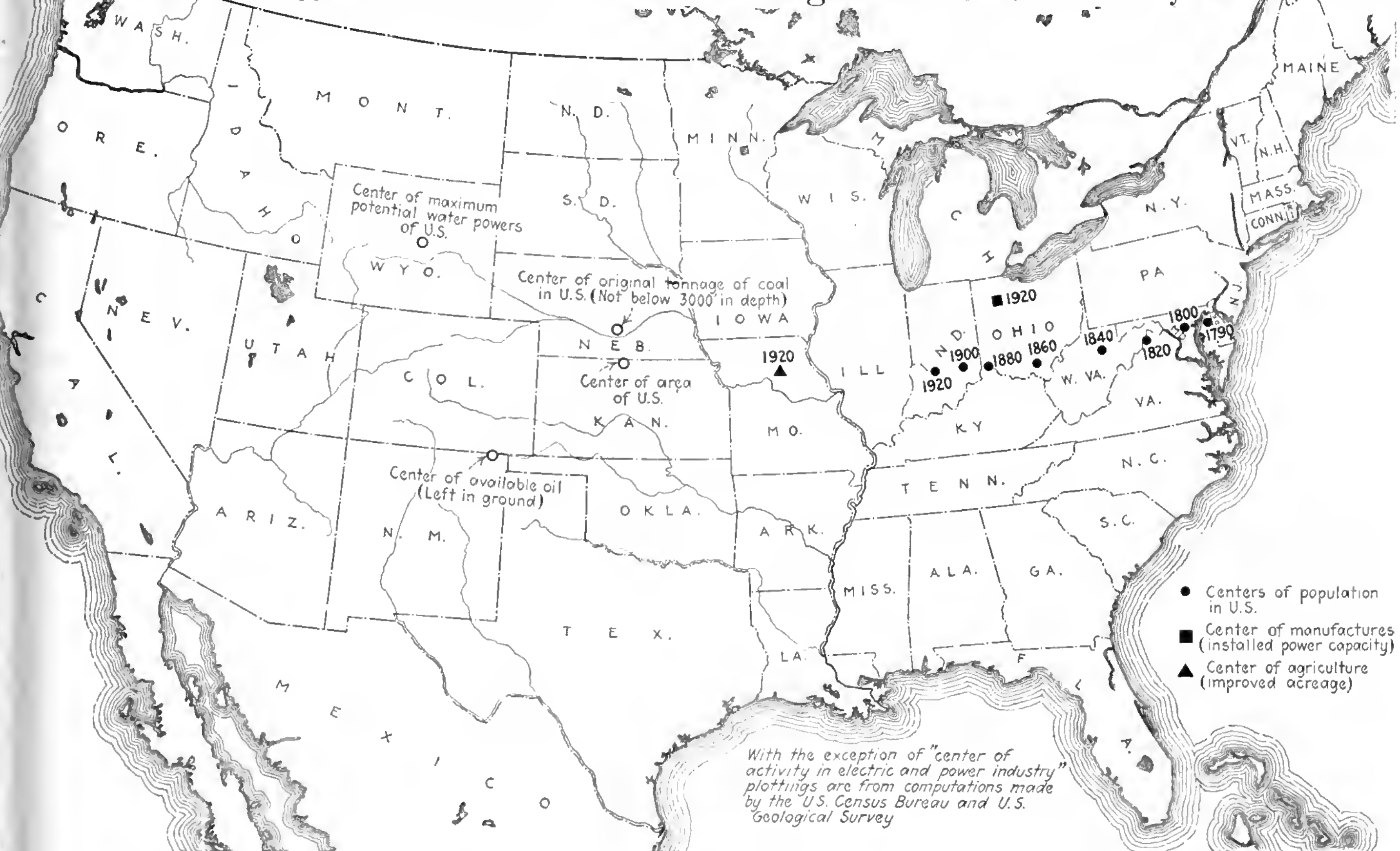
1,441,568. ELECTRODEPOSITION OF COPPER; C. G. Fink, Yonkers, N. Y. App. filed March 10, 1921. From copper sulphate electrolytes containing iron and copper sulphate.

1,441,610. ELECTRIC HEATING AND COOKING; W. B. Topp, Melbourne, Victoria, Australia. App. filed Jan. 16, 1922. Electrodes in water vaporize liquid to heat receptacle.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## Westward Trend of the Electric Light and Power Industry




### Location of Center of Population in United States

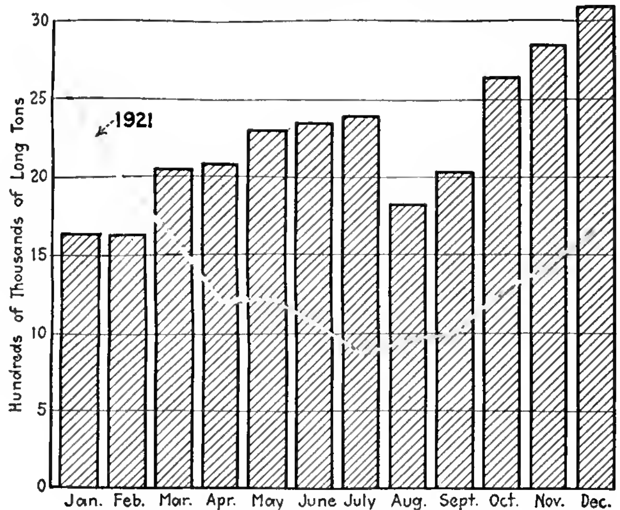
Computed by U. S. Census Bureau

| *Year* | *Latitude* | *Longitude* |
|---|---|---|
| 1790 | 39° 15′ | 76° 11′ |
| 1800 | 39° 16′ | 76° 57′ |
| 1820 | 39° 06′ | 78° 33′ |
| 1840 | 39° 02′ | 80° 18′ |
| 1860 | 39° 01′ | 82° 48′ |
| 1880 | 39° 04′ | 84° 40′ |
| 1900 | 39° 10′ | 85° 48′ |
| 1920 | 39° 10′ | 86° 43′ |

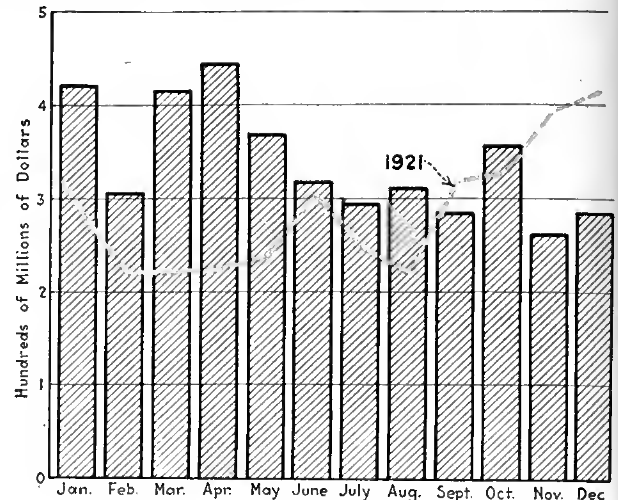
## "Go West, Young Man"

WHEN Horace Greeley in a personal letter advised a young friend that the West offered him the largest opportunities for success, he foretold the westward trend of American industry. Each decade has witnessed the centers of our population, agriculture and manufactures move further and further westward from their point of origin, the borders of the Atlantic. It is but natural, therefore, that the center of activity in the central-station industry should also follow this general trend. But this industry has exhibited a much greater acceleration in movement than the population or the other primary industries of the country. Originating in New York City in 1882, the center of activity in the central-station industry quickly jumped westward. In 1907 it was in Indiana, and in 1921 it had advanced into Illinois and was in Champaign County, about 3 miles northwest of Urbana, or 116 miles south of Chicago. This center is at present many miles west of the center of population and manufactures, an excellent testimony to the rapid electrical development and optimism of the commonwealths of the Far West.

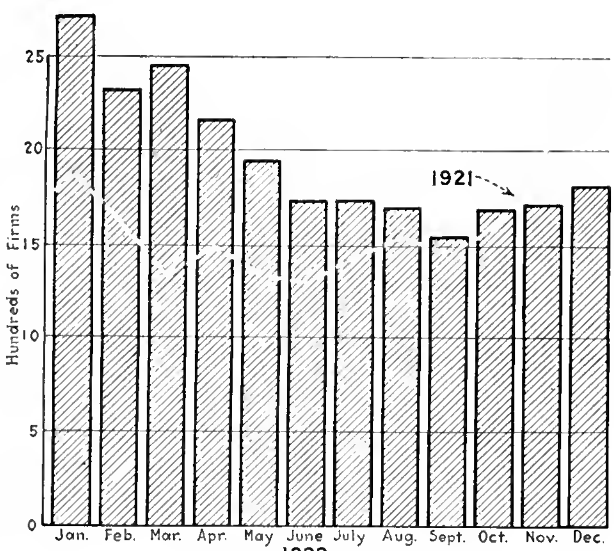
# How the Primary Industries are Trending



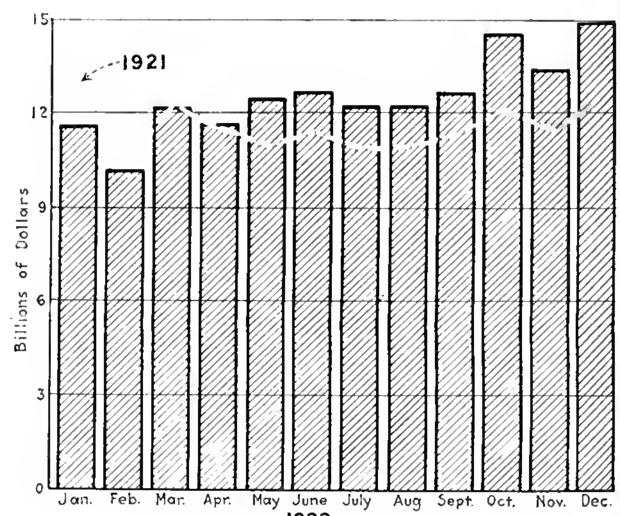

1922
Pig-Iron Production



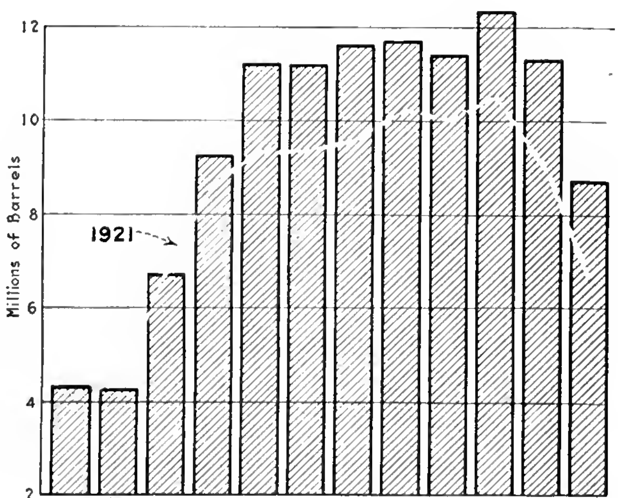

1922
Total Bond Sales, New York Stock Exchange




1922
Business Failures




1922
Bank Clearings
(Outside of New York City)




1922
Portland Cement Production

## Pig-Iron Production Indicates Prosperity Ahead

PIG-IRON production, which is considered by many prominent economists and statisticians to be a fair barometer of general business conditions, showed a remarkable recovery during 1922. The iron and steel industry was from 60 to 70 per cent more active than in 1921, but was less active than in the boom year of 1920. Last December, however, pig-iron production touched the high point of the year and appeared to be well on its way to new high figures for the industry. Unfilled orders of the United States Steel Corporation rose about 60 per cent during 1922.

The number of business failures during the past year was 27 per cent larger than 1921 and exceeded any previous year since 1915. The amount of defaulted liabilities exceeded the large defaults in 1921 by 5 per cent. But it is encouraging to note that the number of failures steadily declined during the year and during November and December was less than those reported for the same months of 1921.

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# Farm Power as an Issue

SOMETHING like six and a half million families are engaged in agriculture on the farms of the United States. The farm is a factory as well as a home and the use of power is almost continuous. Practically one-third of the entire population of the country are therefore looking to the day when electric service will be made as available to them for universal use as it has been in the industrial workshops of our cities.

For the farmer knows that adequate electric power will bring to him the greatest contribution to farm efficiency since the introduction of the self-binder. Not even the gasoline tractor can challenge it.

ACCORDING to the United States Census of 1920, there are at present in use on the farms of America 19,767,161 horses, 5,432,391 mules, 246,083 gasoline tractors and 139,169 motor trucks, which represent on a conservative estimate 25,000,000 primary horsepower. In addition, there are 2,146,362 passenger automobiles and a countless number of steam tractors, stationary gas and steam engines, windmills and electric motors. Each of these prime movers, including the automobile, is an essential unit in the farm power plant under present conditions. Therefore, the total primary horsepower engaged in agriculture exceeds the 29,504,792 primary horsepower used in the manufactures of the country by a considerable amount.

Farm-management studies show that the cost of power and machinery represents from 30 to 50 per cent of the present expense of farm operation. Annually from 50 hp.-hr. to 60 hp.-hr. per crop acre is required to produce the crops of this country over the 503,073,007 acres under cultivation. In the neighborhood of one-third of this gigantic load is admirably adapted to the use of electric power. The farmer is impatiently waiting for the expansion of urban electric systems so that they will reach out into the country and assist him with his burden.

WHEN more than one-third of the people of the country are needing and clamoring for an organized public utility service which the other two-thirds are enjoying, the time has passed when the utility man can profitably discuss whether or not the service shall be given. It has become entirely a question of how it can be done. The farm needs power. The farm home also suffers for want of all those comforts which electricity brings and which have become so prominent a feature of the public service which the central station renders. And the entire country is affected by these conditions. Therefore the problem is to find as speedily as may be the way to carry central-station service to the farm on a basis profitable both to the seller and the user of the power.

The American Farm Bureau Federation and the N. E. L. A. rural lines committee are at work endeavoring to find a method of reconciling the agricultural and the engineering difficulties and thus making possible this great economic development. They realize that electric power will bring a more fundamental revolution in farm life and a saving of waste in food production greater even than the coming of the motor car has wrought, and they are sensible of the urgency of their responsibility. Meanwhile the executives of utility companies are under obligation to familiarize themselves individually with the needs and opportunities of their own neighborhoods, so that when a practical farm service policy is finally perfected they may be ready to apply it intelligently in the service of the surrounding farming country that must look to them for more and better power.

# Orin B. Coldwell

*An engineer of note and an executive of broad experience who is a recognized leader in electrical activities in the Northwest.*

ABOUT 1892, when the electrical industry was still in its pioneer state, O. B. Coldwell, then a high-school boy in Oregon, entered the shops of the Willamette Falls Electric Company, working on arc lamps, meter testing, transformer and armature winding. With a short interval for further education, he has been associated with the electrical industry in the Pacific Northwest ever since. At the present time he is vice-president of the Portland Railway, Light & Power Company in charge of light and power. He is also a recent vice-president of the A. I. E. E. for that district and prominent in the N. E. L. A.

The foundation for this achievement was laid at the time he served as repairman, groundman, lineman, inspector and troubleman, following all this up by a year or two of service as station wireman and operator. About this time he began to think of the need for more knowledge, and the fall of 1897 saw him entered as a student in Stanford University, where he remained for three years. In 1900 he entered Cornell, from which university he was graduated in electrical engineering in 1902.

Upon his return to Portland he resumed work with the Portland General Electric Company and became assistant superintendent of that company. Later he became general superintendent of the light and power department of the Portland Railway, Light & Power Company. Since that time he has become vice-president of the company, maintaining control over the power end of the business. He has, besides, played a very prominent part in the Northwest Electric Light and Power Association ever since its beginning.

Not the least of Mr. Coldwell's contributions to the industry has been in the engineering and economic development of his district. It is under his direction that the work on the present 75,000-kw. Oak Grove project of the Portland Railway, Light & Power Company is going forward. In spite of his standing as an engineer, however, his major work has been along executive lines. He has demonstrated exceptional ability in drawing about him and holding a group of competent and loyal subordinates, and their harmonious co-operation with one another has unquestionably been due largely to Mr. Coldwell's organizing ability. He has a tremendous capacity for work, is filled with nervous energy and has a consuming hatred for red tape. To his clear engineering analysis, combined with executive ability and a way of "getting things done," the electrical industry, and particularly the electrical industry of the Pacific Northwest section of the country, owes much.

# Editorial Comment

Electrical World, February 3, 1923

Volume 81 Number 5

## Prevalence of Dangerously Low Rates

THE data on central-station output and income that were published in the first issue of the year show in a very remarkable manner the cheapening of electric service due to improvements in the art and to increase in facilities. In fact, the showing is so striking as to give rise to certain misgivings over the rates charged to large users of energy. With a central-station output of approximately fifty billion kilowatt-hours and a gross income of one billion dollars, the average rate for the energy sold during 1922 was thus two cents a kilowatt-hour. For domestic energy the rate was considerably higher than that, indicating that the rate to large power users is becoming precariously low. Even with energy generated from water power there is a serious question as to whether the exceedingly low rates for large power users are justifiable on competitive or any other grounds. The margin is becoming entirely too meager for proper sustenance. Prices for all other commodities have gone skyward whereas the electrical industry has strained every effort and taken advantage of every discovery of science to keep the cost of its output down. The public, or at least the large power user, has derived more benefit from this effort than has the industry, and it would be well for the latter to take thought for its own safety as well as for its obligations to the general masses of the public.

## The Tax-Exempt Security Amendment Has Started, but Needs Help

WITH a rocky road ahead and with many barriers to surmount, the proposed amendment to the United States Constitution designed to prohibit further issues of tax-exempt securities was started on its way last week by the affirmative vote of the House of Representatives. For this much those interested in seeing that investment funds are devoted to constructive and reproductive enterprises should be thankful, but more vigorous action is needed in the future than has been necessary in the past. For the further the amendment travels on its way through Senate, White House and thirty-six legislatures the more determined will be the opposition to its passage. The Senate committee has referred the amendment to a sub-committee, and there is activity in various places all over the country aimed against this bill. Fundamentally the debate is whether to do away with the higher surtaxes on incomes or to do away with the tax-exempt security.

Recently Garet Garrett in the *Saturday Evening Post* and Prof. E. R. A. Seligman in the New York *Times* have made convincing analyses to show the positive public good which would result from passage of the amendment in addition to the cessation of the harm which the present system entails. Answers to these and similar defenses of the proposed amendment have for the most part failed to meet the fundamental issues.

Public utility men, engineers and all others in the electrical industry are usually accustomed to face facts and possess the ability to look ahead and not at immediate expediencies. They are in a most advantageous position to see and foresee the evils of the present combination of tax-exempt securities and the graduated income tax, and they will fail in their duty to their industry and to the general social welfare if they neglect study of this question and action upon it. This is not a minor matter.

## Possible Consumption of Electricity in Agriculture

FIFTY kilowatt-hours per acre per annum as a practical agricultural use of electrical energy sounds like a fairy tale in the light of the present state of development in America. Nevertheless, it is a serious estimate made for British farms, according to a paper presented before the Institution of Electrical Engineers by R. Borlase Matthews. This paper affords food for thought that must not be missed by central-station men in the United States. The author has had the good fortune to have an experimental laboratory in the form of a 600-acre farm that has given him actual experience in carrying out not only the minor farmstead operations but the major operations of plowing and harvesting. It has also enabled him to try out some operations such as hay curing that seem, in the light of our practice, rather reasonable.

The processes employed in this work are still in an experimental stage, Mr. Matthews declared frankly, but his conclusions leave no doubt as to his belief that electrical energy is destined to play an important part in British agriculture. Competition with the rest of the agricultural world, high railway rates, labor costs and high taxation are facts just as disagreeable to the American farmer as to his British colleague. Profit to the American farmer in the past has come from appreciation in land values rather than from farm operation. The day of cheap land is past, and the American farmer is in a position where profitable farm operation is a vital question. Cheap mechanical power and better mechanical equipment are factors just as important to him as to the British or continental farmer.

It may be that the estimate put by Mr. Matthews on the possible uses of energy is out of all reason, but the realization of one-half the figure would be double the fondest dreams of the most optimistic central-station man in the American field. Anyway, it would be probably ten times the present average usage outside the irrigation field. There is nothing in the methods suggested for plowing by Mr. Matthews that is at all out of line with developments in other fields. For example, the suggested use of cables for plowing is at least comparable with their use in mine work, and as a matter of fact steam rigs of this kind are in use. The real question is how the equipment can be reduced in cost to make it practical for average farm use and make the cost of the operations lower than when carried out in any other way. The account of British

practice deserves careful consideration in this country and ought to stir up research work in American agricultural experiment stations.

## No Man Can Long Hold Back the Progress of the Industry

A CONTRACTOR in a New England city wrote in the other day in regard to a "home electric" demonstration which he was organizing. He said: "This will be the first 'home electric' ever exhibited in this locality, . . . We are alone in the project as it seemed too great a task to get the lighting company and the other contractors to agree on essentials. . . . We will not solicit sales of any kind and will hope to reap our reward in publicity and future business." What a picture that statement portrays!

The "home electric" has proved itself the most effective method ever devised for demonstrating to large numbers of people the uses of electricity in the modern home. In city after city the central-station company has got behind the idea and with the co-operation of the local contractors and dealers made it a family affair. More than eighty such homes were exhibited last year to an average attendance of twenty thousand people. The central station is ever the greatest beneficiary, and it would seem that it would be hard to find any executive of any light and power company anywhere who would not eagerly grasp the opportunity to do wheelhorse work in the organization of such a "home electric" urged by a local contractor, and do it without quibbling.

It simply proves again that the electrical industry will wait for no man. The central station is the mother of the local electrical family. It should inspire, encourage and support all local work that has as its objective the promotion of the electrical idea. But where the manager sleeps in a corner, blind to the vision of opportunity which his industry holds out to him, some other man inevitably will come some day to raise the banner and carry it forward. In the meantime how much time is lost for all!

## Another Step in Inductive Co-ordination

THE latest report of the joint committee representing the National Electric Light Association and the American Telephone & Telegraph Company adds to the statement of principles covered in the two previous reports an account of approved practices in the construction and operation of both signal and power systems. For the first time since the issuance of the rules of the California Railroad Commission there is now available a set of principles and rules governing inductive interference which cannot be called one-sided. The practices included in the new report cover both those applicable to signal systems and those applicable to supply systems, as did the principles covered in the report made before the Atlantic City convention of the N. E. L. A. last May.

Undoubtedly many will find fault with the new report because certain things are left uncovered and others may not seem to be adequately covered; but the document is in the nature of a progress rather than a final report, and preparations have already been made for research and development which will shed light on subjects that the committee frankly states have not been covered for lack of sufficient data. The important fact that should be recognized is that the committee, after much hard work, has made generally available material on which the practical handling of relations between signal and power systems can be carried out. It represents the best the engineering talent of both industries knows. It is therefore the duty of every man who must face such problems to familiarize himself with the reports of the joint committee and to get behind the principles and practices unreservedly. Only by enthusiastic acceptance and intelligent application can the improvements needed be ascertained. The committee is entitled to the whole-hearted support of the entire electrical industry and, more than that, to honest, constructive criticism based on use and designed to improve the practices on both sides so that the public will have the best signal and power services that can be given.

## Evaporator Systems Prove Economical

OPERATING results show that evaporator systems for feed-water "make-up" are successful competitors of water-treating plants. This is true particularly where boilers are operated at high ratings and where electrically driven auxiliaries are used. The capital and operating charges with either system are about equal, but indications point to a reduction in the cost of evaporators which will give the advantage to them. There are other benefits, such as better make-up, reduction in the frequency of "blow-downs" and production of fewer concentrates in the boilers. Room remains, however, for improvement in evaporator operation. Too stiff piping may cause air leakage, and for good results the water they contain must be maintained at the proper level. Neither system will remedy condenser leakage —this is best done by providing treating arrangements for each main unit.

Successful evaporator installations have been made on the basis of the evaporator having little effect on the amount of steam that can be bled from the main units or exhausted from the house turbines. With a low-pressure evaporator and single-stage bleeding sufficient capacity can be obtained, but the recent trend toward multistage bleeding introduces complications. With multistage bleeding it is difficult to get sufficient temperature head, considering the amount of available condensate, to absorb the heat in the vapor from the evaporator, and it is difficult too to get sufficient evaporator capacity. If high-pressure evaporators are used, the temperature of the feed water will be raised, which may so reduce the recovery from the economizers as appreciably to lower the station thermal efficiency.

The great advantages of the evaporator systems lie, as already intimated, in the reduction both of concentrates and of the frequency of blowdowns. The blowdowns affect the station economy, and more and more it is realized that in many stations concentrates are a source of trouble. They are detrimental to piping and valves, clog the superheaters and cause trouble in the turbine blades and condensers. Experience in the use of evaporators shows instances where with a blow-down only once in two weeks the amount of concentrates is very low.

Results from the existing installations point to a more extensive use of evaporators and warrant their serious consideration by power-station designers, even though their comparatively recent entry into the game handicaps their acceptance by conservative engineers.

### More Investigation Needed Before Porosity Tests Will Be Conclusive

SOME very interesting porosity tests were described and discussed last August at the Vancouver convention of the American Institute of Electrical Engineers. They deserve careful attention from engineers. The authors, C. C. Farr and H. E. R. Philpott, start with the assumption, quite generally accepted, that many insulator troubles are due to porosity in manufacture and that an accelerated porosity test is highly important. They kept unbroken insulator sections or disks in an aqueous solution of fuchsin dye, at pressures as high as 2,000 lb. per square inch, for several days at a time, thus apparently obtaining the same penetration of moisture as would require perhaps months or years in actual service. They seem to have proved to their satisfaction that insulators which stood such a "soaking" test without appreciable penetration also withstood a subsequent high-voltage test, and vice versa. We seem to have here a promising criterion, both for the maker and the user, of the service to be expected from an insulator.

Of course, penetration tests for porcelain, with and without liquid pressure, have been employed before and are in regular use in some research laboratories in this country, but the assurance of the authors that such a test is conclusive will require further and careful studies. Incidentally, this test again brings to mind the possibility of improving a newly finished insulator before moisture has penetrated into it. An impregnation with some light oil or with molten paraffin (as already suggested by E. E. F. Creighton) under high pressure should seal the pores for a subsequent entry of moisture and thus prolong the useful life of the insulator.

### The Coming of the Neon Lamp

FROM time to time a great deal has been heard about small neon lamps being put on the market and becoming fairly common in Europe. In this country they have so far been conspicuous mainly by their absence, but they are beginning to appear and may take their place among the regular lighting devices used for special rather than for general purposes. The brief report on some of these lamps, as tested in this country, printed last week is, therefore, a timely one.

Of course, the neon tube as a spectacular lighting "stunt" had, through the energy of M. Claude, been made known in Europe before the war, but these early tubes were of fairly high voltage and did not have a normal place in central-station activities. The lamps referred to by A. Palme in the last issue are designed for 220-volt circuits, alternating or direct current, this voltage being a usual one in foreign distribution systems. The lamps are likely to be used mainly for advertising and similar purposes, it being possible to obtain a letter-shaped lamp working at an expenditure of not more than 2 watts or 3 watts per letter in the smaller sizes and giving the characteristic neon glow of vivid orange with the faint violet fringe about the electrodes due to a small amount of more refrangible light. The effect is characteristic and pleasing. These lamps may also find useful functions as fuse and switch indicators, polarity testers, and for similar purposes for which it is not now easy to get a lamp of really small size suited to the ordinary distribution voltages. In the United States a night lamp of this type has been adapted to work on 110 volts alternating current, giving a small fraction of a candlepower for an expenditure of energy of less than 2 watts.

Altogether, it would appear that the neon lamp is likely to have a real place in auxiliary service. The actual efficiency is low, the specific consumption of the small lamps here described being about 10 watts or 15 watts per candlepower, but where the only requirement is a very small amount of light for purposes that cannot really be considered within the scope of illumination high efficiency is not important, while the need of a lamp of very low power on circuits operated at the ordinary distributing voltages is a real one.

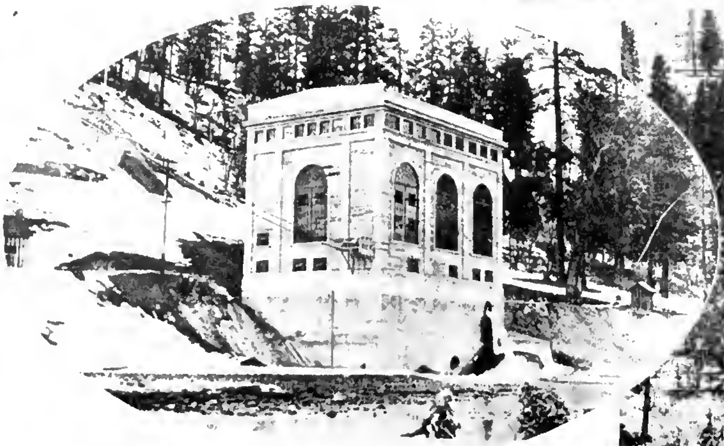
### Another New Electron Tube

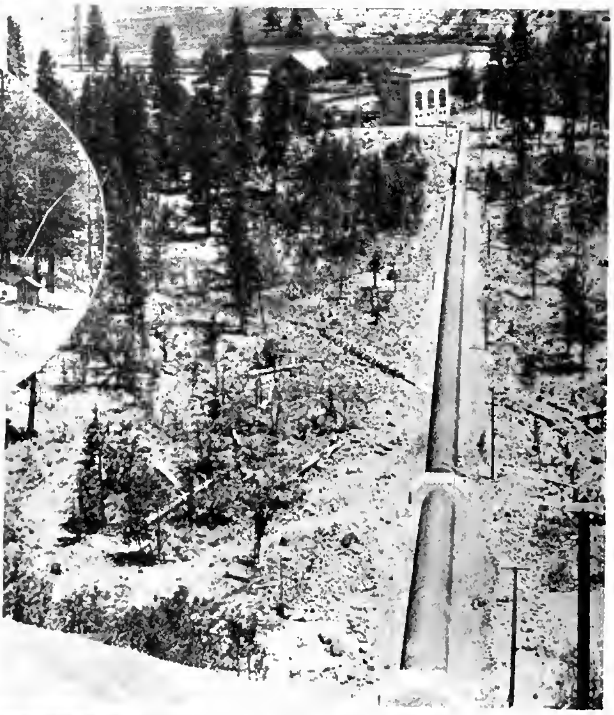
THE development of the three-electrode tube presents a striking example of the dependence of applied science upon research in the field of pure science. The unsymmetrical conductivity of the residual gas in the bulb of the carbon incandescent lamp was noticed by Edison years ago, and this was followed by the discovery by Fleming of the valve action of hot filaments. But it was many years before the work of Thompson, Townsend, Richardson and others on the conductivity of gases and the emission of ions from hot bodies laid the real foundation for the De Forest audion and the subsequent development which is still under way and which really marks a new era in scientific and engineering achievement.

As this careful laboratory study has proceeded hand in hand with the observations of practice, not only have new possibilities been discovered but the limitations of the principles involved have also been laid bare. Power tubes of larger and larger capacity are appearing, but at the same time, when used as detectors, conductivity and sensitivity are seriously limited by space charge and the shape of the current characteristic. The operation of the best-known type of tube depends entirely on the electron emission from the hot filament. But it was soon realized that the conducting properties of gas at low pressures could also be used. Moreover, the control of the filament emission may be accomplished by means of the magnetic field, as well as by the grid potential. Various combinations of these principles have led to a variety of tubes, principally for use in the radio field.

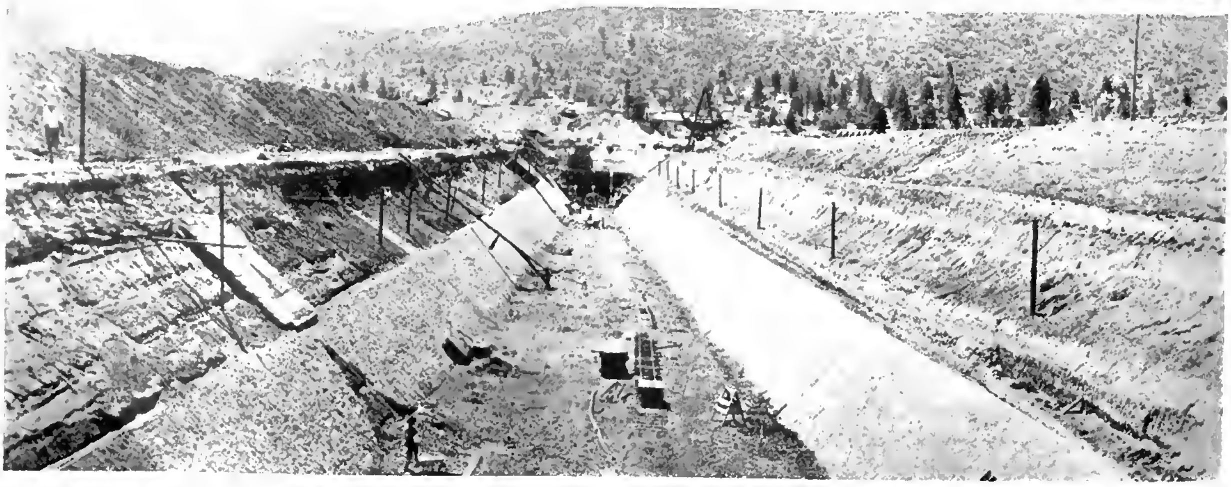
It is readily seen that with two different sources of ions in the same tube, and both under control, it should be possible to alter the form of the characteristics to meet particular needs. The use of this principle is indicated in a new tube described by H. P. Donle at a recent meeting of the Institute of Radio Engineers. Moreover, in this tube a further new source of ionization, the vapor of pure metallic sodium, is used. The tube has the usual hot cathode filament and a so-called "collector" instead of a grid, but the plate is replaced by a pool of metallic sodium which is also heated by the filament current, through the wall of the tube. Greatly increased sensitivity as a detector and other desirable characteristics are claimed by the author, who, however, does not attempt an explanation of the principles underlying its properties. Sodium vapor is known to be readily ionized in electric fields of relatively low intensity, and apparently it is this property in conjunction with control of the filament electron emission which permits the performance shown.

## Pit River Basin Development Furnishes 100,000 Hp. Now and Ultimately Will Furnish 500,000 Hp.





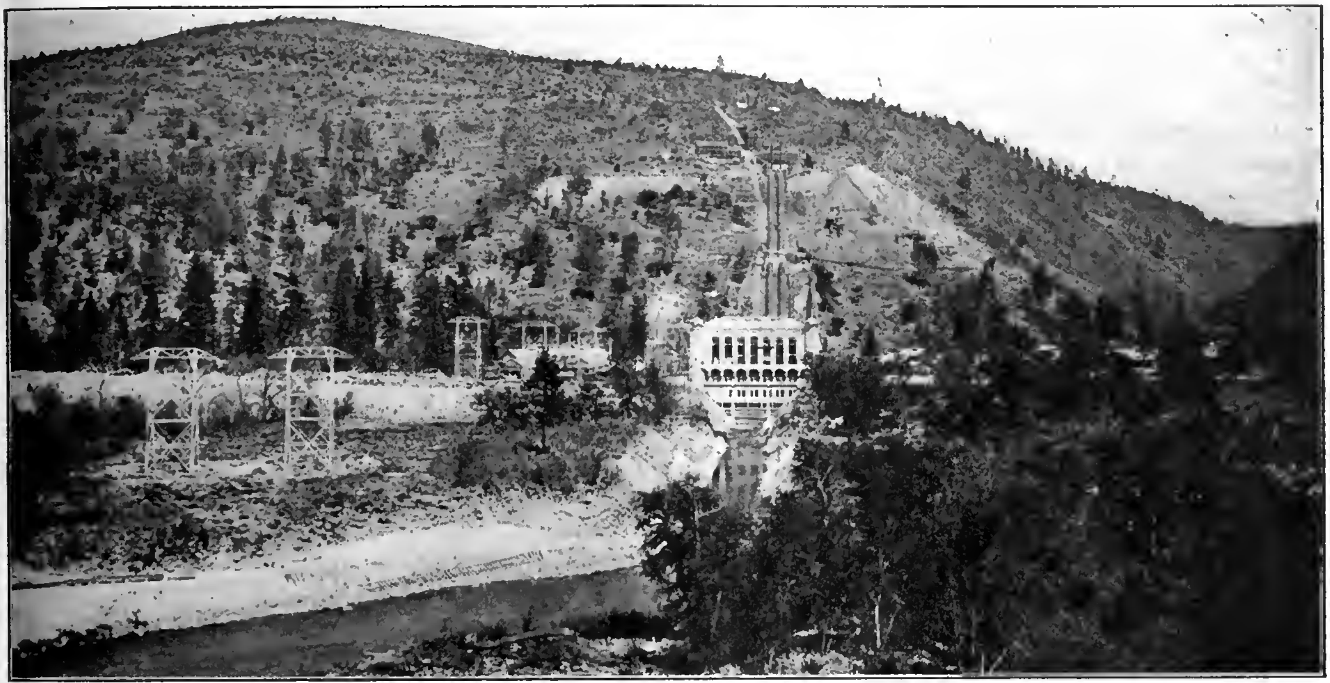
POWER stations will be located at several points in the basin and the energy will supply the San Francisco Bay district over a 220,000-volt transmission line. Views are shown of several existing developments: At the top a view of the head works and intake dam for Pit No. 1 plant is shown; in the center are the two power houses on Hat River which transmit their energy to Pit No. 1 plant at 60,000 volts; at the bottom is the open canal construction for Pit No. 1 plant.



# Pit River Power Developments—Part II

An Analysis of the Power Possibilities of This System and a Description of the Plants at Hat Creek and Pit River Utilized in Its Development—Ultimate Possibilities Amount to 500,000 Hp.

By FRANK G. BAUM* and S. BARFOED†



POWER HOUSE NO. 1 ON PIT RIVER AND THE 220,000-VOLT TRANSMISSION LINE

AMONG several important water-power developments carried out in California recently, one, the initial step in harnessing Pit River, has just been completed by the Mount Shasta Power Corporation, a subsidiary of the Pacific Gas & Electric Company. This first step forms a complete unit, composed of three power plants of 95,000 kva. capacity, a transmission line of 200 miles for 220 kv., and a substation for 100,000 kva. at the end of the line. Power conditions in this region are most unusual.

### WATER AND POWER CONDITIONS IN PIT RIVER BASIN

The Pit River basin in northeastern California is part of one of the largest lava fields in the world, its southern end being marked by the north fork of the Feather River, its northern end extending into Canada.‡ This immense lava field has completely covered the original country.

According to geologists, northeastern California was an area of low elevation (an extension of the Sacramento Valley into the Willamette Valley) after the Coast Range and the Sierras were formed. Then came the lower Cascade Range, which extends from Washington to Oregon into northeastern California, its southern line lying roughly along the north fork of the Feather River, and closed the gap between the Coast Range and the Sierras. The southern extremity of the Cascade Range thus formed a dam—in fact, a series of dams—across the outlet of what was the extension of the Sacramento Valley into northeastern California and formed the Pit River basin, covering an area of about 5,000 square miles. Similar small lava dams have later been formed across several of the branch streams of the Pit, namely, Fall River, Rising River, Crystal Lake and Burney Creek.

The precipitation on this immense lava plateau largely sinks through the lava and, being cut off by direct outflow by the lava flows across the old stream channels, is stored in lava-covered storage basins, emerging in very large springs, almost perfectly regulated. Such, roughly, is the explanation of the remarkable water conditions of the Pit River basin, on which about 80 per cent of the low flow of the Sacramento River at Red Bluff depends.

What probably has happened in the Pit River basin, formed by the inflow of the Cascade Range, as explained above, is illustrated in a small way by Burney Creek. A lava flow across the old stream bed lifted it more than a hundred feet, which has resulted in forming Burney Falls. At the falls a spring of about 160 cu.ft. a second rises or comes through the lava layers with almost constant regulation. This amount of water is more than is used by all the San Francisco Bay cities combined. The elevation of the stream bed by the lava flow probably once formed a lake many

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‡The Pit River, like the Columbia, has cut through the range of mountains called the Cascades.

miles in area. This area has since been filled in by lava débris and now forms a valley, being much larger, however, than the valley that is commonly called Burney Valley. The underground storage basin formed by the lava flow across the stream bed gives us the regulated waters of Burney Falls.

In the Pit River basin, about 8 miles east of Burney Falls, there is a similar spring at Crystal Lake, near Cassel, giving about the same quantity of water as Burney Spring. At Rising River, about 3 miles above Crystal Lake, another spring of about 350 cu.ft. a second rises, and Fall River, about 20 miles to the north, is formed by similar springs, giving an almost perfectly regulated flow close to 1,500 cu.ft. a second. Fall River is the most remarkable river formed by springs of which we have knowledge. The four springs mentioned total about 2,300 cu.ft. a second, and other springs in the basin raise the total for Pit River above Peck's bridge to about 2,500 cu.ft. a second. Pit River, formed mainly by the above springs, has its source east of the summit of the Cascades and has cut its way through the range to the Sacramento Valley.

The total economic power drop available is more than 2,000 ft., and we have therefore possible dependable power developments on the Pit River close to 500,000 hp. constant. This power it is planned to take to the San Francisco Bay region, the initial step now being in operation. The power output could be practically constant, as storage sites are available to make up the summer deficiency of about 10 per cent, which is largely due to irrigation and evaporation. The water supply of the Pit and its branches is for power purposes the most continuous contained by any stream known. This stream also furnishes underground water storage for the irrigation of the Sacramento Valley lands of more than 1,000,000 acre-feet per year.

These spring-fed streams therefore demand a different solution in their development from that demanded by most other streams in California. There will be no large storage reservoirs with costly dams, and only very moderate floods occur. Such floods as do occur come chiefly from the upper reaches of the Pit, where the character of the watershed changes. The maximum flood before the inflow of Fall River is about 30,000 cu.ft. per second.

The three first developments utilize water from tributaries only, and these streams are without floods as the term is ordinarily understood, their water surface varying only from a few inches to half a foot during a season. There is little surface run-off on these tributaries, as rain and melted snow at once sink into the porous lava, find underground channels and come to the surface at some place where a tighter basaltic flow or other deposit forms a dam across the old stream channels or canyons.

TABLE II—EQUIPMENT INSTALLED

| Plant | Main Turbines: Maximum Hp. | Speed, R.P.M. | Draft Tube | Main Generators: Kva. | P.F. | Voltage | No. | Total Kva. |
|---|---|---|---|---|---|---|---|---|
| Hat Creek No. 1 | 15,000 | 225 | Straight and flaring | 12,500 | 0.8 | 6,600 | 1 | 15,000 |
| Hat Creek No. 2 | 15,000 | 225 | Straight and flaring | 12,500 | 0.8 | 6,600 | 1 | 15,000 |
| Pit River No. 1 | 40,000 | 257 | Hydraueone | 35,000 | 0.9 | 11,000 | 2 | 70,000 |

The tributaries utilized in these first developments are Fall River and Hat Creek. These two streams furnish the major part of the low-water flow of the Pit. (See map on page 266.)

Fall River is only 15 miles long from its spring source to the Pit and comes from the north, rising in the upper end of Fall River Valley, formerly a large lake. It enters the Pit over a 55-ft. fall. The combined streams have cut their way through the Mount Lassen volcanic ridge, forming a gorge with nearly vertical walls where the successive eruptions show in cross-section like a layer cake.

Hat Creek enters about 8 miles below, coming from the south. The upper reaches drain the north slope of Mount Lassen. The real flow of Hat Creek comes from Rising River, 6 miles upstream from the mouth, and from Crystal Lake, 3 miles upstream. (See map for series of plants that it is proposed to develop on Pit River.)

### Hat Creek and Pit River No. 1 Developments

The total drop utilized at Hat Creek is a little more than 400 ft., split by nature into two heads of about 200 ft. each, and 2½ miles apart. The topography is such that they could not have been combined, and the water from Crystal Lake and other springs could not have been utilized through the conduit.

The power developed is not fed directly to the transmission line to the bay region, but is sent over a 60,000-volt line to Pit River plant No. 1, where it is stepped down to 11,000 volts, and over the 11,000-volt bus system to the 220,000-volt transformers and to the line for transmission to the San Francisco Bay district.

The name of the plant known as Pit River No. 1 is due to the fact that the power house is on the Pit, although it utilizes Fall River water. A tunnel pierces the intervening ridge, as shown on map. The 220,000-volt transmission line starts here, and the plant is an energy center for four plants, Hat Creek Nos. 1 and 2

TABLE I—HYDRAULIC STRUCTURES

| Plant | Diversion Dam: Kind | Maximum Height, Ft. | Length, Ft. | Conduit: Kind | Cross-Section | Length, Ft. | Maximum Capacity, Sec.-Ft. | Head, Ft. | Pipe Pressure: Kind | No. | Diameter | Length, Ft. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hat Creek No. 1 | Rock-filled timber crib | 7 | 211 | Unlined canal | 17-ft. bottom width, 9.5 ft. deep, side slopes 1½:1. | 2,750 | 600 | 215 | Riveted steel | 1 | 10 ft. to 8 ft. | 1,650 |
| Hat Creek No. 2 | Rock-filled crib and piles | 16 | 460 | Timber flume | 7 ft. x 16 ft., 3 in. | 4,700 | 800 | 194 | Riveted steel | 1 | 10 ft. to 8 ft. | 400 |
| Pit River No. 1 | Concrete | 15 | 600 | Lined canal and tunnel | 50-ft. to 22-ft. bottom width, 10 ft. to 25 ft. deep. | 1,100 | | | Riveted and welded steel | 2 | 10 ft. 9 in. to 9 ft. | 330 |
| | | | | | Horseshoe 154 sq.ft. (equal to 14 ft. diameter). | 10,160 | 1,800 | 454 | | | 9 ft. to 8 ft. | 1,140 |

and Pit River Nos. 1 and 2, of which Pit River No. 2 is yet to be built. The principal facts concerning these plants are given in Tables I and II, and their location is indicated in the map.

It is thought that the electrical features of these plants will be of greater interest to the readers of the ELECTRICAL WORLD than the hydraulic feature, and the former will therefore be described at greater length.

### Equipment of Hat Creek Plants

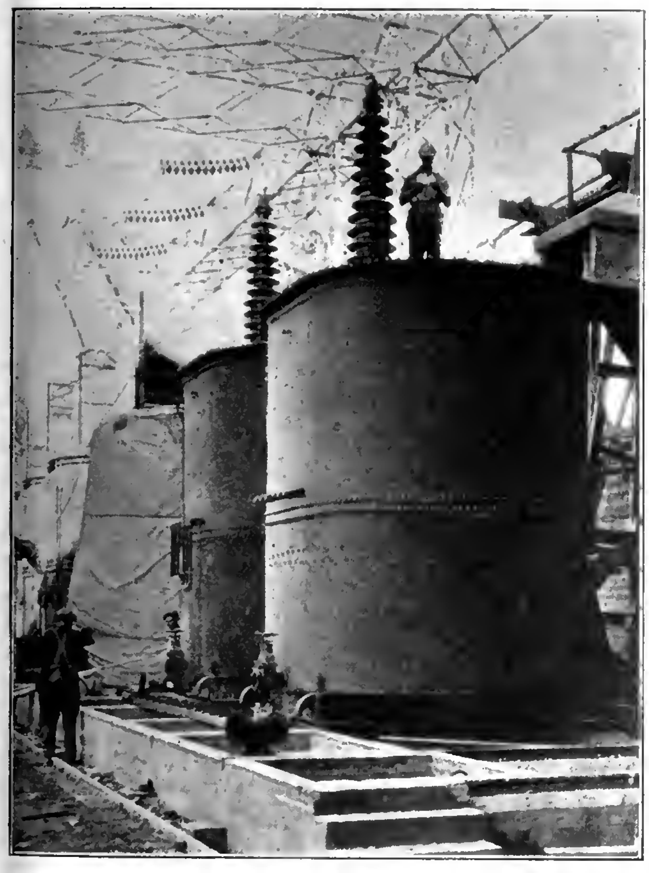
As stated previously, the power from Hat Creek plants Nos. 1 and 2 is transmitted to Pit River No. 1 over a 60,000-volt double-circuit tower line about 3½ miles long. This course was taken so that 60,000 volts would be available for distribution and also to reduce to a minimum the trouble from atmospheric disturbances, thus placing reliance on the step-up and step-down transformers rather than exposing the 11,000-volt generator windings, if the transmission was at generator voltage.

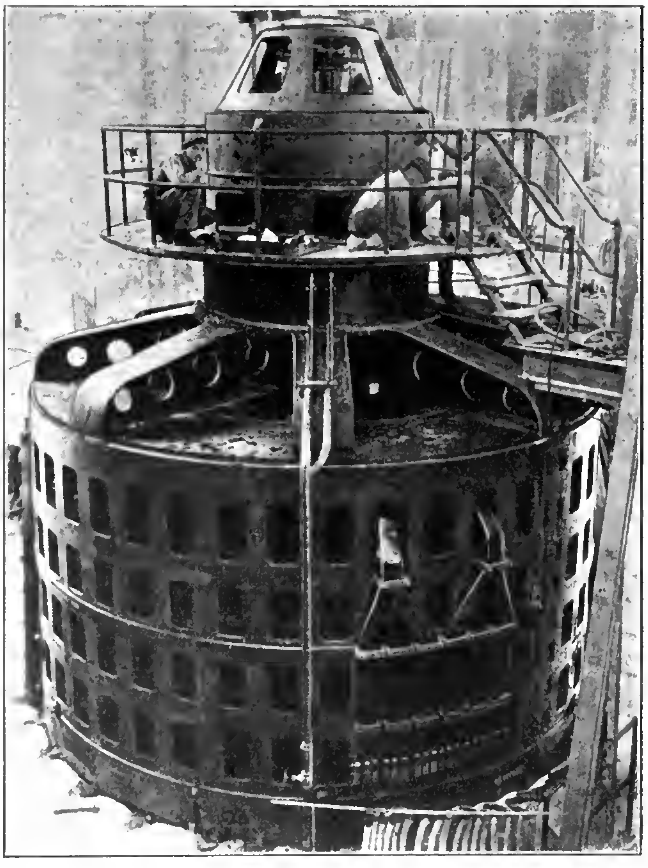
The equipment in the two Hat Creek plants is identical, although there will be considerable difference in the kilowatt-hour outputs. When conditions warrant it will be possible by the use of pondage on Rising River to increase the peak capacity of Hat Creek Nos. 1 and 2 so as to utilize the equipment more fully.

The main units are vertical-shaft, one in each station, with exciters separately driven by double-nozzle impulse wheels. Owing to the constant flow characteristic of the stream, there is very little fluctuation permitted in the load, a load-limiting device on the governors preventing an overdraft. There is no governor on the exciter wheels, but control of the nozzle setting is had from the switchboard through two small motors and a gear train mounted directly on the nozzle body, one for each needle. There is nothing new in the switching equipment of the Hat Creek plants, and as is now common the generators are protected against internal trouble by balanced relays, the neutral of the windings having been leaded out for the purpose and being also solidly grounded. The three-and-one-half-mile 60,000-volt double-circuit line is relayed to trip out on insulator flashovers selectively. One bank of transformers serves at each station to step up from 6,600 volts to 60,000 volts. At Pit River No. 1 the voltage is stepped down through one bank to 11,000 volts, which is the low-tension bus voltage at this plant.

### Equipment of Pit River Plant

The Pit River plant has attracted more attention on account of the 220,000-volt transmission line starting here. Since the bulk of the market for Pit River power will be in the large district around San Francisco Bay, it was necessary to transmit a little over 200 miles to the first substation and eventually 275 miles to the second substation. Economically this could best be done at 220,000 volts.





VIEW OF THE 220,000-VOLT, 16,666-KVA. TRANSFORMERS AND 30,000-KVA. GENERATOR USED IN PIT NO. 1

Such a line imposes at once certain conditions to be fulfilled by the generator equipment, which is that it must be of sufficient capacity to handle the charging current not alone from a kilovolt-ampere standpoint, but also as regards self-excitation due to the charging current at light load furnishing magnetizing power. The field excitation for this condition is reduced to a minimum by cutting in resistance in series with the field automatically. The generator is then capable of supplying 90 per cent of its full-load current at zero power factor leading, with a terminal voltage of about 82 per cent of normal. The two machines in Pit No. 1 are

rated at 35,000 kva. with 90 per cent power factor lagging, 11,000 volts.

The selection of switching equipment had reference to the total amount of ultimate generating capacity which can be concentrated on the 11,000-volt bus. This ultimate rating is 115,000 kva. The double-bus system is used.

### Simplicity Controlled Design

The controlling idea in laying out the switching equipment was to avoid the necessity of building several stories to house it. Simplicity controlled the designs. Accordingly all heavy low-tension switches are arranged on the generator-floor level in an adjoining and separate low part of the building, extending to the rear and forming a T with the main generator room. (See Part I, issue of Jan. 27.)

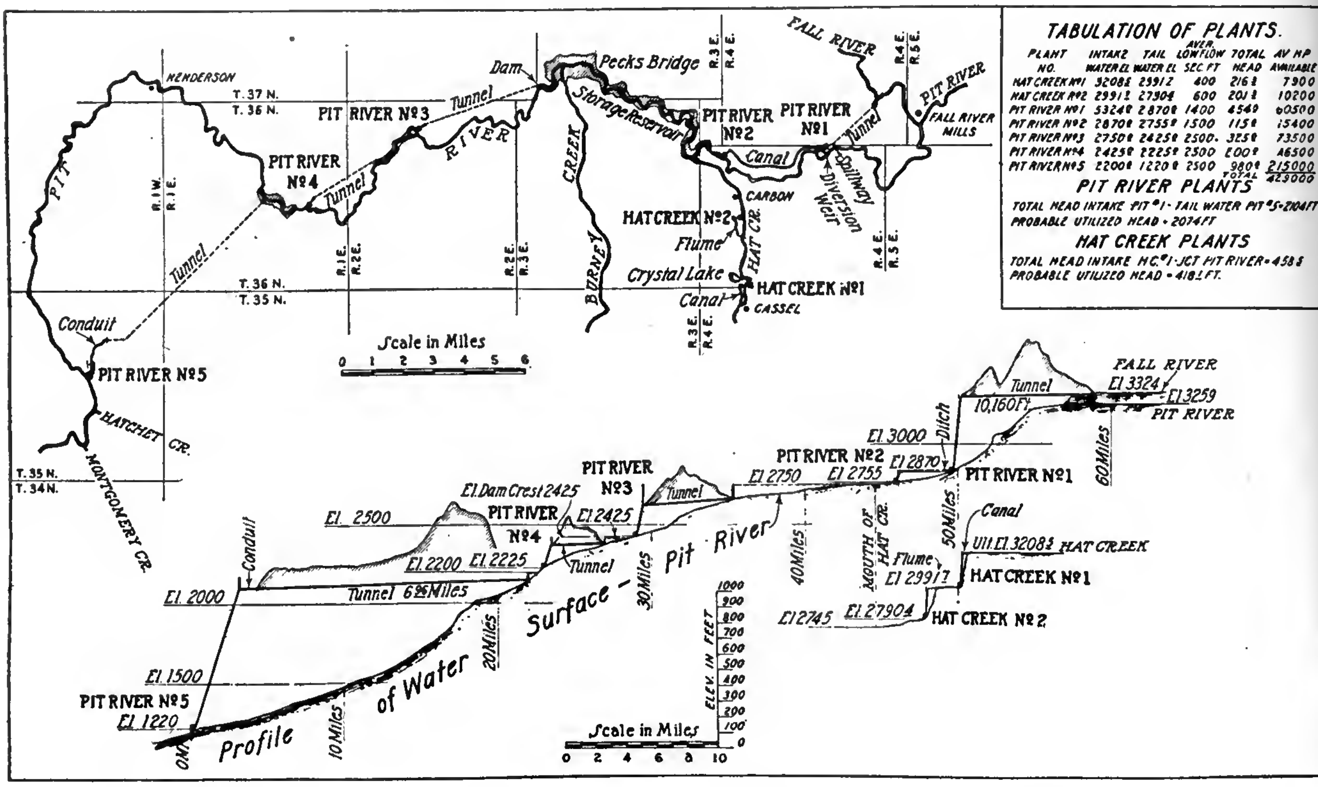
All high-tension switch equipment is installed out of doors, also at generator-floor level. Thus all heavy equipment may be trucked under a crane in the generator room with a minimum of rigging.

The control board, instrument and relay board, exciter board and station-service boards are in the generator room on an elevated platform 13½ ft. above the floor, all housed in a neat glass-covered canopy giving miximum light and keeping out dust and noise. The generator-field rheostats are installed below this platform between the generators.

The voltages in this station are: Ultimate high tension, 220,000; low-tension or generator voltage, 11,000; auxiliary power equipment, 440 (motors); lighting, 110, alternating or direct current; excitation, 250; battery for control circuits, 125.

The exciters are mounted on top of the vertical generators, and each is of 225 kw. capacity. A spare of the same rating is arranged to be driven by an impulse wheel or by an induction motor which is mounted on the same shaft.

There are two banks of three transformers, each with one spare unit. The high-tension voltages which may be obtained from them are 125,000, 175,000 and 220,000. Experience is to be gained from operation at all three voltages successively, but it is thought that in less than a year full voltage will be used all the time. The connection is star high-tension, delta low-tension. On the high-tension side the connections are single-terminal, taken out through a weatherproof condenser bushing. The other end of this winding is grounded through a current transformer mounted on the cover plate of the transformer casing. Relay protection is had through this current transformer and bushing transformers on the high-tension oil switches.




PLAN AND PROFILE OF THE CONTEMPLATED 400,000-KVA. DEVELOPMENT ON PIT RIVER

Cooling water is taken from the penstocks through a tank half way up the hill reducing the pressure. A rather complete oil-handling outfit is provided for storing, handling and filtering. The tank system consists of three 10,000-gal. tanks, placed in the open, in a reinforced concrete valut, below general ground level, so that new oil as well as oil from transformers and switches will flow to them by gravity. A complete yet simple piping system connects the tanks with the apparatus, and the connections are such that any mixing of the different oils can be prevented.

### Switching Equipment

The 220-volt switching equipment is installed out of doors. The oil circuit breakers are equipped with a bypass arrangement whereby any of them may be taken out of service for repair or inspection. The bypass is provided by a combination of three air-break disconnecting switches mounted on a structural steel framework surrounding the breaker, the whole combination

forming a distinct unit. The air breaks open in a plane parallel with the conductors with one or two gaps in series. Contacts and metal projections are covered with corona shields.

At present the total number of oil breakers installed is three, one in each line and a tie breaker. There is space provided for adding two more on the transformer side. Two air-break disconnecting switches will take their place now and will later be used in the bypass arrangement when the full equipment of breakers has been installed. The total number of breakers then will be five. These breakers serve two 220,000-volt lines and two banks of transformers which are of 50,000 kva. rating each.

### Double Bus Used on Low Tension

The low-tension switching system is operated at 11,000 volts, with a double bus. The main equipment consists of fourteen oil circuit breakers with their disconnecting switches, all mounted in concrete cellwork. Here also are mounted the necessary current and potential transformers, with the exception of the current transformers in the ground leads of the generators, which are mounted near the machines. The potential transformer fuses with limiting resistors and disconnecting switches are mounted similarly to the main disconnecting switches.

The oil circuit breakers are of the heaviest type available at time of purchase. The current-carrying capacity varies according to the service. These breakers are: For Hat Creek Nos. 1 and 2, incoming lines, four, rated at 2,000 amp.; for transformers and outgoing lines, four, 3,000 amp.; for generators, four, 2,000 amp.; for station power and exciter transformers, two, 400 amp. The disconnecting switches which are used to isolate these breakers have corresponding current capacities.

The double bus extends overhead between switch groups, each phase being in a concrete cell. The switch groups are mounted two and two, with a passage between each group and disconnecting switches to the rear of each breaker. This arrangement prevents a wrong set of disconnecting switches being opened. The three doors for each set of these switches open together by a single mechanism with only one lock. Indicating lamps are also provided.

To place all of the equipment at generator-floor level, the breakers are what is known as back-connected; that is, the terminals of the breakers are brought out at the rear above floor level. Usually these types of breakers are bottom-connected, requiring a different mounting from the one adopted. The direct current needed for actuating the motor-operated breakers is supplied by a storage battery having an instantaneous discharge current of about 500 amp. at 125 volts.

A motor-generator charging set is provided for this battery and installed on the switchboard gallery. The battery also furnishes energy for operation of high-tension solenoid-actuated breakers, generator-field circuit switches, emergency lighting, etc.

As at Hat Creek the neutral of the generator is brought out for balanced relay protection. In addition, if a fault develops in the generator winding, the balanced relays operate to actuate the governor to close the turbine gates in order that the energy fed into the faulty winding may be reduced as quickly as possible. A latch is also tripped in the operating levers which control the air-discharge dampers, shutting off the ventilating air as much as possible. The machines are also equipped with powerful air-operated brakes which are able to stop any unit very quickly.

VIEW OF SURGE CHAMBER FOR PIT RIVER NO. 1 WHILE UNDER CONSTRUCTION AND IN ACTUAL OPERATION

The water turbines were furnished by the Allis-Chalmers Manufacturing Company, the guarantee being 40,000 hp., but they give about 44,000 hp. Official tests have not yet been made. The generators were also furnished by Allis-Chalmers. The step-up 220-kv. transformers were furnished by the Westinghouse Electric & Manufacturing Company, and this company also furnished the high-tension switches. The switchboard and low-tension switch equipment was furnished by the General Electric Company.

The tunnel and canal contract was let to F. Rolandi of San Francisco. All other contractors assumed a wet tunnel in bidding, but, as predicted by the engineer, the tunnel proved perfectly dry. The engineering designs from the intakes for the water conduits clear through to the 110,000-volt busbars at the Vaca substation were handled by S. Barfoed, chief engineer for F. G. Baum. The result is one of the best pieces of hydro-electric design work in the world, considering the variety of the problems, the magnitude of the work and the money involved. The principles controlling were simplicity of layout to meet the conditions, and the use of a few high-class designers, rather than a large number of draftsmen, has resulted in a piece of hydro-electric work of which all are proud.

# Uses of Electrical Energy in Agriculture

## Electrification of Plowing, Harvesting and Other Farm Operations Can Develop Annual Energy Consumption Exceeding 50 Kw.-Hr. per Acre for 150-Acre to 600-Acre Farms, According to British Experience

ASSERTING that experience on the European Continent shows the annual consumption of electricity in farm buildings alone to be proportional to the size of the whole farm and to average 10 kw.-hr. an acre, R. Borlase Matthews, in a paper presented in Great Britain before the Institution of Electrical Engineers, estimates that the probable energy consumption on a well-equipped farm should total 44 kw.-hr. per acre of arable land for plowing, cultivation, electroculture, electric silage, harvesting, etc. The figures in question were worked out from a study made by the author of results attained on the continent and in England and from experience in the operation of a 600-acre farm of his own. He concluded that, as in all other industry, the successful solution of the application of electricity to farming is not merely a matter of belting a standard motor to existing machinery. The conditions and circumstances of farming are peculiar to the industry, and not the least of the problems is the fact of limited seasonal use of much of the machinery, coupled with the further fact that a large portion of the labor available is prejudiced against and unused to machinery in any form. The author's opinion is that in the future the use of electricity in the operation of farms will be essential from the points of view both of cutting down the total cost of labor and power and of obtaining an increased output. If the efficiency of farming is to be improved, a change from present methods is imperative, and Mr. Matthews maintains that an increased efficiency, including circumvention of adverse weather conditions, is easily obtainable by using electrical energy.

While the main or transmission circuits may be at any potential over 50 kv. in Europe, the distribution is becoming standard at 10 kv., three-phase, 50 cycles. The final voltage for farm supply is 380 volts for three-phase motors and 220 volts for lighting. The distribution circuits are four-wire, the fourth wire being the neutral from which the single-phase lighting circuit is obtained in connection with one of the phase wires. The useful minimum size of transformers is 50 kva. From this transformer distribution lines can be conveniently run in any direction for a distance not exceeding 2,500 yd. (2.3 km.). In Denmark on this class of service a conductor corresponding to No. 4 A.W.G. is used, and on the heavier loads a wire corresponding to No. 2 may be employed. To compensate for the line drop, motors rated at 10 to 15 per cent lower voltage than the normal line voltage are used. The same rate difficulties experienced in the United States seem to plague the central-station men of Great Britain and the continent.

Milking machines, water pumps, cream separators and other dairy equipment, electric light, electricity to stimulate the production of eggs, incubator heating, household appliances and other smaller fields for the use of electricity seem to have had about the same consideration as in the United States. Electroculture and the use of electrical energy for the major operations have received greater attention both in England and on the continent than has been the case in the United States, and while the developments are admittedly in the experimental stage, some very interesting things that are worthy of attention in this country are described.

Plowing by the use of electrical energy has received a considerable amount of attention. Mr. Matthews gives consideration to five methods. The first is that in which the storage battery is used, and this method is dismissed with the remark that the equipment is too heavy, packs the land excessively and cannot be used on soft ground. The plow with a trailing supply cable provides a heavy piece of equipment with a cable winding gear that is unsatisfactory and a great deal of wear on the trailing cable itself. The third method involves an electrically hauled plow on the Fowler steam system, the fourth one with a modified Fowler system employing a single cable-winding device, and the last an outfit based on the "Roundabout" or Howard steam system. The characteristics of the last three systems are shown in Figs. 1, 2 and 3.

The objection to the double-haulage Fowler system is the cost of equipment. Motors rated at 80 hp. to 100 hp. are required. The system compromising between the Fowler and the Howard systems is characterized as the most practicable for ordinary farms. The outlay for the straight Howard equipment is reasonable, the power required is from 12 hp. to 60 hp., and anchorage difficulties are not nearly so great as in the Fowler system. The tackle comprises a single electric motor with two haulage rope drums, either of which can be driven by the motor while the other pays out the cable. The haulage cable is arranged to follow around the sides of the field, and at two corners anchored angle pulleys are provided. Cable pulley wagons are anchored at the other corners of the field. The plow is hauled from one anchor wagon to the other, and when turned for the next set of furrows the anchor cable on the wagon next the plow is slacked off so that the wagon moves ahead the width of these furrows.

Some data on energy requirements and the amount of land plowed per hour at different furrow depths are given in the table. These data are taken from experiments with an electric haulage set of considerably

ENERGY REQUIRED FOR PLOWING PREVIOUSLY CULTIVATED SOIL AND WORK PER HOUR WITH ELECTRICALLY DRIVEN PLOWING SET

Made by the Société Générale Agricole. This set works on the Fowler system. A 50-hp. gas engine provides the means of moving the set, which uses a 100-hp. electric motor and 1,100 yd. of trailing supply cable for 5,000-volt service.

| Depth of Furrow In. | Work per hour, Acres | Consumption, Kw.-hr. per Acre |
|---|---|---|
| 6 | 2.5 to 2.75 | 14 |
| From 8½ to 10 | 1.87 | 18 |
| 10 plus 6 of subsoiling | 1.25 to 1.38 | 36 to 40 |

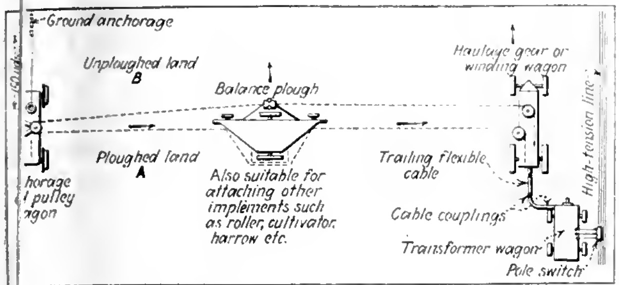



FIG. 1—ARRANGEMENT OF ELECTRIC PLOW SET ON THE FOWLER STEAM-PLOW SYSTEM

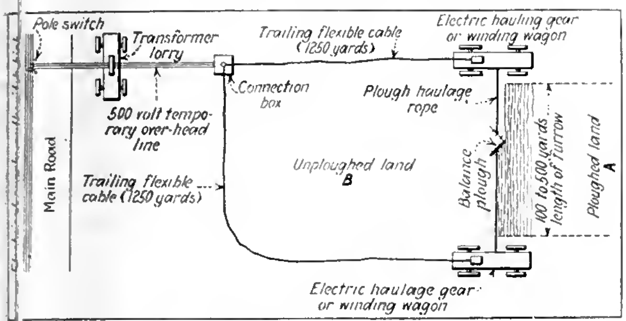



FIG. 2—MODIFICATION OF FOWLER SYSTEM WHICH USES ONE CABLE

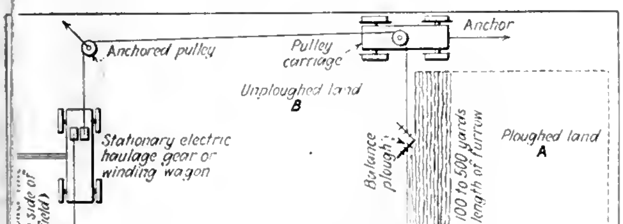
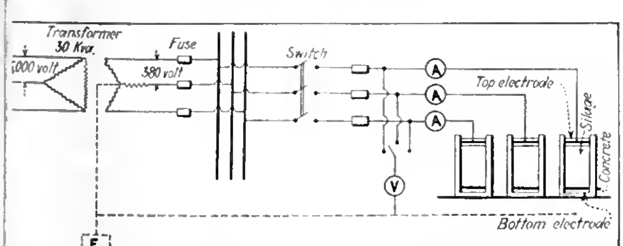



FIG. 3—ELECTRIC PLOW ON THE ROUNDABOUT OR HOWARD SINGLE-CABLE SYSTEM

This is said to be the most practicable for use under British m conditions.




3. 4—ELECTRIC PREPARATION OF SILAGE CLAIMED TO PROVIDE A BETTER PRODUCT

Nearly 100 installations of this kind are said to be in use in rmany.

'eater capacity made by the Société Générale Agricole. he energy requirements are dependent on the resistice of the soil being plowed. On such sets as illustrated eeds of 3 ft. (0.9 m.) and 5 ft. (1.6 m.) per second e provided, and by a change of gears 4 ft. and 7 ft. 1.3 m. and 2.1 m.) per second can be had. The praccal furrow length even on very large fields rarely cceeds 450 yd. (381 m.). A large haulage set will ow 19 acres to 20 acres (7.7 hectares to 8 hectares) r day.

"Unfortunately," Mr. Matthews remarks, "the problem of electric plowing is not merely a matter of solving electrical difficulties. It involves also a careful consideration of the design of the implements to be employed. Though agriculture is such an ancient art, or perhaps because of this, the scientific principles of the design of even such features as plowshares do not seem to have been so carefully investigated or mathematically analyzed as they should have been." The use of the best possible mechanical design, including ball bearings, is recommended for all equipment, and special attention should be paid to foolproof equipment requiring the minimum of skilled attention.

Electric drive of harvesting equipment seems to be of the partial type, the machines being hauled by a tractor which also carries a small generator to supply a motor of approximately 1½ hp. driving the cutting and binding parts of the harvester. The constant speed of these parts, owing to their being independent of the speed at which the harvester must be drawn, is said to make for better handling of crops, particularly those that are down and badly tangled. With electric motor drive it is claimed that crops can be cut at a rate about one-third greater than normal with ordinary equipment. Mr. Matthews says that the combined harvesting and threshing machines used in America (known in the West as "combines") cannot be used in Great Britain owing to the need of curing the grain before threshing because of climatic conditions. To overcome this difficulty some experiments have been conducted in the effort to cure and dry the grain with the air from electrically driven fans. The combined machine is essentially one that should be electrically driven. Experiments which have been made with the electrically driven thresher seem to indicate a labor saving.

The English practice in threshing involves more farmyard and less field work than in the United States, and therefore American practice may involve more difficulty in getting a supply of energy. Motors of about 12½ hp. seem to fit this character of work. Mention is made of equipment supplied by English manufacturers for which threshing operations are carried out in two stages, the first leaving an uncleaned grain for farm use and the second cleaning and preparing all the grain for market. For this work a 5-hp. motor is sufficient for each operation.

An interesting development in the preparation of silage is outlined by Mr. Matthews. Each silo is equipped with a grounded electrode at the bottom and a live electrode which can by placed on top of the green stuff stored in the silo. Germany already has nearly one hundred examples of such silos. Ten tons of fodder are said to require between 130 kw.-hr. and 200 kw.-hr., and the time for treatment in a silo varies from twenty-four to forty-eight hours. Better preservation of the silage due to the arrest of harmful bacterial action is claimed.

In making hay artificial curing is carried out by running a wooden duct into the base of the stack and air from an electrically driven fan under water pressure of 2½ in. is blown into the stack. The rate of drying is inversely proportional to the amount of moisture in the air. The artificially dried hay is said to look better, has a better aroma and the food value is held to be better because of prevention of high temperatures in natural curing that destroy food values and may even set the stack on fire. In connection with this form of use of electrical energy it is recommended

that measures for curing fruit, vegetables and other products be made. In this way a more economical installation can be obtained, and many things that would otherwise be wasted can be made useful.

Regarding the farm load factor Mr. Matthews says: "A somewhat difficult query has been put forward asking for the probable load factors of a 300-acre and a 600-acre farm. . . . Different farmers will have different ideas as to the most suitable equipment for their work. On an intelligently equipped farm a load factor of 33 per cent may be anticipated." For dairy, mixed and arable land farms he gives load factors of 13, 15 and 31 per cent respectively for the farm only. With the addition of farmhouse lighting, cooking and part heating he raises the figures to 24, 25 and 33 per cent, respectively.

"Since the size of farms in any neighborhood varies considerably," Mr. Matthews observes, "it is useless to make the assumption that if a 600-acre farm has a demand of 25 kw. the central-station demand would be 25 kw. per square mile. In any event the supply undertaking would run its lines along the route of the maximum demand, and continental experience shows this practice to be advantageous in units of 50 kw. Further, farms cannot be considered apart from rural industries and the varied demands of even small villages in the same neighborhood."

Reference has been made to the difficulty of arranging the distribution system on a farm, more especially for the field work. This is not so troublesome as might at first be anticipated, the author of the paper says. Since each stationary plowing gear has to be brought into only one corner of the field it is merely necessary to bring the distribution lines within reach of the plow flexible electric cable, which is usually over 100 yd. in length. However, on the continent, to economize in copper, the posts and insulators are installed permanently and the copper lines are moved about as required. The author has one transmission line crossing his farm (of 600 acres) and has planned one other line at right angles to this. He hopes that this simple arrangement will be sufficient for all the farm field requirements.

Since a large amount of power is used on a farm in the course of a year, it is a very serious question what form of power should be employed. In England the horse is in universal use, aided nowadays very largely by the oil tractor and steam plow. It is improbable that the horse will entirely disappear, though he is a costly animal to keep. At Greater Felcourt Farm in 1919, without any overhead charges, the cost per horse, including a part of the driver's time, worked out at £147 (about $715). This compares with the figures of well-known agricultural writers, Fream and Parkside. Electricity at 2 shillings (48 cents normally) per kilowatt-hour would have been far cheaper than horses for work to which it would have been applicable. On a small farm where an electric supply is available one horse should suffice, and on a 600-acre farm the number should not exceed two or three, Mr. Matthews thinks. He himself keeps three horses on his 600-acre farm and hopes shortly to reduce this number to two.

Mr. Matthews goes on to say: "It is not a sound principle to reduce the number of men; rather, the object of each farm should be to increase the output and profits by farming more intensively. It has already been stated that nine-tenths of the farms in this country [Great Britain] compete in growing products with the world, hence their fortunes must vary with the rest of the world. Therefore, it is very important that, in spite of high taxation, high railway rates and high costs, the output should be a maximum at a minimum cost. Cheap and suitable power will, in the future, render considerable assistance in this direction, and experience shows that a great deal of this power should be electrical. . . . The farmer is not going to use electricity because he loves it, but because he finds it will do the work he requires more cheaply, more effectively and more quickly. . . . One speaker in the discussion referred to the necessity of going over the land eight times with horses for the preliminary cultivation work, but with mechanical power five or six times suffices. This alone means a considerable saving of time and cost. The so-called handy little oil engine (already obsolete on continental farms) has been advocated as a substitute for the electric motor, but the author knows, to his cost, a great deal about such engines. In a farm laborer's hands they are not nearly so convenient as the manufacturers' catalogs would appear to suggest. In the course of a year the total time taken in tinkering with such engines, the cost of repair parts and the loss of time in getting work done, etc., amount to quite a serious figure. . . . While the British farmer is far ahead of his continental neighbors in animal breeding and pasturing, he is far behind in intensive agriculture and the use of electricity. Enormous scope still exists for improving farming by attention to important details. It will be easier for the farmer to take up improved methods if at the same time he makes use of what to him is a new power, because it facilitates the handling of his very conservative men, as the author has discovered in many instances."

### WHERE AMERICAN CONDITIONS DIFFER

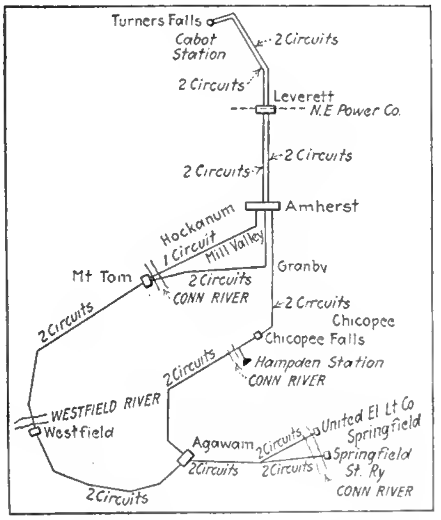
In quoting the above figures on the cost of the horse it should be borne in mind that they are undoubtedly very much out of line for American conditions. Depending on what part of the country is considered, the cost of the horse in the United States seems to be between $100 and $200 per year, and in sections where pasturage is cheap the cost will be below $100. These figures are only approximate and for comparison with the figures given should be added to the cost of the driver. The point of the remarks so far as American conditions are concerned lies in the lines of investigation indicated. This applies to all of the data covered briefly in this article, since methods and conditions are such that direct application of the methods of using electricity on European farms might lead to serious error.

The outstanding fact is that electrical energy has been used in operations that have seemed the last to be considered in the United States. In the paper quoted, an estimate of 50 kw.-hr. per acre per annum has been made for farm use of electrical energy. The farms talked about are from 150 acres to 600 acres in size. Irrigation is not a factor. For American farms that are comparable one must look to the Middle West or the Eastern States. At present the data available seem to indicate a consumption on these farms of only 1 kw.-hr. to 5 kw.-hr. per acre annually, with the latter figure a very unusual one. Of course, there are some farms where greater use of electrical energy may be found, but it is for special purposes. That there should exist such a discrepancy between the British estimate of 50 kw.-hr. per acre and the present American use of less than 5 kw.-hr. gives food for thought.

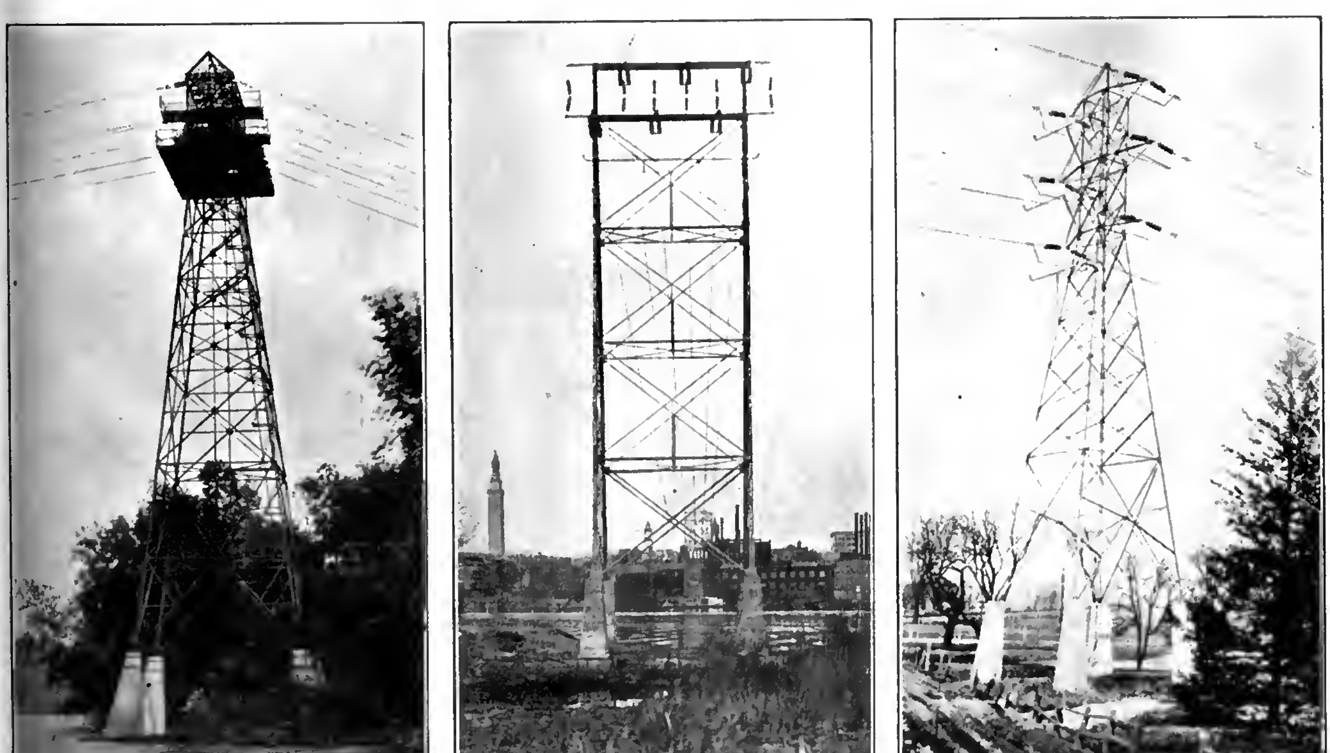
# Cost of Transmission Lines

**General and Price Data on the 78-Mile System of the Turners Falls Power & Electric Company, Which Connects Turners Falls with Springfield, Mass., and Serves the Connecticut Valley from Both Steam and Hydro-Electric Plants**

A COMPREHENSIVE summary of the investment cost of the 66,000-volt transmission lines of the Turners Falls (Mass.) Power & Electric Company, one of the largest transmission organizations of New England, was completed not long since in connection with a security issue for which authorization was asked from the Massachusetts Department of Public Utilities. The company operates hydro-electric and steam generating plants in the central Connecticut Valley and is interconnected with the New England Power Company and the United Electric Light Company systems. A line is at present under construction between the Connecticut Valley and the Berkshire Hills district centering in Pittsfield, Mass., but the costs presented herewith cover only those lines completed and in operation in the Connecticut Valley. Through the courtesy of the company the photographs accompanying the data printed here have been furnished to give the reader an idea of the types of construction adopted in the development of the system. The first line was built during 1910 to furnish a connection between Turners Falls and the Mount Tom steam plant via Amherst, the line between Turners Falls and Amherst at that time being a 22,000-volt wooden-pole line. This new line was built for 66,000 volts, but was operated until 1913 at 22,000 volts. The primary cause for its construction was a mill load in Easthampton, near Mount Tom. The second line was built between Turners Falls and Springfield in 1912 and 1913, the Springfield district being the only available market at the time for the sale of the output of the company's No. 1 plant in Turners Falls. The third line was built between Turners Falls and Amherst in 1916 by the company. This line was constructed as a first step toward furnishing transmission capacity equal to the entire hydro-electric development. This line was originally built with two circuits to Leverett (the point of interconnection with the New England Power Company) and one from there to Amherst, but had




LINE DIAGRAM OF TURNERS FALLS POWER & ELECTRIC COMPANY, SHOWING LOCATION OF LINES (NOT TO SCALE)



LEFT—A RIVER-CROSSING TOWER ON THE AMHERST-SPRINGFIELD LINE. CENTER—A DOUBLE-CIRCUIT RIVER-CROSSING TOWER IN SPRINGFIELD. RIGHT—TOWER RAISED ON CONCRETE PIERS ON A RAILROAD CROSSING ON THE CHICOPEE-SPRINGFIELD LINE

hardly been put into operation before load conditions warranted the completion of the other circuit, as well as the addition of one circuit from Granby to Mount Tom, this circuit being tapped off the Turners-Springfield line at Granby.

The fourth line was built between Amherst and Granby by the company in 1917, one circuit being run at that time. The load in the Springfield district had by this time increased sufficiently to require improved regulation, and this circuit relieved the load carried by the Granby-Mount Tom line from the Turners-Springfield line south of Amherst.

Soon after the completion of this line negotiations were under way to care for the Springfield Street Railway Company's load, which required additional circuits from Amherst to Springfield. Estimates from surveys showed that a line built by way of Westfield to Agawam would not call for a greater investment than to build over the right-of-way already owned by way of Chicopee, and the fact that a line via Westfield gave a complete loop system from Amherst, together with the advantages of having a 66,000-volt line into the Westfield section, made this routing much more desirable.

The section from Mount Tom to Westfield and Agawam was started in 1917, and at the same time an additional circuit was added from Amherst to Granby and from Granby to Mount Tom. During 1917-1918 an extension was built from the Turners-Springfield line between Agawam and Springfield to the Margaret Street Station of the Springfield street railway; also, a tap from the Turners-Springfield line in Chicopee was made to the Hampden Steam Plant.

The line between Turners Falls and Amherst consists of a single line of towers with two circuits of No. 1/0 seven-strand copper and one ⅜-in. seven-strand galvanized-iron ground wire. The towers are four-post galvanized-steel Millikens, 75 ft. 6 in. in height, with a spread at the base of approximately 17 ft. The cross-arms are spaced vertically 10 ft.

The line between Turners Falls and Amherst consists of the same general type of towers as the above

TABLE I—GENERAL DATA ON TRANSMISSION LINES

| | Turners Falls-Springfield | Mount Tom via Mill Valley | Mount Tom via Granby | Agawam via Mount Tom |
|---|---|---|---|---|
| **Rights-of-Way:** | | | | |
| Length of right-of-way, miles | 43.7 | 8.04 | 5.78 | 21 |
| Amount taken in easements, miles | 40 4 | 7.79 | 5.78 | 20.24 |
| Total easements taken | 254 | 71 | 45 | 177 |
| Amount taken in purchase, miles | 3 3 | 0.25 | 0 | 0.76 |
| Total parcels purchased | 21 | 0 | 0 | 29 |
| Amount previously owned by company, miles | 1 1 | 0 | 0 | 0 |
| Width of right-of-way, ft. | 150 | 0 | 100 | 100 |
| Number of acres land purchased | 66 27 | 0.75 | 0 | 9 |
| **Distance on Line:** | | | | |
| Building lots, miles | 4.9 | 0 | 0 | 1.2 |
| Cultivated land, miles | 7.2 | 4.8 | 2.4 | 5.42 |
| Pasture and brush, miles | 18.4 | 1.84 | 5.3 | 13.6 |
| Timber, miles | 2.4 | 0 | 1.9 | .6 |
| Meadow, miles | 10.8 | 1.4 | 2 0 | 0.18 |
| Number of tower lines | 2 | 1 | 1 | 1 |
| **Standard Construction:** | | | | |
| Number of miles standard construction | 67.82 | 8.04 | 5.78 | 21 |
| Number of towers | 683 | 93* | 42 | 193 |
| Number of straight-line towers | 485 | 89 | 31 | 135 |
| Number of dead-end towers | 198 | 4 | 11 | 58 |
| Number of railroad-crossing towers | 22 | 1 | 1 | 6 |
| Number of river-crossing towers | 7 | 2 | 2 | 2 |
| Height of standard tower, ft. | 72.5 and 75.5 | 54 | 73 | 73.9 |
| Area at base, ft. | 16.05 and 17 | 12 | 17 | 17 |
| Spacing between cross-arms | 9 and 10 | 6 | 10 | 8 |
| **Excavation and Setting:** | | | | |
| Number of earth footings | 407 | 80 | 16 | 180 |
| Number of rock footings | 80 | 0 | 16 | 0 |
| Number of combination footings, earth and rock | 70 | 0 | 4 | 1 |
| Number of swamp footings | 30 | 0 | 0 | 0 |
| Number of footings in concrete | 96 | 16 | 6 | 12 |
| Size of transmission wire | † | No. 2 | No. 1/0 | No. 1/0 |
| Number of wires to tower | 6 | 3 | 6 | 6 |
| Size of ground wire | 3/16-in. | 3/8-in. | 7/16-in. | ⅜ in. |
| Size of telephone wire | No. 6 iron | ¼-in. iron | 0 | ¼-in. iron |
| Number of telephone wires | 2 | 2 | 0 | 2 |
| Manufacturer of tower | Milliken | U. S. W. E. & Pump Co. | Aermotor | Downing Ship Co |

* Eleven Milliken towers. † 100.6 miles No. 1/0, 35.04 miles No. 2/0.

TABLE II—SUMMARY OF TRANSMISSION-LINE COSTS

| | Turners Falls-Springfield | Mount Tom via Mill Valley | Mount Tom via Granby | Agawam via Mount Tom | Total |
|---|---|---|---|---|---|
| Land | $40,916.17 | $417.77 | None | $16,781.96 | $58,115.90 |
| Easements | 258,515.30 | 12,931.52 | 9,987.94 | 89,318.96 | 370,753.72 |
| Tower lines | 791,128.72 | 60,812.70 | 69,893.13 | 432,508.58 | 1,354,343.13 |
| Total | $1,090,560.19 | $74.161 99 | $79.881 07 | $538.609 50 | $1.783,212.75 |

TABLE III—COST DATA ON TRANSMISSION LINES

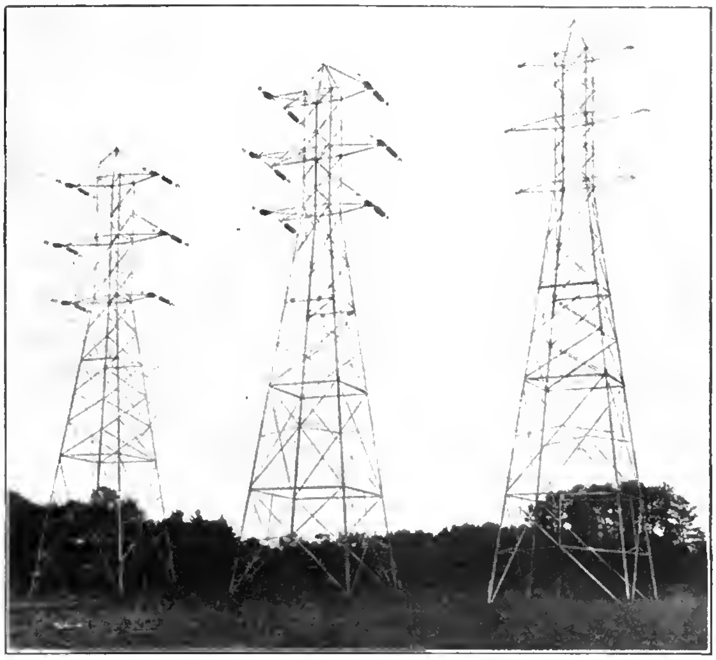
| Rights-of-Way | Turners Falls-Springfield | Mount Tom via Mill Valley | Mount Tom via Granby | Agawam via Mount Tom |
|---|---|---|---|---|
| Cost of easements | $258,515.30 | $12,931.52 | $9.987.94 | $89,318.96 |
| Cost of land purchased | 40,916.17 | 417.77 | None | 16,781.96 |
| Cost per mile of easements | 5,915.68 | 1,608.40 | 1,728.02 | 4,253.28 |
| Cost per mile of land | 936.30 | 52.20 | ......... | 799.14 |
| Cost per acre of land | 617.41 | 556.04 | ......... | 1,864.66 |
| Average cost per easement | 1,017.00 | 182.13 | 221.93 | 504.62 |
| Average cost per parcel of land | 1,948.39 | 417.77 | ....... | 578.69 |
| Number of tower lines allowed for | Two | One | One | One |
| Total cost of standard construction | $607,359 34 | $60,812.70 | $43,232.39 | $268,150.76 |
| Coast per mile standard construction | 8,955.46 | 7,563.77 | 7,479.65 | 12,769.08 |
| Cost per mile of material | 5,874.68 | | 4,887.56 | 8,238.26 |
| Coat per mile of labor and transportation | 2,401.53 | | 1,993.72 | 3,317.76 |
| Rate of labor wage | 2.25 | | 2.50 | 4.00 |
| Cost of engineering and supervision | 626.16 | | 598.37 | 1,213.06 |
| **Cost per Mile of Material:** | | (See Note) | | |
| Towers | 1,739.43 | | 1,457.76 | 2,909.04 |
| Copper | 3,014.39 | | 2.652.12 | 3,570.16 |
| Ground wire | 116.86 | | 130.37 | 149.78 |
| Telephone | 235.06 | | None | 640.86 |
| Insulators and hardware | 768.94 | | 647.31 | 968.42 |
| **Cost per Mile of Labor and Transportation:** | | | | |
| Clearing | 302.17 | | 501.87 | 381.24 |
| Footings | 369.81 | | 269.20 | 578.65 |
| Erection | 373.44 | | 403.50 | 420.17 |
| Installing wire and insulators | 363.92 | | 374.36 | 494.13 |
| General items* | 992 19 | | 444 79 | 1,443.57 |
| **Special Construction:** | | (See Note) | | |
| Total cost of special construction | $183,769.38 | | $26,660.74 | $164,357.82 |
| Total coat of railroad towers | 21,727.64 | | 891.25 | 3,892.43 |
| Total cost of river towers | 110,620.00 | | 17,903.09 | 50,896.99 |
| Total cost of special footings | 51,421.74 | | 7,866.40 | 109,568.40 |
| Cost per railroad-crossing tower, including footing | 987.62 | | 891.25 | 1,946.22 |
| Cost per river crossing, complete | 27,655.00 | | ......... | 25,448.48 |
| Coat per yard, special footings | 38.58 | | 30.55 | 46.15 |
| **Summary of Lines:** | | | | |
| Standard | $607,359.34 | $60,812.70 | $43,232.39 | $268,150.76 |
| Special | 183,769.38 | ......... | 26,660.74 | 164,357.82 |
| Total | $791,128.72 | $60,812.70 | $69,893.13 | $432,508.58 |

* General items: general foreman, preliminary work, permits, interest, insurance and taxes, dead time, stock clerks, field office, timekeepers, stock sheds, blacksmith shops, accidents, repair of fences, cleaning up, making topographic maps, guying, reports, inspection, excess freight and express, danger signs.

Note:—Both special and standard construction included in standard construction figures on the Amherst-Mount Tom line. This line was constructed before the present organization had anything to do with this system, so no records are available for detail costs.

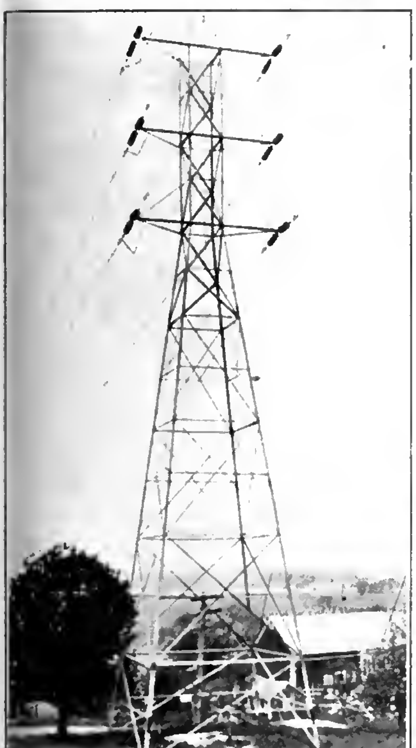
line, with two circuits of No. 2/0 seven-strand copper wire and $\frac{3}{8}$-in. seven-strand galvanized-iron ground wire and two $\frac{1}{4}$-in. seven-strand galvanized-iron telephone wires.

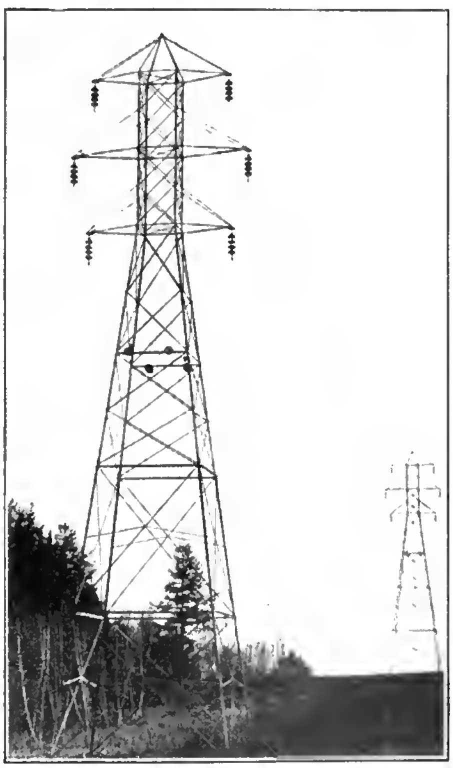
The line between Amherst and Springfield is built of Milliken four-post galvanized-steel towers, similar in design to the above, but with an arm spacing of 9 ft. and a total height over all of 72 ft. 6 in., with a spread at the base of approximately 16 ft. 6 in. On this line are three river crossings. These towers were designed by J. R. Wor-

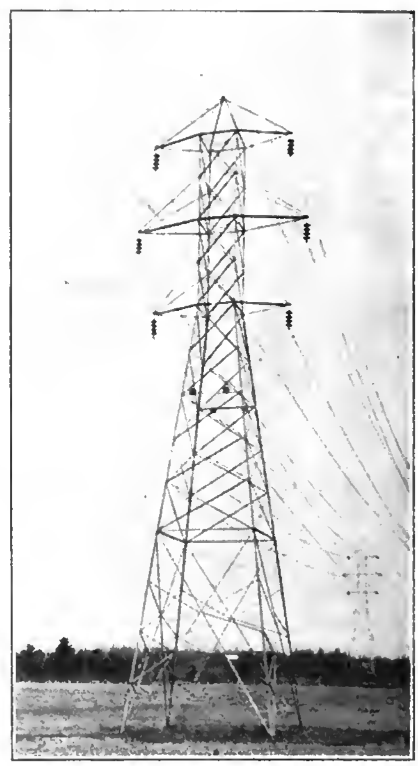


sists principally of Milliken standard four-post 75-ft. 6-in. galvanized-iron towers. There is a section along the south side of the Holyoke Range which is built of four-post "Aërmotor" towers, the general dimensions of which are the same as those of the Milliken type. On this line is considerable special construction through what is known as "Hockanum Meadows," as well as river crossings.

As a help to explaining the variation in the costs of different types of line, the company has tabulated the amount of







TYPES OF TOWERS USED IN LINE CONSTRUCTION

Top—Standard construction on the Mount Tom-Agawam Line. Left—"Aërmotor" towers are used on the Springfield-Mount Tom line via Granby. Center—Towers on the southgoing lines from Amherst. Right—Standard towers on the Turners Falls-Amherst lines.

cester & Company, Boston, and were furnished and erected by the Eastern Bridge & Structural Company, Worcester, Mass.

The line via Mill Valley between Amherst and Mount Tom consists of a single line of single-circuit, galvanized-steel four-post towers furnished by the U. S. Wind Engine & Pump Company, and it carries three No. 2 seven-strand copper wires, one $\frac{3}{8}$-in. seven-strand galvanized-iron ground wire and two $\frac{1}{4}$-in. seven-strand galvanized-iron telephone wires. In this line there is also a river crossing, built of special towers designed and furnished by the U. S. Wind Engine & Pump Company. The line between Amherst and Agawam con-

each kind of land through which it was necessary to purchase a right-of-way. This to some extent should explain the difference in cost between two rights-of-way, but the human element and the fact that rights for other lines may have been purchased in the same vicinity are more important factors, perhaps, than the actual value of the land itself.

In construction work the company was able to arrive at closer units of cost, the important factors in comparison being unit costs of material, rate of wages, type of digging, accessibility to line, proximity of freight yards to line, contour of land, amount of timber to be cut, time of year construction was carried on, size

of transmission wire, labor-housing conditions and special construction, such as concrete footings, railroad crossings, river crossings, switching towers, etc. By giving careful consideration to the variation of these items in different lines the comparative cost can be accurately determined.

As a matter of general information, there are given in Table III a few unit costs of work which represent a fair average of cost of several lines similar in construction to those covered by the tables.

## New Production Records During December

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that new high activity records were set within the industry during December. Data issued by the Department of Commerce indicate that a new record since 1920 was established in pig-iron production, an industry which is regarded by many prominent economists and statisticians as the best barometer of general business conditions. Other outstanding activities during December were a larger output of coal and coke, very heavy car loadings and the largest volume of retail sales ever recorded. The large production of fabricated steel bears cut the statement made in these columns last month that the seasonal decline in general construction had failed to materialize.

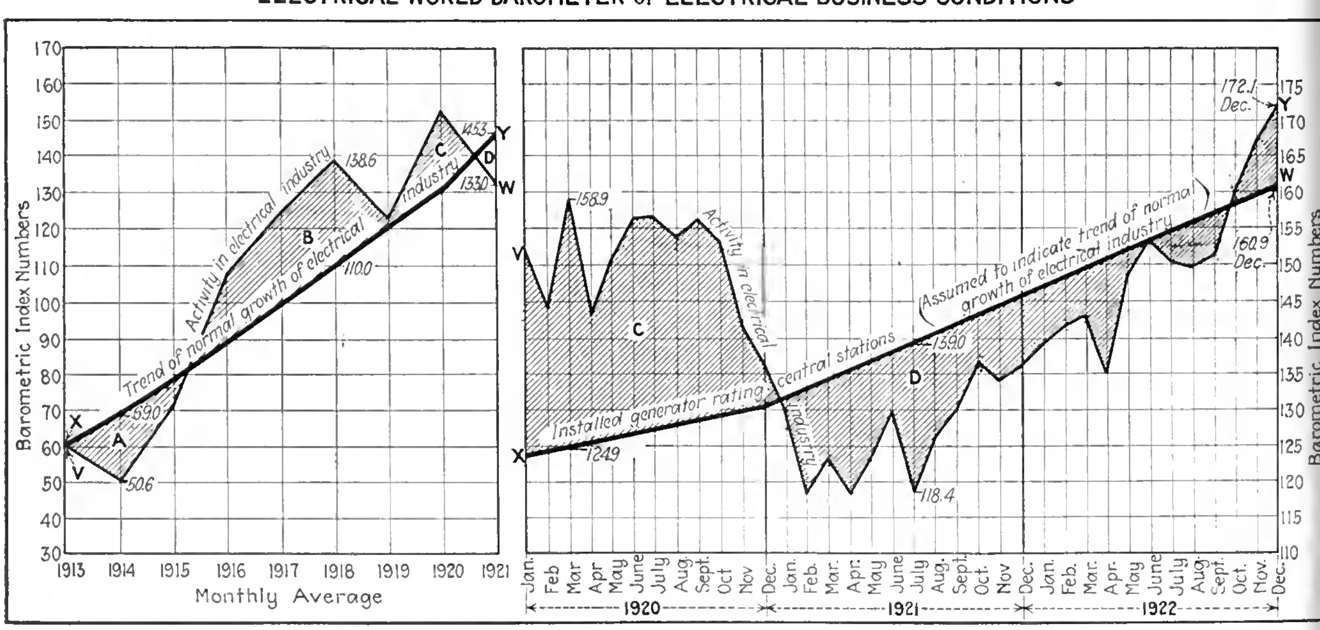
The "ELECTRICAL WORLD Barometer" indicates that in the month of December business conditions in the electrical industry, taken as a whole, continued to show the monthly improvement which started in September. The basic data indicates an increase of 5.0 points on the barometer scale as compared with November. The electrical industry as a whole in December was operating at 11.2 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In November it was operating at 7.7 points or per cent above the point of normal demand.

The year 1922 witnessed some remarkable changes in the activity within the industry. In January the industry was operating at about 8 per cent below the point of normal demand, whereas at the end of the year it was operating at 11.2 per cent above the point of normal demand. It must not be forgotten, also, that during this twelve-month period the normal productivity of the industry had increased about 10 per cent in order to supply the increased demand for energy, machinery and apparatus.

In its review of general business conditions the Harvard University Committee on Economic Research has the following to say:

"The business improvement inaugurated early in 1922 continued during the last month of the year. The rise of the business curve of our index chart has been substantial and persistent. The maintenance of this upward movement has evidenced the soundness of basic conditions and the strength of the favorable economic forces. At the opening of 1923 these forces are still operative. We forecast, therefore, further increase of wholesale commodity prices and continued expansion of business activity during the first half of 1923, with a strong probability that the upward swing will continue during the second half of the year."

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



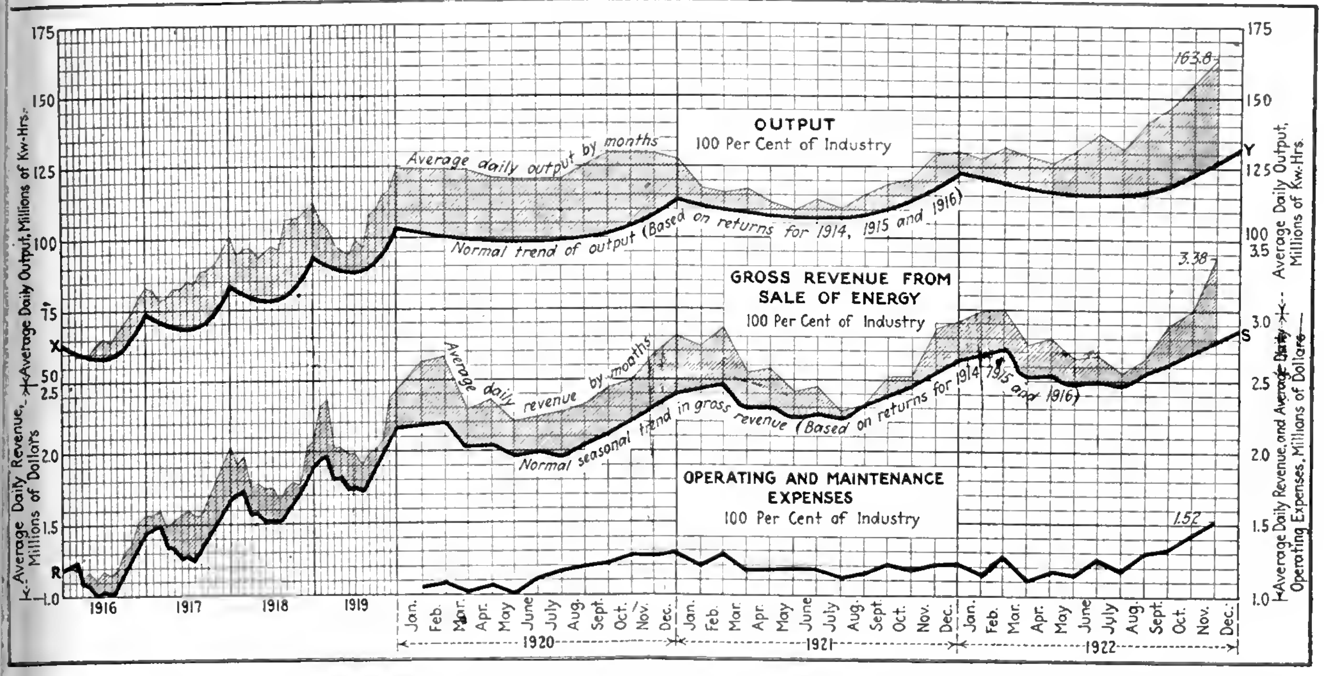

### THE BASIS FOR THE "ELECTRICAL WORLD BAROMETER"

By the "electrical industry" is meant the electric light and power branch, the electrical manufacturing branch and the electrical merchandising branch, taken as a group. The chart is not believed to be barometric for these branches as units.

By reason of their large influence on activity within the electrical industry the following nine primary industries have been adopted as a basis for the "activity curve" of the electrical industry: Active cotton spindles, pig-iron production, bituminous-coal production, copper production, newsprint-paper production, passenger automobile production, truck automobile production, yellow-pine lumber production and Portland cement production.

Activity in each of these basic industries referred to its own normal growth curve is found, and then this index of activity is applied to the electrical industry in proportion to the influence of the particular basic industry on the electrical industry. The estimated horsepower of the motors installed in the plants of the various basic industries has been taken as a basis for weighting the industries in their influence on the electrical industry. In weighting the lumber and Portland cement industries the large domestic load of the electric light and power branch and the sale of domestic apparatus have been taken into consideration. Applying these weights to the activity in each basic industry, adding the totals and dividing by the total of the weights gives the activity in the electrical industry referred to the "trend of normal growth of the electrical industry."

The line showing the "trend of normal growth of the electrical industry" is based upon the rating of the active installed generators of the central stations of the country. Further details concerning the development of the "Barometer" will be gladly furnished upon request.




# Record Output and Revenue in November

## Output for November Totaled 4,915,000,000 Kw.-Hr., an Increase of 23.1 per Cent for the Twelvemonth Period—Average Daily Revenue Exceeded $100,000,000

FOUR new records were hung up by the electric light and power industry during November. Reports for the month received by the ELECTRICAL WORLD for electric generating and distributing companies representing 81 per cent of the installed generator rating of the country indicate that the average daily output was 163,813,000 kw.-hr. This exceeded the previous record made during October by 9,323,000 kw.-hr. In addition, the total output for the month of November was 4,915,000,000 kw.-hr., which exceeded the former high monthly figure set during October by 130,000,000 kw.-hr. and the output reported for November, 1921, by 23.1 per cent. The second set of record figures reported by the industry for the month of November is to be found in the revenue received from the sale of energy. The average daily revenue from the sale of energy during November was $3,380,000, which exceeded the previous record, made during February, 1922, by $353,000. In addition, for the first time in the history of the industry the total gross revenue for the month exceeded one hundred million dollars, the exact figures being $101,400,000, which exceeds the previous record, made during October, 1922, by $8,100,000.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to the gross revenue from the sale of energy, shows that financially the industry is very close to the position it occupied this time last year. The operating ratio reported for November by companies having steam plants only, taken in the aggregate, was 50.4 per cent against 50.2 per cent for November of last year. It is encouraging to notice that the operating ratio has decreased from 56.6 per cent in August, or by about 6.2 per cent. Such a decrease in the operating ratio between winter and summer months is to be expected, however, on account of the relatively higher percentage of low-revenue industrial energy sold during the summer months. During the past fall this was overcome to some degree by the higher price of coal subsequent to the strike. If the normal trend of past years is followed, the operating ratio should continue to decrease and the lowest point should be reached during December or January, when the high revenue load is at its peak. However, if the price of coal decreases in the spring, it may be that the operating ratio will decrease further, notwithstanding the curtailment in domestic lighting requirements which occurs as summer approaches.

A final government report indicates general advances

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

| Mos. | Percentage of Installed Ratings Represented | Kw.-Hr. Output (Companies Reporting) | | | Percentage of Installed Ratings Represented | Revenue from the Sale of Energy (Companies Reporting) | | |
|---|---|---|---|---|---|---|---|---|
| | | 1922 Thousands | 1921 Thousands | Per Cent Increase | | 1922 Thousands | 1921 Thousands | Per Cent Increase |
| Sept.. | 83 | 3,647,228 | 2,987,072 | 22.0 | 76 | $66,435 | $57,977 | 14.6 |
| Oct... | 82 | 3,927,193 | 3,183,173 | 23.4 | 76 | 70,886 | 61.039 | 16.1 |
| Nov.. | 81 | 3,980,691 | 3,232,200 | 23.1 | 75 | 76,051 | 65,268 | 16.5 |

| Mos. | Percentage of Installed Ratings Represented | Operating and Maintenance Expenses (Companies reporting) | | | OPERATING RATIO | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Steam Plants | | Hydro Plants | | Combined Systems of Steam and Hydro | |
| | | 1922 Thousands of Dollars | 1921 Thousands of Dollars | Per Cent Increase | 1922 | 1921 | 1922 | 1921 | 1922 | 1921 |
| Sept.. | 62 | 24,559 | 22,353 | 9.8 | 53.4 | 53.2 | 26.4 | 25.8 | 46.9 | 48.3 |
| Oct... | 62 | 27,710 | 23,260 | 19.2 | 52.1 | 51.1 | 28.9 | 27.8 | 48.8 | 47.7 |
| Nov.. | 62 | 28,225 | 26,028 | 8.4 | 50.4 | 50.2 | 24.3 | 25.0 | 46.0 | 45.2 |

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

| Month | Percentage of Installed Ratings Represented | New England States | | | Percentage of Installed Ratings Represented | Atlantic States | | | Percentage of Installed Ratings Represented | North Central States | | | Percentage of Installed Ratings Represented | South Central States | | | Percentage of Installed Ratings Represented | Pacific and Mountain States | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1922 Thousands | 1921 Thousands | Per Cent Increase | | 1922 Thousands | 1921 Thousands | Per Cent Increase | | 1922 Thousands | 1921 Thousands | Per Cent Increase | | 1922 Thousands | 1921 Thousands | Per Cent Increase | | 1922 Thousands | 1921 Thousands | Per Cent Increase |
| KW.-HR. OUTPUT: | | | | | | | | | | | | | | | | | | | | |
| Sept....... | 81 | 261,523 | 225.408 | 16.1 | 82 | 1,307,413 | 1,037,644 | 26.0 | 81 | 1,170,148 | 976,556 | 19.7 | 64 | 194,866 | 158,373 | 23.0 | 97 | 713,248 | 589,091 | 21.0 |
| Oct....... | 80 | 297,362 | 251,833 | 14.1 | 80 | 1,408,383 | 1,132,485 | 24.3 | 82 | 1,306,654 | 1,059,771 | 23.3 | 64 | 196,846 | 160,283 | 22.8 | 97 | 715,356 | 578,801 | 23.7 |
| Nov....... | 78 | 313,057 | 248,472 | 26.0 | 78 | 1,443,083 | 1,167,993 | 23.6 | 81 | 1,327,148 | 1,079,325 | 23.1 | 64 | 209,918 | 161,865 | 29.7 | 97 | 687,485 | 574,545 | 19.7 |
| REVENUE: | | | | | | | | | | | | | | | | | | | | |
| Sept....... | 81 | $6,335 | $5,754 | 10.1 | 76 | $24,478 | $20,973 | 16.7 | 68 | $20,516 | $17,592 | 16.6 | 64 | $4,495 | $4,029 | 11.5 | 97 | $10,612 | $9,629 | 10.2 |
| Oct....... | 80 | 7,055 | 6,370 | 10.7 | 74 | 26,437 | 22,468 | 17.6 | 69 | 22,112 | 18,704 | 18.2 | 64 | 4,683 | 4,099 | 14.3 | 97 | 10,599 | 9,398 | 12.8 |
| Nov....... | 78 | 7,760 | 6,882 | 12.7 | 73 | 28,707 | 24,363 | 17.8 | 69 | 23,542 | 20,046 | 17.4 | 62 | 5,111 | 4,333 | 17.9 | 96 | 10,931 | 9,644 | 13.4 |
| OPERATING EXPENSES: | | | | | | | | | | | | | | | | | | | | |
| Sept....... | 53 | $2,029 | $2,091 | −2.9 | 56 | $7,640 | $7,357 | 3.8 | 55 | $8,924 | $7,295 | 22.4 | 63 | $2,300 | $2,046 | 12.4 | 96 | $3,666 | $3,564 | 2.9 |
| Oct....... | 52 | 2,387 | 2,023 | 17.9 | 55 | 9,172 | 7,681 | 19.4 | 54 | 10,625 | 8,586 | 23.7 | 63 | 2,383 | 2,094 | 13.8 | 95 | 3,700 | 3,409 | 8.6 |
| Nov....... | 52 | 2,546 | 2,160 | 17.8 | 54 | 8,928 | 7,752 | 15.2 | 57 | 10,556 | 8,456 | 24.6 | 62 | 2,521 | 2,189 | 15.1 | 94 | 3,674 | 3,550 | 3.5 |

in production, transportation and distribution during November. One of the outstanding facts is that the usual seasonal decline in building contracts failed to materialize in November. Expansion of employment throughout the nation was the greatest since January, large gains being reported in the iron and steel industry, tobacco, textiles, and metal products other than iron and steel. These favorable industrial data, taken in conjunction with the fact that the advancing season called for largely increased consumption of electrical energy for electric lighting purposes, explains very clearly the record figures quoted above.

Every section of the country except the Mountain and Pacific States reported material gains in output over October. The largest gain was reported from the Atlantic States. The slight decrease reported by the Mountain and Pacific States was undoubtedly due to the decrease of irrigation requirements with the advancing season.

## Hydro-Electric Plant Within the Arctic Circle

THE unusual size of generating sets used in the Norwegian state power house on the Glomfjord, 30 miles above the Arctic circle, together with a number of unique features of the general station layout, attract considerable interest. According to G. Troeltsch in the *Elektrotechnische Zeitschrift*,* this development has a watershed of 96 square miles, yielding on an average 88 cu.ft. of water per second. Several large lakes into which a group of glaciers discharge serve as a natural water-storage reservoir, totaling 18,356,000,000 cu.ft., or about 70 per cent of the yearly water flow. A 9,050-ft. pressure tunnel of 192-sq.ft. cross-section delivers the water to the collecting bay, from which two high-pressure penstocks lead down to the power house at the seacoast, representing a head of 1,542 ft. These pipe lines taper from 6½ ft. top diameter to 4.6 ft. at the lower end. They are built up of welded-steel pipe lengths riveted together. For topographical reasons it was necessary to lay about two-thirds of the penstock in one direction and the rest of it at an angle of almost 90 deg. to the first run. At the upper end of each of the penstocks three independently operating closing gates are installed to minimize the danger of flooding the power house in case of failure of the pipe lines.

*E. T. Z., Nov. 9 and 23, 1922.

The foundation of the power house provides for six sets of turbines, but the present superstructure will house only four. The turbines are of the Pelton double-runner type, built by Voith, with a rating of 25,000 hp. for two of the units and 27,500 hp. for the third, all to operate at 300 r.p.m. The runners of the larger unit measure 11 ft. in diameter and have each twenty buckets 2 ft. in width. The waterwheel rotor weighs complete with the shaft 35 tons. The water jets from the two nozzles are 10 in. in diameter. Double regulation with needle and jet deflectors is provided, being operated by a double-piston "servo-motor," for which the pressure is derived from two independent sources. One oil pump is belted to the main turbine shaft, and a second pump is driven by a small Pelton wheel. Tests made on the turbine at the power house showed a highest efficiency of 88.2 per cent and an increase in speed of 8.8 per cent when a load of 23,000 hp. was disconnected.

The direct-coupled three-phase generators, built by the Almänna Svenska, are rated for 20,000 kva. at 80 per cent power factor, 25 cycles, 15,000 volts and 300 r.p.m., but are guaranteed to withstand a permanent overload of 2,000 kva. The machines are completely inclosed and are ventilated by two fans made of fins attached to each end of the rotor. The over-all diameter of the large generator is 22 ft. The complete machine weighs 225 tons, of which 95 tons are rotating.

The entire stator rests on a number of rollers in the bottom of the generator pit, so that in case a coil section burns out in the lower part of the stator that part can be turned upward for easy repair. The rotor is built up of six steel disks, to which are fastened ten poles. The main generator bearings are water-cooled. To each of the three bearings of a set a small hand pump is connected to force oil under the heavy shaft of the machine before it is started. An exciter is directly connected to the generator shaft.

As the center of energy consumption is only about three miles from the power house, the 15,000-volt generator voltage is used directly as transmission voltage. Two three-phase lines of 240-sq.mm. copper carry the entire output of the power house. For a distance of 1 mile they run through a tunnel along the seacoast, and then outdoors for 2 miles more on very attractively built reinforced-concrete towers.

The cost of constructing this station with its present capacity of 77,500 hp. was $5,600,000, or $72.50 per installed horsepower.

# Keep Public Contacts from Sparking—III

### A Few More Suggestions Pointing to Opportunities Where Central-Station Executives May Develop Policies that Will Prevent Small Points of Friction and Improve the Standard of the Public Service

By E. L. MILLIKEN
*Stone & Webster Management Division*
*Assistant Manager Blackstone Valley Gas & Electric Company, Woonsocket, R. I.*

MUCH has been written of late on the subject of educating certain classes of central-station employees who are in particularly close touch with the consumer. Less stress has been laid on the importance of the managers and executives of companies setting an example for these employees, not only in their own dealings with the public, but in their relations with the employees.

The force of a good example is just as much needed in our public relations work as it is in any other phase of human endeavor. Proper and courteous treatment of employees by company officials is bound to be reflected in similar treatment of the public by these employees. The pyramid is not complete unless there is an apex as well as a base. As a matter of fact, the relation of most employees to the management and executive staff is a dual one. They are consumers as well as employees, and as today, under state regulation, they rarely receive preferential rates, their status as consumers is on a par with that of all other consumers. So proper public relations, like charity, must begin at home. This thought is stressed in order that the points in the following paragraphs may be understood to apply to the entire organization of a public utility.

*Employees' Attitude When Buying in Local Stores*—Purchasing from local merchants by employees may well be fostered in an unobtrusive, diplomatic way. Local merchants, particularly in the smaller cities and towns, feel that they are entitled to at least a fair portion of the trade of the employees of the local central station.

#### ENCOURAGE EMPLOYEE BUYING

The official family of a utility may help wonderfully in this respect. Yet the good may be nullified if they make deprecatory statements as to a merchant's goods or compare his prices with what they can get elsewhere. They do not have to buy from him if they do not so choose, neither do such complaints ever help them, and their attitude many times reflects unfavorably on public sentiment regarding the company.

*Family Affairs*—The attitude of the family of a central-station official, and especially of a manager, may do much harm to the company. His wife or his children may offset all that he may do to improve his company's standing in a community. His happy relations with the men of the community may be brought to naught or diminished in value if his family, working through their families, creates a negative impression.

*General Social and Business Intercourse*—Seldom does a central-station official make an enemy without that enemy some day being in a position where he can refuse to do the company a favor or give it additional business. The converse is true as regards making friends. The pigeons always come home to roost.

A central-station manager particularly cannot afford outwardly at least to condemn, disparage or discredit any person or movement. On the other hand, he can well afford to boost each and every legitimate civic movement and praise and make friends with every citizen. The dollar of the central station's income knows no sex, no creed, no nationality and no political faith.

*Passive Resentment*—We have heard much of the "passive resistance" policy of the followers of Gandhi in India. From this we may well learn a lesson. The central-station company which becomes lulled into complacency because of lack of complaints may well become suspicious. No matter how good the service rendered, there is always an underlying sentiment in the community which, for lack of a better term, we will call "passive resentment." This is antagonism to the company unexpressed either to it or even to other consumers. It is the nursing of grudges many times of long standing. Its particular danger lies in the fact that those consumers who entertain the feeling have been unable to get satisfaction from the company and have given up in disgust. This sentiment can only be unearthed by a constant broadening of the service policy and by having company officials and employees keep their ears close to the ground.

#### WOMEN CAN CREATE FAVORABLE SENTIMENT

The "greater service" policy of the Southern California Edison Company points one way in which such sentiment can be reached and negatived. Another way is for the central station to send around women to do house-to-house repair service. Possibly in this latter way, on account of using woman representatives, more complete information is acquired about passive resentment. These women seem to get closer to the housewife, and she tells them more freely her troubles. The sentiment of business men and all civic bodies may be favorable to a company, but that company is not strong in the community unless the sentiment in the homes of its consumers is likewise favorable.

*Studying Buying Impulses*—In order best to understand the public we serve and to increase our gross earnings to the maximum possible, we should study the impulses which prompt people to buy various classes of commodities, including our own service. After having become familiar with these we should, so far as possible, cater to them.

Too often we take it for granted that all people are convinced of the need for our service. This is not true, and there is a large portion of the public who have yet to be shown wherein our service can benefit them. We should find out what it is that people want in the line of service and then try to show them wherein our own service supplies their wants.

Various statements have been made in recent months commenting on the number of people who have bought automobiles as compared with the ones who have had their homes wired. Not much effort seems to have been made to fathom why a given family makes various sacrifices in order to buy and run an automobile. By studying this question it is very possible that we shall be able to produce arguments which we can use to induce people to make a somewhat smaller sacrifice than is required to buy an automobile and have their homes wired.

*Study Mercantile Practices*—The writer not long ago sat in a store sipping one of those concoctions made popular by the Eighteenth Amendment. The proprietor of this particular store had a reputation not altogether to be envied as regards his relations with other men, yet his business was prosperous and growing. Observation at the time showed that whatever his qualities were which resulted in lack of favor in the eyes of his fellow business men these qualities did not enter into his relations with his customers. His clerks were uniformly attentive and courteous to each and every customer, regardless of his or her station. The proprietor was at the front of the store, and while he did not make sales directly he had a pleasant word for nearly all his customers before they left.

### Study Business Methods of Small Dealers

This experience, so opposite from what had been expected, caused me to wonder if we could not profit in our industry by actually studying the business methods of the successful small retailer. As far as residential lighting is concerned, the central station is a retailer, and it is only the nature of the business, the great need for and value of the commodity sold—gas or electric service—that results in an unusually large number of consumers and makes the central station a larger industry than the small retailer.

The relations with the individual consumer are, or at least should be, no different from those of the grocer, the baker or the shoe dealer. Therefore study of the business methods of the small stores should be productive of good, if but to show in some instances things not to be done.

*Advising Customers Regarding Appliances*—The natural zeal which all good salesmen show in selling lighting or heating appliances sometimes leads to strained relations with purchasers. This is more particularly true of those appliances which are naturally large consumers. The indiscriminate sale of room heaters or hot-water heaters is decidedly inadvisable. In the case of hot-water heaters, particularly of the automatic type, not alone is the first cost of the appliance considerable, but likewise the increase in the customer's bill. Unless he is thoroughly advised as to the cost of operating the appliance, it will invariably give rise to complaint on his part.

Many times this results in the company having to take back the appliance, but it cannot take back—and in fact it is very difficult to overcome—the distrust engendered in the customer's mind by the whole transaction. It would be better not to sell such appliances than to have this result.

Salesmen should be made to understand that the sale of an appliance by the company is not completed with his making out the order for delivery or with the customer's payment in full for the appliance. They should be educated to the point of view that the appliance is only finally sold when the customer is satisfied with the service which the appliance renders and with the expense to him of such service.

There is only one way to forestall conditions arising such as those above outlined, and that is a careful study on the part of the sales organization of the adaptation of the various types of the more expensively operated appliances to the needs of the various classes of customers. The sales department must know all of the characteristics of these various types and the cost to operate under various conditions. Then only are the salesmen properly equipped to sell these appliances in such a manner that they will stay sold.

*Instruction in the Schools*—We all know the difficulty of educating the present generation to an understanding of the gas or electric meter. There is no excuse however, for permitting the next generation to be unfamiliar with the principles of the meters and how to read them. This is best accomplished through the physics classes in the high schools. Some of the modern physics textbooks already devote some space to the reading of meter dials, and some even go so far as to illustrate the meters.

The trend of modern physics instruction seems to be towards practicability, and most instructors on the subject will be only too glad to have presented to their laboratories some modern house meters with glass cases. If they are properly approached, the chances are that they will allow the company to send a representative to talk to the physics classes on the construction and reading of meters whenever this subject is reached in the courses. In this way the consumers of tomorrow can be made to understand the accuracy of the meter and learn how to read it.

What is true of meters is likewise true of domestic appliances. The central station in any territory may well make it a point to see that the domestic science laboratories in the schools in its territory are equipped with standard gas and electric appliances, such as electric ranges, vacuum cleaners, electric flatirons and washing machines. There would seem to be no better place to teach the housewives of tomorrow the benefits of gas or electric service than at that formative period of life when they are receiving instruction in the public schools.

### Help School Courses

The study of optics, which comes under the general consideration given to "light" in the physics courses, offers another field for valuable work in the schools. Hitherto considerable time has been spent on the study of various optical problems which the student rarely encounters in his every-day life after leaving school. If a presentation is made to the school laboratories of some of the new portable luminometers, the physics instructors, when they come to the subject of "light," will have the means of teaching their students practical illumination problems. If we can by this means bring before the children of the country the importance of proper and scientific illumination in the schools, in their homes and in factories, the entire plane of artificial illumination will be raised, with a very evident favorable effect on the electric lighting industry.

*Telling the Story*—In their efforts to improve public and consumer relations, there is nothing to be gained by central stations "hiding their light under a bushel," and there is everything to lose. Advise the public

when you cut out application cards, when you adopt a liberal policy as regards rebates, when you instruct your employees on this and that movement to better the service. The public will respond and assist your employees in carrying out this policy.

*Giving Credit Where Credit Is Due*—To give to an employee or group of employees credit for some particular accomplishment in connection with the company's business has a very favorable effect on public sentiment. Such action on the part of the executives of the company always becomes known in the community eventually. The organization which has the reputation of giving credit where credit is due is bound to stand in a favorable light. The effect is favorable primarily on the employees, because they feel that those higher up along the line are watching their efforts.

There is nothing new in these paragraphs. The conditions of which they treat have existed since the earliest days of the industry. In some instances remedies have been applied, and in others it yet remains for them to be applied. The instances quoted are not theoretical, but are the results of actual experience and observation. The remedies suggested have proved successful in attaining the ends sought.

# Lamp-Socket Standardization

**International Agreement on Receptacle Dimensions Takes Precedence Over Lamp-Base Gage—Conference of Manufacturers to Be Called**

AS PUBLISHED in the ELECTRICAL WORLD of Dec. 2, the International Electrotechnical Commission met at Geneva, Switzerland, Nov. 20-25. Among the subjects taken up for consideration was the standardization of lamp bases and sockets. Delegates from France, Holland, Germany, Great Britain, the United States and Italy came prepared for action on the matter and as a result of their deliberations it can be confidently said that international agreement on lamp and socket dimensions is fairly well assured.

The printed report of the lamp committee of the Association of Edison Illuminating Companies and the sub-committee of the standardization committee of the American Institute of Electrical Engineers showed that the Americans had delved more deeply and exhaustively into the subject than any of the other delegates, and for that reason the fundamental facts in their report served as the basis of the discussion. At the outset it was agreed to consider only standard lamps with screw bases, leaving candelabra and miniature lamps as well as lamps with bayonet bases to come up for discussion and action at some other time. It developed that the screw base is used all over the world except in France, England and certain French and English colonies, where lamps with bayonet bases predominate.

The main general question considered at a preliminary meeting on Nov. 24 was whether to standardize the lamp base first or the lamp socket. The English delegates were inclined to favor the former, while the American delegates favored the latter and in this were suported by the Germans. The reason advanced was that the socket is the permanent or long-lived investment and piece of apparatus, so that it was logical to make that part of the combination standard and uniform, after which lamp-base standardization would immediately and automatically follow.

The chief difference between American and European practice rests in the depth of thread, the German lamp possessing a deeper thread than the American lamp. It was explained by the German delegates that a deeper thread was resorted to in order to eliminate trouble which had been experienced from lamps falling out of sockets. While incandescent electric lamp manufacture in Europe is concentrated in the hands of a few manufacturers, sockets and receptacles are made in many small factories and machine shops without standard gages, dies or jigs, so that the sockets are not so uniform as the lamps. German manufacturers of lamps had hoped that by deepening the lamp thread they would force the adoption of a deeper thread in the sockets.

### AMERICA FAVORS SOCKET STANDARDIZATION

At the formal meeting of the committee it was proposed by the American delegates that an effort be made to standardize a universal socket which the data at hand indicated would be substantially of the same dimensions as the standard American socket. There was some discussion over the name to be given this standard, objection being made to the use of the word "American." The words "universal" and "Edison" were proposed as alternatives, but no formal recommendation was made. The European makers expressed themselves as being willing to adopt and use the American socket as standard if it could be demonstrated that in practice there is no possibility of trouble in regard to the fit of the European-base lamp in the socket.

Inasmuch as some of the delegates could not commit themselves to any fixed set of dimensions without consultation with manufacturers of the metal parts, definite action could not be taken at that time. An agreement was reached, however, on the following points:

1. That effort should be concentrated on the standardization of a universal type of socket.

2. That through the good offices of representatives of the manufacturers present the questions of fact which had been raised at the meeting shall be subjected to inquiry by a group of manufacturing experts of interested countries, and that this group shall meet in Europe for the purpose of discussing the actual manufacturing dimensions and tolerances which are requisite in such a universal socket.

3. That this group of manufacturing experts shall report its findings to the national committees represented at the meeting and to the central office of the I. E. C. for general distribution.

4. That subsequently a meeting of this I. E. C. advisory committee shall be called, preferably about the middle of 1923, the time and place to be at the discretion of the central office. The suggestion was made that this meeting be held preferably at The Hague, in Holland, in the month of May or early in June, depending upon the completion of the work of the manufacturing experts. The work acomplished by the manufacturing experts will be reviewed at the proposed meeting of the I. E. C. advisory committee, at which as wide a representation as possible is suggested.

At the conference were Dr. C. O. Mailloux, president I. E. C.; C. le Maistre, secretary, and Percy Good, assistant secretary. The French delegate was C. Zetter, the Dutch delegate Dr. G. Holst, and the German delegation comprised Dr. H. Remane and Dr. Hermani. The British were represented by S. W. Attwell and E. G. Batt. The American delegation comprised Clayton Sharp, M. D. Cooper, S. E. Doane and F. V. Magalhaes. Italy was represented by Signor Clerici.

## Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

### Fears Reaction of European Chaos on America

*To the Editors of the* ELECTRICAL WORLD:

As a result of a short business trip to Europe I have been so impressed by the uncertain conditions abroad that I cannot help believing our country will and must be affected to a great extent by what is happening in the Old World. I have made inquiries from many different sources and to my surprise I have always received the same answer. The people over there do not expect war, but they all fear that something is going to happen which may be worse than a war. In some countries there is a tendency to throw the governments over, and in others legislation is threatened which is destructive of capital and will undoubtedly throttle enterprise. Even the little Republic of Switzerland, which was saved from the horrors of war and has a currency almost on a par with our dollar, is going through a serious crisis in the way of legislation which is headed in the direction of communism. If the chaos in Europe grows greater, there is no telling what will happen, and I cannot help but fear that if Europe "blows up" the explosion will be badly felt in this country.

ARNOLD PFAU.

Allis-Chalmers Manufacturing Company,
Milwaukee, Wis

### Paper-Pillar Switch Insulation

*To the Editors of the* ELECTRICAL WORLD:

The interesting article in your issue of Jan. 13 by Clifford N. Anderson, entitled "Hydraulic Power-Plant Practice in Northern Europe," has brought to my mind some facts with reference to our practice here in the United States, particularly with reference to extra-high-voltage disconnecting switches and circuit breakers.

Mr. Anderson's article illustrates 100,000-volt disconnecting switches with paper-pillar insulators. It may interest your readers to know that a considerable number of paper-pillar-insulated disconnecting switches were supplied ten years ago to the Big Creek system of California for the 150,000-volt power-plant and substation equipment. These have given entirely successful and reliable service on this system, which is now operated by the Southern California Edison Company. The design of the switching equipment was carried out under the supervision of the writer, and the following data thereon may be of further interest.

In appearance the switches were practically the same as those illustrated, but they were equipped with somewhat larger "static shields" or "brush-discharge rings" than the paper-tube or pillar diameter. They were also equipped with corresponding brush-discharge rings at the base of the tubes or pillars to control better the distribution of the static field relative to the supporting structure. Air clearance between static shields, either between pillars or to ground, was approximately 4 feet.

It was during the development of the details for these switches and the oil circuit breakers for corresponding applications, as well as the details for the 132,000-volt and 110,000-volt applications made in the five years prior to 1912, that the advantages of proper static-field distribution both in air and in oil were demonstrated.

It is, moreover, interesting to note that the design of this 150,000-volt apparatus contemplated and the tests demonstrated its adequacy to withstand 500,000 volts at 60 cycles, based on three times 165,000 normal voltage to ground.

J. N. MAHONEY,
Consulting Engineer.

Brooklyn, N. Y.

### Meter Maintenance on Scattered Systems

*To the Editors of the* ELECTRICAL WORLD:

I note with great interest an article on "Meter Maintenance on Scattered Systems" written by H. M. Johnson in the ELECTRICAL WORLD of Oct. 28 last. It occurs to the writer that Mr. Johnson is following a wise course in the method of testing large power meters that he employs. However, I am of the opinion that tests are made more often than necessary. Of course, where the consumption is large and expense of testing kept down to a minimum, the ratio of expense to income would largely control such a test. I am pleased to observe that an over-all test is made, as this is the practice of most Pacific Coast companies and has been for several years.

The company with which the writer is connected does not remove meters to relag for power factor. This is done by the use of a phase-shifting transformer made by J. C. Albert of Los Angeles. The test blocks used are satisfactory, but it would seem that a double switching arrangement would be more advisable as it would eliminate the possibilitiy of the tester coming in contact with high voltage while making connections. A scheme has been worked out by using two sets of cutouts and a pole-top switch. The switch is locked open under normal conditions. We have found that outdoor current and potential transformers are more flexible and less expensive than self-contained metering outfits for primary voltage.

The arrangement of test instruments and equipment is worked out very well, and Mr. Johnson should be commended highly for the system which he describes.

W. H. TALBOTT,
Superintendent Electric Meter Department.

H. M. Byllesby & Company,
San Diego, Cal.

### Water Resistance and Temperature

*To the Editors of the* ELECTRICAL WORLD:

In an article on electric boilers in the ELECTRICAL WORLD of Dec. 2, 1922, page 1211, the statement is made with reference to water resistance: "To this comes the very decided increase of resistance with increasing temperature." I have always found a decrease of resistance, the boiler current increasing quite rapidly as the water heats up. There is also a decrease of resistance due to concentration of impurities as the water evaporates, so the final resistance will be very much less than that of the feed water.

LOUIS E. MCCOY.

St. Maurice Lumber Company,
Three Rivers, Quebec.

[We agree that the above correction should be made. As a general principle water resistance decreases with an increase in temperature and we do not know of any impurities that might be present in sufficient quantity with negative temperature coefficients to offset this condition.—EDITORS.]

# Central Station and Industrial Practice

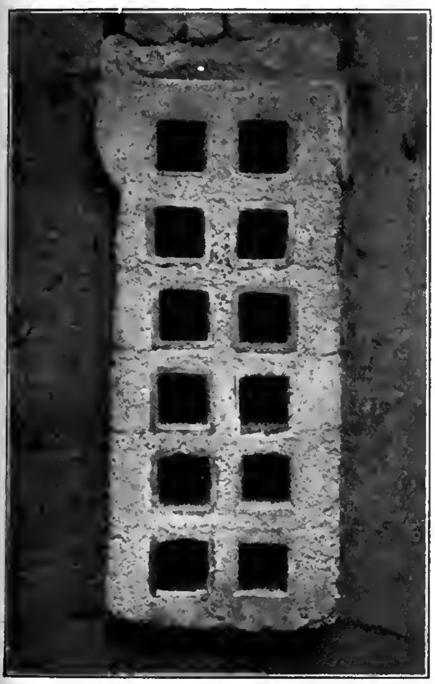
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Gaining Speed in Laying Tile Conduit

IN THE past two years a number of subway lines have been constructed in Kansas City with vitrified-clay conduit $4\frac{1}{2}$ in. and 4 in. square, consisting of eight, ten and twelve ducts. The ducts were laid with $1\frac{1}{2}$-in. separation, filled with a mixture consisting of one part Portland cement, three parts sharp sand and five parts $\frac{1}{2}$-in. rock. When using this thick layer of concrete between ducts it was necessary to allow the concrete to set from eight to twelve hours before each successive layer was laid. It was found that if a second layer were laid on soft concrete there was considerable settling of the duct, throwing joints out of line.

The method of laying was to paint both sides of the tile with paint and wrap 3-in. muslin around one end, painting the muslin thoroughly on the outside. This work was done on top of the trench by the helper and handed down to the layer, who painted the tile and the outside of the tape. There was no other fastening used to hold the tape—the paint drying very rapidly and making a comparatively firm joint. A 48-in. x $3\frac{3}{4}$-in. square mandrel made of hard maple was drawn through each duct as the layer advanced, the mandrels being drawn ahead.

The manufacturer furnished this duct with a $\frac{7}{8}$-in. wall in the $4\frac{1}{2}$-in. duct and a $\frac{3}{4}$-in. wall in the 4-in. tile duct. The outside of tile was grooved, which has been the general plan in making tile duct. The manufacturer was asked to eliminate these grooves and make the outside plain. Considering the method of painting the tile and using the muslin for making joints tight, it was felt necessary to have a plain surface to eliminate the chance of cement or water leaking into joints during construction. There was thus a saving of time, as it was very simple to paint the smooth surface and insure tight joints. This change was made by the manufacturer and proved successful.



SUBWAY LINES CONSTRUCTED IN KANSAS CITY WITH VITRIFIED CONDUIT

Right—Built-up-in-the-trench method ready for concrete. The joints are staggered and painted tape laid over the ends ready for the next joint.
Center—Built-up method employed experimentally on a ten-duct line.
Left—A twelve-duct conduit built by the layer method ready for the construction of the concrete manhole.

The problem of waiting for concrete to set as each successive layer was laid presented itself in cases where crossings were made under railroad tracks or in places where soil was difficult to hold in place. To speed up the work, the "built-up" method was employed, using concrete separators 6 in. wide by 12 in. long and $1\frac{1}{2}$ in. thick. These were placed at each joint, laying two joints on each separation and staggering them approximately 2 in. When the eight, ten or twelve ducts were built up, sloppy concrete was poured from a wheelbarrow into a convex steel trough or chute, causing the concrete to flow to the sides of the trench and drain from the sides toward the conduit. In other words, the concrete flowed from the sides and bottom of the trench between the layers of duct, filling all voids. This is an improvement over the old method of dumping concrete on top of duct, which left voids between and at the bottom of duct line. While the concrete was being poured a long-handled tamper with a steel blade 10 in. wide, 20 in. long and $\frac{3}{16}$ in. thick was used continuously, with an up-and-down motion, causing suction and helping to fill voids in the concrete.

A test section of conduit, consisting of ten ducts which were built up in the regular way, is shown in one of the illustrations. After setting for seven days the bank was

torn down. No voids whatever were found. In another photograph the "built-up" method with part of the work concreted and back-filling work in progress is shown. It is approximately 12 ft. to the bottom of the trench on account of the fill-in at railroad tracks. In the third picture is shown a completed twelve-way subway line of 4½-in. duct. This is at the entrance to a manhole which has been excavated and is ready for the construction of the manhole walls.

T. C. RUHLING,
Superintendent Underground Distribution.
Kansas City Power & Light Company,
Kansas City, Mo.

# Extracts from Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Detailed Instructions for Boiler-Room Force

AMONG the principal points to consider in the operation of the boiler room of a power plant are these: Maintaining proper amount of water in boilers, evenly loading all units, protection of brick lining and stoker bearings, blowing down boilers to remove light contents from surface of water which tend to produce foaming, and blowing the main blow-off valves to remove sludge and scale-forming material that may be in the water.

The reasons for operating boilers at or near the same rating are as follows: (1) Greater reliability in following load variations, as the same increase in load can be taken up more rapidly and with less damage to the fires if the increase is made on a large number of boilers at moderate rating than it can when only a few are operating at a very high rating. For the same reason it is much easier for the operator to control boiler-feed water, prevent safety valves from blowing, control blowers and dampers, etc. (2) Trouble on any one boiler, necessitating taking it off from the line, can more easily be handled with boilers at same rating than if they were at different ratings. (3) Better efficiency of the boiler room as a whole is obtained. (4) The clinkers stick less in fires that are operated at low ratings. (5) The maintenance cost of furnace parts and outside stoker parts is greater on boilers that are operated at high rating than on boilers operated at medium ratings.

The actual operating code used by the Philadelphia Electric Company in the general operation of the boiler room follows:

1. After assuming responsibility for the shift, the boiler operator or water tender must not leave the boiler-room floor under any consideration without notifying the shift superintendent or boiler engineer, or, in the event that he has a stoker operator under him who is capable of tending water, he may notify this man that he is to take responsible charge. In any event the water tender or boiler operator must not leave the floor in time of trouble or impending trouble.

2. Maintain proper amount of water in each boiler when steaming.

3. All boilers should be operated at or near the same rating.

4. Draft and stoker speed should be set according to previously determined instructions.

5. Always maintain the draft over the fire as stated on the chart used for this purpose. Exception is made to this only for a short time in the case of dumps in stations where there is no means of putting air on the extension grates.

6. All extension grate dampers should be opened according to the general instructions of the boiler engineer.

7. Fires should be inspected by the water tender or boiler operator from the front, side and rear doors from time to time to determine their condition. This should be done by the aid of colored glasses made for this purpose.

8. When dumping time approaches all fires must be inspected, and those fires which have good coal on the dump plates must be burned down in the rear before dumping. If there is so much coke on the dump plates that it is impossible to burn it down properly, this coke should be winged back on the fire with a bar.

Where extension grates are installed, the rear of the fire may be burned down by opening the extension grate dampers. Where these are not installed, the rear boiler damper should be opened wider than usual.

9. Dump each fire as rapidly as possible, but allow sufficient time between boilers so that the steam pressure will not be affected.

10. With boilers equipped with clinker crushers, care must be taken to see that large clinkers do not form in such a position that they will not go through the rolls. This type of clinker should be hooked around with a bar so that its length is parallel with the clinker crusher.

The cinder in the crusher ash pit should be tested with the bar to determine if large clinkers are forming. The ash should be held at about half way up the long waterbacks and all the way up the short waterbacks.

11. Blow down the boiler from both the main and surface blow off (when provided) according to the instructions of the boiler engineer. The main "blow-down" should be made with the boiler banked if possible. The surface "blow-down" should be made while steaming.

12. The blow-off valves of the economizers should be operated according to instructions of the boiler engineer. Feed-water valves to economizers should be opened and valves to the boiler should be closed while blowing down the economizer.

13. The procedure in blowing down main blow-offs is as follows: (a) Open plug cocks with lever wrench; (b) open main blow-off valves slowly; (c) close main blow-off valves slowly, and (d) close plug cocks with lever wrench. While blowing down, the water tender should watch the level of the water in the gage glass.

14. The water tender should enter on a suitable boiler-room log sheet the number of hours each boiler was steaming, floating on the line, banked and out of service, the time of dumping, the number of hours the fans were in operation, and the reading of the stoker counters at midnight or at a predetermined time.

## Switching on Lines

TRANSMISSION and distribution lines above 6,000 volts are energized from the source end as a precaution against service interruptions. If a faulty line is put on at the generating station this line will trip out without causing any further disturbance. If, however, it is put on at the substation end, it may trip out the lines feeding the substation and cause the loss of the entire substation load. Likewise, where two lines feed an industrial consumer, if the second line is energized at the industrial load consumer's end and if it is faulty it may trip out the loaded line, causing the loss of his entire load; whereas if the second line were energized at the substation, the fault current would be a smaller proportion of the capacity of the substation lines and therefore less likely to cause interruption.

The instructions issued by the Philadelphia Electric Company covering switching on transmission and distribution lines are given in the following paragraphs:

1. All lines must be energized from the source end, whether originating at a generating-station bus or at a substation bus.

2. Operators must wait for a pilot light on an incoming line before paralleling, unless otherwise instructed by the load dispatcher. No lines shall be paralleled without first synchronizing, in stations where the bus may be energized from separate sources.

3. When a line is put back in service after an interruption, the operator should watch its ammeter closely, and if the load does not come on within three minutes, the load dispatcher must be notified.

## Field Testing of Insulators Essential to Good Service

"DESPITE the fact that insulator manufacturers are all turning out much better material than they were able to do several years ago, we as operating engineers still have to wipe out the old picture of restoring service as quickly as possible after a shutdown," declared J. H. Sturge, division superintendent Public Service Electric Company, New Jersey, before a recent meeting of the Boston Section of the A. I. E. E., discussing a paper by Frank C. Doble of the Doble Engineering Company, Boston, on "Insulator Testing Problems."

Mr. Sturge said: "Now the picture is that there must be no shutdown. This means that we must be able to locate defective insulators easily and safely without taking the line out of service." He pointed out that last year a line 50 miles long was tested by this method. The line was equipped with three-piece insulators and was connected grounded-Y and operated at 26,400 volts. Every pole was climbed with the line shut down, every insulator was examined, and every insulator showing visual defects such as hair-line cracks and chipped shells was removed before applying the Doble test. Two per cent of the total insulators were thus removed from the line after this visual inspection. The line was then put into service and gone over again with the Doble tester, with the result that 1 per cent of the insulators were indicated as defective. These insulators when removed to the laboratory were tested and all were found defective in fact. Mr. Sturge said that he would not adopt any other known method, such as the short-circuit method, because of lack of safety.

TESTING PIN-TYPE INSULATORS ON LIVE LINES

K. A. Hawley, Locke Insulator Corporation, Victor, N. Y., pointed out that there were about twenty-five million insulators in service in the United States and that some means for testing them in the field is very valuable. Insulators began to be put out twenty-five to thirty years ago, and a fair percentage of the early ones are still in use. The quality of insulators is being improved year by year. The causes of depreciation of insulators are, first, bursting due to internal stress; second, moisture absorption, due to porous porcelain. These two types of failure deserve separate consideration. When an insulator is on its way to complete failure, it constitutes a hazard to the system. An insulator which will not megger infinity is either cracking or leaking through absorption of water. A three-piece insulator in good condition should show better than 200,000 volts on puncture test, and a suspension type which flashes over at 90,000 volts would not be likely to puncture at a potential under 130,000 volts.

### Insulators Will Always Require Service Tests

Prof. D. C. Jackson of the Massachusetts Institute of Technology doubted whether the industry would ever reach the point where insulators would attain such perfection of design and manufacture as to require no tests in service. Tests will cost less than the interest on the cost of overinsulation of lines, buses, etc.

It was generally recognized in the discussion (1) that every transmission-line insulator should be tested in the field before being placed in service, (2) that every insulator in the field should be tested periodically, (3) that live-line testing is most satisfactory from the standpoint of cost and efficiency, and (4) that live-line testing apparatus should protect the operator from direct shock and protect the insulator under test from short circuit of its parts, reduction in leakage path and potential in excess of normal operating value.

A vital need of today is an agreement in the industry upon some standards to determine when an insulator is bad enough to warrant its removal from service.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Mixed Culm and New Coal Keeps Up Service

BY COMBINING culm with freshly mined coal the Ohio Power Company was able to utilize its reserve of culm coal in maintaining service during the coal strike. This system of blending culm with the newly mined coal has been in operation for the past six years. By this method the average cost per ton of mixed coal burned was lower than the price of the coal obtained during the coal-strike period and burned alone. Although no comparative figures on the cost of plant operation have been completed, about 15 per cent more storage slack, or culm coal is required for the same steaming capacity that is obtained from freshly mined coal.

LOADING THE MIXED COAL BY BELT CONVEYOR

During the miners' strike a weekly maximum tonnage of 1,750 was loaded at Cambridge, the location of the culm piles, and shipped into Newark. To do this three gasoline tractors were employed, together with teams, and the total cost of loading operation was reduced 50 per cent compared with an all-team equipment. The illustration on the following page shows the tractor in use for reclaiming the slack coal.

In mixing this slack coal with the freshly mined the method used is that when the bunkers are filled one bucket of culm slack and then one bucket of freshly mined coal are placed into the bunkers at one time. While this does not give a uniform mixture, experience has shown that the desired results are obtained. An average heating value of this mixed coal is about 12,000 B.t.u. The only

objection in using culm is that the soot and dust become a nuisance, but by employing a balanced draft and keeping the coal sufficiently wet before it goes into the furnace troubles of this nature have been reduced about 50 per cent.

The company has about 100,000

GASOLINE TRACTOR LOWERS LOADING EXPENSE 50 PER CENT

tons of this slack coal in storage and has found it valuable in giving continuous uninterrupted service regardless of the market price of coal. E. T. WAGENHALS,

Ohio Power Company, Manager.
Newark, Ohio.

## Three-Phase Transformer Rating Standardized

STANDARD ratings for three-phase power transformers have been augmented recently by the Electric Power Club to include the range between 44,000 volts and 220,000 volts. These ratings have been adopted and became effective Jan. 1, 1923. The standard sizes, voltage ratings and taps of stepdown transformers for supplying lighting and power service as they now stand are given in the accompanying table.

The standard type of transformers for this class of service are self-cooled oil-immersed, water-cooled oil immersed, and air blast. The application of air-blast transformers is confined to systems where the voltage does not exceed 25,000. Standard frequencies are 25 cycles and 60 cycles. Standard sizes for oil-immersed self-cooled transformers in kilovolt-amperes continuous rating at 55 deg. C. rise are 300, 450, 600, 750, 1,000, 1,200, 1,500, 2,000, 2,500, 3,000, 3,750, 5,000 6,000, 7,500, 10,000, 15,000, 20,000, 25,000 and 30,000. For water-cooled oil-immersed or air-blast transformers the lowest rating is 750 kva., the sizes above this being the same as for the self-cooled type.

Transformers having low voltage rating of 230/460 are suitable for series or multiple service only. Standard three-phase step-down power transformers for supplying secondary distribution and having voltage ratings listed in the table will be designed for successful operation when excited on full winding at 5 per cent above their rated voltage. Standard three-phase step-down power transformers having voltage rating as given in the table are not suitable for supplying 4,000-volt distribution as such service would necessitate a "Y" connection on both high-voltage and low-voltage side simultaneously, and this connection might result in excessive stress in the winding due to harmonic voltages.

When a standard transformer is suitable for normal application to two voltage ratings, this flexibility will be definitely indicated on the nameplate, on the connection diagram or on a poster inside the transformer cover.

The standard ratings for three-phase distribution transformers in

THREE-PHASE POWER TRANSFORMERS FOR SUPPLYING LIGHTING AND POWER SERVICE

Voltage ratings shown in bold type are the normal voltage ratings of these lines and, unless otherwise specifically requested, manufacturers will offer guarantees covering electrical characteristics such as efficiency, regulation, etc., on these normal-voltage ratings only.

For Supplying Service Voltages 600 and Below

| Standard-System Voltages | Standard Sizes for Each Voltage Class: Oil-Immersed Self-Cooled | Transformer High-Voltage Ratings for Operation from Various Standard-System Voltages: On Full Winding | Approximately on Taps: 5% | Approximately on Taps: 10% | Transformer Low-Voltage Ratings for Supplying Service Voltages of 600 and Below | |
|---|---|---|---|---|---|---|
| 2,300 | 300 to 1,500 | 2,200/3,810Y<br>**2,300 4,000Y** | 2,090/3,615Y<br>2,185/3,785Y | 1,980/3,430Y<br>2,070/3,585Y | .... to 220/440<br>.... to **230/460** | .....or to 550<br>.....or to **575** |
| 4,600 | 300 to 1,500 | 2,200Y<br>**4,400Y** | 2,090<br>4,180 | 1,980<br>3,960 | .....to 220/440 | .....or to 550 |
| | | **2,300Y**<br>**4,600Y** | 2,185<br>4,370 | 2,070<br>4,140 | .....to **230/460** | .....or to **575** |
| 6,600 | 300 to 1,500 | **6,600Y**<br>**6,900Y** | 6,270<br>6,555 | 5,940<br>6,210 | .... to 220/440<br>.....to **230/460** | ...or to 550<br>.....or to **575** |
| 11,000 | 300 to 1,500 | 11,000Y<br>**11,500Y** | 10,450<br>10,925 | 9,900<br>10,350 | .....to 220/440<br>.....to **230/460** | .....or to 550<br>.....or to **575** |
| 13,200 | 300 to 1,500 | 13,200Y<br>**13,800Y** | 12,540<br>13,110 | 11,880<br>12,420 | .... to 220/440<br>.....to **230/460** | .....or to 550<br>.....or to **575** |
| 22,000 | 300 to 1,500 | 22,000Y<br>**23,000Y** | 20,900<br>21,850 | 19,800<br>20,700 | .....to 220/440<br>.....to **230/460** | .....or to 550<br>.....or to **575** |
| 33,000 | 300 to 1,500 | 33,000Y<br>**34,500Y** | 31,350<br>32,775 | 29,700<br>31,050 | .....to 220/440<br>.....to **230/460** | .....or to 550<br>.....or to **557** |

For Supplying Distribution Voltages Above 600

| Standard-System Voltages | Standard Sizes for Each Voltage Class: Oil-Immersed Self-Cooled | Standard Sizes for Each Voltage Class: Oil-Immersed Water-Cooled or Air-Blast | Transformer High-Voltage Ratings for Operation from Various Standard-System Voltages: On Full Winding | Approximately on Taps: 5% | Approximately on Taps: 10% | Transformer Low-Voltage Ratings for Supplying Secondary Distribution |
|---|---|---|---|---|---|---|
| 6,600 | 300 to 3,000 | 750 to 7,500 | **6,600Y** | 6,270 | 5,940 | ..to **2,300** |
| 11,000 | 300 to 7,500 | 750 to 15,000 | **11,000Y** | 10,450 | 9,900 | ..to **2,300** |
| 13,200 | 300 to 7,500 | 750 to 15,000 | **13,200Y** | 12,540 | 11,880 | ..to **2,300** |
| 22,000 | 300 to 7,500 | 750 to 15,000 | **22,000Y** | 20,900 | 19,800 | ..to **2,300**..or to **6,900** |
| 33,000 | 300 to 7,500 | 750 to 15,000 | **33,000Y** | 31,350 | 29,700 | ..to **2,300**..or to **6,900**..or to **11,500**..or to **13,800** |
| 44,000 | 300 to 10,000 | 750 to 15,000 | **44,000Y** | 41,800 | 39,600 | ..to **2,300**..or to **6,900** .or to **11,500**..or to **13,800** |
| 66,000 | 300 to 10,000 | 750 to 15,000 | **66,000Y** | 62,700 | 59,400 | ..to **2,300**. or to **6,900** .or to **11,500**..or to **13,800** |
| 88,000 | 1,200 to 10,000 | 1,500 to 15,000 | **88,000Y** | 83,600 | 79,200 | ..to **2,300** or to **6,900** .or to **11,500**..or to **13,800** |
| 110,000 | 2,000 to 10,000 | 2,500 to 15,000 | **110,000Y** | 104,500 | 99,000 | ..to **2,300** .or to **6,900** .or to **11,500** .or to **13,800** |
| 132,000 | 2,500 to 10,000 | 3,000 to 15,000 | **132,000Y** | 125,400 | 118,800 | ..to **2,300** .or to **6,900** or to **11,500**..or to **13,800** |
| 154,000 | 3,000 to 10,000 | 3,750 to 16,000 | **154,000Y** | 146,300 | 138,600 | ..to **2,300** .or to **6,900** or to **11,500**..or to **13,800** |
| 220,000 | 3,750 to 10,000 | 5,000 to 15,000 | **220,000Y** | 209,000 | 198,000 | ..to **2,300** .or to **6,900**..or to **11,500**..or to **13,800** |

the 6,600, 11,000, 13,200, 22,000 and 33,000-volt classes have been modified to include two 5 per cent full-capacity taps in the high-voltage winding instead of one 10 per cent tap.

These standards will be incorporated in the next edition of the Electric Power Club Handbook.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Rigid Transformer Supports Insure Reliable Service

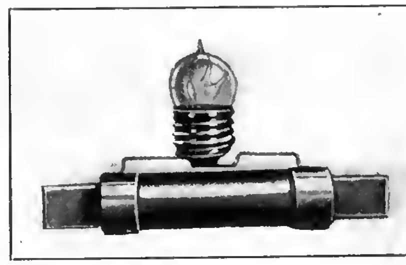
IN SUPPLYING energy to industrial plants service entrances and transformers are frequently placed on walls, roofs or other exposed places, and mechanical strength in wiring supports is vital to continuous service. Four examples of recent installations designed with this requirement in mind are shown herewith. A transformer installation of unusual compactness and rigidity is shown in Fig. 1 of the illustration. The transformers are hung by metal straps from a horizontal angle iron bolted through the factory wall, the comparatively low-voltage primary leads being run at the top of the bank in rigid conduit, with short taps into the cases, appropriately drip-looped. The secondaries, running single-phase, are carried up the side of the building from one unit and into the factory direct from the other two. The weight of the transformer bank is further supported by a horizontal strap at the bottoms of the cases, with bolts into the pilasters and window casings as shown. The bank takes up little space outside the bays between pilasters, and the wiring is adequately safeguarded.

A transformer installation on an industrial plant roof is shown in Fig. 2, under construction. A simple frame of vertical and horizontal angle irons carries insulators at the top for an outdoor bus line, and at the intermediate height are secured tie rods and strain insulators by which an incoming three-phase circuit can be dead-ended and provide ample space for downward taps into the transformer casing. A convenient means of carrying various circuits over the cornice of an industrial building and downward toward the street for an overhead crossing is shown in Fig. 3. Here angle-iron bracing firmly attached to the building wall is equipped with insulators carried far enough out to provide a desired separation of circuits, clearing the wall satisfactorily and still accessible with reasonable care for future changes. In place of the unsightly runs of heavy cables and home-made wooden frames sometimes used in supplying energy to industrial establishments via the roof, the use of rigid conduit and junction boxes in Fig. 4 is of interest. The joints are copper-flashed to keep out moisture, and intermediate supports for the conduit run are in the form of rings attached to horizontal cross-bars carried on vertical pipe risers. The last are seated in foundation blocks fastened to the roof. Changes in direction are easily made at the junction boxes, and the whole installation has a "shipshape" appearance far from usual in industrial applications of electrical importance.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Indicator for Blown Fuses Increases Production

INTERRUPTION to the chain of production, discouragement of speeding piece workers and opportunity for complaints and excuses caused by blown fuses can be completely avoided by those who will



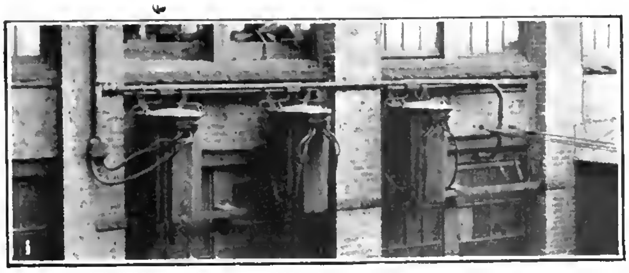
TEST LAMP ON FUSE INDICATES WHEN FUSE HAS BLOWN

take the trouble to have small test lamps permanently installed on each fuse and a supply of proper fuses in readiness. Lamps in their sockets can be installed on the outside of fuse boxes and the wires run to the fuses within the box.

By this arrangement the test lamp is shunted by the fuse so that when the fuse blows the circuit is completed through the lamp and indicates the trouble. Lamps should be of low wattage and of the same voltage as the circuit on which they are to be used.

Because of the installation of these fuse indicators in one shop the improvement in morale has been very marked and the slight expense has been returned many times in increased production.

C. F. P. CARRIER,
Philadelphia, Pa. Engineer.



FOUR GOOD EXAMPLES OF INDUSTRIAL POWER INSTALLATIONS WITH AMPLE PROVISION FOR ADEQUATE MECHANICAL STRENGTH

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## Building Industrial Load

**Some Suggestions for the Commercial Man on Developing the Electric Light, Heat and Power Loads in Shops and Manufacturing Plants**

By J. W. Carpenter
A. E. Fitkin & Company, New York, N. Y.

Any central-station man who starts out to develop the industrial load of his company has three distinct opportunities in every place of business he may approach. He is able to offer modern lighting, power and industrial electric heating.

Each of these services is something which can be sold if the proper study is given to the development of demand and if the selling effort is maintained. The reward for the effort expended in securing this business is found in the substantial additions to gross income, the large increase in business through one contract that may equal several dozen residential contracts, and the satisfaction that comes with the knowledge that there has been a distinct step of progress by the new customer.

### Prerequisites for Developing Industrial Load

There are certain fundamentals in the development and negotiation of industrial load that must be followed carefully to insure continued success. The man closing the contract, whether he be property manager, visiting engineer or local salesman, must first study externally the situation on which he is to work. In this he must (1) grasp the general conditions of the business of the company, (2) know the personal fancies of the men with whom he deals, (3) find the particular need of the prospective customer for the service, (4) arouse advance interest on the part of the "prospect" by the use of letters and printed matter, (5) know of the recent developments in electric apparatus in order that he can recommend the newest types of equipment or the most advanced practices.

There is in addition to the foregoing one urgent caution. Negotiations should be started with the chief executive of the prospect company. Many times successful efforts have been made to convince plant engineers, foremen or superintendents of the advisability of adopting electric service, but the entire negotiation has fallen through when it is carried to the owner or general manager because he had not grasped the situation first. On the other hand, if the man at the top is approached first in an introductory way, he will be waiting for a report of the details which are worked out with his subordinates.

### Lighting

A man working on industrial business has much to offer. In the lighting field there is unlimited opportunity for load. Probably about 95 per cent of the factories and shops in this country need a completely new lighting installation. Commercial men can readily call to mind the inadequate lighting in many places in their own district where outlets are placed in haphazard fashion, lamps are too small and dust covers the fixtures. Such conditions are crying for attention. The industrial emergency during the war taught us that better and brighter light brings greater production and finer workmanship.

Any man who will take a few lamps under his arm can find places enough for their installation. It is a specific opportunity for the salesman in the central-station company or for the local contractors. Any manager who will convince just one local contractor of the profit he can obtain from rewiring and relamping industrial plants in his territory will find that the contractor, the central-station company and the customer will profit greatly.

In the power field there is large opportunity for increased business that calls for intelligent, diplomatic and persistent effort. The Electrical World for Jan. 6, 1923, tells us that the industrial field of the central station is only one-third developed. There are certain common methods of obtaining this load: (1) by gaining a foothold with an initial installation, (2) emergency service, (3) new building, or (4) complete conversion.

### Power and Heating

In the first of these the central station gets a small load by installing a motor or two and perhaps all of the lighting, owing to the overloaded condition of the isolated plant. This will lead, with good service and treatment, to the gradual acquirement of the entire load. In the second case a broken-down engine, a leaky boiler or a fire gives an energetic central station a chance to install one large motor for urgent power needs. Perhaps this will be used for only a short time, but the convenience of that electric drive will bring the entire load over with group or individual drive in a short time. In the third case—new building—it is comparatively easy to obtain the motor load.

By the use of manufacturers' data and the information prepared by the national electrical societies the isolated plant can be shown to be much more expensive in first cost and in operating costs. This is particularly true if sufficient weight is placed upon the cost of duplicate equipment needed in an isolated plant for continuous service. In the fourth case, complete conversion of a plant requires particularly the proper preliminary work, careful engineering and continuous follow-up. Rome wasn't built in a day, and a private plant cannot be converted overnight. Securing the power contract for a plant of from 100 hp. to 500 hp. after a year of negotiations is pretty good work. However, the economy and convenience of central-station service will conquer the most stubborn "prospect" if the story is brought to him often enough.

The newest field for development is industrial electric heating. Many electrical men know very little about it and do not appreciate its possibilities. Nevertheless, electric heating in industrial processes is growing by leaps and bounds. Paint drying, bread baking, japanning, core baking, heat treating, vitreous enameling, brass melting and steel refining are a few of the things accomplished electrically. All of these cannot be done so cheaply by electric heat as with some other sources of heat, when fuel cost alone is considered, but other economies in saving of material and improved quality of the product more than offset the difference in cost.

### Follow-Up Essential

Finally, the cardinal rule of the golfer, to "follow through," applies equally well to the central-station business. Quiet but persistent, polite but tenacious "follow-through" is needed until the contract for new business has been signed and forgotten by the customer who has learned to consider this service as an integral part of his operations.

## Servicing Electric Ranges

**Company Policy — Chief Causes of Trouble and Cost of Maintenance and Repair Work**

By A. H. Kruel

Assistant Superintendent Meter and Service Department, Portland (Ore.) Railway, Light & Power Company

ON NOV. 1, 1922, there were 1,475 electric ranges on the lines of the Portland Railway, Light & Power Company, and approximately 125 additional range sales had been booked, which would bring the total up to 1,600 at the end of the year. To keep these ranges in satisfactory operating condition the company has adopted a very liberal attitude in its repair service. The policy is to maintain each range connected—largely without cost to the customer for material or labor—indefinitely.

This service includes elements, plates, switches, thermostats, door springs and hinges, racks and pans. It also includes refinishing and painting of oven linings to a limited extent, but does not provide for new linings except when renewed within the year's guarantee of the manufacturer because of defectiveness. All other repairs are made for the cost of material only to the customer unless the range requires a general overhauling in the shop, for which a charge for both labor and material is made. The range service applies to all ranges, whether purchased through the company, the retailer or the competitive power company, as long as they are served by this company.

### Three Principal Causes of Trouble

The most common complaint from customers is that the plates or ovens do not heat. Aside from the heating elements being defective, this complaint is due to, first, the range being equipped with plates or oven

PORTLAND COMPANY'S ELECTRIC RANGE SERVICE CAR

elements designed for a higher voltage than that of the distribution system; second, low voltage on the range, which requires increased transformer capacity, and, third, defective thermostats on the ovens. Much emphasis is placed upon this third cause for low heat, because practically all range customers rely entirely upon the indicated heat as shown by the thermostat. Such a wide variation is shown in thermostats of the same make that consumers are advised by range service men to disregard the tables sent out with ranges for various cooking heats and to use their own judgment about the quantity of heat required. There seems yet to be designed the perfectly efficient and reliable thermostat. The greatest common defect of electric ranges is the short life of the heating element. Table I shows a classification of complaints

TABLE I—CLASSIFICATION OF RANGE COMPLAINTS

| Defects | Number |
|---|---|
| Coils and plates | 443 |
| Contacts | 116 |
| Door springs and hinges | 75 |
| Oven elements | 44 |
| Thermostats | 34 |
| Painting ovens | 33 |
| Switches | 26 |
| New linings | 17 |
| Shorts, grounds and miscellaneous calls | 365 |
| Total | 1,153 |

TABLE II—COST OF SERVICING ELECTRIC RANGES

| Year | Complaints | Average Ranges in Service | Complaints per Range | Material Cost per Range | Labor Cost per Range | Total Cost per Range |
|---|---|---|---|---|---|---|
| 1919 | 1,153 | 456 | 2.1 | $1.56 | $3.96 | $5.52 |
| 1920 | 1,506 | 701 | 2.1 | 3.34 | 4.54 | 7.88 |
| 1921 | 2,009 | 846 | 2.3 | 2.53 | 5.31 | 7.84 |

on service calls received during 1919. No summary has been made at a later date. Table II shows the costs of maintaining electric ranges for three years, not including 1922.

Two service automobiles, similar to the one shown in the accompanying illustration, equipped with a full stock of range parts are used in servicing ranges. In addition, a third machine takes care of new installations and also does service work when necessary. One of the two service machines can also make deliveries and installations when occasion demands. Five ranges have been delivered and installed in one day by one machine, and occasionally both machines have installed as high as nine ranges in one day. At present there are three range men with a helper to service and install ranges besides the one man (sometimes two) who burns off and sets up ranges for delivery from the shop. About six hundred new ranges were added to the system during 1922, and the indications are that this number will be exceeded in 1923.

## To Win the Confidence of the Public

THE Interstate Power Company of McGregor, Iowa, which serves a number of communities in southwestern Wisconsin and northeastern Iowa, has adopted a policy of taking the public into its confidence which is reacting in the company's favor. From time to time small properties have been purchased and added to the company's transmission system, which extends on both sides of the Mississippi River. While these different properties were in process of being interconnected it was not possible to render 100 per cent service. In some cases misunderstandings arose, and to clear away such difficulties and create good will for the company moderate advertising campaigns are being carried on in the towns served.

As new additions to the company's plant and property are made an-

nouncements are carried in all the newspapers published in the communities. For instance, when connection had been established with a new hydro-electric plant at Prairie du Sac, Wis., an announcement was made stating that this plant had become a part of the company's system and would give the territory another source of water power which would increase the reliability of the service. In one case an interruption to the service, caused when a house mover fouled the company's transmission line, was explained as follows:

### Why the Lights Went Out

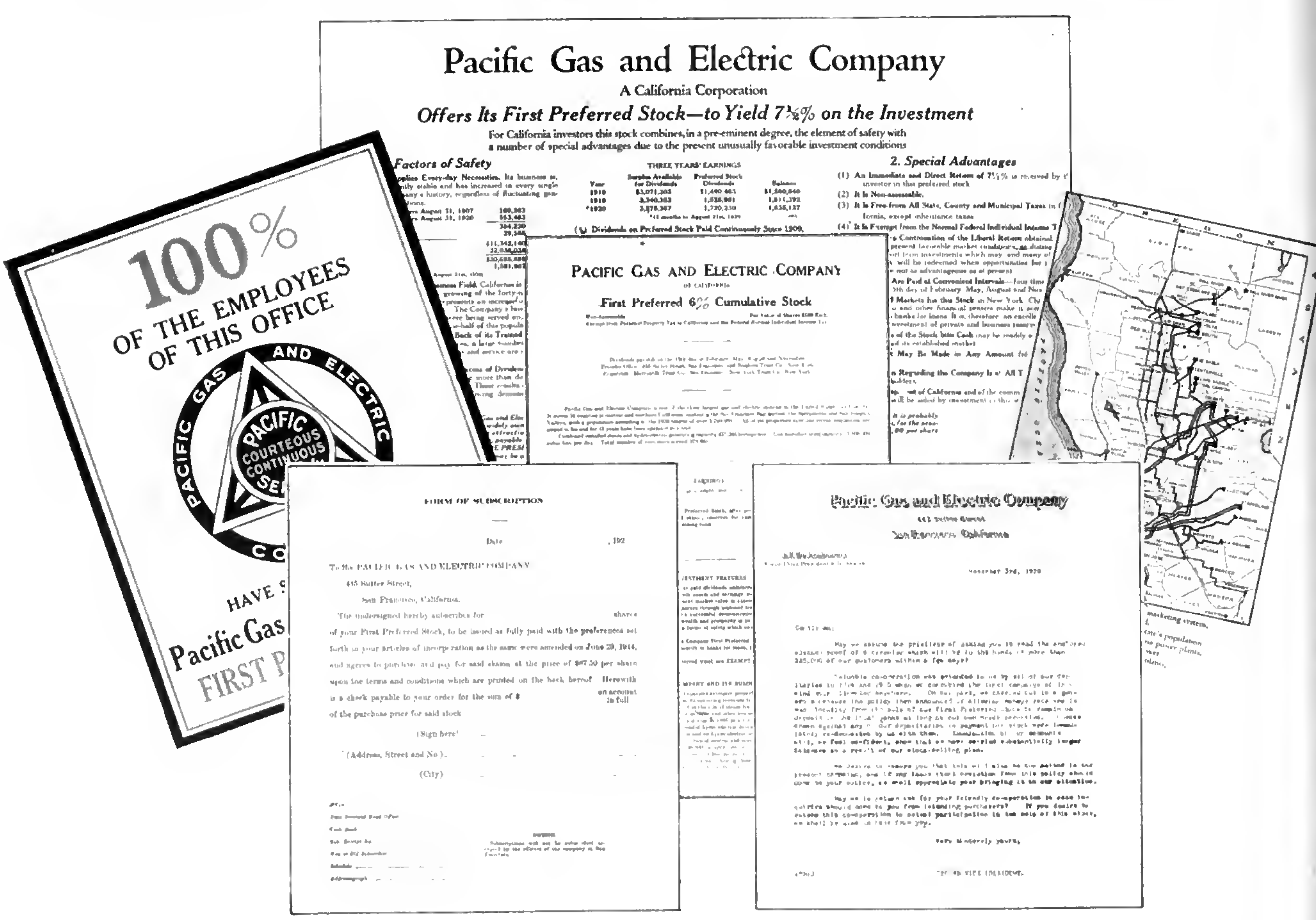
At 2:57 p. m. on Dec. 28 all of our towns from Platteville to Cresco suffered an interruption. This was due to a house mover in Boscobel, Wis., allowing a house which he was moving to become fouled in our transmission line. It was just luck that this house was not set on fire or some one injured. All towns suffered minor interruptions, and Boscobel was without service for two hours and a half.

If any one who has trees to trim or houses to move which will come near our lines will notify our local representatives or the general office at McGregor, we shall gladly have representatives on the job to prevent damage to property or interruptions to service.

In an effort to educate the public and win its confidence in another direction, the company is making use of a motion-picture machine. Last summer during a wild-life school for nature study which is conducted at McGregor every year the Interstate Power Company, to do its part toward making the gathering a success, rented a motion-picture projector, obtained several films which were appropriate to the work of the school and showed them at the evening meetings. The idea took so well with the public that other reels were shown at the request of the women's clubs and church organizations. It became so popular that the company purchased the projector and screen, which are now kept at its headquarters subject to call.

A photographer has been sent over all of the company's lines and has taken pictures of the transmission system, stations and scenes along the lines and in the towns served. One of the company's engineers is now making the rounds of the various communities served, showing the reels in the different motion-picture theaters. Invitations to prominent men and women are extended by the company's representative at each place, and the exhibition is very well received by the public. The company feels that it has been more than repaid for the trouble and expense of purchasing the machine and showing the pictures.

## Publicity Which Helped to Sell $35,000,000 of Stock to California Customers




When the Pacific Gas & Electric Company first opened its customer-ownership campaign in 1914 it adopted a definite policy of keeping its stock constantly in the mind both of the public and of its employees. This was accomplished through a well-planned program of newspaper advertising, reading notices, display cards and frequent bulletins to employees, all of whom at some time have acted as salesmen. Typical examples of the different forms of advertising used are shown above.

During the eight and one-half years of the campaign the volume of stock sold at any particular time has been in direct proportion to the amount of money which was being sent for advertising. Over the entire period, in which more than $35,000,000 of preferred stock has been sold, the advertising expense has averaged only 84 cents per share.

## Elimination of Red Tape Improves Service

VARIOUS steps toward making relations with the public smoother were described in a recent address before managers of Stone & Webster properties by Gardner Rogers, manager of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I. During the past year many minor changes have been made in business methods, in an effort to eliminate red tape, complicated forms and everything appearing intricate or arbitrary in relations with the public. Representatives of the company have also endeavored to introduce a little extra courtesy in their dealings with customers.

To all new customers a courteous multigraphed letter is sent when their order for service has been taken. All customers who have registered trouble calls are called on the telephone to see if the trouble has been satisfactorily remedied, and if they cannot be reached in this way, a letter is written. A card is being sent to customers, accompanying their final bill, thanking them for their patronage and hoping for a further renewal of business relations.

### CUSTOMERS SHOULD "ORDER," NOT "APPLY" FOR, SERVICE

All signed orders for gas and electric service have been eliminated, and the management believes this is one of the biggest steps so far in the interest of good public relations. "A good while ago," said Mr. Rogers, "we came to the conclusion that when a customer wants to buy service he should be allowed to *order* rather than to request or apply for it. Either gas or electric service may now be secured on telephone order and wherever possible we set the meter immediately upon receipt of such an order, without waiting for credit to be established. If we find a deposit is needed, it is secured after the meter has been installed. We feel that this is a step in the direction of both quicker and more acceptable service.

"We have reduced considerably the number of deposits required and are now taking them only in case of customers who appear to indicate less than an even chance of prompt payment. We are taking only about half as many deposits per thousand new customers as we were doing a year ago, the present ratio being about one to eight."

The company has also started refunding old deposits to customers who have established their credit. This refunding is proceeding gradually. The money now held as deposits, divided by total customers, is $1 as against $1.26 two years ago.

## What Other Companies Are Doing

**Hartford, Conn.**—Less than two-tenths of 1 per cent of the 39,000 residential customers of the Hartford Electric Light Company requested the restoration of the former rate of 10 cents per kilowatt-hour after a year's trial of the company's new rate comprising an area charge plus 6 cents per kilowatt-hour. This rate went into effect in January, 1922. The company offered to rescind the new rate after twelve months' use in case of dissatisfaction, and as the year closed it published in the daily press form letter blanks addressed to the Mayor, in order to facilitate the filing of objections.

**Chicago, Ill.**—Subsidiary operating companies of the Middle West Utilities Company on Dec. 1, 1922, had a total of 394,706 customers, or an increase of 58,555, this representing a gain of 17.4 per cent in twelve months. Connected load of these companies on Dec. 1 was 333,890 kw., an increase in twelve months of 104,152 kw., or 24.3 per cent. Merchandise sales for the twelve months were $1,450,755, or a gain of 20 per cent over the previous twelve months.

**Tacoma, Wash.** — In the last year out of 847 employees of the Tacoma division of the Puget Sound Power & Light Company, 501 have purchased stock in the company. This, in connection with the previous sale of notes to employees and to the public, has been a factor in the improvement of public relations, according to a report presented before a recent convention of managers of companies operated by Stone & Webster, Inc.

**Lake Geneva, Wis.** — Forty-two employees of the Southern Wisconsin Electric Company received Christmas presents in the form of paid-up life-insurance policies of from $500 to $1,500, depending upon their length of service. The policies were taken out by the company under the "group" life-insurance plan and total in amount of insurance $36,000. Nine employees received policies for $1,500, two for $1,200, two for $1,000, six for $800, sixteen for $600, six for $500, and one a policy for $700. Every employee who had served with the company on or before June 30, 1922, received a policy for $500, those who had served a year and less than two years $600, two years and less than three years $700, three years and less than four years $800, four years and less than five years $1,000, and six years and more $1,500. The policies are so drawn that should an employee leave the service of the company he can continue the insurance by paying the premium himself.

**Salem, Mass.** — Before central-station service was introduced into the mills of the Naumkeag Steam Cotton Company, it was customary, as in many other engine-driven factories making textile goods, to shut down the plant annually for painting and repairs to machinery. In 1914 this establishment opened a new plant supplied with energy by the Salem Electric Lighting Company, and until the summer of 1922 no shutdowns were necessary for general overhauling. The argument for central-station service and the motor drive is obvious.

**Pawtucket, R. I.** — New power business to the amount of over 2,600 kw. was contracted for during 1922 by the Pawtucket division of the Blackstone Valley Gas & Electric Company, 2,160 kw. of this representing actual gain in power load. As a result of obtaining this business three steam engines and one oil engine were shut down and considerable inroads were made into the power load carried by three other private steam plants operating in the territory.

**Ann Arbor, Mich.**—Next Easter vacation at the University of Michigan the electric light and power men of Michigan will gather for a week of intensive study and demonstration of the principles of good wiring and installation and handling of meters. A short course has been designed to cover most of the demands for a high standard of service as required by the Michigan Public Utilities Commission in a recent general order. Those in charge of the course from the university department of engineering are Profs. B. F. Bailey, Joseph H. Cannon, H. H. Higbie and A. H. Lovell; for the Michigan Electric Light Association, Herbert Silvester, Ann Arbor, secretary; J. C. Langdell, A. S. Albright and Oscar Hauser, Detroit.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*An Ultimate 65,000-Kw. English Power Plant.*—The first 10,000-kw. turbo-generator unit for the new power plant at Leicester, England, has recently been placed in operation. While this amount of power is all that can be generated at this time, space is available for extension until a total capacity of 65,000 kw. is reached. An interesting feature of the station is the arrangement of the oil-break switches and other apparatus necessary for controlling the electrical output. The layout of the switching equipment in relation to the rest of the station is of the most up-to-date character.—*Electrician,* Dec. 15, 1922.

*Principles of Boiler Design.*—The leading principles involved in boiler design with special reference to economy are reviewed. The main points brought up are high furnace temperature effects, convection and velocity of gases, natural draft, air heaters, superheaters, economizers, high velocity of flames, reductions of furnace temperatures and oil burning.—*Engineer,* Dec. 22, 1922.

*Fuel Oil Versus Steam Engines for Small Power Plants.*—G. T. PRINCE.—Advantages of oil engines for municipal plants, experiences with Diesel engines and the high cost of coal affecting steam-engine operation are the main subjects discussed in this paper.—*Canadian Engineer,* Dec. 26, 1922.

## Generation, Control and Switching

*Operation and Control of Storage Batteries in Central Stations.*—A. FASTMAN. — Out-of-balance charging current should be minimized as far as possible, extent of charging should be limited, and floating charge should be avoided, while in addition observation of appearance of cells should play an important part during charging and observation of instruments should be practiced at all times, together with a careful regard to the working instruction card. If proper care and treatment are given to storage batteries and reliable judgment is cultivated by careful attention, depreciation can be avoided to a considerable extent.—*Electrical Review,* Dec. 22, 1922.

*Power Factor, Its Physical Meaning and Commercial Manipulation.*—W. G. H. CAM.—In discussing the question of power factor, the author first reviews the fundamental relations of electricity in order to create a background upon which to base his arguments. He then considers the advantages of keeping a plant power factor in the neighborhood of 100 per cent and describes the various methods by which this may be accomplished. — *Engineering Journal, (Canada)* January, 1923.

*Reducing Electrical Hazards in the Industrial Plant.*—Installation of modern types of inclosed and remote-controlled switches, the placing of all wires in conduits, the educating of employees to the understanding that every wire is to be considered "alive," and the prohibiting of all employees, except electricians engaged for that purpose, from operating or tampering with electrical equipment, have been the important factors in reducing electrical accidents and hazards in industrial plants. The practices of several companies in this regard are related.—*National Safety News,* January, 1923.

## Transmission, Substations and Distribution

*Electrical Developments at Liverpool.*—A new 12,500-kw. generator and an automatic substation have recently been placed in operation at Liverpool, England. The 500-kw. rotary-converter automatic substation is the first of its kind to be operated in England. The main features and details of the apparatus are described.—*Electrician,* Dec. 22, 1922.

*Economy of Transformer Connections.*—R. KORNFELD.—The author compares in this mathematical paper the relative advantages of operating (a) a bank of three single-phase transformers with a fourth single-phase unit as spare, (b) one three-phase transformer with an identical unit as spare, and (c) a bank of three single-phase transformers, operating in V in case of breakdown of one of the three units. The operation of (a) is 20 per cent cheaper than (c) but has 20 per cent higher losses. These losses can be materially reduced by operating in V-connection during periods of low loads. How far this can be carried out without too serious a distortion of the phase voltages resulting in an asymmetrical feeding of three-phase consumers is shown mathematically.—*Elektrotechnik und Maschinenbau,* Dec. 17, 1922.

*Causes of Transformer Failures.*—S. A. STIGANT.—The faults that most frequently occur in practice, and to which the discussion of the paper is devoted, may be classified as follows: (1) Breakdowns in the magnetic circuit, (2) breakdowns in the electrical conducting circuit, (3) breakdowns in the dielectric circuit, particularly in the oil and major insulation, and (4) miscellaneous structual breakdowns. A study of the records of modern transformer breakdowns over a period of years shows very conclusively that between 50 per cent and 80 per cent of the number of failures are due to short circuits between coils.—*Electrical Review,* Dec. 1 and 8, 1922.

## Units, Measurements and Instruments

*Determination of the Calorific Value of Liquid Fuels.*—H. MOSS and W. J. STERN. — Although accurate comparisons of the calorific values for different fuels may be found by the bomb calorimeter, the absolute values are not obtained with the same certainty. Investigations, explained in detail, have been carried on by the authors of several other methods. Experiments were made with gasoline, benzine, alcohol and paraffine oil at various rates of burning and with different water flows. The heat losses were examined and the accuracy of the instrument determined. —*Engineering,* Dec. 15, 1922.

*Recent Developments in Electric Clockworks.*—M. LAVET.—A large number of modern electric clocks are described and illustrated schematically, and their features are investigated mathematically. Many of the theoretically ingenious mechanisms do not show a good performance because of the unreliable operation of their auxiliary parts. The paper describes only self-maintained clocks, excluding so-called secondary clocks regulated from master clocks. — *Revue Générale de l'Electricité,* Dec. 2 and 9, 1922.

## Illumination

*Measurement of Light.* — J. W. WALSH.—The fundamental photometric magnitude from the point of view of visual measurement is, according to the author, brightness and not illumination. The photometric unit is one of luminous intensity or luminous flux. Of the two possible systems of definitions based on these respective magnitudes, that in which the unit is maintained seems preferable because it follows the natural order of mental conception. The relation between the flux unit of brightness (the lambert) and the intensity unit (the candle per square centimeter) is pointed out. — *Philosophical Magazine,* December, 1922.

## Motors and Control

*Motor Drives in Manufacturing Processes.* — R. TRAUTSCHOLD. — The modification of existing plants by changing from mechanical to electric drive will in nearly every case bring about results favoring the electric drive. Substituting a motor drive for a mechanical one for the average machine tool will as a rule entail no greater expenditure than will be returned by the economies obtained in one year's operation. The advantages of motor drive as pointed out by the author are reduced friction, flexibility, safety, and lighter building construction. — *Southern Engineer,* December, 1922.

*Automatic Plant for Village Lighting.*—A small engine-driven generator including a storage battery outfit has been used for lighting villages in England. The operation of this automatic generating unit is entirely controlled by voltage regulation, a detailed description of which is given.—*Electrical Times,* Dec. 7, 1922.

## Heat Applications and Material Handling

*Driving of Handling Machinery.*—H. BLYTH.—The supply of fuel to power plants and gas plants where the energy of the fuel is converted into either electricity or gas for distribution to consumers is best carried out by motor-equipped handling machinery. Typical coal-handling apparatus, such as the telpher system, belt conveyors and bucket conveyors, are described.—*Electrician,* Dec. 29, 1922.

*The Production of Carbon Black.*—J. J. JAKOWSKY.—The effects of several types of electrical discharges on natural gas has been studied in order to determine the fundamental factors underlying the reactions and their possible influence in the recovery of a greater part of the carbon content of natural gas than is now possible. Present commercial plants using natural gas recover from 0.8 lb. to 1.5 lb. of carbon black per 1,000 cu.ft. of gas consumed, or less than 5 per cent of the total carbon in the gas. Investigations, including apparatus set-up of the various methods so far used with natural gas, are summarized.—*Serial No. 2417 of the Bureau of Mines.*

## Electrophysics, Electrochemistry and Batteries

*Inspection of Ferrous Materials.*—E. A. ALLCUT.—Ferrous materials may be divided roughly into four classes, (1) rolled sections, such as bars, billets, and sheets; (2) tubes and drawn sections, (3) forgings, and (4) castings. Under these headings the author discusses characteristic defects, methods of identification, slag seams and piping, straightness, forging characteristics and various tests such as tensile and impact tests, blowholes, hard spots, etc. —*Canadian Engineer,* Dec. 5, 1922.

*Corrosion as Affecting the Metals Used in the Mechanical Arts.*—W. H. HATFIELD.—An interesting set of experiments which were conducted to decide upon the relative resistance of typical industrial metals to various corroding media are enumerated. An analysis of various metals which form the subject of experiment is given in tabular form. The mechanical properties, standard acid tests and corrosion tests of the metals are also given in this form.—*Engineer,* Dec. 15, 1922.

## Traction

*Electric Locomotives for Japanese Government.*—Two of the new locomotives for the Imperial Government Railways of Japan are considered. These are equipped with motors specially designed for narrow-gage track. They have high-speed circuit breakers and a new form of electropneumatic control, each feature being described briefly. The locomotives for this railway have been built for 1,500-volt direct-current operation.—*Electric Railway Journal,* Dec. 23, 1922.

*Diesel-Electric Railway Car.*—One of the first large Diesel locomotives built and run was the thermo locomotive delivered early in 1913 to the Prussian State Railways. This was a 1,000-hp. engine, giving train speeds up to 60 miles per hour. Since that time several engines have been built and have been in successful operation. The main part of the article is devoted to a description of an engine built for the Baden Nieg-erglat Section of the Swiss Federal Railways.—*Engineer,* Dec. 29, 1922.

*Automatic and Semi-Automatic Railway Signaling.*—H. S. PETCH.—The evolution of railway signaling to meet the demands of safety, and later of traffic capacity, has culminated in the modern automatic and semi-automatic systems. The track circuit, which forms the basis of all modern automatic signaling, is considered in this article, including its modifications to suit electrified lines. Apparatus controlled by track circuits is described, together with additional schemes for its safe operation. The article concludes with a description of some auxiliary apparatus designed to expedite traffic handling. — *Institution of (British) Electrical Engineers,* December, 1922.

## Telegraphy, Telephony, Radio and Signals

*Vacuum-Tube Amplification.*—S. E. ANDERSON.—For sensitivity the author claims that direct radio-frequency amplification should be used. One stage of radio-frequency amplification in a non-regenerative circuit gives about the same sensitivity as a first-class regenerative receiver. Two stages with good transformers will be about five times as sensitive as a simple regenerative circuit, and the regeneration in the amplifier will multiply this by about three. One additional stage of audio-frequency amplification will bring the weaker signals up to a more comfortable volume. Additional stages of audio-frequency amplification—never more than two—should be used only for operating a loud speaker, as they add nothing to the sensitivity of the receiver.—*Q. S. T.,* January, 1923.

*Telephonic Repeaters and Long-Distance Telephony.*—J. A. COOPER.—The paper reviews the development of long-distance telephony and shows the great improvements effected by the introduction of telephonic repeaters employing thermionic valves.—*Journal of Institution of (British) Electrical Engineers,* December, 1922.

## Miscellaneous

*Properties of Electrical Insulating Materials of the Laminated Phenol-Methylene Type.*—J. H. DELLINGER and J. L. PRESTON.—A comprehensive experimental research has been made upon the principal electrical and mechanical and a few other properties of the laminated phenolic materials. Measurements were made upon materials such as are furnished commercially by several manufacturers. The data collected have been arranged in such a manner as to be conveniently available for reference. A summary-comparison tabulation of the characteristic values of these properties of various materials is reproduced here. Average values for the various properties of laminated phenolic insulating materials are given regardless of grade, make or thickness. — *Technologic Paper No. 216 of the Bureau of Standards.*

CHARACTERISTIC VALUES OF PROPERTIES FOR SEVERAL INSULATING MATERIALS

| | Bakelite-Dilecto, Grade | | | Bakelite Micarta, Grade | | | Condensite Celoron, Grade | | Formica, Grade | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Property | XX | X | Continental Bakelite | 32-X and 21-X | 323 and 213 | 21-D | 10 and 15 | 20 | M | M-2 | P | R |
| Power factor, per cent | 3.6 | 3.3 | 6.6 | 5.1 | 4 2 | 9.9 | 5.1 | 11.0 | 5.3 | 7.7 | 5.1 | 7.9 |
| Dielectric constant | 5.2 | 5.5 | 5.3 | 5.8 | 5.9 | 6.4 | 6.6 | 6.8 | 5.6 | 5.8 | 5.8 | 6.5 |
| Flash-over voltage, radio frequency | 9,800 | 19,800 | 21,100 | 20,000 | 19,700 | 22,000 | 21,000 | 27,800 | 19,700 | 20,600 | 18,300 | 21,000 |
| Volume resistivity, ohm-cm $+ 10^8$ | 8,800 | 520,000 | 200 | 9,400 | 29,900 | 100 | 15,100 | 63 | 2,200 | 250 | 900 | 60 |
| Surface resistivity at 24 per cent humidity | 38,900 | 445,000 | 100 | 3,300 | 10,400 | 580 | 12,500 | 1,800 | 600 | 340 | 670 | 340 |
| Surface resistivity at 50 per cent humidity | 3,900 | 4,000 | 9 | 900 | 2,700 | 130 | 2,300 | 275 | 160 | 120 | 300 | 220 |
| Surface resistivity at 84 per cent humidity | 48 | 6 | 1 | 22 | 30 | 3 | 77 | 13 | 10 | 5 | 34 | 80 |
| Density | 1.34 | 1.34 | 1.30 | 1 35 | 1.37 | 1.36 | 1.41 | 1.34 | 1.36 | 1.34 | 1.38 | 1.38 |
| Water absorbed in 24 hours, per cent | .21 | 1.76 | .49 | .33 | .88 | .91 | .26 | .39 | .26 | .49 | .60 | 1.22 |
| Ultimate tensile strength, lb. per sq.in. | 12,800 | 17,800 | 8,700 | 10,900 | 16,600 | 8,900 | 12,300 | 7,800 | 12,600 | 13,200 | 18,200 | 9,900 |
| Modulus of (tensile) elasticity, 1,000 lb. per sq.in. | 1,500 | 2,100 | ...... | ... | ...... | ...... | ...... | ...... | ...... | 1,950 | 2,260 | ...... |
| Modulus of (transverse) rupture, lb. per sq.in. | 18,000 | 22,700 | 13,600 | 16,200 | 21,400 | 13,900 | 15,800 | 11,100 | 17,700 | 17,300 | 21,400 | 15,100 |
| Modulus of (transverse) elasticity, 1,000 lb. per sq.in. | 1,310 | 1,900 | ...... | 1,260 | 1,600 | ...... | ...... | ...... | 1,270 | 1,430 | 1,410 | ...... |
| Brinell hardness at 50 deg. C. | 40 | 26 | 30 | 34 | 32 | 32 | 35 | 32 | 34 | 41 | 34 | 34 |
| Scleroscope hardness at 50 deg. C. | 83 | 64 | 58 | 80 | 76 | 70 | 82 | 82 | 80 | 89 | 82 | 64 |
| Impact strength, ft.-lb. | 0.7 | 0.9 | 1.2 | 0.2 | 0.8 | 2.1 | 0.4 | 1.0 | 0.3 | 0.3 | 1.5 | 2.9 |

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Birmingham Is to Rival Pittsburgh in Electric Power

The Alabama Power Company has started the construction of a substation at Leeds, Ala., which will cost in the neighborhood of $1,500,000 to complete. This station will distribute the power from Lock 12 and Mitchell Dam to the Birmingham district. When the power to be furnished through this station is available, together with the power furnished through the stations at Magella and Bessemer, 371,000 hp. will be provided for the industries of the Birmingham district, which will be the center of a power "loop" supplied from Jackson Shoals, Lock 12, Gadsden, Gorgas and Mitchell Dam.

The power at present available to Birmingham is put at 250,000 hp. Officials of the Alabama Power Company are responsible for the statement that when the station at Leeds shall have been completed Birmingham will exceed Pittsburgh in abundance and constancy of electrical power.

## N. E. L. A. Technical Committees Take Up Many Matters

With about two hundred men present from all over the country, the Technical Section committees of the National Electric Light Association were in session at headquarters in New York from Monday to Friday of this week.

Among the important questions before the committees is that of insurance as affecting plant apparatus, a matter which the electrical apparatus committee is considering in co-operation with the prime movers and insurance committees. The question of revision of the N. E. L. A. 1914 handbook on overhead-line construction is up for consideration by the overhead-line committee. It is hoped that the needed revision can be undertaken soon. The transition in power-plant practices to higher steam pressures is engaging the attention of the prime-movers committee, particularly with reference to materials that will successfully withstand the higher temperatures involved. The problems bound up in the trend toward use of extra-high-voltage cable are before the underground distribution committee.

Plans are under way to make a more effective distribution of the reports and other data coming from all the technical committees, and a satisfactory scheme has been evolved, announcement of which is expected in the near future.

On Tuesday evening Executive Manager Aylesworth addressed the members of the various committees at a general meeting. He emphasized the need of engineers directing their attention to the economic and political problems of the industry as well as those purely technical. A well-rounded consideration of all phases of the industry is needed, he held, to enable the engineer to accomplish his work to the best interests of the public and the utilities.

## Conference on Abbreviations and Symbols

The American Engineering Standards Committee has called a conference to consider the standardization of abbreviations and of the symbols used in engineering equations and formulas. The conference will meet in the board room of the American Society of Mechanical Engineers, Engineering Societies Building, New York City, at 10 a.m., Tuesday, Feb. 13. It will determine whether unification of engineering abbreviations and symbols should be undertaken and, if so, what the scope of such work should be and has been called in response to requests received from the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the Association of Edison Illuminating Companies. Because of the peculiar nature of the subject and the fact that some of the interested organizations will be unable to have representatives present, the Standards Committee has provided a questionnaire through which such organizations may send information by mail.

## Public Utility Commission for Texas Planned

A committee of officials of Texas municipalities has completed the draft of a public utilities bill for Texas, and this bill is now in the hands of members of the Legislature. The measure designates the Railroad Commission of Texas as the public utility commission of the state and increases the pay of its members $1,000 a year each. It provides a tax of one-half of 1 per cent of the gross receipts of the utilities to pay the expense of the commission and provides that any balance in this fund shall go into the state's revenues.

Texas has a "home rule" provision in its constitution, and this bill seeks to preserve to the home-rule cities all their present powers over their utilities while setting up state regulation also. Local utilities have the right to appeal to the Railroad Commission from decisions in the home-rule cities.

## House Passes Bill for the Control of Radio

The administration bill to regulate radio communication was passed by the House of Representatives on Wednesday of this week, and early action by the Senate is expected. Briefly, the bill provides that all operators of transmitting stations be licensed. All transmitting stations must be registered. A definite wave length will be assigned by the Secretary of Commerce to each, and the Secretary is to have broad authority to promulgate rules and regulations. Government stations are excepted from the licensing feature but agree to conform to the regulations when engaged in transmitting other than government business. Aliens cannot operate transmitting stations.

A section of the bill dealing with possible monopolies of the wireless business of the nation vests in the Secretary the power to refuse or revoke licenses where a monopoly is threatened.

The bill provides for an advisory committee consisting of men appointed by department heads, radio experts and amateurs, to keep abreast of development and the needs of the wireless industry. A provision for actual expenses of members of this committee when engaged in research work or such other duties as may be assigned them by the Secretary was stricken out.

## Consolidated Gas Issue Oversubscribed 300 per Cent

The recent offer by the Consolidated Gas Company of New York City—of which the New York Edison Company, the United Electric Light & Power Company and other electric utilities are subsidiaries—of $15,000,000 of preferred stock to customers and employees, under liberal terms, has been, officials of the company announce, oversubscribed by more than 300 per cent. In other words, nearly 58,000 subscribers applied for slightly more than $48,000,000.

Definite allotment of the full number of shares asked has been made to all who subscribed for from one to six shares. These 33,377 individuals received $4,347,650. Reductions in the number of shares allotted as compared with those subscribed for were made in all other cases, the proportionate amount of the reduction increasing as the number of shares desired increased. Employees of the Consolidated Gas Company and its affiliated companies subscribed for 52,751 shares, their average allotment being 3.21 shares, representing $2,637,550.

## Pacific Coast Men Prepare

**A. I. E. E. Committee Has Technical Program for Fall Convention Nearly Completed**

MEETING in San Francisco on Tuesday of this week, the convention committee of the American Institute of Electrical Engineers having in charge the annual Pacific Coast convention confirmed the tentative decision already announced to hold it at Del Monte, Cal., on Sept. 25 to 28. There will be three half-day technical sessions in the nature of symposiums covering nine outstanding problems now before the electrical industry. Seven of these subjects have been determined upon and are as follows: "Mechanical and Electrical Construction of Modern Power Transmission Lines," "Waterwheel Construction, Operating and Governing," "Experience of Manufacturing and Operating Engineers with Oil Switches," "Practice and Theory in High-Voltage Operation," "Operation of Group Power Sources with the Transformer Tertiary Winding in Operation," "Frequency Problems Arising with Extension of 60-Cycle Practice and Direct-Current Parallel Operation of 45-Cycle and 60-Cycle Power Groups," "Radio Communication Over Power Transmission Networks." The names of the leaders in these symposiums have not as yet been announced.

On Wednesday evening of the convention week the Edison medal will be formally awarded to Dr. R. A. Millikan, and on Thursday evening the formal convention banquet will be held. The afternoons of the convention week will be devoted to recreation in the historic setting of Del Monte and Monterey. On Friday afternoon a special train will leave for Hetch Hetchy, in the Yosemite Valley, when members and their guests will be shown the Moccasin Creek hydro-electric development and all the features of this water project of the city of San Francisco, which is designed to conserve water in the high Sierras and convey it 180 miles to San Francisco, developing 150,000 hp. en route as a by-product.

No stone will be left unturned to make this the most interesting and instructive convention of the Institute thus far held in the West. The convention committee consists of Harris J. Ryan (chairman), Robert Sibley (vice-chairman), R. A. Balzari, W. C. Heston, W. H. Hitchcock, W. P. L'Hommedieu, S. J. Lisberger, H. H. Millar, R. F. Monges and W. B. Sawyer, Jr.

## Service at Cost in Milwaukee

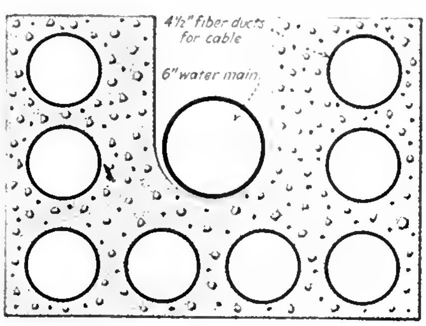
Service-at-cost operation of the electric light and street-railway public utility properties of the Milwaukee Electric Railway & Light Company in Milwaukee and the ultimate purchase of the property by the city are provided for in a contract which the public utilities committee expects to present to the City Council within the next two weeks, according to Fred S. Hunt, chairman of the committee. The contract must be ratified by the Council and authorized by a state law. Then the voters of the city must accept it. The value of the electric light and street railway properties will be fixed and the rate of return to the company agreed upon. The rates to be charged by the company will be fixed by the city, subject to appeal to the State Railroad Commission. Surplus revenues beyond the rate agreed upon will belong to the city.

Three methods are provided by which the city can acquire an interest in the property and ultimate ownership: By investing in the company's securities, by advancing money through a municipal mortgage and by applying the surplus revenues to purchase.

# Los Angeles to Install 35,000-Volt Cable

**Bureau of Power and Light Will Lay Seven Miles of Underground Conductor with This Rating for Substation Service in Downtown District**

SEVEN miles of 35,000-volt cable is to be installed by the Bureau of Power and Light of the city of Los Angeles between its central receiving substation No. 1 and substation No. 2, in the downtown business district, to relieve the badly overloaded condition of the cables now supplying the substations in the business section of the city. Three sections of cable, each 12,000 ft. long, will be installed. Two of these lengths will be of the belted type and the other of the Hochstadter type. Both types will be three-conductor, 400,000-circ.mil lead-covered cable. One of the noteworthy features of this cable is that the conductors will be sector-shape. Both types of cable will be paper-insulated, the thickness of insulation on the belted type being $\frac{33}{64}$ in. and that on the Hochstadter type $\frac{27}{64}$ in. The capacity of the two types will be 12,000 kw. and 15,000 kw. respectively.



CROSS-SECTION OF CONCRETE SUBWAY WITH 6-IN. MAIN IN CENTER

This installation will be watched with interest by engineers throughout the country because it will constitute the largest 35,000-volt underground cable installation in this country if not in the world. There is at present some 33,000-volt cable in operation, but very little cable working at 35,000 volts. For many years it was thought impossible to build cable for operation at pressures above approximately 19,000 volts, but recent successful installations have demonstrated that cables for operation at from 33,000 volts to 35,000 volts are feasible.

An ingenious method of installing the cable to dissipate the heat will be used. Fiber ducts 4½ in. in diameter will be cast in a U-shaped concrete block, and a 6-in. water main will be laid in this concrete trough, as shown in the accompanying illustration. Running water in this main will serve to dissipate the heat more rapidly. The manholes will be constructed with a concrete partition through the center, and four of the cables will pass through one-half of the manhole and four through the other. The water main will pass through the concrete partition. This concrete wall will be an effective fire barrier and will permit of the cables in one-half of the manhole being shut down while workmen are engaged, without danger of accident.

The first shipments of cable will begin to arrive soon, and the installation will be completed about June of this year. Only three cables will be installed at the present time, while the ultimate duct capacity will be eight cables. The cost of the immediate installation will be approximately $300,000.

## Tenney Interests to Manage Beverly Company

A controlling interest in the Beverly (Mass.) Gas & Electric Company has been acquired by Charles H. Tenney & Company of Boston, the negotiations having been conducted by John West of Macomber & West, engineers. The company will be managed by the Tenney organization, which also operates the adjacent northern Boston utilities serving the cities of Salem, Malden, Everett and Revere. The Beverly company operates a 1,500-kw. steam generating station which may later be interconnected with the large plant of the Salem company, the nucleus of electrical production in the territory named. A residential business of unusual value is included in the Beverly company's service, which covers a considerable portion of the famous Massachusetts North Shore.

## Yadkin River to Take Over Palmetto Properties

Announcement is made by P. A. Tillery, vice-president and general manager of the Yadkin River Power Company of Raleigh, N. C., to the effect that that company is about to acquire all the electric power and light properties now owned by the Palmetto Power & Light Company of Florence, S. C.

Since the organization of the Palmetto Power & Light Company in May, 1917, all of its capital stock has been owned by the Yadkin River Power Company and its properties have been operated under the general supervision of Mr. Tillery. The electric transmission lines of the two companies are also interconnected. Consequently the acquisition of the properties by the Yadkin River Power Company does not mean any change in ownership or in operating supervision. No changes in the personnel of the local managers in the communities served by the Palmetto Power & Light Company are expected to follow the change in ownership. The acquisition of the properties by the Yadkin River Power Company is for the purpose of facilitating the financing of the extensions to properties which are steadily being made.

# Telephony Over High-Tension Lines

### Westinghouse Electric & Manufacturing Company Tries Out "Wired Wireless" on 66,000-Volt System at Pittsburgh with Much Success

A SUCCESSFUL test of the transmission of radio waves over high-tension power lines was made on Jan. 11 by the Westinghouse Electric & Manufacturing Company before the radio sub-committee of the National Electric Light Association, a committee comprising representatives of some of the larger light and power companies of the United States. The test was carried out between experimental stations in the Colfax and Brunot's Island power stations of the Duquesne Light Company, about 30 miles apart, by engineers of both the manufacturing company and the power company. It was also demonstrated, according to observers, that this system could be used for remote control of all manner of apparatus.

For a long time the Westinghouse company has been working on a method of carrier-current control for use in central power stations and electric railways or other points using high-tension lines, and in this work the Duquesne Light Company has co-operated. Preliminary research on ordinary transmission lines and feeder circuits had indicated that the use of wired wireless was simple and effective on such lines. But when trying out the Duquesne company's lines it was found that its system was so complicated and extensive that many additional problems would have to be solved before it could be used for carrier current.

#### Unique Features of System

The demonstration, which was made in a small room of the power plant in Colfax where the committee had assembled, showed the feasibility of central-station companies carrying on telephone communication over high-tension lines, which, besides obviating inductive interference, would often save the expense of an additional right-of-way. The new system, which is unique in that it is duplex and operates as does the ordinary telephone, was demonstrated over a 66,000-volt line. When the telephone receiver is unhooked the transmitting station automatically starts up, allowing talk in both directions without any switching. This feature is entirely new in radio, as transmitting and receiving by other methods must be done by switching back and forth, because a station transmitting cannot receive messages. The calling or ringing of numbers is selective and operated by special selector keys which cause the bell to ring only at the station desired. This eliminates distracting code ringing and allows station operators to keep their minds on their work.

The improved system developed by the Westinghouse company has been carefully worked out by C. A. Boddie, radio engineer of the company, and its technical and economic features are now being analyzed by Mr. Boddie, assisted by M. W. Cooke of the Duquesne Light Company.

## "Farm Bloc" at Odds on the Muscle Shoals Bills

Lack of harmony among the members of the congressional "farm bloc" over the Muscle Shoals bills is reported from Washington. Some of its members resent the introduction by Representative Dickinson of Iowa of the bill already summarized in the Electrical World which provides for government ownership and operation of the properties over which there has been so much contention.

"I originally supported the Ford offer, but becoming convinced that it could not be accepted by Congress, I proposed the government corporation plan," said Mr. Dickinson. "I want action that will insure cheaper fertilizer to farmers. Since action on the Ford plan seemed impossible, I thought it time to suggest something else. If the Ford offer could be taken up soon and accepted by Congress, I would support it, but I do not want the whole question of disposing of Muscle Shoals postponed until December, 1923, or later. Many farm bloc members of the House will not vote for the Ford offer."

Representatives of the American Farm Bureau Corporation, which sticks by the Ford bill, now accuse Representative Dickinson of "trying to ride two horses." While some members of the farm bloc in the House, especially Southern Democrats, are standing by Mr. Ford, Senator Norris, who is numbered as one of the Senators supporting the farmers' movement, is quoting as saying that he knows of only two members who are supporting the Ford offer, outside of some Southern Democrats. These are Senators Capper (Kan.), chairman of the bloc, and Ladd (N. D.), a Non-Partisan League man. Senator Norris has proposed an appropriation of $2,000,000 for experimenting in the production of fertilizer at Nitrate Plant No. 1 to establish its possibilities.

## Bernard Baruch for Ford's Muscle Shoals Plan

Acceptance of Henry Ford's offer for Muscle Shoals, provided no better offer is available and conditioned on the actual production of nitrogen for fertilizer at the rate of 40,000 tons a year, is recommended in a special report made to the American Farm Bureau Federation by Bernard M. Baruch. A statement issued by Gray Silver, Washington representative of that federation, asserting that the Ford offer would make possible a reduction of three-fourths in the price of nitrogen used as fertilizer has been vigorously attacked by Senator Norris, chairman of the Senate committee on agriculture, who asserts that Mr. Silver is trying to deceive the farmers.

## Reorganization of American Public Utilities

A reorganization plan for the American Public Utilities Company, which controls the electric utilities operated by Kelsey, Brewer & Company of Grand Rapids, Mich., has been sent to stockholders. It provides for the elimination of the present 6 per cent preferred stock through its exchange into new prior preferred 7 per cent and 6 per cent participating preferred on the basis of three-tenths share of the prior preferred and eight-tenths share of the participating preferred for each share of the present 6 per cent preferred, with its right to accumulated dividends, and the dividend scrip or accrued dividend notes. Where the present holders of the 6 per cent preferred are not owners of scrip or dividend notes they will be required to pay $7.50 in addition to surrendering their stock for exchange.

The management announces payment of dividends beginning with April 1, 1923, on the new issues, provided that the plan is consummated. No change is contemplated in the common stock, of which $2,995,000 is outstanding, and no additional bonds are to be issued under the plan.

## Philadelphia Electric Company to Expand

Stockholders of the Philadelphia Electric Company will receive notice on Feb. 1 that at the annual meeting, which comes in April, they will be asked to approve an increase in the authorized capital stock from the present $65,000,000 to $100,000,000, of which it is proposed to issue an additional $10,000,000 of common stock. This new stock will

be offered for subscription at par pro rata to the holders of common stock, which will make the allotment from 33⅓ per cent as the maximum down to such lesser proportion as it may become by conversion of preferred stock into common in the meantime. There is a total of $15,000,000 8 per cent cumulative preferred, the holders of which have the privilege of converting share for share into common stock, upon which the dividend rate has been established at 8 per cent.

Only common-stock holders will have subscription rights to the prospective issue of new common stock, which is to finance expansion of the existing service facilities to include an increase in rating of 60,000 kw.

## Puget Sound Power & Light Takes Over North Coast

Purchase by the Puget Sound Power & Light Company of Seattle of additional electrical properties in western Washington, valued at approximately $3,500,000, was announced and control of the properties assumed on Jan. 20. The properties purchased were those of the North Coast Power Company, consisting of various power systems between Tenino, Wash., and Portland, Ore. The purchase includes the street-railway lines, the light and power plants at Kelso and Chehalis, the power line between Chehalis and Centralia, light and water plants at Tenino and Kalama, the electric railway, light and power plants at Vancouver, Wash., and the electric light and water plants at Hillsboro, Rainier, Beaverton and Forest Grove in Oregon.

This purchase, together with the purchase of the Washington Coast Utilities Company properties announced a short time ago, gives the Puget Sound Power & Light Company control of virtually all of the electrical properties in Western Washington except the Grays Harbor companies and the municipal plants of Seattle and Tacoma.

## Consumers' Power Expansion Projects

Preliminary plans for the 1923 power development of the Consumers' Power Company, Jackson, Mich., comprise a new 20,000-kw. plant at Zilwaukee and a new central-station heating plant at Grand Rapids. The Zilwaukee plant, to be built 5 miles north of Saginaw, will have an ultimate capacity of 60,000 kw. Construction plans call for Taylor stokers and a Green induced-draft system with B. & W. boilers to operate at 375 lb. per square inch steam pressure with 250 deg. F. superheat.

The central-station heating plant at Grand Rapids will, according to H. F. Eddy, mechanical engineer of the Consumers' Power Company, supply low-pressure steam with service at 2 lb. and high-pressure service at 50 lb. and 100 lb. per square inch for the downtown section of Grand Rapids. With a steam pressure of 350 lb. per square inch, 250 deg. F. superheat, operating non-condensing through a 1,500-kw. and a 3,000-kw. unit, sufficient steam will be obtainable to heat 600,000 sq.ft. to 1,000,000 sq.ft. of radiating surface. The European design will be adapted for chimney draft by installing the Venturi type of stack.

# January Financing Active

DURING the month of January stock, bond and note issues of electric light and power public utilities aggregated $71,451,000. This figure represents an increase of more than fifty million dollars over that reached the preceding month, December, 1922, and of more than twenty million over January's total a year ago. Of the total $33,445,000 was used as new capital, $5,739,000 for refunding outstanding securities and $32,267,000 for both refunding and capital expenditures. Of the twenty-five issues, an unusually large number, the highest single offering was the seventeen-million-dollar issue of the Laclede Gas Light Company. The financing was substantially of a long-term nature and the average rate of return yielded the investor was 6.08.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES JANUARY

| Name of Company | Amount of Issue | Period | Class of Security | Purpose of Issue | Rate of Interest | Offered at | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Utah Power & Light Co. | $2,156,000 | Twenty-one-year | First mortgage gold bonds | To retire bonds | 5 | 91½ | 5.70 |
| Long Island Lighting Co. | 3,000,000 | Twenty-five-year | First refunding mortgage gold bonds, series A | To reimburse for acquisition of properties | 6 | 97½ | 6.20 |
| Ohio Power Co. | 2,000,000 | Twenty-nine-year | First and refunding mortgage gold bonds, series B | To provide funds for construction | 5 | 92 | 5.55 |
| United Light & Railways Co (Mich.) | 2,500,000 | Fifty-year | Gold debenture bonds, series A. | To retire notes | 6 | 90 | 6.70 |
| Old Dominion Power Co. (Va.) | 500,000 | Five-year | First mortgage collateral trust gold notes | .......... | 6½ | 99 | 6.75 |
| Keokuk Electric Co. | 400,000 | Two-and-one-half-year | Mortgage notes | To pay maturing bonds | 6 | 98½ | 6.65 |
| Laclede Gas Light Co., (Mo.) | 17,500,000 | Thirty-year | First mortgage collateral and refunding gold bonds, series C | To retire bonds and for general purposes | 5½ | 96.45 | 5.75 |
| Community Power & Light Co., (Ark.) | 725,000 | Fifteen-year | First mortgage collateral sinking fund gold bonds, series B | To provide funds for acquisition of property | 6½ | 97 | 6.80 |
| Detroit Edison Co. | 1,500,000 | Nine-year | Convertible debenture bonds | General corporate purposes | 6 | 104 | 5.95 |
| North Missouri Power Co. | 850,000 | Nineteen-year | First mortgage and refunding bonds | To provide funds for acquisition of properties and refunding | 6½ | 99 | 6.60 |
| Brooklyn Edison Co. | 15,000,000 | .......... | Capital stock | To reimburse company for expenditures, etc. | .. | Par | .... |
| Wisconsin-Minnesota Light & Pwr. Co. | 300,000 | Twenty-four-year | General and refunding mortgage gold bonds | .......... | 7 | 103 | 6.75 |
| American Public Service Co. (Ill.) | .. | Nineteen-year | First lien gold bonds | .......... | 6 | 93½ | 6.60 |
| Central Power & Light Co. | 3,000,000 | Twenty-nine-year | First lien and refunding gold bonds | To pay for properties and other purposes | 6½ | 97 | 6.75 |
| Denver Gas & Electric Light Co. | 383,000 | Twenty-eight-year | First and refunding mortgage sinking fund gold bonds of 1911 | .......... | 5 | 89 | .... |
| Indiana Electric Corp. | 4,500,000 | Twenty-four-year | First mortgage gold bonds, series A* | For additions and other purposes | 6 | 95½ | 6.37 |
| Oklahoma Gas & Electric Co. | 1,000,000 | Eighteen-year | First and refunding mortgage gold bonds, series B of 1921. | For payment of floating debt for extensions | 6 | 96 | 6.37 |
| Power Corporation of New York | 1,000,000 | .......... | Cumulative preferred stock | .......... | 7 | 98 | 7.15 |
| Western United Gas & Electric Co. (Ill.) | 570,000 | Three-year | Collateral gold notes | .......... | 6 | 99 | 6.25 |
| Memphis Power & Light Co. | 5,500,000 | Twenty-five-year | First and refunding mortgage gold bonds, series A | To provide funds for acquisitions | 5 | 89½ | 5.80 |
| Nebraska Power Co. | 1,000,000 | .......... | Cumulative preferred stock | .......... | 7 | 98½ | 7.10 |
| North Boston Lighting Properties | 1,500,000 | Three-year | Gold notes | .......... | 5½ | 99½ | 5.70 |
| Philadelphia Suburban Gas & Electric Co. | 650,000 | Forty-six-year | General mortgage gold bonds of 1919 | To reimburse for additions | 6 | 96 | 6.25 |
| Yadkin River Power Co. (N. C.) | 4,000,000 | Eighteen-year | First mortgage gold bonds | For new properties and to retire gold bonds | 5 | 89 | 6 |
| Eastern Wisconsin Electric Co. | 1,917,000 | Nineteen-year | First lien and refunding mortgage gold bonds, series A. | .......... | 6 | 92½ | 6.65 |
| Total | $71,451,000 | | | | | | |

* Guaranteed principal and interest by Central Indiana Power Company.

## Appeals to Federal Courts

### Speakers at Meeting of Indiana Public Utility Association Oppose Resort to Them

THE folly of public ownership of utilities, the need for care in rushing into federal courts under the provisions of the Fourteenth Amendment in appealing from decisions of public service commissions, closer co-operation between utilities and the public, the labor situation and many other matters were discussed at the third annual meeting of the Indiana Public Utility Association, held in Indianapolis on Jan. 25.

At a noon luncheon Taylor Groninger, corporation counsel of Indianapolis, and Gov. Warren T. McCray of Indiana gave addresses. Mr. Groninger not so long ago was one of the leaders, under the supervision of Mayor Lew Shank, in seeking legislation to abolish the Indiana Public Service Commission. In his address he commended the work of the commission, but he insisted that state machinery should be used before resorting to the United States courts.

Governor McCray declared he was for the Public Service Commission law and would do all in his power to prevent any amendments to it which would in any way curtail the effectiveness of the work of the commission. He said he did not believe if it came to a real test that any legislature would do away with the commission.

DANGER IN CONSOLIDATIONS

James P. Goodrich, president of the National City Bank of Indianapolis and formerly Governor of the state, made an address at the afternoon session. "It is my opinion," he said, "that if the reins were thrown down and the public told there would be no opposition to repealing the service commission law, not one in ten would want it repealed." He believed, however, that there are elements of danger in large consolidations such as are being perfected now, and he, too, saw danger in too frequent appeals to the federal courts.

B. J. Mullaney, Chicago, director of the Committee of Public Utility Information, told of the experiences of utilities in Illinois with commission regulation. He brought out that in that state it is possible for any city to free itself from the workings of the law by popular vote and go back to the "home rule" system, but that, in spite of agitation, not a city in the state has done this yet.

G. B. Maxwell, former secretary of the Ohio Public Service Commission, said the public must be made to understand the necessity for new capital for extensions of service.

Arthur W. Brady, Howard Dill, T. E. Bohn, S. E. Mulholland and Harry Reid made short addresses.

Customer ownership as the real remedy for economic ills, and not government ownership, was championed by Edward N. Hurley of Chicago, former chairman of the United States Shipping Board, who declared that the electrical industry must provide as much power in the next seven years as it has produced in all its history. "It may seem strange," Mr. Hurley said, "that an industry which is providing 97 per cent of its magnificent service through plants privately owned and operated should feel required to take any serious thought about movements for public ownership, yet the fact remains that in some sections which are not receiving adequate service from their local lighting or street-railway companies and where misunderstandings have created bitterness there is a tendency to harken to those who urge public ownership.

"The federal government's ventures into the field of public management of industrial and public service enterprises demonstrated conclusively," Mr. Hurley went on, "that not more than 50 per cent personal efficiency can be obtained under such management. They demonstrated that not more than 50 per cent of personal interest in the work of the individual can be obtained under this system. I speak advisedly and out of full and intimate knowledge of the facts, and I do not hesitate to tell you that this average of 50 per cent gradually decreases the longer the individual manager or the individual employee continues in industrial service under public management."

C. L. Henry, head of the Indianapolis & Cincinnati Traction Company, was re-elected president. Other officers were elected as follows: Vice-presidents, S. E. Mulholland, Fort Wayne, head of the Northern Indiana Service Corporation, and F. J. Haas, Evansville, head of the Southern Indiana Gas & Electric Company; secretary, Marshall V. Robb, Clinton, an official of the Wabash Valley Electric Company, and treasurer, Charles C. Perry, Indianapolis, president of the Indianapolis Light & Heat Company.

## Smith Finds Hard Sledding for Water-Power Scheme

Governor Alfred E. Smith of New York had not up to the time the ELECTRICAL WORLD went to press sent to the legislature his special message on his plan to have the state itself develop and manage its water-power resources, though he had taken occasion more than once to reiterate his views. Strong opposition to this program of public ownership is certain to manifest itself. Already Paul A. Schoellkopf, president of the Niagara Falls Power Company, has notified the Governor that he is menacing the vested rights of that company.

The Governor has made it plain, however, that for the present he is not contemplating disturbing any private developments or taking any steps toward acquiring them for the state through condemnation proceedings in the exercise of the right of eminent domain. Immediate governmental activities will probably be confined to the plans already being carried out on the Mohawk River at Crescent Dam and Vischer Ferry.

A further complication is caused by the suit now pending in the United States Supreme Court, brought by the former Attorney General of New York, to have the federal water-power act declared an unconstitutional infringement of state rights. Opponents of Governor Smith's policy contend that if the decision goes against the state there will be very little horsepower that the state could develop—at the most 500,000 hp.—since all the chief sources not now in private hands will remain under federal control. On the other hand, should the state win its suit and proceed to acquire power sites on navigable and boundary streams it would confront an expenditure estimated at a billion dollars—a prohibitive sum.

## New York State Mayors Act on Water Power

Development of water power by the state is favored by the New York State Conference of Mayors, and its water-power committee has submitted reports of this nature to Governor Smith and the Legislature. The plan favored provides that the State Conservation Commission shall act as an agency of the state to acquire and to utilize the waters within the state and the boundary waters and to develop the water power and sell or lease it to municipalities. The commission would be empowered to purchase, lease or otherwise legally acquire any water power, developed or undeveloped, and any power plants of transmission lines. Water-power rights that have been materially developed could not be acquired under the proposed plan.

The commission also would be empowered to sell electrical energy to municipalities, individuals or corporations, or lease its plants, but it would have to give preference to municipalities. It would be authorized to establish electrical zones, and any municipality within one of these zones could contract for electrical power or energy. In selling the energy to the cities the commission would have to regulate it according to population. The commission would have control over rates, but these would be only sufficient to make the projects self-supporting.

## Dominion Defers Action on Deep Waterway

That the Canadian government is not disposed at this time to negotiate a treaty with the American government looking to the deepening of the St. Lawrence waterway to enable ocean-going steamers to reach the Great Lakes, with the incidental project of vast water-power development, has been reiterated from Ottawa. This utterance followed a report from there that Premier King had announced that the Dominion government would consider suggesting to Washington a conference to discuss the report of the Interna-

tional Joint Commission on the St. Lawrence deep-waterway and power scheme. The large outlay of money that would be involved is understood to be the primary reason why the Canadian government does not find it advisable to enter into a treaty in the immediate future.

At the State Department in Washington the statement was made that there had been no fresh correspondence between the United States and Canada on the subject.

## The Colorado River Pact

Everything points to the ultimate ratification of the water-power treaty negotiated by representatives of the seven states watered by the Colorado River and its tributaries who met in November at Santa Fé, N. M., under the presidency of Secretary of Commerce Hoover. Some opposition has, however, been reported from Arizona. The Utah State Legislature ratified the agreement on Monday of this week, and the ratifying act was promptly signed by Governor Mabey.

## Optimism at Convention of Wisconsin Contractors

The electrical contracting business will be better in 1923 than in 1922, when all previous records were broken, according to L. G. Ross, Superior, president of the Wisconsin Electragists' Association, which met at the Hotel Pfister, Milwaukee, on Jan. 24 for its sixth annual convention. Mr. Ross dwelt on the increasing demand for electrical appliances and comforts in the home.

One of the purposes of the convention, which was attended by 125 members, was carried out in the adoption of a resolution favoring a bill under which no electrical work in the state will be done except by licensed contractors, journeymen or superintendents.

Last year's officers were re-elected as follows: President, L. G. Ross, Superior; treasurer, J. L. Hacker, Sheboygan; secretary, H. M. Northrup, Milwaukee.

## Would Have Delaware Developed by Three States

Development of the upper Delaware River for power purposes and as a source of potable water by combined action on the part of New Jersey, New York and Pennsylvania is contemplated in a bill just introduced into the New Jersey Legislature. The bill provides for appointment by the Governor of three commissioners, who would have power to act with similar bodies from New York and Pennsylvania in the preparation of a report recommending a policy to be followed by the three states and the United States in the proposed development project.

"The vast and natural resources of the Delaware River for potable water supply purposes and for the development of water power hae lain dormant principally because it is an interstate boundary," says the explanatory statement attached to the bill. "The advantage of substituting hydro-electric development for high-priced fuel and the necessity of providing adequate water supplies for the increasing population and manufacturing development of the metropolitan section of New York, New Jersey and Pennsylvania all point to the necessity of the preparation of a comprehensive report made under the direction of a tri-state commission such as would be established by the passage of this act by the Legislature of New Jersey and similar acts by the Legislatures of New York and Pennsylvania."

## Holiday Illumination of Denver's Civic Center

The brilliantly illuminated scene shown below represents Denver's civic center as it appeared in the holiday season of a few weeks back. Each Christmas tree bore 2,000 lamps, all of which except the large lamp at the top gave either red or green light. Floodlighting was also used to good effect, as the picture shows. The photograph (a prize one) was taken by O. E. Lindevall, Ossen Photo Supply Company, Denver, and will be copyrighted.

BRILLIANT HOLIDAY ILLUMINATION OF THE CIVIC CENTER OF DENVER

## Southern Power Curtailment Program Soon Over

Another power curtailment program instituted at the request of the Southern Power Company among textile mills using its electric power, which went into effect on Wednesday of last week, was suspended on Friday. Lack of rainfall, which caused the request for the curtailment of the use of electric power, was relieved by snow and sleet.

## Another Indiana Commission Bill Introduced

A bill to take from the Indiana Public Service Commission jurisdiction over public utilities the property or operations of which are wholly within a city or within one county and confer the jurisdiction on city councils or boards of trustees of towns has been prepared for introduction in the Indiana Legislature. It would abolish by May 1 indeterminate permits that have been issued by the commission to take the place of surrendered franchises, and utilities operating wholly within a city or county would go back under the old franchise contracts, which would stand until legally repealed, modified or canceled. In the cases of utilities that have received indeterminate permits from the commission and did not have franchise contracts with cities, the indeterminate permits would continue for not more than one year after the date of enactment. Within that year such utilities and municipalities would enter into contracts, or, if they failed to reach an agreement, a city council or board of trustees could petition in the circuit or superior courts that rates and other terms be fixed by civil action. The measure provides that there be no appeal from the decision of the trial court.

In this connection an analysis of the operating costs of privately owned and municipal utilities compiled from their annual reports is interesting. It shows that the operating cost of the municipal plants is greater than that of the other class. The municipal utilities pay much more for coal than the private concerns. More also is paid for wages and salaries, which are to some degree mixed up with politics. Out of each \$100 of revenue received by electric utilities the privately owned plant spends \$71.61 for operating expenses whereas the municipal utility spends \$73.44.

## Two Views of Fusing Rule

**Lively Discussions at Chicago Meeting of Electrical Inspectors Over This and Other Matters**

A LIVELY discussion developed at the Thursday session of the Western Association of Electrical Inspectors in Chicago last week over the revision of Rule 23 d of the National Electrical Code, covering fuses for branch circuits. The rule as amended allows fusing of only the underground conductor of a two-wire circuit provided that the grounded conductor be identified in some unmistakable manner. A. L. Eustice of the Economy Fuse & Manufacturing Company raised the question of safety with such a practice when only one fuse in the underground conductor is used, advocating the use of two fuses in series. He showed a number of fuses which had been tested under short-circuit conditions, some with only one fuse and some with two fuses in series. In the discussion which ensued considerable difference of view developed, though it seemed to be the consensus of opinion that the new rule covers a practice that has been followed for a long time without serious results. The discussion was participated in by F. R. Daniel of Milwaukee, J. C. Forsyth of New York and Ben W. Clark of Detroit.

Another subject that aroused much interest was the new Rule 12 b, which calls for an approved weatherproof or rubber insulating cover between outside line wires having less than 5,000 volts between conductors. W. J. Canada called attention to the operating rule of utilities which calls for treatment of such conductors as bare wires because of the unreliability of the insulating materials, which must be subjected to all sorts of weather. Because of the danger involved in men placing unwarranted dependence upon the insulating values of such materials, Mr. Canada took a strong stand against the inclusion of this rule, which is really a restoration of one in the editions of the code previous to 1920. He was supported by F. R. Daniel, J. C. Martin and several others. W. S. Boyd argued for the rule as representing practice that utility companies have been following for a good many years. It was suggested that such a rule should not be included until a committee shall have carefully investigated the subject and determined a reasonable limit, if there is such, for wires on which insulation should be required. In the discussion several asserted that 5,000 volts is not a logical division point as experience has proved that insulating materials now available for conductors carrying up to 2,300 volts are unreliable.

### Recodification of Code

Dana Pierce, vice-president of the Underwriters' Laboratories of New York, made a report on the recodification of the code. He indicated the difficulty of getting an arrangement satisfactory to every one, particularly an arrangement that assembles all the material on any one subject in one place. To do this would require an enormous amount of repetition and would defeat the purpose to simplify the code. The arrangement proposed is to place all the material on general subjects at the beginning, following this with an arrangement of the material referring to specific subjects under these subjects in such a way that all the specific material on one subject will be together. This will provide for the fewest cross-references, but will necessitate a complete change in the form of the code.

In connection with the 15-amp. capacity limit in Rule 38 e 2, Ben. W. Clark offered an amendment which restricted the use of gas-filled lamps above 200 watts in boiler rooms. The new Rule 279, showing the number of conductors per conduit size, was altered to improve the ease of drawing wire through conduit without materially damaging the insulation. Opinion as to the number of No. 10 B. & S. wires which could be drawn through a ¾-in. conduit seemed to average four, depending upon the length of run.

Some confusion over the revised Rule 276, relative to the concealed extensions in fireproof construction, seemed to exist until Victor H. Tousley, Chicago, explained that it is for the use of oval cable laid next to the tile and plastered over. This avoids breaking the tile for "fishing in" the regular armored cable, thereby facilitating improved arrangements of fixtures; but these extensions are to terminate in the room where they originate.

A. P. Denton, Association of Electragists International, urged that all inspectors work together with the contractors with the view of assisting and interpreting the recent changes. To do this one of the most effective ways, he said, would be the use of diagrams or charts showing the new rules.

Registration for the convention, a report of the opening sessions of which was printed last week (page 237), totaled 162. The newly elected officers are: President, F. O. Evertz, Columbus, Ohio; first vice-president, W. B. Hubbell, Cincinnati; second vice-president, John Hoeveler, Madison, Wis.; secretary and treasurer, W. S. Boyd, Chicago. The 1923 members of the executive committee are James S. Mahan, K. W. Adkins, W. G. Kelly, W. P. Briggs, W. A. Haig and F. A. Barron.

## Electrical Exposition in St. Louis

The St. Louis Electrical Exposition will be held at the Coliseum from March 12 to 17 inclusive under the auspices of the St. Louis Electrical Board of Trade. It is expected that there will be about 150 exhibitors, consisting of both local and nationally known manufacturers and jobbers of electrical equipment as well as many allied industries. Almost all of the available space for exhibition purposes has been contracted for. This will be the first real electrical show to be held in St. Louis for a number of years.

## Brief News Notes

**Moncton, N. B., Soon to Have Hydro-Electricity.**—Moncton, New Brunswick, which expects to be connected with the hydro-electric station at Musquash, in that province, early in February, will be the first city in the Maritime Provinces of Canada to obtain power and light from a hydro-electric source. Arrangements have been made with the Moncton Tramway, Light & Power Company to distribute the energy in the city.

**Opposition to Public Service Commission in Missouri.**—A bill has been introduced in the Missouri House of Representatives by Frank R. Smith, representative from St. Louis, to curtail the power of the State Public Service Commission by taking away from it the right to abrogate contracts pertaining to fares and rates entered into between cities of more than 75,000 people and the public utility companies operating in them. Other political efforts are being made to abolish the commission or restrict its authority.

**Increase in Capital of Public Service Company of Northern Illinois Planned.**—Announcement has been made that the directors of the Public Service Company of Northern Illinois will recommend to the stockholders at the annual meeting on Feb. 26 that the authorized capitalization of the company be increased by the addition of 100,000 shares of no-par common stock and $5,000,000 of additional 6 per cent preferred stock. The company, which serves the territory in northeastern Illinois surrounding Chicago, is expanding rapidly to take care of the increased industrial activity in its district.

**Electrophysical Research in Arctic Circle.**—Donald B. MacMillan, Arctic explorer, expects to set out again for the Far North about the first of next July, this time to establish a permanent scientific station in the northern part of Labrador for the study of terrestrial magnetism and atmospheric electricity. At about 56 deg. north latitude Mr. MacMillan plans to establish two observatories on a running base line about 10 miles long, these observatories to be connected by telephone and each equipped with a moving-picture camera. The cameras will be focused on the same star and will photograph the same ray to determine the height of the aurora.

**New Testing Laboratory for Southern California.**—The Southern California Edison Company will soon begin the construction of a testing laboratory on its property at Alhambra, near Los Angeles. Here it will install high-tension testing equipment, a transformer test room, insulator testing pits, cranes for handling heavy machinery, a meter department and test room, a general warehouse and general shops. The buildings and equipment will cost more

than a million dollars. It is expected that the new premises will be ready the latter part of the coming summer.

**Proposed Bond Issue in St. Louis.**—A special bond issue election will be held in St. Louis on Feb. 9 to vote upon proposed indebtedness for municipal improvements. Two projected issues of interest to the electrical industry are that of $8,000,000 for the purchase and installation of equipment for an electric street-lighting system and that of $1,000,000 for the erection of a plant to provide light, heat and power to municipal buildings. The first of the two issues mentioned is subdivided as follows: For double lighting system along all major streets, $3,500,000; for installing electric lamps in place of gas lamps along all streets now lighted by gas, $3,000,000; for lighting all streets now unlighted, for electric lamps in new subdivisions as they are established, and for other future extensions, $1,500,000.

**Grand Falls (N. B.) Project.**—According to advices from St. John, N. B., the government of New Brunswick is planning to develop the hydro possibilities at Grand Falls, N. B., on the upper St. John River, at the boundary between the Canadian province and the State of Maine. Present plans are to spend about $800,000 in the development. The water-power privileges at Grand Falls are now under lease to the International Paper Company of New York City, but at the expiration of the lease in March the New Brunswick government, it is said, will not renew it, despite reports that the company desires to build a hydro-electric station at Grand Falls to supply cities and towns on both sides of the international boundary. The New Brunswick government has already issued bonds to pay for the Grand Falls project.

**Card-Indexing the Engineers**—As a part of the program of the War Department to work out plans which will enable it to make most effective use of man power in the event of an emergency, the American Association of Engineers is compiling information as to the qualifications of individual engineers. The association recently sent out what it terms an occupational study sheet. The individual engineer is asked to furnish specified information as to his skill, education, specialties and personal qualifications. The association is confining itself at the start to gathering information from highway engineers. Later it expects to undertake similar work among technical engineers on railroads and among electrical, mechanical and chemical engineers, probably in the order named.

**Farmers Fail to Get Large Sums for Wisconsin-Minnesota Right-of-Way.**—Awards in the condemnation proceedings of the Wisconsin-Minnesota Light & Power Company, at Chippewa Falls, Wis., have been filed by the land commission appointed to determine the value of the property of eight farmers who protested against the company's plans to route its proposed high-tension line on their land. The amounts granted are very much smaller than those asked by the property owners, who demanded sums up to $2,500 or more, claiming danger from the line and loss to the value of their farms. The basis for the settlement is close to that suggested by the power company. By it farm owners will receive sums varying from $98 to $515 as damages for property included in the right-of-way.

**Consolidation in Southern Texas.**—The Valley Electric & Ice Company of Brownsville, Tex., a subsidiary of the Central Power & Light Company, has been granted a charter and will take over the recently acquired holdings of the Morrison-McCall syndicate in a number of towns in the Lower Rio Grande Valley. Among the utilities to be absorbed are the ice, water and electric plants at McAllen; the Pharr Ice, Light & Power Company, which supplies Pharr, San Juan and Alamo; the Donna Light & Ice Company, supplying Donna and Weslaco, and the Mercedes Electric & Water Company. The company will also take over the Rio Grande Ice Company plants at Son Benito, Harlingen and Houston. The San Benito light plant, purchased some time ago by the Central Power Company, is still under the direct supervision of that company, but will be included in the list of plants to be merged in the new company.

**Hydro-Electric Developments in North Wales.**—The extensive scheme for distribution of hydro-electric power throughout north Wales as outlined by the British Electricity Commissioners last year promises to be one of the most noteworthy reorganizations under the electricity supply act. The hydro-electric generation and the high-tension transmission are to be undertaken by the North Wales Electric Power Company, which has already carried on fairly wide operations in north Wales. The controlling interest in this company is held by the Aluminium Corporation, and the main power output is taken by the corporation. This company is in a specially good position to supply power to the slate and granite quarries and other industries in the area and to give a bulk supply to many towns. A new dam at Cowlyd Lake increases the storage capacity of the lake from 700,000,000 gal. to 3,110,000,000 gal., so that the North Wales Power Company has at its disposal sufficient water power for many years.

**Mexico to Get More Power from Boquilla Dam.**—Important extensions of the power-transmission facilities of the Compãnia Agricola y de Fuerza Electrica del Conchos, formerly called the Mexican Northern Power Company, are to be made as a result of a renewal of the state concession for the operation of the hydro-electric plant and power transmission lines for a period of fifteen years. It is stated by T. G. Mackenzie, representative of the company, that a transmission line will be constructed within fifteen months from the plant at Boquilla, where the company has its great dam, to Camargo and Chihuahua. Other lines must be built during the life of the concession until all the towns and mining camps within a radius of two hundred miles of the plant are supplied with electrical energy. The company is already furnishing power and lights for the cities of Jiminez, Santa Rosalia and Parral and to a number of mining camps. The company is owned largely by financial interests of Toronto.

## Associations and Societies

**Safety Engineers to Meet.**—A joint meeting of the Engineering Section of the National Safety Council and the American Society of Safety Engineers will be held in New York City on Feb. 16. Electromechanical interlocks and electric contacts in elevators will be among the topics.

**Wisconsin Utilities Association.**—General plans have been announced for the meeting at the Hotel Pfister, Milwaukee, on March 22 and 23, of the Wisconsin Utilities Association, which is a consolidation of the former Wisconsin Electrical and Wisconsin Gas Associations, comprising sixty companies. There will be group meetings of executives, engineers, accountants and merchants.

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### Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

New Mexico Electrical Association—Albuquerque, Feb. 12-13. C. E. Twogood, Albuquerque, N. M.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14; general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Electric Railway Association—Washington, D. C., Feb. 15-16. J. W. Welsh, 8 West 40th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

American Physical Society—New York, Feb. 24; Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

Pennsylvania State Association of Electrical Contractors and Dealers—Lancaster, Feb. 28.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 16-17. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

Tri-State Water and Light Association—Birmingham, April 17-20.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Wills, 403 Slaughter Bldg., Dallas, Tex.

American Society of Mechanical Engineers—Montreal, May 28-31.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

# Recent Court Decisions

**What Constitutes a Public Utility?**—In annulling an order of the California Railroad Commission holding a certain water company to be a public utility (McCullagh vs. Commission) the Supreme Court of California said that the mere fact that the articles of incorporation empowered the company to exercise the right of eminent domain did not make the corporation a public utility where the power so reserved was never exercised. (210 Pac. 264.)*

**Refusal of Peremptory Instruction on Negligence Sustained.** — The Supreme Court of North Carolina, in Springs vs. Tallassee Power Company, has sustained the refusal of the lower court to instruct the jury to find for the defendant on the issues of negligence, contributory negligence and assumption of risk, holding that there was sufficient evidence for the plaintiff to justify the submission of the case for a jury verdict. The action was one for damages because of the death from contact with electricity of a workman engaged in painting one of the power company's towers. (114 S. E. 628.)

**Municipal Acquisition of Utility Property.** — In rendering its decision forbidding the city of Los Angeles to acquire by condemnation proceedings property rights of the Southern Sierras Power Company acquired by the latter from the Mono Power Company (Electrical World, Nov. 18, 1922, page 1118), the United States Circuit Court of Appeals said (Mono Power Company vs. City of Los Angeles): "The theory upon which a municipal corporation may condemn and appropriate to a public use the property of a private corporation engaged in serving such municipality or its inhabitants is that the private corporation is using its property for a public use for a profit and that the municipality has the right, in the interest of itself and its inhabitants, as an economical administrator of municipal affairs, to perform this public service itself and thus eliminate the profits of the private corporation. This is not the case. The defendant is not rendering any public service to the city of Los Angeles and does not propose to do so. Defendant's transmission and distributing lines do not extend into the city of Los Angeles, and it has not proposed so to extend them. The property of the defendant has been appropriated to the public use of other counties, municipalities, incorporated cities and towns and the inhabitants thereof, and not for the city of Los Angeles or its inhabitants." The court further expressed its inability to see how if by reason of the "public use" to which the defendant's property was under law appropriated defendant could not sell, lease or encumber its property without the authority of the state commission, this property could be condemned by another corporation in another county for a public use in that other county.

**Rate-Fixing Powers of Illinois Commission.** — In Illinois Bell Telephone Company vs. Illinois Commerce Commission it was sought to enjoin the commission from proceeding to prevent the enforcement of rates filed with it by the telephone company. The Supreme Court of Illinois found that while the commission has no authority to make rates for a public utility in the first instance, as that right lies with the utility, the commission, in order to prevent unjust discrimination, undue preferences and extortionate rates and charges, is charged with the duty of establishing just, reasonable and uniform rates, and in a hearing it is the commission's duty to establish the rates proposed, in whole or in part, or others in lieu thereof which it shall find to be just and reasonable. Where the commission ordered rates permanently canceled, but did not enter any finding as to whether they were reasonable or as to what would be reasonable rates, it was held that injunction would not lie to prevent the commission's interfering with the charging or collection of the scheduled rates, the remedy by mandamus being adequate to compel the performance of the duty imposed by the law. (137 N. E. 449.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**New York Telephone Rates Revised.**—As the outcome of an inquiry concerning the rates of the New York Telephone Company conducted by the Public Service Commission of New York since November, 1921, affecting rates in all portions of the state, and also the case involving rates in New York City brought before the Public Service Commission, Second District, in 1920, the existing commission has handed down a final order revising rates and charges for telephone service throughout the state, effective March 1. The state-wide case was instituted by the present commission on its own motion. The New York City case was brought by the New York Telephone Company on a petition to increase exchange rates $16,000,000 in New York City. The order just issued provides for a revision of all rate schedules in New York City, effects decreases for small users estimated at $250,000, increases rates for large users to about $2,500,000, decreases flat rates in effect in Brooklyn by about $75,000, increases the long-haul interzone toll rates in Greater New York and makes a decrease in toll rates to suburban areas adjoining Greater New York, with consequent elimination of the federal tax on such messages, estimated to be $300,000. Complaints from about 135 up-state communities are adjusted. The valuation of the property of the New York Telephone Company is placed at $167,153,634 in Greater New York and at $68,531,357 in the rest of the state. On this valuation a 7 per cent return is allowed.

**Unprofitable Extensions Not Obligatory.**—The Connecticut Public Utilities Commission has denied a petition asking that the Danbury & Bethel Gas & Electric Light Company be forced to extend its transmission line 2,000 ft. for the benefit of the petitioners. The commission, regretting that it has not the legislative authority to permit another utility ready and able to supply the service to enter the territory, in which the one named has charter rights, nevertheless has asserted that an electric utility should not be required to extend service into a sparsely built-up community in which there are no prospects of development or growth of population in the near future and where the probable cost of extending the line, maintaining it and furnishing the required service would be greatly disproportionate to the probable return.

**Condemnation of Hasty Construction.**—The rivalry between the Eastern Wisconsin Electric Company and the Badger Public Service Company as to which should have the right to serve the town of Calumet (Electrical World, Dec. 2, page 1237) led to the following declaration by the Wisconsin Railroad Commission: "In deciding this case the commission has given no weight to the fact that actual construction of lines in this town has gone forward. It might be well, however, to indicate that the commission regards the attempt to secure or maintain advantage by hasty and uneconomical construction work while a matter is being litigated as inconsistent with the proper conception of the duties and obligations of a public utility. The law provides an orderly means for the settlement of territorial disputes, and any attempt to forestall such orderly procedure is bound to be futile in the long run."

**Linking Electric Plants.**—The modern tendency in the electric utility field toward linking together separately operated electric light and power companies for their mutual benefit and that of their customers was recognized by the Public Service Commission of Pennsylvania when it granted to the Metropolitan Edison Company permission to acquire control of a local power company by stock purchase, despite objections that existing contracts would be vitiated, rates increased and electrical energy diverted from the charter territory of the local company. It was shown that the consolidated company would have financial resources sufficient to develop and utilize a vast quantity of water power that was being wasted, and, declaring that "wherever practicable the utilization of water power is to be encouraged as a conservation measure," the commission refused to see anything wrong in the consolidation.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

### Arthur W. Berresford Resigns

Arthur W. Berresford, vice-president of the Cutler-Hammer Manufacturing Company for more than fifteen years, has resigned his office owing to a need that he feels for rest from business pursuits. Mr. Berresford has long been a prominent figure in the electrical industry not only as one of the chief executives of the company which he has served for twenty-two years, but

A. W. BERRESFORD

also as an active partaker in association affairs. He began his professional career with two years of general engineering work. Then he became associated with the Riker Electric Company as designer and subsequently with the Ward Leonard Electric Company in charge of testing and designing work. In 1898, with two others, he purchased the assets of the Iron Clad Rheostat Company from the receiver in whose hands it was and formed the Iron Clad Resistance Company, of which he was made vice-president and manager. In 1900 this company was purchased by the Cutler-Hammer Manufacturing Company and he entered the engineering department. In 1901 he was made superintendent, in 1902 secretary and three years later general manager. It was in 1907 that he became vice-president as well as general manager. In May, 1920, Mr. Berresford was elected president of the American Institute of Electrical Engineers, having previously served as its vice-president and also as manager. Mr. Berresford has, besides, been president of the Electrical Manufacturers' Club, and during the war he was elected chairman of the General War Service Committee of the Electrical Manufacturing Industry and was as well chairman of the general war service committee of the Associated Manufacturers of Electrical Supplies. Mr. Berresford was born in Brooklyn, N. Y., in 1872 and is a graduate of Cornell University. He plans to devote time in the immediate future to work in the various associations of which he is a member.

### Alabama Power Company Appoints Division Managers

W. M. Stanley has been made manager of the eastern division of the Alabama Power Company, with offices at Anniston, Ala.; C. B. McManus has been made manager of the western division, with offices at Birmingham, and O. K. Seyforth has been made manager of the northern division, with headquarters at Huntsville.

### Tenney & Company Elect New Executives

Isaac S. Hall has been elected a vice-president of Charles H. Tenney & Company, Boston. Mr. Hall, who is a native of Stillwater, Minn., was educated at Yale University. He entered the bookkeeping department of the Malden (Mass.) Electric Company in 1909, later becoming cashier and assistant manager. From Malden he went to Boston as office manager for the Tenney organization and in 1920 was appointed auditor. Clifford E. Paige, formerly manager of the Worcester (Mass.) Gas Light Company, was also elected a vice-president of the company.

### Byllesby Organization Elects New Vice-Presidents

Halford Erickson has been elected a vice-president and director of the Byllesby Engineering & Management Corporation, in charge of operation of all subsidiary utility properties of the Standard Gas & Electric Company. Mr. Erickson for many years was a member of the Railroad Commission of Wisconsin, and for two years, 1915 and 1916, he was the chairman of that commission. For the last five years he has been vice-president of the Louisville Gas & Electric Company.

Announcement was made at the same time of the election of four new vice-presidents of H. M. Byllesby & Company, all of whom have had long experience with the companies composing the Byllesby organization. They are R. G. Hunt, Joseph H. Briggs, B. W. Lynch and M. A. Morrison. Mr. Hunt, who has been in the organization for nineteen years, has for the past seventeen years been assistant to the vice-president in charge of operation of the Byllesby Engineering & Management Corporation; Mr. Briggs, who has been with the organization for fourteen years, has for the last four years been manager of the bond department; Mr. Lynch, of eighteen years' service with the organization, was formerly general auditor, and Mr. Morrison, who has been in the corporation's service fourteen years, was assistant secretary and assistant treasurer.

### A. N. Kemp Resigns

A. N. Kemp, vice-president in charge of finance of the Southern California Edison Company, has resigned to accept the office of a senior vice-president of the California Bank of Los Angeles. Mr. Kemp has been associated directly with the Southern California Edison Company since the merger into that

A. N. KEMP

company of the Pacific Light & Power Corporation in 1917, having served with the latter company as treasurer and controller for many years prior to the consolidation of the two companies. His duties with both of these corporations have been directly in connection with the companies' financing and sale of their securities, and particularly, in directing the very extensive and successful activities of the Edison company in interesting its consumers and the public generally in becoming partners in the business.

By education Mr. Kemp is a banker. Although a native Californian, he spent several years in study and experience in Great Britain and New York, returning to California in 1905. His concentration of effort in the financial field has developed in him a remarkable grasp of the financial situation, which will be of great value to the institution with which he is now associated. His resignation became effective Feb. 1.

W. P. L'Hommedieu has been appointed manager of the newly organized central-station division of the San Francisco district office of the Westinghouse Electric & Manufacturing Company, with which office he has been connected for a number of years.

## P. W. Koch New President Chicago Electric Club

Paul W. Koch, who was recently made the president of the Electric Club of Chicago, served on the board of directors for three years and as vice-president during the past year. Mr. Koch became associated with the Chicago City Railways Company in 1907, where he served until 1910 as assistant division engineer of substations. He then became a salesman in 1911, after spending a year in development work for the Thomas J. Grier Company, manufacturer's agent for oil circuit breakers. It was in 1915 that he purchased this company, organizing it under the name of Electrical Sales Engineers, Inc. In 1919 the name of the organization was changed to Paul W. Koch & Company, and this firm has been functioning as manufacturers' agents ever since. The assumption by Mr. Koch of the president's chair brings to that office a man well versed in the aims of the club.

**Clyde H. Loughridge**, consulting electrical engineer, has opened offices in Cleveland, Ohio. Mr. Loughridge has had nineteen years' experience in electrical design and construction both as an electrical engineer and as an electrical contractor.

**William P. Creager**, chief engineer and a director of the Northern New York Utilities, Inc., has been elected a vice-president of the corporation. Mr. Creager is also vice-president and chief engineer of the Power Corporation of New York.

**H. C. Spoden**, formerly of Chicago and more recently with the Electric Lighting Supply Company and the Pacific States Electric Company of Los Angeles, is now assisting E. P. Markee, district manager of the Edison Lamp Works of the General Electric Company.

**W. W. Trench**, assistant secretary of the General Electric Company, has been appointed secretary of the various committees which will administer the Charles A. Coffin Foundation, the income from which is to be employed in making various awards for meritorious service in the electrical field.

**R. B. Harvey**, formerly connected with the Westinghouse company and the Litscher-Lite Corporation, has been appointed sales manager of the farm light and power division of the Matthews Engineering Company, Sandusky, Ohio. Mr. Harvey's experience covers all phases of the farm light and power business from manufacturing to sales.

**H. H. Walker**, president of the Electrical Contractors and Dealers' Association of Los Angeles and one of the leading electrical contractors of southern California, has been appointed representative on the advisory committee of the California Electric Co-operative Campaign by the Southern District, California State Association of Electrical Contractors and Dealers.

**H. B. Cannon**, formerly agent of the San Joaquin division of the Pacific Gas & Electric Company at Newman, Cal., has been made electrical superintendent on the North Bay division, with headquarters at Vallejo.

## New Manager of Alabama Power Has Had Wide Experience

Eugene A. Yates, who has been appointed general manager of the Alabama Power Company, as was announced in the Jan. 27 issue of the ELECTRICAL WORLD, has been for years in close touch with the development and growth of this company and other power companies in the South. Mr. Yates was

E. A. YATES

chief engineer of the company from 1912 to 1914 in the construction of Lock 12 and has been connected with the company as a consulting engineer since that time. From 1914 to 1918 he was vice-president and chief engineer of the T. A. Gillespie Company, contractor, New York City, in charge of construction work, involving dams, subway construction, bridges, etc. Since 1918 he has been engaged in consulting work in New York City, mainly along the lines of hydro-electric plants and power developments and studies, which included a study of power companies and power situations in the entire Southeast. Mr. Yates was born in Elizabeth, N. J., in 1880 and was graduated from Rutgers College in 1902.

**A. W. McConnell** of the Electric Construction Company has been elected president of the Little Rock (Ark.) Electric Club.

**H. W. Reed**, who recently was connected with Landers, Frary & Clark, is now connected with the Illinois Electric Company in Los Angeles.

**John Fordyce** of Butternut, Wis., has acquired a controlling interest in the Glidden Light, Power & Water Company, heretofore owned by Fred Boheim of Ashland. Mr. Fordyce is now president of the organization and John C. Kneifel has been installed as manager of the local plant.

**F. L. Hunt**, chief engineer of the Turners Falls Power & Electric Company, has been elected vice-president of the Engineering Society of Western Massachusetts.

**P. M. Duncan** has severed his connection with the Allis-Chalmers Manufacturing Company, Milwaukee, to accept a position as method engineer with the Western Electric Company, Hawthorne plant, Chicago.

**Robert G. Kittle** has resigned as sales manager of the Laundryette Sales Company to enter the New York office of the Benjamin Electric & Manufacturing Company, under Basil Kodjbanoff. Mr. Kittle has been connected with the electrical industry since 1907, when he entered the employ of the Adams-Bagnall Electric Company. He left that organization in 1916 to go with the Luminous Unit Company as district sales manager.

**F. D. Phillips**, who for twenty-two years has been actively connected with the electrical industry, has been appointed manager of the H. C. Roberts Electrical Supply Company of Syracuse, N. Y. His introduction to the industry was in 1900, when he accepted a position with the Electric Appliance Company of Chicago. In 1906 he removed to St. Louis to take charge of the city sales department of the Wesco Supply Company, and seven years later he was made general sales manager. Mr. Phillips became sales manager of the Central Telephone & Electric Company of St. Louis in 1916. Soon afterward he was elected vice-president of that company and in 1918 he became president. During the sixteen years that he was connected with the electrical industry in St. Louis he was particularly active in all its co-operative efforts, including the Jovian Order and the St. Louis Electrical Board of Trade.

# Obituary

**David Cochrane**, inventor of steam specialties, died on Wednesday, Jan. 24, at his home in Wissahickon, Philadelphia. Mr. Cochrane, who was seventy-three years of age, died of septic poisoning after an illness of about a week. He was born in Scotland and came to this country when he was thirty years of age. Soon after he arrived here he became connected with the Harrison Safety Boiler Works, which is now known as the H. S. B. W.-Cochrane Company.

**Robert Edes Chetwood**, who has been in charge of all engineering and development work of the Western Union Telegraph Company since 1913, died on Friday, Jan. 26, at his home in Elizabeth, N. J., after an illness of a few weeks. Previous to his association with the Western Union Company in 1910, Mr. Chetwood was connected with the engineering department of the American Telephone & Telegraph Company. He was born in Elizabeth and was a graduate of Lehigh University.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Proper Marking of Nameplates*

**What This Accessory Means, for Example, on the Electric Motor—Abuses that Have Crept Into Its Use**


By Bernard Lester

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.


No manufacturer of a complete piece of machinery for general use can conduct his business with any degree of permanent success without marking each of the individual units which he manufactures, with its capacity and principal characteristics, in a complete and honest fashion. If the manufacturer does not do this, he makes it difficult for the purchaser of the apparatus to use it intelligently, or he may at times even go so far as intentionally or unintentionally to misrepresent the actual characteristics of the apparatus.

Complete and correct nameplate marking is therefore of primary importance, and this is particularly true in the case of motors which are purchased and sold again in their original form or resold mounted upon some particular machine or appliance which the motor is intended to drive. In such instances the second party, who may not be so familiar as the manufacturer with characteristics of the motor, is usually involved, and unless the nameplate clearly defines the motor capacity and motor characteristics, there is much likelihood of misconception in some form.

In addition to the interest of the motor manufacturer, resale agent, machine manufacturer and user, there is also the interest of the central power station on whose circuits the motor is usually attached. The central station is distinctly interested, either from the point of view of revenue in the sale of energy or from the point of view of the motor characteristics which may affect the operation of his system or the safety of his customers. Horsepower rating is to some extent used as a measure of energy consumption, and we are all familiar with the central-station motor service rules adopted by the National Electric Light Association.

*A paper presented before the Electric Power Club, at its Asheville (N. C.) convention, Oct. 30, 1922.

### What Nameplates Are For

The principal uses of nameplate markings upon motors may be summarized briefly as follows:

1. To instruct the user or resale agent as to the correct operating character of the motor.

2. To furnish sufficient information for the successful connection of motor to the supply current.

3. To supply the user of the motor with information of identification for purposes of duplication or repair.

In addition to these factors, the individual marking of a motor with a serial number or some other form of individual identification is often used by the manufacturer of the driven appliance or machine to distinguish the identity of the complete driven unit. Motor serial numbers are therefore used to some extent, as the serial numbers of driven units and records are kept in this way by the manufacturer of the appliance.

In the case of standard fractional-horsepower alternating-current motors, the following nameplate markings have been adopted by the Electric Power Club as "recommended practice": (a) Manufacturer's type and frame designation; (b) horsepower output; (c) time rating; (d) temperature rise; (e) r.p.m. at full load; (f) frequency; (g) number of phases; (h) voltage; (i) full-load amperes.

In the interest of economy these nameplate markings should obviously be reduced to a minimum. At present they apply to motors from 0.05 hp. to 0.75 hp. Upon the small series-wound motors which are used for sewing machines, vacuum cleaners, electric drills and other appliances an elaborate marking such as this is probably entirely unnecessary. There seems to be no way, however, under present conditions of eliminating any of these items from the standardized line of fractional-horsepower motors unless some designation based on the Electric Power Club standard and recognized as such be substituted for the time rating and temperature rise. This, however, is a subject which should be seriously considered in the future in connection with fractional-horsepower motors. Perhaps the nameplate information itemized above may appear to some as being unnecessarily elaborate, but a careful analysis of each item will show that its elimination would cause considerable difficulty. Obviously a number of other characteristics could be added, but the effort should be toward simplification.

### Nameplate Abuses

In connection with the nameplate-marking situation certain abuses have arisen, and there has been on the part of the motor manufacturers a laxness of practice. These irregularities may be summarized as follows:

1. Incomplete nameplate marking.

2. Substitution of symbols for figures in the nameplate markings or other forms of designation.

3. Acquiescence in the practice of customers taking off nameplates and substituting therefore nameplates incompletely marked, incorrectly marked or both.

In regard to the matter of incomplete nameplate marking, motor manufacturers generally have been slow in adopting the practice recommended. This standard as a "recommended practice" was last revised over five years ago, so that there is probably little reason for any manufacturer not to adopt the present nameplate marking on his product.

In this connection an interesting analysis was made about two years

ago of the nameplate marking of all motors mounted on motor-driven appliances at a prominent electrical show. Obviously this did not include motors used in connection with vacuum cleaners, electric drills, etc., since the motor usually in such instances loses its identity. There were a total of thirty-two motor-driven appliances exhibited. Of these all but five appliances had nameplates incompletely marked. Only on five motor nameplates were the temperature rating and time rating marked, and on most of the nameplates no space was provided for such marking.

In some instances motor manufacturers have been induced to substitute for the horsepower some symbol or letter which has little or no meaning to the user of the machine. On some occasions the purpose of this has been to get around existing central-station rules. In addition to this some motor manufacturers have been induced by appliance manufacturers to increase or decrease the horsepower marking on the nameplate to enable the manufacturer to give the purchaser of the machine the impression that the machine is driven either by a large motor with reserve capacity or by a small motor which requires less energy than that ordinarily used to operate similar devices. These, of course, are "tricks of the trade" which simply start trouble and ultimately reflect on all motor manufacturers, as well as establishing practices among appliance manufacturers which are unethical and do not promote honest and stable business. The removal of nameplates by resale purchasers for the purpose of substituting a nameplate which in any way misrepresents the capacity or performance is certainly something which should be not only discouraged but discredited in every way possible.

### Built-in Machines

One of the most difficult situations which arise in connection with nameplate marking is in connection with special motors. Often motors of special characteristics are purchased and built directly into the driven appliance, so that it is impossible to detach them and use them as general-purpose motors. In such instances there does not seem to be any objection to special nameplate marking, provided that there is no misrepresentation, as the motor in these cases is called on only to operate the complete machine and its identity is tied up with the machine itself. Appliances will probably be built more and more with the motor an integral part of the driven appliance. Such a tendency will simplify problems in connection with nameplate marking.

Motor manufacturers are often called upon to furnish their motors with special nameplates which may include the name of the manufacturer of the resale motor-driven appliance upon which the motor is to be mounted. This practice is obviously an expensive one unless a large number of motors is involved, but as long as the nameplate expresses the characteristics and does not misrepresent there seems to be no logical objection to such a practice.

# Fighting the High Cost of Small Orders

**The Experience of One Manufacturer of Electrical Equipment in Penalizing Small Orders by Adding a Dollar to the Regular Price to Cover Loss**

By J. C. Belden
President Belden Manufacturing Company, Chicago

FOR the past two years competition in our line has been so keen that we have felt it necessary to investigate every possible avenue through which business might reach us which would result in a loss. We found among other things that we were receiving a great many orders, principally from jobbers, calling for a few ounces up to a few pounds of wire, many of these orders amounting to from 50 cents to $5.

We are organized to do a wholesale business. The average value of our orders should be about $100, and it is unless we take a lot of small orders that we should not take. We make a varied line of material, and in order to avoid costly mistakes it is absolutely necessary that each order be separately entered with a full description, and possibly reference to specifications, that will safeguard our factory from mistakes. We have ascertained that it costs about $1.62 each for all the paper work connected with putting an order into the factory, getting it out and billing it to the customer.

It is perfectly obvious that we could not enter an order under $5 at regular prices without incurring a loss. In addition, many of these fractional orders put up for jobbers at a few cents a pound profit, on which we incurred all the expense of preparation, and which in many cases we shipped direct to the customer, were billed out by the jobber at prices netting them a margin far exceeding our profit even before we deducted the special cost of handling a small quantity. We, therefore, determined to make an extra charge of $1 on every order under $5 and announced this program by sending the notice to our customers which is shown here.

RESULTS OF ADDING PENALIZING CHARGE TO SMALL ORDERS

| | Charged on Invoices as Small-Quantity Charge | Credited on Account Complaints |
|---|---|---|
| May | $212.00 | $31.00 |
| June | 234.00 | 20.00 |
| July | 138.00 | 19.00 |
| August | 163.00 | 17.00 |
| September | 116.00 | 7.00 |
| October | 112.00 | 18.00 |
| November | 140.00 | 9.00 |
| December | 97.00 | 2.00 |

IMPORTANT!

Beginning April 1, 1922, a Small Quantity Charge of $1.00 will be added to all orders amounting to less than $5.00 net, not including spool or prepaid transportation charges.
Our business is organized to manufacture and sell economically in large quantities. Owing to the large and diversified stocks carried we receive many small orders, which cannot be handled as cheaply as if organized to do a retail business.
We have accurately figured the cost of handling these orders, from the time they are entered until the goods leave the factory, and find that we must make this Small Quantity Charge, which makes up in part only the loss incurred on same.

Belden Manufacturing Co.,
Twenty-third Street and Western Avenue
CHICAGO

METHOD OF ANNOUNCING SMALL ORDER CHARGE

We gave our department managers authority to waive this charge to customers whose general business is such that we can afford to include the handling of such orders with their larger ones. But we have made some mistakes and made charges against customers who were entitled to receive this service as an accommodation. Some of our customers accept our position as a reasonable one,

Others, however, insist that it is the result of pure greed and that we are trying to gouge them. We have received a number of threats to cancel our name from the list entirely.

The accompanying table shows results since this policy was adopted.

It is somewhat difficult to draw exact conclusions from these figures, but we feel that while the money derived from this charge is inconsiderable, we have prevented the receipt of hundreds of small orders that would have cost us money to fill and, what is of much greater importance, would have clogged the wheels of the machinery that gives service on our big orders.

We believe that the jobber who is conscientiously trying to reduce the waste in the distribution of electrical goods should look upon this policy when adopted by a manufacturer with favor and endeavor to apply the same principle in his own selling in so far as possible. This has not generally been the case, however, in our experience.

# Business Conditions

**A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand**

## Dr. S. S. Wheeler Discusses the European Market

DR. S. S. Wheeler, president Crocker-Wheeler Company, who has just returned from Europe, where he was a delegate to the International Electrotechnical Conferences at Geneva, does not see much of a market in the near future for American electrical motors in Europe. "The European," he pointed out in an interview with a representative of the ELECTRICAL WORLD, "still insists on individual treatment and service in his every desire and need. It seems inbred in all continental Europeans, at least, to conduct themselves and their business on an individual basis—the antithesis of 'mass production.' Thus in their own manufacturing and also in their purchasing they look at things the same way."

Dr. Wheeler pointed out that there is not much production in France, a little more in England and practically none in Italy, but that Switzerland can produce enough heavy machinery for their needs and is willing to meet the individual wishes. The great variety of odd and unusual voltages in use is another deterrent to American manufacturers now selling successfully at a profit in some of the European markets. Italy, however, is going ahead fast on long-distance high-tension transmission construction, but, according to Dr. Semenza's statement to Dr. Wheeler, even with this large new development is not able to come to standard voltages because the new transmission lines are connected up with existing systems.

In addition to all this Dr. Wheeler points out that with the further conditions of the high-tariff wall around the United States and the depreciated currency in Europe, it does not look like much of an immediate market in Europe for American equipment, except for specialties which Switzerland cannot supply. On the other hand, lack of production in Europe should open even wider other world markets which Europe in pre-war days supplied so freely.

Speaking of business conditions in this country, Dr. Wheeler said that he expects sound progress to continue. His own company shows an activity of 100 per cent over two years ago at this time and 50 per cent over this time last year, with every evidence of continued increase in business demands.

## Road Conditions Hamper Farm Lighting-Set Sales

Sections of the country in the grip of severe winter weather are at present difficult territory for salesmen trying to cover such districts, road conditions hampering both travel and shipments of ordered equipment out of local stocks. The demand for farm lighting sets has held up remarkably well during the past few months. One representative field agent covering six states reports that the quota for his office sales was exceeded in December, ordinarily a dull month in this line, and the outlook for 1923 is excellent. Prices are firm at present, and it is believed that if a good volume of business is forthcoming in the next few months, fairly stable quotations will be in order.

## English Electrical Exports in 1922 Gained £17,000,000

The report of the British Board of Trade for December completes the figures for English exports and imports for 1922. The total British exports for the year were £720,496,426 against £703,399,542 in 1921 and £1,334,469,269 in 1920. Although the total fell far short in money value of 1920, yet there is a rise of £17,000,000 as compared with last year, and it has to be remembered that there has been a steady fall in values since 1920. Imports of all kinds were £1,003,918,124 against £1,085,500,061.

The December imports of electrical goods and apparatus were valued at £204,558 against £177,643 for November, and electrical machinery at £58,076 as compared with £72,539. The exports of electrical goods and apparatus were £7,306,578 and of electrical machinery £4,151,735, a grand total of £11,458,313. This compares with £17,779,092 in 1921 and £14,272,479 in 1920. In actual money value it will be seen there is a drop of £6,000,000 on last year, but how much of the drop is due to decreased values it is not easy to say. Another factor which entered more largely into the figures of 1921 than into those of the twelvemonth just closed is the effect of the sales of surplus stock. Much of the stock which accumulated during the closing period of the war and which was sold in the year 1921 must have gone out of the country.

Imports of electrical goods and machinery totaled £2,711,591 last year compared with £2,639,998 in 1921 and £3,157,964 in 1920.

## The Metal Market

**Domestic Copper Buying Is Strong at 14.87½ Cents—Sales for the Week Estimated at 30,000,000 Lb.**

Domestic copper buying is strong and the price has advanced to 14.87½ cents for deliveries to the end of June. Most inquiry is for February, March and April shipments, with a little also for May. Indications are that another buying movement has begun in earnest, and it is estimated that sales during last week totaled 30,000,000 lb. Foreign sales are improving. Domestic orders generally are known to be in large amounts.

NEW YORK METAL MARKET PRICES

| Copper | Jan. 24, 1923 Cents per Pound | Jan. 31, 1923 Cents per Pound |
|---|---|---|
| Electrolytic | 14.62½ | 14.87½ |
| Lead, Am. S. & R. price | 7.50 | 7.75 |
| Antimony | 6.75 | 7.00 |
| Nickel, ingot | 36.00 | 30.00 |
| Zinc, spot | 7.00 | 7.00 |
| Tin Straits | 38.62½ | 40.00 |
| Aluminum, 98 to 99 per cent | 23.00 | 23.00 |

### Copper and Brass Products

Copper, brass and bronze mills quote the following prices on brass and copper products:

Copper wire, 16.38 to 16.63 cents net, mill; brass wire, 19.5 to 21.5 cents; copper sheets, 22.25 cents; copper rods, 15.5 to 15.75 cents; brass rods, 17.25 to 21.38 cents; sheet brass, 19 to 20.63 cents.

**Commercial Inquiries.**—The Bureau of Foreign and Domestic Commerce answered 7,822 electrical inquiries during June, 1921, and July, 1922; 13,843 during July, 1922, and January, 1923, and 567 during the week ended Jan. 13. 1923.

# The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

VOLUME of orders received during the week indicates a steady demand for wire, conduit, armored cable and high-tension equipment. The amount of business being placed by the jobbers is heavier than for some time, and further indicates throughout the country that this year's business may be expected greatly to exceed that of 1922. Deliveries in New England and the Middle West are held up because of snow and storms, and salesmen in the rural districts are hindered by difficult travel. Business in materials for central-station extensions and interconnections promises to be fair. Prices generally are firm and stocks are improving.

**New York** Improvement in manufacturers' and jobbers' business continues; stocks are being improved each day and the volume of materials entering into new residences and commercial buildings is slightly larger. Conduit stocks are very low and there is little relief in sight. High-tension equipment for central stations has received some additional attention during the last few days, and the prospects for the spring are very bright. Prices generally are firm.

**Chicago** Although jobbers report a steady week of electrical trade, the main volume was not so brisk as the first three weeks of the year. Most jobbers consider this lull merely as a slight reaction to the excellent start of the year's business, and they do not express much apprehension for future trade. Building construction is constantly requiring a steady volume of wiring material, which is rapidly moved from dealers' shelves. Stocks are in good condition, since carry-overs for 1922 were greater than in 1921. Price trends on wire and conduit are still inclining upward. The lamp market is experiencing its regular active winter demand and supplies are still normal. High-tension apparatus is reported brisk. One company received an order for 66,000-volt outdoor substation equipment for New England. Another sold one 33,000-volt, 600-kw. substation for New England, two 44,000-volt, 1,500-kw. substation for the Northwest and three 22,000-volt, 300-kw. substations for the Middle West.

**Boston** Business holds up well despite a seasonal lull in heavy supply movement and appliance demand. Building activities are vigorously maintained. Jobbers are buying more for stock than for some time. Public utility earnings are gaining rapidly and house-wiring campaigns are meeting with striking success. Prices are firm except in wire, which is weakening as a result of local efforts to move accumulated stocks. Deliveries in northern New England are greatly handicapped by snow and ice, and sales representatives report travel as extremely difficult in the more remote interior sections. Throughout the trade in New England the expectation is that this year's business will be of surpassing volume. The outlook is favorable for increased purchase of transmission-line material in the near future for interconnection work.

**Atlanta** The past week witnessed a very severe sleet and wind storm throughout north Georgia and the western Carolinas, which resulted in considerable damage to telephone and telegraph lines and in somewhat less damage to distribution systems and high-tension transmission lines. Replacements made necessary by this damage should stimulate sales of pole-line material in the sections affected. Service has been restored, and all utilities report their conditions as nearly normal. Municipal activities in South Georgia and Florida are on the increase, manufacturers reporting very satisfactory business in generating equipment up to 100 kw. capacity. This will, of course, be reflected in the increased demand for construction materials in these sections. Electrical jobbers had anticipated a good season for air heaters, but, owing to the unusually mild weather to date, the volume of sales has been far below expectations. Good stocks are on hand. Stocks are being brought up to normal and satisfactory business is generally reported by all electrical jobbers and dealers.

**Cleveland** Industrial equipment orders dominated the week. Motors were not especially active, although inquiries were received for quotations on the larger types. Conduit sales have been in good volume and the demand for armored cable continues. Radio jobbers and dealers have enjoyed a favorable week and stocks are in good shape.

Storage-Battery sales are sluggish, radio dealers reporting a departure from their use in radio sets. Batteries for use in motor cars have received some slight stimulation with the placing of spring orders. The building program promises much activity for fixture dealers and central stations. Congestion continues to hamper deliveries, but with the railroads promising relief it is expected that traffic movements may be expedited within the week. Retail sales are satisfactory. Appliances particularly are selling without much apparent effort, and dealers forecast an unusual spring. Collections are fair.

**Pittsburgh** Prices generally are more settled, and fluctuations are less noticeable. Construction of residences and industrial building continues in fair volume. Wire is still selling actively with low stocks. The main difficulties which are troubling manufacturers and jobbers in this district are those induced by the conditions in the coal fields and the car shortage.

**St. Louis** Electrical jobbers report business for the month of January better than anticipated and considerably over the average for the past twelve months. One jobber reports the sale of 500 4,000-volt lightning arresters to a central station, and orders from salesmen on the road show a splendid demand for merchandise. The annual review of business in St. Louis for 1922 places the total volume during that period at $1,326,793,000, which is an increase of 10.4 per cent over that shown for the year 1921. An increase appears in almost all lines, but the greatest increase was shown by the electrical industry, which shows a total volume of $50,000,000 in 1922 against a volume of $35,000,000 in 1921, or an increase of 43 per cent.

**St. Paul-Minneapolis** The amount of orders during January is as heavy as in the average months of 1922. Some jobbers expected a slump. There seems to be plenty of money and some are planning big campaigns in the spring. Supply of small conduit is very short. Inquiries show big municipal and central-station business in spring. Demand is still big for radio. Prices show slight decline.

**New Orleans** January's electrical business is better than last year's and better than the average in January. Furthermore, the prospects for the entire year are considered remarkably good because of the large building activity in this city and section. A number of large structures have been begun or are about to be begun. The new electrical license law, which went into effect Jan. 1, is weeding out the inefficient contractors. New Orleans has been troubled with a very large number of these during the last few years.

**Denver** Jobbers report reasonably satisfactory business for first month of new year, with indications that late spring and summer will be record-breaking. Stop appliance sales, excepting flat irons are slow. A recent increase of $10 on most washing machines has not retarded sales, although demand is not so brisk as several months ago. New interest is being taken in sales of farm light and power plants through reasonable terms based on pre-war prices and certain allowances. Sales organizations for these plants are being reestablished in light of favorable prospective business. Credit conditions in agricultural communities are holding back this business

# Demand, Supply and Price Trend of Eighteen Commodities as Sold in Fifteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Radio, Rectifiers and Heaters

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Storage Batteries | Farm Lighting Plants | Electric Tools |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **New York** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Sdy. | Slow | Slow | Slow | Sdy. | Slow | Sdy. | Spy. | Sdy. | Sdy. | Act | Sdy. | Sdy. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Hi. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml |
| Price trend | Dec. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy | Sdy. | Slow | Slow | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Act. | Slow | Slow | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Boston** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slow | Slow | Slow | Slow | Slow | Sdy. | Sdy. | Act | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Dec. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Slow | Act. | Act. | Act. | Act. | Slow | Act. | Act. | Act. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slow | Slow | Slow | Slow | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Dec. | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Low | Act. | Slow |
| Supply | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Act. | Act. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Slow | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Sdy. | Slow | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. |
| **St. Paul-Minneapolis** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Act. | Slow | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Slow | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Hi. | Nml. | Nml. | Low | Hi. | Nml. | Nml. | Nml. | Hi. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Inc. | Firm | Dec. |
| **Denver** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Slow | Act. | Act. | Slow | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Slow | Sdy. | Act. | Slow |
| Supply | Nml. | Nml. | Low | Low | Nml. | Low | Low | Low | Hi. | Nml. | Low | Nml. | Hi. | Hi. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Slow | Act. |
| Supply | Hi. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Slow | Act. | Act. | Act. | Sdy. | Slow | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Slow | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm |

along with other staples. However, the outlook is an optimistic one with continued good weather and an extensive building campaign under way.

## Portland-Seattle

Electrical jobbing business for January has been very satisfactory. Seattle jobbers report business 100 per cent better than a year ago. There is a general feeling of optimism regarding prospects for the coming season. Reports from contractor-dealers, however, are more variable and generally not so optimistic. The lumber industry is particularly active at this time, and building is moving along in a very satisfactory manner. Copper wire has advanced 5 per cent during the week, and further advances are in prospect on all steel and iron products as well as copper. A slight advance is reported on glass insulators and loom is up 10 per cent. Shortage in conduit is still acute. Farm lighting plants are moving very slowly at this time and no marked improvement is expected before fall. The demand for electric tools is small, and jobbers have practically discontinued handling storage batteries except for radio work. The present market is primarily supplied by agents of the battery manufacturers.

## San Francisco

Export business, particularly with China and Mexico, showed remarkable improvement during January. Healthy buying conditions in the Bay Cities is reflected by San Francisco's response to its "community chest" drive. Lower prices on such staples as porcelain and boxes are evidence that 1923 promises to be stiffly competitive, reproducing in its turn the conditions which prevailed in the East several months ago. Cotton, copper and steel are firm, with every indication of advancing. Farm plants are slow, supply normal and prices firm. Most country agents apparently have drifted away to new fields because of poor prospects

## Salt Lake City

The development of railroad extensions, iron and coal projects and hotel facilities in southern Utah continues. This points to a steadily improving business in Utah and adjacent territory. The mild weather has passed and a spell of real winter now prevails. The effect has been to slow up retail trade. Electrical dealers are now giving much attention to pending washer campaigns scheduled to start early in March. There is a disposition to make more extensive preparations than has been the custom for several years past. Prices generally are firm.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## American Engineering Acquires Standard Crane & Hoist

The American Engineering Company, Philadelphia, manufacturer of stokers and marine auxiliaries, announces that it has taken over the Standard Crane & Hoist Company and the patent and manufacturing rights to mono-rail electric hoists as manufactured by the latter named company.

The American Engineering Company has reorganized its No. 1 plant to accommodate the work of building and testing the hoists. H. S. Valentine, formerly chief engineer of the Standard Crane & Hoist Company, is directing sales and supervising manufacture of the hoists.

## Holslag Wins Welding Decision in Patent Office

A decision of the United States Patent Office issued recently and signed by the three examiners in chief affirms the priority of a welding machine invention to Claude J. Holslag of the Electric Arc Cutting & Welding Company, Newark, N. J., on all counts.

The patents refer to apparatus for and a method of using alternating current for arc welding by means of a transformer. The patents were issued June 3, 1919. The first decision in Mr. Holslag's favor was given in May, 1922, and the affirmation of that decision was rendered Jan. 12, 1923.

## Westinghouse's Order from Japan

The Tokyo Electric Light & Power Company, which supplies the city of Tokyo, Japan, with electrical energy, has recently placed with the Westinghouse Electric & Manufacturing Company a large order for generating and switching equipment to be used in extensions now being made to its system. The order covers switchboard, switching and generating equipment to be used in four of the Tokyo Electric Light Company's stations.

## Contractors Feature Convenience Outlets in Wiring Campaign

A co-operative house-wiring campaign under the auspices of the Malden (Mass.) Electric Company and the Malden-Everett-Melrose Association of Electrical Contractors has just been opened on the basis of emphasizing convenience outlets rather than the ordinary outlets for lighting service. For an initial payment of $2 on a contract guaranteeing a payment of $2 per month for eleven additional months, or $22 cash on completion of the work, the customer receives a wall outlet in the kitchen, a floor outlet in the dining room and another in the parlor, giving the opportunity to use a flatiron, floor lamp, toaster, vacuum cleaner or washing machine.

Return post-card folders describing the offer were mailed to 40,000 residential occupants at the beginning of the campaign Jan. 18, and thirty inquiries were reecived on the first day. Eight of these "leads" averaged service requests involving outlays of $100.

## Gifford-Wood Appointment

Directors of the Gifford-Wood Company, Hudson, N. Y., manufacturer of elevating and conveying machinery, have announced the appointment of Joseph A. Boucher to the position of sales manager. Mr. Boucher's first few years with Gifford-Wood were spent in the company's offices in Hudson, much of his time being devoted to engineering work. Eventually he joined the sales force and was assigned to the New York City office. He is now stationed in Hudson.

## Wakefield Brass Appointment

F. I. Wilson has recently joined the sales organization of the F. W. Wakefield Brass Company, Vermilion, Ohio, manufacturer of "Red Spot" hangers. Mr. Wilson was formerly with the appliance department of the Erner Electric Company, electrical jobber, Cleveland. He graduated from the University of Indiana in 1917.

## Hart & Hegeman Promotions

Monroe Guett, for some time factory manager of the Hart & Hegeman Manufacturing Company, Hartford, Conn., has been elected vice-president of this organization, retaining his former title also. Mr. Guett has been in the employ of this company for about thirty years. John R. Cook, who has been in the sales department for about seven years, has been appointed assistant sales manager, with headquarters at Hartford.

## American Wiremold Appoints New York Sales Manager

C. C. Sibley has been appointed district sales manager of the American Wiremold Company, Hartford, Conn., with headquarters at 27 East Tenth Street, New York City. Mr. Sibley will handle the company's business in northern New Jersey and the lower Hudson Valley in addition to the metropolitan area.

# Cleveland Electrical League's Program

The Electrical League of Cleveland has announced its plans for co-operative development work for the year 1923. This activity will be organized under four departments, specializing in the promotion of wiring, lighting, appliances, and industrial power and heat. According to the program:

The wiring section plans to distribute wiring suggestion booklets to all who take out permits for dwelling buildings, to encourage builders to bring plans to the league for expert advice on wiring and lighting the home, to maintain through a special representative, the point of contact with architects, house building contractors and wiring contractors, to endeavor to influence appliance manufacturers to distribute room plans like or similar to those prepared by the league, to continue the work started by the public information committee of compiling under one cover data and drawings which beyond any question of a doubt will result to the benefit of the entire industry, to encourage the installation of convenience outlets in old homes by the aid of a wider distribution of room plans and through editorial copy and display space in daily newspapers, and to co-operate with lighting section to improve lighting in all new buildings as well as buildings previously constructed.

The lighting section plans to conduct three store lighting exhibits, to employ a special lighting representative to conduct store lighting exhibits and to endeavor to influence architects and wiring contractors to provide for better lighting installations, to distribute lighting suggestion booklets to present and prospective home owners, who take out permit to erect dwelling building, to conduct a home lighting contest, to co-operate with builders of electrical homes, and to assist in promoting better lighting in offices, shops and factories.

The appliance section plans to conduct an eight weeks' campaign on the value of the clothes washed in the home, to conduct an eight weeks' campaign on the value of the vacuum cleaner in the home, to conduct an eight weeks' campaign on the value of the ironing machine in the home, to continue the services of a range representative to try to make each range owner a satisfied user, and to co-operate with the wiring committee in the distribution of room or home wiring plans that will prompt the installation of additional outlets in buildings which are to be constructed for the future use of electrical appliances.

The program for the industrial power and heating section has not been completed.

### Uehling Instrument Appoints New Jersey Representative

Announcement is made that Royal E. Terhune has been placed in charge of the northern New Jersey sales territory of the Uehling Instrument Company, Paterson, N. J., manufacturer of "$CO_2$ recorders" and other power-plant equipment. Mr. Terhune was formerly associated with the Uehling Laboratories and is therefore well qualified to co-operate with power-plant operators on the subject of power-plant economy.

### Edison Appliance Offices Moved

The New England district offices of the Edison Electric Appliance Company, Inc., have been moved to 99 Bedford Street, Boston. C. P. Myrick, district sales manager, states that increased business required the change and that in the new quarters double the former floor space is being occupied. Samples of all lines produced by this organization will be carried for display purposes at the new offices.

### Betts & Betts Sales Change

The Betts & Betts Corporation, 645 West Forty-third Street, New York City, manufacturer of refillable-fuse plugs, bell-ringing transformers, radio apparatus and motor-driven controllers, announces that H. O. Klug, whose appointment to the territory formerly covered by F. Maples, consisting of western Pennsylvania, Ohio, Michigan, eastern Indiana, northern Kentucky and West Virginia, was announced in the ELECTRICAL WORLD for Jan. 13, has resigned owing to illness in his family. He is succeeded in the position by William J. Gannan.

### States Company's Orders Gained 100 per Cent in 1922

A decided improvement in business was experienced during 1922 by the States Company, Hartford, Conn., according to H. J. Blakeslee, treasurer, who said that the demand for testing apparatus for both domestic and foreign use is increasing.

The total sales of the company were about 100 per cent better in 1922 than in 1921. Two and one-half times as many test tables were sold in 1922, and orders received during January maintain the recent improvement in this class of business.

Sales to Australia, Mexico, Canada and China feature the company's more recent foreign business. The winding department is being relocated near the main factory and the number of persons employed is about double the force required a year ago. A new automatic cut-out for series lighting circuits has lately been put into regular production, and the company is developing other apparatus to facilitate testing with special reference to portability. Sufficient orders for radio transformers are on the books to occupy the company until spring. The demand for phantom loads and other equipment used in meter testing in the field is also encouraging.

### Master Electric Company's New Building in Dayton, Ohio

The Master Electric Company, Dayton, Ohio, manufacturer of motors, has recently moved into its new offices and factory at First and Sears Streets, Dayton, Ohio, where greatly increased floor space, enlarged facilities and strengthened organization enable it to increase production in order to take care of its growing business.


NEW OFFICES AND FACTORY OF THE MASTER ELECTRIC COMPANY

**The Mine & Smelter Supply Company**, with branches in Denver, Salt Lake City and El Paso, has taken over the representation of the Wilson Welder & Metals Company, 132 King Street, New York City, for the States of Colorado, Utah, Nevada, Wyoming and New Mexico and for western Texas for Wilson plastic-arc welders and Wilson color-tipped welding metals.

**The Ledox Storage Battery Company**, 314 Bergen Street, Brooklyn, recently organized, has arranged for the construction of new works at 76 Fourth Avenue. Initial operations provide for the manufacture of plates and castings, with assembling department at the company plant, and other manufacture carried out under contract. Extensions in manufacturing facilities are planned. J. D. Moulton is president and O. W. Larson secretary and treasurer.

**The Westinghouse Lamp Company**, 165 Broadway, New York City, with plant at Bloomfield, N. J., has authorized Stone & Webster Inc., 147 Milk Street, Boston, engineers, to prepare plans for new works in the vicinity of the present factory, primarily for the manufacture of bases for incandescent lamps. They are estimated to cost $500,000, with machinery.

**The Western Electric Company** announces purchase of a tract of land comprising 55 acres on the Kearney Meadows in New Jersey, south of the Lincoln Highway, adjoining the large plants of the Federal Shipbuilding Company and the Ford Motor Company, having a frontage on the Passaic River of about 1,600 ft., upon which it will immediately begin the erection of factory buildings. It is the intention of the Western Electric Company to establish on this land an Eastern factory to supplement the manufacturing operation now carried on at its Hawthorne plant in Chicago.

**The Frank E. Wolcott Manufacturing Company**, Hartford, Conn., has secured a charter to manufacture electrical equipment and appliances, the authorized capital being $50,000. The incorporation is a continuance of the business previously conducted by Mr. Wolcott. At present part of the work is let out to contract.

**James. A. Condon, Inc.**, has taken over the business formerly conducted at Third and Arch Streets, Philadelphia, by Howard W. Read. The new company, which will specialize in steam, electrical and contractors' equipment, is headed by James A. Condon, who for twenty-one years was with Frank Toomey, Inc. The company has a warehouse at 1114 Frankford Avenue.

**The Electrical Dealers' Supply Company**, 162 West Randolph Street, Chicago, manufacturer of electrical fixtures and equipment, has awarded a contract for a three-story-and-basement plant, 100 ft. x 200 ft., to cost $250,000, including equipment. Simon Frankel is president of the company.

**The Allis-Chalmers Manufacturing Company, Inc.**, Milwaukee, Wis., announces that its board of directors has declared a dividend of $1 per share on the common stock, payable Feb. 15, 1923, to common-stock holders of record at the close of business Jan. 24, 1923.

## Foreign Trade Notes

HYDRO-ELECTRIC DEVELOPMENT IN NEW ZEALAND.—Proposed hydro-electric developments in New Zealand, according to a schedule drawn up, *Commerce Reports* states, involve a total expenditure of £12,902,000, covering a period of ten years, reaching a maximum of £2,023,000 in 1925. It has been necessary to postpone for a couple of years the commencement of the main works at Lake Waikaremoana, owing to financial conditions in New Zealand, and to hold over a number of the smaller developments in the South Island until power boards have been appointed to handle the question of distribution. Transmission lines and projects to be developed will be pushed ahead in order to make the supply of electricity as general as possible up to the capacity of the headworks at each site. The mains from Lake Coleridge will be extended into Otago and North Canterbury, and those from Mangahao will reach to Wanganui and Napier. These are in addition to lines already under construction.

AUTOMATIC PREPAYMENT TELEPHONES TO BE INSTALLED IN FRANCE.—The French administration of posts and telegraphs, according to *Commerce Reports*, has awarded a contract to a company, recently organized, for the installation of an automatic system. This company, which controls the rights of the so-called taxiphone for France, is to receive the exclusive concession for twenty years to establish and operate in France telephone booths fitted with automatic prepayment telephones. The company plans ultimately to extend its operations to all parts of the republic, but for the present it will install only about one thousand stations. The name and address of the company which has received the contract may be obtained upon application to the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., or any of its district offices.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in South Africa (No. 5,155) of a rotary wheel for cutting cotton, to be operated on alternating current at 200 volts.

An agency is desired in Spain (No. 5,179) for electrical machinery, pumps, ventilators, etc.

Purchase and exclusive agency is desired in Spain (No. 5,183) for miscellaneous electrical supplies for installations in homes or offices, motors up to 20 hp. or 25 hp., wire, incandescent bulbs and electrical novelties.

Purchase and agency is desired in Poland (No. 5,190) for electrical goods, machinery, supplies and apparatus.

Purchase or agency is desired in Chile (No. 5,193) for transmitting and receiving radio apparatus suitable for various distances up to several hundred miles.

An agency is desired in South Africa (No. 5,209) for railway and industrial equipment, electric meters and other machinery suitable for the South African market.

An agency is desired in Poland (No. 5,225) for electric generators, motors and current-measuring apparatus, copper wire and cable of all sizes, supplies for electrical installations, telephone and telegraph apparatus, electric fire-alarm and burglar-alarm systems and parts, and electric railway block signals.

EQUIPMENT FOR MORWELL (AUSTRALIA) POWER SCHEME.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until April 28 for transformers and spares (Specification No. 23/9), for the Morwell power scheme. Tenders will also be received until March 15 for motors, starters and isolating switches (Specification 23/7), for the Morwell power scheme. R. Liddelow is secretary.

DEMAND FOR SMALL ELECTRIC LIGHT PLANTS IN PORTUGUESE EAST AFRICA.—In spite of the intense business depression prevailing throughout Portuguese East Africa and its hinterland of the Eastern Transvaal and Rhodesia, Consul Cecil M. P. Cross, Lourenço Marques, states that there is a moderate demand for small electric lighting plants suitable for farmhouses. Practically all of these in use are of American manufacture. A strong potential demand exists throughout Portuguese East Africa, as only the cities of Beira and Lourenço Marques have central electric plants. Cheaper plants operated by kerosene or some cheap fuel would better meet the requirements of the markets, owing to the high price of gasoline. The two distributing centers are Beira and Lourenço Marques.

## New Apparatus and Publications

CENTRIFUGAL PUMPS.—The De Laval Steam Turbine Company, Trenton, N. J., is distributing a bulletin and instruction manual describing and illustrating the "De Laval" type "F" small single-stage centrifugal pumps.

RADIO HORN.—The Bristol Company, Waterbury, Conn., has placed on the market a new "loud speaker" horn, known as "Audiphone, Jr.," which is used for radio receiving.

ARC WELDING.—The Electric Arc Cutting & Welding Company, Newark, N. J., has developed a new device for direct-current arc welding.

BENCH DRILL.—A new "Dunmore" portable sensitive bench drill has recently been placed on the market by the Wisconsin Electric Company, Racine, Wis.

ELECTRIC FANS.—The Century Electric Company, 1,827 Pine Street, St. Louis, has brought out a new induction-type single-speed, alternating-current fan, in 9-in. and 12-in. sizes. Bulletin No. 32 issued by the company describes and illustrates its alternating-current and direct-current fans.

PRESSURE PIPE.—Catalog No. 22 issued by the American Spiral Pipe Works, Chicago, Ill., describes and illustrates the "Taylor's" spiral-riveted pressure pipe.

RADIO APPARATUS.—The Whiteland Manufacturing Corporation, Washington Avenue from Sixth to Seventh Avenue, Long Island City, N. Y., is distributing two leaflets describing the "Whiteland" loud-speaking radio apparatus and loud-speaking telephone equipment.

RADIO HORNS.—The Betts & Betts Corporation, 645 West Forty-third Street, New York City, is distributing a leaflet describing its fiber radio horn.

ACCESSORY FOR TESTING MICROSCOPE STANDS.—An interference accessory for testing microscope stands and fine adjustments has been developed by Adam Hilger, Ltd., 75a Camden Road, London, N.W.1.

LIGHTING FIXTURES.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, is distributing serial No. 401, which calls attention to the use of the "Curtis Adapter" for indirect lighting without ceiling fixtures.

SHOW-WINDOW LIGHTING.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, has issued serial No. 402, covering its No. 33 show-window floodlight.

OIL CIRCUIT BREAKERS.—A new line of circuit breakers, type F-10, designed primarily for industrial applications, such as textile, cement and flour mills and in mines, has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

FUSE PLUG.—A new fuse plug, "H & H," of the renewable-fuse type has been placed on the market by the Hart & Hegeman Manufacturing Company, Hartford, Conn.

## New Incorporations

THE SOUTH GEORGIA PUBLIC SERVICE COMPANY, Albany, Ga., has been incorporated with a capital stock of $10,000, with privilege of increasing it to $3,000,000. The company proposes to secure electricity from the plant of the Georgia-Alabama Power Company on the Flint River, above Albany, which it proposes to distribute in Tifton and neighboring cities.

THE MARTHASVILLE (MO.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $4,000 to generate and distribute electricity and to deal in electrical supplies, etc. The incorporators are F. H. Suhre, H. W. Duebbert, E. H. Koch, O. F. Dickmann and R. H. Morhaus.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

PORTLAND, ME.—The Cumberland County Power & Light Company is considering changing its system in Portland from direct to alternating current.

BOSTON, MASS.—The North Boston Lighting Properties, 201 Devonshire Street, has issued $1,500,000, part of the proceeds to be used for extensions and improvements to its plants and systems at Malden, Everett and vicinity.

PITTSFIELD, MASS.—The Pittsfield Electric Company contemplates building a pipe line from its Silver Lake power plant to the center of the city in the spring, to continue the heating service which it has been furnishing to the business blocks in North Street. The cost is estimated at $70,000.

SALEM, MASS.—Electric power equipment will be installed in the ice and cold-storage plant to be erected by a new company now being organized by P. A. Sweeney, 246 Essex Street, to cost about $150,000.

UXBRIDGE, MASS.—The Uxbridge Worsted Company is planning to build a new power plant. The equipment will include two 500-kw. turbo-generating units and 1,500 hp. in boilers. George P. Carver, Inc., Boston, industrial engineer, will design and construct the plant.

PROVIDENCE, R. I.—The annual report of the Metropolitan Park Commission presented to the General Assembly contains a recommendation that funds be appropriated for lighting the Barrington Parkway in East Providence with electricity.

NEW MILFORD, CONN.—Electric equipment will be installed in the proposed refrigerating and packing plant to be erected by the Confederated Abattoirs Corporation, to cost about $90,000.

## Middle Atlantic States

GOUVERNEUR, N. Y.—The Oswegatchie Light & Power Company is considering the installation of a 600-hp. engine for use in case of emergencies.

LE ROY, N. Y.—The Genesee Light & Power Company, Batavia, has acquired the property of the Le Roy Hydraulic, Electric & Gas Company. A transmission line will be erected from Batavia and extensions made in the local system.

MADRID, N. Y.—The St. Lawrence Transmission Company, Potsdam, has applied to the Public Service Commission for permission to establish an electric plant in Madrid.

NEW YORK, N. Y.—The Navy Purchasing Officer, South and Whitehall Streets, has received authority to purchase 144 porcelain post insulators (N. S. A. req. 112) and 110 storage-battery testing outfits (N. S. A. req. 453).

PLATTSBURGH, N. Y.—The Lake Champlain Pulp & Paper Company has acquired a site on the Saranac River near here, where it contemplates building a hydro-electric plant to cost about $75,000. It is estimated that about 1,500 hp. can be developed.

POTSDAM, N. Y.—The St. Lawrence Transmission Company has petitioned the Public Service Commission for permission to extend its transmission line from Potsdam to Gouverneur.

CHATHAM, N. J.—The installation of electrically operated pumping machinery at the municipal waterworks is under consideration. Extensions will be made in the lighting system on North Summit Avenue.

MEYERSDALE, PA.—Plans are being prepared by the Meyersdale Electric Light, Heat & Power Company for extensions to its power house, including the installation of new equipment.

NOXEN, PA.—The Noxen Electric Company, recently organized, plans to install a local system.

PHILADELPHIA, PA.—The Quaker City Rubber Company, Milnor and Comly Streets, will build a one-story power house at its plant.

PHILADELPHIA, PA.—The Art Loom Rug Company, Mascher and Westmoreland Streets, will erect a power house at its plant, to cost about $50,000.

PHILADELPHIA, PA.—The Beswick & Clay Company, Twenty-sixth and Callowhill Streets, will build a one-story power house in connection with extensions to its plant. M. Ward Easby, 1814 Chestnut Street, is engineer.

PHILADELPHIA, PA.—Bids will be received by the Department of Wharves, Docks and Ferries, Room 211, Municipal Pier, No. 4, until Feb. 9, for electric wiring and other work at the Girard Pier, No. 3, North Delaware River.

PHILADELPHIA, PA.—The Philadelphia Electric Company has called for bids for the erection of a substation at Trenton Avenue and Somerset Street. Plans are being arranged for an increase in capital from $65,000,000 to $100,000,000, part of the proceeds to be used for extensions.

PITTSBURGH, PA.—The West Penn Power Company has authorized plans for the initial unit of its proposed hydro-electric plant on the Monongahela River, Cheat River Valley, W. Va., to have a capacity of 50,000 hp. The cost is estimated at $3,500,000.

SCRANTON, PA.—Plans are under consideration by the Scranton Commercial Association for the installation of an ornamental lighting system on Wyoming Avenue between Lackawanna Avenue and Green Ridge Street.

SELLERSVILLE, PA.—The Pennsylvania Power & Light Company has acquired property of the Excelsior Light & Power Company. Extensions are contemplated.

BALTIMORE, MD.—The Washington, Baltimore & Annapolis Electric Railway Company is planning to supply electricity for lamps and motors in a number of small villages along its lines. This service will be furnished by the Annapolis Public Utilities Company, a subsidiary. The railway company is negotiating for the purchase of the municipal electric plant at Laurel.

CLARKSBURG, W. VA.—The Clarksburg Gas & Electric Company is negotiating with the Council for the installation of an electric lighting system in the Glen Elk section.

COLLINSDALE, W. VA.—The Paint Creek Mining Company plans to rebuild its power house and tipple, recently destroyed by fire.

GRAFTON, W. VA.—Plans are being prepared for the installation of a street-lighting system on Main Street.

LOGAN, W. VA.—Contract has been awarded by the Kentucky & West Virginia Power Company to the Foundation Company, New York City, for an addition to its power plant. A steel-tower transmission line will be erected from Logan to Hazard, Ky., 125 miles long. The cost of the work is estimated at about $800,000.

HARRISONBURG, VA.—Plans are considered for the installation of another 500-hp. unit at the municipal auxiliary steam-operated electric plant now in course of construction.

NORFOLK, VA.—The Virginian Railway is considering plans for the electrification of 16 miles of mountain roads, to cost about $500,000.

WINCHESTER, VA.—The Northern Virginia Power Company has petitioned the State Highway Commission for permission to extend its transmission lines along the Shenandoah Valley turnpike from Stephens City to Strasburg.

## North Central States

DETROIT, MICH.—Plans for a new group of buildings to be erected by the board of directors of the Sacred Heart Seminary, 1219 Washington Boulevard, provide for a two-story power house, 64 ft. x 147 ft. The cost of the entire work is estimated at $500,000.

DETROIT, MICH.—The Public Lighting Commission is preparing plans for the erection of a municipal power plant at Morrell Street and the Detroit River and for a substation in this section. Smith, Hinchman & Grylls, 800 Marquette Building, are architects.

CLEVELAND, OHIO. — Arrangements have been made whereby the Cleveland Electric Illuminating Company will supply the Northern Ohio Traction & Light Company, Akron, with additional energy to be distributed in Akron and nearby towns. Provision is also made for an interchange of power. The project will involve an expenditure of about $700,000 and will include the erection of a high-tension transmission line to connect the two cities. The Cleveland company will erect the line to the Cuyahoga County line and the Northern Ohio company from this point to its plant in South Akron. An additional transformer station will be erected at the Akron plant. Additional generating equipment will be installed at the Cleveland plant, increasing the output from 208,000 kw. to 263,000 kw. The system when complete will connect Cleveland with Toledo on the west, Pittsburgh on the east and Mansfield, Zanesville and Bridgeport on the south.

MAYSVILLE, KY.—The Maysville Public Service Company contemplates extensions and improvements to its plant and system.

INDIANAPOLIS, IND.—Plans are under way for the construction of a central power house for service at the James Whitcomb Riley Hospital, Indiana University of Medicine and the Robert W. Long Hospital, to cost about $275,000. The State Executive Committee is in charge.

SULLIVAN, IND.—The Vigo Mining Company, Ross Dispensary Building, Terre Haute, contemplates the erection of a power plant here, to cost about $75,000. The Shourds-Stoner Company, Tribune Building, Terre Haute, are architects.

BLOOMINGTON, ILL.—The installation of an ornamental lighting system on South Main Street from Mill Street to Highland Park is under consideration.

ELBURN, ILL.—Extension will be made to the municipal power plant, to cost about $25,000. Alford, Burdick & Housch, 8 South Dearborn Street, Chicago, are engineers.

EVANSTON, ILL.—Steps have been taken by the merchants on Davis Street to install an ornamental lighting system on that thoroughfare.

FREEPORT, ILL.—Plans are being prepared by the Arcade Manufacturing Company for a new power house and woodshop and plant alterations, to cost about $60,000.

GILLESPIE, ILL.—Arrangements are being made by the Southern Illinois Light & Power Company for extensive improvements to its local system.

McLEANSBORO, ILL.—Plans are being prepared for construction of water-works system, including an impounding reservoir, filter plant, several miles of pipe line, new engines and generators. W. A. Fuller, Railway Exchange Building, St. Louis, is engineer.

FORT ATKINSON, WIS.—The Fort Atkinson Canning Company is planning to build a new canning factory, including power plant and other buildings, to cost about $100,000. Bids, it is understood, have been asked for the work.

JANESVILLE, WIS.—The Board of Public Works has awarded a contract to the Janesville Electric Company for the installation of ornamental street lamps on South Main and South Jackson Streets.

MANITOWOC, WIS.—Plans are under consideration by the Wisconsin Public Service Corporation for the rearrangement of its lines to enable it to improve its lighting and power service in towns of Manitowoc and Calumet Counties. The proposed plans include the establishment of a substation at Valders and extensions of its line to Collins to furnish service there; also the erection of a new transmission line between Manitowoc and Chilton.

MILWAUKEE, WIS.—Extensions to the street-lighting system, to cost about $100,000, are under consideration. G. Staal is city engineer.

OSHKOSH, WIS.—The Badger Lumber & Manufacturing Company has started work on a new plant to replace the factory and power house recently destroyed by fire. The plant will cost about $150,000 and will be equipped throughout with motor-driven machinery.

ADA, MINN.—Bonds to the amount of $28,000 have been voted for the installation of a new electric distribution system.

SIOUX CITY, IOWA.—The installation of a new street-lighting system in the downtown district is under consideration. L. Hintgen is city engineer.

PARIS, MO.—Extensions and improvements will be made in the municipal power house and a city-owned ice manufacturing plant established. W. B. Rollins & Company, 521 Railway Exchange Building, Kansas City, are architects.

ST. LOUIS, MO.—The Light & Development Company of St. Louis has purchased a site of about fourteen acres in the Columbia bottoms adjacent to the Mississippi River in North St. Louis as a tentative location for a power house to be operated in conjunction with and supplementary to the power plant of the Cupples Station Light, Heat & Power Company, a subsidiary of the former company.

BROCK, NEB.—Bonds to the amount of $6,500 have been voted for the purpose of securing electricity from the Nebraska City Utilities Company.

CHESTER, NEB.—Bids will be received by the village clerk until Feb. 7 for changing the system of the municipal electric plant from direct to alternating current. The Prince-Nixon Engineering Company, Peters Trust Building, Omaha, is engineer.

LINCOLN, NEB.—The Lincoln City Hospital Association, it is reported, is receiving bids for the construction of a hospital and power house at Seventeenth and Sewel Streets. Davis & Wilson, Security Building, are architects. J. L. Teeters, 1812 D Street, is chairman of association.

BALDWIN, KAN.—The installation of an improved street-lighting system is under consideration by local business men.

EMPORIA, KAN.—The Kansas Electric Power Company will make extensions and improvements to its generating plant, including the installation of additional equipment. Horner & Wyatt, 306 McMillen Building, Kansas City, Mo., are engineers.

PITTSBURG, KAN.—Bids will be received by Leonard Boyd, city clerk, until Feb. 7 for an electrically operated pumping plant to be used in connection with new sewage-disposal works. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

PRATT, KAN.—The installation of a new boiler in the municipal electric plant is under consideration.

## Southern States

RALIEGH, N. C.—The Yadkin River Power Company has issued $4,000,000 in bonds, part of the proceeds to be used for the purchase of the property of the Palmetto Power & Light Company and for proposed extensions and improvements.

WHITEVILLE, N. C.—Bids will be received by the Council until Feb. 9 for equipment for the municipal electric plant, to include one 90-kva. and two 150-kva. generators, direct-connected to "uniflow" engine; three-panel switchboard, exciter and auxiliary equipment; also, at the same time, for alternate estimates for Diesel engines. J. B. McCrary, Atlanta, Ga., is engineer.

CLEVELAND, GA.—O. C. Bell is organizing a company to construct and operate a local power plant for commercial service. Robert & Company, Atlanta, are engineers.

FORT LAUDERDALE, FLA.—The Carmichael Development Company plans to install an electric system for commercial street-lighting service on a 700-acre tract now being developed for residential purposes.

CHATTANOOGA, TENN. — The Casey-Hedges Company will install electric power equipment at its new boiler and tank manufacturing plant, to cost about $200,000.

RICHARD CITY, TENN. — The Dixie Portland Cement Company, Chattanooga, will install motors and other electric power equipment in connection with extensions and improvements, to cost $250,000.

CHILDERSBURG, ALA.—The Alabama Power Company has been granted a franchise to install a distributing system here.

RUSSELLVILLE, ALA. — Bonds to the amount of $24,000 have been issued for extensions and improvements to the municipal light and water plant.

SHEFFIELD, ALA.—Plans for the proposed new local cement manufacturing plant to be built by a company now being organized by Samuel W. Kendall, Meridian, Miss., include a power plant. The cost is estimated at $1,000,000.

WIGGINS, MISS.—The Finkbine Lumber Company contemplates the construction of a power house in connection with rebuilding its lumber plant, recently destroyed by fire, causing a loss of about $500,000.

ARKADELPHIA, ARK.—The Arkansas Power Company is making arrangements for an issue of $500,000 in bonds for extensions and improvements.

EL DORADO, ARK. — The Arkansas Light & Power Company has started work on the erection of a high-tension transmission line to Smackover, to cost about $95,000.

EL DORADO, ARK.—The Evans-Thwing Refining Company, 624 Finance Building, Kansas City, Mo., will install electric power equipment at its proposed local oil-refining plant, to cost about $500,000.

KETCHUM, OKLA.—The Grand River Hydro-Electric Power Company contemplates the construction of a hydro-electric plant on the Grand River, with initial capacity of about 17,000 hp.

ABILENE, TEX.—Plans are being considered by the West Texas Utilities Com-

pany for extensions to its main power station and system.

CLARKSVILLE, TEX. — Electrically operated machinery and other equipment will be installed in connection with extensions to the municipal waterworks system.

SAN ANTONIO, TEX.—The Valley Electric Company, recently organized, will take over the plants at McAllen, San Juan, Alamo, Donna and Mercedes. The company is a subsidiary of the Central Texas Company.

## Pacific and Mountain States

MANSON, WASH. — The Washington Water Power Company will install and operate a distributing system here. Power will be secured from the proposed transmission line to Lake Chelan.

RIVERSIDE, WASH. — The Riverside Irrigation District, which plans to establish an irrigation project covering 4,000 acres of land, has authorized an issue of $450,000 in bonds. A hydro-electric plant will be built on the Okanogan River at McLaughlin Canyon to furnish power to operate the pumping system. N. Aall, Riverside, is engineer.

SEATTLE, WASH. — Bids will be received by the Board of Public Works until Feb. 9 for electrical equipment for the North substation of the municipal Skagit River development.

TACOMA, WASH.—The Puget Sound Power & Light Company has been granted a franchise to erect and operate electric transmission lines in a large district in Pierce County, including Puyallup.

FRESNO, CAL.—The San Joaquin Light & Power Corporation will erect a substation at Orange and California Avenues, to cost about $102,000, to replace an existing plant. Plans are being prepared for the construction of a hydro-electric plant on the Kings River and a 22-mile transmission line to the site from Piedra, to cost about $175,000.

HUNTINGTON, CAL.—The installation of an ornamental lighting system on Ocean Boulevard, a distance of 3 miles, is under consideration by the Board of City Trustees.

LONG BEACH, CAL.—The Southern California Edison Company contemplates the erection of a transformer station at the intersection of Pine and Locust Streets, to cost about $250,000.

LOS ANGELES, CAL. — The Southern Pacific Railroad Company, San Francisco, will build a power plant in connection with its new shops and terminal on the San Fernando Road, to cost about $1,000,000.

OAKLAND, CAL.—Bids will be received by George B. McDougall, chief of division of architecture, Forum Building, Sacramento, until Feb. 15 for construction of an employees' cottage, women's shop building, power house and recreation building for the Industrial Home for Adult Blind, Oakland.

SAN FRANCISCO, CAL.—Electric power equipment and a substation will be installed at the plant to be erected at South San Francisco by the Metal & Thermit Corporation, 120 Broadway, New York, and Swift Street, San Francisco, to cost about $1,500,000.

SANTA ANA, CAL. — Plans are being prepared for the installation of a fire-alarm system.

ADAIR, IDAHO.—The Smith River Light & Power Company, recently organized, is planning to erect a power plant on the Smith River. The proposed plant will be driven by Diesel engines. C. Romander is general manager.

TOMBSTONE, ARIZ. — The installation of a municipal electric plant is under consideration.

## Canada

GRAND FALLS, N. B.—The International Paper Company, 30 Broad Street, New York, contemplates the construction of a hydro-electric plant in connection with a new local paper mill, to cost about $500,000.

BRIDGEBURG, ONT.—The installation of an electric light and power system in Bridgeburg, to cost about $50,000, is under consideration. It is proposed to secure energy from the Hydro-Electric system at Stevensville, 8 miles distant.

NORTH BAY, ONT.—The French River Power and Development Association has been organized in connection with a proposition to develop the power resources of French River. D. Barker, North Bay, is chairman.

ORILLIA, ONT.—The Water, Light and Power Commission contemplates extending the municipal electric lighting system to Victoria Point and Grape Island.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued Jan. 9, 1923)

1,441,640. SHUNT CONNECTION; R. B. Taylor, Cleveland, Ohio. App. filed March 28, 1922. Connecting shunts or cables to the brushes of electric machines.

1,441,685. ELECTRIC ARC SOLDERING; E. H. Jones, London, England. App. filed Sept. 18, 1918. Electrode covered with suitable material to prevent excessive oxidation.

1,441,686. METAL ELECTRODE USED IN DEPOSITING AND SOLDERING BY THE ELECTRIC ARC; E. H. Jones, London, England. App. filed Sept. 18, 1918. Base-metal electrode covered with nickel or other suitable coating.

1,441,687. ELECTRIC ARC SOLDERING; E. H. Jones, London, England. App. filed July 16, 1919. Electrode of base material covered with carbon.

1,441,688. ELECTRODE AND WELDING AND LIKE ROD USED IN SOLDERING AND DEPOSITING METALS; E. H. Jones, London, England. App. filed Feb. 18, 1920. Formed of rods of different materials.

1,441,755. TROLLEY-WHEEL MOUNT; T. Sanders, Kingman, Ind. App. filed July 5, 1922.

1,441,791. TELEPHONE SYSTEM; H. M. Friendly, Portland, Ore. App. filed June 11, 1917. Enables party calling from a central exchange telephone to obtain access over a trunk line to stations in a private automatic exchange.

1,441,792. ELECTRIC ACCUMULATOR; W. O. Garbutt, Gloucester, England. App. filed June 19, 1922. Method of desulphating battery plates.

1,441,801. TERMINAL; F. G. Guenther and W. C. Grabau, Seattle, Wash. App. filed Dec. 6, 1920. Moisture-proof housing for covering connection between battery and cable.

1,441,822. FLASHLIGHT; E. R. Barany, New York, and W. S. Pritchard, Mount Vernon, N. Y. App. filed Sept. 14, 1921. Light beam carefully focused.

1,441,872. AUDIBLE SIGNAL DEVICE OF THE VIBRATORY DIAPHRAGM TYPE; J. F. Monnot and E. T. Cook, London, England. App. filed June 24, 1919. Operated by racket and motor.

1,441,877. DIRECTION SIGNAL; P. W. Padden and O. C. Reynolds, Maumee, Ohio. App. filed Nov. 5, 1920. For automobiles.

1,441,883. FLASHLIGHT; J. T. Roffy, Brooklyn, N. Y. App. filed Jan. 2, 1920. Guard around lens to prevent breakage.

1,441,884. FLASHLIGHT; J. T. Roffy, Brooklyn, N. Y. App. filed Jan. 3, 1920. General diffused illumination.

1,441,902. INTERMITTENT ELECTRIC LIGHT FLASHER; E. M. Bailey, Albion, Ill. App. filed July 10, 1920. Operated by pendulum of clock.

1,441,988. WIRELESS-WAVE DETECTOR; E. P. Lindner, Indianapolis, Ind. App. filed Dec. 18, 1920. Carborundum detector.

1,442,013. LAMP RECEPTACLE; G. B. Thomas, Bridgeport, Conn. App. filed June 3, 1918. Cleat receptacles.

1,442,027. CHAIR FOR X-RAY WORK; R. Levenson, New York, N. Y. App. filed July 28, 1921. Means for accurate positioning and supporting of patient's head.

1,442,031. METHOD OF SUSPENDING ELECTRODES; C. E. Söderberg, Christiania, Norway. App. filed Jan. 27, 1920. Electrodes baked in furnace in which they are used.

1,442,033. METHOD OF OPERATING ELECTRIC FURNACES; M. O. Sem and Einar Lund, Christiania, Norway. App. filed Oct. 22, 1921. Charging fuel to furnace through hollow electrode.

(Issued Jan. 16, 1923)

1,442,041. GRINDER REGULATION SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Sept. 11, 1920. Control of hydraulic pressure employed to force material into pulp grinder.

1,442,042. GRINDER REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Sept. 11, 1920. Load-control apparatus for pulp grinders.

1,442,048. ELECTRIC WATER HEATING APPARATUS; H. W. Christian, Detroit, Mich. App. filed Aug. 25, 1921. Thermostatic mechanism regulates temperature of water.

1,442,050. ELECTRIC REGULATION; J. L. Creveling, White Plains, N. Y. App. filed March 7, 1917. Voltage regulator for generators.

1,442,053. CONTROL SYSTEM; R. E. De Camp, Wilkinsburg, Pa. App. filed May 12, 1919. Motor-starting resistance automatically cut out.

1,442,064. REMOTE CONTROL FOR INDICATORS; O. E. Groshall, Salt Lake City, Utah. App. filed Jan. 21, 1920. Auxiliary cash-register indicators.

1,442,082. PARTY-LINE TELEPHONE SYSTEM; T. G. Martin, Chicago, Ill. App. filed July 20, 1905. Complete automatic system.

1,442,085. MAXIMUM-DEMAND METER; W. G. Mylius, Wilkinsburg, Pa. App. filed May 13, 1918. Integrated periodic demand.

1,442,086. AUTOMATIC TELEPHONE SYSTEM; F. Newforth, Jr., Norwood, Ohio. App. filed Sept. 18, 1914. Measured-service reverse-battery telephone system.

1,442,109. ELECTRIC RANGE; A. W. Walker, Malden, Mass. App. filed June 2, 1921. Current carrying and controlling apparatus readily accessible.

1,442,130. TELEPHONE SYSTEM; H. D. Currier, Chicago, Ill. App. filed July 18, 1918. Filters out all low-frequency currents.

1,442,131. ELECTROMAGNETIC GOVERNOR; C. W. Dake, Chicago, Ill. App. filed Aug. 20, 1919. Governor for turbo-generator sets.

1,442,146. MODULATING AND TRANSMITTING SYSTEM; R. A. Heising, East Orange, N. J. App. filed April 13, 1918. Radio-sending apparatus.

1,442,147. PRODUCTION OF MODULATED FREQUENCY OSCILLATIONS; R. A. Heising, East Orange, N. J. App. filed Nov. 17, 1916. Methods for producing modulated high-frequency oscillations.

1,442,202. ELECTRICAL SYSTEM; R. J. Wensley, Edgewood Park, Pa. App. filed March 14, 1918. Automatic starting and stopping of rotary converter.

1,442,238. ELECTROLYTIC APPARATUS; A. K. Smith, Cleveland, Ohio. App. filed July 29, 1922. Overvoltage prevented by coating electrodes with a nickel oxide.

1,442,243. PROCESS FOR CLEANING SCALE FROM METALS; G. A. Avery and F. Bamblett, Detroit, Mich. App. filed March 23, 1922. Material subjected to current in solution of mineral acid.

1,442,273. TROLLEY; W. T. Hill, York Harbor, Me. App. filed June 15, 1922. Wheel attachment to prevent contact from leaving wire.

1,442,284. ELECTRIC CONNECTOR; J. A. McKay, New York, N. Y. App. filed Feb. 21, 1920. Several types of plugs may be used with outlet box.

1,442,288. ELECTRIC SIGNALING SYSTEM; W. C. Neahr, Denver, Col. App. filed Dec. 17, 1918. Semaphore for railroad crossings.

1,442,310. TIME-LIMIT, CURRENT-LIMIT CONTROL FOR ELECTRIC MOTORS; L. W. Thompson, Schenectady, N. Y. App. filed Aug. 11, 1920. Starting and stopping control for motors.

1,442,320. SYSTEM OF ELECTRICAL DISTRIBUTION; E. Beuer and W. A. Turbayne, Niagara Falls, N. Y. App. filed Sept. 14, 1917. Voltage regulator for variable-speed generator for charging batteries.

1,442,425. TELEPHONE-REPEATER SYSTEM; R. D. Conway, Chatham, N. J. App. filed Dec. 27, 1918. Methods for automatically selecting and associating balancing networks with a repeater.

1,442,427. ANTI-SIDE-TONE SUBSTATION CIRCUIT; G. D. Edwards, East Orange, N. J. App. filed Aug. 6, 1919. Circuit specially adapted for train dispatcher's telephone.

1,442,429. IMPULSE-TRANSMITTING MECHANISM; J. B. Harlow, Upper Montclair, N. J. App. filed July 14, 1917. Transmitting mechanism provided with indicator showing operator condition of distant signal.

1,442,430. ELECTRON-DISCHARGE DEVICE; R. V. L. Hartley, East Orange, N. J. App. filed Dec. 31, 1919. Filament and plate energized from same machine in which any variations are automatically neutralized.

1,442,437. PROCESS OF GALVANIZING WHEEL RIMS; L. V. Mather, Detroit, Mich. App. filed Nov. 12, 1920. Mechanical cleaning of metal used instead of pickling process.

1,442,438. ELECTROPLATING APPARATUS; L. V. Mather, Detroit, Mich. App. filed Feb. 6, 1922. Articles progressively advanced through electrolytic bath.

1,442,439. VACUUM REPEATER; R. C. Mathes, New York, N. Y. App. filed Nov. 4, 1916. Minimizing variations of plate circuit due to supply voltage.

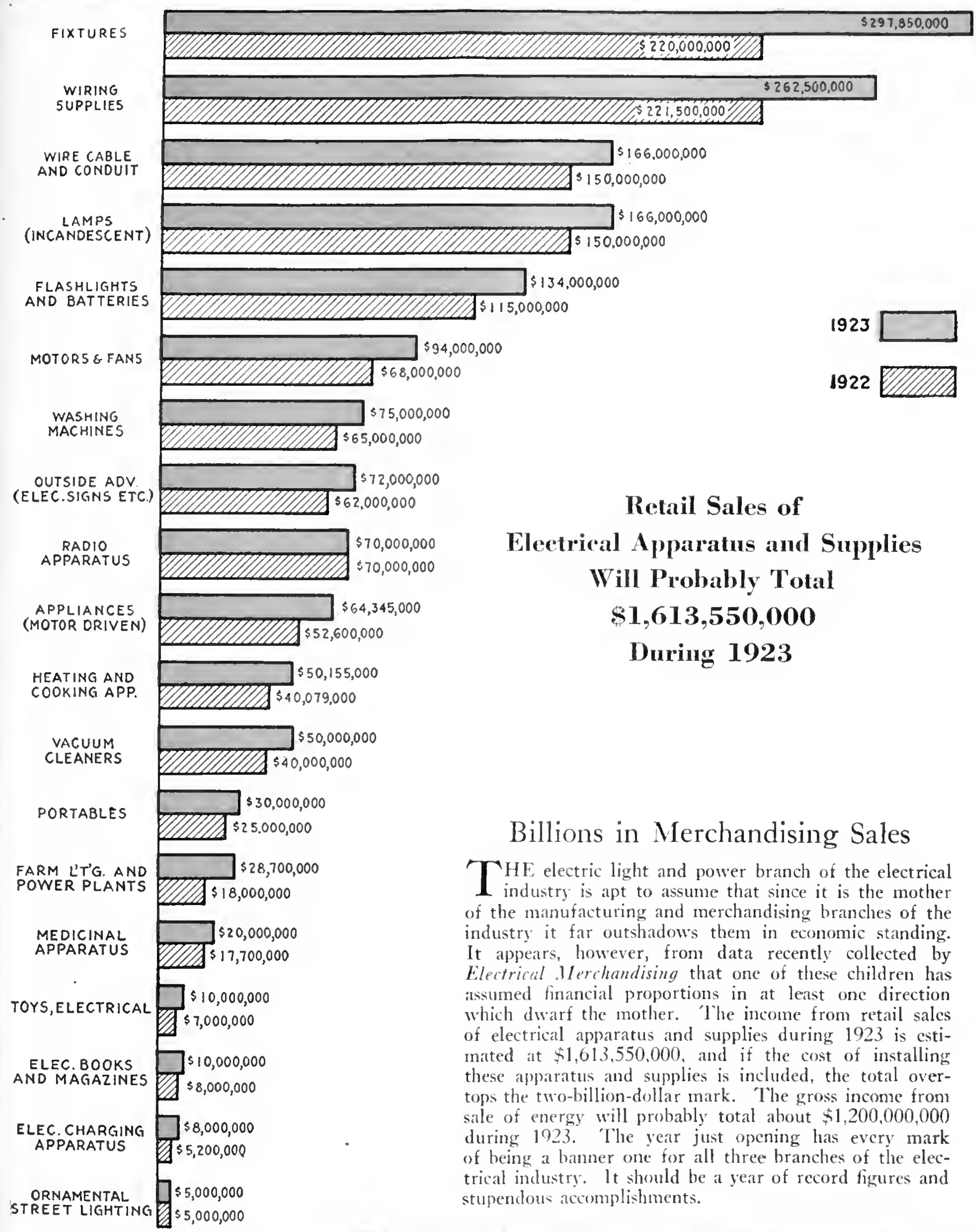
1,442,455. TRANSMISSION MEASURING CIRCUITS AND METHOD; D. F. Whiting, New York, N. Y. App. filed Oct. 22, 1919. Measurement of repeater gains in telephone circuits.

1,442,456. MOUNTING AND PROTECTING ELECTRICAL APPARATUS; D. F. Whiting, New York, N. Y. App. filed June 1, 1920. Mounting of telephone repeater equipment on panelboards.

1,442,460. CURRENT-CONTROLLING MEANS FOR ELECTRIC CIRCUITS; G. A. Anderegg, Oak Park, Ill. App. filed June 30, 1917. Reactor for transmission lines.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

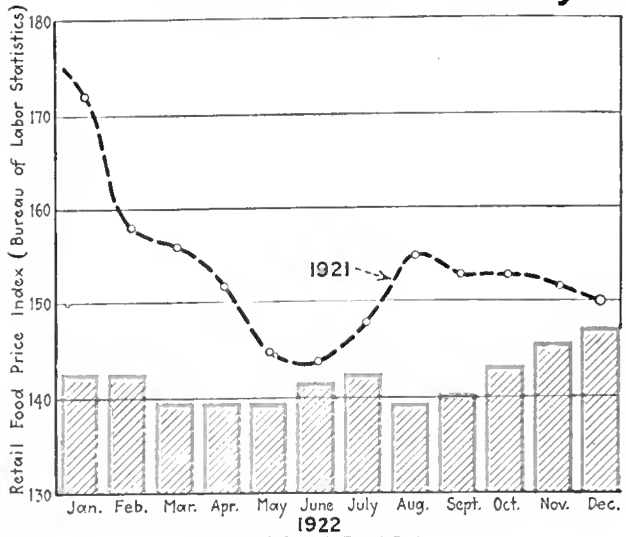



**Retail Sales of Electrical Apparatus and Supplies Will Probably Total $1,613,550,000 During 1923**

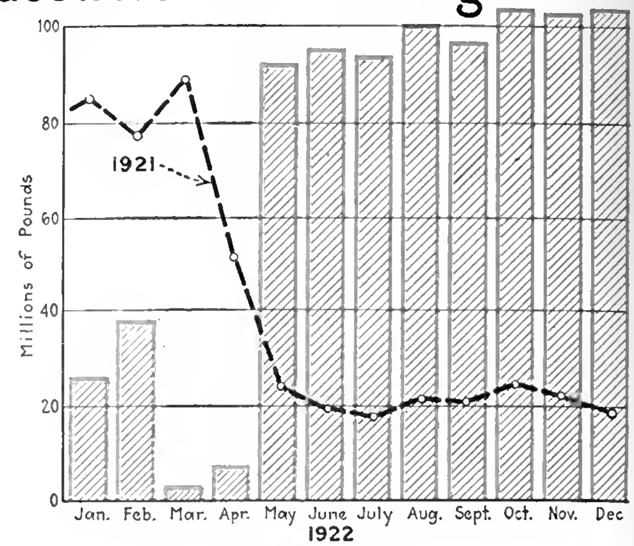
## Billions in Merchandising Sales

THE electric light and power branch of the electrical industry is apt to assume that since it is the mother of the manufacturing and merchandising branches of the industry it far outshadows them in economic standing. It appears, however, from data recently collected by *Electrical Merchandising* that one of these children has assumed financial proportions in at least one direction which dwarf the mother. The income from retail sales of electrical apparatus and supplies during 1923 is estimated at $1,613,550,000, and if the cost of installing these apparatus and supplies is included, the total overtops the two-billion-dollar mark. The gross income from sale of energy will probably total about $1,200,000,000 during 1923. The year just opening has every mark of being a banner one for all three branches of the electrical industry. It should be a year of record figures and stupendous accomplishments.

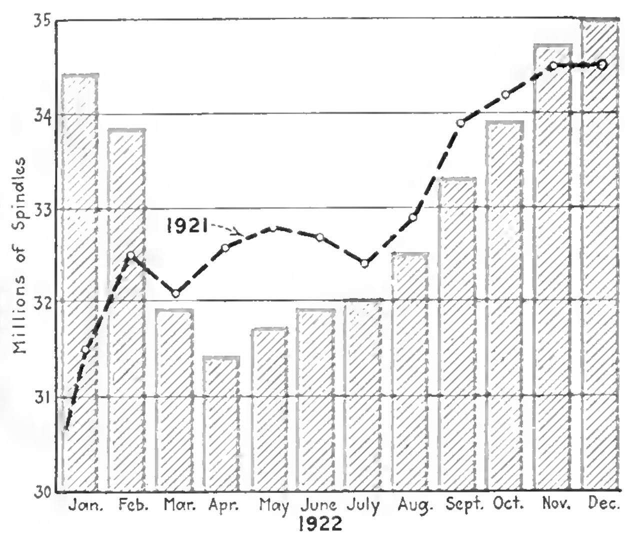
# How the Primary Industries are Trending



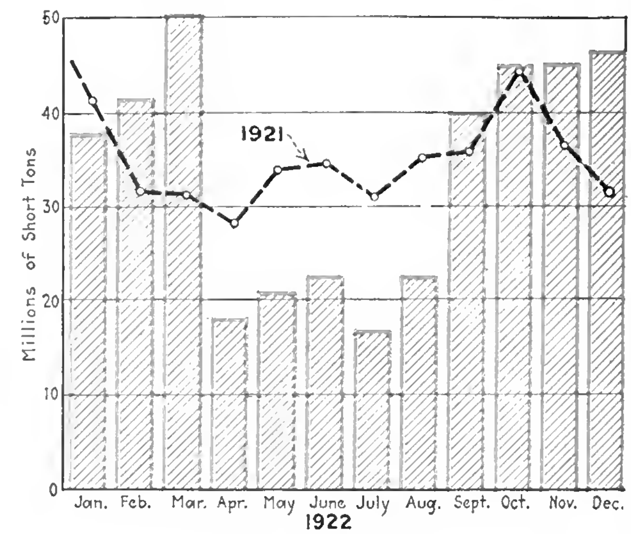

Index of Retail Food Prices



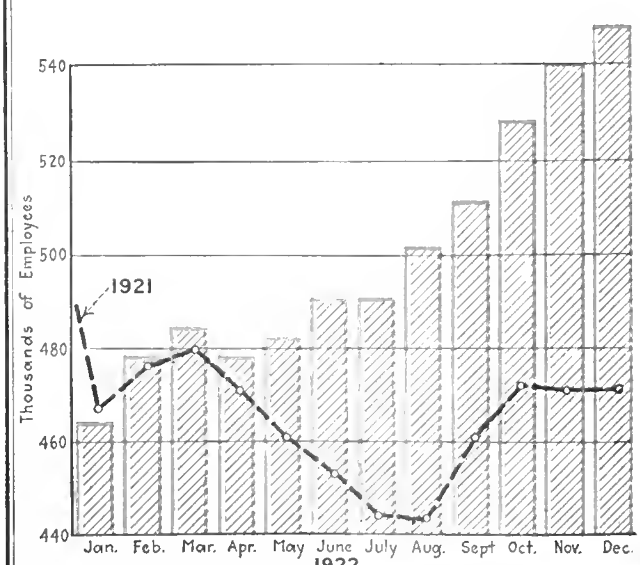

Copper Production




Activity of Spindles in Cotton Mills




Bituminous Coal Production




Employees in Factories of New York State

## The Coal Shortage Disappears

MOST gratifying are the data which have been issued by the Department of Commerce on the production of bituminous coal for the year 1922. These data indicate that, despite the five months' strike, bituminous-coal production was only 11,000,000 tons, or less than 3 per cent, below the tonnage mined during 1921. In December, notwithstanding the fact of the holiday season, the production was the greatest since March and was 50 per cent above the amount taken from the mines in December, 1921. Such favorable activities taken in conjunction with the recent agreement entered into by the operators and miners point to a year free from fuel shortage troubles, and it is to be hoped that this condition will be reflected in a material reduction in the price of coal to the consumer.

Copper production was maintained during December, being 458 per cent greater than the production reported for December, 1921.

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# Why Do We Work?

MEN say that businesses are organized and run for profit. They say that those who labor in them work for pay. But beyond all that — specifically, what is the goal? What has inspired these business enterprises? What are the inner purposes—the ultimate toward which the effort is directed?

In every case analysis will show that the real fruit of such corporate activity is not profit — indeed, the profits are but the wages paid to the capital and brains which must be hired to do the work. The true aim is service. For every organized business has inevitably as its obligation either the saving of labor, the development of economy or the contribution of comforts that will better the conditions of living and bring to mankind more time and opportunity for self-culture, self-expression and the enjoyment of the better things of life. Test where you will and it is so. Any enduring business will be found to have as its far objective some such essential benefit.

Trade, after all, is but the instrument working toward this end, and not the end itself. Management and finance are secondary. The vital purpose is to render service to mankind, and in this there need never be a question as to compensation for all such work well done. America is ever lavish in the rewards she pays for service to the common weal.

What are these services which benefit mankind?

Agriculture is one. Mining is another. The agencies of distribution also render vital service in that they carry to man the urgent necessities of life. Each in turn contributes something fundamental to the well being of the people. The engineer finds his opportunity in his ability to aid in working out the scientific solution of the many problems which beset the way of these great life-giving services. And in this in his turn he himself contributes a further service to mankind that has a value past all estimation.

# H. Birchard Taylor

*An engineering executive who holds a leading place in the manufacture and development of hydraulic turbines.*

TO HAVE been in responsible charge of the manufacture of hydraulic machinery aggregating nearly two million horsepower and at the same time to have been a pioneer in the engineering development of this type of prime mover is an achievement of a kind that few men reach. Only courage, foresight, tenacity and knowledge enabled H. Birchard Taylor to accomplish these results in a very few years after leaving college. Today as vice-president of the William Cramp & Sons Ship & Engine Building Company this young executive continues to make notable contributions to this phase of the electrical industry.

Among the first installations for which Mr. Taylor became responsible were the developments on the New River in Virginia by the Appalachian Power Company and the Keokuk development of the Mississippi River Power Company. The Appalachian development was notable for the distinct forward step which it represented in hydro-electric practice. This comprised the abandonment of the many forms of multi-runner, horizontal-shaft installations then in vogue in favor of the vertical-shaft, single-runner unit of great simplicity and high efficiency. Mr. Taylor was a pioneer in advocating this form of unit, which represents the accepted practice of today in all large installations. The form of setting adopted by Mr. Taylor in the Appalachian development has since been generally adopted for all low-head and medium-head installations, namely, the use of a spiral casing molded in the concrete of the power-house substructure, and in combination with it a so-called "speed ring," or ring of stay vanes, embedded in the concrete and capable of supporting the weight of the superimposed structure. The Appalachian turbines under careful test established a world's record for efficiency. The Keokuk development was probably the largest hydraulic installation which had ever been carried out as a single project, and the turbines were of unprecedented dimensions. Many other installations of first rank have followed, and a high-water mark is represented by the two 70,000-hp. turbines now under construction by the Cramps for the Niagara Falls Power Company.

Mr. Taylor relinquished the office of hydraulic engineer in 1917, having been made vice-president of the Cramp company in that year, but has maintained his active supervision over the hydraulic business of his company, and a number of important inventions have been produced by him during this period. He is president of the Pelton Water Wheel Company and also a director of the Dominion Engineering Works.

# Editorial Comment

Electrical World, February 10, 1923

Volume 81 Number 6

## The People Want to Know

THE people want to know more about the electrical industry—how big it is in their own town, how it has grown, what it is going to do for them some day. This fact brings an opportunity which every central-station man should eagerly appropriate unto himself. For there is so much to tell, and there is a degree of romance in the tale that makes it fascinating.

But we must remember that the story must be phrased in human terms that paint a human picture. It must not be expressed in technicalities and statistics, for the jargon of our craft means little to outside ears. The mere statement that a utility has spent three or four million dollars in a year means nothing to the average householder and his wife. But a story of what the money bought, and how it will be used, and why it was required, and how much it will benefit in service to the people of the community, does mean something. What the expenditure has effected in terms of visible growth and the number and the kinds of people who have loaned their savings to the company to help finance this community improvement—people are interested in that too. For if it is interpreted to everybody, a better, bigger power station will become as much a matter for local pride as a better, bigger library.

## "Experts May Be Found to Justify Any Valuation"

THE editors of this and other technical journals, as well as several engineers of prominence, have at times almost gone out of their way to point out the opportunity and obligation of engineers as a class to undertake to help solve national and international social and economic problems by the application of engineering thinking. Nor is it intended to modify or do else than still more strongly impress that exhortation. But when the editorial page of one of the country's leading daily newspapers states, as a matter of course, that "Experts may be obtained to justify any valuation," it is apparent that the public must gain in some way a greater respect for the engineer as an arbiter or adviser before the engineer is going to be intrusted with the solution of the larger problems mentioned. It is not enough to answer this by saying that "experts" differ because some of them are not orthodox or are urged to become partisan for one reason or another. On the other hand, it is, of course, not practicable, much less within the bounds of probability, for two fair-minded and capable engineers to arrive at an identical result in a valuation. But it is possible and practicable, and it should be the invariable rule, that two engineers shall approach and deal with a valuation in such a way that they arrive at results of the same order of magnitude. Reason should be given to the public for confidence that the engineer approaches his problems in such a way as to find the one answer based on fact or expert judgment, and not as a special pleader or advocate.

Engineers have, by training and in general by practice, the ability and the attitude to reach conclusions based on fact or at least on clear analysis. Modern society, both nationally and internationally, needs that sort of assistance or leadership today. It is the opportunity—in fact, the duty—of the engineer to prove that he can contribute materially to the solution of larger problems. But he must build a sound confidence in the public mind that he is fully able to handle his humbler problems of an economic-engineering-social nature before he will be intrusted with others.

Such statements as the editorial utterance alluded to above are a direct challenge to the engineering profession.

## The Search for International Standards

IN THE determination of international standards allowances must often be made for temperamental and national prejudices. Such standards can be arrived at only by voluntary agreement; and we do not all think alike or act alike. To some, standards are commercial, to others technical. It is hard to avoid these differences of viewpoint. Yet there is, as has repeatedly been shown, an opportunity for an agreement which is ultimately to the advantage of all.

At the recent international conference at Geneva it was apparent that the delegates talked from two distinct standpoints on the question of motor ratings. Most of the European nations had proceeded on the belief that motor ratings would follow the I. E. C. recommendation of two years ago, which was that motors should be definitely rated at that continuous load which would produce a temperature rise not to exceed 50 degrees C., and they were still inclined to support that recommendation. The American delegation was somewhat divided in its own ranks, consisting as it did largely of individual representatives holding more or less divergent opinions on the subject, there being, unfortunately, no agreement on the subject in this country before the delegation left. Primarily, our delegates went over as observers, not ready to act on any program. But, as at least one observer has remarked, as the discussion went forward the Americans were naturally drawn into it until finally our differences had a public airing. The British delegation, on the other hand, came with a very definite viewpoint, and with a program built around it, that this old I. E. C. rating had not proved a practical proposition, at least in the case of motors for general distribution and use. Theirs was fundamentally a commercial viewpoint, gained through what they said was instructive experience. The British delegation of thirteen was a unit on the proposition, and eventually a recommendation to the commission was passed based on

the British proposals. (For details see ELECTRICAL WORLD, Dec. 2, 1922, page 1230, and Dec. 23, page 1404.)

Fundamentally, the situation now is that the Geneva conference has recommended that another motor rating standard be authorized in addition to the present I. E. C. standard. According to this recommendation motor ratings will be authorized on the basis of 40 degrees C. rise for continuous operation, with a 25 per cent overload guarantee for two hours without exceeding the I. E. C. maximum temperature limitation (approximately 90 degrees C.), but with the provision that on the same nameplate the rating according to the old I. E. C. continuous (50-degree C.) rating should also be indicated. Fortunately the only apparatus affected by this complicated arrangement is a limited range of motors.

Thus, in the effort to advance international standards, a somewhat awkward and confusing set-up (at least from the standpoint of the general purchaser and user) has been made. It was, perhaps and under the circumstances, the best that could be done, and it has at least brought forcibly to light the fact that international "commercial-engineering" standards cannot be decided solely from a highly technical standpoint, as can absolute engineering or scientific standards such as volts, amperes and similar quantities.

## A Present Opportunity for American Leadership in Standards

THE situation as left by the Geneva conference and by subsequent events now presents an opportunity, which is almost a challenge, for America to establish leadership in the question of motor ratings. It should surely serve as a spur to us to reach an agreement in this country on this question. The British, now that they have won their first proposal, hardly know exactly what to do with it, in detail. The principle they fought for was admitted—that there should be recognized a more "generous" motor rating than a rating based on the maximum the motor would do. On this point it is understood the American delegates, as well as those of other nations, all finally agreed with the British. But the actual method of application of the principle is indefinite, or at least undefined to the satisfaction of every one, and it is here that American commercial practicability and engineering ingenuity should step in and assume leadership.

As pointed out last spring by the editors of the ELECTRICAL WORLD and by several others who contributed to the discussion in these columns, it is illogical and uneconomic to continue the present double standard—that is, the two standards (the so-called 40-degree–55-degree and the 50-degree) of rating motors. One single standard, whatever it may be, should be found. As apparently agreed upon at Geneva, the 50-degree standard alone does not seem practicable. The solution would appear to be some standard at a lower temperature, with or without overload guarantee or even mention. Fortunately American manufacturers are fast coming to see that such a solution will be wise. The editors of this paper cannot and do not assume to state what any such actual basis should be, but, considering the 40-degree action at Geneva and considering the simplicity and commercial practicability of a single rating, it appears that an agreement to rate motors "at that horsepower which they will carry continuously without exceeding a temperature rise of 40 degrees" above the surrounding atmosphere would be both sound and practicable. And it seems safe to predict that if American manufacturers and engineers shall agree on some such single standard rating (whether on the exact definition and temperature above stated, or not), they will find themselves better off in their domestic business and also in a most advantageous position to assume world leadership in a final international agreement on motor ratings.

## Cost of Living and Electric Utilities

IN THE *Monthly Labor Review* issued by the United States Department of Labor and in the cost of living data issued by the National Industrial Conference Board a great wrong is done to the electric light and power companies of the country. This wrong is not done openly or possibly knowingly, but inferentially, and it is the inference which newspaper headline writers are quick to grasp and play up to our detriment. Why the cost of electric light should be combined with the cost of fuel in the curve "fuel and light," particularly since its effect is almost nil, is somewhat difficult to understand. The injustice is instantly apparent in the statement of the Labor Department that "fuel and light have increased 83.8 per cent in cost from 1913 to September, 1922," whereas its own reports on retail prices of electricity used for household purposes in thirty-two cities of the United States show that the rates for electricity were actually less in September, 1922, than they were in December, 1914. Since 1913 also the improved tungsten lamp has come into wider use, so that light for light the cost is now considerably less.

The National Electric Light Association has very properly taken this matter up with the Labor Department at Washington, and it is to be hoped that the injustice will be quickly righted. Water is more essential to life than artificial light, yet no note is taken of water by the Labor Department, nor of telephone or street-railway service. These have a greater effect on the cost of living than has the cost of electric light.

## Important Advances in Street-Lighting Equipment

DREARY standardization of street-lighting equipment has been threatened of late, and therefore it is refreshing to find that a step forward is actually being taken, one in a direction already familiar, the automatic operation of substations combined with outdoor apparatus. The progress referred to has been achieved in Kansas City and is described in this issue by A. E. Bettis.

Time was not many years ago when the suggestion of placing even switches and transformers out of doors was regarded as a dangerous heresy, stamping the engineer who proposed it as a harebrained innovator who should promptly be suppressed lest he break in on the beautiful symmetry of catalog equipment. But the world moves, and as time has gone on more and more apparatus has gone out of doors, sometimes indeed more than under the local conditions might always be desirable. The radical departure in Kansas City lies in placing the constant-current transformers and their immediate equipment on the line poles at convenient outlying points for the supply of the street-lighting circuits. To feed and control these a single 4,000-volt, three-phase, four-wire circuit is run out of each of

seven general substations. The several phases are distributed as 2,300-volt feeders in three symmetrical territories around each substation. In the automatic street-lighting units the line feeder is connected as usual, but is controlled by a time clock which operates the master controller, energizes the circuit and puts the equipment into operation. The same time clock takes the street-lighting circuits off by opening the control circuit and thus checking the activities of that particular feeder. The ordinary constant-current transformer used in this way is rated at 20 kva., smaller units being employed in some of the outlying districts. Each of these 20-kva. installations is good for about forty 600-cp. lamps or a proportionately greater number of 400-cp. or smaller sizes. As there are more than six thousand lamps in all, of which more than half are of 600 cp., the thorough subdivision of the transformer system is self-evident.

This automatic service does two very important things. It eliminates a serious amount of equipment in the substations, necessarily well filled with apparatus for other purposes and, what is even more important, it gets rid of the long and troublesome dead runs of wire on the street-lighting circuits. Any one who is familiar with the complication of laying out street-lighting circuits which have to be operated from one or a few substations will realize the value of pole equipment for handling comparatively short circuits automatically. In this way one can get the maximum number of lamps per actual mile of circuit and avoid contingencies which might put out of action a large portion of the circuit at once.

The other outstanding feature of the Kansas City installation is the underground cable work. The city was not provided with the conduits adequate for the new system even if it had been desired to use them, and it was desired to get rid of overhead wires in so far as this was humanly possible in a growing installation. The difficulty was met by a special lead-covered cable laid over with a triple jute covering impregnated with insulating compound. The chief purpose of the jute covering is to check danger from electrolysis. The cables are paper-insulated, carrying a single No. 8 conductor, and the experience of a year with this cable, of which 750,000 feet are now under ground, has been entirely satisfactory. It is laid directly in earth in a narrow trench 12 inches or 14 inches deep, and at street intersections an additional protection is installed in the form of a 2-inch fiber contact. Special lamp posts are used only where there are no trolley poles handy. Where these are available a special bracket carries the lamp. This arrangement of cable for the underground supply of street lamps has proved to be reasonably cheap. The cost of trenching, placing and filling is running less than 10 cents a foot in clear ground, while the typical total installation cost is reckoned at about 23 cents per foot exclusive of street crossings. Very little trouble has been had with the underground system, and experience indicates that no serious difficulty is to be anticipated.

Of course, the critical period for any such installation is after some years of service, and future results will be watched with interest. Enough has been done, however, to show not only that a thoroughly practical system of automatic pole transformers for street-lighting service can be used but that supply by underground cables laid simply in the earth is here, as it has been proved in various places abroad, an entirely satisfactory means of getting the wires out of the way.

### A Plant Investment That Paid

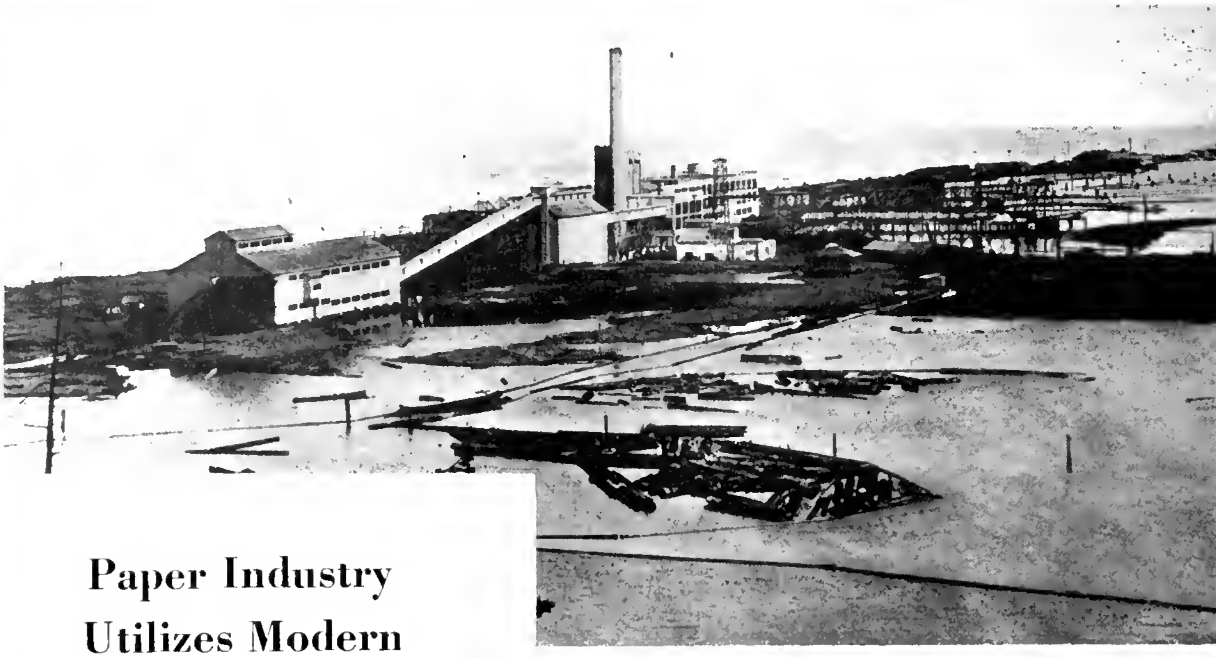
UNTHINKING criticism is sometimes launched at central-station companies on account of the large sums of money invested in plant construction, but when a plant situated within a hundred feet of an exploding gas tank goes through the experience without the injury of a single operating man or the loss of a single second of service over its outgoing lines little remains to be said in defense of substantial construction.

The manner in which the State Street station of the United Electric Light Company of Springfield, Mass., sustained the shock of an explosion in a gas-purifier tank on the opposite side of an intermediate railroad last week speaks volumes for the foresight of the engineers who designed the boiler plant and switch house and justifies the acceptance of their plans by the management of the company against a natural feeling that unnecessary quantities of reinforced concrete were put into these structures. Readers of the "News of the Industry" this week will join in congratulating the United company, its engineers and the Springfield public because the disaster to one great utility was not augmented by the interruption of the service of another, with all the interruption to local activities and the consequent loss and suffering which such a calamity would have entailed. Once more "safety first" has proved itself the most economical policy.

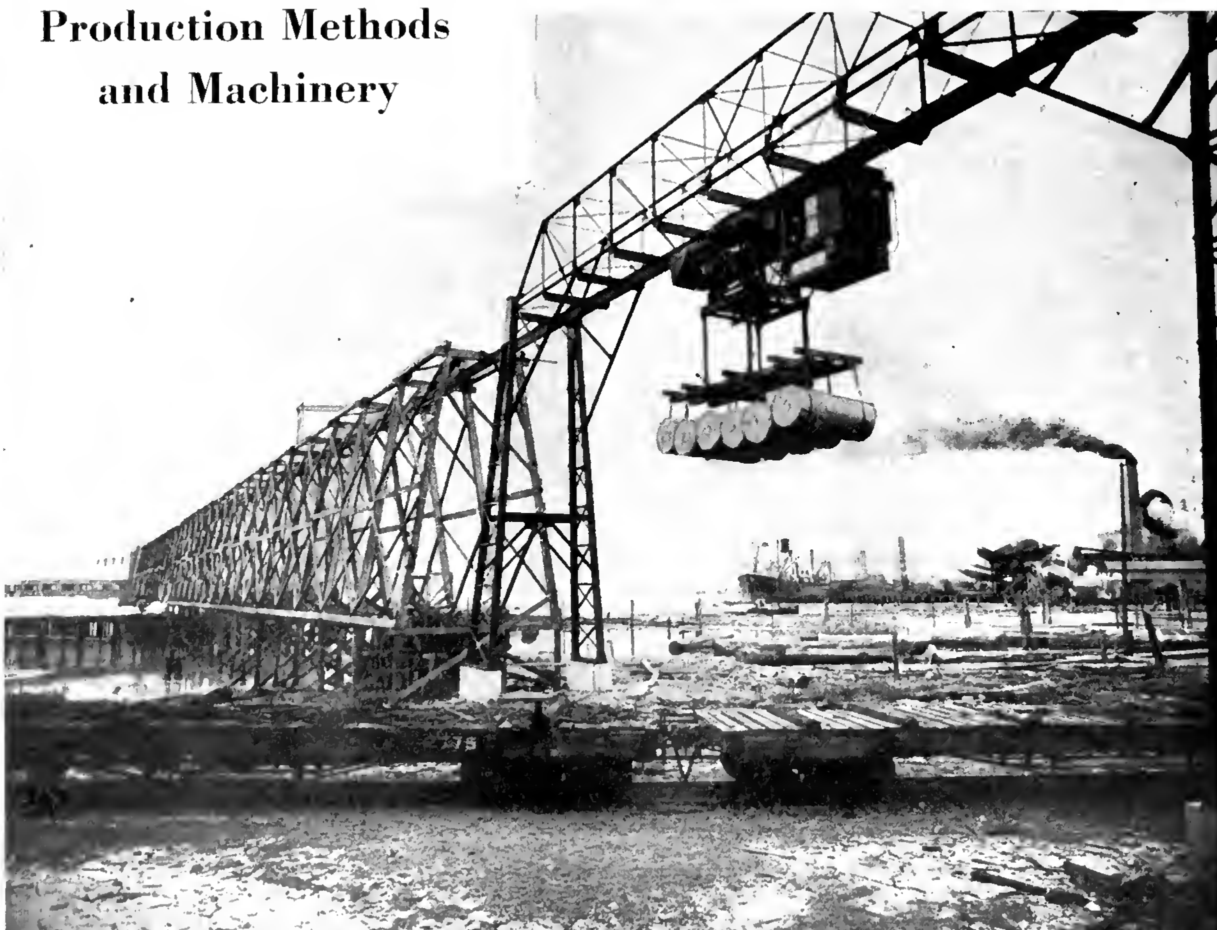
### Polyphase Circuit Measurements

THE proper method of making measurements on polyphase circuits has been the subject of considerable discussion within the last few years. With balanced circuits the methods are well known and commonly accepted, but this was not the case with unbalanced circuits. It was recognized that if the definition and methods of measurements were to have any assured standing they should cover unbalanced circuits. The present extensive use of the two-element wattmeter is incontrovertible evidence of the general recognition of the importance of unbalance in polyphase circuits; but the devices corresponding to the polyphase wattmeter were not developed for measuring power factor and reactive power on unbalanced circuits.

Recently a new system of measuring devices particularly applicable to unbalanced circuits has been proposed. These devices, which are described this week in an article by R. D. Evans, are relatively simply and employ standard types of instrument transformers and meter or relay elements, with an auxiliary network of resistors and reactors. Some of the advantages of the proposed system of measuring devices are discussed in the article by Mr. Evans and others in the paper on "Polyphase Power Measurements" to be presented by C. L. Fortescue at the midwinter convention of the American Institute of Electrical Engineers. The future of this new system cannot be predicted until the commercial instruments have been completely developed. It may be that measuring devices of this character will supplement and to an extent replace present systems. The principle, however, offers opportunity for immediate application to special polyphase motor installations in order to protect equipment from injury through single-phase operation.



# Paper Industry Utilizes Modern Production Methods and Machinery



The consumption of paper for all purposes requires immense mills and a great amount of power machinery. The accompanying views show the mill and log pond of the Washington Pulp & Paper Corporation at Port Angelus, Wash., on Puget Sound. A monorail system is used for carrying the finished paper rolls from the mill to the dock. In the mill itself are found sectionalized electric drives on the paper machines and numerous other applications of electrical equipment used to secure reliable and continuous production.

# New Practices in Street Lighting

## Pole-Type Transformers Used in Kansas City to Reduce Substation Equipment to a Minimum —Installation Conditions Required Underground Cable of Special Type—Features of Lamps—Standard Construction Used on Overhead Circuits

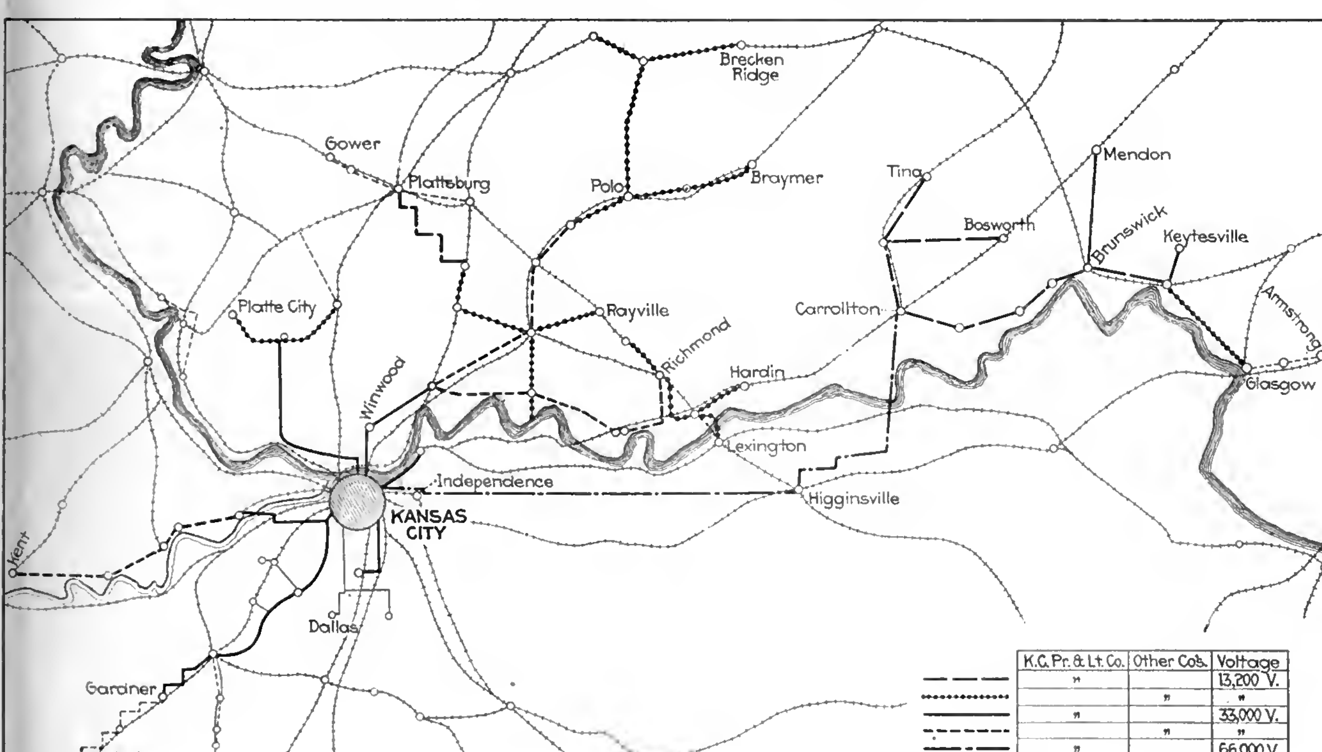
By A. E. BETTIS

*Superintendent of Distribution Kansas City Power & Light Company*

TWO radical departures have been made in the installation of a new street-lighting system in Kansas City, Mo. These are the removal of all street-lighting equipment from the substations, except one complete three-phase circuit switching equipment in each of seven substations, and the placing of a large part of the lamp circuits underground, a special cable buried in the earth without ducts save at street crossings being used. Ducts are used at street crossings to facilitate repairs in case of cable burnouts or other breakdowns. The removal of all of the usual series transformer and switching equipment from the substations means the saving of a great amount of valuable space and in some cases obviates the necessity of special substations for the street-lighting equipment. This in itself has meant a material saving in expense. The placing of the series circuits underground has enabled the use of a simple and attractive ornamental post on streets where there are no street-car lines. On the streets with street-car lines and steel trolley supports a simple type of ornamental bracket has been utilized for mounting on the trolley poles, the conductors being carried overhead. The plans which were followed made possible the removal from the streets of many of the unsightly wiring and lamp supports that overhead construction usually involves. These results have been attained because it was possible to start with a comparatively clean slate, much of the previous street lighting having been with gas.

Series-type constant-current transformers mounted on the line poles at points most convenient to the territory to be served are utilized throughout, thus removing all series equipment of any character from the substations. To control the series transformers one three-phase, 4,000-volt, four-wire, 60-cycle grounded-neutral circuit is run out of each of seven substations. The constant-current transformers are connected to these circuits in the same manner as the ordinary distribution transformers, care being taken to balance the phase loads. The usual oil-switch and relay equipment for a supply circuit is provided for the control panel of this circuit.

The A, B and C phases are distributed one in each of three territories around the substation serving a particular section. Each of the single-phase, 2,300-volt feeders is connected through knife disconnecting and oil switches to the station bus. The oil switches are single-element type, remote-controlled, with a separate inverse-time-element relay on each phase. In the automatic stations serving street-lighting circuits the street-lighting feeder is connected to the bus the same as in manually operated substations. The control, however,




LAYOUT OF TRANSMISSION CIRCUITS IN THE TERRITORY ADJACENT TO KANSAS CITY

is different. The circuits are put into and taken out of operation by a time clock which closes the control circuit and in turn operates the master controller, which then rotates to the position of the street-lighting feeder and energizes the control circuit closing the feeder oil switch. Relays are provided for tripping out the circuits in case of trouble. If any single-phase feeder is tripped out, a motor timer is put in operation. This two things. The first is the elimination of a mass of station equipment requiring valuable space, and the second is the elimination of dead runs of wire to reach lamps a long distance from a substation. The series transformers can be so placed as to obtain the shortest possible series circuit mileage, and the three-phase circuits pick up load at the point where they leave the substation.

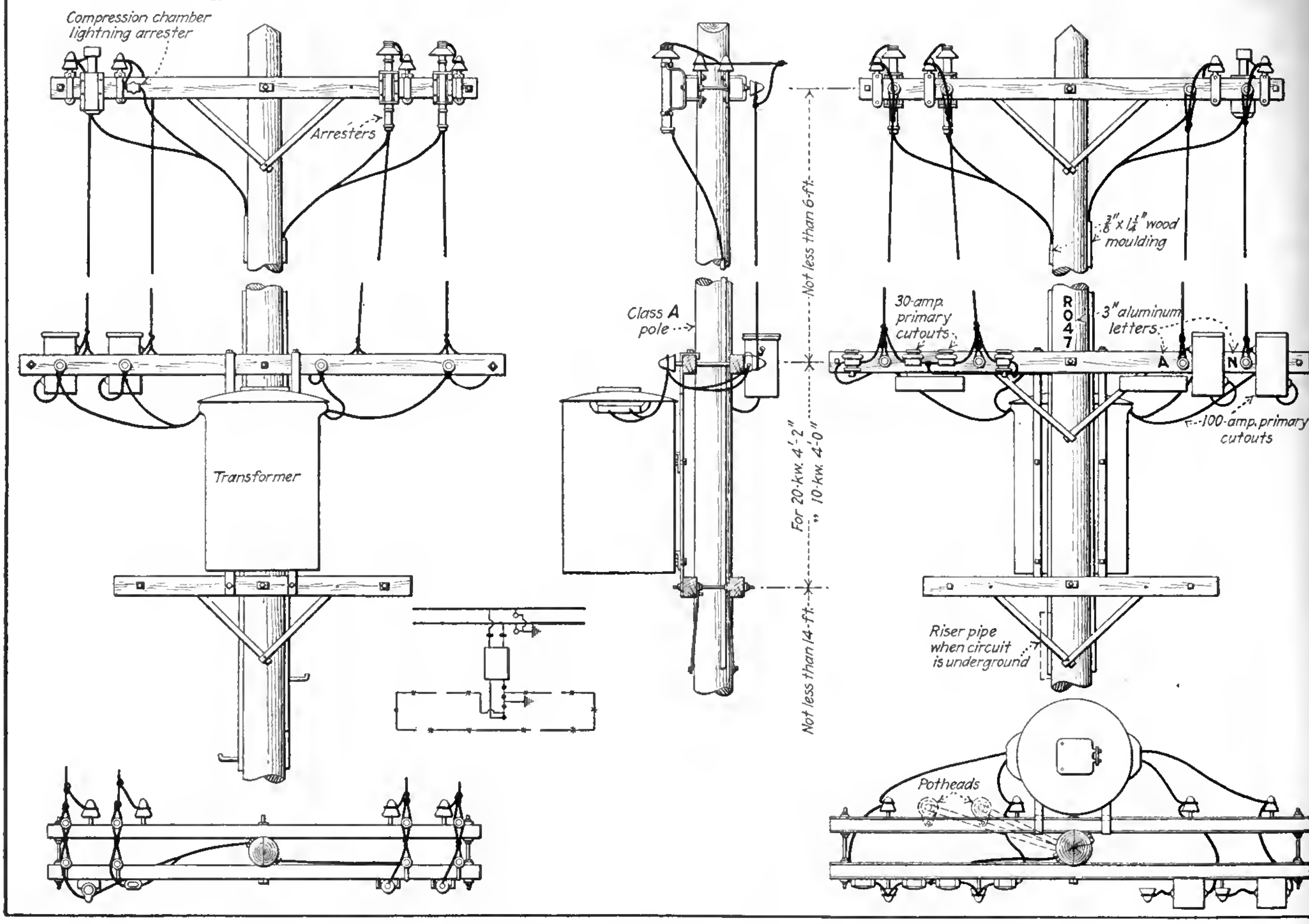
Lightning Arresters

Type and voltage of the lightning arrester depends on the capacity of the circuit. (Size of the R.O. transformer used)

| R.O. Transformer Size | Type of Arrester and G.E. Cat. No. | Operating Voltage of Arrester |
|---|---|---|
| 3 Kw. | Comp. Chamb. 178915 | 300 to 1,000 |
| 5 " | " " 79218 | 1,000 - 3,000 |
| 10 " | " " 79218 | 1,000 - 3,000 |
| 15 " | " " 1591185-G1 | 3,000 - 5,000 |
| 20 " | " " 1591185-G1 | 3,000 - 5,000 |

Fusing Transformers and Series Circuits

| Size of R.O. Kva. | Fuse Primary Boxes Amperes | Fuse Tungsten Circuit Plugs Amperes |
|---|---|---|
| 20 | 50 | 15 |
| 10 | 25 | |
| 5 | 15 | |
| 3 | 10 | |




STANDARD CONSTANT-CURRENT TRANSFORMER INSTALLATION AT KANSAS CITY

All substation equipment is eliminated except that required to control one 4,000-volt, four-wire, neutral-grounded, three-phase, 60-cycle circuit from each of seven substations. These installations are connected to the supply circuits in the same manner as ordinary customers' transformers, the supply circuits being switched at the proper time, either manually or automatically, depending on the type of substation from which they come. A standard size of 20 kva. has been adopted for use, the other sizes being used only under special conditions, such as in slow-growing outlying districts or small towns. In a few special situations where it is not practicable to run special supply circuits the installation is controlled by a time switch and connected to the regular service circuits. This type of series transformer installation eliminates a great deal of substation equipment.

motor timer will close the oil switch three times, hesitating approximately eight seconds, thirty seconds and one and one-half minutes before reclosing. This is accomplished by contact arms, rotating on a dial, which are spaced to give the desired time. Lock-out relays, one on each phase, open the control circuit for reclosing the oil switch and prevent any further operation on this feeder until the lock-out relays are set by hand. The street-lighting circuits are taken out of service by the time clock opening the control circuit and preventing any further operation of the feeder.

The foregoing arrangement obviously accomplishes

For city use constant-current transformers rated at 20 kva. are standard. Lower ratings, down to 3 kva., are used in small towns or outlying districts where development has not proceeded far. Where the smaller sizes are used there are a few cases in which the individual installations are controlled by a time switch on the pole as they are too far away or too scattered to justify the installation of a three-phase circuit for street lighting only. It is expected that these installations will be changed to the standard size and to substation control as the territory in which they are located develops.


BEFORE AND AFTER IMPROVING STREET LIGHTING ON HARRISON STREET SOUTH OF ARMOUR IN KANSAS CITY

Each transformer installation is protected by primary and series circuit fuses. Expulsion-type fuses are employed for the primary side, and the ordinary porcelain cut-out used on 2,300-volt service circuits is employed for the series circuit. In addition, two of the same type of cut-outs are placed on the circuits with the plug normally out, so that the circuit may be grounded on either side for test purposes. Compression-type arresters are used on each installation. Separate grounds through driven pipes are provided for lightning-arrester and test purposes. On the 20-kva. installations the normal number of 600-cp. lamps used is forty, while sixty to sixty-five 400-cp. lamps are used on the same size of transformer. The 600-cp. lamps are of the 20-amp. type. The 400-cp. are 15 amp. The 250-cp. lamps are 6.6 amp., no transformers between the lamps and the circuit being used for these.

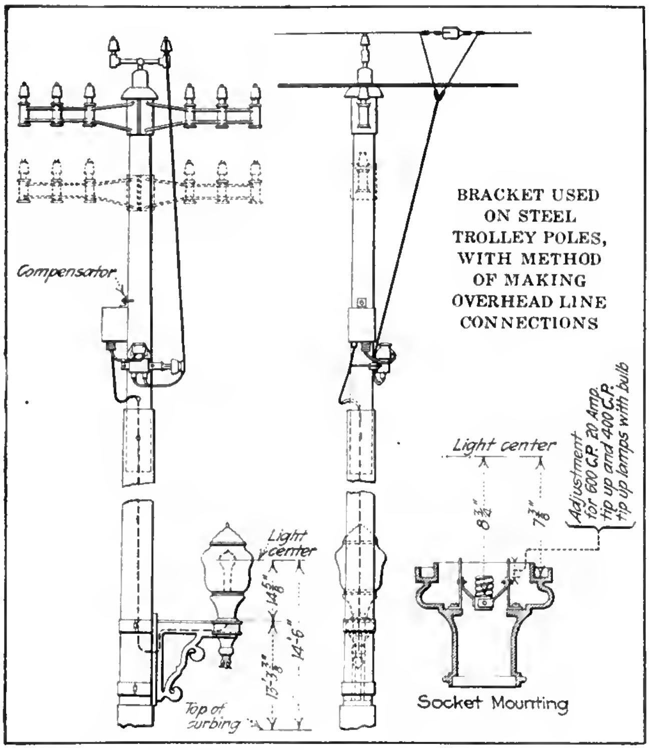
Each installation is provided with the markings necessary to identify it, so that record checking and inspection is easy. The standard marker board indicates the substation (*P* is the symbol); *S* indicates that it is a street-lighting circuit, and the number is the number of the circuit. On the primary side the circuit number and the indication that it is a street-lighting service circuit is given. The *RO* number is that of the transformer installation.

Several knotty questions were involved in the selection of cable for the underground work. Duct work except at points like street crossings under pavements, where to save expense of installation tunneling was resorted to, was out of the question on account of expense. Armored cable was the first thought, but it involved expense that in Kansas City experience hardly seemed justified. The theory of the armor is that it will prevent street laborers from damaging the cable. Experience has shown that a laborer digging into a cable not only tears off the armor but often takes a considerable portion of the cable with it or damages it so that it must be replaced. The cable finally adopted is easily cut through and damage is thus limited to short pieces. The danger of electrolysis prohibited the use of a plain lead-covered cable, even though this danger is materially lessened by the facts that the cables between lamps are thoroughly insulated from each other and that the total length of any run is very short.

STREET-INTERSECTION LIGHTS OF THIS TYPE ARE PLACED ON THE STREET-LIGHTING CIRCUITS

The cable finally selected is lead-covered and has in addition a triple jute covering heavily impregnated. This is expected to provide sufficient insulation to pre-

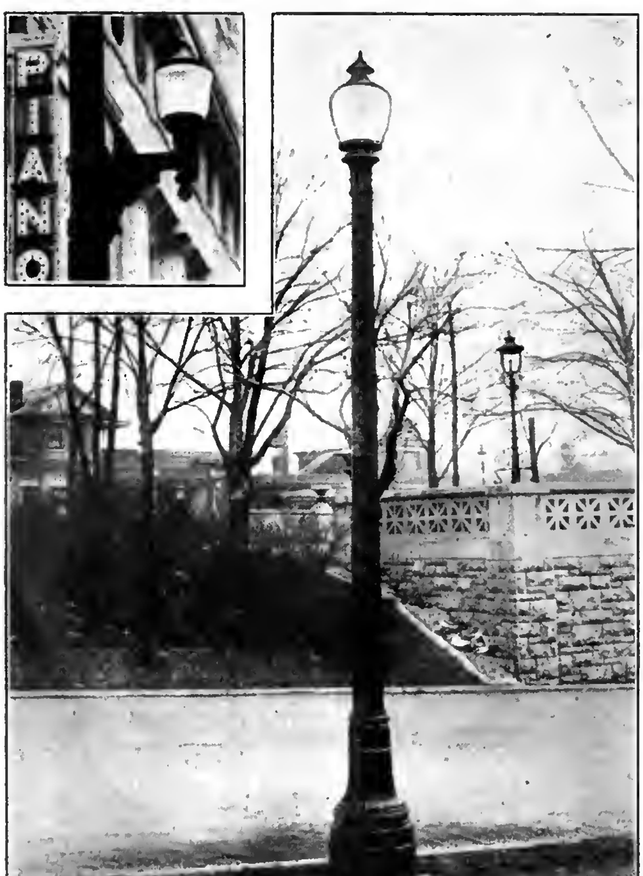

BEFORE AND AFTER ON ARMOUR STREET EAST OF BROADWAY



BRACKET USED ON STEEL TROLLEY POLES, WITH METHOD OF MAKING OVERHEAD LINE CONNECTIONS

vent damage from electrolysis to the short runs of cable used. The single No. 8 A. W. G. conductor is insulated with $\frac{3}{32}$ in. of saturated paper. An objection that will be raised is the immediate possibility of trouble on such a cable in case moisture enters it. It is felt, however, that this is an advantage rather than a drawback. With rubber-insulated cable it has been found that moisture entering the cable may not become apparent for some time, and by the time it is evident considerable sections of the cable may be damaged and have to be replaced. With the paper-insulated cable the entrance of moisture means an immediate blow-up which affects only a short length of cable. The defective section can be cut out, the cable dried out and a new section put in. The trouble is then over, which might not be the case with a rubber-insulated cable. Another criticism that has been made is that a single conductor inside a metal sheath is likely to give rise to serious inductive effects. Careful tests and the experience of a year have failed to show any. The cable, of which 750,000 ft. has so far been used, has withstood repeated tests at 15,000 volts.

The cable is buried directly in the earth. A narrow trench about 12 in. to 14 in. in depth is dug and the cable laid in. At street intersections where pavements are encountered trenching was first undertaken, but later tunneling and the installation of 2-in. fiber conduit was resorted to to reduce the expense. On high-class paving the cost of paving repair is a serious item.


TYPES OF STREET LIGHTING USED—THE LARGE VIEW SHOWS A STEEL TROLLEY POLE; IN THE INSET, AN ORNAMENTAL POST

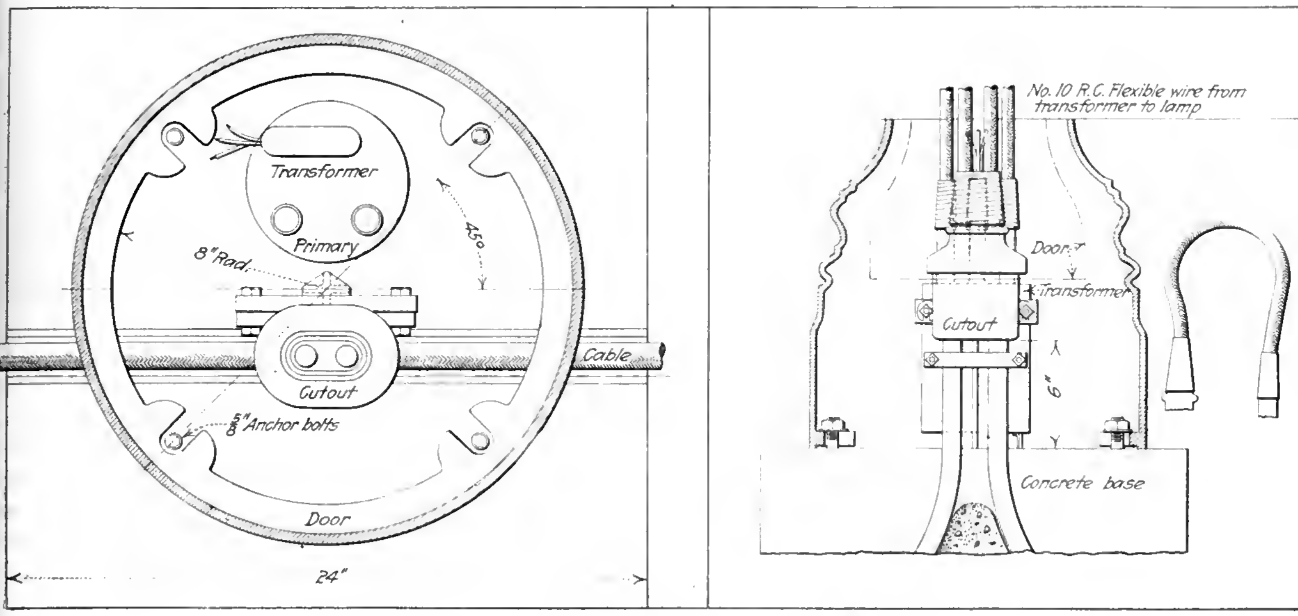
### Construction Employed for Lamp Supports

At present there are 6,206 lamps installed, of which 3,706 are rated at 600 cp. Twelve hundred and twenty-five of these are installed on ornamental posts and 2,311 on brackets mounted on trolley poles. There are still 3,781 250-cp. lamps to install on trolley-pole brackets, and it is expected that before long the total number of lamps on the system will reach 12,000. The cast-iron ornamental post used is shown in an accompanying illustration. A No. 107 "Novalux" unit with form T6 "Novalux" top is used with the 600-cp. lamps. No. 109 unit is used with an ornamental post. In the majority of cases the lamp posts used bring the center of the lamp 14½ ft. above the ground, though in one residence district a post with a distance of 11 ft. to the center of the lamp is employed. This is to meet a special condition and is not recommended as a regular practice.

In the base of each lamp standard is a cut-out bolted to a metal support anchored in the concrete. Alongside this support is a transformer with leads running directly to the cut-out. The cut-out is made up of a cast-iron jacket and a porcelain top carrying the contacts. The cables are sealed into the bottom of the cut-out with compound so that the cable sheaths are insulated from each other. The form of construction is such that in case of an accident which tears the post down there is little chance of an injury to the cable, since the top of the cut-out merely pulls out and the pole and transformer may be jerked free of the foundation without putting any strain on the cable. This has already happened in several instances without any disturbance to the cables. Moreover, in case work must be done on the installation a dummy top may be put on the cut-out and the pole and all other parts removed without affecting the rest of the installations in service. Any live parts are thoroughly protected.

Generally there is only one transformer installed in these post bases. However, to take care of lights placed in the street to give warning of street intersections arrangements are made for the installation of a second cut-out in the base of the nearest post, and the circuit for this lamp is carried underground to the center of the street. This makes these warning signs a part of the regular street-lighting system.

For trolley-pole installations a special bracket is used




CONCRETE FOUNDATION AND ARRANGEMENT OF TRANSFORMER AND CUT-OUT

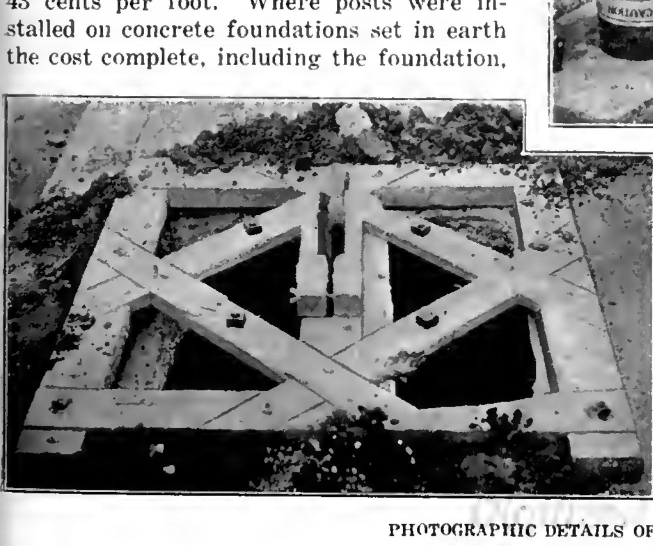
which involves no novel features. Care has been taken to get the best possible appearance. For these installations the conductors are run overhead on the trolley poles and the compensators and cut-outs are mounted on the poles above the bracket, the lamp conductors being taken from the compensators to the interior of the pole and thence to the bracket.

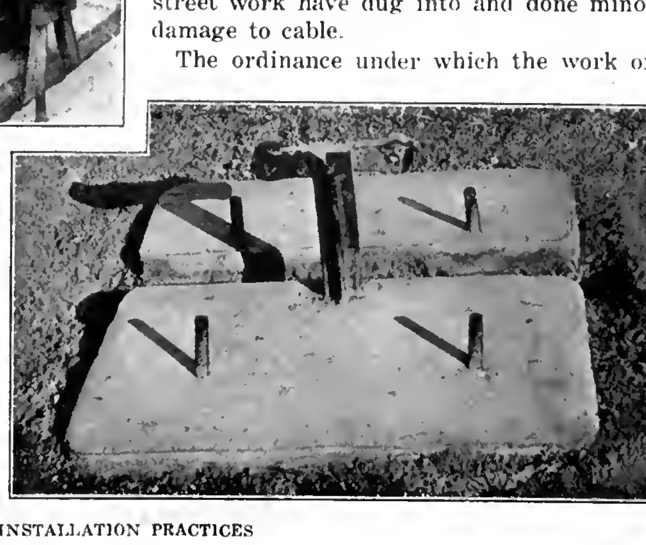
### Some Installation Costs

A variety of conditions had to be contended with so that no statement of average costs would have any meaning. A few costs under specific conditions may, none the less, be of interest. A number of the ornamental posts had to be installed in places where it was necessary to place the conductors in channels cut in concrete walks. In a typical case of this kind the cost of the post installed complete, including wiring, labor and all materials up to the cable, was $131. Anchor bolts were used in the sidewalks to hold the post in place. The installation of cable in the sidewalks, including the cable itself, channeling and the repair of sidewalks, cost approximately 43 cents per foot. Where posts were installed on concrete foundations set in earth the cost complete, including the foundation, ran about $130. The labor cost of installing the foundation and the cut-out in these cases was approximately $12, including excavation. In a typical instance of cable installation which covers a lot of about 12,000 ft. the cost was slightly over 9 cents. This was for the labor of trenching and the cost of placing the cable as well as for replacing sod and otherwise repairing the parking in which the cable was laid. A typical installation cost for cable installed complete is approximately 23 cents per foot. The street crossings where high-grade pavement was excavated cost approximately $2.26 per trench foot complete, including the 2-in. fiber conduit and cable used and the repairs to the pavement. In the outlying districts with the cheaper type of bitumen pavement this cost was approximately $1 per foot.

A large part of the present installation has been operating for nearly a year. In that time almost no trouble has occurred outside of accidents incident to traffic, as where posts are run into and knocked down. One case of trouble with a cut-out due to a loose connection has been recorded. In several instances laborers employed on other street work have dug into and done minor damage to cable.

The ordinance under which the work of



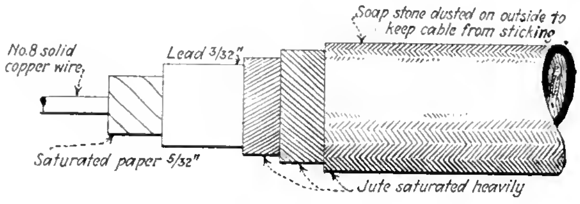


PHOTOGRAPHIC DETAILS OF INSTALLATION PRACTICES

installing the system was carried out was passed in May, 1921. It provides the following schedule of prices for the various types of lamps used:

For 600-cp. series street lamps, equipped with "Novalux" units, supported by posts at an elevation of 14 ft. 6 in. from the ground and supplied from underground circuits, necessitating channeling or excavation in sidewalks in order to install the necessary underground cable; price per lamp per annum, $78.

For 600-cp. series street lamps, equipped with "Novalux"




TYPE OF CABLE USED FOR UNDERGROUND STREET-LIGHTING CIRCUITS

The ordinary type of armored cable used for burial directly in the earth did not seem to offer enough protection against mechanical injury to justify the expense. This cable with a heavily impregnated jute covering outside the lead was used, and for protection against electrolysis troubles dependence is placed on this covering and the fact that the cable is broken at each post and the sections thoroughly insulated from one another.

units, supported by posts at an elevation of 14 ft. 6 in. from the ground and supplied from underground circuits, necessitating channeling or excavation in grass plats in order to install the necessary underground cable; price per lamp per annum, $67.

For 400-cp. series street lamps, equipped with "Novalux" units, supported by posts at an elevation of 14 ft. 6 in. from the ground and supplied from underground circuits, necessitating channeling or excavating in sidewalks in order to install the necessary underground cable; price per lamp per annum, $69.

For 400-cp. series street lamps equipped with "Novalux" units, supported by posts at an elevation of 14 ft. 6 in. from the ground and supplied from underground circuits, necessitating channeling or excavating in grass plats in order to install the necessary cable; price per lamp per annum, $58.

For 600-cp. series street lamps, equipped with "Novalux" units, supported by brackets on trolley poles and supplied from overhead circuits; price per lamp per annum, $57.50.

For 400-cp. series street lamps, equipped with "Novalux" units, supported by brackets on trolley poles and supplied from overhead circuits; price per lamp per annum, $48.

For 600-cp. series street lamps, suspended from mast arms attached to wooden poles and supplied from overhead circuits; price per lamps per annum, $55.

For 250-cp. series street lamps, suspended from mast arms attached to wooden poles and supplied from overhead circuits; price per lamp per annum, $34.

For 100-cp. multiple street lamps, supported by posts and supplied from underground circuits; price per lamp per annum, $24.

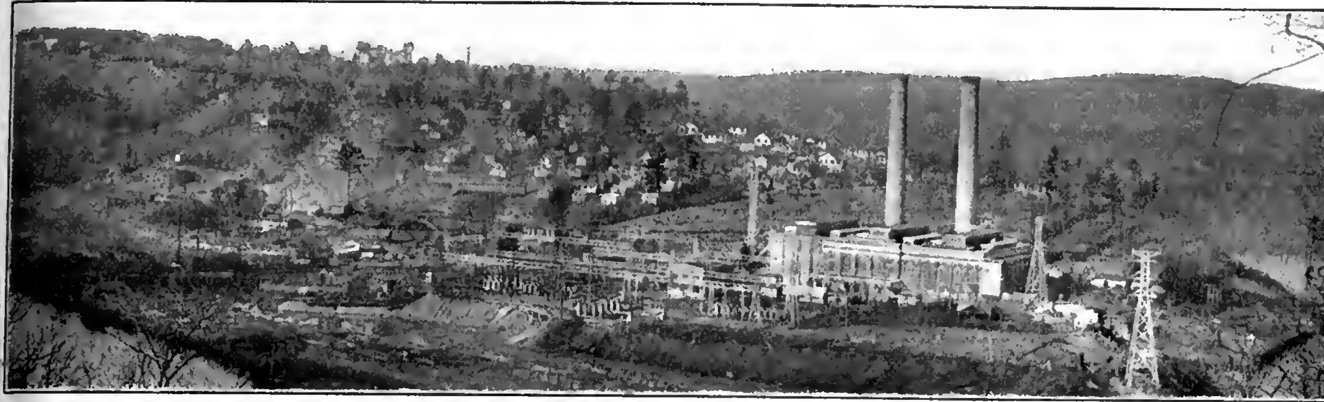
For 100-cp. street lamps used in "traffic standards," now installed or to be installed by the city at street intersections: In case the city shall furnish, install and maintain at its expense all "traffic standards" referred to in this class of street lighting the company shall extend its lines to supply such street lamps and will at its expense maintain the lines, supplying the light and the incandescent lamp; price per lamp per annum, $30.

In this contract the city has the option of purchasing at the end of ten years or any other five-year period thereafter the entire plant, property and equipment devoted exclusively to the furnishing of street-lighting service at the cost to the company less the accumulated depreciation at an annual rate of 3.5 per cent per annum at the time the option to purchase is exercised.

### City to Allow Depreciation

Accumulated depreciation shall be reduced to the extent of any reinvestments of depreciation reserve made by the company in its plant used for street-lighting service to the city. Deferred maintenance, if any, shall be considered at the time of purchase. The term "cost to the company" is specified as meaning the original construction cost of the plant and property devoted exclusively to street-lighting service, including a percentage to be agreed upon by the parties at the time of purchase to cover the cost of organization and legal expenses, engineering, interest, insurance, taxes and injuries and damages during construction. No allowance will be made in the purchase price for going value, franchise value, cost of promotion, bond discount, brokerage commissions, development losses or operating losses. The price to be paid for lamps is to be based on the cost of the posts and glassware used. Any price in excess of this will call for an adjustment of the rates. The city has the right to select the posts, brackets and glassware to be used.

TRENCHING FOR STREET-LIGHTING CABLE



GORGAS STEAM STATION OF THE ALABAMA POWER COMPANY

# Salvaging a War Contract

## How the Gorgas Steam Station, Erected by the Government on the Warrior River, Has Continued to Function and to Serve the Interconnected Network and Industries of the Southeast with Power

By R. D. COOMBS*
*Consulting Engineer, New York*

THE extension of the Gorgas steam plant on the Warrior River in Alabama was made by the War Department to assure an early and adequate supply of power for the construction and operation of the United States nitrate plant then being built at Sheffield, Ala.

When the government, as a war measure, decided to construct the air-nitrate plants at Sheffield, in order that a war necessity might be guaranteed, a very important factor to be worked out in conjunction therewith was the source of the supply of electric power for construction purposes and a guarantee that such power would be available very promptly. For the government to depend on any water power from Muscle Shoals was out of the question, as was also dependence on the completion of new steam-power facilities at Sheffield. It would have involved a delay of several years if the construction of the nitrate plant had awaited the building and completion of water-power plants at Muscle Shoals, and to have delayed the construction of the nitrate plants pending the building from the ground up of a complete steam plant at Sheffield would have involved delay for a period of more than one year.

The Alabama Power Company at this time was operating a large hydro-electric plant at Lock 12 on the Coosa River, Alabama, and this plant was connected by high-tension transmission lines to its steam plant at Gadsden, Ala., and to its much larger steam plant at Gorgas on the Warrior River, the latter plant being approximately 90 miles south of Sheffield. The Gorgas plant was an exceptionally efficient one as the power company owned and operated its own coal mines at the plant and was thus able to avoid the heavy freight charge which ordinarily constitutes a large proportion of the cost of coal for steam-power plants.

As the Alabama Power Company therefore owned and operated a large and dependable power producing and distributing system throughout Alabama, situated less than 100 miles from the proposed nitrate plants at Sheffield, it was a logical conclusion for the government to call upon the power company to supply quickly the power needed to permit of the rapid construction of the all-important nitrate plant.

### EXTENSION OF GORGAS STATION

When the Alabama Power Company built its Gorgas plant provision for future extension to a capacity approximately three times the capacity as first installed was made by expenditures for extra land, foundations, water intakes and discharge culverts. It was therefore possible to make a very important saving in time by utilizing the work already done.

The War Department decided that the best and quickest way to obtain both the power needed immediately and also a portion of the total subsequent power was to build a high-tension transmission line from the existent facilities of Gorgas to the proposed nitrate plant at Sheffield so that power would be available from the power company's system in the course of a few months, and also to install additional equipment in the spaces previously provided in the steam plant at Gorgas. As it was impossible for the power company to raise the necessary funds by financing in the ordinary manner, owing partly to the war emergency control of the government which prohibited the financing of projects of this nature, the government contracted with the power company, as its agent, to install the extensions at government expense, with the agreement that the power company should have the right to purchase at some future time at a fair value the improvements paid for by the government.

Ordinarily a 110,000-volt, 30,000-kw. transmission line, with provision for additional circuits and situated in rather rough country, would be built with long-span steel towers and would be intended as a permanent installation.

The known facts governing the Gorgas-Sheffield line

*Major Coombs was the officer in charge and agent of the contracting officer in the Alabama Power Company contract.

at the time of its design, in the winter of 1917-1918, compelled a different type of construction. It was of the utmost importance that construction power, then estimated as 2,000 kw., followed by furnace-test power of 10,000 kw., should be made available from some existing source within six months. The nearest and most available source of power was the Alabama Power Company system. In addition to the above preliminary blocks of power it was desired that approximately 30,000 kw. be supplied by an addition to the Gorgas steam station for use in the final operation of the nitrate plant and that this power be available in about nine months. Further, it was contemplated that in emergency an additional circuit might be required, the power therefor to be commandeered from the system of the power company. It should be noted that, rightly or wrongly, we considered power in terms of kilowatts bearing the stamp U. S. A. and available at any or all times, 100 per cent capacity, twenty-four hours a day, if needed.

A 110,000-VOLT LINE ADJACENT TO A 44,000-VOLT LINE ON THE SAME RIGHT-OF-WAY

In the circumstances the writer decided in favor of wooden poles, first because the steel market was facing a chaotic condition and no delay was permissible, and second because the life of the line was uncertain. The Muscle Shoals dam project had not then been authorized. It was also possible to construct a long span, H-frame one-circuit line and duplicate it if necessary without interruption to service.

### Details of Transmission Line

Right-of-way was comparatively inexpensive, and the right to trim outside the right-of-way was readily obtained. Therefore the structures were placed near the sides of the 100-ft. width of way, with a small side clearance, the center being reserved for a 44,000-volt existing circuit to Jasper and for the government telephone line. The route of the line lay through rough, scrub-timbered, undeveloped country with very poor roads and these not often parallel to the right-of-way. Cutting and clearing began in January, 1918, during what was said to have been one of the worst winters of local record. The line crews, scattered in from three to six camps along the route, suffered considerably from the cold and wet, the negroes being particularly susceptible to pneumonia.

In five months from the ordering of supplies and the start of right-of-way purchase and clearing, which were approximately simultaneous, the 90-mile transmission line was ready for service and considerable work had been done on the permanent substations. Although this progress is not offered as record-breaking, it represents a very intense effort and is entitled to high rank of performance in view of the conditions.

The wooden poles used were mostly creosoted Southern pine, with some Western cedar in the northern end of the line. Cross-arms were creosoted long-leaf yellow pine, 6 in. x 8 in. x 29 ft., with a grounding wire connected to each insulator eyebolt. In view of the angle braces used with these arms it might appear that the arms were unduly large, but experience with this line indicated that they were not too large since there were some indications of bending in the arms. It seems probable that suspension braces instead of compression braces might eliminate this tendency.

It may be noted that the horizontal separation of conductors on tangent suspension frames is 14 ft., which is less than will be required by certain recent specifications, and that thus far no failures have resulted.

The power-house construction presented no unusual difficulties, as it was essentially an extension of an existing station by the addition of a boiler house, a 30,000-kw. turbine and accessories, though it is perhaps unusual in the East to have to convey all materials and equipment by river barge 18 miles from the rail head.

### Gorgas Substation

The Gorgas substation was designed to make the Gorgas-Sheffield line an integral part of the power system so that in any apparent combination of conditions it would be possible to obtain power from the government unit, the Alabama Power Company unit or the system or connections of the power company.

The substation design followed the usual lines of a high-voltage latticed-steel structure with concrete foundations. An incident occurred in connection with this substation indicating the rapid action of corrosive agencies. In the incidental filling in of low ground adjoining the river with hot ashes from the boiler house the ashes were dumped close to the guard fence and to one of the supporting columns of the substation. Either rain or fog from the river, acting in conjunction with the fumes from the ashes, started a very noticeable corrosion first of the galvanized-wire fence and then of the painted column.

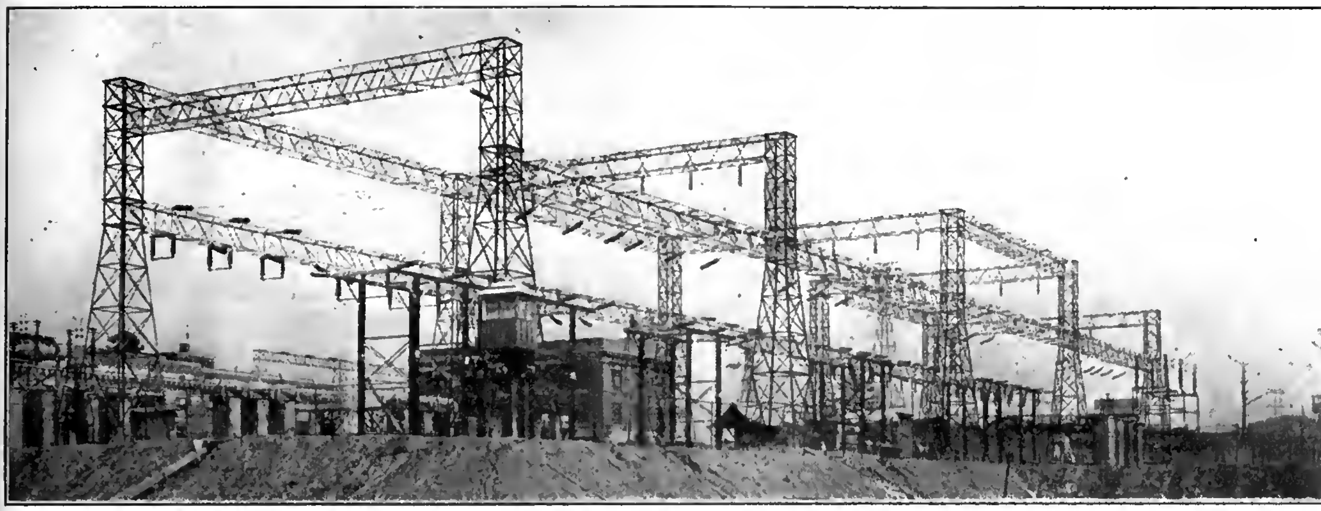
### Contract with Ordnance Department

Under the contract the Alabama Power Company, as an agent of the United States, was in about the position of an engineering-contracting concern doing work under the supervision of an owner. However, the position of the agent was different from that of the peacetime contractor, since all purchases were made after the specific approval of the Ordnance Department, and the Ordnance Department inspected and paid for them. On the other hand, the agent was in fact adding to an

operating station of its own and expected ultimately to purchase the government's construction. Further, the contract contained a limit to the fee to be paid the power company for service, etc. Under the circumstances it is hard to discover a reason why either the power company or the Ordnance Department should have had any tendency to follow a course other than the one pursued—to build a workmanlike job as fast as possible.

After the haze of accusation and counter-accusation arising from the supply contracts of the war, it is interesting to be able to discern at least one type of such contracts which now appears to have had a relatively high salvage value from the standpoint of the public interest. Further, it would appear that the ultimate benefit will be greater than was to be foreseen at the beginning of the contracts in question.

Starting from the premise, which was partly the understanding if not indeed the law of the appropriations, that the war supply expenditures were temporary expenses rather than permanent governmental underwritings, it yet appears that the public utility type of construction contract was in fact a permanent improvement in the public interest. On the other hand, it migh' be said—indeed, it was said—that there was no sure peacetime need of such additions and that there would be no market for the power until a long time after the war.



OUTDOOR SUBSTATION OF ALABAMA POWER COMPANY

### Peace-Time Utilization of Station

In a certain section before the war there was no interconnection or transfer of power. Compare that situation with the power and textile companies of Georgia and the Carolinas joining in a petition to the government to lease the Muscle Shoals power plant to the Alabama Power Company so that company could transfer power to their communities. During the war the impetus to interconnection was greatly strengthened, and the Alabama power and Georgia power companies were afterward connected through a 50-mile transmission line. Next the Alabama Power Company found it necessary and desirable to rent the use of the government power station at Gorgas, which was an extension of its own station at that point, and then to rent the government station at Muscle Shoals. Along came the coal strike, and Alabama, a coal state, needed electric power to replace the coal which was not being mined. On top of the coal strike came the driest year, in a hydro-electric sense, that region had ever known and a pressing need for public utility service and the power to transfer service. As a result the industries of the Southeast clear up to North Carolina were depending to a very considerable extent upon the usefulness in public utility service of the War Department's contracts.

The Gorgas project has already made a return to the government and to the public and stands out above the ordinary war-time contract in the value of this return and also in the relative salvage value of the plant. Operated as it has been, in co-ordination with the large power-producing facilities of the Southeast, it has been a means of accelerating the growth of industry, and, particularly in the past two years of low water flow in the rivers, the operation of this plant and the distribution of the energy to the states of the Southeast, has permitted the operation of numbers of cotton mills which otherwise would have closed down and thrown their employees out of work.

It is the writer's understanding that the Alabama Power Company has made an offer to the government to purchase for cash the portion of the Gorgas plant now the property of the government and has agreed to pay a sum which is equal to or greater than the present construction cost of these facilities. An income to the government in the form of rental for the use of its Gorgas project, the great benefit to industry throughout the South, which otherwise would have been compelled to curtail operations, and the salvage value of the plant as measured by the offer of the power company under the contract to buy it for cash, are among the benefits which have accrued to the government and to the public.

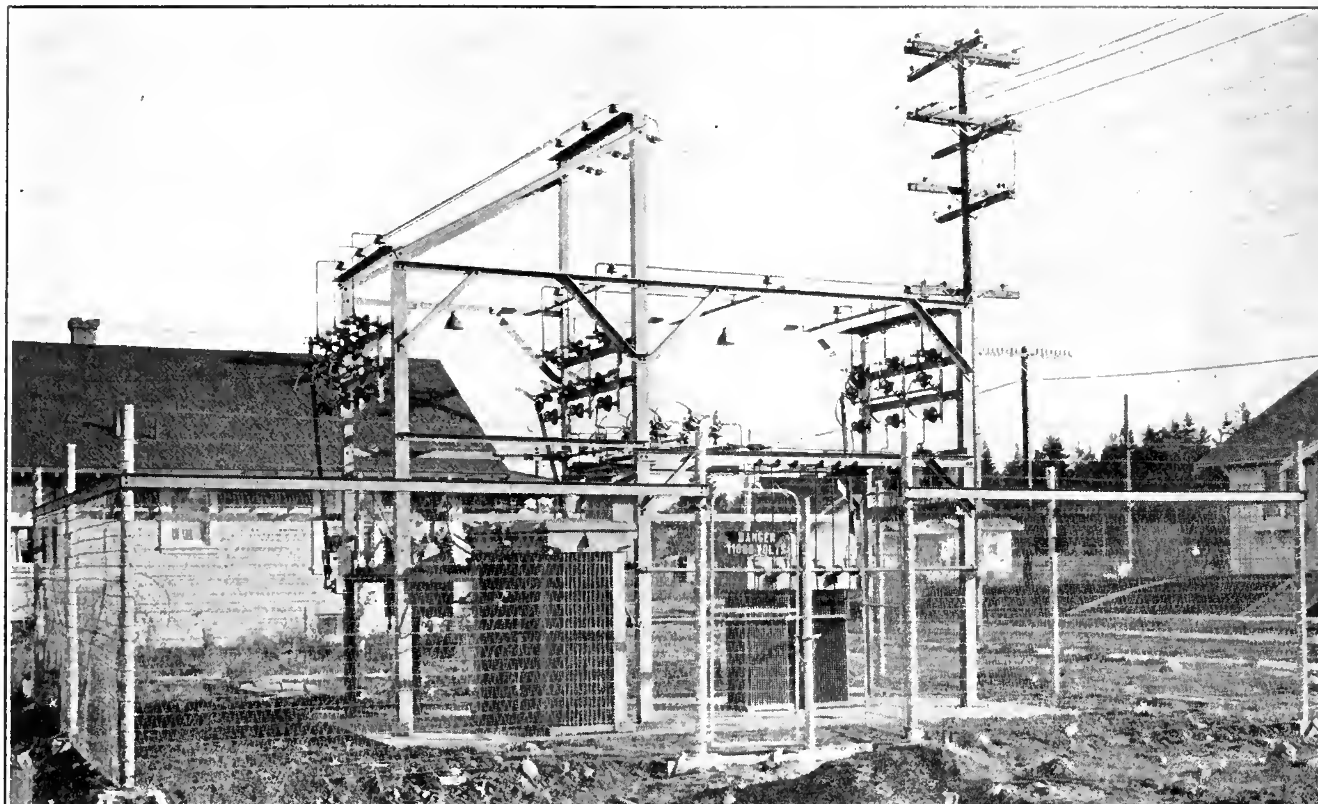
At the site of the nitrate plant at Sheffield, and entirely independent of the Gorgas plant, the government built a steam plant of approximately twice the size of the Gorgas plant. This plant was never used and would have been idle now had not the power companies leased it from the government and distributed its power over their systems.

The wide distribution of power from these plants to industries throughout the Southeast is to the writer a most convincing argument that the power to be created at Muscle Shoals dam should be made available for distribution to industries in the whole Southeast rather than be kept for local use in the vicinity of Sheffield.

# Outdoor Substation for 2,400 Volts

## Including Real Estate, the Type of Outdoor Substation for City Distribution Adopted in Portland, Ore., Cost About $8,500 Each—Construction Features Shown and Design Details

By E. D. SEARING
*Construction Engineer Portland (Ore.) Railway, Light & Power Company*




OUTDOOR SUBSTATIONS OF THIS TYPE ARE USED IN RESIDENTIAL DISTRICTS OF PORTLAND, ORE., TO SUPPLY 2,400-VOLT DISTRIBUTION

MANY changes in the distribution systems of power companies to relieve the overloaded conditions of lighting and power feeders have become necessary as a result of the increase in load due to the building activity and the general business revival throughout the country. Some companies are going to 4,000-volt, four-wire, star-connected systems, while others are changing over single-phase, 2,400-volt feeders to three-phase, or increasing the size of copper in existing three-phase circuits.

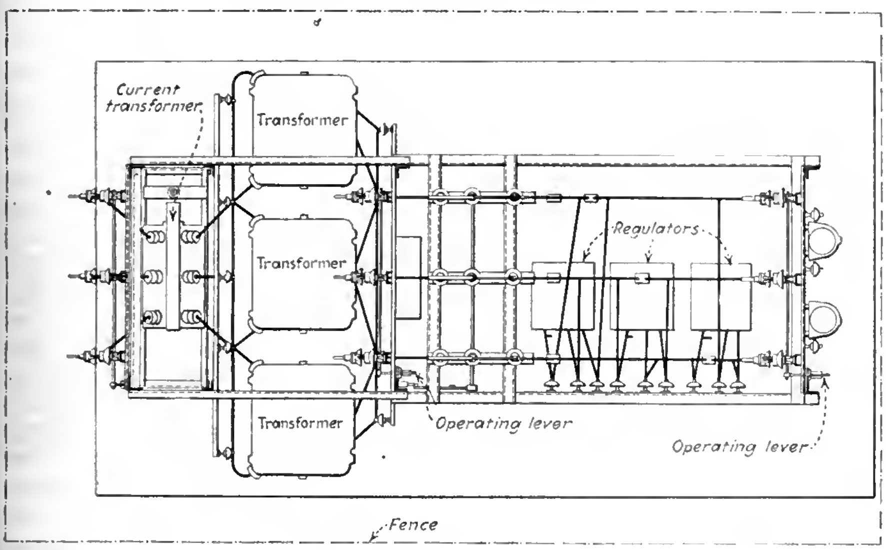
The practice of the Portland (Ore.) Railway, Light & Power Company in the past has been to supply all 2,400-volt city distribution circuits from substations having one or more personal attendants. The installation of feeders from such substations usually consisted of two wires forming a single-phase circuit. As the load grew a third wire would be run, making the circuit three-phase, thereby insuring a greater capacity and more efficient utilization of the copper. Following the period of winter load in 1920-1921, it became apparent that some means of supplementing the existing distribution circuits was necessary. The greater use of electricity per customer and a large increase in the number of customers established the fact that either more feeders would have to be run from existing stations or that other provisions must be made to handle the growing load. The existing substations, besides being located considerable distances from the centers of load, were in most cases found already congested with equipment and outgoing feeder circuits.

From an economic study it was seen that outdoor substations located near the center of load were preferable, and as a result this solution of the problem was adopted. Consideration from the standpoint of reliability of service and accessibility for inspection and repair led to the adoption of a ground location for the equipment in preference to the pole-type structure sometimes employed. A study of the districts being served was made and new centers of load located. A canvass of vacant lots in the vicinity of these distribution points was made, and suitable property on which to locate the outdoor substations was purchased.

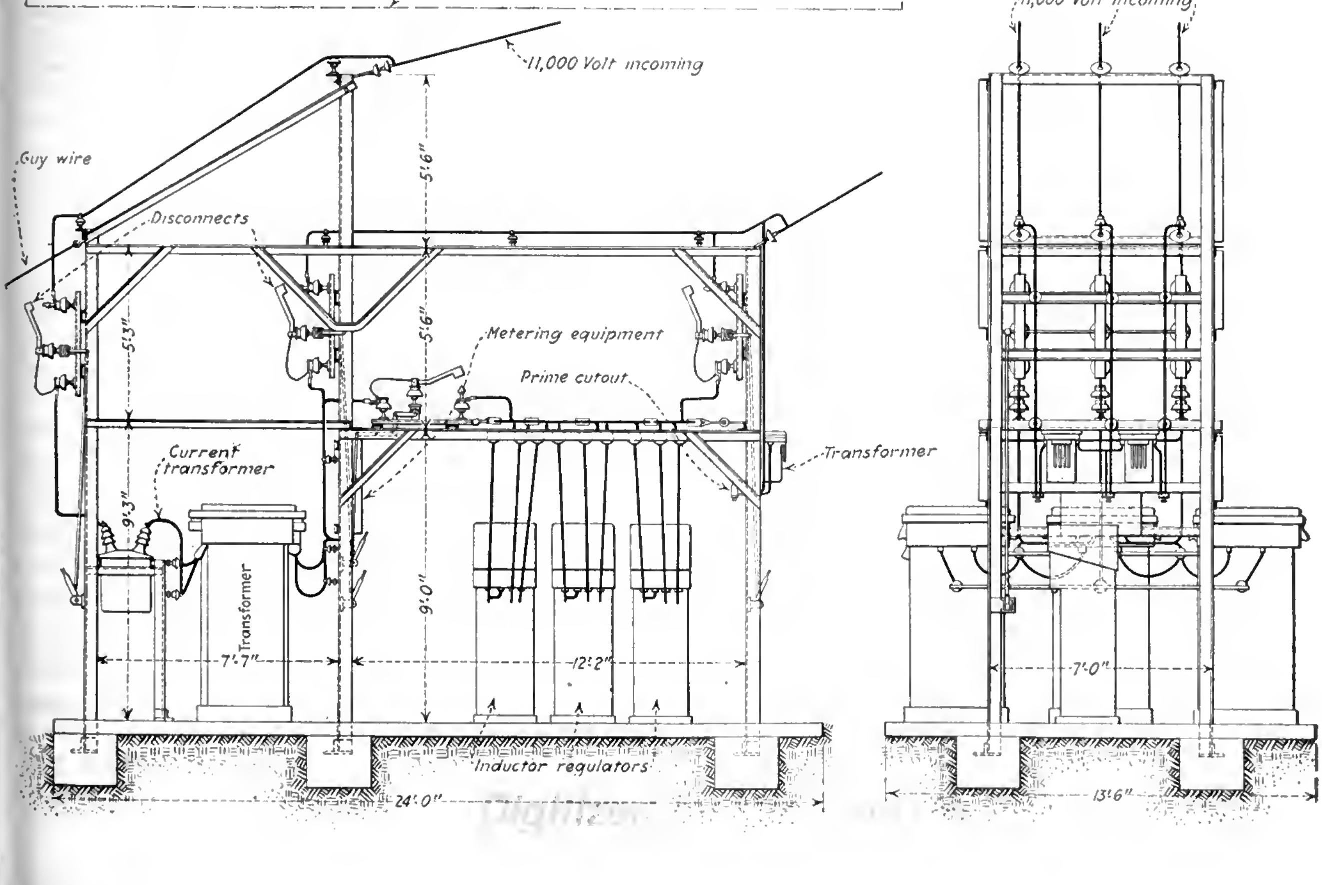
The type of substation decided upon called for step-down from 11,000 volts to 2,400 volts. Connection to each substation was made from existing 11,000-volt tie lines between substations having attendants, and

new lines were run where no 11,000-volt lines already existed. The company's low-tension transmission system consists of 11,000-volt tie lines between various substations having attendants. Usually each substation is fed from two or more adjacent substations by 11,000-volt tie lines and occasionally from the 57,000-volt transmission lines as well. It will thus be seen that the system of 11,000-volt lines is somewhat analogous to a spider-web network. This arrangement insures that each substation is normally fed from at least two sources. The 11,000-volt tie lines which feed the outdoor substations have pole-top sectionalizing disconnecting switches on either side of the connection to the substation, thereby making it possible to feed the outdoor station in case of line trouble from the substation on either end of the tie line.

The outdoor substations are each designed to contain three 200-kva., 11,000/2,400-volt, single-phase transformers, three 150-amp., 10 per cent buck-or-boost induction regulators and one 11,000-volt automatic oil circuit breaker. Control and auxiliary equipment consist of disconnecting switches between the oil circuit breaker and the line and between the 2,400-volt bus and feeder, also for shunting out the induction feeder regulators. Two 1½-kva., 2,400/120-240-volt transformers are provided for furnishing power to the regulator motors, lighting, and potential for a recording demand watt-hour meter. The meter, together with current transformers, is installed in a weatherproof metal box mounted on the structure. The initial installation generally includes only two transformers and two regulators, the third transformer and regulator being added as the growth of load necessitates. The transformers and regulators are mounted on a concrete slab on the ground, a structural-steel framework being erected to support the disconnecting switches, oil



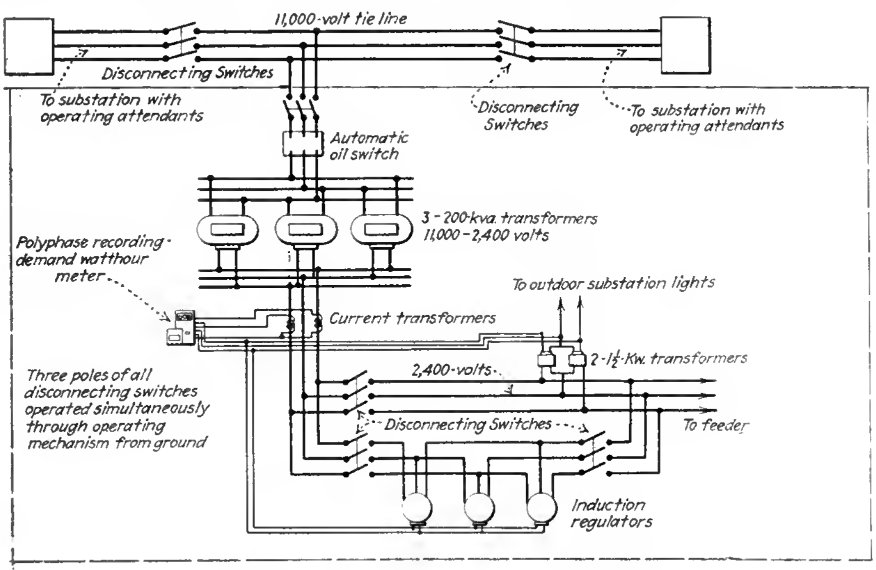

POLE TOP DISCONNECTS MAKE IT POSSIBLE TO FEED THE STATION FROM EITHER TIE LINE



circuit breaker and buses for the incoming and outgoing circuits.

The equipment is inclosed by a close-mesh, non-climbable type of woven wire fence surrounded with three barbed wires, the fence being supported on pipe supports set in concrete. Entrance to the inclosure is provided by a double swinging steel gate with a good padlock to insure protection.

The accompanying illustration shows one of the typical outdoor substations. There are five of these substations in operation at the present time, and plans are now under way for the construction of four more during the early part of 1923. The equipment and its arrangement in all substations are identical. A telephone mounted in a weatherproof metal box is installed within the fenced inclosure for use in case of substation trouble or in line patrolling. This telephone is connected with the company's railway and load-dispatching telephone systems. A number of lamps are provided on




WIRING FOR OUTDOOR SUBSTATIONS, TRANSFORMERS AND TIE LINES

a circuit controlled by a switch for use at night should occasion require. The disconnecting switches are all arranged for simultaneous three-pole operation by handles placed on the structural framework and accessible from the ground. The output from each of the substations is ascertained from a recording demand watthour meter which is read each day. The hourly distribution of the load is found from the demand records of the same meter.

Consideration is being given to the addition of suitable automatic reclosing equipment to the oil circuit breaker as insurance against extensive service interruptions due to feeder trouble. In case of trouble the reclosing equipment would be designed to close the oil circuit breaker periodically a sufficient number of times either to allow the trouble to clear itself or to establish the fact that the trouble is serious, in which case the switch will automatically lock open and the trouble will require the attention of troublemen to clear it.

So far these substations have fully served their purpose, and there is every reason to recommend their general adoption under similar conditions. The average cost of each of the installations complete, including real estate, was about $8,500; this is very reasonable in comparison with the indoor type of substation.

## Why to Use the Radio Telephone

By H. L. WILLS
Georgia Railway & Power Company

THE development and operation of large electric power generating stations and widespread distributing systems would have been delayed and hampered had there been no means for keeping in close and almost instant communication with the activities of those engaged in the construction and operation of the more or less distant units.

During the time when electric service systems were distributed over relatively small areas and power stations were within easy reach of the local telephone lines, a ready means for inter-system communication was obtained through the service of the telephone companies. It soon developed, however, that valuable time was lost by inattention and mistakes of telephone operators, the chance of lines wanted being in use and similar difficulties. Moreover, group conferences were almost impossible. As an emergency measure private telephone lines were installed between the most important points, and as the power systems expanded these private telephone lines extended until in some cases a very real and very busy telephone system resulted and the once "private line" was lost in the system.

Then the call for some means of intercommunication between these private systems and the public telephone system had to be answered, and as a result the old troubles—"Line busy," "Number Six-two-eight doesn't answer," overworked or inattentive operators—flourish as of yore, the only difference being that a few minutes in the business of yesteryear was of less importance than a few minor fractions of a minute are now.

Today another means of communication is available for use—the radio telephone—and where the importance of communication service warrants, advantage should be taken of it, not with the idea that it is a cure-all or an infallible agent, but with the conviction that it is a valuable reinforcement to lines of communication.

It has been urged that the radio telephone is not reliable. How about the reliability of the wire lines when wind, flood, fire, power-line troubles and the troubles of the telephone line and apparatus cut off communication, leaving one absolutely helpless so far as connection with the remote power house or with some important switching center is concerned? What would one not give sometimes to be able to put across a half-dozen sharp, incisive, full-of-meaning words and hear the "All right, I get you, boss," come back assuring him that co-ordinated effort toward the restoration of an interrupted service is under way? Has not many a central-station man added a year to his age in an hour's time as he sat with tense nerves and toyed in impotent rage with a worse than useless telephone? Wouldn't he try another way if he had an opportunity? The radio telephone offers this opportunity. With it one almost always gets a message through some way. It has already proved to be a faithful tool to have in reserve.

# New Sequence System of Polyphase Meters

## A Proposed Method of Meters and Metering for the General Case of Polyphase Circuits Based on Sequence Analyses—Simplicity and Accuracy Are the Keynotes of the Plan

By R. D. EVANS

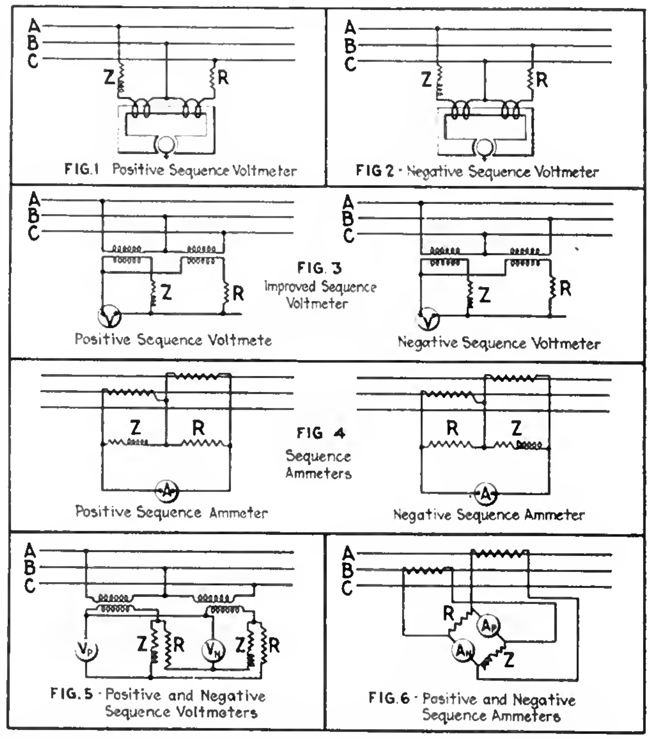
*General Engineer Westinghouse Electric & Manufacturing Company*

A NEW system of measuring devices for polyphase circuits has been proposed. The new measuring devices form a complete system for polyphase circuits and include voltmeters, ammeters, wattmeters, reactive wattmeters, power-factor meters, unbalance meters and also relays. The advantages of the proposed system in comparison with the systems in use at present may be stated as (1) simpler and more direct indications of circuit conditions, and (2) the requirements of fewer metering elements to indicate circuit conditions.

The present systems of measuring devices for polyphase circuits in general indicate phase quantities, as voltages or currents, or summate the phase quantities, as in the case of the polyphase wattmeter. In the development of these systems for polyphase circuits consideration was given principally to the "particular case," i.e., the balanced circuit. The "general" case of the polyphase circuit—i.e., the unbalanced circuit—was not well understood as evidenced by the discussion as to the definition of "polyphase power factor."

A method for analyzing unbalanced polyphase circuit conditions was presented by C. L. Fortescue in his paper on "Symmetrical Co-ordinates." This method is based on the fact that any unbalanced polyphase system may be resolved into two or more balanced or symmetrical systems. For example, in a three-phase, three-wire circuit an unbalanced system of currents may be resolved into two symmetrical three-phase systems in which the currents of one system reach their maxima in the different phases in a positive sequence, as *A*, *B*, *C*, and the currents of the other system reach their maxima in the negative sequence, *C*, *B*, *A*. The method used here of resolving currents into components, positive and negative sequence, is similar to the method now in general use for resolving currents into components in phase, or active, and out-of-phase, or reactive. The reasons for the resolution of the currents into components for the two cases are the same, namely, that the different components have different effects, thus simplifying the solution of the problem. One advantage of this method resides in the fact that it is possible to deal with a few symmetrical systems—two for the three-phase, three-wire system—in varying proportions instead of dealing with an infinite number of combinations of unbalanced systems. Two results this investigation has produced are (1) a revision in the conceptions of polyphase circuit measurements, and (2) recognition of the desirability of a new system of measuring devices which is simpler and more accurate for the general application.

The new measuring devices are based on the resolution of the different quantities of the "general" polyphase circuit into the different phase-sequence components. Each of these phase-sequence components, if present on a polyphase circuit, may be measured. The method of separating these components is accomplished by the devices which will be described in the latter part of this article.




METERS USING THE SEQUENCE PRINCIPLE AFFORD SIMPLICITY IN CONNECTIONS, ACCURACY IN METERING AND RELIABLE RELAYS FOR PROTECTIVE PURPOSES

The following explanations of the phase-sequence devices will, for the sake of brevity and clearness, be based on their application to the three-phase, three-wire circuit. For these circuits, the relations between the different voltages may be expressed as follows:

$$E_A = E_P + E_N, \quad (1)$$

$$E_B = a^2 E_P + a E_N,^* \quad (2)$$

$$E_C = a E_P + a^2 E_N, \quad (3)$$

where $E_A$, $E_B$ and $E_C$ are the line voltages and $E_P$ and $E_N$ are the positive and negative sequence components of voltages respectively. The solutions of these equations for positive and negative sequence voltages are:

$$E_P = \frac{E_A - aE_C}{1 - a^2} \quad (4)$$

$$E_N = \frac{E_A - aE_B}{1 - a^2} \quad (5)$$

These equations show how the voltage of one sequence component may be obtained from the voltages measured in the usual way.

The next step is to show that the separation of the

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*$a$ is an operator similar to $j$. $a$ is equal to $(-\frac{1}{2} + j\sqrt{3}/2)$ and effects a rotation of 120 deg.; $a^2$, a rotation of 240 deg.; $a^3$, 360 deg.; or $a^3 = 1$.

different phase-sequence voltages, accomplished mathematically as shown above, can be accomplished by measuring instruments. Considering the positive sequence voltage, equation (4), all that is necessary is a meter with one winding taking a current in phase and proportional to the voltage $E_A$, and another winding taking a current proportional to the voltage $E_C$, but with a phase relation of $-a$. Such a meter is shown in Fig. 1. The external impedances, $Z$ and $R$, are of such high value as to determine the magnitude and phase relation of the currents going through the windings. $R$ is a resistance, and the current going through winding 1 is in phase with the voltage $E_A$. The next step is to determine the value of $Z$. The power factor of the impedance must be such that the current is proportional to $-aE_C$. As $a$ represents a rotation of 120 deg., $-a$ represents $-60$ deg., or 60 deg. lag. Hence the impedance must be such as to cause the current in the winding 2 to lag 60 deg. behind the voltage $E_C$. To meet this requirement $Z$ must be equal to $(0.5 + j0.866)R$. Hence this meter measures a quantity proportional to $E_A - aE_C$, and therefore proportional to $E_P$, the positive sequence voltage.

This same conclusion can be obtained in another way by showing that positive sequence voltages cause the meter to register, but negative sequence voltages do not. Hence the meter operates on a system with unbalanced voltages to indicate only the positive sequence voltage.

Negative sequence voltage may be measured in a similar way and by the same meter, only a change in connection is required. The diagram of connections for the meter to measure the sequence voltage is shown in Fig. 2 and the explanation follows directly from equation (5).

This method of measuring the different sequence voltages is generally applicable and may be extended to a different number of phases and to measure other sequence voltages. Another form of the positive and negative sequence voltmeters is shown in Fig. 3. This form appears to be the best for commercial use, as standard meter elements and standard potential transformers are employed.

### Phase-Sequence Ammeters

The different sequence currents may be measured in a manner similar to that of the different sequence voltages. Fig. 4 shows devices for measuring positive and negative sequence currents. The devices shown in Fig. 3 and 4† may be explained in the manner indicated above, or they may be explained from a different viewpoint, that of a network in connection with a standard meter element. This method of viewing the problem is very simple and gives a solution in convenient terms. From this viewpoint a voltmeter or an ammeter consists merely of a meter element which measures voltage or current, depending upon the network which connects it to the circuit. Hence to measure positive sequence current it is only necessary to obtain a network that permits only current of positive sequence to flow in the branch in which the meter element is connected. Such a network is shown in Fig. 4.

It is possible to combine the networks for positive and negative sequence-measuring devices so that separate transformers for each device are not required. Such a combination for measuring positive and negative sequence voltage is shown in Fig. 5, and a corresponding positive and negative sequence-current device‡ is shown in Fig. 6.

†This improved form is due to C. T. Allcutt.

‡This device was suggested by C. L. Fortescue.

### Sequence Wattmeters, Reactive Wattmeters, Power-Factor Meters, Etc.

Having separated out the positive and negative sequence voltages and currents, it becomes evident that it is possible to combine them to measure power, reactive power, and power factor. Standard instruments supplied with positive-sequence voltage and current measure positive-sequence watts, positive-sequence reactive watts and positive-sequence power factor.

A study of the preceding diagrams and explanations will show that there are certain devices now in operation whose success depends upon separating out more or less effectively the different phase-sequence components of voltages or currents. Such devices include those for indicating phase rotation and the ground-current relay operated from three-current transformers on the three-phase grounded neutral circuit. Instead of a number of isolated devices, there is proposed a complete system of devices, all utilizing the same principle.

The phase-sequence-measuring devices are relatively simple, involving standard meter or relay elements with standard types of potential and current transformers and auxiliary networks consisting of resistors and reactors. With the phase-sequence method fewer metering elements are required to indicate circuit conditions. For example, one positive and one negative sequence ammeter will replace three single-phase ammeters. In addition, the phase sequence devices indicate circuit conditions to better advantage. An example in point is the application of the negative-sequence current device as a relay to provide protection against single-phase operation of motors. Some of the advantages of the sequence method of making polyphase power measurements are pointed out in a paper by C. L. Fortescue, entitled "Polyphase Power Measurements," to be presented at the 1923 midwinter convention of the American Institute of Electrical Engineers. In considering the application of the proposed system of measuring devices, there are two cases to be considered: First, one with no unbalance present, in which case the two systems give the same result and the proposed system has the advantage of employing fewer meter elements than are employed at present; second, one with unbalance present, in which case the two systems will give different results and it will probably be desirable to give consideration to unbalance, which is best measured by the system proposed.

## Permissible Electric Drills

THE Bureau of Mines has issued a report embodying the results of an investigation into the matter of permissible electric drills, "permissible" referring to use in gaseous or dust-laden mine atmospheres. The report (Serial 2,434) has been compiled by H. B. Brunot and H. B. Freeman. Two makes of electric drills have successfully met the requirements of the bureau. The formal approval of these drills means that if they were inadvertently operated while immediately surrounded by an explosive mixture of gas as the result of accidental interference with the ventilation, the atmosphere surrounding the drill would not be ignited even though an explosion took place within the equipment.

# Aspects of the Central-Station Sales Effort*

## Necessity of High-Type Service—Customer's Position Reversed in Merchandising Department, Where He Is No Longer a Supplicant

DURING the past few months the sales departments of the central-station industry have furnished a topic for many discussions. It seems to be generally believed that these departments should be more seriously considered, receive more attention and in many instances have the scope of their activities greatly broadened. If the men in such departments have not developed as rapidly as might be desired or the departments been as helpful as they should, the fault may not be entirely their own. In the stress of other problems sales departments have too often been permitted to drift of their own momentum and have not been used to the extent which might have been the case with proper organization training.

In some companies of our industry, even today, the sales department is organized merely to merchandise goods; in other cases it takes on some additional responsibilities for soliciting small-power business; but in few instances does such a department really function in a broad way as a bureau of general business development and as a service department. Only in recent years has more been expected of a sales manager than to be the efficient head of a group of solicitors; but even though this be considered the sole purpose of such an organization, it is not certain that the industry has always reaped the full benefit of it.

### Quality Service Essential

The real mission of the sales department is to sell more electricity by both direct and indirect methods, and merchandising for profit cannot be considered as more than incidental. Probably for several years to come the long-debated question of whether a central station should deal in merchandise at all will continue to be a perennial cause for difference of opinion. It would seem that the answer may be found by considering another question, namely, "By selling merchandise can we render a needful or a desirable service to our customers which they cannot otherwise obtain?" If local dealers and contractors offer but an inadequate service, then most assuredly the central station should fill the gap, even though the transactions themselves may not net a direct and traceable profit.

If the dealer and contractor does this work as well or better than the central station, there does not appear to be much justification for it to remain in a business for which it is not organized and for which it is not pre-eminently equipped. However, even in the latter case it is sometimes urged that central-station merchandising has a very salutary effect upon the methods and practices of other agencies engaged in the distribution of electrical goods.

### Giving the Customer the Advantage

Another view of central-station selling asserts that in all other departments of utility companies the customer's relations are more or less those of a supplicant for service, which is granted him under certain conditions of the central station's making, while the floor of the sales department is a place wherein these relations are reversed. Here the company is actually soliciting favors from its customers, and it is believed by some that to have at least one department which of necessity must have contact with the public from a somewhat different angle is valuable and not to be lightly eliminated.

It is at least generally conceded that the public utility does not desire a monopoly of the merchandising business, that the activities of dealers and contractors all redound to the direct and immediate benefit of the central station, and that the latter should encourage and stimulate the contractor and dealer as far as possible, always having in mind that the central station's most profitable obligation is its customer. Utilities have not always been patient and helpful in their dealings with these outside local agencies. Some sales managers have been trained to expect the value of their services to be measured by the volume of their sales, and all such very naturally look upon the dealer as a rival instead of as an ally. This appears to be a somewhat narrow viewpoint which should be found easy to correct.

### Are Our Goods Well Sold?

Those who are responsible for companies having established merchandising departments may well ask themselves: "Are our goods well sold?" Speaking very generally, the answer is "No," or at least not so well sold as they will be when volume ceases to be the goal of sales effort. There is room for much improvement in this respect. Stating the problem in other words, it would be: "Do our salesmen make people buy their goods rather than make them *want* to buy them?" and therein lies an important distinction.

Customers' closets and shelves contain many devices which they bought but did not want, and so they are out of use, producing neither revenue for the utility nor satisfaction for the owner. Some test inspections have shown as high as 25 per cent of owned devices out of use, largely because the keen desire for the service which the appliance could render was not sold with the device itself. In most instances, probably, this desire could have been implanted.

Doubtless more than 50 per cent of the electrical devices in customers' homes are not used to anywhere near their possibilities. Sweeping a floor is only one of many uses to which a suction cleaner may be put; percolators will do more than make coffee; flatirons are capable of far more service than merely smoothing out damp cloth, and yet a discussion with a selected group of owners of such devices proves that they know little or nothing of their possibilities. It must be assumed that the salesman did not know them either, or that he was merely marketing an energy-consuming device and considered it no part of his duty to sell a service, his mission having ended with the making out of his sales slip.

In our calculations of the possibilities of load building we should not overlook the one of better selling. The dealer is interested in selling those devices yielding him the greatest profit. It chances that nearly all such are the most insignificant consumers of electricity, while, on the other hand, devices which are the best load builders cost so little in the first place that the retailer cannot give more than casual service. If we find upon investigation that those devices which have been poorly

*From an address by H. T. Edgar, division manager Stone & Webster, Inc., Boston, before managers of utilities under the company's administration.

sold have been marketed by the dealer, we can at least consider the desirability of reselling them through advertising, service calls, etc. In any event our own sales departments must become something more than order takers and record writers if they are in any measure to justify their existence. It appears to be rather inconsistent with good business judgment to place so vital a factor as business development in the hands of the type of man who may be attracted by an inadequate salary and whose sole qualifications are those of a clever peddler.

### The Public Relations Opportunity

Like the head of any operating department, the chief of the sales department should be a man capable of contributing real strength to the manager's staff. He should be familiar with the larger problems of public utility operation if he is to bring to his job that broad vision and understanding which now appear essential to successful operation. His position demands that he and his assistants maintain close contact with the public. It would seem to be desirable to select and train our sales managers to represent adequately their companies in that capacity. If they are to be bigger men, they will as a matter of course command larger salaries, but no public utility has yet conclusively determined the limiting value which can be placed upon the services of the right sort of man in this position, assuming that the latter means selling the company and its service to its customers rather than merely selling them energy-consuming devices.

Serious effort to train sales managers in many cases implies supporting them by furnishing better personnel in their departments. It has been too often assumed in the industry that if a given candidate for employment has no training, little education and appears good for nothing else, he should enter the sales organization. More careful selection of this sort of material could be exercised. It cannot be seriously maintained that our sales departments are today in general what we would like to have them. A reasonable length of time, if accompanied by genuine effort, will make them more profitable and helpful adjuncts of the utilities and a constructive force in the community.

Having raised the standard of requirement and performance in our sales departments, we shall have therein organizations specially trained in an understanding of the consumer and his desires, his dissatisfactions and state of mind—certainly a factor of great potentiality in accomplishing our desire for improved public relations. That such departments are not generally used for things which they presumably can best do is simply another way of stating that they are susceptible to substantial improvement, without depreciating the excellent work which they have accomplished in their previous development.

## Ontario May Start Peat Manufacture

THE solution of the fuel problem of the Province of Ontario through the erection of a government-owned peat plant is made in a report of a committee of the Provincial Legislature. The committee, which has completed researches occupying seven years, expresses itself as strongly of the opinion that the manufacture of fuel from Ontario's peat beds is a commercial possibility and should be considered.

## Electric-Steam Boilers in Western Sweden

THE use and employment of electricity for the generation of steam has been the subject of close study in Sweden for many years and has, United States Consul W. H. Sholes reports, to a certain extent been successfully realized in western Sweden, notably at Gothenburg and Vargon, especially during and immediately after the world war, when coal could be obtained only in insufficient quantities or at exorbitant prices.

The problem is chiefly of an economical character and of interest to countries either devoid of coal or endeavoring to eliminate it from their import budgets. The purely technical problems do not cause any difficulties; in fact, electric boilers, according to Swedish engineers, have proved to be simpler in construction, easier to build and erect than ordinary steam boilers, because fireplaces, smoke channels, smokestacks and fuel storage are unnecessary. Loss of heat by the smoke and gases escaping through the smokestack is avoided, it is claimed, and the loss of heat on account of radiation from an electric steam boiler can be reduced to such an extent that the working efficiency of the boiler can be brought up to 98 per cent, even if no more than 96 per cent can be counted upon in normal operation. Steam with working pressure can be raised within ten to twenty minutes.

Engineers in Sweden calculate that with a normal effect of 96 per cent about 825 caloric units are obtained per kilowatt-hour. The amount of heat required for generating 1 kg. of steam depends, however, on the temperature of the feed water as well as on the heat of the steam generated and the pressure to which it is subjected. Besides this, the price of coal as compared with the price of electrical energy must be taken into consideration, also continuous or interrupted use of electric power, the use of "surplus" electric power at night and on holidays and similar factors.

Local experience is that in electric generation of steam 1 kw-hr. can supplant 0.18 kg. of coal of average quality, and that therefore, with a coal price of 15 kronen ($4.02 at par) per ton, which was not unusual before the war, the cost of fuel for generating 1,000 kg. of steam will be 2.14 kronen ($0.574 at par). In order that the cost for the electrical energy per 1,000 kg. of steam generated in an electric boiler shall in this case be the same as the cost of fuel for the same amount of steam generated in an ordinary boiler, the price of energy must not exceed 0.27 öre (0.07236 cent) per kilowatt-hour. In Gothenburg the price is 15 öre. However, if the price of coal be 200 kronen ($53.60) per ton, which it was occasionally during the war, the equivalent price of electrical energy would be about 3.6 öre, and the cost of fuel or of the electrical energy would be 28.57 kronen ($7.66) per 1,000 kg. of steam.

For purpose of comparison, it may be mentioned, however, that the present price of coal in quantities is about 50 kronen ($8.04) per ton, and that the lowest ordinary price of second-hand converted electric power in the city of Gothenburg is 15 öre (4.02 cents) per kilowatt-hour. Therefore it is evident that first-hand alternating current direct from hydro-electric power stations can come into consideration only for the purpose under discussion.

Electrical energy in western Sweden is in many cases sold per kilowatt-year. In such cases the price of the electrical energy per kilowatt-hour is in an indirect proportion to the effective time of operation per annum.

# Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

## Cost of Selling Appliances

*To the Editors of the* ELECTRICAL WORLD:

Some two or three years ago the Electrical Contractors' Association sent out a questionnaire to its members and compiled some statistics which showed that the cost of handling electrical appliances amounted to about 35 per cent of the selling price. Inasmuch as several commodities, particularly washing machines, vacuum cleaners and ranges, which ran into a large figure did not carry on an average more than 25 per cent to a dealer, it was evident that there was no money in handling appliances from the contractor-dealer's standpoint.

The jobbers have also investigated this matter, but as jobbing experience is more or less varied between men who only receive and ship out in original packages and those who retail, I have no record of any definite figures being determined. I was at the contractors' meeting in Cincinnati where Mr. Gilchrist brought out the fact that central stations' contractor-dealers must get more of a "spread."

From our experience in appliances we know that the central station or the dealer that retails units such as washing machines, vacuum cleaners, ranges, refrigerating outfits and appliances of that type has a large expense bill in connection with demonstrating, trucking back and forth and then servicing the apparatus after it has been installed. We believe it is all right for central stations to exploit machines which require demonstration and a large amount of service, even though this may not show a profit, since the demand must be created and the experimental "try-out" with the public must be conducted by somebody and central stations are naturally better equipped financially to do this experimental work. But after the appliance has reached the condition that the vacuum cleaner, washing machine and range have reached today it should not be necessary to sell these goods at a loss, but the public will then be well enough acquainted with them to make the expense of exploitation unnecessary.

This is illustrated in the case of the flatiron. When the flatiron was first brought out it was necessary to allow a customer to try it out and experiment with it, which added to the selling cost. In fact, in the early years of the flatiron it was sold at a loss. Today the flatiron is recognized as a household commodity, and there should be no expense in connection with demonstrating or exploiting it. We believe, from our experience, that selling appliances such as flatirons, toasters, percolators, etc., can be handled at a smaller margin of profit than in the case of other types of machines.

I have looked into this situation from the department store's and furniture store's standpoint. I find as a general thing that department stores and furniture stores are not interested in handling large electrical appliances unless there is a spread of 50 per cent or more. I understand the usual spread in furniture is even higher than this. It would seem to me the only thing for us to do is to let the jobber, the central station and the contractor-dealer on the one hand get together and determine what is an equitable profit for handling these goods and then present this proposition to the manufacturer.

JOHN P. COGHLIN.

Worcester, Mass.

## Does Not Consider Absolute Elimination of Ionization Essential

*To the Editors of the* ELECTRICAL WORLD:

I have read with interest D. W. Roper's article on "Recent and Prospective Developments of Underground Cable." I agree with his statements with one exception —I do not feel sure that it is necessary to eliminate air ionization entirely as specified in the third paragraph from the end of his article. I know of a number of cables which have been in satisfactory service for several years in which ionization of occluded air undoubtedly occurs at operating voltages and has not been harmful in any way.

Mr. Roper is quite right in placing so much importance upon inspection at the factory. It will only be by very thorough control that it will be possible to obtain cables for voltages of 110,000. However, it is not only at the cable factories that this control is needed, but also at the factories of the paper makers and oil refiners.

WILLIAM A. DEL MAR,
Chief Engineer.

Habirshaw Electric Cable Company, Inc.,
Yonkers, N. Y.

## Ungrounded Lighting Fixtures Condemned as Unsafe

*To the Editors of the* ELECTRICAL WORLD:

I wish to register approval of the suggestion made by Fred Clayton in your issue of Dec. 20 last regarding the fusing of a grounded neutral. His idea of placing two fuses in series on a hot wire is very good in overcoming the objection that protection of only one fuse will be provided if the grounded wire is run continuously. There are serious doubts in my mind, however, whether this objection is justified considering the benefits derived from continuously wired ground. My personal opinion is that the use of one fuse to protect a circuit meets with objection simply because it is not the way we are accustomed to doing things. In other words, the use of one fuse to protect a circuit must overcome the inertia of the old methods with their historical backgrounds.

Along this same line, the writer cannot understand why agitation has not been brought to bear in the past against the use of ungrounded electric lighting fixtures. While death from lighting voltages occurs rarely, nevertheless a few instances are known to the writer where death would have been prevented had the fixtures been grounded as is done in the case of motor frames. This, perhaps, would create a little additional fire hazard, but I think it is high time that the value of human life as well as the value of property should be considered.

It is the writer's personal opinion that the frame of every electrical device, whether it be motor, transformer, electric light fixture or what, should be securely grounded and that the neutral of lighting circuits should be grounded and run continuously without fuse from transformer to end of circuit. This practice would result in uniformly safe installation.

EARL E. NORMAN,
Superintendent.

Department of Public Utilities,
Kalamazoo, Mich.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Testing Relays Prior to Installation

**Checking Correctness of Operation Before Placing Apparatus in Service—An Account of Particular Interest to Small Companies Unfamiliar with This Work**

THE relays which are provided throughout an electrical generating and distribution system are far more important than would appear on first thought as the continuity of service of a part of a system or even an entire system depends upon the correct functioning of such relays. Too much stress, therefore, cannot be laid upon the care which should be used, first, in selecting the proper types of relays; second, in inspecting and checking them at the time of placing them in service, and, third, in maintaining a rigorous routine inspection and calibration. The failure of relays to isolate a piece of equipment at the time of the occurrence of a fault may lead to serious damage which would not be caused if the equipment were removed from the system instantly.

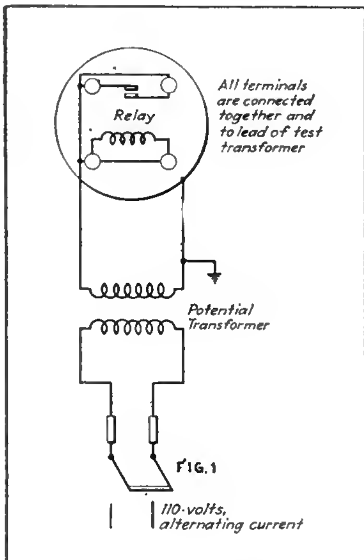
It is intended in the following discussion to cover the most important points that should be taken care of in the inspection of relays when they are received prior to placing them in service, but not to touch on those comparative tests which should be made on a number of relays at the time a choice is made of the particular type to be used.

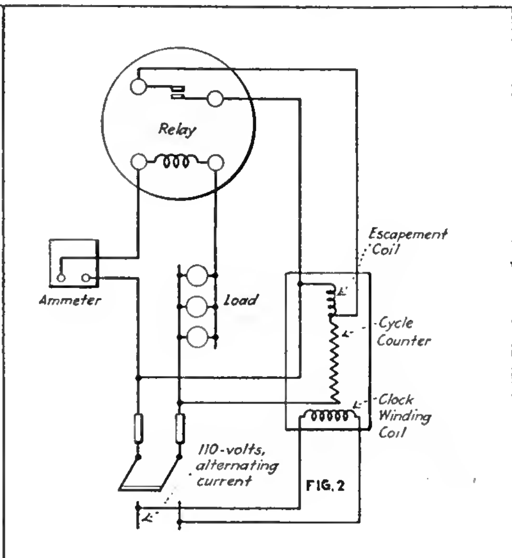
All relays when received should be inspected very carefully to make sure that there is no foreign material in them and that no breakage has occurred since leaving the factory. All moving parts, such as plungers, disks, etc., should be examined to make sure that they move freely throughout the entire range. It is also important to see that all contacts close and open properly and that no parts have worked loose.

Potential tests (about 1,000 volts) should be made on the windings and contact systems of the various relays to make sure of good insulation and clearance. Typical connections for this test are shown in Fig. 1.

Most excess-current relays have time adjustments and should be checked for operating current and time at several points, one of which should be the minimum operating current and another a current large enough to cause the relay to operate on the flat part of its characteristic curve. A cycle counter will be most convenient to measure the time, and the general scheme of connections can be as given in Fig. 2. Usually there are characteristic curves furnished with the relays which should be compared with these test data and used later for setting the relays when installed.

Power directional relays, in addition to being inspected as outlined above, should be connected to a test circuit in the laboratory to make sure that the leads are brought out properly so that the tripping contact will close on the proper direction of energy transfer. Fig. 3 shows the connections for making this check on Westinghouse type CR relays. The General Electric type IK relay can be tested in the same manner with slightly different connections. The adjustment of the power directional relay must be very carefully made as in case of line failure the voltage is much reduced and with this low voltage on the potential coil comparatively little torque is pro-



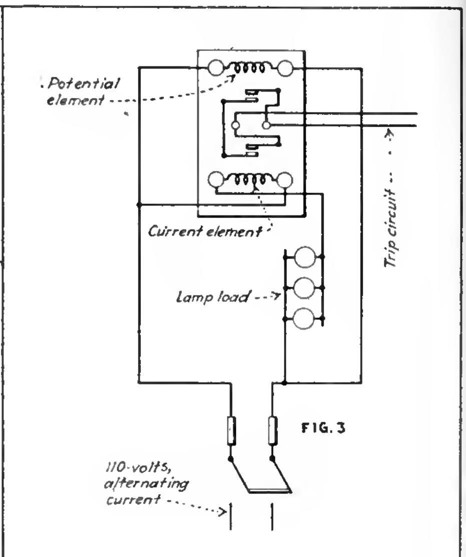




FIG. 1—TESTING INSULATION OF RELAY WINDINGS AND CONTACT SYSTEM. FIG. 2—CONNECTIONS FOR TESTING EXCESS-CURRENT TIME-LIMIT RELAYS. FIG. 3—TRIPPING CONTACTS SHOULD CLOSE WHEN TESTING WESTINGHOUSE TYPE CR REVERSE POWER RELAYS USING THESE CONNECTIONS

duced. If not carefully adjusted, it is possible under the condition of low voltage that the operation of the directional relay may require more time than with the excess-current relay which is properly set in conjunction with other relays on the system and thus destroy selective action. The excess-current relay used with power directional relays may or may not be in the same case with them, but in any event should be tested as outlined above.

Single-winding differential relays are to all intents and purposes instantaneous excess-current relays and should be inspected carefully and checked for operating current.

In later issues comments will be given on the checking of relay installations prior to placing them in service and on routine testing and calibration of relays.

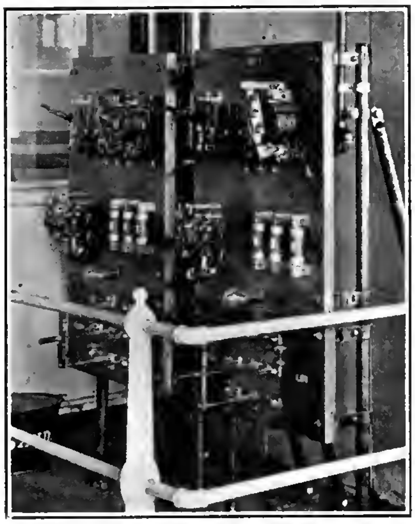
RAYMOND BAILEY,
Assistant Chief Electrical Designer.
Philadelphia Electric Company,
Philadelphia, Pa.

## Electric Japanning Ovens for Optical Company

TWO batteries of electrically heated japanning ovens are now operating in the Bausch & Lomb Optical Company's factory at Rochester, N. Y., and the company's experience with them is interesting both because of the character of the work done and the results obtained. The material baked comprises not only high-grade japan, but rubber enamels and bakelite, and the finished parts are used in the assembly of microscopes, field glasses and other instruments where the quality of the finish is of paramount importance. The effect of electric heat on the quality of the finished articles and upon the over-all production cost, under these exacting conditions, should be of interest to those with similar problems to overcome. Since the ovens have been installed the percentage of parts rejected because of improper baking has been reduced to about 4 per cent of the total amount baked, as compared with about 50 per cent with the gas ovens formerly used for the same purpose.

The total installation of ovens comprises two truck-type and three shelf-type units, both types having a connected load of 36 kw. each in heaters, or a total of 180 kw. at 230 volts, three-phase, 60 cycles.

The two box-type ovens are installed in one end of a small room, the rest of which contains the spray hoods, trucks, etc. Each oven is 5 ft. wide by 6 ft. 6 in. deep by 6 ft. 9 in. high. They are of the box type built by Young Brothers of Detroit. The heaters are installed in two banks, on each side of the ovens, extending from front to back, about half way up the walls. The control is automatic. The two automatic control panels, furnished by the General Electric Company, are installed together at one end of the ovens and carry the necessary contractors, pilot lights, overload relays and a double-pole, double-throw switch on each panel for changing the heater connections from Y to delta to obtain high or low heat. The temperature range is between 300 deg. F. and 450 deg. F.



CONTROL APPARATUS FOR ELECTRIC OVENS

The shelf type ovens are mounted along the side wall of another room, which is also used as a spraying room. The baking space of these ovens are each 3 ft. 4 in. wide by 2 ft. 5 in. high by 3 ft. deep. The heaters are installed between the bottom of the lower baking compartment and the floor level of the room. These ovens are also automatically controlled. The automatic control panel for each oven is mounted directly above the oven itself, while the instruments are mounted on the rear of the ovens.

FEWER REJECTIONS AND GREATER SPEED IN BAKING ARE ADVANTAGES OF ELECTRIC OVENS

The most interesting feature of the installation, however, is the effect the ovens have had upon production as regards both economy and volume. The parts must have an exceptionally high quality of finish owing to the uses to which they are put. This may be elaborated by saying that these finishes must be duplicated time after time on a large number of different parts, as these are baked in large numbers and then returned to stock for assembly later. The effect of a number of parts with varying degrees of finish assembled together on the same microscope, for instance, need not be emphasized.

### STRICT TEMPERATURE CONTROL IMPORTANT FACTOR

The ability to control the temperature of the ovens accurately makes this duplication of results possible, as the degree of finish is determined by the temperature of baking. Furthermore, the absence of contaminating gases in the oven interior is an important factor in decreasing spoilage.

This same freedom from contamination, which extends to the atmosphere surrounding the ovens, makes it possible to put the spraying machines in the same room, which naturally saves much time and labor in handling the material to be baked. Since articles can be baked much more rapidly owing to the higher temperatures possible with electric heat, the time of baking per load has been reduced from about five hours with gas ovens to about one and one-half hours with electric ovens, at temperatures of from 300 deg F. to 450 deg. F. according to the finish desired. To sum up the matter, the economy of the electric oven has been found to exceed that of the gas oven because of fewer rejections, greater speed in baking and the saving in space, labor and material that can be directly traced to its use.

E. H. FETZ,
Factory Engineer.
Bausch & Lomb Optical Company,
Rochester, N. Y.

COMBINATION OF BELT CONVEYOR AND BOX-CAR LOADER UTILIZED IN JAPANESE POWER PLANT TO HANDLE COAL

## Coal-Conveying System in Japan

THE installation of an American-built belt conveyor and a box-car loader at the gas works in Kobe, Japan, proves that the efficiency of this method permits it to compete with the cheap labor obtainable in Japan. This plant operates with slack coal. The combination of a belt conveyor and a box-car loader, as illustrated, makes for very flexible operation in handling coal. The loader has been developed to deliver sand and other materials to the farthest corner of a box car without the machine itself taking up much room; but Japanese engineers have used this loader in conjunction with a standard belt conveyor so that still more efficient operation is obtained. This information was obtained from the Link-Belt Company, Chicago.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Gravity Pipe Line Saves 150 Kw.-Hr. a Day

BY BUILDING a new condensing-water intake line from the Concord River to a cold well outside the local 1,200-kw. municipal lighting plant located at Concord, Mass., it was found that 150 kw.-hr. a day could be saved which had formerly been consumed in operating a motor-driven centrifugal pump. Formerly a 7.5-hp., 200-volt, two-phase vertical motor in a pump house near the river ran a pump which lifted the water about 8 ft. and delivered it to the plant through a 12-in. pipe 600 ft. long. The new line of 18-in. wooden staves enables gravity flow to be obtained from the river, the length of the line being about 620 ft. On account of quicksand and other poor foundation conditions, the cost of the new line with intake-screen connections, etc., was about $6,600, but at a conservative figure for the energy consumed by the pumping outfit, the investment will be retired in a reasonable time by the change, besides giving a more reliable service. The former pipe line and pumping outfit are held in reserve.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Reversal of Meter Torque at Low Power Factors

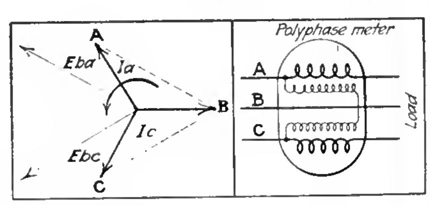
OCCASIONS often arise when it is desired to determine which element of a three-phase watt-hour meter is exerting a backward torque under conditions of lagging power factors below 50 per cent. This condition is easily ascertained if a small highly inductive load, such as a motor lightly loaded or running idle, can be put on the line and the potential circuits of the meter alternately opened. However, such opportunity is not always available, in which case it is convenient to determine the phase sequence at the meter, thus indicating which is the reversing element, as explained below.

A tester usually has as a part of his testing equipment the necessary apparatus to determine the phase sequence or rotation. A very common method is to connect two 25-watt or 40-watt, 110-volt lamps and the 110-volt primary of the phantom loading transformer or the 110-volt potential coil of the rotating standard in star connection to the three-phase line. Then if *A, B* and *C* represent the phase rotation, as shown in the accompanying illustration, line *A* should be the one connected to coil, line *B* the one connected to the dim lamp and line *C* the one connected to the bright lamp. A telephone condenser rated at 1 mfd. might be used in place of the coil and the order would be reversed.

If the upper element of a meter reverses at low lagging power factors, it is found that the lower element will be the reversing one if two of the line wires ahead of the meter are interchanged, causing the phase rotation to be reversed. It is thus apparent that there is a definite relation between phase rotation and the question of which of the elements will reverse in direction of torque exerted on the meter disk when the power factor of the load is lagging and below 50 per cent.

A study of the vector diagram will show that if phase rotation is indicated by *A, B* and *C,* the current coil of the reversing element will be in line *A*; the line *B* will be the one common to both potential coils, while the current coil of the element always running forward will be in line *C*.

Referring to the diagram and assuming a balanced load, vectors $I_a$ and $I_c$ represent the current in the two current coils in phase relation (under conditions of unity power factor) to the vectors $E_{ba}$ and $E_{bc}$, representing the voltage across the potential coils of the upper and lower elements respectively. The vector rotating in the direction indicated by the arrow, it is evident that as the current lags behind the voltage, due to inductive condition of the load, the voltage vectors $E_{ba}$ and




REVERSAL OF METER TORQUE ON INDUCTION MOTOR LOAD STUDIED BY USE OF VECTOR DIAGRAM

$E_{bc}$ will advance ahead of their respective current vectors, $I_a$ and $I_c$. Now, since the voltage vector $E_{ba}$ of the upper element is already (at unity power factor) 30 deg. ahead of its current vector $I_a$, while the voltage vector $E_{ba}$ of the lower element is, under the same condition, 30 deg. behind its current vector, it is shown that the voltage vector $E_{ba}$ of the upper element will become 90 deg. ahead of its current vector first.

Any further separation of the voltage and current will cause reversed torque on the meter disk by the upper element.

FOSS C. HUSH,
Iowa Service Company, Meter Tester.
Red Oak, Iowa.

## Standard Nomenclature for Oil Circuit Breakers

A NUMBER of definitions covering standard nomenclature for oil circuit breakers were adopted by the Electric Power Club at its regular fall meeting held at Asheville, N. C. These should greatly assist in furthering clarity in specifications. A partial list of the definitions is given below.

*Accessories* — To be used broadly to include both attachments and auxiliaries.

*Attachments* — Accessories to be attached to a circuit breaker as distinguished from auxiliaries.

*Auxiliaries* — Accessories to be used with circuit breakers but not attached to them, as distinguished from attachments.

*Automatic Trip*—Operation of a circuit-opening device due to changes in current or voltage or other electrical conditions without requiring manual control. Automatic operation may be obtained by the use of any one of the following devices: (a) Self-contained overload trip connected to current transformers with or without relays; (b) shunt trip energized through relays operated by current or potential transformers; (c) self-contained series trip directly connected in the circuit; (d) under-voltage trip with or without potential transformers.

*Baffle (Deflector)* — Device for deflecting oil or gas.

*Barrier*—Partition for insulation or isolation of electric circuits or arcs.

*Bell Alarm Switch* — A switch controlled by the automatic opening of a circuit breaker and designed to close the circuit to a bell or other audible signaling device.

*Bell Crank* — A rectangular lever by which the direction of motion is changed through an angle.

*Bushing* — The part insulating a through conductor.

*Calibration* — A set of graduations marked to indicate the values of current or voltage at which an automatic trip device can be set to operate.

*Cell*—A compartment to isolate circuit breakers or other switching equipment.

*Cell Doors* — Doors for closing the front or rear of a cell.

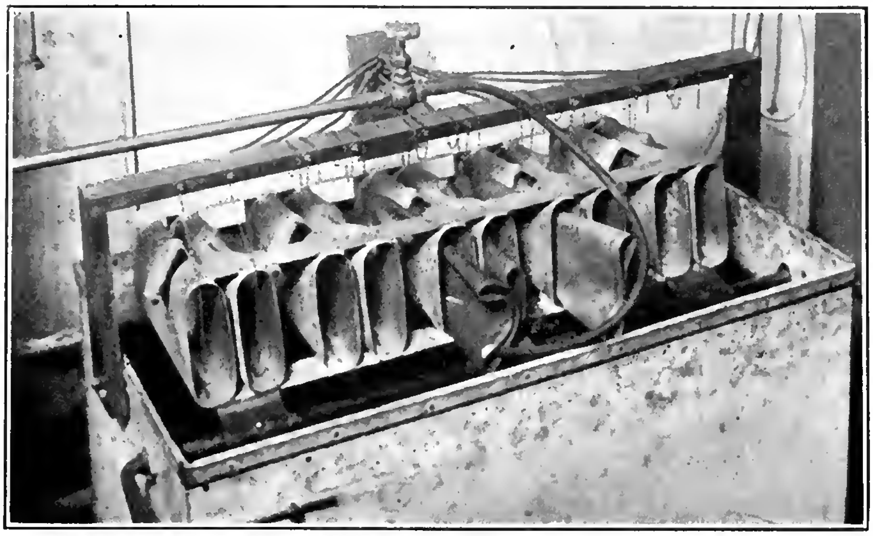
*Cell Structure* — A set of compartments to house switching equipment.

*Clevis*—A fitting having a U-shaped end and arranged for attaching to the end of a pipe or rod.

*Fume Resisting* — Fume-resisting switching and control apparatus is apparatus so constructed that it will not be readily injured by the specified fumes.

*Pipe End (Rod End)* — A fitting arranged to connect the end of a pipe or rod to a lever, bell crank or other part.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.



ROTATING ARM HOLDING GLOVES IN TESTING EQUIPMENT SAVES TIME

## Time to Test Rubber Gloves Cut 60 per Cent

THE number of rubber gloves which must be tested regularly is often considerable, and labor-saving methods are very helpful in this work. During the first half of 1922 an average of more than 550 gloves a month was tested at the laboratory of the Edison Electric Illuminating Company of Boston, and the time per pair has been cut from about five minutes to about two minutes by co-ordinating the equipment and methods used. The test for leakage follows well-known lines, the safe limiting value of leakage current being set at 10 milliamperes at 10,000 volts. The basis of this reduction in time is a rotating holder devised by a member of the laboratory staff and illustrated herewith.

The customary tank for glove testing is in this case large enough to permit testing ten gloves at once. The tank is equipped with a swinging arm carrying ten individual metal glove holders, and the arm can be moved through 90 deg. by means of an external handle. In testing, the arm is swung above the surface of the water so that the glove holders are brought into a horizontal position as shown. The gloves are inserted in the holders, and the arm is swung back into the water, the end of its travel bringing the gloves into a vertical position in the water, which rises to within about 2 in. of the edge of the cuff. Water is introduced into the gloves one by one through a rubber hose with convenient valve above the group. Above each glove on a wooden bar is a binding post with chain for use as an electrode within the glove, each chain being wired to an insulated push button on a control switchboard. One side of these buttons is grounded, voltage being applied between ground and the metal tank. A milliammeter is so arranged that pushing any particular button causes the leakage current of the corresponding glove to be indicated on the instrument. This arrangement enables the leakage current of ten gloves to be readily observed within the required sixty seconds' time limit of the test. After testing, the rotation of the arm to the horizontal position automatically empties the gloves.

R. W. CHADBOURN.
Edison Electric Illuminating Company,
Boston, Mass.

## Synchronous Motors for Industrial Drives

THE method of synchronizing a motor while on the starting tap at low voltage and then throwing over to full-line voltage was advocated by S. H. Mortensen in a paper on "Self-Starting Synchronous Motors and Their Application to Power-Factor Correction and Industrial Drives," presented before the A. I. E. E. section of the Western Society of Engineers on Jan. 15. He illustrated this point by showing the two "V" curves for a synchronous motor, one for half voltage and the other for full voltage. It was preferable to synchronize where these two curves cross each other rather than at the bottom of the curve, which would give rise to excessive armature current under full voltage.

Regarding the application for industrial drives, Mr. Mortensen listed

three things which were essential before any changes were made, namely, first to examine the details of the cable system from power stations with respect to the inductance of these lines; second, not to have the drive overmotored; third, consideration of the replacement of three or four small motors by one large-size motor.

Mr. Mortensen declared that synchronous motors for industrial purposes were now obtainable from 35 hp. up to 5,000 kva. The full-load losses of the last-named machine with proper design, he declared, would be only about 100 kva., with the no-load loss 50 kva. With regard to reciprocating loads such as air and ammonia compressors, care must be taken to keep the forced frequency of the load and the natural frequency of the motor at least 20 per cent apart, as otherwise the forced frequency will magnify the rotor swing and cause fluctuations in power input to the motor. The permissible value of the swing depends upon the relative capacity of the power feeder and the constants of the motor, but most compressor motors in successful operation limit this swing to approximately 60 per cent of the current fluctuation.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

# Extracts from Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Firing and Putting Boilers on the Line

BEFORE starting up a boiler and placing it on the line the steam-pressure gage and water column should be carefully inspected, the section of pipe between the main stop and automatic non-return valve should be drained and trap lines should be used to drain the condensate from the steam piping and prime movers. When the condensate from the steam piping and prime movers is not drained damage is often caused. Water should be turned on to the waterbacks before the fire is started, otherwise the waterbacks will become so hot that they will be cracked when cold water enters. At first raw water should be used to prevent taking too much condensate from other boilers.

Below are listed the directions for starting up a boiler and putting it on the line as abstracted from the operating code of the Philadelphia Electric Company:

PUTTING A BOILER ON THE LINE

1. Remove danger signs from main stop, main feed, blow-off valves and control board.
2. See that blow-off valves are all closed. Where a safety stop gate valve is connected to blow-off line see that this valve is open.
3. Open all vent valves.
4. Close all drain valves.
5. See that valves controlling water column and pressure gages are in operating condition and open.
6. Open the water-feed valves to the boilers slowly for one or two turns. On boilers equipped with separate economizers see that the valves between the boilers and economizers are open.
7. Fill the boiler to about one gage.
8. Open the superheater drains.
9. Start the stoker and fill the grate about half way down with coal.
10. See that the change-over valve on the waterback lines is set for raw water.
11. Open the feed and discharge valves on the waterbacks.
12. See that "telltales" are open and discharging water and that the drains are clear.
13. Turn on the spray of the clinker crusher pit.
14. Open the stack damper.
15. Dig holes in the coal over the tuyères and put a shovelful of fire in each hole or use wood and oil-soaked waste.
16. Cover the fire with "green" coal.
17. Start both the induced and the forced draft fans slowly. Have the electrician inspect the motor-driven forced and induced draft fans before starting.
18. Adjust the stack damper to proper draft over the fire.
19. Apply proper blast on the forced draft.
20. Close all vents on the boiler as soon as steam escapes.
21. Note that the pressure gage is operating.
22. Raise from 30 lb. to 50 lb. pressure on the boiler.
23. Close the drain valves on the superheater. These valves may be left cracked until the boiler is about to go on the line.
24. Increase the speed of the fans for both induced and forced draft to such a degree as may be required.
25. Bring the boiler gage pressure up to from 150 lb. to 180 lb.
26. See that the drain valves between the main and automatic non-return valves are open.
27. Open the by-pass valve of the main stop-valve and blow out all water from the gooseneck between the automatic non-return valve and the main stop valve.
28. Close the drain valves.
29. Open the trap line valve above the automatic non-return valve.
30. Open the main stop valve and close the by-pass on the same.
31. Unlock the automatic non-return valve when pressure has risen to within 50 per cent of the line pressure.
32. Increase the stoker speed and air blast until the boiler begins to steam. Keep the fire as light as possible. The rate of increasing the blast and stoker speed is determined by how fast the boiler must be put on the line.
33. Set the change-over valve on the waterback line for condensate.
34. Inspect all boiler-setting doors and see that they are tightly closed.
35. Blow down both water columns to check the water level.

## Inspection of Rotating Electric Machines

GOOD electrical contact between brushes and commutator or slip rings is essential to prevent sparking and excessive heating. This can easily be obtained if the brushes are clean, free in the holder and under the proper spring tension and can, therefore, accommodate themselves to the surface of the commutator or slip rings. Very serious mechanical or electrical damage may sometimes be caused by small objects, such as bolts, nuts and screws left on or near a machine, which may be shaken down by vibration or drawn in by magnetic force. In the operation of all machinery one of the most important points to observe is to see that oil is properly fed to the bearings.

The acquiring of systematic habits in practice will go far toward preventing trouble and accidents, and the following rules abstracted from the operating code of the Philadelphia Electric Company should be of value:

INSPECTION BEFORE STARTING

1. Go over the machine carefully, inspecting alternating-current and direct-current brushes. See that they move freely in the holders, that they fit closely to the commutators and slip rings, that all connections are tight between brush holders, shunts and brushes, and that on rotary converters provided with brush-lifting devices the direct-current brushes, except the pilot brushes, are lifted off the commutator.
2. Examine all speed-limit devices and see that they are in proper operating condition.
3. Wipe off commutator, slip rings and brushes.
4. Examine the interior of the machine for foreign material and for visible damage to the insulation.
5. Remove all bolts, tools and foreign material which may have been left lying near the frame.
6. Examine bearing housings to make sure that there is the correct amount of oil in the wells and that the rings are free to turn.
7. Examine all switches to see that they are in proper position for starting.

INSPECTION AFTER STARTING

Immediately after starting and before putting on load examine all oil rings to make sure that they are turning over and carrying oil.

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## Simplified Rates a Good-Will Asset*

**Complex Schedules Irritate the Majority of Residential and Small-Power Customers—Specific Instances—The Question of Discounts**

BY A. S. PRATT
District Manager Stone & Webster, Inc., Boston

THE small house owner, the fellow who pays rent and the one who just lodges are quite fond of thinking of themselves as being more or less the "downtrodden" victims of the big business concerns and financial institutions on the street. When we enter upon a discussion of public relations these men come into their own, for they constitute the one important factor to be considered. In so far as the public utility is concerned, the financial and business sentiment of a city is likely to be relatively unimportant—if, in fact, it is not already sympathetic because of its better understanding of big business—but the chap who is so gleefully pictured by the "reform" newspapers as of the "common peepul" is the man whose tolerance and consideration we must win. And so our most important field for missionary work is that occupied by the residence lighting user and the small power consumer.

For a number of years the national associations and many companies have directed a very earnest and expensive campaign toward teaching the housewife and her husband the significance of a kilowatt-hour, and some even more optimistic and ambitious crusaders have still further refined their educational program by dilating upon the advantages of comprehending a watt. Possibly the progress made by those who have labored so long and heroically along this line has been satisfactory, but we might pause and ask "What of it?" What particular advantage is it to us for Mrs. Jones to know what a kilowatt is? She doesn't buy kilowatts and she doesn't use them. She does buy heat and light. Perhaps all of this is of no importance except to illustrate the angle from which a great industry may approach a desired objective. Apparently it has thought it necessary to force upon Mrs. Jones its own arbitrary terms rather than to permit her to be happy and contented in the use of her own. In any event it has not been notably successful. In the beginning it would have been far easier to have fitted our performance into the customer's requirements and mental state than has been the attempt to force him to fit his to our own.

### SOME RATES TOO COMPLEX

Some of the industry's rates are too complex. No doubt the various factors which enter into them are justified from the engineer's viewpoint, but the fruit grower who sought to sell peaches to the housewife at so much for the first "gazook" plus a service charge plus a charge because she didn't buy last week plus a half-dozen other factors of which she knows nothing and whose real existence she doesn't concede would carry his peaches home with him when the day came to a close.

Probably our busines is not so simple as selling peaches, but we might find it profitable to make it as nearly so as possible. Any rate other than a perfectly simple one contains elements of mystery to the consumer, and any human being is suspicious of anything he cannot understand. Perhaps much thought could be profitably expended in contriving simple rates which will bring in the revenue. that a scientific analysis of conditions determines necessary, but which will be expressed in more or less general terms.

Not long ago a central-station company had occasion to seek an increase in its lighting rates before a city council. The rate expressed its intentions in the ordinary electrical nomenclature. The people were willing that an increase of some sort should be established, but would not accept the one proposed. After much fruitless negotiation and delay a committee of customers came before the city council with a rate schedule which it had prepared and which it was willing should be established. The company accepted it. It was a slightly higher rate than the company had proposed, but it was expressed in a manner that everybody could understand and every one was satisfied.

In a Western city the public became very much worked up over a lighting rate of 9 cents per kilowatt-hour which was locally in use. The agitation following a city election resulted in a situation where the city undertook to do its own retailing, purchasing energy from the old company at approximately 2 cents per kilowatt-hour. Under city management the ostensible rate became 3 cents, but it started off with a flat annual charge varying from $20 to $50. Actually it works out that the people are paying in the vicinity of 11 cents per kilowatt-hour but they are perfectly happy. The figure which really sticks in their minds is the 3 cents, and they appear able to forget the flat advance charge. Incidentally, the company is more prosperous than formerly, so every one is satisfied. Almost any resident of this city will descant upon how much cheaper lighting is than formerly.

Another company changed from the usual rate structure to one wherein cubic-foot content of used rooms is apparently the principal factor, and by so doing slightly raised its rates. This broke the back of an agitation for lower rates which threatened the utility's occupation of its field. This rate was actually more complex than the one it replaced, but it had the merit of being expressed in familiar terms. There are in existence in not a few com-

*From an address before managers of Stone & Webster properties.

panies small-power rates which are so complicated that it would embarass many managers if they were asked to interpret them without prolonged study. Such a rate cannot possibly have an effect on the customer other than to weaken his confidence in the utility. He can never feel sure that he is paying only for that which he has used.

Large-power rates do not have the same effect on public relations as do the small-power tariffs.

A discount for a prompt payment of a bill is not a discount in any sense of the word. It is a roundabout and legal way of imposing a penalty for delayed payment. One of its disadvantages is that it is the gross rate and not the net which is fixed in the public mind when any discussion of rates is before it. One company has, for example, a gross rate of 10 cents for lighting, with a prompt payment discount of 25 per cent. Therefore the net rate is $7\frac{1}{2}$ cents. Yet customers do not think of the rate as being the latter figure; it is always 10 cents in newspapers and elsewhere.

#### Abolishing Discounts

Some interesting experiments are being made in abolishing discounts. One company did this and in this way obtained a "chocolate-coated" rate increase. Of two others which have tried it, one reports that the change has made no material difference in collections, while the accounting department of the other questions the wisdom of the change while volunteering the information that collections appear to be pretty good so far. The advantage is that the abolition of the discount will make the rate appear to be lower and the consumer who fails to pay his bill on time is not penalized, as he generally believes, unjustly.

## Dayton Company Rescues Municipal Plant

TROY, Ohio, has a municipal electric light plant and this plant has had more than its share of troubles. It has in the past few years encountered everything from inadequate equipment to internal dissension, and the citizens of Troy have suffered and lost money.

Recently the new plant which the municipality had been trying to make go this year gave up and quit. The system of the city of Piqua is owned by the Dayton Power & Light Company, and A. J. Patrick, the superintendent at that place, learned of the neighboring city being in darkness and communicated with the Dayton office to know whether it could help Troy out. O. H. Hutchings, general manager of the Dayton company, made the connection in a few hours by installing two 500-kw. transformers, building a line and stringing wires, crossing a railroad right-of-way underground with 33,000-volt conductors and building an outdoor substation and connection in Troy.

The city of Troy has spent approximately $300,000 on a plant, and the whole undertaking now appears to be a sorry mess.

# The Banker's Side of Customer Ownership

### Co-operation Between the Utility Company and Local Banks in Public Offerings of Securities Develops Good Will and Makes Financing Easier

WITH the increasing sale of public service company stock to customers and residents of the community served the attitude of local bankers is frequently a matter of concern to utility executives. At times the banker has looked somewhat askance at a customer-ownership campaign, for he felt that the utility company was encroaching too much upon his field. Again, when a drive for the sale of stock got under full swing, depositors have made rather heavy withdrawals from their bank accounts to purchase the stock, which, in the aggregate, temporarily disturbed the equilibrium of the banks' cash deposits. As a matter of fact, customer-ownership has always proved beneficial to the community by keeping investment money at home and forestalling wildcat speculation, encouraging thrift and, in the long run, increasing the deposits and business of the local financial institutions.

Most bankers, however, are far-sighted and therefore eager to cooperate with a company in customer ownership. They feel, and rightly, that they have a vital interest in every industry and business project of the community. The bankers' viewpoint was set forth in a most interesting manner by Robert Neill, vice-president of the Hot Springs National Bank, at the convention of the Arkansas Public Utilities Association in that city on Nov. 7-9. His statements are particularly pertinent and merit serious consideration by central-station officials when laying out a program and preparing the ground for the sale of securities locally. Pointing out that the local utility stock is a logical form of investment for its customers, Mr. Neill said:

The discriminating public, while not always capable of analyzing balance sheets and earning statements, is inclined to invest in the things it knows something of, or at least of which it thinks it knows something, and it seems to me therefore that those concerns which serve the necessities of our every-day lives in these modern times come most readily to the minds of people who have a surplus and are looking around for a suitable investment. With our vanishing supply of firewood and bad labor conditions holding back coal production, gas and electricity are the only dependable sources of heat and light, and in this day, when rapid transportation facilities are imperative, I class these with food and raiment as our first necessities. You who are in the business of bringing these supplies to your respective communities should receive your public's first consideration when you have something to offer in the way of investment.

The theory of profit sharing with employees in vogue in many of the industrial and manufacturing establishments of the country had its inception in the desire of the employer to get the benefit of a psychic feeling in the minds of his workmen that they were partners in his business. The same rule, broadened somewhat, is workable with the public you serve. Give them an opportunity of investing in your company to some extent, and they will have a personal interest in the well being of that company and assist in molding a favorable public sentiment toward your enterprise and organization.

#### Let the Banks Join in Selling Stock

Some of the largest stock issues of recent times have been disposed of on this plan, and in its ramifications the local banker should not be overlooked, for he helped finance all your projects at some stage of their development and perhaps took a chance with some of you which led to your success. The bank, as a rule, expects to be the custodian or depository for the funds of its public only for that period when a profitable investment may not be had, except, of course, as regards its active commercial accounts and those who are satisfied with the comparatively low returns of savings-bank interest. There is, however, a very comfortable proportion of the average bank's funds made up of deposits which are comparatively inactive, and these are the bulwark of the bank and its earning capacity.

When a utility corporation sets under way a program of permanent, or even temporary, financing in a public offering, that offering makes an appeal to the owner of this inactive bank account.

who proceeds to invest, sometimes seeking the advice of his banker and at others giving his check without explanation or comment. When your country banker sees his deposits going out in this channel it makes an impression. Therefore, I say that the course of some corporations which had stock issues to market of first interviewing local bankers and securing their co-operation in making sales, even at the expense of allowing a small brokerage, discloses good judgment. This is giving some measure of recompense for the banker's loss and is worth the cost to the corporation in good will. That may sound like the devil's theory that every man has his price, though I do not consider it so, for we all like to feel that we are getting an even break in all our business and commercial dealings.

Branch banking is rather irrelevant to the subject, but at this point it seems apropos to say that the individual, locally owned banking organization has been the cause of the rapid development of this big country of ours, and while no doubt this argument of centralized power, consequently cheaper power, applies logically to your line of business, I submit that it does not to mine. I confidently believe that a banking institution controlled and officered by individual residents in and conversant with their locality can much better serve that community than could the branch of some large bank operated by executives at a distant point who are not in sympathy, perhaps, with local plans and ambitions. The enlargement in the amount of money under the control of such an organization would not necessarily mean cheaper money, the probability being that your locally controlled bank would loan for local purposes more liberally in amount and rate than would its big rival.

What chance would a local utility have in securing help and co-operation in a local flotation of securities with a branch office of a non-resident banking institution? This is the application of branch banking to the subject in hand.

### An Endless Chain of Prosperity

Any increase in the income of your utility due to legitimate causes means an increase in the banking business in your town. If you have to lay new mains or build new lines to serve new patrons in a new district, that means so many more people to earn and spend with your merchants and to deposit in your banks. An increase in power sales means another industry started which will furnish employment to more men to earn money to put in channels of trade, whence it gravitates to the banks.

It is an endless chain. The more general prosperity the more prosperous is the bank serving this community, for the bank which does serve its community makes its loans in such lines as will tend to build up and increase business and population, and it usually takes its losses with its community when business goes wrong and periods of depression set in.

Harmonious co-operation of component parts is necessary to make a smooth-running machine of any kind, and the banking interest is perhaps in the same boat with the public utility interest in that we are neither to be classed primarily as producers and are not therefore indispensable; for you know there was a time when there were no banks and folks carried their money in belts and there was a time when you had to use a pine torch or a tallow candle to make your way afoot to the stream where you quenched your thirst or took your bath. But who wants to live in those times again?

Having this community of interest, therefore, I believe even closer co-operation between banking and utility lines will be mutually advantageous, it being perhaps possible to reach the condition where financing will be done through your banker rather than through your broker or underwriter.

## Good-Service Publicity Bears Fruit

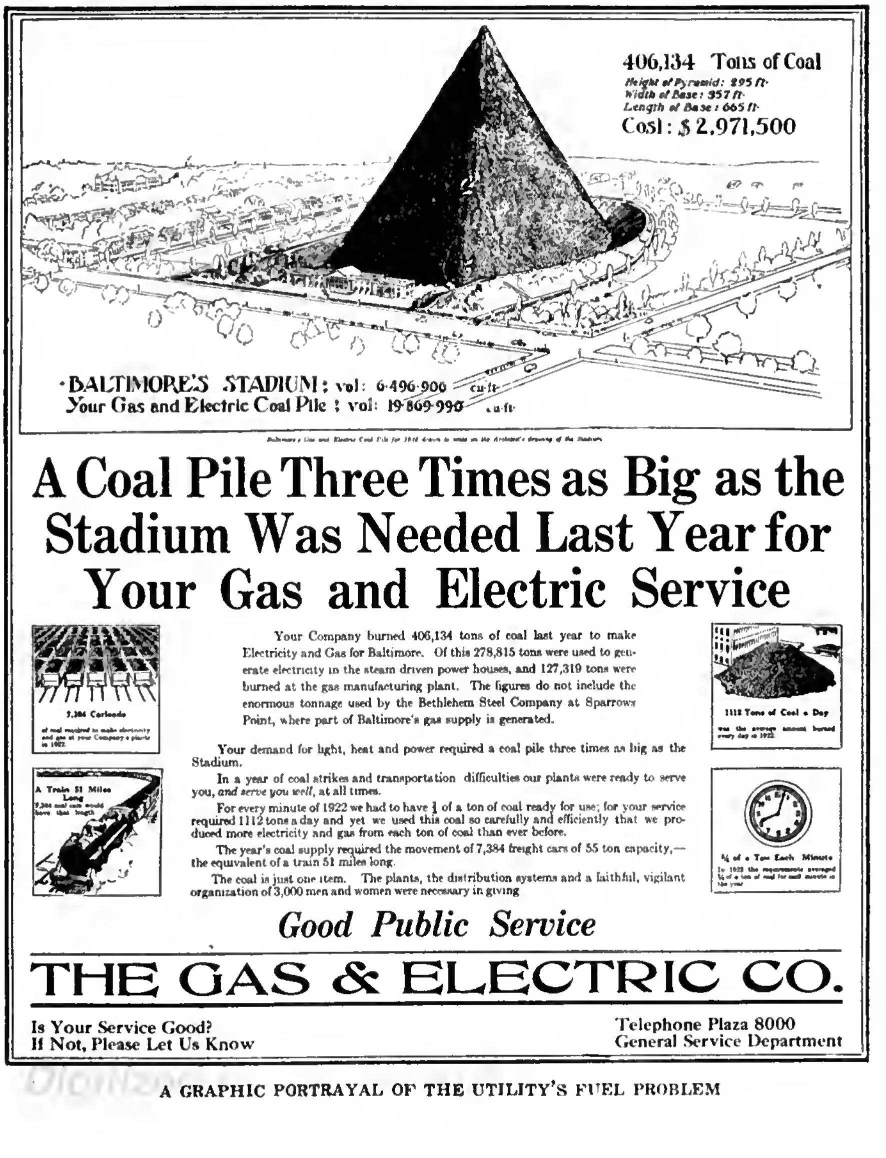
As a MEANS of acquainting its customers and the public with the different phases of the work required to maintain a high standard of service, the Consolidated Gas, Electric Light & Power Company of Baltimore has for some time been running full-page advertisements which illustrate and explain many outstanding features about the company. One of the most interesting of the series, one which is particularly timely during the present coal stringency, is shown here. It gives a graphic picture of the company's fuel problem and visualizes to the public the magnitude of its operations.

All of the advertisements are written around the slogan "Good public service," and each carries the inquiry, "Is your service good? If not, please let us know." A most gratifying response to this effort to improve the service is seen in a letter from a customer which was published as one of the advertisements after the customer's permission had been obtained. Under the caption "One of Our Customers Writes a Public Service Advertisement" the letter read:

*The Gas & Electric Company:*

Gentlemen: Two men were discussing the series of "Good Public Service" advertisements now being published by the Gas & Electric Company. The suggestion was made that in covering the larger aspects of service the little items be not overlooked.

It is, of course, right to talk about the wonderful electric turbines on the Susquehanna and the high-power cable transmission line that brings the energy to Baltimore, but all this great equip-




A GRAPHIC PORTRAYAL OF THE UTILITY'S FUEL PROBLEM

ment is valueless temporarily to the householder whose fuse blows.

It may seem to be just a matter of routine to be able to go to your telephone at any hour, as I did, and tell the company your lights are out and have a man at your side door, as I did, to fix the trouble in a few minutes, but it is more than that.

It is an evidence of the determination of the company organization to help in the little things for which there is no charge as well as in the more important service that shows on the monthly bill.

A burned fuse may not be important to the company engineers, but they know it is important to the family in a home gone suddenly dark with company at dinner, and they have organized to take care quickly of big-little emergencies like this, just as they have prepared to meet more serious accidents that might interrupt "good public service." A SATISFIED CUSTOMER.

Here is evidence indeed that the customer has gained a fuller understanding of the Baltimore company's business, and it shows the possibilities for building good will where the utility takes the pains to put its story honestly before the public.

## Boston League Launches Electric Home

COINCIDENT with the organization of the Boston Electric League plans were approved for the establishment of an "electric home" group under the auspices of the central-station, jobbing and contracting branches of the industry in eastern Massachusetts. H. B. Gilmore was elected president of the league, Frank S. Price vice-president, Welles E. Holmes secretary, R. M. Miller assistant secretary and Rockwell C. Tenney treasurer. Fifty-three electrical men pledged their support to the league and its work. Committee chairmen elected were: Publicity, L. D. Gibbs; wiring and illumination, I. L. Matson; appliances, K. L. Norris, and house manager, W. J. Freethy.

The Boston "electric home" project is being conducted through the co-operation of prominent real-estate men and house-furnishing firms with the league, and it is planned to open the first home in Newton, Mass., April 14 and to exhibit it until May 5 on weekdays, for subscribers from 10 a.m. to noon and for the public from 2 to 10 p.m. The home is to be run on a purely educational basis, without distinctive identification or demonstration of appliances. Other homes will be established later in other places in eastern New England.

## A Decisive Victory for the Electric Truck

BACK of the accompanying advertisement offering at auction the complete delivery equipment of a baking company is a most convincing piece of evidence of the superiority of the electric truck for city delivery. As stated in the advertisement, the equipment was disposed of because the owner, the Wagner Pastry Company, Newark, N. J., was changing to electric trucks. This move is largely the result of missionary work and co-operation on the part of the electric vehicle department of the Public Service Electric Company in Newark, and R. R. Young, new-business agent of the company, in telling of the change-over says:

**AUCTION OF DELIVERY EQUIPMENT**

**DON'T FORGET ON DECEMBER 15**

WE WILL SELL FOR THE WAGNER PASTRY COMPANY, NEWARK, N. J., AT PUBLIC AUCTION, WITHOUT RESERVE, TO THE HIGHEST BIDDER, THEIR ENTIRE DELIVERY OUTFIT OF HORSES, WAGONS, HARNESSES AND GAS AUTOMBILES, ALL IN FIRST-CLASS CONDITION, ON ACCOUNT OF THEIR CHANGING TO ELECTRIC TRUCKS, ON FRIDAY, DECEMBER 15, 1922, AT 10 A. M., AT THE COMPANY'S STABLE, VESEY STREET, NEWARK, N. J., CONSISTING OF—

57 Horses
7 Mules
32 Top Wagons
1 Concord Buggy
2 Double Trucks
14 Sets Single Harness
21 Sets Double Harness
90 Collars
1 Set New Single Harness
1 Horse Swing
1 Oat Crusher
Blankets
Stable Utensils

6 1922 1-Ton Ford Trucks with Bodies.
2 1922 1-Ton Ford Truck Chassis.
4 1922 ¾-Ton G. M. C. Truck Chassis.
3 1922 ¼-Ton G. M. C. Trucks with Bodies.
7 2-Ton Pierce-Arrow Trucks with Bodies
These Cars are all in first-class mechanical condition.

**The Vogel & Schonfeld Commission Stables**

H. M. VOGEL, Prop. JOHN S. WILLIAMS, Auctioneer

For Particulars Phone Market 8793

ELECTRICS DISPLACE GAS TRUCKS AND HORSE-DRAWN WAGONS

"The Wagner Pastry Company is purchasing 177 electric trucks, which, so far as we know, is the largest single order that has been placed for these vehicles. They are to supersede the gasoline trucks and horse-drawn vehicles used by the baking company on its delivery routes, which now cover a total of 3,500 miles daily.

"The Wagner Pastry Company first began to experiment with electric trucks about fifteen months ago, when it ordered six wagons from the Commercial Truck Company and several of other makes. These were tried out on all of the company's routes. To prove beyond a doubt that electric trucks would be satisfactory the tests were continued for fifteen months. The results proved that electric trucks are more satisfactory than any other type of delivery equipment.

"The trucks were used for a whole winter, careful records being kept of the various items of cost. W. J. Bittles, president of the Wagner Pastry Company, stated: 'We expect to save $100,000 a year with 70 of these trucks at our Newark plant, where they will replace an equal number of gasoline trucks and wagons.'"

Data covering the tests and performance of these trucks, with which it was decided to replace all of the gas trucks and horse-drawn wagons, will be published in a later issue of the ELECTRICAL WORLD.

## What Other Companies Are Doing

**New York City.** — Results of a census of electric signs by the New York Edison Company shows that there are 9,577 electric signs along Broadway and all other streets in the five boroughs of New York. More than a million lamps of various kinds are used in these signs. Of these lamps 947,623 are the 10-watt size.

**Fitchburg, Mass.**—The Fitchburg Gas & Electric Light Company, F. S. Clifford, sales manager, sold 400 table, bridge, floor and boudoir lamps during the year just ended and a total of 1,381 other major appliances which are estimated to add about 71,000 kw.-hr. to the system's output per year.

**Hartford, Conn.**—Appliance sales of the Hartford Electric Light Company for 1922 totaled about $155,000 against about $107,000 for the preceding year. January, 1923, sales ran about one-third ahead of the corresponding month last year. Improving industrial conditions, active merchandising effort and a rate composed of an area charge and a 6-cent energy charge have all been factors in the above results.

**Vancouver, B. C.** — To the Oak Bay district, served by the British Columbia Electric Railway Company, goes the honor of serving the first permanent entire electrical home. This place is not for demonstration purposes, but for ordinary occupation. The residence is a bungalow which, besides having an all-electric kitchen, is completely heated electrically. The connected load is approximately 25 kw.

**Springfield, Ill.**—During the five weeks ended Dec. 30, 1922, the Central Illinois Public Service Company gained 650 electric customers, sold merchandise to the amount of $49,861.01, connected to its lines 351 kw. of lighting load and 1,963 kw. of power load and contracted to serve 7,199 kw. of additional power load.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Comparing Value of Power-Plant Fuels.*—G. M. LEVY.—A graphic method of computing cost of steam generated with oil or coal as fuel is described. Three charts are included for determining the cost of steam with various fuels, steam costs for varying efficiencies, heat values and coal costs, using both 2,000 lb. and 2,240 lb. as making a ton of coal.—*Power Plant Engineering*, Dec. 1, 1922.

*Modern Boiler-Feed Regulation.*—E. W. NICK.—A regulator that feeds a boiler continuously as long as it is under load, but at the same time lowers the water level during peak and overloads so as to increase the steaming capacity and during subnormal and no loads raises the water level so as to conserve the energy which would otherwise be wasted is the subject of this article.—*Sibley Journal of Engineering*, November and December, 1922.

*Furnace Maintenance with Pulverized Fuel.*—M. W. ARROWOOD.—The effect of imperfect mixing in causing overheating of brick surfaces, abrasion of eddying currents, efficient firing and maintenance are points in connection with the pulverized-fuel system that are discussed in the article.—*Iron Age*, Dec. 21, 1922.

*Combustion of Bituminous Coal.*—R. REDDIE.—The author discusses in a practical manner boiler-furnace material, the action within the furnace during combustion, elementary chemistries of combustion, etc.—*National Engineer*, December, 1922.

## Generation, Control and Switching

*Electric Generator Troubles.*—R. L. TULLIS.—Failure of the power and light generating equipment of a large institution with its own power plant sometimes calls for quick thinking and action on the part of the engineer. Some of the most common troubles that arise and methods for overcoming these are described. — *National Engineer*, January, 1923.

*Causes of Reversed Polarity in Direct-Current Generators.*—CLARENCE LYNN.—A number of conditions that may cause reversal of polarity, with methods for correction, are discussed.—*Power*, Jan. 9, 1923.

*The Applications of Relays.*—L. A. TERVEN.—The most common method of protecting alternating-current apparatus against internal faults is by means of current overload relays. This is really an application of the differential current relays, where the current entering a transformer and leaving it is made to pass through a relay which trips out the circuit when there is an unbalance within the transformer. The general application of this form of relay for various types of electrical apparatus is described.—*Electric Journal*, December, 1922.

## Transmission, Substations and Distribution

*Corrosion of the Lead Sheaths of Cables by Water Seeping Through Concrete.*—G. C. BUNKER and A. H. KHACHADOORIAN.—The cost of the repairs to the control cables at the Miraflores locks of the Panama Canal is large enough to call attention to the breakdowns and damages liable to result to unprotected cables installed in damp locations in concrete-covered duct lines and to merit a careful study of the conditions of each installation so that similar failures may be avoided. To prove that the water in the lock chambers, after dissolving lime salts from concrete, would attack lead several laboratory experiments were made, the results of which are narrated.—*Journal of the Worcester Polytechnic Institute*, November, 1922.

*Full and Semi-Automatic Versus Manual Operation for Substations.*—C. M. DAVIS.—A statement of the principles involved, showing that the interurban railway application is simpler than the urban, but that labor, feeder copper and incidental savings in general more than offset the fixed charges on the additional investment, is the most important part of this paper, presented at the annual meeting of the Central Electric Railway Association, Louisville, Jan. 18.—*Electric Railway Journal*, Jan. 27, 1923.

*A Low-Voltage Cathode-Ray Oscillograph.*—J. B. JOHNSON.—In the new type of Braun tubes low-voltage operation has been obtained by the use of a Wehnelt cathode as the source of electrons, so that the lower limit of voltage is set by the effect of the electrons on the fluorescent screen and not by the voltage needed to obtain the electrons. The tubes are designed to operate at 300 volts to 400 volts.—*Electrical Communications*, Vol. I, No. 2.

## Units, Measurements and Instruments

*Magnetic Observations by United States Coast and Geodetic Survey in 1921.*—D. L. HAZARD.—A comparison of the declination results obtained at repeat stations throughout the United States, Alaska, Hawaii, Porto Rico, the Virgin Islands and Siberia during 1921 is given. The results of earlier observations in the same localities are presented in table form. The investigations indicate that in the past few years there has been little change of declination in the southwestern part of the country and a decrease in the northwestern part.—*Serial No. 205 of the United States Coast and Geodetic Survey.*

## Illumination

*Recent Developments and Modern Requirements in Street Lighting.*—H. T. HARRISON.—In a paper presented before the British Illuminating Society the author refers to the great importance of good public lighting in promoting order and safety in the streets. The burden of rates is one reason why progress has been delayed, but improved street lighting need not always be at an increased expenditure. He also pointed out that the classification of streets on the basis of minimum horizontal illumination by joint committees on this subject in England and the classification by the street lighting committee of the N. E. L. A. were in close accord as to the amount of light. —*Electrical Times*, Dec. 28, 1922.

*Equipment to Improve the Lighting of Homes.*—P. C. KELLER.—The problem of lighting homes already occupied is radically different from that of designing proper illumination for a house in course of construction. This article presents a survey of suitable equipment with suggestions for simple demonstrations to show the advantage of good practice as compared with bad, and it pictures equipment suitable for carrying on this work.—*N. E. L. A. Bulletin*, January, 1923.

## Motors and Control

*Applying the Electric Motor to the Pulp Industry.*—GORDON FOX.—The heavy machinery used in the manufacture of pulp for paper making is well adapted for motor drives. A detailed description of these drives is given.—*Power Plant Engineering*, Dec. 1, 1922.

*Determining the Performance of an Induction Motor Without Plotting a Circle Diagram.*—G. T. SMITH.—A method is described for determining induction-motor characteristics that is easier than the circle diagram and has the added advantage that the accuracy of the result is not dependent upon reading values from charts. The method is in fact the circle diagram put into mathematical terms.—*Electric Journal*, December, 1922.

*Operation of Direct-Current Motors.*—E. C. PARHAM.—Features of application and operation, characteristics of different types and troubles encountered and their remedies are the chief points considered.—*National Engineer*, January, 1923.

*Production of Noise and Vibration by Squirrel-Cage Induction Motors.*—F. T. CHAPMAN.—A suggestion is made that the high-pitched notes emitted by some induction motors are due to a side pull arising from an unsymmetrical field which may be produced when cer-

tain numbers of rotor slots are used. A simple case is first considered and the dissymmetry shown, the forces produced being indicated and their effects considered. The motor field is analyzed, and it was found to include pairs of components such that in each pair the numbers of poles differ by two. *Institution of (British) Electrical Engineers*, December, 1922.

## Heat Applications and Material Handling

*Coal Handling and Electricity Supply.*—G. F. ZIMMER.—When coal is received by both railway and waterway the difficulty of handling is much greater than if coal is received at one source only. At the Blackburn (England) power station a novel traveling crane is employed that can either take coal from a barge or pick up railway cars bodily and empty them into the storage yard.—*Electrician*, Dec. 29, 1922.

*Electric Welding of Storage Tanks.*—Report of the American Welding Society committee, working with the American Bureau of Welding, on the specifications for the welding of a 5,000-barrel tank by the electric process. Specifications are included in the report.—*Journal of the American Welding Society*, December, 1922.

*Ferro-Alloys and Hydro-Electric Power.*—F. A. J. FITZGERALD.—The author contrasts the popular clamor for the benefits of cheap electricity from water power with the propaganda designed to discourage the reasonable use of such natural resources as Niagara Falls. Demand for ferro-alloys is increasing, and the question is raised as to where the great quantities of cheap electric power which are needed for the natural growth of the ferro-alloy industry are to come from. —*Iron Age*, Jan. 4, 1923.

## Electrophysics, Electrochemistry and Batteries

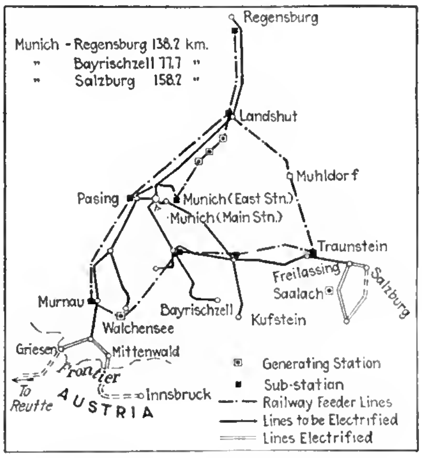
*Five-Wire Balancers for Charging the Batteries of Electric Vehicles.*—J. P. KEMP.—The advantages of the five-wire system for charging electric storage batteries are outlined. A table shows the cost of such a system as compared with the cost of an ordinary motor-generator set operating directly from 440-volt mains, and a detailed description is given of the five-wire system. The method of employing the balancer set is explained.—*Electric Vehicle*, November and December, 1922.

*Atomic Systems Based on Free Electrons, Positive and Negative, and Their Stability.* — R. HARGREAVES. — In the atomic scheme, of which a planetary system is the model, negative electrons have the position of planets and a positive charge is condensed at a central nucleus. It is then postulated from experience — chemical, electrical and spectroscopic—that the nucleus shall contain an integral number of standard charges. The question of how far these structures, regarded as representations of the atom, meet the demands from the various branches of physics and chemistry is a fundamental one to which the author devotes forty pages.—*Philosophical Magazine*, December, 1922.

*Vapor Recompression Systems for Evaporators.*—W. L. BADGER.—A technical history of regenerative evaporation, enumerating the advantages and shortcomings of this system, is given. This is followed by an analysis of recorded data on test runs, a critical discussion of the regenerative evaporating system with particular reference to the general theory of design and construction, comparison of operating economies with single and multiple-effect evaporators and a bibliography of patents and literature references.—*Chemical and Metallurgical Engineering*, Jan. 3 and 10, 1923.

## Traction

*Electric Traction in Bavaria.*—B. GLEICHMANN. — The electrified lines and proposed lines in Bavaria are shown in the accompanying illustration. Electric operations began in 1912 on the Mittenwald Railway, power being supplied at 50,000 volts from the Reutz works. The system adopted was single-phase at $16\frac{2}{3}$ cycles, with overhead-conductor pressure of 15,000 volts




ELECTRIFIED RAILWAYS IN BAVARIA

in conformity with the system used in other German states which have adopted electrification. The extensions since that time, working costs, sources of supply and details of system employed, as well as the advantages of the single-phase system used, are among the factors discussed.—*Electrician*, Jan. 5, 1923.

*Electric Locomotives for Norfolk & Western Railway.*—Four double-unit 4,000-hp. locomotives are under construction for the Norfolk & Western Railway's Elkhorn grade and electrified extension. These will supplement twelve lighter locomotives that have been in service since 1915. A general description is given of these locomotives, including the equipment that they will carry.—*Electric Railway Journal*, Dec. 30, 1922.

## Telegraphy, Telephony, Radio and Signals

*Characteristics of 5-Kw. Elwell-Poulsen Arc Generator.*—A. T. C. MOORE.—Tests were made on this type of generator to determine the distribution of transverse magnetic field in the air gap, the effect of magnetic field on the magnitude of the high-frequency current, and the relation of wave lengths to the high-frequency current, the generator operating with the field coils connected in series with the arc.—*Engineering*, Dec. 8, 1922.

*An Electron Tube Amplifier.*—P. D. LOWELL.—The apparatus described is an amplifier developed by the Bureau of Standards using a crystal detector and five stages of amplification, three stages of radio-frequency amplification and two stages of audio-frequency amplification. The tubes are energized from a 60-cycle supply for both filaments and plates. Circuit diagrams and values of condensers, resistors and inductors used are included.—*Scientific Paper No. 450 of the Bureau of Standards.*

*Calculation of an Antenna.*—F. PERRIN.—The author shows the way in which a somewhat unusual antenna was calculated for its mechanical strength and its electrical characteristics. The efficiencies of this antenna are then investigated mathematically for five different wave lengths.—*Revue Générale de l'Electricité*, Dec. 23, 1922.

## Miscellaneous

*Reclamation of Used Petroleum Lubricating Oils.*—W. H. HERSCHEL and A. H. ANDERSON.—Used lubricating oils may be reclaimed by apparatus already commercially available and thus saved for further use. Such reclaimed oils will pass all the commonly accepted tests for new oils, such as flash point, viscosity and sediment. It is often the case that high acidity is accompanied by readiness of emulsification, but exceptions have been found, so that the value of the test for acidity must lie in the possibility that an oil of high acidity will not prove durable in use. Important points discussed are the deterioration of lubricating oils in use, present methods of reclaiming used oils, tests with motor-oil purifier refining processes and the cause of sludge formation.—*Technologic Paper No. 223 of the Bureau of Standards.*

*Neon-Glow-Discharge Lamp on Alternating-Current Circuits.* — R. A. BROCKBANK and L. E. RYALL.—After giving the various characteristics of this type of lamp by means of numerous curves, the author suggests further experiments that should be carried on to determine future applications. Among these experiments would be a detailed study of the lamp for stroboscopic purposes at all frequencies, a study of the photometric properties of the lamp and experiments to determine the possibilities of its use for photographic purposes. — *Electrician*, Jan. 5, 1923.

# New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

### Theoretical and Practical Electrical Engineering

By Louis Denton Bliss. Vols. I and II. Washington, D. C.: Bliss Electrical School. 1470 pages.

This treatise includes a very complete discussion of the fundamentals and application of electrical phenomena. The descriptions are, in general, clear without the use of mathematics. A much larger range of electrical applications is included than in the usual textbook. A large number of illustrations are used to illustrate fundamental principles and wiring connections. Complete machines are illustrated as well as their constructional features. Historical facts are introduced in a manner to add interest.

There may be exceptions taken to a few explanations of certain features of electrical apparatus. In the treatment of generators the fact that field distortion is corrected by commutating poles is emphasized. This, of course, is not true except at the point of commutation. In a later discussion on commutating-pole motors this point is clarified. In describing three-wire generators with balance coils an incorrect statement is made, that the current in the outside wires is continuous while the current in the middle wire pulsates between points of maximum and zero value. Obviously any pulsation in current must be the same throughout the circuit and will be small as it is due to the varying resistance in the armature circuit and leakage reactance of the balance coil. The treatment of the transformer is very good in detail and introduces a more accurate conception of leakage flux than can be gained from many textbooks.

The subjects covered include static electricity, electric circuit, magnetic circuit, electromagnetic phenomena, wiring for bells, lighting, etc., measuring instruments and use of same, direct-current generators, boosters and motors, alternating-current principles (with the minimum of mathematics), alternators, transformers, synchronous motors, induction motors, synchronous converters with their modern developments, phase advancers, single-phase induction motors, and commutating motors both single-phase and polyphase.

Applications of electrical apparatus are also described, with the modifications for the particular application, including electric elevators, automobile engine ignition, starting and lighting, electric railways, communication and illumination. The power system is treated by a brief description of prime movers as well as an account of power transmission by various systems and power station protective and metering devices.

From the standpoint of instruction the questions at the end of each chapter serve to emphasize the important facts of the chapter. However, a larger number of numerical problems might be used to clinch certain facts.

The completeness and simple treatment of electrical phenomena should give these two volumes a definite place among electrical engineering literature, particularly for the man who has not been able to keep up with the development of modern apparatus or who has not been fortunate enough to have a college education. R. G. WARNER.

### André Marie Ampère, 1775-1836

A special issue of the *Revue Générale de l'Electricité*, dated November, 1922, is dedicated to the memory of Ampère. This elaborate publication of more than 300 pages contains nine chapters of a biographical nature dealing with the life and achievements of the great French electrophysicist. Then follows a description of the recent centennial Ampère festival in France, all the addresses being published. The second half of the book gives descriptions of the salient features of forty of the most important electrical generating centers of France. The first part of the book will be of great value to the historian and bibliographer, and the second part will serve as an excellent and up-to-date reference book on the existing electric systems of France.

### Principles of Electric Spark Ignition in Internal-Combustion Engines

By J. D. Morgan. London: Crosby, Lockwood & Sons. New York: D. Van Nostrand Company. 92 pages with diagrams.

This is not a book describing the construction and operation of electrical ignition apparatus, which fact makes it unique in the literature of electrical ignition. It presents the physical facts underlying gas ignition. The treatment is purely physical and descriptive, with an almost complete absence of mathematics.

The discussion covers such matters as gas characteristics (inflammability, rate and manner of flame propagation), spark characteristics (capacity and inductance components of spark currents), effects of sparks on gases, effect of spark-gap form on sparks and ignition, effects of inductance and capacity of spark generator and spark circuit, and effect of resistance leak across spark gap. The subject matter is in part a collection of information scattered through technical journals, but more largely the result of the author's own investigations. The presentation is pleasantly clear and comprehensible. Intended primarily for the designer of gas engines or ignition equipment, the book is of interest and value to any engineer who drives a car and is interested in its operation. W. B. HALL.

### The Lead Storage Battery

By H. G. Brown, A.M.I.E.E. London: The Locomotive Publishing Company. 162 pages, 60 illustrations.

The fundamental theory of the lead storage battery is very well set forth in this book and in terms that will be found quite clear to a reader not thoroughly posted in electrochemical theories.

In taking up the description of different types of plate and cell assemblies and various storage-battery applications, including details of installation and auxiliary apparatus, however, the book is practically limited to English practice. In many respects European practice is so different from that in this country that the descriptive matter is of little value and may in some cases be actually misleading to one who is looking for information in regard to storage-battery practice in the United States. For example, the discharge curves given in Fig. 7 on page 17 show final voltages which are considerably higher throughout the entire range of discharge rates than those which have been established as standard in this country. As another example, on page 27 the statement is made that the Planté positive is without a serious rival for stationary battery work. In this country the Faure, or pasted plate, has been almost universally adopted for standby service for the large standby batteries in central-station lighting systems.

In many places the descriptive matter reveals a prejudice on the part of the author in favor of the product of a particular manufacturing company, which is rather unfortunate in a book supposed to deal with the subject generally and from an unbiased standpoint

Some of the fundamental data do not appear to be quite correct, such as the curve given in Fig. 3, page 11, showing the variation of open-circuit voltage with acid density. The temperature at which this curve is intended to be used is not given, but if a temperature of 80 deg. F. be assumed, which will make the highest point on the curve correct, the rest of the curve is too high.

## Books Received

**Practical Tests for the Electrical Laboratory.** By Chesley H. Johnson and Ralph P. Earle. New York: D. Van Nostrand Company. 347 pages, illustrated.

**Engineering Economics.** By John Charles Lounsbury Fish. New York: McGraw-Hill Book Company. 311 pages.

**Rate Making for Public Utilities.** By Lamar Lyndon. New York: McGraw-Hill Book Company. 209 pages.

**Lehrbuch der Praktischen Physik.** By Friedrich Kohlrausch. Leipzig: B. G. Teubner. 802 pages, illustrated.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Reorganization of Northern Illinois Company

The Public Service Company of Northern Illinois on Feb. 6 announced the executive reorganization of the company to meet exigencies created by the death of Frank J. Baker, vice-president of the company. Samuel Insull resigned from the presidency to become chairman of the board with general authority over the company's affairs conferred by amendments to the bylaws. Britton I. Budd, president of the Chicago Elevated Railroads and the Chicago, North Shore & Milwaukee Railroad, was elected president; John G. Learned was elected vice-president in charge of the commercial and new-business departments, and Julius L. Hecht was made vice-president in charge of engineering and operation. Charles A. Munroe resigned as vice-president, but retains his position as a director and a member of the executive committee. John H. Gulick remains vice-president in charge of finances.

## Carrier Current in Operation at Hartford

One of the "wired-wireless" installations now being made by central-station companies as an aid to operation has, with characteristic enterprise, been put into use by the Hartford (Conn.) Electric Light Company between its South Meadow and Falls Village generating stations. This installation differs from others in that it is the first one to be made on a long rambling transmission line with numerous taps. A frequency of 13,000 cycles is used, and the sound wave is impressed on the 66,000-volt transmission line through a coupling wire which is about 1,000 ft. long and runs parallel to and within a few feet of the high-tension wires.

The transmitter contains two 50-watt tubes. When the microphone is spoken into, the voltage on the grid of the second tube, called the modulator, is varied. This in turn creates a much greater variation in the current flowing from the plate of this tube to the filament. Since the plates of the modulator and oscillator tubes are connected in parallel, the current in the plate of the oscillator will vary, and this causes a variation in the amplitude of the oscillations generated; in other words, the voice frequency is carried along with the carrier frequency. The receiving unit contains three tubes, a detector and two amplifiers. Different combinations of tubes may be used for receiving the calling and taking frequencies. The receiving tubes burn constantly and a switch is so connected that while one battery is lighting the filaments another one is being charged.

## News from the Capital

**Ford Bill Doomed — Radio Bill Meets Obstacle—Ratification of Colorado Treaty in Doubt**

ALTHOUGH the announcement by Representative Madden, the chairman of the appropriations committee of the House, that he regards it as desirable for Congress to accept Henry Ford's Muscle Shoals proposition did much to stimulate the flagging hope of the advocates of that proposal, the Washington correspondent of the ELECTRICAL WORLD reports that it apparently has brought the realization of those hopes no nearer. It is admitted that support from such a prominent member of the House of Representatives is a great asset to the advocates of the Ford offer, but it is an asset which will be of little service in this Congress, since it is conceded that no vote can be had in the Senate at this session. The bill, therefore, will die with the Congress on March 4.

The radio bill is in a very difficult position in the Senate. Its passage virtually depends on its receiving unanimous consent. This seems improbable owing to the fact that a number of Senators are insisting that action wait on an international agreement. Secretary Hoover, however, has taken pains to call attention to the fact that a recent federal court decision does away with every shred of authority which his department has been exercising over radio matters.

Doubt as to the ratification of the Colorado River compact by Congress at this session has been expressed by Secretary Hoover. Delay on the part of Arizona and Colorado in securing its ratification by their legislatures has precluded consideration of the compact by Congress so long that, in the face of the usual congestion of legislation at the close of the session, federal action, even if those states should take belated action, is endangered. Mr. Hoover emphasizes the responsibility which those states are assuming in delaying works of flood protection and those necessary to the utilization of the resources of the river. He points out, however, that failure on the part of the legislatures of Arizona and Colorado as now constituted in no way impairs the existence of the compact itself, which can be ratified at any future time.

## Edison Seventy-six Years Old Tomorrow

Tomorrow, Feb. 11, Thomas A. Edison will be seventy-six years old. There will be no celebration on Sunday, but on Monday the Edison Pioneers, composed of Mr. Edison's associates between 1885 and 1900 and the descendants of his associates before 1885, will hold their annual meeting and luncheon in the Edison plant at West Orange, N. J. Mr. Edison's presence at this luncheon is always an event of great interest to his old associates.

No special program has been arranged. Samuel Insull, president of the Edison Pioneers, will speak. John W. Lieb is chairman of the dinner committee, other members of which are C. E. Esterbrook of the General Electric Company, F. A. Scheffler of the Fuller Engineering Company of New York, vice-president of the Pioneers; William H. Meadowcroft, confidential secretary and personal representative of Mr. Edison, and Frank A. Wardlaw, curator of the Museum of Edisonia and secretary of the Pioneers.

## Radio Monopoly Debated in Congress

Just previous to the passage of the administration's bill for the control of radio, reported in last week's issue, a lively debate arose in the House of Representatives over the clause authorizing the Secretary of Commerce to refuse or revoke licenses in cases where a monopoly of radio transmission was threatened. Representative Jones of Texas led in an attempt to have the Secretary "directed" instead of "authorized" to revoke or refuse licenses in such cases and also to give to any one whose application had been refused or permit revoked or suspended the right to appeal to the courts, the Secretary's order to remain in force pending judicial decision. Mr. Jones declared that there was grave danger of a monopoly in the radio business by four great companies.

As named by Representative Jones in speaking to his amendment, these are the American Telephone & Telegraph Company and the allied Western Electric Company, the Westinghouse Electric & Manufacturing Company and the American Radio Corporation. In pursuing his remarks, however, he brought in also the General Electric Company.

The proposed amendments were defeated and the refusal or revocation of licenses because of monopoly was left to the decision of the Secretary.

## Miller's Quarter Century

**President Southern California Edison Receives Congratulations on His Twenty-five Years' Service**

A BANQUET long to be remembered by those in attendance was given at Los Angeles last week to John B. Miller, president of the Southern California Edison Company, in celebration of the completion of his twenty-fifth year of service with that company. The event, which was participated in by three hundred executives, engineers and district managers of the company, served to drive home again the ideal of service that has made possible the building of this company's great network. G. C. Ward, vice-president in charge of operation and construction, speaking at the banquet, delcared that this ideal was what had made possible the budget of new expenditures for 1923 of $26,000,000 and the coming drive for an additional connected load in the present year of 100,000 hp. or more.

Vice-president S. M. Kennedy read a score of congratulatory letters and telegrams from leaders of the electrical industry, among them Thomas A. Edison, C. A. Coffin, Frank W. Smith, Joseph B. McCall, Charles L. Edgar, Samuel Insull, W. E. Creed, John A. Britton, H. M. Byllesby and James H. McGraw.

Roy V. Reppy, chief counsel of the company, said Mr. Miller had "built not only physical transmission lines, but a human co-operative association that with its high ideals, its loyalty and its enthusiasms has shown to the people that a corporation is indeed possessed of a soul." Vice-president W. A. Brackenridge presented the twenty-five-year service button to Mr. Miller, saying that it was a symbol of the untiring effort he had displayed in behalf of the public.

### TRANS-ROCKY MOUNTAIN PROBLEMS

Mr. Miller in his response told his hearers that west of the Rockies lay 70 per cent of the undeveloped water powers with only 8 per cent of the industry of the nation. He said his vision had been to transport the industrial scenes of the East, where 42,000,000 hp. developed by steam is now used, to the West coast, where lie such vast untouched water powers.

Referring to the subject of the Colorado River and its development, alluded to in the congratulatory telegram of James H. McGraw, Mr. Miller said: "I am glad that the subject of the Colorado has been alluded to this evening. We do not as yet need the Colorado, but we stand ready to go into the Colorado if permitted to do so and carry out this great work. We are now doing work of equal magnitude, and should we undertake this development we should like to proceed in the same way we have proceeded in the past. We should like to have as partners all the people of the Colorado River Basin. We believe that such a system of development works the highest justice in economic service to the consuming public, to the employees and to the investor."

R. H. Ballard, vice-president and general manager of the company, presented to Mr. Miller a painting of a California hillside, a gift to the president from the eight thousand employees of the company.

## Ten-Year Program Beginning in Southern California

The first step in the ten-year construction program of the Southern California Edison Company, the final cost of which is estimated at $375,000,000, will be the erection of a substation in the Vernon district of Los Angeles to serve as a distributing center for power brought from the Big Creek developments. The substation, to be known as the Laguna-Bell terminal station, will have a rating of 160,000 hp., will be of the outdoor type and will cost approximately $2,000,000. Work will begin in the near future. The structure will be of the most modern type and will receive power over a new extension of the Big Creek transmission line. The connection will be made by a trunk line, 30 miles in length, which will join the main trunk line at Eagle Rock.

According to George C. Ward, vice-president in charge of construction, the entire construction project, when completed, will develop in the neighborhood of 1,250,000 hp. The power will be distributed to most of the counties in southern California.

## Solid Building Justified

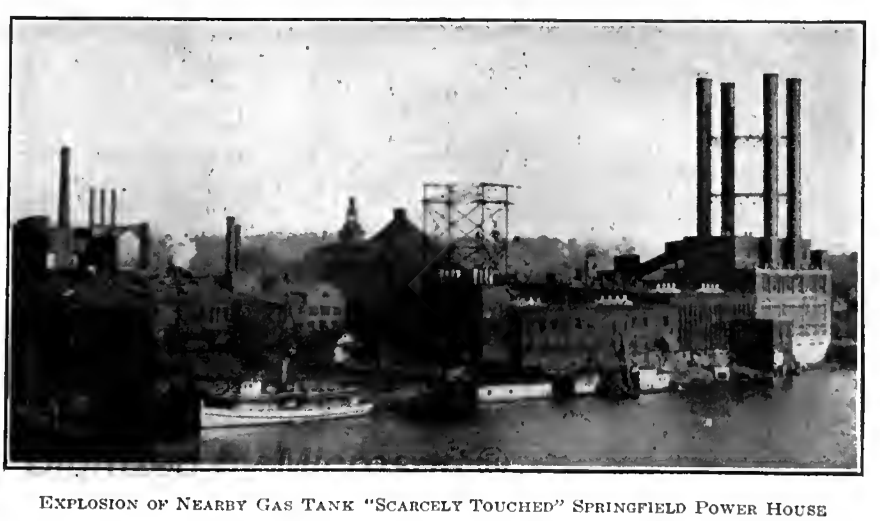
**Springfield (Mass.) Central Station Unscathed When Adjacent Gas Tank Explodes**

ELECTRIC service at Springfield, Mass., sustained no interruption and the property of the United Electric Light Company, the Springfield Street Railway, the Turners Falls Power & Electric Company and the New England Telephone & Telegraph Company escaped serious damage when a purifying tank at the works of the Springfield Gas Light Company exploded in the early afternoon of Feb. 1, although three persons were killed in the disaster, about a hundred injured and downtown property suffered an estimated loss of $500,000. The main steam plant of the United company is on the east bank of the Connecticut River within about 75 ft. of the gas plant, a recently completed boiler house and switch house facing the main line of the New York, New Haven & Hartford Railroad which divides the two properties. About 55,000 kva. in generating equipment is in service and the boiler plant is surmounted by four steel stacks 197 ft. high, supported on the framing of the building. In the switch house are the operating headquarters of the United system, and a 66,000-volt interconnection with the Turners Falls system spans the river at this point, terminating on a steel structure at the top of a transformer house at the north end of the station.

The explosion destroyed 90 per cent of the windows of an older portion of the station and several in the newer section, bulged out a portion of the old boiler-house wall no longer used; showered the office of the chief engineer with glass and covered a rotary converter with fragments. Windows were destroyed at the main office of the company 600 ft. up the street.

### SERVICE UNINTERRUPTED BY EXPLOSION

The solid construction of the boiler house and switch house completely safeguarded the employees on duty, and the service was not interrupted by the opening of a single circuit breaker. Many of the principal lines of the underground service pass the gas company's plant. The mechanical shock of the explosion caused a slight movement of recording-instrument needles in the switch house. The turbo-generators in operation showed no sign of bearing temperature rise when observed closely for eight minutes after the disaster. McClintock & Craig, Springfield, designers of the boiler house, made an immediate inspection of the plant after the explosion and reported no structural damage to either building or stacks. The switch house was designed by Stone & Webster, Boston, and went through the test equally well.



EXPLOSION OF NEARBY GAS TANK "SCARCELY TOUCHED" SPRINGFIELD POWER HOUSE

## Commonwealth Edison Plan

### Samuel Insull Tells of Power House Soon to Be Erected on the Drainage Canal

TRUE selling engineering plus true distribution engineering was declared by Samuel Insull, in the course of an address made at Chicago before the Western Society of Engineers on Thursday evening of last week, to be the basic reason for the growth of the Commonwealth Edison Company. Mr. Insull's address dealt with central-station development in Chicago from 1892 to 1922 and thereafter. After giving a historical account of the building and growth of the company's earlier stations, he came to the Calumet plant, started in 1920, which by the end of 1923 will have a rating of 200,000 kw. The growth in demand has been so great, however, that the company is now compelled to build on an even larger basis. The new plant to be erected at Crawford Avenue on the Drainage Canal will develop at least 400,000 kw., although the possibilities are that the final capacity will be 600,000 kw. The first two units will have a rating between 90,000 kw. and 95,000 kw., operating at a steam pressure of about 600 lb. The first unit is to be purchased from Charles Parsons of England, while the second will be a Westinghouse unit.

#### EFFICIENCY OF CALUMET PLANT

Referring to the increased efficiency and fuel economy obtained in the Calumet plant, which operates on 1.8 lb. per kilowatt-hour as compared with the old Adams Street plant, which required 12 lb. of coal for one kilowatt-hour, Mr. Insull declared that if economy had not been improved in the last thirty years, the annual consumption of the Commonwealth Edison Company would now be 15,000,000 tons to 18,000,000 tons of coal instead of the present consumption of 2,225,000 tons to 2,500,000 tons. This improvement has not been due merely to the increase in steam pressure but has been assisted by the use of condensers. With 400 tons to 450 tons of water pumped through the condensers for every ton of coal burned in the furnaces, the Commonwealth Edison Company pumps more water than the city of Chicago uses for all other purposes.

Estimates on the construction of a transmission system from Waukegan down to the Indiana line involve two 132,000-volt transmission lines with a capacity of 75,000 kw. each, Mr. Insull informed his hearers. Although this transmission line would cost approximately $7,500,000, it would safeguard continuity of service and save a station investment of from $10,000,000 to $12,000,000.

Mr. Insull felt that the fundamental reason for the success of the company was selling large volumes of energy. By distributing 50 per cent more energy and receiving for it one-fifth less money the company was able to make more profit on the dollar invested, he contended, than has been the case with any other large electric light and power company elsewhere in the world.

In closing the speaker paid a tribute to Frederick Sargent, who, he said, had, as a designing engineer, contributed more than any other man toward the development of central stations.

## Empire State Meter Section Meets at Syracuse

The recent annual meeting of the electric meter section of the Empire State Gas and Electric Association, held at Syracuse, brought out papers on demand-meter maintenance, by E. A. Le Fever, Buffalo General Electric Company; demand rates, by W. M. Carpenter; changing distribution from two-phase to three-phase, four-wire, by W. S. Davis, Public Service Corporation of New Jersey; effect of phase angle and power factor on polyphase meters, by J. B. Gibbs, Westinghouse Electric & Manufacturing Company; potentiometers, by I. Melville Stein, Leeds & Northrup Company; meter maintenance, by C. L. Casler, Syracuse Lighting Company; measurement of energy, by F. C. Holtz, Sangamo Electric Manufacturing Company, and jewels and pivots, by B. W. St. Clair, General Electric Company.

Mr. Le Fever said that in some cases 50 per cent of the revenue of electric companies is based on the demand element in rates. He emphasized the importance of the proper location of demand meters and of the regular and thorough cleaning of meter clocks. Mr. Carpenter said that, even ignoring the element of power factor, it is possible to obtain only an approximation of true electrical demand with the instruments now used. Mr. Davis outlined ways and means for changing over distribution, using meters already in stock and with a minimum of expense for the purchase of new transformers.

Mr. Le Fever was elected chairman of the section for the ensuing year.

## All Ready for Institute's Midwinter Convention

All preparations for the midwinter convention of the American Institute of Electrical Engineers, to be held in the Engineering Societies Building, New York, from Wednesday to Friday of next week, are complete. The only change from the program as printed in the ELECTRICAL WORLD for Jan. 20, page 180, is that there will be parallel technical sessions on Thursday morning, three of the papers scheduled for the afternoon being transferred to the morning session. At noon on Thursday the delegates will visit the building of the McGraw-Hill Company as the guests of the publishing firm.

# A Million Kilovolt-Amperes in Big Units

### Large Turbo-Generators Under Order with Westinghouse and General Electric Reach This Rating—Smaller Units and Those to Be Built by Other Firms Will Double Total

THE healthy state of the electrical industry cannot be shown more vividly than by the news that two manufacturing companies alone have under contract 1,139,500 kva. in turbo-generator units of 25,000 kva. rating and larger. Add to these units the production under way by other companies as well as the smaller units being built by the two companies referred to and an estimate of about two million kilovolt-amperes is obtained, representing the power equipment now being made under order from central-station companies.

In order to show the type of unit and the nation-wide extent of the buying, the tabulation given below should be interesting.

The Detroit Edison turbines are for a new station at Trenton Channel; the American Gas & Electric equipment is for a new station at Philo, Ohio; the General Electric turbines for Cleveland, Philadelphia and Chicago will be added to existing stations, as will the equipment ordered by the New York Edison Company. The turbines the Westinghouse company is building for the Commonwealth Edison are for its Calumet station and the coming station on Crawford Avenue, the Brooklyn equipment will go in its new Hudson Street station and the Public Service Production Company's generator will be installed at Jersey City.

LARGE TURBO-GENERATOR UNITS NOW CONTRACTED FOR

| Company Ordering | No. of Units | Rating, Each, Kva. |
|---|---|---|
| **General Electric Company** | | |
| Detroit Edison | Three | 50,000 |
| American Gas & Electric | Four | 35,000 |
| Cleveland Electric Illuminating | One | 30,000 |
| Public Service of Northern Illinois | One | 30,000 |
| Minneapolis General Electric | One | 30,000 |
| Commonwealth Edison | One | 30,000 |
| Philadelphia Electric | Two | 30,000 |
| New York Edison | One | 35,000 |
| New York Edison | One* | 35,000 |
| **Westinghouse Electric & Manufacturing Company** | | |
| Commonwealth Edison | One | 50,000 |
| Commonwealth Edison | One | 37,000 |
| Brooklyn Edison | One | 62,500 |
| Connecticut Light & Power | Three | 25,000 |
| Middle West Utilities | Two | 25,000 |
| Indiana Public Service | Two | 25,000 |
| Counties Gas & Electric† | One | 25,000 |
| Denver Gas & Electric | One | 25,000 |
| Moline & Rock Island Manufacturing Co. | One | 25,000 |
| West Penn Power | Two | 30,000 |
| Public Service Production (N. J.) | One | 25,000 |
| Luzerne County (Pa.) Gas & Electric | One | 25,000 |
| Lorain County (Ohio) Gas & Electric | One | 25,000 |
| Toledo Edison | One | 37,500 |
| Metropolitan Edison‡ | One | 37,500 |
| Pennsylvania Railroad‖ | One | 25,000 |

*Frequency changer. †Philadelphia. ‡Reading, Pa. ‖For Long Island City.

# From Mexico to Puget Sound

### Closing of Two Gaps, Which Is Now Under Way, Will Provide an 1,800-Mile Interconnected Power System on the Pacific Coast, with a Generating Capacity of 1,640,000 Kw.

COULD a kilowatt be isolated at Yuma, Ariz., equipped for travel with a through ticket and a clear line, it would be possible to transfer it to Albany, Ore., over approximately 1,200 miles of copper, composing the backbone of a superpower system whose annual kilowatt-hour output is almost one-tenth the total annual consumption of electrical energy in the United States and whose network of transmission and distribution lines exceeds half the total railway mileage of America. While the East has been talking and agitating for a superpower system in the Boston-Washington district, Western public service companies have gone quietly about the business of interlinking their lines until at the present time there has been built up an interconnected network which covers three states and which within the next eighteen months will cover the entire Pacific Coast, from the Mexican border to Puget Sound.

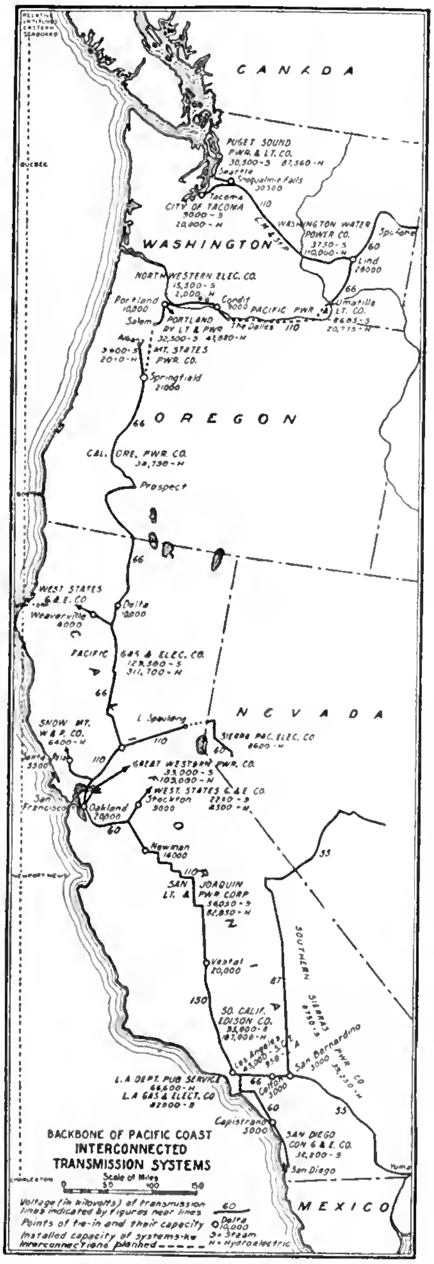
THE REMAINING GAPS

The Pacific Coast Interconnected Transmission System at the present time comprises all of the major California power companies and two of the important Oregon utilities. Plans are now under way for the closing of the two remaining gaps in the Pacific Northwest, and when this is done there will then exist a superpower system whose main trunk will be approximately 1,800 miles long, whose generating capacity, both steam and hydro-electric, will be nearly 1,700,000 kw., and whose annual output will be close to 6,000,000,000 kw.-hr. Were this system to be transposed to the Atlantic seaboard, it would serve a territory extending from Quebec, Canada, to Charleston, N. C.

The lines of the system cross barren deserts, traverse fertile valleys and wooded hills, and finally climb through a pass in the Sierras to carry power to the Nevada mines. They are fed by steam plants fired with oil and natural gas and by hydro-electric plants whose generators are turned by waters from the eternal Sierra snowbanks or from the never-diminishing springs of the Pit River. Even the vagaries of nature are overcome, for in years when rainfall is light in the south and water scarce power can be sent from the north to make up the resulting shortage.

Some idea of the immensity of the present interconnected system existing on the Pacific Coast can be gained from the figures it involves. The present system includes the lines of eleven major companies and one municipality, involving a total steam generating capacity of 402,150 kw. and a hydro-electric generating capacity of 839,990 kw. The annual output of the system for the year ended Dec. 1, 1922, was 4,330,640,821 kw.-hr.

The two gaps which must be closed before the lines of the Pacific North-




BACKBONE OF PACIFIC COAST INTERCONNECTED TRANSMISSION SYSTEMS

west will be tied in with those of California are shown in the map. There is a transmission line at the present time between Springfield, Ore., and Portland, which is the property of the Oregon Electric Company and which operates at 33 cycles. The lines of the Mountain States Power Company and the California Oregon Power Company, which are joined at Springfield, both operate on 60 cycles. The Oregon Electric Railway Company is at the present time installing twelve automatic substations which will operate on 60 cycles, and upon the completion of this installation it is planned to change over the lines to 60 cycles and interconnect with the California Oregon Power Company at Springfield. The Portland Railway, Light & Power Company supplies the railway transmission line, and when this connection is made the interconnected system will extend to The Dalles, Ore., over the system of the Pacific Power & Light Company, which is tied in with that of the Portland Railway, Light & Power Company.

The second gap exists between two of the divisions of the Pacific Power & Light Company. Surveys are being made for a line along the banks of the Columbia between The Dalles and Umatilla and officials of the company predict that the line will be completed within the next eighteen months. When these two gaps are closed there will be added to the interconnected system 99,815 kw. in steam generating capacity and 298,215 kw. in hydro-electric generating capacity.

Interconnection, then, as far as the Pacific Coast is concerned, is an accomplished fact. Quietly, without the blare of trumpets, there is being built up a superpower system which eclipses anything in the world—a system which will serve four states and a population of approximately 5,600,000.

## Tidewater Power Company to Expand

The Tidewater Power Company of Wilmington, N. C., controlled by A. E. Fitkin & Company of New York, is to proceed at once with the construction of a transmission line from Wilmington to Warsaw and Clinton. The line will be about 68 miles in length and cost approximately $130,000. Cotton mills and other manufacturing plants will be served, and it is expected that a number of towns between Wilmington and the two places named will also be supplied with light and power.

## A. M. E. S. Schedules Its March Meetings

The following schedule of section meetings has been drawn up by the Associated Manufacturers of Electrical Supplies for the week beginning March 5. All meetings will be held in the association offices, 30 East Forty-second Street, New York.

MONDAY, MARCH 5

1:30 p.m.: General standards committee. 7:45 p.m.: Committee on section activities.

TUESDAY, MARCH 6

10 a.m.: Snap switch section, molded or formed insulation section, laminated phenolic condensation products section. 2 p.m.: Line material section, lamp receptacle and socket section, air circuit-breaker section. 4 p.m.: Attachment plug section.

WEDNESDAY, MARCH 7

10 a.m.: Fuse section, fan motor section, carbon section, rigid conduit section. 11:30 a.m.: Non-metallic conduit section. 2 p.m.: Armored conductor and metallic flexible conductor section; knife switch section, industrial lighting section. 4 p.m.: Metal molding section.

THURSDAY, MARCH 8

10 a.m.: Panelboard and switchboard section, outlet box section, signaling apparatus section.

FRIDAY, MARCH 9

10 a.m.: Heating appliance section. 2 p.m.: Meeting of board of governors.

## Federal Power Commission Activities

The Tennessee Hydro-Electric Company of Knoxville has applied to the Federal Power Commission for a preliminary permit for projects on the Clinch and Powell Rivers in Tennessee and Virginia. These streams are tributaries of the Tennessee. The ultimate installation of 390,000 hp. is contemplated. The company draws its financial support from New York and Pittsburgh interests. J. R. Paul of Pittsburgh is president. The same interests previously applied for a preliminary permit covering three projects on the Holston River.

The Virginia Power Company, a going concern in West Virginia, has applied for a preliminary permit for a large development on New River, 5 miles above Hinton. The power will be used to extend the present system of the company, which is furnishing power to coal mines, public utilities and manufacturing plants in that region.

The Louisville Gas & Electric Company has declared its intention to apply to the commission for a preliminary permit covering projects on the Green and Cumberland Rivers in Kentucky.

The Susquehanna Power Company of New York recently filed a declaration of intention covering the construction of a dam 70 ft. high in the Susquehanna River at Conowingo, Md. The Chief of Engineers of the army has ruled that the Susquehanna at that point is a navigable stream, and it is probable that the commission will find that the project comes within federal jurisdiction.

Complaints from public utility companies concerning the delay of municipalities in exercising water-power rights probably will result in a formal opinion being rendered by the chief counsel of the commission as to whether or not cities may be granted these rights when no bond issue has been voted, no state charter issued and no approval from the voters obtained.

## Forest Service and Alaskan Development

Hutton, McNear & Dougherty of San Francisco are pressing the Federal Power Commission for a license to cover the power project on Cascade Creek, in the Tongass National Forest, in Alaska. They hold a preliminary permit covering this project, which is among the best power sites in Alaska, and are anxious to begin work in the spring.

The Forest Service has taken the position that the power rights should not be granted until the timber has been sold. Before bids can be asked for the timber, it must be cruised, or inspected, and the proposed sale advertised. These preliminaries will require until July 15 at least. Since the Forest Service is not willing to make an exception in this case, the development may be delayed a year. For the past two seasons the Forest Service has been reconnoitering the possible power sites in the national forests of Alaska, and it is cruising the timber in those areas where development is likely so as to prevent these delays. Every effort is being made by both the Power Commission and the Forest Service to co-ordinate their work, but in this particular case it seems almost certain that the applicant will have to wait.

## Iowa Engineering Society Discusses Furnace Design

Taking exception to the statement that a furnace designed to burn Iowa coal will not successfully handle Virginia or Kentucky coal—an assertion made by J. M. Drabelle in his paper before the mechanical and electrical section of the Iowa Engineering Society on "Arch and Furnace Design for Iowa Fuels"—A. T. Luce of the Des Moines city waterworks called attention to the fact that a furnace designed for Iowa coal is larger than necessary for fuel from the other states mentioned and that the tests made by the Bureau of Mines show that too large a furnace is not a detriment but merely an added expense. Mr. Luce indicated that the real trouble in using the high-heat and low-ash-value coals lies with the natural-draft chain-grate stoker, owing to the lack of ash to protect the excess grate area. He said that this difficulty is encountered with the Illinois coal to a less extent. He also explained that it has been eliminated in the forced-draft-natural-draft chain-grate stoker, which is arranged so that the grate area can be reduced and the air regulated by forced-draft equipment. In an installation under his own observation during the coal shortage it had been possible to burn successfully eastern Kentucky semi-bituminous, Colorado, Illinois and Kansas coals and Iowa "bug-dust," with slight difficulty in changing from one to the other. The heat value and ash range in these fuels was from 13,000 B.t.u. with 7.6 per cent ash to 6,430 B.t.u. with 33.4 per cent ash. Mr. Luce also declared that the chain-grate type of stoker is most effective and satisfactory with the Iowa fuels, although there are several other types working successfully. The large percentage of ash requiring constant dumping makes other types of stokers the exception rather than the rule. The low fusing point of the ash and the high sulphur content lead to clinker troubles when the fuel is agitated.

B. P. Fleming asserted that 50.7 per cent of the fuel of the country is burned in small plants that cannot afford to make changes in furnace design. He thought that the best means of increasing efficiency in these cases is the education of the firemen.

T. A. Marsh of the Green Engineering Company also called attention to the importance of the firemen as a factor in the efficiency of the boiler plant and discussed the tempering of fuel before firing in relation to combustion.

## A. I. E. E. Committee on Ship Electricians' Status

The marine committee of the American Institute of Electrical Engineers and the committee on marine electrical engineering practices of the American Engineering Standards Committee have sent a letter to the board of supervising inspectors of the Steamboat Inspection Service dealing with the status of the men aboard ship whose duty it is to maintain the electrical equipment—a matter that is becoming of increasing importance with the increase of electric propulsion. If competent men are to be obtained for this work, it is evident that they must rank as ship's officers and not simply as working electricians.

To meet this situation the committees suggest that the board establish a series of examinations leading to various electrical certificates that may be obtained by steam engineers in addition to their regular licenses, and another set of examinations leading to electrical certificates for the engineering officers of a ship fully equipped with electric power. The committees recommend further that on all ships carrying electrical officers there shall be carried in addition one or more electricians who shall have a rank comparable to that of petty officer or that of the foreman in land practice. Detailed recommendations are attached to the committee's letter

## Two Big Issues in One Day

On Thursday of last week, Feb. 1, the Alabama Power Company placed upon the market $4,700,000 in first mortgage lien and refunding 5 per cent gold bonds, due 1951, at 89½ and interest, to yield 5¾ per cent. The bonds are callable at 105 and interest, to and including June 1, 1932, and thereafter at a premium reducing one-quarter of 1 per cent per annum.

On the same day the Connecticut Light & Power Company offered a new issue of $4,500,000 in cumulative 7 per cent preferred stock at $100 per share, yielding 7 per cent.

## America's Part in London's Power Congress Unsettled

American participation in the power congress to be held in London in May of next year was to be discussed informally by representatives of the interests principally concerned at a meeting held in New York on Feb. 8. O. C. Merrill, the executive secretary of the Federal Power Commission, had asked a small group to gather on that date so that some idea might be gained as to the feeling in this country concerning American participation. Some objection has been voiced to this country's having any part in congress unless the exposition of electrical machinery and electrical products is opened to American manufacturers. Otherwise, these objectors contend, the

United States will contribute importantly to the success of the congress and will help greatly in attracting attendance at an exposition where the exhibits will be confined to articles of British manufacture. At a preliminary conference held in Washington, Jan. 30, it was suggested that the Federated American Engineering Societies should take the matter up with the promoters of the congress to ascertain the exact facts.

## New Mexico Electrical Men Adopt Program

For its ninth annual convention, to be held at Albuquerque on Feb. 12 and 13, the New Mexico Electrical Association has adopted the following program:

MONDAY, FEB. 12

*Afternoon.*—"Modern Highway Lighting," B. C. J. Wheatlake, General Electric Company, Denver; "The Power-Factor Problem," N. R. Stansel, Southwest General Electric Company, El Paso; "Utility's Place in the Industrial Field," J. E. Moorhead, Mountain States Telephone & Telegraph Company, Denver; "Method of Practical Field Testing of Transformer Loads With or Without Graphic Instruments," E. D. Stewart, Westinghouse Electric & Manufacturing Company, El Paso; "Electrical Homes," C. A. Winder, Southwest General Electric Company, El Paso; open discussion by members on general matters concerning public utility problems.

*Evening.*—Entertainment.

TUESDAY, FEB. 13

*Morning.*—"Recent Scientific Work on Coal," Prof. John D. Clark, State University of New Mexico; "The Public's Response," George E. Lewis, executive manager Rocky Mountain Committee on Public Utility Information; "Power-Plant Construction," George J. Gauthier, engineer Federal Light & Traction Company, New York; "Automatic and Remote Control of Induction Motor," Prof. R. W. Goddard, State College of New Mexico; moving pictures furnished by E. H. Waddington, Western Electric Company, St. Louis.

*Afternoon.*—"Activities of Rocky Mountain Section, N. E. L. A.," J. F. Dostal, president Rocky Mountain Geographic Division, N. E. L. A.; "Manufacture and Operation of Porcelain Insulators," R. H. Marvin, chief engineer R. Thomas & Son, East Liverpool, Ohio; "Electrical Contracting," M. Nash, Albuquerque; election of officers.

*Evening.*—Annual banquet.

## Denver Meet a Big Success

### Commercial Section N. E. L. A. Men Flock to Bureau and Committee Sessions in Mid-Continent

GREAT satisfaction with the three-day meeting of the Commercial Section of the National Electric Light Association held in Denver from Jan. 24 to Jan. 26 was expressed by the chairman of the section, Oliver R. Hogue, who said the sessions, which brought together at a point in mid-continent commercial men from all parts of the country, were the most important yet held. The attendance of 250 delegates and guests made the meetings and banquet seem more like those of a convention than like committee proceedings. An account of the opening day was contained in the ELECTRICAL WORLD for Jan. 27, page 236.

More than one hundred were in attendance at the meeting of the Merchandise Sales Bureau. The discussion centered around the possibilities of the electric range and methods of promoting electric range load. The Lighting Sales Bureau announced plans to work along two important lines during 1923—the development of the residence load and the cultivation of the store-lighting load. It was pointed out that 58 per cent of the revenue of central-station companies comes from these sources and that it is possible with benefit to the consumer to double the present lighting intensities in the home and in the store.

The Power Sales Bureau paid special attention to the problems of Western central-station companies and is to devote effort to new types of drive and control which will increase production and lower operating costs. Western men asserted that there exists a large field in the further electrification of the lumber industry and the oil wells of California. There is now 50,000 hp. in motors in use in the oil fields of that state on the lines of one central station alone. The problem of applying electric drive to the pumping of wells has been comparatively easy, but the application to drilling has not been so simple, because manufacturers do not yet produce the type of equipment necessary. The industrial heating schools started last year will be continued. It is the plan of the Power Sales Bureau to establish such schools next year in various important centers of industry in the West, working through the geographic divisions of the N. E. L. A. The manufacturers have recognized the necessity of having trained salesmen in the field and are planning to send out specialists. During 1923 the bureau will take up the study of the operating economies of uniflow and Diesel engines and will probably undertake a survey to determine the average power factor of induction motors in industrial plants in order to ascertain to what extent overmotoring is responsible for poor power factor.

#### VEHICLE BUREAU NAME CHANGED

At the meeting of the Electric Vehicle Bureau the dominant feeling was that the electric truck is now "coming into its own" as a factor in city transportation and rapidly developing into an important source of revenue for the power companies. A motion was passed at the meeting of the executive committee to change the name of the bureau to "Electric Truck and Car Bureau."

The meeting of the executive committee of the section, held on the last day, was devoted to reports from the chairmen of the various bureaus and a discussion of plans for the national convention to be held in New York in June.

The hospitality of the electrical interests of Denver was profuse and will long be remembered by the visiting delegates.

GROUPS OF DELEGATES TO N. E. L. A. COMMERCIAL SECTION MEETINGS IN DENVER

Standing, left to right—C. R. Skinner, New York; N. T. Wilson, Keokuk, Iowa; Vernon Tallman, Boston; H. S. Meese, Philadelphia; E. Praget, Schenectady, N. Y.; R. M. Bleak, Salt Lake City; R. P. Sanborn, Orange, N. J.; M. C. Morrow, New York; C. O. Dunten, Springfield, Ill.; W. L. Goodwin, New York. Sitting—J. R. Coxe, New York; F. R. Jenkins, Chicago; C. K. Nichols, New York; G. E. Miller, Cleveland; A. K. Baylor, New York; Samuel Adams Chase, New York.

Front row, seated, left to right—Harold Wright, Chicago; R. S. Hale, Boston; Oliver Hogue, Chicago; A. W. Childs, Los Angeles. Standing, left to right, L. C. Spake, Chicago; E. R. Jacobs, Chicago; C. E. Greenwood, Boston; C. A. Cummings, Chicago; James Kirk, Chicago; E. A. Edkins, Chicago; G. B. Regar, Philadelphia; A. M. Frost, Fresno, Cal.; W. E. Clement, New Orleans; D. C. Ray, H. E. Sandoval and Walter C. Heston, all of San Francisco, Cal.

## Illinois Utilities' Chicago Convention

The tentative program of the joint convention of the three Illinois utility associations to be held in the Hotel Sherman, Chicago, March 14 and 15 has been announced. The morning sessions will be joint meetings of the Illinois State Electric Association, the Illinois Gas Association and the Illinois Electric Railways Association. The annual banquet is to be held on the evening of March 14.

The tentative afternoon program for the electric association is as follows: "Survey of Appliances and Their Use in Residences in Chicago," H. B. Gear, Commonwealth Edison Company; "Thirty-Thousand-Watt High-Tension Transformer," representative of the General Electric Company; "Unattended Distributing Substations of the Commonwealth Edison Company," H. E. Wulfing, Commonwealth Edison Company; "Alternating-Current and Direct - Current - Controlled Automatic Feeder Substations," F. E. Goodnow, Public Service Company of Northern Illinois; reports of the Accounting Section of the Great Lakes Division, N. E. L. A., the committee on uniform classification of accounts and the committee on customers' records and billing; "Correct Meter Installation and the Use of Protective Devices Against Thieving," R. D. Hart, Central Illinois Light Company; symposium on merchandising: Domestic appliances, by a representative of the United Appliance Company; commercial appliances, convenience outlets and electrical homes, by E. W. Lloyd, Commonwealth Edison Company.

## Co-operation of Utility May End Holyoke Dispute

Controversy between the Holyoke (Mass.) Water Power Company and the Gas and Electric Department of that city, arising from what city officials construed as unfair competition with the city in supplying electrical energy, now appears to be approaching a settlement. In an acute fuel shortage which the city plant has lately experienced the company offered to re-establish connections between local plants and to furnish the city with energy to meet the emergency. This offer was accepted and an arrangement made for the purchase of 1,500 hp. daily from the company, to effect a saving of a carload of coal daily to the city plant. The immediate occasion of the trouble between the utility and the city was the action of local silk manufacturers in contracting with the company for a large part of their electrical energy, instead of continuing to take it entirely from the city, and the Holyoke Chamber of Commerce appointed a committee to study the merits of the controversy and seek a basis of peace.

This committee has submitted a report in which it approves of the expansion of the company, operating within its franchise rights, and suggests that it ought not to be hampered in furnishing electrical energy to any of its hydraulic power customers. The committee recommends that the connection of the city department with the company's lines be made permanent and that the city's service be developed to the limit of the possibilities of its present location. The report views dubiously the building of a new power plant by the city at a new location, believing that the larger opportunities which are being opened to New England in electric power supply can be utilized to far better advantage by the Holyoke Water Power Company than by the municipality. As the company has extensive resources in surplus hydraulic power the committee recommends that these be developed for the benefit of the community.

## Industrial Heating School to Be Held in Spring

All central-station commercial managers have received a letter from Wirt S. Scott, chairman Industrial Heating Division of the National Electric Light Association, with reference to the conduct early this spring of another central-station school of industrial heating for power engineers like the one which proved so successful last year. The Westinghouse Electric & Manufacturing Company and the General Electric Company have agreed to undertake this work again for one class each, provided that the class is sufficiently large to warrant the expense involved. The course will last two weeks. As outlined by the N. E. L. A. division, it includes lecture courses on industrial heating and high-temperature electric furnaces, a combined shop and lecture course and a shop course. The Westinghouse school will start at Mansfield, Ohio, be continued at Pittsburgh and concluded at Newark, N. J. The General Electric school will start at Schenectady, N. Y., and be concluded at Pittsfield, Mass.

This action by the Industrial Heating Division was the most important outcome of its meeting on Jan. 25, wher members from East Pittsburgh, Schenectady, Waterbury, Cleveland and Youngstown were present.

## E. H. Sniffin Talks to Western Massachusetts Engineers

E. H. Sniffin, manager of the power department of the Westinghouse Electric & Manufacturing Company, addressed the Springfield (Mass.) branch of the American Institute of Electrical Engineers Jan. 16 on "The Engineer." In the course of his remarks he said: "We are wasting more than half the 300,000,000 tons of coal we use in a year for power purposes. Many plants consuming between five and ten pounds of coal per kilowatt-hour should do the same amount of work on two pounds. Forty millions of water horsepower are yearly going to waste in this country, or double what we are now using. The problem is to utilize this power in greater volume and thus effect a vast saving in coal and the expense of hauling it from the mines. Last year the purchases in this country of steam-turbine capacity in sizes of 500 kw. and larger amounted to 10,000 hp. a day. The average size of unit was 6,500 kw. and the largest was 50,000 kw. The new electric power facilities that must be created in this country in less than ten years will exceed in extent all the facilities that exist today and which have been forty years in the making."

# Brief News Notes

**Cupples Station Company May Expand.**—St. Louis papers report the purchase of a 14-acre tract in North St. Louis, near the Mississippi River, by the Light & Development Company as a tentative site for a large supplementary power house for the Cupples Station Light, Heat & Power Company.

**New York Interests Acquire Keystone Power Corporation.** — The American Water Works & Electric Company, New York, has acquired control of the Keystone Power Corporation, which will be managed by the West Penn Power Company. The Keystone Power Corporation supplies Kane, James City, Mount Jewett, Hazlehurst, Smethport, Ridgway, Johnsonburg, St. Marys and Kersey, together with smaller places in western Pennsylvania.

**New Hood River Plant.**—The new 10,000-hp. hydro-electric plant of the Pacific Power & Light Company on the Hood River, near the town of the same name in Oregon, will be completed and placed in operation by March, according to the present estimate of the company. This plant, which will cost approximately $1,250,000, will be tied in with the Condit hydro-electric plant of the Northwestern Electric Company on the opposite side of the Columbia River.

**Quick Recovery from Substation Fire.**—Approximately seven and one-half days after the recent fire which caused damage to the amount of $50,000 to the Eagle Rock switching station of the Southern California Edison Company all impediments to the distribution of power were removed and the system was on a physically normal basis. Men of the Edison company's engineering and repair departments worked day and night to bring this about.

**Genesee Light & Power Absorbs Le Roy Company.**—All the outstanding stock of the Le Roy (N. Y.) Hydraulic Electric Company has been purchased by the Genesee Light & Power Company of Batavia, N. Y., and the latter company is now operating the Le Roy plant. As soon as a transmission line from Batavia to Le Roy can be built the operation of the Le Roy steam plant will be discontinued and the city will be served with Niagara power from Batavia.

**Municipality to Take Over Central-Station Plant.**—The city of Rice Lake, Wis., is to take over the local light and power plant belonging to the Wisconsin-Minnesota Light & Power Company. A price of $233,000 has been set on this plant by the Wisconsin Railroad Commission. This action is in accordance with a popular vote taken in August, 1920, when a majority of more than three to one favored the proposal. The plant has been furnishing electric light and power for thirty years.

**North Penn Merger.**—The Blossburg (Pa.) Electric Light & Power Company and the Mansfield (Pa.) Electric Company, together with seventeen other small electric service companies, have been merged into the North Penn Power Company, to be operated and managed by Gannett, Seelye & Fleming, consulting engineers, Harrisburg. It is proposed to develop this territory extensively. The fiscal agents for the North Penn Power Company are Jay N. Schroeder & Company, who have been in the investment banking business in Lancaster for eighteen years.

**Eastern Connecticut Buys Danielson Property.**—Papers have been signed looking toward the acquisition by the Eastern Connecticut Power Company of Norwich of the People's Light & Power Company and the affiliated Danielson & Plainfield Gas & Electric Company of Danielson. Under the transfer of ownership the Eastern Connecticut company, which operates interconnected steam and hydro-electric plants and which is tied in with the system of the New England Power Company, will distribute energy in the towns of Killingly, Brooklyn, Plainfield, Canterbury, Griswold and Jewett City.

**Buffalo Claims Largest Outdoor Station.**—Terminal "C" of the Buffalo General Electric Company, said to be the largest outdoor station of its kind in the United States, was put into operation at Buffalo on Jan. 28 to furnish power generated by the Niagara Falls Power Company at Niagara Falls. The ultimate capacity of Terminal "C" will be 175,000 hp. Transmission is at 66,000 volts stepped down to 22,000 volts for distribution to substations. The cost of the new station was more than $500,000. The same company will complete a new service building at Niagara and Front Streets about April 1.

**Good Progress on Devon Plant.**—Construction of the new $3,500,000 power plant at Devon, Conn., for the Connecticut Light & Power Company, Waterbury, has started. The site is about three miles above the mouth of the Housatonic River and is convenient for the supply of energy throughout the Housatonic and Naugatuck valleys. Three units, with a total capacity of 75,000 kw., are first planned, and when completed the plant will have six units with a total capacity of 150,000 kw. The foundations are nearly completed. The station building proper will be of steel and hollow-tile construction and will have five 300-ft. steel stacks, each 16 ft. in diameter. The "U. G. I." interests of Philadelphia are in charge of the work.

**Bill to Promote Water-Power Development in New Hampshire.**—A bill introduced into the New Hampshire Legislature by former Governor Bass of that state provides for the selection of a site where a substantial amount of water can be stored at a moderate cost and for negotiations with owners of water-power privileges on the stream below the proposed storage reservoir with a view to making contract with such plants for the additional water to be thus provided. The plan aims to provide additional power at every plant now operating below the site of the proposed reservoir at a minimum cost and without adding anything to the public charges. Those who use the water will, by the terms of the bill, pay for the interest on the cost of development, maintenance and operation and in addition they will pay off the principal within a period of fifty years. At the end of that time, the reservoir and water rights will be owned by the state free and clear.

## Associations and Societies

**Sacramento Valley Electric Society.**—An association under this name has been organized at Sacramento, Cal., with more than sixty members.

**Wisconsin Engineering Society.** — Plans are now being made for the annual convention of the Wisconsin Engineering Society, to be held in Madison, Feb. 22-24.

**Pennsylvania State Association of Electrical Contractors and Dealers.**—The eleventh annual meeting of this association will be held in Lancaster, Pa., on Wednesday, Feb. 28. Among the chief features will be an "electric open forum" designed to bring contractor-dealers into consultation with representatives of other branches of the industry.

**Supply Jobbers to Meet in Chicago.**—The regular quarterly meeting of the Central Division of the Electrical Supply Jobbers' Association will be held at the Sherman House, Chicago, on Tuesday and Wednesday next week, Feb. 13 and 14. The two morning sessions will be open, while the afternoon session on Tuesday will be devoted to an executive meeting.

**Electric Power Club.**—The next annual meeting of the Electric Power Club will be held on June 11 to 14 at the Homestead, Hot Springs, Va., where this association was organized in 1908. It is expected that important standardization of electric power apparatus will be effected at the coming meeting, because the new edition of the Electric Power Club handbook will be published soon thereafter and the different sections of the club are eager to get their work into this book.

**New York Section, I. E. S.**—On Thursday, Feb. 15, Dr. Clayton H. Sharp, will talk on "Observations in Europe" and F. V. Magalhaes will comment on the international standardization of Edison lamp bases and sockets before this section of the Illuminating Engineering Society in the auditorium of the Consolidated Gas Building. Dr. Sharp and Mr. Magalhaes were delegates to the International Electrotechnical Commission meeting at Geneva.

**Gilchrist to Address New England Merchandisers.**—John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago, is to address the first luncheon meeting of the Merchandising Bureau of the New England N. E. L. A. Commercial Section at the Boston City Club, Feb. 14, at 12:30 p.m. His subject will be "Merchandising and Merchandising Conditions." The bureau will hold three or four other luncheon meetings before midsummer, the schedule calling for an address at the Bond Hotel, Hartford, March 14, by A. G. Kimball, president Landers, Frary & Clark, and one by H. A. Lewis of *Electrical Merchandising*, on "Compensation of Salesmen," at the Congress Square Hotel, Portland, Me., May 16.

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### Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

New Mexico Electrical Association—Albuquerque, Feb. 12-13. C. E. Twogood, Albuquerque, N. M.

Electrical Supply Jobbers' Association—Central Division, Chicago, Feb. 13-14; Atlantic Division, New York, Feb. 14; executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Institute of Electrical Engineers—New York, Feb. 14-16. F. L. Hutchinson, 33 West 39th St., New York.

American Electric Railway Association—Washington, D. C., Feb. 16. J. W. Welsh, 8 West 40th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

Wisconsin Engineering Society—Feb. 22-24. L. S. Smith, College of Engineering, Madison.

American Physical Society—New York, Feb. 24; Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

Pennsylvania State Association of Electrical Contractors and Dealers—Lancaster, Feb. 28. M. G. Sellers, 1518 Sansom St., Philadelphia.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 14-15. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Wills, 403 Slaughter Bldg., Dallas, Tex.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

# Recent Court Decisions

**Rate-Fixing Procedure of New Jersey Commission.**—Reversing on a writ of certiorari an order of the Board of Public Utility Commissioners of New Jersey (Hackensack Water Company vs. Commissioners), the Supreme Court of New Jersey held that the board must take the present value as the value of property devoted to public use and may not arbitrarily take the average for the two preceding years, notwithstanding the making of valuable improvements in the second of such years. Moreover, the board must take into consideration deficiencies in earnings accumulated during a series of years under and due to prior insufficient rates fixed by the board. (119 At. 84.)*

**Contributory Negligence in Relation to Linemen.**—In Elliott vs. Water, Light & Transit Company damages were sought for the death of a workman of little experience who was killed while engaged in stringing and connecting transmission wires in Keytesville, Mo., because the current was not cut off and some of the wires were uninsulated. The trial court refused to instruct the jury to render a verdict for the defendant on the ground of contributory negligence, and the jury found for the plaintiff. The Kansas City Court of Appeals has now reversed this finding and ordered a new trial, but on purely technical grounds connected with a defect in the original petition. (245 S. W. 568.)

**Presumption Is That Franchise Rates Are Reasonable.**—Although a city and a utility company are powerless to make an irrevocable contract as to rates, yet the rate specified in the franchise, in the absence of negative allegations, will be presumed to be a reasonable rate for the purpose of considering the sufficiency of a complaint on demurrer, and on a hearing of a motion for a temporary injunction a like force will be given to such specified rate, in the absence of affidavits tending to show that it is unreasonable. This was the finding of the Supreme Court of South Dakota in an action brought by the city of Mitchell against the Mitchell Power Company to prevent it charging a rate for gas in excess of the maximum franchise rate. (190 N. W. 1013.)

**Employer Not Liable for Injury from Explosion of Electric Light Bulb.**—Sustaining a non-suit in Russell vs. St. Louis & San Francisco Railway Company, the Springfield (Mo.) Court of Appeals found the company not liable for an injury to the eye of the defendant caused by the explosion of an electric light bulb from which he got light on his work. The doctrine of *res ipsa loquitur* (the thing speaks for itself) was held not to apply in the absence of allegations that employer manufactured and supplied its own electric light bulbs and the electricity to produce the light, or that an explosion would not have occurred without some negligence in the use of the bulb and electricity, or unless the construction of the bulb was faulty, since the court could not take judicial notice as a matter of common knowledge that an electric light bulb will not explode except as the result of negligence. (245 S. W. 590.)

**Riparian Owners' Rights to Water Power.**—In a suit brought by the Watervliet Hydraulic Company against the State of New York to obtain compensation for lands appropriated for Barge Canal purposes and damages for such appropriation the Court of Claims of New York found that a riparian owner whose lands border on a stream the bed of which is owned by the state has no right to use the water power of the river at that point, where the only practicable method for using that power requires the construction of a dike or dam extending into the river on the state-owned lands. The owner of tracts of land on opposite sides of a river the bed of which was owned by the state, who had for many years maintained a dam across the river between those tracts without objection by the state, is not a mere trespasser, but it must be presumed the state acquiesced in the maintenance of the dam, so that the riparian owner was a licensee, and where the state, instead of requiring the licensee to remove the dam, elected to appropriate it, it must pay the owner the value of the dam, considering the fact that the owner has no right to maintain it if the state should require its removal. (197 N. Y. S. 348.)

**Property Owner Maintaining Electric Conductor Near Sidewalk Liable for Injury.**—Ruocco vs. United Advertising Corporation and United Illuminating Company was a suit to recover damages for the death of a passing pedestrian who was said to have reached over and touched a chain hanging close to the inside of the open door of the first-named defendant's garage, this chain, it was alleged, having become charged with electricity owing to the failure of both defendants to install and maintain properly the wiring and electric apparatus used in the garage. The defendants claimed that the victim was a trespasser as the chain was beyond the sidewalk and on private property, and this contention was sustained by the trial court. The Supreme Court of Connecticut has reversed the judgment and remanded the case, asserting that an owner of property abutting on a highway rests under an obligation to use reasonable care to keep his premises in such condition as not to endanger travelers in their lawful use of the highway, and that if he fails to do so, and thereby renders the highway unsafe for travel, he makes himself liable, even though the consequent injury is received upon his own land and not on the highway. (119 At. 48.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**Proper Expenditure for Extension.**—In adjusting a complaint brought against the Plaistow Electric Light & Power Company the New Hampshire Public Service Commission held that such a company should expend in making an extension an amount which would be equivalent to the total gross income from the business of the new territory for a period of three years in cases where the increase in business is doubtful and the cost of installation substantial. The estimated cost of construction, the commission said, should contemplate a free right-of-way with no expense for tree cutting or other work of a similar kind necessary in making the extension.

**Using Prospective Customers' Labor in Constructing Line.**—Passing upon an application for electric service made by would-be customers of the Utah Power & Light Company living nearly a mile from its lines, the Utah Public Utilities Commission laid down the principle that consumers at too great a distance from existing lines or having peculiar conditions of service which make them a burden upon the general consuming public may be required to share in the special investment made to serve them. The commission said: "The power company has offered to utilize the labor of these prospective consumers in the construction of the extension in so far as they are fitted for the task at hand, or, on the other hand, is willing to let the contract for the work to any competent contractor, so that it does not appear that an injustice will be done"; but it added: "To insure the safety of both the public and employees certain standards of construction must be insisted upon."

**Expenditure to Satisfy Damage Claim Arising During Construction Cannot Be Charged to Capital.**—The California Railroad Commission has denied the request of the San Joaquin Light & Power Company to be permitted to include in capital account the sum of $50,000 representing an award for property damage caused during the construction of a transmission line through the burning of a wheat field. To this plea the commission replied: "This commission estimated the rate base as the reasonable historical cost of the property, and it does not appear that the cost of paying damages for the burning of a wheat field due to conditions which were deemed by the courts as negligence can be classified as a reasonable cost of the construction of the power system. The return allowed by the commission contemplates certain hazards of the business, and it would appear that damage such as the one in question represents one of those hazards which must be borne by the stockholders of the utility company."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## A Man with a Vision

**An Appreciation of John B. Miller, Who Has Built the Southern California Edison Company**

TWENTY-FIVE years ago there went to southern California a man from Michigan. He had no experience in central-station operation, but he had imagination, vision, confidence, executive ability and money. He became interested in the public utility situation in that part of the country and brought about the combination of several electric light and power companies in or near Los Angeles into what later became the Southern California Edison Company. He became the president of the consolidated company at a salary of one hundred dollars a month.

J. B. MILLER

An unheard-of budget, calling for the expenditure of $50,000, had to be financed, and John B. Miller set about the task of raising this money. No man ever undertook a less promising development. For southern California was not a garden spot in those days. It was largely a desert without population, and the vision that pictured the possibilities for electrical expansion had to frame also a dream of gathering population and growing industry.

From the start Miller recognized that spiritual qualities of good service, square dealing and courteous treatment would do more than anything else to bring success to the new type of enterprise he was heading and that such an element in a community would be a great attracting force, a far-reaching appeal, that would call many people and bring them to the city he was seeking to upbuild. As the years rolled by he saw his theory proved in operation, and he continued to interpret and expound his conception of the attitude which utility officials and employees should maintain toward the public in simple words that have now become classic in the industry.

Years before the advent of regulatory commissions he instituted this policy. It is interestingly expressed by a letter that he wrote on Sept. 26, 1905, which is today held as one of the prized records in the archives of his company. He wrote:

"The Edison Electric Company desires to have the confidence and respect of the public with which it deals. Officers, agents and other employees should, in every reasonable way, endeavor to increase that confidence and respect by doing everything in their power to make the name of the Edison Electric Company synonymous in the mind of the public with good service, square dealing and courteous treatment. The public gains impression of the company through contact with its representatives, and they will, therefore, be held responsible in every instance for carrying out the well-established policy of the company—good service, square dealing, courteous treatment."

Last week men pre-eminent in the electrical industry flashed words of congratulation to Mr. Miller from every district of the country upon his completion of twenty-five years of service and as a spontaneous recognition of his success. An account of the banquet given in his honor by the other officials of the great company which he heads is contained in this week's "News of the Industry."

## W. A. Whittlesey Heads Pittsfield Company

W. A. Whittlesey has been elected president of the Pittsfield (Mass.) Electric Company to succeed the late Alexander Kennedy. Mr. Whittlesey has been general manager of the company for some years past and is well known in the New England central-station field. Most of the expansion of the company's plant and service during the last decade has been under his immediate direction, including the reconstruction of the Silver Lake generating station, the arrangement of an interconnection now under construction between the Pittsfield system and that of the Turners Falls Power & Electric Company in the Connecticut Valley, and the development of an active commercial policy in electrical and merchandising sales in the upper Housatonic Valley.

**Karl Smith** has left Grafton, N. D., and is succeeded by E. W. Steinbuck, formerly at Kasson, Minn., as superintendent of the Grafton plant.

## A. C. Marshall Assumes Office of General Manager

Alfred C. Marshall, vice-president of the Detroit Edison Company, became vice-president and general manager of the company on Feb. 1, succeeding Alex Dow in the office of general manager. Mr. Marshall and Mr. Dow have been intimately associated since 1894, when Mr. Marshall allied himself with the public lighting commission, which under the direction of Mr. Dow was building the first public lighting plant erected in Detroit.

In 1899 Mr. Marshall left the commission to become chief engineer of the "rapid railway" system which was under construction between Detroit and Mount Clemens. In 1903 he again became associated with Mr. Dow upon joining the Edison Illuminating Company, planning and superintending construction. Two years later he went to Port Huron to take charge of the electric light plant. A stay of six years in this city gave him valuable training in all phases of the electric light business. In 1911 he rejoined the Detroit Edison Company and later was elected a vice-president and director of the company.

A. C. MARSHALL

Mr. Marshall has been active in association work as secretary and treasurer of the Michigan Electric Association from 1905 to 1910 and as its president in 1911, when it was converted into the Michigan State Section of the National Electric Light Association. Mr. Dow retains his duties as president and chief executive of the Detroit Edison Company.

**G. W. Barker**, electric range expert of the San Francisco division of the Pacific Gas & Electric Company, has been promoted to the position of domestic-appliance sales engineer.

**J. E. Harsh**, general manager of the Lincoln (Neb.) Gas & Electric Light Company, has been placed in charge of the Virginia Power Company, a subsidiary property of the Doherty interests. Mr. Harsh has been in charge of the Lincoln plant for a period of more than five years.

## F. L. Butler Elected Vice-President of Georgia Company

Frank L. Butler, general operating manager of the Georgia Railway & Power Company, has been elected a vice-president, in charge of operation. Mr. Butler has been associated with the company since February, 1921, when he became the manager of its railway department. One year later he was made general operating manager in charge of the railway, electric, gas and steam-heating departments. For three years previous to his assuming the managership of the Atlanta's company railway department Mr. Butler was connected with the Winnipeg (Man.) Electric Railway, and he was manager of that property when he tendered his resignation to go to Atlanta. Mr. Butler was born in Terre Haute, Ind., in 1874 and at the age of twenty entered the employ of the Vandalia Railroad. Subsequently he was connected with the Denver & Intermountain Railway, the Alton, Jacksonville & Peoria Railroad and the Chicago & West Towns Railway.

F. L. BUTLER

**Dudley Sanford**, industrial engineer with the Union Electric Light & Power Company, has recently been appointed assistant treasurer of that company and treasurer of the St. Louis County Gas Company.

**J. K. Leibing** has severed his connection with the Great Western Power Company of California to take a position in the general engineering laboratories of the General Electric Company at Schenectady, N. Y.

**T. L. Nudd**, former electrical engineer with the Newbery Electric Corporation of Los Angeles, in charge of estimating and engineering, has been made electrical engineer for the Allied Architects of Los Angeles to supervise inspecting and estimating. Mr. Nudd is a graduate of the University of California and previous to his connection with the Newbery Corporation he was electrical inspector in the Bureau of Yards and Docks, Navy Department, at the San Diego public works office.

**A. C. Schloth** has resigned as assistant electrical engineer for the General Electric Company at Lynn, Mass.. and is devoting all of his time to patent work.

**J. Elmer Housley** has been recalled to his former position as electrical engineer with the Aluminum Ore Company, East St. Louis, Ill. For the past year he has been in the sales department of the Aluminum Company of America at Kansas City.

**Thomas J. Rabbitt**, who has been associated with the Cape & Vineyard Electric Company, Vineyard Haven, Mass., for about six years, has recently been appointed assistant manager of the company, and Theodore Chaffin, who has been in the company's service about nine years, has been appointed assistant treasurer.

**F. R. Kohnstamm**, who has been acting manager of the domestic heating section of the merchandising department of the Westinghouse Electric & Manufacturing Company, has been made manager of the section, and E. W. Knight, who has been acting manager of the fan section of that department, has been appointed manager of that section.

**W. G. Church** of Wichita Falls, Tex., formerly of Farmersville, in the same state, has been appointed general manager of the Electra (Tex.) Light & Power Company, succeeding E. D. Kelly, resigned. Mr. Church has been connected with the Mid-West Utilities Company, owner of the Electra plant, for about five years, including a period of service before the war.

**A. E. Blackwell** of Denver, Col., has arrived in Sedalia, Mo., to take up the duties of W. M. Little, of the distribution department of the City Light & Traction Company in Sedalia. Mr. Little has been promoted to the business department. Mr. Blackwell has been doing for the Henry L. Doherty Company in Denver similar work to that which he is now undertaking.

**Morgan Brooks**, professor in the department of electrical engineering of the University of Illinois, who is touring Europe on a year's leave of absence from his duties, addressed a convention of Italian electrical engineers held in Rome in January. His topic was the investigation of the fatigue of metals which is now being conducted by Prof. H. F. Moore of the department of theoretical and applied mechanics of the University of Illinois. Stereopticon slides and Professor Moore's motion-picture films were shown. Professor Brooks gave the same lecture before engineers at Prague, Czechoslovakia, in December, on the personal invitation of the President of that republic, following reports from other localities of the interest he had aroused in engineering circles. The international co-operation of engineers exerts a stabilizing influence on the unsettled world conditions, in the opinion of Professor Brooks, who reports great interest abroad in American engineering and educational progress.

## B. L. Worden Succeeds Mr. Berresford

At the annual meeting of the Cutler-Hammer Manufacturing Company of Milwaukee, held Jan. 25, B. L. Worden, president and general manager of the Beaver Board Companies, was elected a director and vice-president to fill the vacancy created by the resignation of A. W. Berresford. Mr. Worden was the organizer and president of the Worden-Allen Company of Milwaukee and the Lackawanna Bridge Company of Buffalo, which interests he has recently disposed of. During the late war he was general manager of the shipbuilding department of the Submarine Boat Corporation, and it was under his supervision that the shipyard at Newark Bay was built.

B. L. WORDEN

**Wiley F. Corl**, general manager of the Missouri Utility Company, Mexico, Mo., has been elected president of the Mexico Chamber of Commerce.

# Obituary

**Albert Brown Chandler**, formerly president of the Postal Telegraph Company, died at his home in Randolph, Vt., on Saturday, Feb. 3. Mr. Chandler, who retired many years ago, was eighty-three years of age.

**E. T. Nye**, general manager of the West Jersey Electric Company and Five Mile Beach Electric Railway Company, died on Jan. 30 at his home in Wildwood, N. J. Mr. Nye had been with these companies for sixteen years and before filling his post at Wildwood had charge of the electric light company in Pleasantville, N. J.

**John Warren Sargent**, a widely known designer and builder of stationary engines and junior member of the former firm of Rice & Sargent, Providence, R. I., died at Providence on Jan. 30. During the past few years Mr. Sargent had devoted himself mainly to research work in connection with prime movers. He was born at Amesbury, Mass.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Price, Selling Cost and the Non-Electrical Distribution*

By W. R. Herstein
Vice-President and General Manager
Electric Supply Company, Memphis, Tenn.

WE HAVE now reached a point in the wholesaling of electrical supplies where, in my opinion, a well-defined issue presents itself to the jobber. This plain, clean-cut issue is, Shall we continue to accept business wherever offered or shall we endeavor to confine our own particular lines to customers who will co-operate with us in the endeavor to keep quality above price, and to pass the product into the hands of the user through the medium of intelligent salesmanship?

### Price the Chief Interest

My first impression in attempting to sell to the non-electrical dealer was that he had little or no regard for quality, which I had been trained almost to reverence, but was chiefly interested in price. He simply knew nothing regarding electrical devices and was not qualified to judge between good and bad. Subsequently, however, he did become qualified, but his interest in price remained unabated, because he was now selling electrical devices at very low prices, as a leader, to draw trade to his store. Furthermore, in order to sell to him, our maximum discounts, regardless of quantity, were demanded, because he was a subscriber to a purchasing syndicate in New York, and if we would not sell him on his own terms, the business went to the syndicate. Still further, his practice of cutting the price on nationally advertised articles caused dissatisfaction on the part of our other dealers in that particular town, and when he advertised these prices in a newspaper that had a state-wide circulation the dissatisfaction extended to our dealers throughout the state.

You will note that I have not said whether this dealer was a department store, grocer, druggist or hardware dealer. He might have been, and in the course of time was, either one or all of them. Then this curious thing began to happen: Some of my local friends who are jobbers in other lines began asking me about the electrical jobbing business. Their interest, they frankly stated, was aroused by requests from their customers—whom I had foolishly begun to believe were mine—that they should carry in stock certain devices such as dry batteries, flash-lamps, incandescent lamps, etc., which they had theretofore been buying from electrical jobbers, but which they preferred getting with other goods from their main source of supply. Here, therefore, was another more or less formidable legion of competitors — competitors, too, knowing nothing of the traditions of the trade. And since the manufacturers of inferior electrical devices are not going out of business, let me recommend to the makers of higher-grade goods that they let the low-grade manufacturer take the non-electrical jobber's business and refrain from forcing his attentions upon the strictly electrical jobber

### Qualifications of Contractor

It will be easily inferred that my own judgment in the choice of retail distributors points unqualifiedly to the electrical man. I have intimated the necessity for technical knowledge in salesmanship, but have not enlarged upon this point because the non-electrical dealer can easily hire help of this character. As a matter of strict fact, we know that he seldom does, but my main objection to him may be summed up in the expression that he is too close, if not absolutely unfair, in buying; he has too little regard for quality, and he does not remain permanently the electrical jobber's customer. I do not accuse him of inability in the matter of servicing goods sold, but he is frequently as indifferent in this respect as he is in the matter of hiring qualified salesmen.

The principal criticisms of the electrical contractor as a retailer are:

1. He is not a merchant and, by inference, never will be one.
2. His credit rating is, as a rule, unfavorable.
3. He is lacking in aggressiveness.

It has been said that the majority of electrical contractors and dealers fail. Granting, solely for the sake of the argument, that this is true, it is not the failures that I am talking about, but the successes.

### Discounts Too Small

If there is any great degree of reason for the charge of inefficiency and incompetency against the electrical retailer, there is abundant defense to be introduced in his behalf. The retailer has never been treated fairly in the matter of remuneration, and he has frequently been subjected to crushing competition by the very jobbers who condemn him. He has been asked to maintain a high-class establishment, frequently in the heart of the high-rent district, with well-paid, neatly dressed, skilled and technical salesmen, and to pay for this out of a commission of 20 to 30 per cent, when his neighboring retailers in other lines receive more than double for services of the same, or less efficient, character.

In recent years sympathy for the retailer has increased, and the conviction has gradually been forced home to jobbers and manufacturers that if this class of customer is to survive at all, fairer treatment must be accorded him. His discounts are slowly but surely creeping through the "thirties" and up to 40 per cent. Nothing less than 40 per cent on ordinary lines will ever save the situation for the electrical retailer. He is no more of a miracle worker than retailers in other lines, and if they must have it, so must he. On specially difficult lines, such as

*From an address before the winter meeting of the Electrical Supply Jobbers' Association, Cleveland.

motor-driven devices, even better than 40 per cent must be given him if he is both to market the device and service it six months or a year without additional compensation.

### COST OF MARKETING

Forty per cent for the retailer, with reasonable compensation for the jobber, means that the jobber and dealer are to receive as much for selling the device as the manufacturer gets for making it. At first blush, it might seem that here is fine political capital for the well-known case of the People versus the Middleman, but a cold and dispassionate analysis of the evidence shows differently.

So long as the public will not go to Pittsburgh for its steel, just so long must steel products be kept on display in retail stores from Maine to California. And so long as the people will not go into the outskirts of the city or its manufacturing and wholesale districts to make their purchases, just so long must the retailer remain in the high-rent district at the expense of the people. Many things combine to make the task of marketing difficult, and who shall say that the man who sells does not do as good a job as he who makes? Shall he not, then, be entitled to equal compensation?

Thus far I have said little or nothing regarding the central station's part in the retail business. Until recent years the central-station idea was that the devices were to be sold for the purpose of creating an off-peak load, and that profit from sales of the devices themselves was of no consideration. Only recently has it become an accepted theory that the merchandise itself must pay its own way, and here the central station has found its position superior in no way to that of the ordinary retailer, so far as overhead expense goes.

### MANUFACTURING EFFICIENCY NEEDED

To summarize the situation, I should say that the jobber is in the industry permanently; that he can handle these lines most economically through the electrical contractor-dealer and, to a limited extent, through the central station. I would say that whoever retails electrical appliances will have to be paid a price commensurate with the work done and the expense involved; that if, after according the jobber and retailer their necessary remuneration, the public will not pay a retail price that leaves the manufacturer a profit, then the manufacturer must become more efficient. Ours is a comparatively new industry, and perhaps our manufacturers still have something to learn.

An electric range, for instance, ought not cost half as much as a Ford automobile. The rugged structure of a 16-in. desk fan ought not cost twice as much as the delicate mechanism, assemblage and calibration of a 5-amp. wattmeter. A coffee percolator should not cost as much as it takes to ship a thousand pounds of them a thousand miles. The jobbers have recently given largely of their time and money to ascertain their own cost of operation and have gladly welcomed the offer of the manufacturers to police this investigation. Would the converse hold good, and may we some day see the manufacturers investigating their own costs with the steadying influence of jobber supervision over the work?

And, finally, would it not be well for both jobber and manufacturer to realize that their interest in an electrical appliance is not ended until it reaches a satisfied consumer, and that satisfied consumers will come only through satisfactory retailers?

# Competition in the Heating Line

**A Few Reflections on the Influence of Business Rivalry—Reasons Why We Need Not Fear Though Patent Bars Are Down**

BY THOMAS C. RUSSELL
President and General Manager
Russell Electric Company, Chicago, Ill.


T. C. RUSSELL

WE WHO are in the business of manufacturing electrically heated appliances are apt to forget when we contemplate the expiration of the Marsh patents this month that competition does us good. The Japanese people probably owe their sturdiness and perseverance largely to the fact that they have lived for ages in a land which, except for about one-eighth of its area, is all cruel mountains. Combat strengthens manhood. I believe it was Theodore Roosevelt who said, "The highest type of man that civilization has produced is a fighting man."

So it is in the field of manufacture. Competition is sometimes destructive, but it certainly sharpens the wits and forces progress in the art and in the industry.

My company for some years has been manufacturing a number of moderate-priced electric heating specialties in competition with the established older, higher-priced lines. Our business has been developed in the face of the keenest competition with well-organized and amply financed concerns of large experience. We have found ways to manufacture quality products at lower than prevailing costs and therefore have been able to sell at very moderate prices. Out of this has come a distinct stimulus to all the manufacturers of these goods, and the public today has a better curling iron, a better grill and better values in other specific appliances than it would have if no competition had impelled us all to eagerness to better our product and reduce the cost. Easy money has ruined many a good business.

There is only one kind of competition that any manufacturer, jobber or dealer in heating appliances need fear—devices that are made for price only and without regard to quality. But such competition is always temporary. In a little while the dealer who sells it finds his customers complaining and he learns his lesson. For it is good will that makes business for the manufacturer, the jobber and the dealer.

The man who starts to sell cheap

stuff makes money, but he loses customers and he soon finds that it costs him more than he makes. Quality is not just a moral obligation; it is a business necessity. If the goods fall down, the woman who owns them looks to the dealer for protection, the dealer looks to the jobber, and the jobber falls back on the man who sold to him, and the business crumples up. We all have a responsibility to prevent the sale of dangerous appliances, but competition in the production of a reliable product is a good thing for us all.

The American people want a guarantee that stands permanently behind the goods and a price that pays an ample profit, but shares with them the benefits of low cost. They know that the man who does not make sufficient on his goods to prosper cannot provide for the protection of his customers, and without this he cannot succeed.

#### TO PROSPER THE FIRST DUTY

It is the first duty of the manufacturer, therefore, to prosper by conducting his business on an economic basis so that his costs may be low and so that he can sell at a reasonable price. If he does this he need not fear competitors. For if he cannot make good merchandise and compete with other men selling good products, at a good profit, he has no right to occupy the stage.

Many men feel that the methods and policies under which they run their business enterprises are entirely their own private affairs, but this is not the case. The prices at which they and their competitors sell their goods are a matter of concern to the industry. It is good business methods that make possible low cost, and it is low cost that makes possible low price. The way the manufacturer of heating appliances conducts his business, therefore, has a lot to do with his ability to meet the more active competition that will undoubtedly come now that all bars are down. Nobody will be able to come in and overnight learn all the kinks of the busines. The losses which the experienced manufacturers have had to stand from time to time are witness to the fact that the newcomers will find it a hard field to work. It will take time for them to learn both their product and their market.

In the meantime it behooves the present manufacturers to look to their efficiencies, not alone in manufacturing but in selling. They must recognize the fact that good customers must not be undermined by selling "fly-by-nights." It is possible to combine an easy credit policy and stiff collections or stiff credits and easy collections, but easy credits and easy collections do not go together. Full financial responsibility right down the line is absolutely vital to permanent success.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Electric Refrigeration Faces Active Season

Owing to unusually snowy weather without periods of extreme cold of sufficient length to form a normal ice crop, many localities in the North and East will furnish remarkably good markets for electric refrigerating equipment during the coming spring and summer. In New England the alternation of snow with warm rains has resulted in the formation of ice of inferior quality and abnormally small thickness. Many cases have occurred where the ice ponds have been cleared of snow only to have these labors rendered vain by the arrival of another storm before harvesting could take place. Predictions are that the ice crop will be small and next summer's prices high. Manufacturers of refrigerating equipment are working hard in preparation for this business, and vigorous efforts are in prospect by central stations and contractor-dealers to cultivate this class of service through intensive advertising and solicitation.

## Increase in Use of Electric Signs in England

A noticeable increase in the use of electric signs for advertising purposes is taking place in England, according to reports to the United States Department of Commerce. The development of this means of public display, however, in no way approaches that of cities of similar size in the United states. Usually they consist only of an illuminated word or two concerning the firm or the product advertised. Some are lighted continuously and others flash off and on. Only in a very few instances are colored lights used, and the result is not particularly effective.

## Number of Delinquent Electrical Accounts Increases

The delinquent electrical account report prepared by the Electrical Credit Association has Chicago in the lead with 1,104 accounts for December, 1922. This is a gain of 291 over November, but a lower average amount by $48.18. Compared with November and December, 1921, the December, 1922, account is lower by 53, but an increase in value from $107.49 to $125.84.

New York is next on the list, with 485 old accounts in December, 1922, as against 434 in December, 1921, with a respective average value per account of $193 and $136. The gain over November, 1922, is 96 accounts, but a decreased average value of $25. The list of accounts is as shown below:

VALUE AND NUMBER OF DELINQUENT ELECTRICAL ACCOUNTS

| Branch and month | Number of Delinquent Accounts Reported | Total Amount | Average Amount |
|---|---|---|---|
| Central Division: | | | |
| November, 1921 | 1,111 | $142,209.09 | $128.00 |
| November, 1922 | 813 | 141,482.10 | 174.02 |
| December, 1921 | 1,157 | 124,376.98 | 107.49 |
| December, 1922 | 1,104 | 126,342.89 | 125.84 |
| New York: | | | |
| November, 1921 | 328 | 57,550.00 | 173.00 |
| November, 1922 | 389 | 84,743.00 | 218.00 |
| December, 1921 | 434 | 58,840.00 | 136.00 |
| December, 1922 | 485 | 93,428.00 | 193.00 |
| Philadelphia: | | | |
| November, 1921 | 202 | 26,540.09 | 131.43 |
| November, 1922 | 215 | 24,703.46 | 114.90 |
| December, 1921 | 186 | 28,992.97 | 155.87 |
| December, 1922 | 183 | 19,307.58 | 105.51 |
| New England: | | | |
| November, 1921 | 68 | 7,912.95 | 116.37 |
| November, 1922 | 47 | 6,130.29 | 130.43 |
| December, 1921 | 44 | 8,484 25 | 192.82 |
| December, 1922 | 34 | 3,809,68 | 112.05 |
| Pacific Coast: | | | |
| November, 1921 | 16 | 1,054.82 | 65.92 |
| November, 1922 | 24 | 4,117.10 | 171 54 |
| December, 1921 | 23 | 2,667,74 | 107.72 |
| December, 1922 | 14 | 2,225.43 | 158.90 |

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.030 | $0.0295 | $0.0271 |
| Cold finished shafting, per lb. | 0.0385 | 0.0378 | 0.0333 |
| Brass rods, per lb. | 0.1742 | 0.171 | 0.155 |
| Solder (half and half), per lb. | 0.2425 | 0.24 | 0.2075 |
| Cotton waste, per lb. | 0.1175 | 0.11 | 0.106 |
| Washers, cast iron (½-in.), per 100 lb. | 4.33 | 4.33 | 3.65 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 3.11 | 3.11 |
| Machine oil, per gal. | 0.36 | 0.36 | 0.40 |
| Belting, leather, medium, off list | 49% | 30-10%@50% | 46% |
| Machine bolts, up to 1-in. x 30-in., off list | 51⅓% | 55%@60% | 64¼% |

## Vacuum Cleaner Sales Increase 15 to 25 per Cent in Six Months

Although this time of the year is generally known as a dull season for vacuum cleaners, manufacturers of grades featured in the larger of the advertising campaigns report increasing sales. These increases range from 15 to 25 per cent heavier than six months ago, which was a season that required less sales effort. Deliveries generally are normal, in some cases it having been necessary to carry on overtime work in order to keep up with orders. Some of the makers of quality cleaners who at the present time report increases in sales ranging from 15 to 20 per cent state that they are confident that their business will grow 15 per cent more during the next half year if their present intensified sales efforts are continued.

## Wholesome Growth in Radio Industry

David Sarnoff, vice-president and general manager of the Radio Corporation of America, believes that the growing increase in sales of complete sets is one of the most wholesome signs of progress that have yet been seen in the radio industry.

"Amateurs who are really young experts have succeeded in putting together sets that have given very creditable results," Mr. Sarnoff said. "They have understood every feature of such a set, operating it with expert knowledge and affectionate regard. Complete sets, however, embody the research and skill of America's foremost radio engineers. From these complete sets the amateurs are obtaining amazing results when conditions are right.

"No one ever dreamed when radio was first discussed that it would be possible to manufacture a home receiving set at a cost that makes possible the low prices now prevailing. The development of manufacturing processes has tended steadily toward simplification, and whereas at the beginning the sales were mainly among the amateurs, the public generally is now beginning to install radio receiving sets.

"There has been a growing appreciation of the fact that expert knowledge is not needed when complete sets are bought. The first big rush of buying came from the amateurs. When this first big demand was supplied there was a noticeable tendency on the part of dealers to wonder why sales had fallen off.

"As a matter of fact, the radio industry had really reverted to normal. It had established itself upon a regular merchandising basis. The increase in business, which began in September, was based upon a growing appreciation by the general public that radio is here to stay and broadcasting is here to stay.

"The growing increase in the sale of complete sets is one of the most wholesome signs of progress that have taken place in the radio industry. It means that the merchandising phase has arrived and is on a sound basis."

## Electrical Exports in 1922 Were $63,213,838

Electrical exports from the United States during the year 1922 amounted to $63,213,838, according to the Bureau of Foreign and Domestic Commerce of the Department of Commerce. This figure shows a falling off of $32,601,047 from the figures of 1921, when exports amounted to $95,814,885, and a falling off of $38,776,166 from the figures for 1920, when they amounted to $101,990,004. Electrical exports for December, 1922, and for the years, 1920, 1921 and 1922 are as follows:

ELECTRICAL EXPORTS FOR THE YEAR 1922

| Articles | Value: December, 1922 | Value: Total Year 1922 |
|---|---|---|
| Turbines | $99,335 | $1,720,480 |
| Generators | | |
| Direct-current— | | |
| Under 500 kw. | 50,446 | 535,501 |
| Over 500 kw. | 62,684 | 998,975 |
| Alternating current— | | |
| Under 2,000 kva. | 29,000 | 290,668 |
| Over 2,000 kva. | 360,556 | 1,412,262 |
| Accessories and parts for generators | 20,994 | 1,135,736 |
| Self-contained lighting outfits | 28,701 | 441,569 |
| Batteries | | |
| Primary, dry | 90,928 | 1,047,093 |
| Primary, wet | 391 | 35,992 |
| Storage | 133,300 | 1,473,560 |
| Transforming and converting apparatus: | | |
| Transformers, power | 247,103 | 4,158,798 |
| Transformers, other | 78,011 | 747,324 |
| Rectifiers | 12,361 | 61,208 |
| Condensers, double-current and motor-generators, dynamotors, synchronous and other converters | 51,224 | 1,305,200 |
| Transmission and distribution apparatus: | | |
| Switches and panel-boards, except telephones | 259,977 | 2,701,508 |
| Switches and circuit breakers | 166,546 | 1,891,921 |
| Fuses and fuse plugs | 24,978 | 198,665 |
| Meters and measuring instruments: | | |
| Watt-hour and other measuring instruments | 52,602 | 564,476 |
| Volt, watt and ampere meters, and other recording, indicating and testing apparatus | 141,322 | 876,453 |
| Lightning arresters, choke coils, reactors and other protective devices | 100,970 | 678,438 |
| Motors, starters and controllers: | | |
| Motors under 1 hp. | 77,059 | 772,433 |
| Stationary motors— | | |
| 1 to 200 hp. | 212,300 | 2,037,231 |
| Over 200 hp. | 45,386 | 665,967 |
| Railway motors | 89,743 | 480,149 |
| Electric locomotives | | |
| Railway | 140,703 | 853,562 |
| Mining and Industrial | ....... | 224,645 |
| Other motors | 6,389 | 351,384 |
| Rheostats, controllers and other starting and controlling equipment | 159,949 | 920,118 |
| Accessories and parts for motors | 86,377 | 1,138,241 |
| Electrical appliances: | | |
| Electric fans | 92,009 | 816,116 |
| Electric lamps: | | |
| Arc | 842 | 21,115 |
| Incandescent— | | |
| Carbon-filament | 8,927 | 62,393 |
| Metal-filament | 89,380 | 1,224,630 |
| Other electric lamps | 19,617 | 184,421 |
| Flashlights | 30,734 | 253,623 |
| Searchlights and projectors | 47,076 | 279,801 |
| Motor-driven household devices | 67,943 | 641,608 |
| Domestic heating and cooking apparatus | 62,357 | 596,895 |
| Therapeutic apparatus, X-ray machines, galvanic and faradic batteries | 46,625 | 585,987 |
| Signal and communication devices: | | |
| Radio and wireless apparatus | 163,236 | 2,897,799 |
| Telegraph apparatus | 53,677 | 316,299 |
| Telephone apparatus, including switchboards | 376,955 | 4,391,498 |
| Police, fire and burglar alarm apparatus | 10,160 | 43,234 |
| Railway signals, switches and appurtenances | 140,778 | 685,227 |
| Bells, buzzers and annunciators | 7,006 | 63,563 |
| Other electrical apparatus and appurtenances: | | |
| Spark plugs, magnetos and other ignition apparatus | 129,537 | 1,092,931 |
| Insulating material | 99,977 | 876,003 |
| Metal conduit, outlet and switch boxes | 21,851 | 295,194 |
| Sockets, outlets and receptacles | 74,310 | 488,703 |
| Other wiring devices | 176,620 | 1,342,426 |
| Other electrical apparatus, not elsewhere specified | 631,056 | 7,844,250 |
| Globes and shades for lighting fixtures | 45,746 | 440,997 |
| Electrical glassware, except for lighting | 25,027 | 172,890 |
| Electrical porcelain | 93,030 | 1,379,750 |
| Carbons for electric lighting, electrodes and batteries | 98,106 | 1,098,094 |
| Insulated wire and cable (iron and steel) | 24,906 | 377,927 |
| Other manufactures of aluminum | 53,579 | 925,238 |
| Copper: | | |
| Bare wire | 135,065 | 1,875,422 |
| Insulated wire and cable | 175,728 | 1,982,093 |
| Total electrical machinery, apparatus and appurtenances | $5,836,391 | (1922) $63,213,838 |
| (1921) | 5,177,276 | (1921) 95,814,885 |
| (1920) | 13,812,180 | (1920) 101,990,004 |

## New England's Growing Volume of Business Helping Collections

Collections in New England are responding to the growing volume of business in manufacturing and jobbing circles, and continued favorable terms for money are helping to restore more stable conditions in the electrical field. Representative houses are rounding up their accounts in an average of fifty-eight to sixty days, although some outstanding paper is not taken care of under eighty or ninety days. Improved relations between central stations and contractor-dealers are doing their part in establishing better conditions. Railroads, central stations and large industrial plants are meeting their obligations well and considerable discounting of bills is being practiced by larger buyers. Overcompetition has tended to reduce somewhat the number of organizations undertaking to do electrical supply jobbing in this territory. While the cost of doing business is still very high, increasing volume of trade is a powerful factor in creating favorable sentiment toward the year's prospects, and there is nothing in sight to justify disquiet as to collections in the next few weeks.

## The Metal Market

### Copper Continues Strong at 15 Cents—A Few Others Selling at 15.12½ Cents

The copper market continues strong, most holders quoting 15 cents a pound. A few other big selling agents are firmly quoting 15.12½ cents and show no inclination of reducing their price to 15 cents to attract some of the going business. These latter sellers are steadfast in their opinion that the market is due to go higher, especially if the present demand from the consumers continues. Export business in copper is slightly better, although orders are not large. Quotations are unchanged at 14.75 to 14.80 cents, f.o.b. New York harbor, and 14.95 to 15 cents, c.i.f., European ports.

NEW YORK METAL MARKET PRICES

| | Jan. 31, 1923 Cents per Pound | Feb. 6, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 14.87½–15.00 | 15.00–15.12½ |
| Lead, Am. S. & R. price | 7.75 | 8.00 |
| Antimony | 7.00 | 7.50 |
| Nickel, ingot | 30.00 | 25.00–30.00 |
| Zinc, spot | 7.00 | 7.05 |
| Tin Straits | 38.62½ | 39.00 |
| Aluminum, 98 to 99 per cent | 23.00 | 22.00–23.00 |

## Copper and Brass Products

Copper, brass and bronze mills quote the following prices on brass and copper products:

Copper wire, 16.38 to 16.63 cents net, mill; brass wire, 19.5 to 21.5 cents; copper sheets, 22.25 cents; copper rods, 15.5 to 15.75 cents; brass rods, 17.25 to 21.38 cents; sheet brass, 19 to 20.63 cents.

# The Week in Trade

**Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

PRICES of wire, conduit and flexible cable are slightly stronger owing to the continued heavy demand by the building industry and to longer deliveries. A noticeable spurt in sales of high-tension equipment and poles to central stations that are making extensions and repairs is reported in the Far West and Middle West. Some labor trouble in the textile field and telephone unions is causing concern. Electrical interests are well satisfied with the building outlook for the spring and summer months. Motor manufacturers report increasing business and fair stocks. One maker of a quality vacuum cleaner reports that his sales are 25 per cent heavier than they were six months ago, 15 per cent of this increase being laid to improved business conditions and the remaining 10 per cent to greater sales effort. Keen competition in metal reflector fixtures along the Pacific Coast has resulted in a 10 per cent price drop. Retail trade has been hampered somewhat by the colder weather, although the volume of heater sales is disappointing. Stocks of complete radio sets are reported spotty.

**New York** Demand for all appliances is only fair, a lull which is expected to be of short duration. Supplies and equipment to central stations show some improvement. Jobbers and contractors expect the coming year's construction of industrial and residential buildings to bring record-breaking orders. Fixtures are on a keen merchandising basis, with firm prices. Motors are showing improvement and stocks are only normal. Radio shows added strength with stocks of the better sets in a decreased state.

**Chicago** Basic commodities, including wire, conduit and flexible cable, are selling well. Shipments of conduit are improving, but the present demand is too great to allow much stocking up on this material. Jobbers report a fair trade in fuses, schedule material and fixtures, since most of the building construction will not be finished until April. Motor manufacturers declare that January was a continuation of December's sales rate.

**Boston** Retail trade has been hampered somewhat by cold weather. Manufacturers are well supplied with orders for many weeks ahead in most lines. Radio stocks are spotty in the face of a heavy demand for apparatus, greatly stimulated by improved broadcasting programs. Labor conditions are disturbed in the textile field, with internal difficulties evident in the telephone unions. The outlook is good for an active spring in the building industry, with price conditions in control of commitments for summer and fall.

**Baltimore** Business is proceeding at a normal rate with an upward trend shown in the prices of cable and wire. Most of the jobbers are well stocked. Although prices are remaining firm on heaters, the demand is beginning to show a seasonal decline. Motors, although showing a steady demand, are declining considerably in price. Business during the month of January was reported as very good from practically all the dealers and jobbers, and the outlook is good.

**Atlanta** Shipments on heavy electrical apparatus are lengthening. Jobbers report business as a whole very good with a pick-up in the demand for pole-line hardware as a result of the sleet storm of ten days ago. The volume of heater sales is disappointing. Telephone interests in this district have announced a program of expansion which will call for the expenditure of $1,500,000 during the coming year.

**Cleveland** Trade generally continues brisk and the volume has been distributed over many commodities. Collections are improving. Manufacturers are increasing production in anticipation of heavy buying in the spring. Despite the colder weather, building operations continue to maintain a strong demand for fixtures and lamps. Appliance sales are fair. Heaters are improving.

**Pittsburgh** Increasing business in the jobbing field is reported. Prices generally are firm, and stocks are quite well maintained. Rubber-covered, bare and weatherproof wire have shown a slight advance with a steady demand. Central-station business is more active than during the month of January. Collections generally are improving. Orders for central-station equipment are larger.

**St. Louis** Jobbing business continues to improve. The holiday demand had a stimulating effect upon the distribution of radio sets, household appliances and fancy lamps. The almost uninterrupted building operations due to the open winter have been reflected in orders for wiring, which are reported as unusually heavy for this season of the year.

**New Orleans** A slight increase in business is noticeable, dealers and jobbers reporting good sales in appliances and lamps. Central-station equipment is moving in larger volume. Collections are somewhat improved. Building construction continues at a fair rate.

# Demand, Supply and Price Trend of Eighteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Washers and Cleaners, Conduit Boxes and Tape

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Radio | Rectifiers | Heaters |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **New York** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Slow | Slow | Sdy. | Sdy. | Slow | Act. | Spy. | Sdy. | Sdy. | Act | Sdy. | Sdy. | Act. | Sdy. | Slow |
| Supply | Nml. | Hi. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy | Sdy. | Slow | S'ow | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Act. | Sdy. | Act. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Firm | Firm |
| **Boston** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Slow | Slow | Slow | Slow | Sdy. | Sdy. | Act | Act. | Act. | Sdy. | Sdy. | Act. | Act. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. |
| Price trend | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Baltimore** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Slow |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Slow | Act. | Act. | Act. | Act. | Slow | Act. | Act. | Slow |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slow | Slow | Slow | Slow | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Slow | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Low | Nml. |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Slow | Sdy. | Slow |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Paul-Minneapolis** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Act. | Act. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Hi. | Nml. | Nml. | Low | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Poles | Act. | Act. | Slow | Act. | Slow | Sdy. | Act. | Sdy. | Act. | Slow | Act. | Sdy. | Act. |
| Supply | Nml. | Low | Low | Low | Act. | Low | Low | Low | Nml. | Nml. | Low | Nml. | Hi. | Hi. | Nml. | Nml. | Low | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Act. |
| Supply | Hi. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Hi. | Low | Nml. |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Inc. | Firm | Inc. | Inc. | Firm | Dec. | Firm | Firm | Dec. | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Slow | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc | Firm | Firm | Firm | Firm | Firm | Firm |

## St. Paul-Minneapolis

Business is excellent with retail buying above normal. Construction of buildings continues at a fair rate helped by open winter weather. Dealers are showing their confidence in the general situation by ordering in large amounts. Demand for complete radio sets and parts is increasing. Radio stocks are low and there is a shortage of quality material. A big demand for rectifiers continues with very low stocks.

## Salt Lake City

The market is steady with no important changes from prices of last week. Jobbers and dealers generally have settled down to hard sales work, adhering strictly to budget limits and keeping to conservative lines. Washer campaigns will be on with the arrival of March, and the tendency will be to limit advertising expenditures. A shortage of skilled labor is expected as construction increases.

## Denver

Sudden cold weather has retarded building construction for the first time. Building permits are increasing, the total for the year thus far having passed $1,500,000, and this represents a 30 per cent increase over the corresponding period of last year. Railroads and industrial plants are making extensive inquiries relative to electrical installations, and a number of central stations in this district are planning improvements.

## San Francisco

Sales continue at a fair rate. Several jobbers are engaged in fixture-sales campaigns and are helped by extensive advertising. There is keen competition along the entire coast in the metal reflector market, which has resulted in a 10 per cent price drop and slower deliveries from the factories. Radio stocks are rather spotty and demand continues fair. Prices are firm.

## Portland-Seattle

Business reports indicate very little change, sales remaining good for this time of the year. There seems to be no indication of a slackening in the demand for materials entering into new construction. Electrical permits in building show an appreciable increase over December, 1922, the valuation for Portland being 30 per cent greater. All the larger power companies in the Northwest are working on developments of considerable magnitude.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Wagner Electric Elects Officers

At a meeting of the board of directors of the Wagner Electric Corporation held Jan. 25 the following officers were elected: W. A. Layman, president; A. H. Timmerman, vice-president; P. B. Postlethwaite, vice-president; T. T. Richards, vice-president; V. W. Bergenthal, treasurer, and J. W. Wescott, secretary. According to officials of the corporation, miscellaneous general sales for the months of December and January increased more than 100 per cent over those of one year ago, and January plant production will be 100 per cent greater than for the same month last year.

## Electric Truck Sales Conference

The Cowan Truck Company, Holyoke, Mass., held a three-day sales conference from Jan. 27 to 29, the sessions being at the company's plant in Holyoke and at a local hotel. A complete tour of inspection of the works was made and a new model electric truck was demonstrated. On Jan. 28 Col. Charles R. Gow, Boston, president of the Associated Industries of Massachusetts, addressed the officers and salesmen on "The Advantages and Disadvantages of Doing Business in New England."

## Uehling Instrument Order

The Solvay Process Company, which installed 24 Uehling $CO_2$ recording and indicating units in its Syracuse (N. Y.) plant last October, has just ordered eight additional similar units from the Uehling Instrument Company, Paterson, N. J., for its boiler plant at the same works. This company also has numerous Uehling $CO_2$ recorders at its Detroit (Mich.) and Hutchinson (Kan.) plants.

## Electric Sign Company Institutes Suit for Patent Infringement

A suit for infringement of patent has been instituted in the Supreme Court, New York County, by the Electric Sign Company, 240 West Twenty-fifth Street, against the Norden Electric Sign Company, American Sign Company, P. J. Martin, Inc., Atlas Electric Sign Corporation and Straus & Company, Inc., to procure an injunction restraining these companies from manufacturing electric display signs which, it is claimed, infringe upon the patents under which the Electric Sign Company is manufacturing. The patent rights involved in this suit cover a new type of electric sign, invented by Bruno von Bueltzingsloewen, for which an extremely low current consumption is claimed. The von Bueltzingsloewen patents are the property of the Electric Sign Company, which is bringing suit not only for patent infringement by the defendant companies but also for an accounting on signs already constructed by the defendants, which, it is alleged, violate the rights in question.

## General Electric Workers Will Receive Stock in April

Approximately ten thousand General Electric Company employees who have been paying for the common stock of the company on the installment plan for the last two years will make final payments in March and will receive their stock probably about the first part of April. Weekly deductions, which have been made at the rate of $1 per share, will terminate March 16. First dividends on this new issue will be paid July 15. The authorization of this stock issue was for 50,000 shares with a par value of $5,000,000.

## Crocker-Wheeler Enters Radio Field with New Line

The Crocker-Wheeler Company, which did a great deal of manufacturing of radio sending apparatus for the navy previous to and during the war, particularly in the line of generators and dynamotors, has now, since the development of the audion, turned its attention to receiving devices. Dr. S. S. Wheeler, the president of the company, has authorized the ELECTRICAL WORLD to announce that the company is now ready to place on the market the "Add-a-Unit" line of radio apparatus, which will consist of high-quality independent units arranged with binding posts. The various units will consist of detector tube or radio frequency amplifier or audion frequency amplifier or variometer, etc., each unit to be in a well-finished case. These units can be combined into "sets" or combinations from simple to most complex. The idea is to market them on an individual-unit basis under quantity production at a reasonable unit cost.

## White-Cedar-Pole Men Meet in Minneapolis

The twenty-seventh annual meeting of the Northern White Cedar Association was held at the West Hotel, Minneapolis, on Jan. 30-31. There was a large attendance from all the cedar-pole producing and selling organizations which make up its membership.

Co-operation with the pole buyers in producing and manufacturing a better quality of white cedar pole was shown. The Northern White Cedar Association specifications were thoroughly discussed, and changes were made in inspection rules to insure the kind of poles needed for hard usage on central-station lines. To show more clearly the buyer of white-cedar poles and the public utilities just what conditions go to make up the production of "quality" poles a constructive publicity and advertising campaign was authorized.

## Bussmann Company Opens New Office in Philadelphia

The Bussmann Manufacturing Company, manufacturer of fuses, St. Louis, has opened an office in the Philadelphia Bourse, Philadelphia, with A. E. Arthurs, district manager, in charge. Mr. Arthurs has been with the Bussmann company for a number of years, the greater part of time as district manager of the Pittsburgh territory. R. C. McDaniels succeeds him in Pittsburgh.

## Takes Maine Pneuvac Agency

C. M. Quick, formerly Portland (Me.) manager of the Gainaday Electric Company, has been appointed agent for Maine for the Pneuvac Company, Worcester, Mass., with a new office under the name of the C. M. Quick Electric Company, 548½ Congress Street, Portland.

**The Electrical Appliance Manufacturing Company**, Waterbury, Conn., has purchased land and buildings at 987 Watertown Avenue, Waterbury, and is altering the buildings for its own occupancy.

**The Litcher Electric Company**, 41 Market Avenue, Grand Rapids, Mich., manufacturer of electrical equipment, is completing plans for three-story and basement works, to replace its plant recently destroyed by fire.

## Westinghouse Awards Contract for $200,000 California Plant

The Westinghouse Electric & Manufacturing Company has awarded a contract for the erection of the first unit of its proposed plant at Emeryville, Cal., where a site of 12 acres has been acquired. The structure will be one and two-story and is estimated to cost close to $200,000. Other units of approximately the same size and cost will be built later. The present plant will be operated by the Westinghouse High Voltage Insulator Company, a subsidiary organization, with headquarters at Derry, Pa., and will be devoted exclusively to the manufacture of high-tension insulators, utilizing local clays for raw material. The main building will consist of four oil-burning kilns, to be extended later to twelve such kilns. The initial working force will approximate one hundred operatives. Ray P. Hunt, manager of the material and process department at the East Pittsburgh works of the parent organization, has been appointed manager of the new Emeryville plant.

## Foreign Trade Notes

NEW ELECTRIC PROJECT IN CZECHO-SLOVAKIA.—A company has been organized with the assistance of the State and the Province of Bohemia which will supply electricity in Prague. The company is capitalized at 180,000,000 crowns and will be known as the Central Electricity Works, with headquarters at Ervenice. The proposed plant, work on which has already started, will be erected near the Edwige lignite field at Ervenice. The initial installation will have a capacity of 45,000 kw. Electricity will be transmitted to Prague at 100,000 volts.

NEWCASTLE, AUSTRALIA, TRAMWAY SYSTEM TO BE ELECTRIFIED.—The state government of New South Wales, Australia, *Commerce Reports* states, has decided to equip the tramway system of the city of Newcastle for electrical operation. The system will cover about 50 miles of tracks in Newcastle and suburbs and will cost about $5,000,000. Power will be furnished by the present 25-cycle electric power plant (a state property) situated within the city limits.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in the Fiji Islands (No. 5,253) for electrical supplies, general hardware, etc.

Purchase and agency is desired in England (No. 5,255) for instantaneous automatic water heaters.

Purchase is desired in Spain (No. 5,276) for a machine for the reconditioning of worn and flattened electric car wheels.

An exclusive agency is desired in Canada (No. 5,290) for electrical devices or appliances.

An agency is desired in Switzerland (No. 5,314) for new inventions in machinery and electrical novelties.

EQUIPMENT FOR PORT ELIZABETH (SOUTH AFRICA) ELECTRIC PLANT.—Tenders will be received by the Municipal Council, Port Elizabeth, South Africa, until April 16 for a 3,000-kw. turbo-alternator, boilers, coal hoppers, coal conveyors, boiler house, steam and feed-water pipes, etc.

METERS, CABLES AND ACCESSORIES FOR ELECTRIC WORKS, MONTEVIDEO, URUGUAY.—Tenders will be received by the State Electricity Works, Montevideo, Uruguay, until March 15 for 1,500 direct-current and 8,500 alternating-current meters, etc. Tenders will also be received until March 10 for 66,000 m. (about 72,600 yd.) of high-tension cable and accessories.

ELECTRIC GENERATOR AND BOILER FOR JOHANNESBURG PLANT, SOUTH AFRICA.—The Municipal Council of Johannesburg, it is stated, has decided to ask for tenders for equipment for the municipal electric plant, including an 8,000-kw. generating unit, with switchgear, cables, etc., and one 45,000-hp. boiler.

APPROPRIATION FOR EXTENSIONS TO THE VICTORIA, AUSTRALIA, ELECTRICITY SCHEME.—A bill has been adopted by the Victorian House of Assembly providing for an appropriation of £1,576,000 for projects of the State Electricity Commission as follows: For additions to the main works, including power house, etc., at Yallourn (Morwell), to cost £760,000; extensions to the transmission line to the southwest of the state £120,000, for the Sugarloaf hydro-electric project, £50,000, and for an electric scheme in Gippsland, beyond Morwell, £70,000.

## New Apparatus and Publications

ARC WELDING.—The Burke Electric Company, Erie, Pa., is distributing bulletin No. 127, covering its electric arc welding equipment.

METALS AND ALLOYS.—Henry Carey Baird & Company, Inc., 2 West Forty-fifth Street, New York City, will soon bring out a new book on alloys, entitled "Metals and Their Alloys," by Charles Vickers.

BALL AND ROLLER BEARINGS.—Pamphlet No. 13 issued by the Hoffman Manufacturing Company, Ltd., Chelmsford, Essex, England, describes the use of "Hoffman" ball and roller bearings on electrical machinery. The Norma Company of America, Anable Avenue, Long Island City, N. Y., is agent for the company in the United States.

LIGHTING DATA.—The Edison Lamp Works of General Electric Company, Harrison, N. J., is distributing bulletins L.D. 110A, L.D. 140, L.D. 141, L.D. 142, L.D. 143 and L.D. 144, entitled "The Lighting of Textile Mills," "The Lighting of Paper and Pulp Mills," "Automobile, Garage and Display Room Lighting," "The Lighting of Woodworking Plants," "Lighting of the Food Industries" and "Street Lighting with Mazda Lamps" respectively.

PULVERIZING MILL.—"Hardinge Conical Mills" is the title of catalog No. 13, section 1, issued by the Hardinge Company, 120 Broadway, New York City, which describes its conical ball and pebble mills and their application to the field of grinding and pulverizing.

TURBOBLOWER.—The B. F. Sturtevant Company, Hyde Park, Boston, is distributing a leaflet describing the "Sturtevant turboblower" installed in the Fall River (Mass.) Gas Works.

BOILER FURNACE ECONOMIES.—Bulletin No. 53 issued by the Quigley Furnace Specialties Company, 26 Cortland Street, New York City, describes and illustrates a method of reconstructing and patching boiler-furnace walls with "Hytempite."

CUPOLA TAPPER AND STOPPER.—The Medart Company, Potomac and De Kalb Streets, St. Louis, is distributing a leaflet covering the "Medart" safety cupola tapper and stopper, recently developed by the company.

OXY-ACETYLENE WELDING AND CUTTING.—The Norman W. Henley Publishing Company, 2 West Forty-fifth Street, New York City, has published the revised and enlarged sixth edition of "Oxy-Acetylene Welding and Cutting," by P. F. Willis.

COAL-HANDLING MACHINERY.—"How Hell Gate Station Handles Coal with Maine Electric Machinery" is the title of bulletin No. 4, issued by the Maine Electric Company, Portland, Me., which describes and illustrates the coal-handling equipment installed in the Hell Gate plant of the United Electric Light & Power Company.

GLOSSARY OF ELECTRICAL TERMS.—The Bureau of Foreign and Domestic Commerce announces a new edition of the "Glossary of Electrical Terms," which has been compiled by the Electrical Equipment Division in co-operation with the Electrical Manufacturers' Council. It has been prepared to conform to changes in the export classification schedule which went into effect on Jan. 8, 1923. This pamphlet is intended solely for reference purposes by exporters when making out their export declarations, so that these will indicate accurately the goods shipped in so far as statistical classifications are concerned.

## New Incorporations

THE EAST RAINELLE LIGHT & POWER COMPANY, Rainelle, W. Va., has been incorporated with a capital stock of $25,000 by D. D. Raine, J. W. Gray and J. G. Shewey.

THE KINZUA (PA.) POWER & LIGHT COMPANY has been chartered with a capital stock of $5,000 by Fred H. Smith, H. R. French, Kinzua, and C. C. Flatt, Corydon. The company proposes to supply electricity for lamps, heaters and motors.

THE LAMAR (IND.) LIGHTING COMPANY has been incorporated with a capital stock of $2,500 to supply electricity for lighting purposes. The directors are B. W. Huebschman, Claude R. Martin and Fred P. Keller.

THE BOCARATONE (FLA.) WATER & LIGHT COMPANY has been chartered with a capital stock of $25,000 to generate and distribute electricity, operate water works, gas systems, etc. The officers are: J. McL. Stevens, president; G. H. Howard, vice-president, and W. L. Brown, secretary and treasurer.

THE SMITH RIVER (CAL.) LIGHT & POWER COMPANY has been organized for the purpose of supplying electricity in Smith River. The officers are: C. Romander, president and general manager; Henry Westbrook, Sr., vice-president, and George D. Wood, secretary and treasurer.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

BOSTON, MASS.—The Edison Electric Illuminating Company of Boston has acquired a site at Warrenton and Carver Streets on which it proposes to erect a large substation, from which electricity generated at the station on Summer Street and later from the new Weymouth station, will be distributed in this territory.

LOWELL, MASS.—The chief of the Fire Department has recommended the installation of a new fire-alarm system. The cost is estimated at about $200,000.

TAUNTON, MASS.—The installation of an ornamental lighting system in tho business district is under consideration.

WAKEFIELD, MASS.—The local works of the Heywood-Wakefield Company will be equipped throughout for electrical operation. The company has contracted with the commissioners of the municipal electric plant for electricity to operate its plant.

CRANSTON, R. I.—Negotiations are under way between Mayor Arthur Rhodes and the Narragansett Electric Lighting Company for improvements to the street-lighting system.

NORWALK, CONN.—Plans for the proposed hat factory to be erected on Van Zandt Street by the Crofut & Knapp Company, South Norwalk, include a power plant. The cost is estimated at $750,000.

WATERBURY, CONN.—The Connecticut Light & Power Company has issued $4,500,000 in capital stock, part of the proceeds to be used in connection with its 100,000-hp. generating plant at Devon. Later three additional units will be installed to double the capacity of the plant.

## Middle Atlantic States

HAMMOND, N. Y.—The Rossie (N. Y.) Electric & Manufacturing Company contemplates extensive improvements to its local plant, including the installation of new generating equipment and the erection of 94 miles of transmission lines.

MEDINA, N. Y.—The Genesee Light & Power Company, Batavia, has acquired the Western New York Utilities Company. Extensions will be made in the transmission system and operations continued under the present name.

NEW YORK, N. Y.—The New York Central Railroad Company is planning to establish a 2,000-kw. substation at Park Avenue and 110th Street for third-rail train service.

NEW YORK, N. Y.—Bids will be received by the Board of Purchase of the City of New York, Room 526, Municipal Building, until Feb. 14 for furnishing weatherproof cable to the Department of Plant and Structures.

NEW YORK, N. Y.—Bids will be received by the Department of Public Welfare, Tenth Floor, Municipal Building, until Feb. 13 for furnishing and installing new partitions, electric wiring and heating on the first and second floors of pavilions 7, 8, 9 and 17, Sea View Hospital, borough of Richmond, city of New York.

SHERMAN ISLAND, N. Y.—The International Paper Company, 30 Broad Street, New York, is planning to build a 25,000-kw. hydro-electric generating plant here.

BLOOMSBURY, N. J.—The New Jersey Power & Light Company, Dover, contemplates extending its service to Bloomsbury and to install a street-lighting system.

PHILLIPSBURG, N. J.—The Board of County Freeholders plans to establish a lighting district in Greenwich Township. Lamps will be installed on all highways.

AVONDALE, PA.—The George F. Lee Coal Company contemplates rebuilding its electrically operated coal breaker recently destroyed by fire, causing a loss of about $250,000.

EGYPT, PA.—The Pennsylvania Power & Light Company will build a transmission line from Laurys to Egypt for power service at local cement mills.

LANCASTER, PA.—Arrangements are being made by the Edison Electric Company to place its wires underground in the business section of the city. The cost is estimated at about $161,000.

PHILADELPHIA, PA.—Among the new buildings to be erected at the University of Pennsylvania is a new central power plant, which will be located on the Schuylkill River front near the South Street Bridge.

PITTSBURGH, PA. — The West Penn Power Company has secured permission to erect transmission lines in portions of Allegheny and Washington Counties.

PITTSBURGH, PA. — Electric power equipment will be installed in the baking plant to be erected by the Ward Baking Company at West Park and Ridge Avenues, to cost about $1,000,000.

RAYSTOWN, PA. — The Penn Central Light & Power Company, Altoona, has been granted permission to acquire the property of the Raystown Light & Power Company. Extensions will be made to the system.

RIDGWAY, PA.—The American Water Works & Electric Company, 50 Broad Street, New York, has acquired the Keystone Power Corporation, operating at Kane, Smethport and vicinity. Extensions and improvements will be made in the system.

SUMMERVILLE, PA. — Arrangements have been made with the Jefferson Electric Company, Punxsutawney, to extend its lines to Summerville. Power will be furnished by the West Penn Electric Company.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company plans to build an electric switching and operating department on Kloman Street, to cost about $105,000.

MONONGAH, W. VA. (P. O. Fairmont) —The Monongah Fuel Company will install a substation, switchboard room and other electrical departments for mine service.

APPOMATTOX, VA.—Residents of the town have organized a company to establish an electric light plant to replace the one destroyed by fire recently. The sum of $25,000 has been subscribed to the stock of the company.

RADFORD, VA.—The City Council is considering the installation of an ornamental lighting system.

WASHINGTON, D. C.—Plans are being prepared by the Commissioners of the District of Columbia for alterations and additions to the Armstrong Manual Training School, to cost about $500,000.

WASHINGTON, D. C.—Bids will be received by Louis A. Hill, director of the Bureau of Engraving and Printing, Washington, D. C., until Feb. 17 for fifty-eight motor equipments for power plate-printing presses.

WASHINGTON, D. C.—Bids will be received by the Purchasing Agent Post Office Department, until Feb. 14 for 500 three-cell cylindrical flashlight batteries.

## North Central States

PONTIAC, MICH. — The Fisher Body Corporation, Detroit, will build a power house in connection with its proposed local plant, to cost about $2,000,000.

AGOSTA, OHIO.—The installation of a local light and power system for commercial service is under consideration.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until Feb. 16 for furnishing turbo-generators, air compressor, vacuum pumps and vacuum cleaning equipment for the Fairmont pumping station, division of water, Department of Public Utilities.

FRANKFORT, OHIO.—Plans are under consideration by the City Council to secure electricity to operate the local system. It is proposed to extend the line from New Holland.

LOWELLVILLE, OHIO.—The Pennsylvania-Ohio Power & Light Company, Youngstown, plans to build an addition to its local plant to increase the output by 15,000 kw.

BROWNSVILLE, KY.—The Rock Asphalt Company, Bowling Green, plans to build a power house in connection with a new plant on the Green River, to cost about $200,000.

LOUISVILLE, KY.—The construction of a joint interurban station at Second and Liberty Streets, to cost about $500,000, is under consideration by the Louisville Railway Company.

MADISONVILLE, KY.—The Kentucky Utilities Company, Louisville, has contracted to furnish electricity here. The municipal power plant will be closed down.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company will install a transmission line on Belmont Avenue and other thoroughfares.

CARLYLE, ILL.—Bids will be received at the office of the city clerk, until Feb. 19 for construction of a filtration plant, including two centrifugal pumps with motors, transformer, valves, connections, etc. Dawson & Walraven, Springfield, are engineers.

CHARLESTON, ILL.—The Central Illinois Public Service Company contemplates the construction of a one-story ice-manufacturing and cold-storage plant, 75 ft. x 75 ft., in Charleston. L. D. Roberts, 130 North Sixth Street, Springfield, is engineer for the company.

CHICAGO, ILL.—Plans are being prepared by D. I. Davis and associates, 327 South La Salle Street, for a power plant, to cost about $60,000.

CHICAGO, ILL.—The Woodlawn Business Men's Association has petitioned the City Council for the installation of new street lamps on Sixty-third Street from Jackson Park to South Park. The cost is estimated at $45,000.

CHICAGO, ILL. — An addition will be built to the power house at the Michael Reese Hospital, Twenty-ninth Street and Ellis Avenue. Schmidt, Garden & Martin, 104 South Michigan Avenue, are architects.

FREEPORT, ILL.—The Arcade Manufacturing Company has engaged C. E. Wolfley, architect, Stewart Building, to prepare plans for extensions to its power house, to cost about $35,000.

GRANITE CITY, ILL.—Extensive improvements are being made by the Madison County Light & Power Company, including the erection of a transmission line from Venice to Wool River and East Alton and the installation of new equipment in the generating stations at Edwardsville and Venice. The cost of the work is estimated at about $200,000.

KEWANEE, ILL.—Plans are being prepared for the installation of a municipal electric light plant, to cost about $125,000. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

CHETEK, WIS.—The Wisconsin Hydro-Electric Company, Amery, will begin work in the spring on the reconstruction of the local system and will also erect heavier wires between Chetek and its two hydro-electric plants at Amery and Colfax.

KENDALL, WIS.—The plant of the Kendall Electric Company has been purchased by the Eastern Wisconsin Electric Company, Sheboygan, which will supply electricity for the local system from its high-tension transmission lines.

MARINETTE, WIS.—Extensive improvements are contemplated by the Menominee & Marinette Light & Traction Company, including extensions to the Rapids power plant, to cost $210,000; improvements to the electric distribution systems of the twin cities, together with the construction of a large substation on Wells Street, Marinette, and that part of the high-tension line in this city, to cost $120,000. The transmission line from Pound to the city limits, connecting the hydro-electric and steam systems, will cost more than $100,000.

MONROE, WIS.—The property of the Monroe Electric Company has been acquired by the Wisconsin Utilities Company, Martintown. The latter company has been granted permission to issue $315,000 in bonds, part of the proceeds to be used for extensions and improvements to the local system.

RACINE, WIS.—The Wisconsin Gas & Electric Company is planning to install additional electrically operated unloading machinery on the river dock property, recently purchased by the company.

SHAWANO, WIS.—The installation of an ornamental lighting system on Main Street is under consideration by the Council.

WEST ALLIS, WIS.—The City Council is considering the installation of an ornamental lighting system on Sixth-eighth Avenue Boulevard and on National Avenue from Forty-seventh to Sixty-sixth Avenue. It is also proposed to establish a brightly lighted street from the northern city limits to Greenfield Avenue.

ST. CHARLES, MINN.—The Minnesota Gold Mining Company contemplates the installation of an electric substation in connection with its proposed ore-reduction plant to cost about $125,000.

BURLINGTON, IOWA.—The Burlington Glass Company plans to build a power house in connection with its proposed local glass works on North Main Street, to cost $250,000.

CEDAR RAPIDS, IOWA.—Plans for the proposed hospital building, to be erected by the Mercy Hospital Association, Sixth and Division Streets, to cost $250,000, include a power house.

KANSAS CITY, MO. — Electric power equipment will be installed in the ice-manufacturing plant to be erected at 4730 Tracy Street by the American Ice Company, to cost about $110,000.

KIRKSVILLE, MO.—A special election will be held on Feb. 24 to vote on the proposal to issue $40,000 in bonds for a municipal electric plant.

EMPORIA, KAN.—The Atchison, Topeka & Santa Fé Railroad Company plans to build a power house in connection with its proposed local repair shops, to cost about $5,000,000.

KANSAS CITY, KAN.—Plans are under consideration for changing the entire street-lighting system from gas to electricity, and also for extensions to the ornamental street-lighting system.

## Southern States

CRAMERTON, N. C.—Plans for the proposed local textile mill to be erected by the Mays Mill, Inc., to cost about $1,000,000, include a power house. J. E. Sirrine & Company, Greenville, S. C., are engineers.

CHARLESTON, S. C. — Electric cranes, transportation equipment, etc., will be installed in connection with the proposed municipal pier to be built by the Port Utilities Commission, to cost about $1,000,000.

GRAYSVILLE, GA.—A power plant will be installed in the proposed crushed stone works to be constructed by the Chickamagua Quarry & Construction Company, with an initial capacity of 500 tons per day.

JACKSONVILLE, FLA.—The City Council is considering a bill submitted by the City Commission recommending an expenditure of $850,000, covering a period of three years, for extensions to the municipal electric plant, erection of substations and transmission lines.

MIAMI, FLA.—The Council contemplates calling an election to submit the proposal to issue $400,000 in bonds for extending the street-railway system to the suburbs. C. W. Murray is city engineer.

ST. PETERSBURG, FLA.—The Greater St. Petersburg Land Company plans to install a lighting system on an 800-acre tract now being developed for residential purposes.

GREENVILLE, TENN. — The Tennessee Eastern Electric Power Company Johnson City, will install a new unit at its local hydro-electric station.

COLUMBUS, MISS.—Bids will be received by the State Bond Improvement Commission, Jackson, until Feb. 24, for the construction of a central power house at the Mississippi State College for Women. The cost is estimated at about $70,000.

GULFPORT, MISS.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 21 for an ice-manufacturing and refrigerating plant at the United States Veterans' Hospital, Gulfport, specification 4,780. The equipment will include motor-driven compressors, condensers, etc.

QUANAH, TEX.—The Quanah Light & Ice Company will install additional equipment at its power plant.

SLATON, TEX. — The Texas Utilities Company will make extensions and improvements to the system of the Slaton Light & Power Company, recently acquired.

STAMFORD, TEX. — The Chicakasha (Okla.) Cotton Oil Company contemplates the erection of a new local plant, to cost about $150,000. The tentative plans include a power house.

## Pacific and Mountain States

ALBANY, ORE.—Extensions and improvements are contemplated by the Mountain States Power Company in the Willamette Valley, including the erection of a transmission line from Prospect to Springfield, to cost about $200,000.

BAKER, ORE. — The Eastern Oregon Light & Power Company is reported to be considering the erection of a steam generating plant, to cost about $200,000, or the purchase of the equipment and business of a power company operating in this vicinity.

HUNTINGTON, ORE. — The Columbia Cement Company, Concord Building, Port-

land, will build a power plant in connection with its proposed local cement manufacturing plant, to cost about $1,000,000.

NEWPORT, ORE.—The property of the Yaquina Electric Company has been taken over by the Lincoln County Light & Power Company, Toledo, recently organized. The local system will be reconstructed and a twenty-four-hour service established. A new substation will also be built.

LOS ANGELES, CAL. — Construction plans which will develop 1,250,000 hp. of electrical energy to serve ten counties in southern California have been announced by the Southern California Edison Company. The work will include as the first step in the large project the erection of a terminal station, to cost $2,000,000, which will be known as the Laguna Bell substation and have a capacity of 165,000 hp. Energy for the new station will be supplied from the Big Creek transmission lines.

LOS ANGELES, CAL. — The County Supervisors contemplate the installation of a lighting system in the Willowbrook section.

LOS ANGELES, CAL. — The Southern California Edison Company plans to erect a transmission line over Anaheim Bay, Seal Beach district.

LOS ANGELES, CAL.—An ordinance has been passed authorizing the installation of an ornamental lighting system on Sunset Boulevard from Stanley Avenue to Vista Street.

PASADENA, CAL.—Extensions are contemplated to the municipal electric plant, including the erection of a step-up substation, cooling towers, etc. The installation of four additional boilers in the generating plant is also planned. The cost of the improvements is estimated at about $300 000.

RIVERSIDE, CAL.—Electric power equipment will be installed in the proposed ice-manufacturing and refrigerating plant, 100 ft. x 100 ft., to be built by the National Ice & Cold Storage Company, Twelfth Street.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 27 for 4,200 ft. of electric wire (Schedule 465) and for 7,500 ft. of radio frequency cable (Schedule 480) for the Mare Island Navy Yard.

SAN JOSE, CAL.—The Pacific Gas & Electric Company will make extensions and improvements to its local plant, including the installation of additional equipment, to cost about $100,000.

SMITH RIVER, CAL.—The Smith River Light & Power Company, recently organized, is building an electric plant. Orders, it is stated, have been placed for a generator and two Diesel engines. C. Romander is president and general manager.

WILLITS, CAL. — The State Railroad Commission has granted the Central Mendocino County Power Company permission to purchase the water and electrical distributing system of the Willits Water & Power Company, together with 5,260 acres of watershed lands.

GERLACH, NEV.—Plans have been prepared by Weeks & Day, California Insurance Building, San Francisco, for a town site for the Pacific Portland Cement Company, Pacific Building, San Francisco, to include hotel, cottages, power plant, tramways, etc.

## Canada

VANCOUVER, B. C.—The Bridge River Power Company contemplates the construction of a hydro-electric plant near Seton Lake, Lillooet, to develop about 400 000 hp. Electricity generated at the proposed plant will be used to augment the power plants of the Vancouver Power Company at Coquitlam and Stave Lake and will be transmitted to and distributed in Vancouver.

MEAFORD, ONT. — A bylaw has been passed by the Town Council authorizing an agreement with the Hydro-Electric Power Commission of Ontario for the erection of transmission line, to cost about $65,000.

PORT ARTHUR, ONT.—The construction of a third unit at the Nipigon hydro-electric plant, to provide an additional 12,000 hp., is under consideration by the Hydro-Electric Power Commission of Ontario.

TORONTO, ONT.—The Temiskaming & Northern Ontario Railway Company has authorized plans prepared for the electrification of its lines, including the road from North Bay to Cochrane, 250 miles; the Iroquois subdivision, 7 miles, and the Porcupine division, 33 miles, to cost about $10 000,000, with equipment.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued Jan. 16, 1923)

1,442,474. RECORDING TELEGRAPHIC RECEIVING INSTRUMENT; J. A. Hulit, Chicago, Ill. App. filed Dec. 13, 1920. Adjustment of pen recorders used on tapes.

1,442,487. LOCKING MECHANISM FOR MOTOR VEHICLES; O. A. Lucier, Baltic, Conn. App. filed May 6, 1921. Ignition circuit lock.

1,442,496. ELECTRICAL CONTROLLER; E. W. Seeger, Milwaukee, Wis. App. filed April 13, 1922. Fluid rheostats for induction-motor control.

1,422,508. BURGLAR AND LIKE ALARM SYSTEM; S. G. Adams, Lewisham, England. App. filed May 1, 1922. Combined with telephone system with visual indicator in exchange.

1,442,514. ELECTROPLATING MACHINE; F. J. Bell, Cleveland, Ohio. App. filed April 22, 1922. Adapted for galvanizing wheel rims.

1,442,545. MAGNETIC CHUCK; O. S. Walker, Worcester, Mass. App. filed March 28, 1919. Number of pole pieces in form of parallel, oppositely magnetized strips.

1,442,608. VARIABLE-FIELD DEHYDRATOR; H. C. Eddy, Los Angeles, Cal. App. filed June 25, 1921. Length of electric field automatically increased when current increases.

1,442,648. CORD CONDUCTOR; C. E. Carter, Montreal, Can. App. filed Oct. 23, 1920. Cord connected to exterior resistances for motion-picture machines.

1,442,728. CONTROLLING AND REGULATING APPARATUS; F. W. Meyer, Milwaukee, Wis. App. filed Jan. 13, 1917. Eliminating hunting action in converters by use of electroionic valves.

1,442,770. AUTOMATIC TELEPHONE AND SELECTIVE SIGNALING SYSTEM; T. G. Martin, Chicago, Ill. App. filed Nov. 30, 1907. Relates to systems in which selective ringing on party lines is necessary.

1,442,773. HOMOGENEOUS CRYSTALLINE PRODUCT AND METHOD OF MAKING THE SAME; H. A. Richmond and R. MacDonald, Jr., Niagara Falls, N. Y. App. filed April 25, 1922. Uses electric arc furnace.

1,442,781. REAMPLIFYING SYSTEM; H. W. Nichols, Maplewood, N. J. App. filed July 7, 1921. One element of the feed-back circuit of amplifier serves as radio-receiving antenna.

1,442,791. AUTOMOBILE STARTER AND GENERATOR; W. L. Bliss, Niagara Falls, N. Y. App. filed May 27, 1915. Single-unit system.

(Issued Jan. 23, 1923)

1,442,834. APPARATUS FOR WELDING RAILS; G. N. Steigerwald, Hatboro, Pa. App. filed Dec. 16, 1921. Welding rail joints by carbon arc process.

1,442,851. EAR FOR TROLLEY WIRES; G. W. Bower, Schenectady, N. Y. App. filed May 27, 1921. Clamping ear for mine service.

1,442,854. ELECTRIC GENERATOR; J. Burke, Erie, Pa. App. filed Nov. 6, 1919. Constant-current generator for welding apparatus.

1,442,858. ADJUSTABLE TEMPERATURE BATH FOR VISCOSIMETERS; W. Claypoole, Forest Hills, N. Y. App. filed Oct. 27, 1919. Thermo-electric relay controls current.

1,442 868. GAS-TESTING MACHINE; T. R. Ernest, Chicago, Ill. App. filed March 3, 1921. Spark test chamber to determine if gas is explosive.

1,442,896. WATCH STAND AND NIGHT LAMP; J. H. Maier, Brooklyn, N. Y. App. filed Nov. 12, 1921. Bulb on stand to illuminate watch dial.

1,442,898. ELECTROMAGNETICALLY CONTROLLED BRAKE; M. E. Neenan and J. J. Neenan, New York, N. Y. App. filed July 23, 1918. For control of elevator apparatus.

1,442,903. SPOTLIGHT; A. P. Paine, New Haven Conn. App. filed Oct. 28, 1921. Variable-focus flashlight.

1,442,908. TRANSMISSION MECHANISM; W. H. Ripley, Orange, N. J. App. filed Nov. 27, 1916. Gasoline engine, generator and motor for automobile drive.

1,442,910. ELECTRICALLY HEATED VESSEL; A. Steinhardt, Berlin, Germany. App. filed Aug. 29, 1921. Element placed in ceramic material in bottom of container.

1,442,925. ELECTRIC FURNACE; D. De Luca, Cotrone, Italy. App. filed Oct. 13, 1919. Furnace for melting scrap material.

1,442,974. DISTRIBUTOR STAND; T. L. Ryan, Muncie, Ind. App. filed Sept. 8, 1921. Method of making base of table lamps.

1,442,977. ETCHING MACHINE; E. G. Schwuchow and G. F. Johnstone, Chicago, Ill. App. filed Jan. 24, 1921. Electrolytic cell for etching flat material.

1,442,988. CONDUIT CAP FOR ELECTRIC INSTALLATION; W. H. Vibber, New London, Conn. App. filed Nov. 1, 1919. Conveniently secured to building, wall or post.

1,442,999. AUTOMATIC REEL FOR ELECTRIC DEVICES; R. B. Boyle, Kansas City, Mo. App. filed March 3, 1921. Wire between telephone and wall box held taut by automatic winding reel.

1,443,007. CONTROL OF ELECTRIC CIRCUITS; L. M. Clement and A. W. Kishpaugh, East Orange, N. J. App. filed Dec. 2, 1920. Rotating tube-filament rheostat and pressing same control current and insert ammeter in circuit respectively.

1,443,011. ATMOSPHERIC DISTURBANCE-REDUCING MEANS; H. J. J. M. de Regnauld, Toulon, France. App. filed Nov. 3, 1922. Amplitude-limiting arrangements for wireless-telegraph signals.

1,443,024. ELECTRIC FURNACE; R. M. Keeney, Denver, Col. App. filed Sept. 7, 1920. Furnace for smelting cyanide precipitates.

1,443,036. FOOT SUPPORTER AND HEATER; I. Panzam, Turin, Italy. App. filed Aug. 23, 1921. Electric heater for automobiles.

1,443,066. TRANSMISSION APPARATUS; E. Belin, Paris, France. App. filed July 31, 1913. Transmitting graphic documents over wires.

1,443,073. DYNAMO-ELECTRIC MACHINE; C. F. Gilchrist, Toledo, Ohio. App. filed June 25, 1917. Automobile generator and starting motors built from same material as far as practicable.

1,443,089. ELECTRIC HAND LAMP; D. Pepper, Philadelphia, Pa. App. filed Aug. 15, 1921. Means for changing focus, and space also provided within lamp for holding two reserve lamps.

1,443,091. METHOD FOR TRANSFORMING THE KINETIC ENERGY IN GASES INTO ELECTRICAL ENERGY AND MANNER FOR UTILIZING THE LATTER FOR CARRYING OUT GAS REACTIONS; C. Petersen, Christiania, Norway. App. filed Jan. 4, 1919.

1,443,106. USHER'S SIGNAL; J. J. Walsh, Syracuse, N. Y. App. filed Sept. 30, 1921. Flashlight to indicate number of vacant seats.

1,443,123. ELECTRIC WELDING APPARATUS; G. Giorgini, Greco Milanese, Italy. App. filed Feb. 16, 1921. Machines for welding metal rims.

1,443,165. ELECTRIC SIGNALING AND CONTROLLING APPARATUS; R. P. Brown, Philadelphia, Pa. App. filed July 20, 1918. Thermo-electric relay for controlling electric furnace temperatures.

1,443,166. FURNACE-REGULATING APPARATUS; R. P. Brown, Philadelphia, Pa. App. filed July 31, 1918. Changing furnace temperature at predetermined rate.

1,443,205. ELECTRICAL APPARATUS; J. Bijur, New York, N. Y. App. filed July 3, 1919. Control device for charging storage batteries.

1,443,209. RADIO RECEIVING SYSTEM; B. Bradbury, Schenectady, N. Y. App. filed Sept. 15, 1920. Apparatus for very sharp turning.

1,443,214. MOTOR-DRIVEN APPARATUS; J. Clayton, Coventry, England. App. filed Aug. 26, 1919. Manufacture of artificial silk similar to Topham system.

1,443,251. AUTO SAFETY SIGNALING DEVICE; J. W. Elardo, Fredonia, N. Y. App. filed July 15, 1921. Rear direction signal.

1,443,254. FIRE-ALARM HYDRANT; E. E. Ferguson, Portsmouth, Va. App. filed Jan. 6, 1921. Apparatus for simultaneously turning in alarm and opening water valve, the valve being provided with hose.

1,443,321. ELECTRIC ACCUMULATOR OR STORAGE BATTERY; H. Leitner, London, England. App. filed June 23, 1922. Each element comprises one or more pencils of active material separated by porous material.

1,443,322. ELECTRIC ACCUMULATOR OR STORAGE BATTERY; H. Leitner, London, England. App. filed June 23, 1922. Cellular structure for pencil electrodes.

(Issued Jan. 30, 1923)

1,443,357. AUDIBLE SOUND INSTRUMENT; B. F. Gardner, Chicago, Ill. App. filed Aug. 4, 1921. Determining quantity of oil and water by means of telephone receiver.

1,443,361. SYSTEM FOR THE TRANSMISSION OF RADIANT ENERGY; J. H. Hammond, Jr., Gloucester, Mass. App. filed July 27, 1917. High degree of secrecy may be maintained.

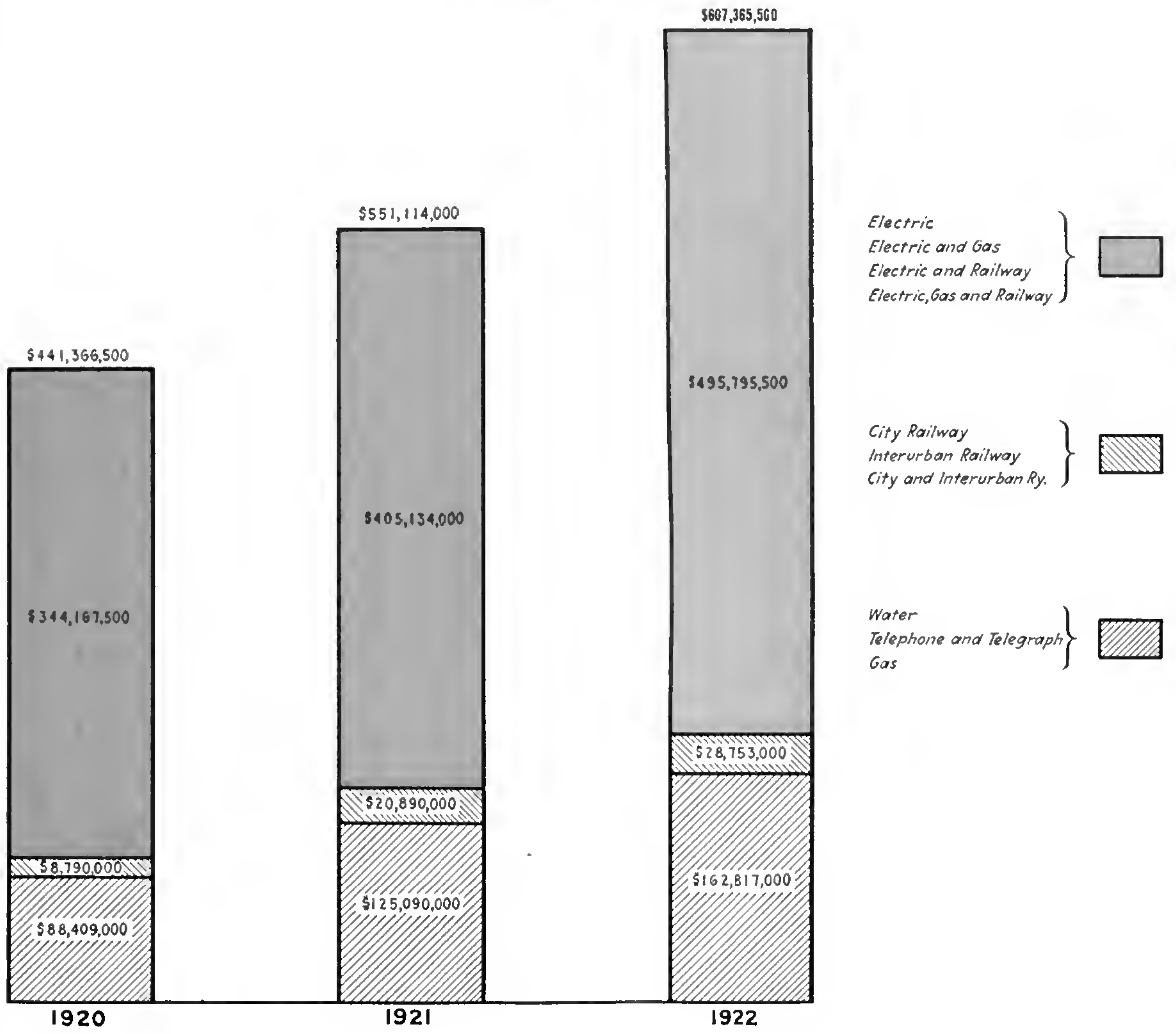
1,443,419. BURNISHING MACHINE; B. S. Lee, Beverly, Mass. App. filed May 6, 1921. Electrically heated setter for burnishing sole edges of boots and shoes.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## Steady Increase in Public Utility Bond and Stock Issues

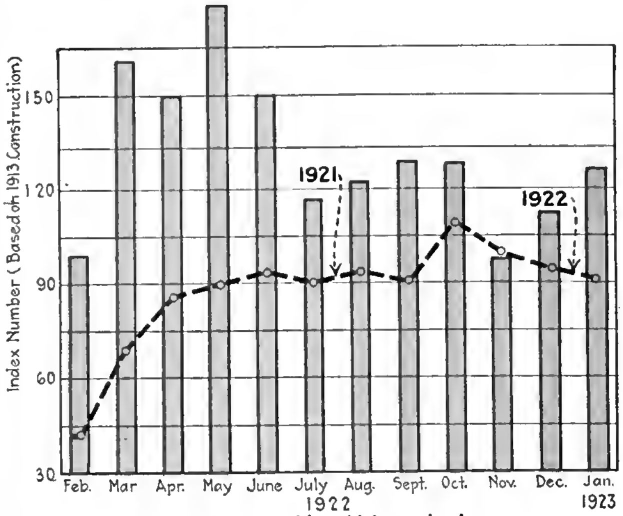
(Blocks of $500,000 and over)



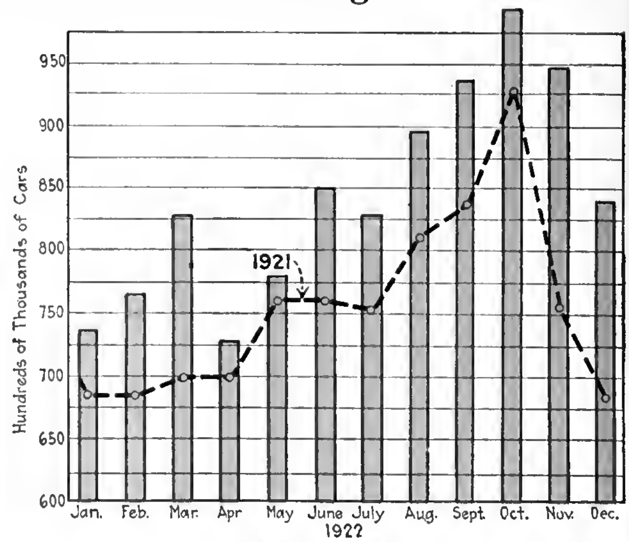

## Economic Stability of the Industry

PUBLIC utility financing during the past three years places that industry in a unique position. During 1921, when business was struggling in the slough of depression, the financing of industry at large was at an extremely low ebb. Statistics show that the financing done in the United States by industrials during 1921 was only about half of that reported for 1920 and about three-quarters of the 1922 financing. Public utilities, especially the electric light and power branch, were an outstanding exception to this decrease in the absorption of new money. Bond and stock issues of central-station companies during 1921 were about 18 per cent in excess of the 1920 financing, and 1922 was about 23 per cent over 1921. The high cost of money during the period of depression, while undoubtedly holding back much-needed extensions to the generating, transmission and distribution equipment of the operating companies, yet was not sufficient to retard materially the historic continuous growth of the industry. Data compiled by National City Company.

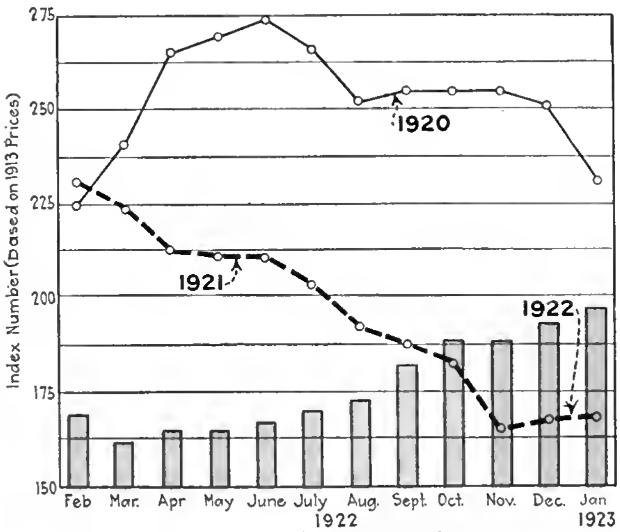
# How the Primary Industries Are Trending



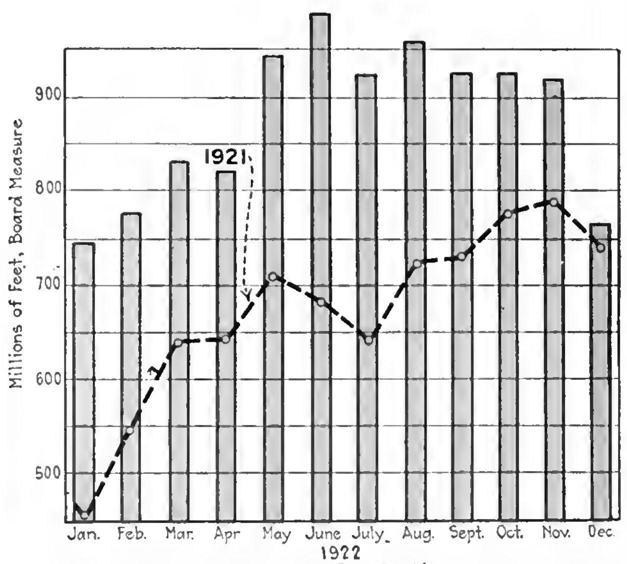

Construction Volume Index
(Engineering-News Record)



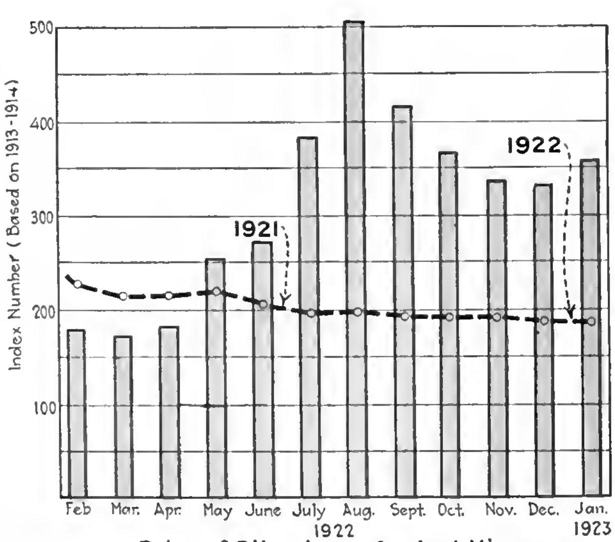

Total Average Weekly Freight-car Loadings




Contruction Cost Index
(Engineering-News Record)




Lumber Production
(Yellow Pine and Douglas Fir)




Price of Bituminous Coal at Mines
(Coal Age)

## Volume of Construction Points to Record Electrical Sales

ONE of the most outstanding economic facts of the present winter is the non-appearance of the normal seasonal drop in volume of construction under way or contracted for. Normally the fall and winter months witness a low ebb in construction. Last November did witness a material drop, but the increased volume reported during December and January points clearly to the year 1923 as one of unprecedented new construction. A reliable survey indicates that the total volume of building construction during 1923 will exceed five billion dollars, of which only about one-fifth will be absorbed in dwellings and apartment houses. Expansion in industry in general will call for new construction in excess of a half billion dollars. These data furnish another indicator of the record volume of business which is before the electrical industry both for apparatus and supplies and also for the sale of electrical energy.

Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

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W. H. ONKEN, JR. Editor    HAROLD V. BOZELL Editor

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# Self-Development

THE creative thinking that is the great power behind all industry is done by but a few men. Upon these few men, therefore, rests the responsibility for the development and the progress of civilization.

The mental tests made by the government during the war in drafting forces for military service produced statistics that embraced 1,700,000 men — men who were taken from every stratum of society and were graded for intelligence. The average mental age of Americans was found to be about fourteen. Only $4\frac{1}{2}$ per cent of our population rate above eighteen, and it is upon them that we must depend. From their ranks must come the superior minds who will carry onward the further advancement of the electrical industry for instance.

IT HAS been said of Abraham Lincoln, whose memory we have honored this week, that the very fundamental of his character was that he permitted himself to develop. Lincoln *permitted* himself to develop. And so he grew in knowledge, in confidence, in capacity, in influence and in usefulness to mankind. And out of the cabin on the frontier came through self-development one of that small group who do the thinking for the world, a great leader for all the people.

Opportunity and achievement do not come by inheritance. A man may enter life blessed with high mentality. He may have unusual advantages of environment and education. But his success in service, his value to society, will depend not alone on the extent of his ambition and his energy. It will be governed also by the degree to which he permits himself to develop and thereby take a higher place among his fellows.

THE greatest enemy of progress is the closed mind. The engineer, the manufacturer, the jobber or any one else who says, "This is my work," and will not learn and think beyond the day's need, is not only refusing to permit his own development, but is restricting his capacity for usefulness to the world that must depend upon his class for creative leadership. And the central-station executive who occupies his thoughts completely with operating, engineering and finance and does not build himself up for leadership in the community—he the head of a vital industry — is failing no less pitifully.

Men of the electrical industry are of that thinking class that carries the responsibility for progress — the small percentage of population that are blessed with superior minds. But the work that will carry civilization forward in the service of mankind will ever be done by individuals. The leaders will be those not born but self-developed to a superior usefulness. And, happily, development will come to any such man who will permit himself to grow.

# James William Perry

*A conservative leader among the electrical manufacturers, for twenty years an influence for constructive progress and good business practice.*

IF ONE looks closely at the electrical industry, he will see a scattered body of enthusiastic men steadily pioneering through forty years in a new science, a new art, and building it into a new industry. These have been years of experiment in invention, in production and in the commercial fabrication of an organized business, and as ever there have been two contributing forces counterbalancing each other. They are the eager-hearted, visionary men who are impatient of restraint and ever seek to hurry on to new adventures and the prudent, sure and thorough-thinking men who keep their feet upon the ground, an influence for conservatism. In combination they evolve a structure that is sound to the core.

James W. Perry, general manager of the electrical department of the H. W. Johns-Manville Company, for twenty years has been a prominent figure among the leaders of the conservatives. A clear thinker, sound in judgment and firm in decision, he has stood midway between the radicals and the reactionaries and done yeoman service in the upbuilding of this industry through the most vital period of its organization and development on national lines. Mr. Perry has exerted a great influence for sound business methods in the electrical industry. He has preached the policy of live and let live, opposing price cutting and all destructive practices. His counsel has been courageous and optimistic. He was a prime mover in establishing the first organized co-operation among the manufacturers of electrical materials, which resulted in the forming of the Associated Manufacturers of Electrical Supplies. He was the treasurer of this association and a member of its board from its inception until last September.

Mr. Perry was born in Parkersburg, W. Va., in 1868. In 1889 he joined the Johns-Manville company's Philadelphia branch, where he continued until the consolidation of this company with the Mansville Covering Company of Milwaukee, in 1902, led to his transfer to New York in charge of the electrical business of the new company. He has continued the active head of the manufacture and sale of its electrical and automotive products and is a director in the company and in several subsidiaries.

Mr. Perry is treasurer and a director of the Electrical Manufacturers' Council, a director of the Electrical Manufacturers' Club, and has long been active in the work of the N. E. L. A., at one time serving for five years as chairman of its exhibition committee. He is a member of the A. I. E. E. and the American Electric Railway Association.

# Editorial Comment

Electrical World, February 17, 1923

Volume 81 Number 7

### Wanted—a Yardstick

MANAGERS of public utilities under a common control and executives of properties that have enough points of resemblance to make comparisons of operations instructive are becoming more and more interested in analyses of performance of all phases of utility operation and service, for thus they hope to better the service and earnings of their own companies. There are many unit data which are suggestive in making such comparisons, but the industry needs more light upon the possibilities of grading public utilities. Some of the well-known groups of utility operators have found the existing units of comparison wanting, and at present the field is open for suggestions as to improved methods of approaching this continuously important problem.

### Selecting the Candidate for the Charles A. Coffin Medal

PRESIDENT FRANK W. SMITH has issued a letter to all electric light and power companies in the country indicating some of the factors which are to be considered in bestowing the Charles A. Coffin central-station medal. Readers will recall (see ELECTRICAL WORLD, Dec. 9, 1922, page 1293) that, according to the provisions establishing the Charles A. Coffin Foundation, "a gold medal . . . will be awarded annually to the public utility operating company within the United States which during the year has made the greatest contribution toward increasing the advantages of the use of electric light and power for the convenience and well being of the public and the benefit of the industry." It will be no small task to make the selection of this particular "public utility operating company," and there will doubtless be criticisms of the selection finally made. This much, however, should be said: that the annual bestowal of this medal will tend to bring into desirable prominence not only the utility receiving it but also and primarily the character of the service and the outstanding quality of this particular company. Thus others will be spurred on to adopt practices which are shown to be valuable and profitable—not for the mere winning of the next annual medal, but rather on account of the proved intrinsic worth of these practices. Of course, this is the principal value of all such medals, and the Charles A. Coffin medals and awards should, in the various lines in which they will be given, all serve to stimulate advance. It is proper and fitting that the name of Charles A. Coffin should be perpetuated in this manner as a constant reminder of his own contribution to the advance of electrical science and industry and as an encouragement to others.

It would also be a most fortunate circumstance if, in the work of the committees for the selection of the central-station company and for the selection of the electric railway company which are to receive the respective medals, some real contribution should be made toward the general question of rating of utilities for administrative or comparative purposes.

### Röntgen's Contribution to Humanity

GREATNESS is sometimes measured by accomplishment, but he enjoys the widest fame who does most for his fellow man. Thus the discoveries of Prof. William Röntgen, who died last week at Munich, will cause his name to be remembered long after the details of his work have passed into oblivion. His contribution to humanity was the discovery of a particular type of radiation produced by the discharge of electricity through a vacuum, or Crookes' tube. These rays, called "X-rays" because at the time their exact nature was unknown, have the quality of penetrating substances opaque to ordinary light and of being absorbed by certain other substances which are transparent to light. When used in connection with the photographic plate, shadow pictures or radiographs of the bones of the body or of metal objects embedded in the flesh or in wood may be obtained.

Although from the point of view of the physicist valuable contributions to our knowledge of X-rays have been made by Prof. J. J. Thompson and the Braggs of Cambridge, England, and Dr. Lane of Zurich, it is the use of the X-ray in surgery, in therapeutics and in dentistry which has been of greatest interest and benefit to mankind. Unfortunately this knowledge was not obtained without sacrifice, and many are the martyrs who have suffered burns and destruction of the flesh or even lost their lives in their endeavors to make the therapeutic value of the X-ray available to their fellow-men.

To Röntgen homage was due. Societies all over the world were named after him, and medals, honors and prizes were awarded him. Unlike many other benefactors of the race, he lived to see a most wonderful development of his discovery and to enjoy the fruits of his labor. His death adds another name to the gradually increasing list of departed scientists whose labors have been of signal benefit to humanity.

### Right-of-Way Purchases Related to Public Policy

"GET your right-of-way before any one knows what you are going to do" was the advice recently given an engineer who had a transmission-line project under consideration. The idea is the survival of a policy acted on by public utilities of various kinds in the early days, but it is one that has produced no small amount of trouble for and ill feeling toward these same utilities. It is doubtful whether there are any cases in which right-of-way for a transmission line has been

obtained where the property owners have been in doubt concerning the nature of the project after permission to cross the first piece of land has been secured. On the contrary, the air of deep mystery with which the old time right-of-way man surrounded his dealings usually resulted in suspicion and higher costs than an open policy would have caused. Moreover, right-of-way acquired in this manner is usually obtained with oral promises that are not written into agreements, and if they are violated, the ill feeling aroused lasts over long periods of years.

The purchase of easements or other rights for transmission-line right-of-way purposes by a power company ought to be a clean-cut business proposition in which the power company enjoys the confidence of those with whom it deals to such an extent that they, believing the advent of the power company to mean good to the whole community, will be willing to suffer some inconvenience, if necessary, in view of the greater good to come. In short, the power company in buying its right-of-way is conducting a legitimate business deal that is essential to the maintenance of its position. If the operation can be handled in this way, it can be made a means of better public relations. So long as it is handled in a secretive, hang-dog fashion there will always be unpleasant and unnecessary misunderstandings to live down.

## Agricultural Engineers Called to Judge Central-Station Practice

THE appointment by the American Society of Agricultural Engineers at its St. Louis convention in December of a committee to deal with the problem of central-station service and utilization of electrical energy on the farm is a move the significance of which cannot be ignored. This society is the body in which the engineers from the agricultural schools and experiment stations meet to discuss mutual problems, and it has had for some time a committee dealing with the problems of service from the individual electric plant.

Back of the appointment of the committee lies a story of many demands from individual farmers for information on the use of electricity. Not only has this been the subject of discussion with the pioneers in the application of engineering principles to agriculture, but central-station practices and faults have also been under review. As might be expected, varying degrees of criticism of central-station policies have been expressed by the farm experts, and by virtue of their position the engineers in the agricultural schools and experiment stations have often been placed in the position of judges.

Several cases have come under observation in discussion with agricultural engineers in which there is serious misunderstanding of central-station conditions or in which central-station men who ought to know better have adopted arbitrary attitudes that provide just ground for criticism. The central station has a real story and a real problem in this situation. The agricultural engineers, many of them electrical engineers who have turned to the agricultural engineering field after graduation, are capable of investigating, appreciating and judging that story. By virtue of their position and the confidence reposed in them the farmer will look to them for advice and final determination as to the reliability of the representations of the central-station men.

From a central-station standpoint, therefore, there is only one outcome to the situation. It is that in every state central-station organizations should work with the agricultural engineering and experimental schools in the search for the right methods of bringing electricity to the farm.

## Need of Simple Methods for Determining Conductor Sizes

TO THE man building up a distribution system the problem of the proper size of wire to use for extensions presents itself several times a day. In the past this problem was too often settled by the application of some set rule passed down from foreman to foreman, sometimes modified as conditions changed materially, but generally having its origin in some vague, general consideration of strength of material, of convenience in stock keeping or safe carrying capacity.

Nowadays it is hardly necessary to point out to the man laying extensions that economical consideration should be the basis in the selection of wire sizes. However, he must fail in his work unless he is given some convenient means of applying economies to such design. While each one of these may seem of quite small importance, the aggregate over a year's work is capable of showing economies involving thousands of dollars.

Any system should be able to work out constants which can be applied generally to its specific conditions. The result of these economical solutions, combined with the element of judgment necessary to determine on the number of sizes to be used, should show real economies in the distribution system.

## Peterson Coil Not a Panacea

TO GROUND or not to ground is a question that has always created discussion. Now that several new types of equipment are available which enter more or less extensively into the solution of the grounding problem and about which extended operating experience is not yet available, the question is revived with more than usual interest.

One of the most prominent new absorption types of transmission-protection equipment is the Peterson earth reactance coil. This is coming into considerable use in some places. A general opinion exists that it is best adapted to low-voltage systems of limited extent, but field experience is needed to determine its limitations in application; and although it cannot be said to have received even a moderate indorsement for high-voltage systems, it has several features that offer possibilities for greater development.

The chief claim is that the coil suppresses an arcing ground through the agency of a local resonant circuit condition and that it decreases the possibilities of electromagnetic induction in neighboring circuits by eliminating the third harmonic. As against these advantages arguments have been advanced to the effect that the system insulation must still possess a high factor of safety as there is a tendency to produce voltage surges. Moreover, there are certain complications in making changes in the coil calibration as the system arrangements or conditions change, for it is very difficult to obtain sufficiently delicate adjustments to extinguish the arc for all conditions of frequency and wave front that may arise on a given circuit.

Variable-frequency transients, unbalanced grounds and resultant corona effects, and energy magnitudes of great variety—all these elements must be encountered by the resonant circuit adjustment. In addition, electrostatic effects still persist to produce disturbances in neighboring circuits, and the telephone engineers are unable to agree on the universal application of the Peterson coil to improve inductive co-ordination.

In the near future actual operating experiences with the coil should be available from several systems, and more definite conclusions can then be formed. It is a cause for congratulation, however, to see the co-operation of telephone and transmission engineers in the common problem of insuring the more satisfactory operation of transmission systems. In the long run what is best for the transmission systems is also best for the telephone system, and vice versa.

### Penalizing the Electric Truck

THE lawmakers of this land do not yet appreciate that there is a difference between the electric vehicle and the gasoline car that should be reflected in the tribute which they pay toward the maintenance of the roads. The new motor-vehicle license law for 1923 in the State of New York, for example, is grossly unfair to both the electric truck and the electric pleasure car. The new tax is fixed on the basis of weight, with the result that a license for a five-ton (capacity) electric truck costs $104, as against $88 for the gasoline truck. The pleasure-car license figured on the same basis is even more unfair. The fee for 1923 is from three to seven times the fee for 1922, depending on the model of the car, that is, the year it was manufactured and its size. The unfairness of the new law is even more evident when the facts underlying its theory are analyzed. Two factors are assumed in shaping the law, one that the tax is in line with paying for wear and tear on the state highways and the other that such wear and tear is proportionate to weight. On both these counts the electric truck is unjustly rated. In the first place, its rapid development during the last three years has been for town and city local haulage and not for interurban and state highway use. In the second place, with any car the wear and tear on roads is not proportionate to weight alone, but is a product of weight and speed and the mechanical conditions of driving. Therefore, in spite of its greater gross weight per net ton carried, due, of course, to the weight of the storage battery, the "electric" is far easier on roads than any other type of truck. The simplest proof of this is that tires give a longer life on an electric truck than on a gasoline truck of the same capacity, and obviously the smooth starting torque of the electric drive and the absence of shock and vibration are the mechanical reasons for this longer tire life.

It is, of course, too late to abate the injustice of the New York law this year, but the issue is not confined to that state. Across the country it has become common practice to reckon license fees on the basis of car weight, and this method of estimating the road-destroying influence of a vehicle discriminates against the "electric" because of the natural characteristics of the car and the kind of service in which it is used. It has become important, therefore, that the manufacturers and users of electric vehicles take the initiative in devising some simple method of determining a license fee that will be fair to both electric and gasoline cars. They must then proceed to lay the facts before all legislative bodies with a constructive recommendation that will provide a fairer basis for taxation.

### What Will Be the Future Ash-Handling System?

ACCORDING to opinions expressed at the recent convention of the American Society of Mechanical Engineers, the most desirable method of handling ashes is to use bottom-dump ash hoppers discharging into industrial or railroad cars. Such equipment is easily operated and maintained, does not require excessive headroom and is adapted to emergency ash-removal methods. When imperative, the ashes can even be dumped on the floor.

The importance of having hoppers of ample size cannot be overemphasized. No hopper should be so small that the corresponding furnace has to be shut down or operated at reduced rating because an accident to the ash-removal equipment has prevented dumping the hopper for several hours. Some companies are going so far as to provide three and even ten days' storage in their ash hoppers. But such large capacity is hardly feasible except with submerged ash pits such as the West Penn Power Company uses.

Submerged ash pits are said by their owners to require no more investment than any other types of ash pits. Besides they prevent emission of carbon monoxide, corrosive gases and flames.

Mechanical conveyor systems will always find a place in plants which are so situated that the simpler form of ash-removal equipment favored at the A. S. M. E. meeting cannot be applied. When space requirements are limited they may be used to advantage, since the apparatus can sometimes be employed for both coal and ash. However, the maintenance expense continues to be a drawback.

Of late considerable attention has been directed to conveyors of the steam-jet and hydraulic-sluice type, apparently because of their simplicity and small space requirements. While they involve no moving mechanism to wear out, there is still the relative motion of abrasive ash and conduit. Furthermore, the steam economy of the jet type may be very poor unless the system is properly designed, the joints kept tight, worn nozzles replaced, and so forth. With proper attention given to the tightness of joints and provision made for readily replacing worn elbows, experience so far seems to indicate that ash containing fairly large clinkers can be handled. The Hell Gate installation of open-flume ash sluice is a noteworthy example of the hydraulic type which has operated very satisfactorily so far in the bulk supply station of the United Electric Light & Power Company.

With either form of fluid conveyor, however, it would seem desirable, in view of the limited experience with this equipment in the public utility field, to provide for some emergency method of ash removal in case the conduits should clog up or some similar contingency should occur.

Speaking generally, that ash system will be best which assures the highest reliability for the least annual expense (including fixed charges) and which can be readily supplemented by some expedient method in an emergency. How existing systems rank in desirability cannot be accurately determined until data like those mentioned above have been carefully compiled.

# Electricity Offers Opportunity to Beautify City Structures by Night

The new $7,000,000 Hampden County Memorial Bridge at Springfield, Mass., crossing the Connecticut River, affords an admirable example of the adaptability of ornamental and utilitarian electric lighting to works of civic pride. This reinforced-concrete structure forms a direct highway in and out of Springfield and shortens the connection between the urban center and the Berkshire Hills region and points west. Four central towers 80 ft. high carry each a 500-watt type C multiple lamp operated at 110 volts and in a globe 2½ ft. in diameter. The sides of the bridge are equipped with inverted magnetite arcs of 5 amp. rating, mounted on posts at a height of 18 ft. above the street. This photograph was taken under floodlight.

# The Future Distribution System

## An Analysis of All Types of Distribution Systems from All Standpoints Indicates that One Type of Distribution System Is Best—Comparison of Methods in Tabular Form

By WILLIAM C. L. EGLIN
*Vice-President and Chief Engineer Philadelphia Electric Company*

IT IS rather remarkable to find that the evolution of the light and power industry is tending in a direction to prove that in every respect the original Edison system possessed the fundamental requirements of engineering and economics which would be specified in an ideal system of today.

The Edison system fed all loads for which it was adapted from generating stations containing only one type of equipment, and it did this from a single type of distributing system. These two fundamental practices are granted to be ideals in modern systems, and the trend of development is in this direction; but investigation proves that action on these fundamental facts has been hampered by the existing installations, and only very haphazard analyses have been made of the possibilities for accomplishing the desired results more rapidly.

The distribution system of today comprises all the plant necessary for delivering energy from the generating station to the meter of the consumer. In the historical development of this phase of the electrical system several systems have been used, some of which have been discarded, but others still exist in their original form, and in many properties several types are found in operation.

For using both alternating current and direct current well-known systems are:

1. *Series System.*—This system requires a series connection for all equipment, utilizes constant current and requires a voltage that varies with number of energy devices connected.

2. *Two-Wire Parallel System.*—This system requires a parallel connection for all loads, utilizes a variable current and requires a constant voltage.

3. *Three-Wire System.*—This system is similar to the two-wire parallel system but allows double voltage.

4. *Feeder and Main System.*—This system requires constant voltage on the mains and a voltage on the feeder which depends upon the load.

In addition to these systems the multiple-wire polyphase alternating-current system is in great use. Three, four, five or more wires may be used in this system and many variations in connections are available.

### Fundamentals in Choice of System

From the available distribution systems choice must be made to secure the best results for the operations of a light and power company. Both financial and operating considerations enter into the study, and in addition the bearing of the decision upon associated activities must be weighed. From an electrical industry standpoint the public, the manufacturers and other light and power companies are concerned in the decision.

The cost of money is a major item in energy production and distribution, and from this standpoint it is essential to secure maximum output from all plant equipment per dollar invested. This points toward the use of one type of generating equipment and a single distribution system in order to take advantage of diversity in loads and to obtain the high load factors possible through the use of interconnected generating stations carrying the diversified loads.

A service element with many ramifications affecting associated activities is the requirement that there should be some fixed standard or standards of voltage applied to energy utilizing devices. A safe maximum voltage at which accidental contact would not be injurious to life would be the logical standard. This would raise the permissible minimum voltage to perhaps 150, either alternating or direct current. Of course, a slight allowance for the effect of line drop would be advisable in connection with the fixing of a standard voltage, and these variations should be kept above the standard value. The use of the highest possible safe voltage would reduce costs to the consumer, because voltage is a direct element in fixing plant investment and in addition is influential in fixing the cost of many energy-utilizing devices. It would seem advisable at this time to give further consideration to the choice of a standard voltage.

### Series System Should Be Discarded

The series system should be eliminated from the industry. Few utilization devices are applicable to the system, and it is almost exclusively used for street lighting, with a consequent load factor of about 50 per cent, no diversity factor and about 10 per cent actual utilization of the copper. It requires a duplication of substation equipment and an added expense in overhead or underground construction. The parallel system must be used to supply other loads, and the present state of the art indicates that the street-lighting load could be carried on the constant-potential system with only minor modifications in circuit and plant arrangements. The development and extensive use of the incandescent lamp and the use which is being made at the present time of the constant potential mains for street lighting even under the handicap of control by time switches, pilot wires or manually, shows that satisfactory operation has already been obtained. The development of a satisfactory remote control switch to be operated over the mains themselves is the sole remaining step and this seems to have been satisfactorily solved on an experimental basis at least.

### Direct-Current System Has Limitations

The direct-current system meets all the requirements imposed by the various uses of the consumer and in certain favored locations where the generating stations

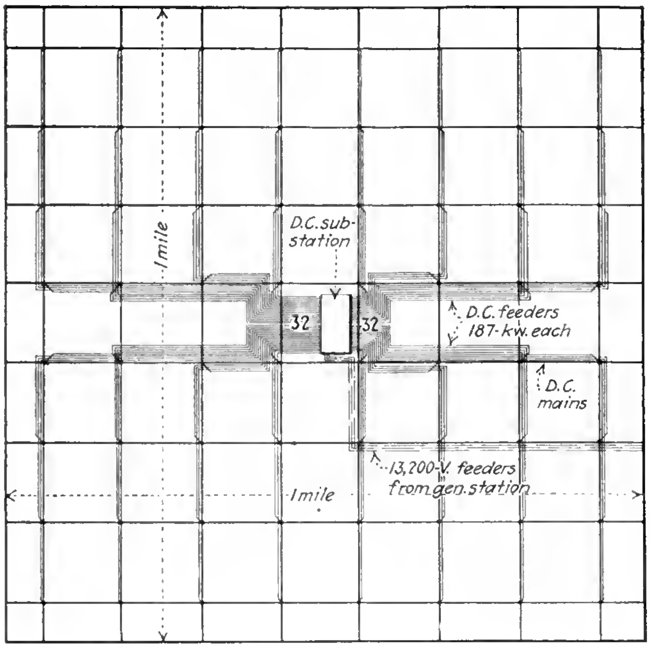



FIG. 1—BUSINESS DISTRICT SUPPLIED FROM ONE D.C. SUBSTATION
Peak load, 12,000 kw.; annual use, 46,000,000 kw.-hr.; load factor, 44 per cent; sixty-four feeders, average length 0.5 mile, maximum length 0.87 mile; weight of feeder copper, 560 tons; annual feeder loss, 6,400,000 kw.-hr. (14 per cent).

can be located at the load centers meets other economical conditions.

However, in the large systems the generating stations cannot be located at the load centers, and with the great increase in load density now found in congested districts the territory that can be served with economy by direct current has been steadily decreasing in area. The economic size of substation supplying the direct-current system is much smaller than is now common practice, and this method becomes more and more expensive as the load density increases.

To make concrete the limitations of the direct-current system assume that a business district including an area of one square mile and having a sustained peak load of 12,000 kw. is to be supplied with power at 230 volts. The annual consumption is estimated to be 46,000,000 kw.-hr., corresponding to a load factor of 44 per cent. The load density is assumed to be uniform, corresponding to 187 kw. supplied at each street intersection, there being eight blocks per mile. Three methods are compared:

1. An Edison direct-current system using one substation at the load center (Fig. 1).

2. The same using four substations each at the load center of its district (Fig. 2).

3. Three-phase, four-wire alternating-current system having a bank of transformers at each feeding point (the street intersections) supplied from a single substation at 2,300 volts. A complete network of 2,300-volt mains is assumed, thus making use of the maximum of copper (offset, of course, by the advantages of reliability and diversity). The power factor is assumed to be 83 per cent (Fig. 3).

Practically the same amount of copper is required in the low-tension mains in each case, and the losses in these mains would virtually be the same. The feeder copper and losses of the above paragraphs 1 and 2 are to be compared with the copper and losses in the 2,300-volt mains, feeders and transformers of paragraph 3, the comparison being as follows:

| System | (1) | (2) | (3) |
|---|---|---|---|
| Current | D.C. | D.C. | A.C. |
| Substations | 1 | 4 | 1 |
| Number of feeders | 64 | 64 | 10 |
| Average length, miles | 0.50 | 0.25 | 0.42 |
| Maximum length | 0.87 | 0.37 | 0.62 |
| Weight of feeder copper, tons | 560 | 280 | 94 |
| Annual feeder loss in millions of kw.-hr. | 6.4 | 3.2 | 1.6 |
| Annual feeder loss, per cent | 14.0 | 7.0 | 3.5 |

Figs. 1, 2 and 3 show the feeder and main systems of the various methods by means of single-line representa-

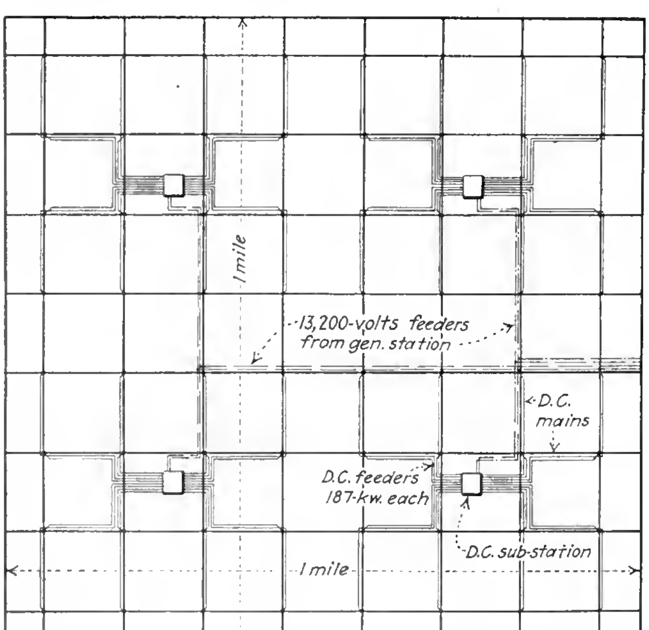



FIG. 2—BUSINESS DISTRICT SUPPLIED FROM FOUR D.C. SUBSTATIONS
Peak load, 12,000 kw.; annual use, 46,000,000 kw.-hr.; load factor, 44 per cent; sixty-four feeders, average length 0.25 mile, maximum length 0.37 mile; weight of feeder copper, 280 tons; annual feeder loss, 3,200,000 kw.-hr. (7 per cent).

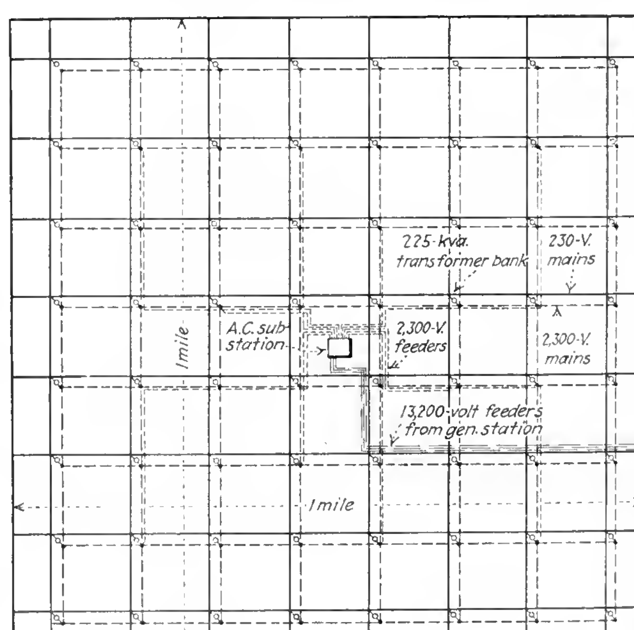



FIG. 3—BUSINESS DISTRICT SUPPLIED FROM ONE A.C. SUBSTATION
Peak load, 12,000 kw., at 83 per cent power factor; annual use, 46,000,000 kw.-hr.; load factor, 44 per cent; ten feeders, average length 0.42 mile, maximum length 0.62 mile; weight of copper in 2,300-volt feeders and mains, 94 tons; annual loss in transformers and 2,300-volt system, 1,600,000 kw.-hr. (3.5 per cent).

tion. The comparison of the figures shows the relative street congestion due to the various methods, and Fig. 4 gives a comparative idea of the relative weight of copper necessary in the different systems and compares the losses also.

The power companies have usually confined the direct-current system to the built-up, heavily loaded districts and have installed alternating-current distributing systems in all of the territory surrounding this built-up section, generally covering a much larger area. The load in this outside territory thus supplied by alternating current is generated usually at the same generating station and transmitted at high voltages to substations, where the voltage is stepped down to a secondary transmission system and connected through line or manhole transformers to the consumers' mains. Here we meet, however, with the greatest differences in methods and an almost complete lack of standardization. There are single-phase lines, two-phase lines, three-phase lines and four-phase lines made up of two-wire circuits, three-wire circuits, four-wire circuits and five-wire circuits. Surely one of these methods must be the most economical in first cost, and the determination and use of this line, as has been pointed out, is of the first importance to the power company.

Polyphase alternating-current supply may be adapted for all of the uses of direct current either directly or by using local motor-generators or rectifying equipment. Alternating-current service is or may be as satisfactory to the consumer as direct-current service, particularly as opportunity is afforded the large consumer to obtain his power at wholesale by assuming the burden of transformation or conversion if he so desires. This conclusion is further justified by the fact that many cities have large business districts containing all classes of consumers which are outside of the direct-current district (if there is one) and that all consumers are satisfactorily served.

The following cost figures are based on an analysis of an existing system comprising a direct-current series system, an Edison system and an alternating-current system consisting of a four-phase, five-wire secondary network supplied mainly by two-phase, three-wire primaries but partly by four-phase, five-wire primaries. Thirteen-thousand-volt, three-phase generation and transmission is used, from which some power is also sold direct.

Generating and substation costs have been found to be as follows per kilowatt: Generating stations, $140; arc substations, $100; direct-current substations, $70; alternating-current substations, $40.

These costs are based on completed station capacity and are the average for several stations built at various times, under varying conditions of prices and in localities with varying load conditions.

Using these station costs, adding the cost of transmission and distribution systems, including substations and distribution transformers, and making allowance for the added generating capacity, etc., necessary to supply the losses in the respective systems, the investment costs per kilowatt delivered at the substation bus and at the customers' services are:

| | Point of Delivery Substation Bus | Point of Delivery Customers' Service |
|---|---|---|
| Series system | $633 | $666 |
| Direct-current system | 356 | 404 |
| Low-tension alternating-current system | 298 | 347 |

Similarly, the operating costs, including fuel, attendance and maintenance of both stations and lines but not including fixed charges on investment, based on the year 1920, were found to be in cents per kilowatt-hour:

| | Point of Delivery Substation Bus | Point of Delivery Customers Service |
|---|---|---|
| Series system | 1.96 | 2.07 |
| Direct-current system | 1.57 | 1.78 |
| Low-tension alternating-current system | 1.28 | 1.49 |

These operating costs include the effects of the comparative efficiencies of the three kinds of substations. These over-all efficiences are approximately as follows, in percentage: Series substation, 74.8; direct-current substation, 81.4; alternating-current substation, 98.

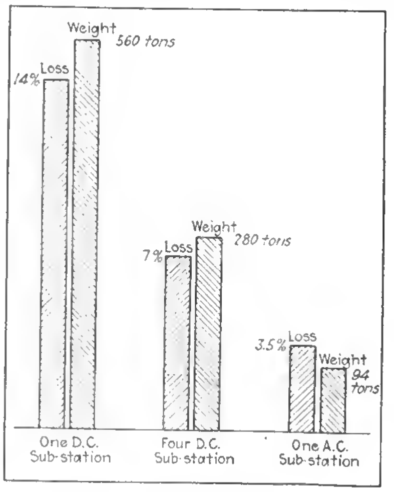



FIG. 4—COPPER WEIGHT AND ENERGY LOSS

Comparison of weight of copper and annual energy loss in various systems based on 500,000 circ.mil mains and 1,000,000 circ.mil d.c. feeders.

These figures show clearly that the low-tension alternating-current system is much cheaper both in first cost and in operation than the direct-current system, although the conditions of delivery into a densely loaded district favor the direct-current system. Moreover, the alternating-current system under consideration is not the particular alternating-current system which has been found by analysis to be the most economical.

The figures also show that the series lighting system is very expensive compared to either of the other systems.

The various methods which can reasonably be used for the primary distribution system are four—(1) two-phase using either three or four wires, (2) four-phase using five wires one of which is grounded and usually common to all other circuits of the same class of a par-

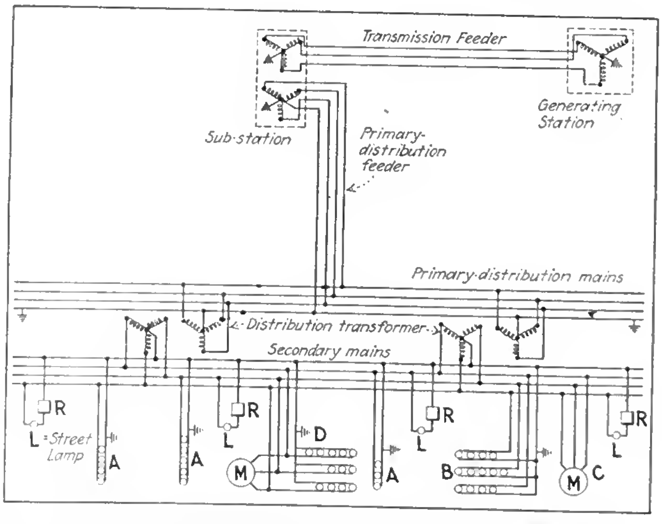



FIG. 5—UNIVERSAL ELECTRIC SYSTEM GIVES BEST AND MOST ECONOMICAL LAYOUT FROM DISTRIBUTION STANDPOINT

ticular pole or duct line, (3) three-phase using three wires, and (4) three-phase using four wires one of which is grounded and common as in (2). The relative economy of these various methods may be most clearly shown by a specific numerical comparison. The use of approximately 2,400 volts between phase wires is almost universal, and this voltage will be used as the basis of comparison. Assume that the line wires are No. 00, as many being used as are required by the particular system under discussion. The carrying capacity for such a wire strung on poles will be assumed to be 225 amp. and the drop with this current, 14½-in. spacing and 80 per cent power factor, is 156 volts per mile of wire. This drop would be increased slightly in some cases by the increased spacing due to poles, spacing between phases, etc. These results are compared in Table I and some further comparisons are made.

Two of these methods indicated by Table I—the four-phase, five-wire, and the three-phase, four-wire—are nearly on a par and stand out so much better than the others that one of them should unquestionably be adopted. The three-phase, four-wire method is simpler both in the substation, where one less bus is required, and on the line, where either four transformers are needed for each bank of the four-phase system or else the circuit must be split into two-phase circuits of the three-wire type, involving then some of the disadvantages of this method, which the comparison shows to be the worst of all. The question of safety is discussed later.

### Secondary Distribution System

The ideal system for general distribution *at lighting voltage* must comply with several requirements: (a) It must be polyphase, so as to permit the operation of motors; (b) it must be a symmetrical polyphase system, so that the line drop due to a balanced load will not cause distortion of the voltages either in magnitude or phase, and the unbalance in voltage caused by unbalanced loads must be small; (c) the voltages available must be suitable for both light and power requirements and must not exceed a fairly safe maximum; (d) the energy delivered to both light and power loads must be capable of being measured by a single meter; (e) the investment cost per kilovolt-ampere delivered must be low; (f) the efficiency must be high; (g) the number of conductors must be as small as possible; (h) one conductor must be a neutral which can be grounded in such a way as to limit the voltage of all other conductors to ground to a value below 150 volts, and which preferably is symmetrical in voltage relations to the others; (i) this system must be capable of simple and economical derivation from the primary distribution system and this in turn from the transmission system.

TABLE I—STUDY OF PRIMARY SYSTEMS

| System | 1-a | 1-b | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Number of phases | 2 | 2 | 4 | 3 | 3 |
| Number of wires | 4 | 3 | 5 | 3 | 4 |
| Capacity per circuit, in kva. | 1,080 | 765 | 2,160 | 933 | 1,620 |
| Per cent drop per mile | 13.0 | 9.2 | 6.5 | 11.2 | 6.5 |
| Number of regulators | 2 | 2 | 4 | 3 | 3 |
| Circuit capacity per wire, in kva. | 270 | 255 | 432 | 311 | 405 |
| Per cent drop per mile per 1,000 kva. | 12.0 | 12.0 | 3.0 | 12.0 | 4.0 |
| Number of circuits per 10,000 kva.* | 9 | 13 | 5 | 11 | 6 |
| Number of wires per 10,000 kva.* | 36 | 39 | 25 | 33 | 24 |
| Number of regulators per 10,000 kva.* | 18 | 26 | 20 | 33 | 18 |

* Nearest whole number.

The only polyphase methods which can be considered are: (1) Two-phase, three-wire, at 115 volts or 230 volts to neutral; (2) two-phase, four-wire, at 115 or 230 volts; (3) two-phase (strictly four-phase), five-wire, at 115 volts to neutral; (4) three-phase, three-wire, delta, at 115 or 230 volts per phase; (5) three-phase, four-wire, delta, at 230 volts, the fourth wire being a lighting neutral tapped from one phase; (6) three-phase, four-wire, star, 120 volts to neutral and 208 volts between wires.

Table II shows a comparison of each of these methods together with the three-wire system (using either direct current or single-phase alternating current) with respect to the requirements enumerated.

### Comparison of Methods

Methods No. 1, No. 2 and No. 4 must be eliminated for the reason that they do not afford satisfactory voltages as well as for other reasons; method No. 5 is not a balanced system and cannot be metered on a single meter, and method No. 3 is needlessly complicated with its five wires, leaving method No. 6, the three-phase, four-wire star system, which seems to fill most satisfactorily all of the requirements and compares favorably with the direct-current three-wire method, the one drawback being its adaptation to the present normal voltages of lighting and power apparatus.

Since the same method was found to be most desirable for the primary distribution system, it seems evident that the general adoption of the three-phase, four-wire system is the only logical course. We will then have, following the present practice in generation, a 13,000-volt or 26,000-volt, three-phase, three-wire generation and transmission system with grounded neutral, a 2,400/4,150-volt, three-phase, four-wire primary distributing system with grounded neutral and a three-phase, four-wire secondary system with grounded neutral, operating at some voltages such as 120/208 to 130/225—the same system throughout. This system is shown in Fig. 5 complete from the generator to the various ultimate consuming devices.

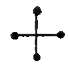
### Safety Must Be Considered

In the direct-current low-voltage distributing system there is practically no danger to life. With alternating-current systems this is a serious hazard and must be considered of first importance in the design of any system; so that the safe maximum for the consumers' devices as it affects the life hazard should be determined.

Next in importance to the life hazard is the fire hazard. It has been proved that any system of distribution must be capable of having its neutral grounded so as to eliminate all fire hazard due to the accidental occurrence of grounds on different conductors. This is of equal importance in either direct-current or alternating-current systems.

Considering in detail the primary distribution system, each of the methods considered uses the same phase voltage. Some are operated normally grounded and others normally free from grounds. However, in times of trouble the normally ungrounded system may be grounded on any wire and wires may cross. The lineman who must clear the trouble may therefore be exposed to the maximum voltage possible because of any combination of grounds and crosses, and usually under circumstances of darkness, storm and excitement, such

TABLE II—COMPARISON OF METHODS

| (a) Method | No. 1 Two-Phase, Three-Wire, 115 or 230 Volts | No. 2 Two-Phase, Four-Wire, 115 or 230 Volts | No. 3 Four-Phase, Five-Wire, 115 and 230 Volts | No. 4 Three-Phase, Three-Wire, 115 or 230 Volts | No. 5 Three-Phase, Four-Wire, Unsymmetrical | No. 6 Three-Phase, Four-Wire, Symmetrical | D. C. or Single-Phase, Three-Wire, 115 and 230 Volts |
|---|---|---|---|---|---|---|---|
| |  |  |  |  |  |  |  |
| (b) Symmetry | N. G. | O. K. | O. K. | O. K. | N. G. | O. K. | O. K. |
| (c) Voltage | 115 volts too low for power<br>230 volts too high for light | 115 volts too low for power<br>230 volts too high for light | O. K. | 115 volts too low for power<br>230 volts too high for light | O. K. | 120 volts light, slightly high<br>208 volts power, slightly low | O. K. |
| (d) Metering | O. K. | O. K. | O. K. | O. K. | N. G. | O. K. | O. K. |
| (e) Relative investment | Equal area / Equal current density<br>115 volts—1.660 1.340<br>230 volts—0.830 0.670 | 115 volts—1 566<br>230 volts—0 783 | 0.978 | 115 volts—1.358<br>230 volts—0.679 | 0.904 | 1.000 | 1.174 |
| (f) Relative losses | 115 volts—1.476 1 784<br>230 volts—0.738 0.892 | 115 volts—2.090<br>230 volts—1.045 | 1.045 | 115 volts—1.808<br>230 volts—0.904 | 0.904 | 1.000 | 1.045 |
| (g) No. of wires | 3 | 4 | 5 | 3 | 4 | 4 | 3 |
| (h) Grounding | O. K. | N. G. | O. K. | N. G. | N. G. | O. K. | O. K. |
| (i) Transformation | 6.7% lost capacity | 6 7% lost capacity | 6.7% lost capacity | O. K. | O. K. | O. K. | Complex |

Note.—Except as noted, the relative investments and losses are calculated on the basis of exactly equal current density in all conductors except the neutral which is equal in size to the other wires. These figures will be subject to modification to suit commercial wire size.

that the danger is even greater than that corresponding to the voltage.

Tabulating the conditions which exist or which may exist with the various methods, we have:

| System | 1-a Two-Phase, Four-Wire | 1-b Two-Phase, Three-Wire | 2 Four-Phase, Five-Wire | 3 Three-Phase, Three-Wire | 4 Three-Phase, Four-Wire |
|---|---|---|---|---|---|
| Normally grounded | No | No | Yes | No | Yes |
| Maximum possible voltage between wires | 3,400 | 3,400 | 4,800 | 2,400 | 4,150 |
| Maximum possible voltage to ground | 3,400 | 3,400 | 2,400 | 2,400 | 2,400 |
| Normal voltage to ground | | | 2,400 | | 2,400 |

The two-phase method using either three or four wires is very uncertain at times of trouble, and the voltage to ground may be larger than the normal phase voltage. The three-phase, three-wire method can introduce no voltage hazard higher than the phase voltage, but all three of these methods have the hazard due to unknown and uncertain conditions. Moreover, two fairly high resistance grounds or swinging grounds may exist on different wires which will not pass current sufficient to open the circuit breakers at the substation but will pass enough to burn off the wire in the resultant arc. In the case of either of the normally grounded systems no abnormal voltage conditions can exist and the accidental grounding of a phase wire is not so apt to arc and burn off the wire, since the first (the normal) ground has a positive, low-resistance path. While this may cause more frequent interruption, the damage is not apt to be so great nor the duration of the interruption so long.

The four-phase, five-wire method has the disadvantage compared with the three-phase, four-wire method that the maximum voltage between wires is considerably higher, which causes a greater hazard and will tend to increase the difficulty of maintaining insulation through tree exposures, and the larger number of wires increases this difficulty as well as the hazard.

The analysis given in this paper of the various polyphase methods of distribution, both for transmission and for distributing at primary and secondary voltages, proves conclusively that the three-phase, four-wire system best fulfills all the requirements as to reliability, safety, economy of pole and duct space, and low operating and maintenance costs; that it provides the largest capacity per dollar invested, and that it can be adapted, with suitable rules and regulations, to meet all of the conditions of central-station service, so that load of any character, not excepting street lighting, may be attached to a single distributing system, allowing it to enjoy all of the advantages of diversity factor, which is essential for the most economical operation of central-station service. This system may be extended into new territory as a single-phase system for light loads using a two-wire circuit, since it is capable of supplying domestic consumers and street lighting, with all the investment of permanent character, and may be supplemented later by the addition of two wires so as to take care of increased load as the territory is developed, enabling a common system to serve the entire area irrespective of the character of load, thus making for economy, simplicity and reliability.

In conclusion, such a system would eliminate many of the overhead wires which are now used and to which both the public and municipal authorities are constantly objecting, so that it would be possible, with substations suitably located, to distribute 20,000 kw. to 30,000 kw. from a single substation with pole lines requiring not more than two cross-arms, enabling the companies to continue distributing overhead over large territories at a lower investment cost than would be necessary in the event of underground distribution.

## Developments of Electric Furnaces During 1922

DEVELOPMENTS during the past in the electric furnace for steel melting have not been lacking, according to views expressed by C. E. MacQuigg in a recent article in the *Iron Age*. New ideas on the induction furnace have been carried out. The position of the electric furnace in the steel industry has been de-

cisively stated by Dr. Mathews before the American Iron and Steel Institute, who is an acknowledged authority on the subject. Elimination of the crucible plant by the electric melting furnace seems about as remote as ever. From the tonnage standpoint, however, the electric furnace will naturally make a constantly larger percentage of the fine steels.

Regarded from one angle, the increased use of the electric heat-treating furnace has had to wait on educational propaganda. The reaction in the past toward a suggested installation for electric heat treating has usually been that the outlay would be prohibitive. Upsets in the relative cost of fuels have brought home the fact that the first cost alone and the fuel costs will not determine final economy per unit of product. While locality determines fuel cost, important factors must often be sought elsewhere in labor costs, quality of the work and ratio of the accepted to the rejected product. Among the considerations urged for electric treating are uniformity of operation, perfection of control, better furnace conditions, lack of danger of overheating the work and absence of gases and dirt.

# Electrons from Hot Filaments

### Thoriated Tungsten Gives 130,000 Times Electron Emission of Plain Tungsten — Other Materials Are Being Studied

WHEN metals are heated in high vacuum electrons, or atoms of negative electricity, evaporate from their surfaces. If there is another electrode in the evacuated space to which a positive charge is given the electrons drift over to this electrode (anode) so that a current flows between the two electrodes. Dushman has recently derived an equation which should supersede the well-known Richardson equation, giving the relation between the electron current and the temperature of the cathode. The advantage of this new equation is that there is only one constant which we need to know for each different cathode material.

The electron emissions from a large number of different materials have recently been measured. The thoriated tungsten cathode gives a current at a temperature of 1,500 deg. absolute which is about 130,000 times greater than that secured from ordinary tungsten. Some of the cathode materials have even much greater emissions.

In order to get all the current that a cathode is capable of giving, it is necessary to apply to the anode a high enough voltage to overcome what is know as the space charge effect. By putting gases inside the tubes positive ions are formed in the space between the electrodes by bombardment, and these neutralize the negative space charge and allow the current from the cathode to pass across the space with much lower anode voltages. In other words, the effect of gases is to increase the current-carrying capacity of the two. Such an effect is used in the Tungar rectifier. Care must be taken what gas is used, for many gases have the effect of cutting down the emission to a small value.

If very high voltages are used on the anode, so as to produce intense electric fields, it is possible to pull electrons out of the cathode. In fact, it is possible to pull electrons even out of cold cathodes—that is, cathodes at ordinary temperatures. The currents obtained in this way from the cathode come from very minute areas, but in these areas the current density amounts to more than 100,000,000 amp. per square inch.

The thoriated tungsten filament is a tungsten filament containing 1 per cent or 2 per cent of thorium, usually in the form of oxide. When such a filament is heated to about 3,500 deg. C. a little of the thorium oxide is changed into metallic thorium. In the meantime, however, any thorium on the surface of the filament evaporates, leaving only pure tungsten. If the filament temperature is then lowered to about 1,800 deg., the thorium gradually wanders or diffuses through the filament, and when it reaches the surface, if the vacuum is very perfect, remains there and gradually forms a layer of thorium atoms which never exceeds a single atom in thickness. The thickness of this film is therefore about one one-hundred-millionth of an inch, and yet this film increases the electron emission of the filament about 130,000 times.

Of course, this useful film is very sensitive and needs some protection to keep it in good condition. Very slight traces of water vapor or other gases would oxidize and destroy it. This can be avoided by putting in the bulb some substance that will combine with the water before this has a chance to attack the thorium film. Such a substance is metallic magnesium. Furthermore, it is necessary to avoid heating the filament to too high a temperature for otherwise the film might evaporate. It is therefore best to operate such filament within a rather narrow range of temperature close to 1,700 deg. C. where the ratio of evaporation is very small and where the temperature is high enough for the thorium gradually to diffuse to the surface and offset the effect of slight traces of residual gases.

The thoriated tungsten filament open up many new fields of scientific investigation. By measuring the electron currents it is possible to determine accurately exactly how much thorium is present on the surface. An amount of thorium corresponding to only one-thousandth of the surface covered with a layer one atom deep is easily measurable in this way. It is possible to knock off a thorium film by bombarding it with positive ions moving at high velocities, and in this way the true nature of this bombardment can be determined.

#### CONTROLLING ELECTRON CURRENTS IN HIGH VACUUM

Most of the applications of high-vacuum tubes have depended upon the control of electron currents, as for example, by the grid in the three-electrode tube. The action of the grid is due to the charge on the grid modifying the space charge effect. This is the action that is employed in practically all tubes used today for radio transmission and receiving. There are many other methods, however, of controlling electron currents. A very important method is that used in the magnetron where there are only two electrodes in the evacuated space and the control is obtained by means of a magnetic field generated by an external coil of wire. A still simpler form of magnetron, suitable particularly to very large power tubes, consists of a very large filament in the axis of a cylindrical anode with very large, straight filaments. The magnetic field produced by the current through the filament is enough to prevent electrons flowing between cathode and anode.

Another form of tube by which electron currents can be controlled is the dynatron. This depends upon subjecting one of the three electrodes in the tube to electron bombardment in such a way as to cause electrons to be splashed out of it.

# Performance Characteristics of Autovalve Lightning Arresters

## Maintenance Reduction and Bettered Performance Are Claims for New Non-Chemical Protective Apparatus Suitable for All Applications—Principle and Basis of Design Described

By A. L. ATHERTON
*Supply Engineering Department, Westinghouse Electric & Manufacturing Company*

THE insulation of apparatus connected to any electrical system is subjected to surge voltages in some degree. Experience in the design of apparatus has led to the adoption of factors of safety which are sufficient to prevent apparatus failure under ordinary service conditions, but it has been found impossible or uneconomical to provide in this way for surge conditions. A benefit will be derived from the use of lightning arresters in all cases, but the need for lightning arresters varies over a wide range with the variation in surge conditions and condition of the apparatus.

The final criterion of lightning-arrester application is economic. The protection must pay for itself in savings to apparatus and service. The wide variety in service conditions, the difficulty in getting an accurate measure of arrester performance and the economic urge toward lower and lower costs has brought about the development of various protective devices covering a wide range in cost and in performance characteristics.

Judgment on any lightning-arrester problem, design, application or selection requires an understanding of the factors which make up both sides of the economic ledger account. On one side of this account is the saving which can be credited to the arrester—that is, the difference between the damage to apparatus and service which would result if the system were unprotected and the similar damage with the proposed arrester. On the other side of the account is the initial and maintenance cost. The damage to an unprotected system depends on local conditions, varies over a wide range and can be estimated only from experience and with engineering judgment. This factor is largely empirical and can ordinarily be determined only by experience on the system in question or on similar systems in similar localities. The damage to be expected with any particular type of arrester depends first on the local conditions which control the damage to an unprotected system and then on the characteristics of the proposed arrester. For an evaluation of this factor it is necessary to have a knowledge of the laws governing the phenomena of surges and of the principles of lightning arrester performance. These laws and principles are known with comparative accuracy. Initial and maintenance cost, on the other side of the ledger account, of course depend on the design of the arrester. For all commercial types they are fairly well known.

### CHARACTERISTICS OF SURGES

For the purpose of lightning-arrester considerations, a surge is a transient overvoltage resulting from the release in a system of a quantity of electrical energy which is free to flow in the circuit controlled only by the inductance, capacity and resistance of the circuit. The circuit has electrostatic capacity between conductors and to ground, and the conductors have inductance. The surge energy resides in the static field of the condensers and in the magnetic field of the inductances. When the energy is released on the line, as by the release of a bound charge following a cloud discharge or by the discharge of the magnetic field of apparatus in switching, a portion of the circuit is raised in potential above that of the adjacent circuit and current flows from the higher to the lower potential section through the distributed inductance of the conductors and charging the distributed capacity of the circuit into which it flows.

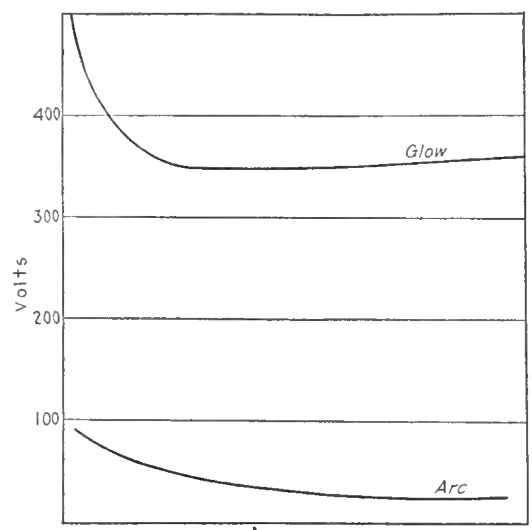



FIG. 1—VOLT-AMPERE CHARACTERISTICS OF ARC AND SLOW DISCHARGE

It has been shown that the relation of the current and voltage in surges is given by the equation

$$E = iZ = i\sqrt{L/C},$$

where

$E$ = the surge voltage,
$i$ = the surge current,
$Z = \sqrt{L/C}$ = the surge impedance,
$L$ = the inductance per unit length of the line,
$C$ = the capacity per unit length of the line.

This relation is of great value since it affords a means to a quantitative conception of the phenomena of the flow of surge current and makes possible the calculation of the division of current and the resulting voltages at branches in the circuit and at points where

the surge impedance is changed. For instance, it makes possible the calculation of the reduction in surge voltage resulting from the use of a lightning arrester of known characteristics.

It has also been shown that the propagation of a surge in a system is approximately at the speed of light; that is, 183,000 miles per second.

### Danger of High Voltages and Steep Wave Fronts

The outstanding characteristics of surges are high voltages and steep wave fronts—the first because this is the major cause of the danger to insulation, and the second because it has considerable bearing on the characteristics which it is necessary to give to a lightning arrester for good performance. While definite data are not available as to the maximum surge voltage which may be impressed on a system, there are indications that surges of external or atmospheric origin may have voltages as high as several hundred thousand volts, and surges of internal origin due to switching may have values of several times the line voltage. The steepness of the wave front is also variable over a wide range. In the case of a surge which travels on the line for a considerable distance, the wave front may correspond to a frequency of less than 100,000, while in the case of a surge which originates at the apparatus, as by the release of a bound charge from a cloud directly over the point in question on the line, the wave front may virtually be infinitely steep.

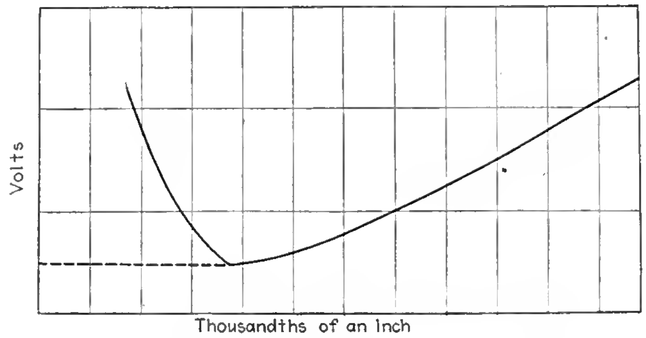



FIG. 2—BREAKDOWN VOLTAGE OF SMALL GAP IN AIR

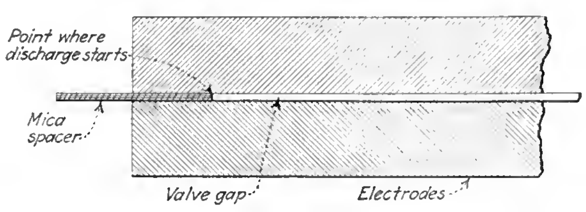



FIG. 3—ENLARGED VIEW OF AUTOVALVE ELECTRODES, SPACE AND VALVE GAP

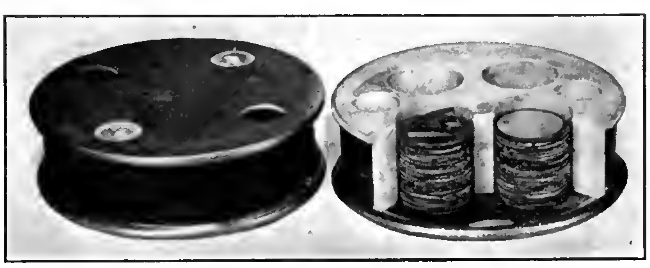


FIG. 4—PROPOSED 3,000-VOLT LARGE-CAPACITY UNIT

Very little is known quantitatively in regard to the effect of surge voltage on insulation. This is because the duration of these overvoltages is extremely short and the magnitude very great, which makes direct investigation difficult, and also because the chief attention of investigators of insulation problems has been given to study of performance under normal service conditions rather than under the abnormal conditions imposed by surges. It is probably a fact, however, that the damage which is done varies as some power of the voltage applied, possibly as the square, and that it varies directly with the time of application.

### Requirements for Lightning-Arrester Characteristics

A lightning arrester is a device which is inoperative under normal conditions, but which when a surge voltage appears should function to hold the surge voltage down to a value which will be safe for the insulation of the apparatus being protected. In order to do this, the requirements are:

1. The initial relief voltage, or the breakdown voltage, of the arrester must be at a safe value.
2. The discharge resistance, or the impedance of the arrester, to the flow of surge current must be low, so that the surge voltage will be reduced to a safe value. After the breakdown occurs the voltage across the arrester, and therefore across the apparatus being protected, is reduced from its original value in the ratio of arrester resistance to the sum of arrester resistance and surge impedance; that is:

$$E_1 = ER/(R+Z),$$

where
$E_1$ = the voltage on the arrester and apparatus,
$E$ = the original surge voltage,
$R$ = the arrester resistance,
$Z$ = the surge impedance.

The value of a low resistance is made apparent by this relation.

3. The arrester must be always ready to perform.
4. The performance must be such that no system disturbances or other troubles are introduced by the operation.
5. Economic limitations must not be exceeded.

### Discussion of Types

Efforts have continuously been exerted to develop a lightning arrester which would meet these requirements in the greatest possible degree, and these efforts have resulted in the development of the electrolytic arrester in its present form. This device is the standard lightning arrester for application where the maximum degree of protection is required. The first four of the requirements listed above are met by this device.

The breakdown voltage under surge conditions is only slightly higher than line voltage. This factor depends not only on the normal or 60-cycle breakdown, which naturally must be made higher than the line voltage, but also, because of the steep wave front of surges, it depends on the speed of breakdown, or, in other words, on the impulse ratio. The normal breakdown is made just enough above the maximum value of line voltage to prevent operation of the arrester due to line-voltage fluctuations. The speed is high—in fact, in the most highly developed form the impulse ratio is less than one; that is, the breakdown on steep wave front occurs at a voltage lower than the normal breakdown value.

The impedance to flow of surge current is extremely low. The only resistance is that of the electrolyte, the

circuit through which is very short and of large area. It is possible to make this type of arrester of such low resistance because no flow of power current is permitted. The characteristic of performance is such that practically no current flows at any voltage below a critical value and that at voltages greater than the critical value the current is proportional to the excess voltage. Thus when the normal conditions are restored the current is immediately reduced to zero and there is no "follow" of power current. Arresters without this "valve characteristic" cannot practicably be made with the very low resistance of the electrolytic, since they would pass large power currents, cause severe disturbances in the system, and since it would be impossible to provide for breaking the power arc in the series gap. With the valve characteristics these complications are all eliminated.

The third and fourth requirements are completely met. In some of the early forms of the electrolytic arrester trouble was experienced due to disturbances on the system set up by the charging operation, but the introduction of charging resistors eliminated this difficulty.

Unfortunately, however, the initial and maintenance cost are high enough to limit the application of electrolytic arresters to the protection of the more valuable or important apparatus. Moreover, the requirement for comparatively frequent attendance prevents their application in unattended installations.

Thus a large field of application cannot be taken care of by electrolytic arresters. Distribution transformers, ordinarily as much exposed to surges as any apparatus, for the most part do not economically warrant the use of arresters of such high cost, and it is practically never feasible to provide for the necessary frequent attendance. The growing use of unattended small substations and of the larger automatic substations introduces another large field where the use of electrolytic arresters is often not justified.

From the standpoint of service requirements, these applications require the same degree of protection as the larger attended equipments; but there has thus far been available no principle of operation which would provide the necessary valve type, or high-quality, arresters and at the same time be sufficiently flexible in design to meet the wide range of requirements of the various applications on the proper economic basis. There has been need for the development of a valve-type arrester based on a principle which is suited by flexibility to universal application and which will be of low initial cost, low maintenance expense, and will require, at the most, infrequent inspections. Such a device is provided in the autovalve arresters.

## Principle and Design Basis of Autovalve Arresters

The autovalve lightning arrester is essentially a spark-gap type of arrester to which the practically essential valve characteristic has been imparted by proper design of gaps and electrodes. To have valve characteristics spark gaps must have a breakdown voltage equal to the voltage while the current is flowing. The voltage across an arc in air is as shown in Fig. 1, in the lower curve. When the electrodes are kept cool the discharge is no longer an arc, but becomes a glow discharge with volt-ampere characteristics, as shown in Fig. 1, the upper curve. The breakdown voltage of a gap in air is as shown in Fig. 2. Obviously, if gaps can be made which break down at the minimum point, 350 volts, and which maintain the discharge as a glow, the conditions for valve characteristics are fulfilled, for with such gaps current will start to flow at 350 volts per gap, will be proportional to the excess of voltage over this value and will cease flowing when the voltage is reduced to this value. Such gaps are used in the autovalve arresters.

The minimum breakdown voltage is secured by using electrodes separated by thin mica spacers, as shown in Fig. 3. With such gaps breakdown occurs at the edges of the spacers at a voltage far lower than would be required for the gap itself, as is well known. When the mica is made of the correct thickness, this breakdown voltage remains approximately at the minimum valve of 350. The discharge is maintained as a glow by the use of electrodes of moderately high resistivity. The high resistivity prevents concentration of the discharge and thus keeps the energy distributed over the surface of the disk, preventing local heating and thus preventing the formation of arcs.

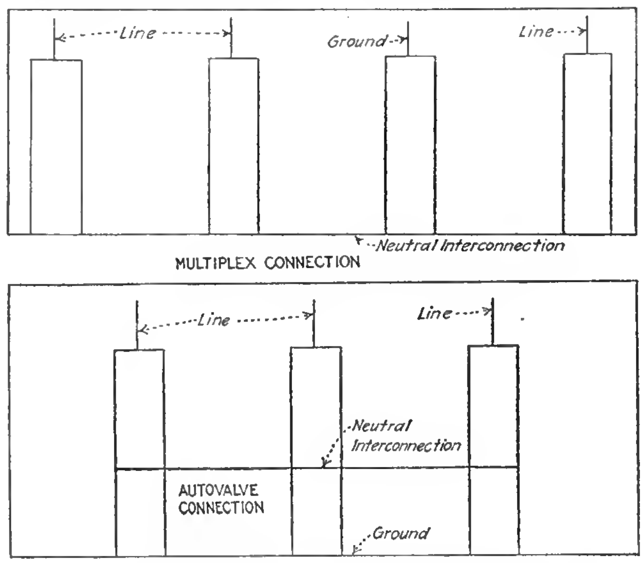



FIG. 5—AUTOVALVE AND MULTIPLEX CONNECTIONS FOR THREE-PHASE ARRESTERS

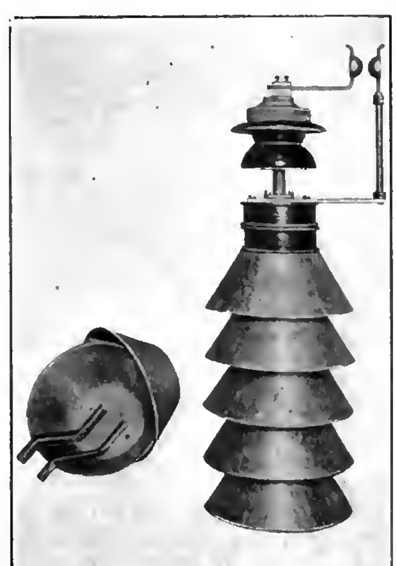


FIG. 6—PHASE LEG OF 37-KV., THREE-PHASE LARGE-CAPACITY ARRESTER

In the commercial form an autovalve arrester consists essentially of a column of disks and spacers forming a series of valve gaps, the number being proportioned to the line voltage and the area of the disk electrodes being such as to give the arrester the required resistance. Such a column in a proper casing is connected between line and ground through a series gap.

The number of valve gaps for any particular voltage is clearly indicated. In order to prevent the flow of power current, the line-voltage peak value must be less than the critical or counter voltage of the arrester—350 times the number of valve gaps.

The required resistance is not so clearly indicated because of the uncertainty in the maximum value of surge voltage which may be anticipated and because of the lack of complete information as to permissible surge voltages for standard or commercial insulation. In the design of these arresters, however, dependence has been placed on the years of experience with electrolytic arresters which have established that these arresters have performance characteristics which meet the service requirements. The area of the electrodes in the autovalve arrester has been selected to give a discharge resistance not greater than that of the standard electrolytic arrester.

Arresters of large capacity are made up of 3,000-volt units, each of which consists of four columns of

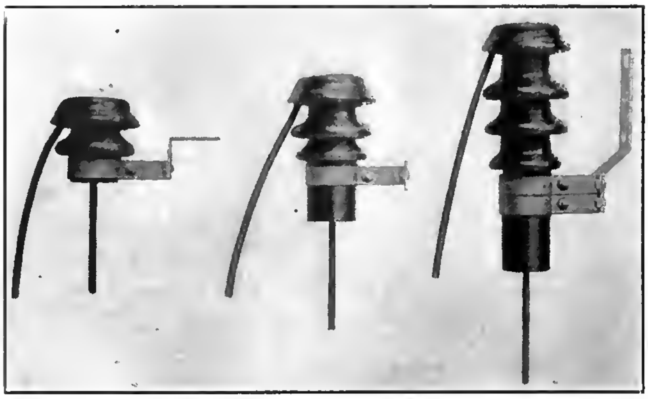


FIG. 7—DISTRIBUTION SIZES OF AUTOVALVE ARRESTERS

Three sizes of the line are shown with various forms of mounting bracket. The illustrated sizes are for 2,500, 7,500 and 15,000 volts.

disks 2 in. in diameter inclosed in a single porcelain case and held in place by metal ends spun over beads at the ends of the porcelain. These units are used in series to build up the phase legs of the large arresters for the protection of important apparatus in generating stations or substations. A single-phase leg of such an assembly for 37 kv. is shown in Fig. 6. In place of the familiar multiplex connection, using four columns each for phase voltage, three columns are used, each for line voltage. The two connections are schematically shown in Fig. 5. With the multiplex connection, the heavy surges of atmospheric origin pass through the three line elements in parallel and then all pass through the ground element. The voltage built up by the $iR$ drop in the arrester resistance of the line and ground elements in series is thus four times that across a line element. With the autovalve connection this is reduced, since each element carries current from one line only. In the developed form there results a reduction of the equivalent resistance of the arrester to 43 per cent of that of the same arrester except with the multiplex connection.

Arresters such as are shown in Fig. 6 parallel the commercial forms of electrolytic arresters very closely in performance characteristics. The critical voltage or voltage maintained across the valve gaps while current is flowing is approximately 25 per cent above the peak value of maximum rated line voltage. This margin of 25 per cent is the only point of appreciable magnitude in which the performance characteristics differ. With the electrolytic arrester the critical voltage is determined by the voltage applied in charging and is equal to the peak value of the voltage thus applied. The 25 per cent margin of safety is justified, since it is relatively unimportant from the standpoint of protection and since it eliminates the possibility of the flow of power current due to extreme line-voltage fluctuations.

The initial relief voltage is only slightly higher than the critical voltage. As has been stated, the normal breakdown voltage is approximately 350 volts per gap and thus approximately equal to the critical voltage. The speed is very high, since the great time lag required for puncture of solid insulation is not present because the breakdown occurs in air only. The time lag is so small that only the most refined testing procedures have sufficed to measure it.

The discharge resistance is determined by the resistivity, thickness and area of the disks. The resistance is chosen to insure glow discharge and thus prevent the formation of arcs. The thickness is chosen for proper mechanical strength. With these two factors known, the area required to give a discharge resistance equal to that of the electrolytic is readily calculated and obtained. This disk area, with a factor of safety, is used.

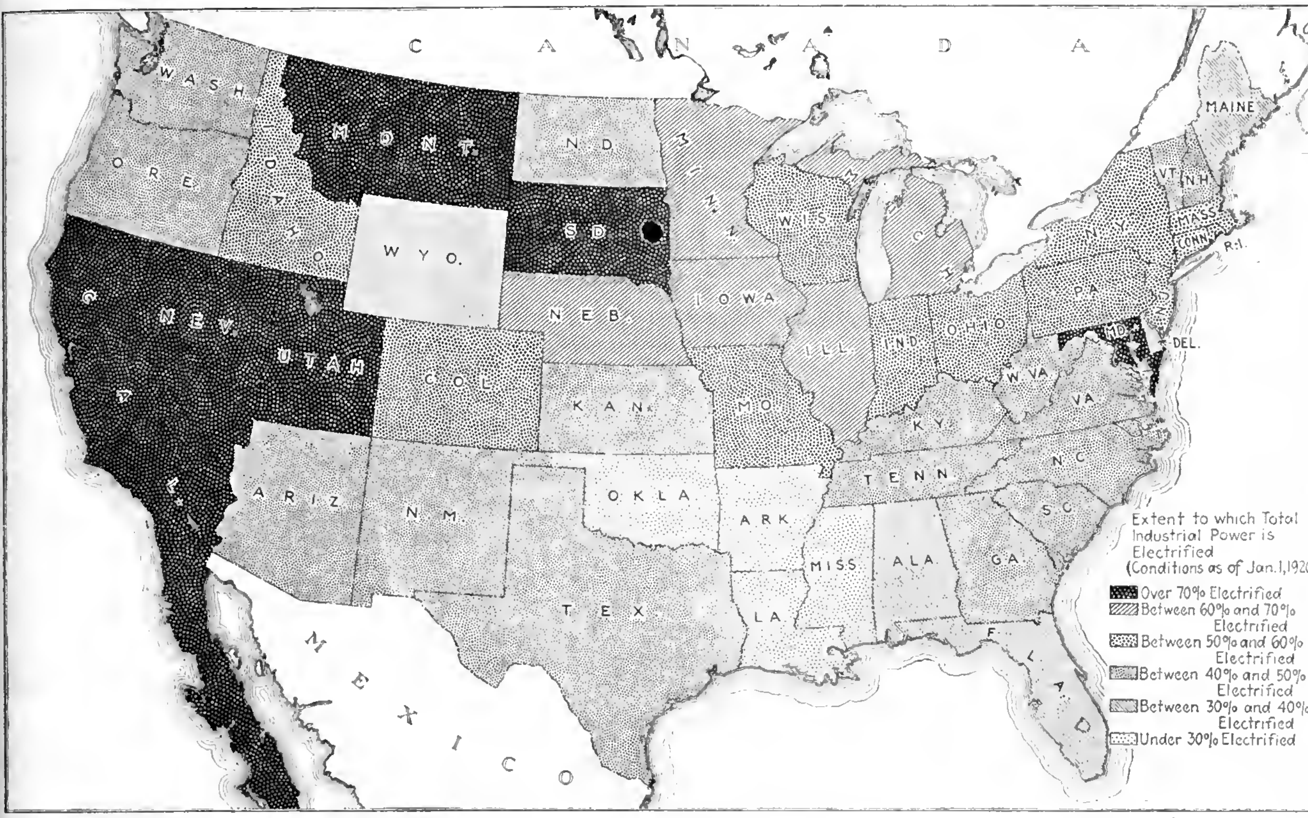
For use in applications where the expense of the large-capacity arresters is not justified, and particularly on distribution systems where arresters are installed close together so that more than one operates on any surge, a line of arresters of reduced area is provided. Three sizes, for 2,500, 7,500 and 15,000 volts, of this type "LV" line are shown in Fig. 7. In these arresters the design basis is the same as in the units of larger capacity except that a single column of disks is used. The performance is thus the same for the two types except that the discharge resistance is four times as great for the type "LV" as for the proposed large-capacity arrester.

Extensive laboratory tests over a period of two years and observation of more than 500 trial installations for periods ranging from nine to eighteen months have verified the theoretical basis both as to performance and as to durability.

The introduction of this principle of lightning-arrester construction marks a step of great importance in the control of apparatus failures due to surge voltages. Since valve-type arresters, suitable for use unattended and of any desired performance characteristics, can now be made within the economic limitations, it becomes feasible to provide adequate protection for apparatus of all classes and sizes under all conditions of installation.

## Tests of Thermocouples

TESTS of the pure platinum and platinum-rhodium wire prepared at the Bureau of Standards for thermocouples have been carried out by the heat division. These tests are the same as those applied to commercial couples, which were recently reported by Fairchild & Schmidt in *Chemical and Metallurgical Engineering*. Results so far obtained are said to show that couples of material purified, melted and drawn to wire at the bureau are appreciably superior to the best commercial couples previously tested. Papers covering these subjects will be presented at the spring meeting of the American Electrochemical Society.




# Rapid Growth of Industrial Load

## Central-Station Motor-Connected Business Totaled 19,561,200 Hp. on Jan. 1, 1922—Pennsylvania Leads All Other States—Industry in the Aggregate About 61 per Cent Electrified at Present Time

THE growth of the central-station motor-connected load is one of the most remarkable facts pertaining to that industry of unusual achievements. Prior to 1907, only sixteen years ago, the lighting customers consumed more electrical energy than the industrial power customers, but since that date the total energy consumption by industrial consumers has increased by about 953 per cent, while the total energy consumed by the lighting customers has increased by only about 320 per cent. The electrical energy consumed by industrial power customers during 1922 was approximately 23,000,000,000 kw.-hr., while the lighting requirements probably did not exceed 8,000,000,000 kw.-hr.

The extent to which the motor-connected load has been cultivated by the central-station companies during the last eight years is clearly indicated by a survey recently completed by the ELECTRICAL WORLD. Returns received from about 70 per cent of the electric light and power industry indicate that subsequent to 1914 the connected motor load has almost tripled, totaling 19,561,200 hp. on Jan. 1, 1922. During this period the number of motors served has grown from 719,800 to 1,759,300, an increase of about 144 per cent. Details of this growth will be found in the tabulation on page 400.

A study of the data issued by the United States Census Bureau indicates that in 1920 there were 520,400 motors run by energy generated in private plants and that the rating of these motors totaled 8,228,800 hp. Adding these figures to those for central stations gives a total of about 2,300,000 electric motors installed on Jan. 1, 1922, with a total rating of about 28,000,000 hp. Further studies based on the census data indicate that in 1920 there was a total of 20,294,400 of industrial horsepower which had not been electrified, and that approximately 1,796,400 additional motors would be required to electrify fully all the industries of the country. A comparison of related figures indicates, therefore, that in 1920 the total industrial power of the country was only about 54.1 per cent electrified. It is estimated this figure has increased to about 61 per cent.

The central stations of the East North-Central States reported the largest motor-connected load on Jan. 1, 1922, with 5,251,300 hp. and a total of 530,900 motors. The Middle Atlantic States, another intensely industrial section, followed with 4,744,000 hp. and 429,300 motors. A study of the motors served by energy generated in private plants, however, indicates that the central stations in the Middle Atlantic States have a more fruitful field for increasing their motor-connected load through the gradual elimination of the private generating plants.

It appears that in 1920 California led all other states in the electrification of its industries. The reports indicate that 80.4 per cent of the industrial power of that state was electrified. Other states reporting a high percentage of industrial electrification are Utah with 76.8 per cent, Nevada with 72.2 per cent, Maryland with 70.5 per cent and Montana with 70.4 per cent.

## Central-Station Motor-Connected Load and Degree of Electrification of Various States, 1915-1922

| Division and State | Industrial Motors Served by Central Stations* (Thousands) | | | | | | | | Motor-Connected Load of Central Stations* (Thousands) | | | | | | | | Private Generation (1920) † | | Unelectrified Industrial Power (1920) | | Per Cent of Industrial Power Electrified (1920) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 | 1921 | 1922 | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 | 1921 | 1922 | Motors Served (Thousands) | Hp. of Motors Served (Thousands) | Horsepower (Thousands) | Equivalent (Thousands of motors) | |
| United States | 719.8 | 817.8 | 922.3 | 1,066.5 | 1,212.0 | 1,413.0 | 1,607.8 | 1,759.3 | 7,345.3 | 8,657.2 | 10,015.4 | 11,762.2 | 13,551.0 | 15,672.0 | 17,974.8 | 19,561.2 | 520.4 | 8,228.8 | 20,294.4 | 1,796.4 | 54.1 |
| SECTIONS | | | | | | | | | | | | | | | | | | | | | |
| New England | 81.8 | 91.1 | 100.9 | 116.9 | 130.9 | 159.6 | 181.8 | 195.6 | 688.6 | 764.6 | 882.4 | 1,046.3 | 1,184.3 | 1,420.7 | 1,621.8 | 1,783.5 | 68.5 | 796.9 | 2,201.1 | 231.7 | 50.2 |
| Middle Atlantic | 147.8 | 174.2 | 201.4 | 242.6 | 292.5 | 348.1 | 400.2 | 429.3 | 1,496.7 | 1,867.7 | 2,250.4 | 2,730.2 | 3,346.3 | 3,786.0 | 4,364.5 | 4,744.0 | 204.8 | 3,098.9 | 5,948.5 | 509.0 | 53.7 |
| South Atlantic | 51.8 | 56.9 | 64.5 | 75.8 | 88.4 | 104.5 | 118.9 | 125.7 | 548.2 | 848.1 | 790.7 | 984.2 | 1,219.5 | 1,493.1 | 1,656.8 | 1,723.0 | 28.9 | 648.3 | 2,098.9 | 143.7 | 50.6 |
| East North Central | 208.5 | 240.1 | 276.3 | 323.3 | 354.6 | 413.2 | 478.1 | 530.9 | 1,908.3 | 2,180.9 | 2,520.0 | 3,071.5 | 3,571.3 | 4,072.5 | 4,778.0 | 5,251.3 | 158.3 | 2,514.0 | 4,466.9 | 460.1 | 59.7 |
| West North Central | 67.5 | 73.5 | 81.0 | 91.8 | 101.2 | 116.3 | 128.6 | 136.9 | 542.9 | 634.2 | 744.6 | 845.7 | 926.1 | 1,043.2 | 1,080.1 | 1,138.0 | 24.7 | 380.1 | 1,106.8 | 119.8 | 56.3 |
| East South Central | 20.1 | 21.7 | 23.5 | 25.0 | 27.3 | 30.6 | 31.6 | 35.2 | 186.6 | 231.6 | 291.3 | 360.2 | 448.7 | 516.2 | 696.2 | 778.9 | 11.0 | 245.9 | 1,232.9 | 80.0 | 38.2 |
| West South Central | 19.5 | 22.5 | 25.2 | 29.2 | 33.4 | 37.9 | 39.8 | 43.0 | 148.3 | 180.8 | 226.9 | 287.4 | 344.8 | 498.7 | 587.2 | 614.8 | 7.2 | 146.7 | 1,474.5 | 117.5 | 30.4 |
| Mountain | 28.0 | 31.5 | 34.5 | 41.1 | 44.6 | 50.1 | 55.7 | 65.1 | 484.4 | 484.7 | 650.0 | 723.8 | 750.0 | 811.3 | 898.2 | 999.7 | 7.9 | 237.5 | 700.8 | 44.3 | 59.9 |
| Pacific | 94.8 | 106.3 | 115.0 | 120.8 | 139.1 | 152.7 | 173.1 | 197.6 | 1,341.3 | 1,464.6 | 1,659.1 | 1,712.9 | 1,760.0 | 2,030.3 | 2,292.0 | 2,528.0 | 9.1 | 160.5 | 1,064.0 | 90.3 | 67.3 |
| NEW ENGLAND | | | | | | | | | | | | | | | | | | | | | |
| Maine | 6.6 | 6.8 | 6.4 | 6.9 | 7.4 | 8.2 | 9.3 | 10.0 | 82.3 | 84.8 | 87.4 | 101.3 | 107.2 | 116.2 | 132.8 | 145.9 | 3.3 | 72.0 | 413.2 | 28.2 | 31.3 |
| New Hampshire | 4.9 | 5.3 | 6.0 | 6.9 | 7.5 | 8.0 | 9.1 | 9.8 | 54.2 | 57.7 | 64.0 | 77.6 | 89.3 | 103.8 | 118.4 | 130.0 | 2.9 | 67.1 | 226.7 | 17.5 | 43.0 |
| Vermont | 6.7 | 6.7 | 7.1 | 7.7 | 7.9 | 8.5 | 9.0 | 9.4 | 64.2 | 73.8 | 79.6 | 87.8 | 88.2 | 96.2 | 106.0 | 106.4 | 0.9 | 13.0 | 124.4 | 11.0 | 46.8 |
| Massachusetts | 32.0 | 39.0 | 46.0 | 56.5 | 67.5 | 81.0 | 86.4 | 90.9 | 277.2 | 314.3 | 391.3 | 482.0 | 567.0 | 683.0 | 733.0 | 789.0 | 39.7 | 424.3 | 918.7 | 108.8 | 54.7 |
| Rhode Island | 9.0 | 9.7 | 10.9 | 12.5 | 13.2 | 14.9 | 17.0 | 18.3 | 57.3 | 63.0 | 69.6 | 80.6 | 90.6 | 120.5 | 137.6 | 151.2 | 7.7 | 65.9 | 184.0 | 22.8 | 50.3 |
| Connecticut | 22.6 | 23.6 | 24.5 | 26.4 | 27.4 | 39.0 | 51.0 | 57.2 | 153.4 | 171.0 | 190.5 | 217.0 | 242.0 | 301.0 | 394.0 | 461.0 | 14.0 | 154.6 | 334.1 | 43.4 | 57.8 |
| MIDDLE ATLANTIC | | | | | | | | | | | | | | | | | | | | | |
| New York | 93.0 | 108.8 | 120.8 | 135.2 | 161.2 | 177.8 | 197.0 | 212.0 | 842.0 | 1,017.0 | 1,147.0 | 1,292.0 | 1,481.0 | 1,639.0 | 1,825.0 | 1,902.0 | 54.8 | 519.2 | 1,516.0 | 164.3 | 58.7 |
| New Jersey | 15.4 | 19.4 | 24.6 | 30.9 | 40.5 | 42.5 | 48.9 | 52.5 | 139.7 | 180.7 | 233.4 | 298.2 | 372.3 | 397.0 | 419.5 | 512.0 | 36.8 | 427.1 | 611.8 | 65.5 | 57.4 |
| Pennsylvania | 39.4 | 46.0 | 56.0 | 76.5 | 90.8 | 127.8 | 154.3 | 164.8 | 515.0 | 670.0 | 870.0 | 1,140.0 | 1,493.0 | 1,750.0 | 2,120.0 | 2,330.0 | 113.2 | 2,152.6 | 3,820.7 | 279.2 | 50.6 |
| SOUTH ATLANTIC | | | | | | | | | | | | | | | | | | | | | |
| Delaware | 1.0 | 1.1 | 1.3 | 1.6 | 1.6 | 1.9 | 2.2 | 2.3 | 4.4 | 4.9 | 9.2 | 14.5 | 22.0 | 23.2 | 25.6 | 26.6 | 1.7 | 25.2 | 51.3 | 4.2 | 48.6 |
| Maryland | 5.9 | 6.9 | 7.9 | 12.7 | 17.4 | 23.0 | 26.5 | 29.1 | 77.8 | 87.9 | 99.2 | 161.2 | 223.4 | 297.0 | 332.0 | 357.4 | 5.4 | 162.7 | 168.2 | 13.2 | 70.5 |
| District of Columbia | 1.5 | 1.8 | 2.0 | 2.5 | 2.8 | 3.3 | 3.7 | 3.9 | 11.1 | 14.0 | 16.1 | 17.7 | 20.2 | 24.0 | 26.8 | 28.1 | 0.2 | 2.0 | 12.0 | 1.7 | 68.4 |
| Virginia | 6.5 | 7.5 | 9.5 | 11.8 | 13.4 | 16.6 | 18.2 | 18.9 | 44.8 | 63.7 | 90.2 | 118.8 | 164.2 | 179.0 | 196.7 | 210.0 | 4.0 | 85.8 | 277.0 | 25.7 | 48.9 |
| West Virginia | 7.2 | 7.7 | 8.7 | 9.7 | 13.9 | 15.4 | 17.5 | 18.5 | 132.4 | 167.4 | 211.5 | 243.5 | 270.0 | 337.7 | 377.8 | 384.2 | 8.0 | 187.4 | 639.1 | 29.2 | 45.1 |
| North Carolina | 12.6 | 13.6 | 15.3 | 16.6 | 17.3 | 19.6 | 22.3 | 23.6 | 98.0 | 107.2 | 131.3 | 154.2 | 196.2 | 237.4 | 262.8 | 273.5 | 5.5 | 63.7 | 318.9 | 26.3 | 48.5 |
| South Carolina | 6.9 | 7.2 | 7.8 | 8.1 | 8.4 | 9.3 | 10.6 | 11.2 | 79.5 | 89.8 | 103.0 | 120.6 | 141.0 | 167.7 | 185.7 | 193.0 | 1.3 | 36.8 | 238.4 | 13.2 | 46.1 |
| Georgia | 8.6 | 9.4 | 10.2 | 10.7 | 11.2 | 12.2 | 14.0 | 13.8 | 93.4 | 105.2 | 120.7 | 141.3 | 164.7 | 196.7 | 216.5 | 214.5 | 2.0 | 40.5 | 261.4 | 16.2 | 47.6 |
| Florida | 1.6 | 1.7 | 1.8 | 2.1 | 2.4 | 3.2 | 3.9 | 4.4 | 6.8 | 8.0 | 9.5 | 12.4 | 17.8 | 30.4 | 32.9 | 35.7 | 0.8 | 44.2 | 132.6 | 14.0 | 36.0 |
| EAST NORTH CENTRAL | | | | | | | | | | | | | | | | | | | | | |
| Ohio | 82.2 | 91.6 | 102.0 | 113.2 | 118.7 | 131.8 | 159.3 | 170.3 | 508.0 | 560.0 | 622.0 | 834.0 | 996.0 | 1,227.1 | 1,488.0 | 1,636.0 | 47.8 | 860.1 | 1,696.5 | 181.8 | 55.2 |
| Indiana | 12.3 | 13.6 | 15.1 | 20.2 | 32.0 | 44.8 | 56.1 | 62.3 | 289.2 | 316.0 | 346.0 | 376.0 | 425.0 | 484.9 | 568.0 | 625.0 | 17.5 | 322.2 | 628.2 | 58.1 | 56.3 |
| Illinois | 61.2 | 71.4 | 83.5 | 100.4 | 108.0 | 125.3 | 158.8 | 177.8 | 665.0 | 792.5 | 910.0 | 1,079.0 | 1,200.0 | 1,305.0 | 1,528.0 | 1,692.0 | 46.7 | 681.5 | 924.1 | 88.7 | 68.2 |
| Michigan | 29.6 | 37.9 | 48.6 | 56.4 | 59.8 | 71.3 | 50.1 | 55.7 | 321.3 | 372.0 | 475.0 | 565.5 | 631.5 | 725.5 | 850.0 | 933.0 | 24.7 | 385.4 | 704.5 | 69.2 | 61.2 |
| Wisconsin | 23.2 | 25.6 | 27.1 | 33.1 | 36.1 | 40.0 | 53.8 | 64.8 | 124.8 | 140.4 | 167.0 | 217.0 | 318.8 | 330.0 | 344.0 | 365.3 | 21.6 | 264.8 | 513.6 | 62.3 | 53.7 |
| WEST NORTH CENTRAL | | | | | | | | | | | | | | | | | | | | | |
| Minnesota | 19.3 | 19.6 | 20.0 | 24.0 | 24.4 | 29.1 | 32.2 | 36.7 | 244.2 | 267.0 | 290.7 | 326.0 | 343.0 | 370.0 | 383.0 | 436.0 | 5.2 | 100.7 | 360.0 | 28.3 | 61.7 |
| Iowa | 16.3 | 18.3 | 20.5 | 22.8 | 24.1 | 25.4 | 26.3 | 26.9 | 95.1 | 105.7 | 117.3 | 130.5 | 138.3 | 150.8 | 156.0 | 153.0 | 4.0 | 58.5 | 115.0 | 19.4 | 64.5 |
| Missouri | 16.7 | 18.4 | 21.7 | 24.0 | 27.0 | 30.2 | 36.1 | 37.2 | 122.7 | 135.7 | 164.7 | 184.8 | 213.5 | 248.4 | 264.3 | 256.3 | 10.1 | 122.9 | 305.2 | 37.1 | 54.8 |
| North Dakota | 0.9 | 1.0 | 1.1 | 1.3 | 1.4 | 1.7 | 1.9 | 2.0 | 4.9 | 5.2 | 5.4 | 6.0 | 6.4 | 6.9 | 7.1 | 7.3 | 0.1 | 1.4 | 11.6 | 4.7 | 41.7 |
| South Dakota | 2.3 | 2.6 | 2.6 | 3.1 | 3.5 | 4.3 | 4.8 | 4.9 | 15.8 | 16.9 | 17.6 | 19.7 | 21.2 | 22.9 | 23.7 | 24.4 | 0.4 | 12.8 | 14.0 | 2.6 | 71.9 |
| Nebraska | 6.0 | 6.8 | 7.5 | 7.8 | 10.7 | 14.4 | 15.4 | 16.3 | 24.8 | 28.3 | 49.1 | 57.4 | 74.5 | 100.2 | 100.3 | 112.0 | 2.0 | 26.6 | 65.0 | 9.3 | 66.1 |
| Kansas | 6.0 | 6.8 | 7.6 | 8.8 | 10.1 | 11.2 | 11.9 | 12.9 | 35.4 | 75.4 | 99.8 | 121.3 | 129.2 | 144.0 | 145.7 | 149.0 | 2.9 | 57.2 | 236.0 | 18.4 | 46.1 |
| EAST SOUTH CENTRAL | | | | | | | | | | | | | | | | | | | | | |
| Kentucky | 4.2 | 4.7 | 5.2 | 5.6 | 7.3 | 8.9 | 9.0 | 10.0 | 24.1 | 39.2 | 64.0 | 80.8 | 97.7 | 125.6 | 216.8 | 252.0 | 4.4 | 91.4 | 237.0 | 16.8 | 47.8 |
| Tennessee | 7.8 | 8.3 | 9.0 | 9.5 | 9.7 | 10.5 | 11.0 | 12.0 | 81.5 | 90.7 | 101.5 | 110.0 | 114.2 | 138.9 | 140.2 | 158.2 | 2.6 | 45.7 | 252.4 | 19.1 | 42.3 |
| Alabama | 6.6 | 7.1 | 7.7 | 8.2 | 8.5 | 9.4 | 9.7 | 11.0 | 72.1 | 90.6 | 113.4 | 155.6 | 222.5 | 234.7 | 316.3 | 344.5 | 3.3 | 87.2 | 526.2 | 21.1 | 37.9 |
| Mississippi | 1.5 | 1.6 | 1.6 | 1.7 | 1.8 | 1.8 | 1.9 | 2.2 | 8.9 | 11.1 | 12.4 | 13.8 | 14.3 | 17.0 | 22.9 | 24.2 | 0.7 | 21.6 | 217.3 | 23.0 | 15.1 |
| WEST SOUTH CENTRAL | | | | | | | | | | | | | | | | | | | | | |
| Arkansas | 2.1 | 2.3 | 2.5 | 2.7 | 2.9 | 3.1 | 3.2 | 3.5 | 21.9 | 24.7 | 28.0 | 25.4 | 28.1 | 35.1 | 42.7 | 46.3 | 0.8 | 17.3 | 195.9 | 17.3 | 21.1 |
| Louisiana | 1.5 | 2.0 | 3.0 | 3.2 | 3.7 | 4.5 | 5.3 | 7.1 | 15.8 | 20.8 | 30.8 | 37.2 | 44.3 | 68.3 | 74.5 | 83.0 | 2.0 | 43.5 | 363.0 | 23.9 | 23.6 |
| Oklahoma | 4.0 | 4.6 | 5.2 | 6.4 | 7.3 | 8.8 | 8.9 | 8.9 | 31.1 | 36.8 | 45.6 | 61.3 | 70.2 | 94.8 | 108.0 | 101.0 | 1.2 | 25.3 | 505.6 | 46.9 | 19.2 |
| Texas | 11.9 | 13.6 | 14.5 | 16.9 | 19.5 | 21.5 | 22.4 | 23.5 | 79.5 | 98.5 | 122.5 | 163.5 | 202.2 | 300.5 | 362.0 | 384.5 | 3.2 | 60.6 | 410.0 | 29.4 | 46.8 |
| MOUNTAIN | | | | | | | | | | | | | | | | | | | | | |
| Montana | 7.3 | 9.4 | 11.7 | 13.0 | 13.6 | 14.5 | 15.8 | 18.0 | 162.3 | 204.5 | 211.5 | 231.5 | 237.5 | 256.0 | 280.0 | 317.0 | 0.4 | 11.0 | 112.3 | 6.4 | 70.4 |
| Idaho | 2.3 | 2.4 | 2.4 | 3.0 | 3.5 | 4.1 | 5.2 | 5.9 | 10.1 | 23.2 | 34.8 | 43.8 | 47.4 | 59.2 | 75.4 | 85.3 | 0.4 | 12.8 | 58.6 | 4.1 | 55.2 |
| Wyoming | 0.4 | 0.4 | 0.4 | 0.8 | 0.9 | 1.5 | 1.7 | 1.8 | 15.8 | 16.3 | 15.8 | 15.0 | 22.8 | 23.7 | 26.2 | 26.9 | 0.2 | 6.2 | 55.5 | 3.5 | 35.0 |
| Colorado | 7.4 | 7.7 | 8.1 | 8.8 | 9.7 | 10.2 | 10.4 | 11.1 | 78.8 | 0.8 | 129.3 | 155.6 | 157.4 | 158.6 | 168.4 | 189.0 | 2.2 | 41.2 | 170.7 | 11.0 | 53.9 |
| New Mexico | 0.5 | 0.8 | 0.9 | 1.1 | 1.1 | 1.3 | 2.0 | 2.7 | 8.6 | 9.1 | 9.6 | 10.1 | 10.1 | 9.9 | 11.9 | 13.2 | 1.4 | 26.7 | 52.9 | 7.0 | 40.8 |
| Arizona | 1.2 | 1.5 | 1.7 | 2.1 | 2.1 | 2.4 | 2.7 | 2.7 | 53.8 | 55.6 | 59.0 | 61.2 | 62.5 | 61.7 | 68.3 | 68.3 | 1.9 | 97.6 | 160.1 | 6.2 | 49.9 |
| Utah | 7.2 | 7.3 | 7.5 | 9.4 | 10.8 | 12.6 | 14.0 | 18.8 | 115.0 | 133.7 | 146.2 | 160.8 | 166.5 | 197.0 | 218.0 | 242.0 | 0.9 | 26.1 | 67.2 | 4.3 | 76.8 |
| Nevada | 1.7 | 2.0 | 2.3 | 2.9 | 2.9 | 3.5 | 3.9 | 4.6 | 40.0 | 41.5 | 43.8 | 45.8 | 45.8 | 45.2 | 50.0 | 58.0 | 0.5 | 15.9 | 23.5 | 1.8 | 72.2 |
| PACIFIC | | | | | | | | | | | | | | | | | | | | | |
| Washington | 8.5 | 8.7 | 10.6 | 14.0 | 22.6 | 25.1 | 28.4 | 29.4 | 156.8 | 160.6 | 174.4 | 211.4 | 253.4 | 280.7 | 317.0 | 321.0 | 3.4 | 72.9 | 447.9 | 40.1 | 44.8 |

# Facts on the Value of Wholesale Business

## The High Points of an Analysis of the Profitableness of Orders, Lines of Merchandise and Individual Customers, Based on the Experience of the Largest Electrical Jobber

By O. D. STREET

MANUFACTURING accounting is a highly developed art. This is because manufacturing accounting has received for the past half century an increasing amount of scientific attention. However, in the field of distribution, there is probably not a firm in the country which knows what it costs to sell any one of its articles, unless it sells only one article, nor a firm which knows what it is costing to sell to any one of its individual customers.

MR. STREET, who has recently become vice-president of the McGraw-Hill Company, was for ten years general manager of distribution of the Western Electric Company, in executive charge of its great system of fifty electrical supply jobbing houses. Through this period the business of these many branches has been analyzed and classified in deliberate, systematic effort to develop a sufficient volume of dependable statistics to make it possible to determine what has been the matter with the electrical jobbing business, by finding out what kind of orders, what kind of merchandise and what kind of customers are profitable and why. What these findings have been Mr. Street has briefly pictured in this article, which was presented as a paper before the Association of National Advertisers, just prior to his resignation.

Approximately ten years ago the Western Electric Company came to recognize how incomplete its knowledge was as to how it made even the little money which was then made in its jobbing business. We could not get away from the thought that there must be something, or several things, fundamentally unsound in our program—that there must be leaks somewhere, or that we were unconsciously pulling against some unseen resistance.

Analytical work was started. Clerks were put to work studying the cost copies for a period of twelve months on the number of orders received where the value was less than $5. Similar data were obtained at the same time on orders where the value was from $5 to $10, $10 to $25 and over $25. Table I is a summary of the results of such a study. These figures proved that we were losing money, and a pile of it, in connection with at least 60 per cent of our transactions—the small orders which carried the highest rate of profit.

A further analysis of the details of our expenses showed us that a great many of these expenses varied directly with the number of orders handled. A continuation of our studies along this line brought us to the point where we found we could closely approximate our costs in dollars and cents for handling the different size orders. Table II shows the result of one of these studies. This indicated that our expense on small orders—those where the value was less than $25—varied from $3.25 to $5, while the average gross profit on these orders averaged from $0.71 to $4.48. The average amount of loss on these orders was about $1.63, and as such orders represented about 60 per cent of all of our orders, the aggregate loss was found to be very large—close to three-quarters of a million dollars annually.

It is seen, therefore, that there were two major advantages derived from this particular line of investigation:

1. We discovered, contrary to our belief, that the orders which carried the highest rate of profit were in reality the ones on which, taken as a class, we were losing an enormous amount of money.

2. We discovered, again contrary to our belief, that the orders which carried the lowest rate of profit were in reality the ones on which, taken as a class, we made all our money.

### PROFITABLENESS OF LINES OF MERCHANDISE

Having determined to our satisfaction the kind of orders on which we made money and the kind on which we lost money, we began to study lines of merchandise in order to see what we could learn in that direction.

Prior to the time of these studies and because we did not know of a more accurate method of approximating our costs, we, like other distributors, were accustomed to estimate the profitableness of our business by lines of merchandise by comparing the gross profit rate earned on each line with the average expense rate realized on the entire business. In computing the percentage of net profit earned on investment, consideration, of course, was given to a low investment, such as would result from consigned stock, direct shipments and prompt payments, but, in the main, the amount of net profit was determined by taking the difference between the gross profit rate on the line and our average expense rate and multiplying the sales of the line thereby.

But the studies above referred to had proved conclusively that such a method of computing costs was most misleading. We now know that just because our average expense rate is 15 per cent it does not follow

TABLE I—ANALYSIS OF ORDERS HANDLED

| Value of Orders | Number of Orders | Per Cent of Total | Total Value | Per Cent of Total Value | Average Value per Order | Amount Gross Profit | Per Cent of Total Profit | Gross Profit Rate | Average Gross Profit per Order |
|---|---|---|---|---|---|---|---|---|---|
| Under $5 | 193,000 | 25 | $463,200 | 1.0 | $2.40 | $137,030 | 1.6 | 30 | $0.71 |
| $5 to $10 | 108,000 | 14 | 783,000 | 1.7 | 7.25 | 223,560 | 2.6 | 29 | 2.07 |
| $10 to $25 | 162,000 | 21 | 2,783,160 | 6.0 | 17.18 | 725,760 | 8 3 | 26 | 4.48 |
| Total above classes | 463,000 | 60 | $4,029,360 | 8.7 | $8 70 | $1,086,350 | 12.5 | 27 | $2.35 |
| Over $25 | 309,000 | 40 | 42,577,800 | 91.3 | 137.80 | 7,630,200 | 87.5 | 18 | 24.70 |

TABLE II—RELATIVE PROFITABLENESS OF ORDERS HANDLED

| Size of Order | Annual No. of Orders Handled | Average Value per Order | Average Gross Profit Rate, per Cent | Average Gross Profit per Order | Average Expense per Order | Average Net per Order | Total Net |
|---|---|---|---|---|---|---|---|
| Under $5...... | 193,000 | $2.40 | 30 | $0.71 | $3.25 | —$2.54 | —$490,220 |
| $5 to $10...... | 108,000 | 1.25 | 29 | 2.07 | 3.74 | —1.67 | —180,360 |
| $10 to $25..... | 162,000 | 17.18 | 26 | 4.48 | 5.00 | —0.52 | —84,240 |
| Total above classes..... | 463,000 | $8.70 | 27 | $2.35 | $3.98 | —$1.63 | —$754,820 |
| Over $25...... | 309,000 | 37 80 | 18 | 24.70 | 14.58 | 10.12 | 3,124,500 |

that our expense rate on all our items, or on all our lines, or on all our orders, is 15 per cent. This 15 per cent is an average, and, being an average, it means that the expense rates on some orders are higher than 15 per cent and on some lower than 15 per cent.

By discovering and introducing this cost-per-order factor we had provided a gage whereby we could the more closely compute our costs on orders and on lines of merchandise. One of the more conspicuous instances where we changed our sales practice as a result of the application of this new method of computing costs was in connection with a certain line of merchandise on which we had always thought that we had made little if any money. Our average expense rate at this time was about 15 per cent, and in computing net profits on this line an estimated expense rate of 13.5 per cent was applied. As the gross profit rate that year on the line was 12.5 per cent, we figured that we had lost 1 per cent on sales and about 15 per cent on the investment. But in one of our studies we had found that the average value of our orders on this line was about $70, while the average value per order on all our business was at that time only $30 and the average expense per order was $4.50. This was before the war.

Since the average value of the orders on this line was $70, and since we had applied an expense rate of 13.5 per cent against the line, it was the same as saying that the cost per order for handling the line was $9.45 ($70 × 13.5 per cent) as compared with an average expense of but $4.50 per order on all our business. It must be remembered that our average order, the distributing cost on which was $4.50, contained two and one-half items, but here we were assessing $9.45 worth of expense against one item—more than twice as much money as it cost to handle the average two-and-a-half-item order.

After considering the expense from this angle, we concluded that our average expense of handling that line which was on consignment and on which we had no abnormal sales expense and did no advertising did not cost at the outside any more money per order than did our average order. Thereafter we applied 6.5 per cent as the expense rate applicable to our sales on this line, and since our gross profit rate has been averaging about 15 per cent on the item, we have been showing during the past few years a net profit of about 8.5 per cent on sales, instead of a loss, as had been our previous practice. Eight and one-half per cent net on sales indicates, as you can imagine, a handsome net return on the investment.

On still another line we had been showing a profit on sales of 15 per cent and a profit on investment of 38 per cent, but now on that same item, the gross profit rate being about the same as before, we are showing a loss on sales of about 2.5 per cent and a loss on investment of about 8 per cent. This was one of the items we had been pushing hard, because since the gross profit rate was 30 per cent we had thought we were making a great deal of money on it; but instead our new system of computing expenses proved that we were really losing money on every sale.

### Gross Profit No Guide

In years gone by we, in common with other distributors, had been possessed with the idea that the only way to increase the net profit earned on our investment was to increase our rate of gross profit. Now we have come to see that there is vastly more money in some business taken at a low rate of gross profit than there is in other business taken at an appreciably higher rate. We see now that a gross profit rate means nothing until we know to what amount that rate is going to be applied.

As is seen by referring to Table III, since our average expense per order is about $7, we cannot make money if our orders average a value of $30, even if our gross profit rate be 20 per cent, for this would give us an average profit of but $6 per order. As our expense is $7, we should be losing $1 on every order. On the other hand, if the value of our average order is $45 and the average profit rate 18 per cent, resulting in a gross profit per order of $8.10, we shall make some

TABLE III—ANALYSIS OF TOTAL SALES BY MONTHS

| | Net Sales | Gross Profits | Gross Profit Rate | Expenses | Net Profit | No. of Orders | Average Value per Order | Average Gross Profit per Order | Average Expense per Order | Average Net Profit per Order | Per Cent Earned on Investment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| January................ | | | 19.1 | | | 50,912 | $46.85 | $8.93 | $7.65 | | |
| February............ | | | 19.1 | | | 58,617 | 46.20 | 8.83 | 6.73 | | |
| March................ | | | 19.7 | | | 63,042 | 46.75 | 9.21 | 6.55 | | |
| Average for the first quarter............. | $2,682,000 | $518,000 | 19.3 | $399,000 | $119,000 | 57,524 | $46.60 | $9.01 | $6.94 | $2.07 | 14.2 |
| April.................... | | | 17.9 | | | 60,383 | 48.95 | 8 77 | 6.93 | | |
| May.................... | | | 18.4 | | | 59,622 | 49.70 | 9.10 | 6.89 | | |
| June.................... | | | 18.4 | | | 60,756 | 51.45 | 9.49 | 6.71 | | |
| Average for the second quarter............. | $3,013,000 | $550,000 | 18.2 | $413,000 | $137,000 | 60,254 | $50.00 | $9.13 | $6.84 | $2.29 | 19.7 |
| July.................... | | | 17.1 | | | 62,620 | 54.38 | 9.30 | 6 94 | | |
| August.................. | | | 17.7 | | | 64,303 | 56.66 | 10.03 | 6.86 | | |
| September.............. | | | 17.1 | | | 65,424 | 60.54 | 10.40 | 6.96 | | |
| Average for the third quarter............. | $3,673,000 | $635,000 | 17.3 | $443,000 | $192,000 | 64,116 | $57.30 | $9.92 | $6.91 | $3.01 | 26.9 |
| October................ | | | 17.0 | | | 76,992 | 62.00 | 10.50 | 6.90 | | |
| November.............. | | | 16.4 | | | 72,886 | 64.30 | 10.50 | 7.16 | | |
| December................ | | | 16.4 | | | 92,302 | 66.83 | 10.95 | 7 67 | | |
| Average for the fourth quarter............. | $5,207,000 | $862,000 | 16.6 | $587,000 | $275,000 | 80,727 | $64.50 | $10.68 | $7.27 | $3.41 | 33.8 |

money, and we shall make even more if the average value is $60 and the average profit rate 17 per cent, since that would give us an average gross profit per order of $10.20 against an average expense of $7.

Small orders, the more so where they are 60 per cent of all orders, tend to lower the average profit per order below $7. The large orders are the only ones which help to raise the average profit, and only by raising the average profit per order well above the average cost per order can we hope to make a good return on the investment. With us, under ordinary conditions of investment, the average amount of gross profit per order must be from $2.50 to $3 greater than the average cost per order in order to show a return of 25 per cent on the investment. This can be figured out by assuming a given condition where the average value per order is $56, the average profit rate is 18 per cent, the average amount of profit per order is $10, the average expense per order is $7, the average number of days receivable is 50 and the average investment in merchandise is $4. Our formula would then work out as follows:

$$\frac{G-E}{M+R}=\frac{\$10.00-\$7.00}{\$\ 4.00+\$8.00}=\frac{\$\ 3.00}{\$12.00}=25 \text{ per cent.}$$

### Cost per Order Constant

To comprehend thoroughly, you must see the line of reasoning followed in reaching the conclusion that our expenses per order tend to be relatively constant. Our expense per order is about 70 per cent higher than it was before the war, but the expense has gone up proportionately at all houses and most likely among all distributors. This increase is the result of the higher cost of labor, trucking, rent, etc. If these factors go higher, our average cost per order will be higher than at present. If they decrease, the average cost per order will decrease.

At our Salt Lake house, where the organization is small, the cost per order is $6, and only at one or two of our fifty houses, where certain known abnormal expenses prevail, have we a cost in excess of $7.50 per order.

With us the expense per order is relatively constant month by month at each house, month by month at all houses. This is because the expenses of such a distributing organization tend more closely to follow transactions than to follow sales value. This point is made more clear by the figures in Table IV.

You see that Chicago handles ten times as many orders as Salt Lake, and that the average value of the order at Chicago is twice as large; yet the average expense per order at Chicago is but $7.61 and only $1.61 more than the average expense at Salt Lake. If expenses followed values, and since the average value of Chicago's order is exactly twice as large as the average value of Salt Lake's order, Chicago's expense per order would be twice as large as at Salt Lake, or $12 instead of $7.61. For the past eight years the number of orders handled at each of the houses, and for the company as a whole, has not varied from one year to

TABLE IV—DATA FOR CHICAGO AND SALT LAKE FOR TWELVE MONTHS

| | Number Orders Handled | Average Value per Order | Average Expense per Order | Average Expense Rate |
|---|---|---|---|---|
| Chicago | 131,000 | $76.00 | $7.61 | 10.0% |
| Salt Lake | 13,000 | 38.00 | 6.00 | 15.5% |
| Per cent difference | +900 | +100 | +27 | —35 |

the next to any appreciable extent, and we do not expect that this condition will change. (See Table V.)

While I have been emphasizing the fact that our average expense per order tends to be quite constant, I have not forgotten that we may still have too many employees at some of our houses and that the work of others is not as efficient as it might be. In other words, there is a chance at every point to do a more efficient, hence a cheaper, job. On the other hand, we recognize that with our office and warehouse work more or less standardized as it is, and with the competent department heads we have in charge at the houses, no great amount of money is being wasted. Our general department specialists are finding it harder each year to develop new methods by which we can reduce expenses. To be sure, a couple of men, after working a month last year at one house, were able to point out where changes could be made that would effect savings amounting to $4,000 per annum. Now, $4,000 is worth saving, but even if saved it will reduce the expense at that house only to the extent of 10 cents an order, since the house handles 40,000 orders a year. It is right that we keep our expenses down, and we expect to continue searching for better and cheaper methods, but we think that it is much easier by applying the knowledge we now have to get our average profit per order up 50 cents than it is to get our average expense per order down 10 cents. Not only is it easier, but it is nearly five times as valuable from a net profit standpoint.

### Profitableness of Individual Customers

We have now considered how to test the profitableness of orders and the profitableness of lines, and how to watch the progress of the business as a whole; and there is one other thought which is worth considering. Let us see if by the use of these same methods we can get a better idea as to the profitableness of the individual customers, for, after all, it is the customer to whom we are trying to sell and whom we desire to serve.

Why is it that we have warehouses in fifty cities carrying in each several thousand items of merchandise? Why do we publish an expensive year book in which we indicate our ability to furnish no less than fifty thousand different items of merchandise? In short, for what purpose has this national sales organization of ours been created if not to seek out and serve customers in the expectation that the business relation thus established may prove profitable?

If it is the job of the distributor to endeavor to show a net profit on the business of each customer he serves, it is essential that we should have a gage whereby we

TABLE V—DATA OF NUMBER OF BILLS RENDERED

| | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 | 1921 | Aver. 7 Years |
|---|---|---|---|---|---|---|---|---|
| Pittsburgh | 27,363 | 30,976 | 31,417 | 28,450 | 33,228 | 39,979 | 33,527 | 32,134 |
| Atlanta | 39,693 | 46,170 | 40,934 | 39,951 | 41,733 | 48,646 | 40,088 | 42,459 |
| Minneapolis | 37,763 | 41,262 | 37,115 | 33,213 | 35,741 | 47,418 | 41,486 | 39,143 |
| St. Louis | 34,614 | 41,180 | 36,845 | 34,952 | 39,584 | 43,596 | 35,258 | 38,004 |
| San Francisco | 38,255 | 39,598 | 36,652 | 34,092 | 38,604 | 47,144 | 45,110 | 39,922 |
| Total all houses | 700,459 | 800,653 | 752,605 | 705,407 | 788,572 | 913,835 | 757,922 | 774,208 |

can at least approximate the profitableness of a customer's account. A number of years ago we designed and sent to our houses a form to be used for this purpose, reproduced herewith in Table VI.

The very least we need to know is the annual sales, the average gross profit rate, the number of orders handled during the year and the average amount of profit per order. Above all, we must know the average amount of profit per order, for without those data we can tell nothing at all about an account from a net-profit standpoint. We may guess that it is good, but we are only guessing. An estimate based on fairly correct accounting principles is to be preferred.

Where we found that accounts were not being analyzed from a net-profit standpoint, some spot checks were made, along the line suggested by Table VI, and the results of some of these are cited below.

**Monthly Analysis of Individual Customer's Account**

| | Sales | Gross Profit Rate | Amount Gross Profit | No. of Orders Handled | Average Value per Order | Average Profit per Order | Average No. Days Receivable |
|---|---|---|---|---|---|---|---|
| January | | | | | | | |
| February | | | | | | | |
| March | | | | | | | |
| Average first quarter | | | | | | | |
| April | | | | | | | |
| May | | | | | | | |
| June | | | | | | | |
| Average second quarter | | | | | | | |
| July | | | | | | | |
| August | | | | | | | |
| September | | | | | | | |
| Average third quarter | | | | | | | |
| October | | | | | | | |
| November | | | | | | | |
| December | | | | | | | |
| Average fourth quarter | | | | | | | |
| Average twelve months | | | | | | | |

TABLE VI—FORM USED BY ALL BRANCHES IN ANALYZING CUSTOMER'S ACCOUNT

At one house we took an account of our sales, which were about $16,000 a year and the profit rate about 15 per cent. The sales manager expressed his belief that the account was profitable because, to use his argument, "the volume was large." After going to the books and counting the number of orders which had been rendered during the year, we found that the average profit per order produced by this sixteen-thousand-dollar account was $2.10. The average expense per order at that house was $6.50. The customer was being allowed 120 days in which to pay his bills, was receiving the benefit of our best prices, and the stores manager had stated that, from a service and claims standpoint, the customer was a "perfect pest," yet his unreasonable demands for special services were accorded, 120-day payments were allowed and best prices were quoted, because it was thought the account was profitable, and it was considered profitable simply "because the volume was large." When it was found that the average profit was but $2.10 per order, neither the sales manager nor any one else thought the account was profitable, and instantly steps were taken to change the situation, not by closing the account, but by changing the character of it.

At another house, where the average expense per order was $6.25, the two largest accounts on the books happened to be two central-station accounts. The purchases of one amounted to $60,000 that year at an 11 per cent rate of gross profit and those of the other to $58,000 at a 12 per cent rate. One was in the home city of the house and the other a hundred miles away. Asking the house concerned which was the more profitable account of the two, we were told that the one in the home city was the better. We counted the orders rendered during the year and found that the gross profit on the home city account averaged $6 per order and that on the other averaged $27 per order. You see, the management had guessed wrong, for there was no chance for a net profit in the home city account, while in all probability the other account, which produced $27 profit per order, was showing a return of better than 100 per cent on the investment. Bills in each case were being discounted and paid in ten days. It goes without saying that the home city account is now being studied so that it may be made a net profit earner as well as a volume builder, and the outside account is receiving more attention than ever before lest it should be lost. No house is going to take chances in losing so profitable an account after it once knows how profitable it is.

At another house, where the average expense per order was $7.50, several dealer accounts were analyzed. The volume in each case was large, the gross profit rate was good, and payments were prompt. The volume of sales and gross profit per order for twelve months on a few of these accounts are shown below:

| | Total Sales | Gross Profit Rate | Average Value per Order | Average Profit per Order |
|---|---|---|---|---|
| Account No 1 | $43,637 | 17% | $232 | $39.44 |
| Account No. 2 | 25,035 | 19% | 169 | 32.11 |
| Account No. 3 | 40,548 | 18% | 157 | 28.26 |
| Account No. 4 | 35,350 | 18% | 121 | 21.78 |
| Account No. 5 | 28,550 | 17% | 170 | 28.90 |

Since we know there were no abnormal expenses in connection with the business of these accounts, we were satisfied that they were good money makers for the house. It is all right to watch sales volume, but we must not fool ourselves by assuming that a large volume of sales made to a customer necessarily means that we are deriving any net profit from the account. Such an assumption is not warranted without further analysis.

If, as is generally assumed, new alignments are to be worked out in the producing and distributing fields, and since it is a certainty that the successful agencies in both of these branches five or ten years hence will be those whose efficiency is of the highest, perhaps you will agree with me that those of us who would be recorded among the survivors must hasten to ascertain where we now stand, in order that losses incurred in unproductive endeavor may be eliminated and that the money thus saved may be invested in productive endeavor.

When we know the production and the distribution cost of each thing we market, when we know the profitableness of the account of each jobber we serve, and when the jobbers and wholesalers know the profitableness of the account of each retailer they deal with, then, and not until then, will there be fewer factories in which the same thing is made, fewer distributors who vend these articles in the wholesale mart and fewer dealers who pretend to serve the buying public. Then, and not until then, shall we have solved the question as to why production and distribution costs are so high.

# Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

## Value of Mathematical Studies in Engineering Education

*To the Editors of the* ELECTRICAL WORLD:

Current literature on electrical engineering subjects reveals a very marked and increasing interest on the part of prominent engineers in the education of engineering students. At a recent convention of the A.I.E.E. no less than five papers by leading engineers were devoted to this subject. The dominating idea of the discussion was the extreme importance of mathematics as the foundation upon which the superstructure of engineering must be built, it being even more important than physics and chemistry. The consensus of opinion also appeared to be that the majority of engineering graduates are very deficient in mathematics, especially in its application to engineering problems. To quote a very distinguished engineer on this subject: "Most of the graduates of the technical schools are woefully weak in mathematics."

The attention given by engineers to the teaching of mathematics in engineering colleges is intensely interesting in that it is obviously indicative of a change in the methods of handling engineering problems. It is one phase of the transition from the "cut-and-try" kind of engineering to what Mr. Lamme has so aptly termed "engineering by analysis" (B. G. Lamme, "Electrical Engineering Papers," page 755). The colleges are generally held responsible for the engineering graduate's lack of skill in applying mathematics to engineering problems, but are they altogether to blame for this condition?

Because of the prominence of the engineers who have voiced a demand for more thorough instruction in mathematics, it is readily inferred that this demand is a general one on the part of engineering executives. From the writer's experience he would judge, however, that this is far from being the case and that most executives still prefer to have their engineering problems solved by the "cut-and-try" method rather than by analysis. The main reason for this probably is that efforts put forth in experiments are more in evidence than when they are expended in analytical investigations.

In development of new apparatus many schemes will ordinarily be investigated and discarded before a really good one is discovered; that is, many investigations will of necessity lead to negative results. However, if the conclusions reached, even though unfavorable, have been arrived at through experiments, enough energy and enthusiasm has usually been displayed by the engineer to satisfy most executives. On the other hand, although the cost of obtaining the same negative results by analysis may be only a fraction of the cost of experiments, the executive is likely to conclude that the engineer has been doing nothing, unless he, himself, happens to have a clear grasp of the mathematical processes involved, which appears to be the exception rather than the rule.

An incident which came to the writer's attention about a year ago is a case in point. Monel metal was found to have the peculiar and interesting property of changing its magnetic reluctance at a temperature near the boiling point of water. It was discovered that a thin circular disk of this metal, mounted so as to rotate with little friction, could be made to revolve if one pole of a magnet was brought near the edge and heat applied to its surface a little distance from the point nearest the magnet pole.

Then, arguing from this fact, the brilliant idea was conceived of revolutionizing the design of energy-converting apparatus. At considerable expense a motor was constructed in which sections of the rotating element were to be alternately heated and cooled by air currents. An extremely simple calculation would show that the amount of energy which is required to make sufficient weight of the metal pass through the necessary temperature variations rapidly enough for even moderate speeds is so large that the efficiency of such a motor would approach the vanishing point. As reported to the writer, it did not even turn over when put on test.

Of course, this is an extreme case, and few executives would consider such a proposition seriously, but the point to be emphasized is that many of them as yet do not fully appreciate the value of "engineering by analysis." When the analytical side of engineering becomes recognized as a powerful tool of investigation and a general demand for engineers with more thorough knowledge of mathematics is created thereby, it is very probable that colleges will respond by turning out graduates better equipped to handle such problems than they are doing at present. K. L. HANSEN.

Milwaukee, Wis.

## Testing Polyphase-Type Watt-Hour Meters

*To the Editors of the* ELECTRICAL WORLD:

In reference to the letter of Prof. A. E. Knowlton published in the Jan. 13 issue of the ELECTRICAL WORLD (page 102) I would like to say that I appreciate criticism from such a high source and that this criticism is theoretically just. However, in connection with the practice of using resistance in the primary circuit of a phantom load in testing meters as described in an article on that subject in the Dec. 23 issue, I should like to say that there must have been some misunderstanding on the part of Professor Knowlton, or else the matter was not stated in a clear manner in the article.

In the plan outlined it might not have been clear that the resistance is not inserted in the primary to change the secondary current when differently sized meters are being tested, but only to compensate for the slight changes in the primary voltage due to fluctuations. The secondary current is regulated by the size of meter connected in the circuit and will automatically adjust itself to the required value due to the different and proportional resistances in the current coils of the variously sized meters, combined with that of the standard. In fact, this resistance in the primary is rarely ever changed, even when testing meters from 5 amp. to 50 amp., and consequently the power factor does not drop to an objectionable value and, by actual measurement, hardly ever below 90 per cent. Of course, this system is not recommended to calibrate rotating standards or to settle lawsuits. DAN C. HOFFMANN.

Austin Power & Light Company,
Austin, Tex.

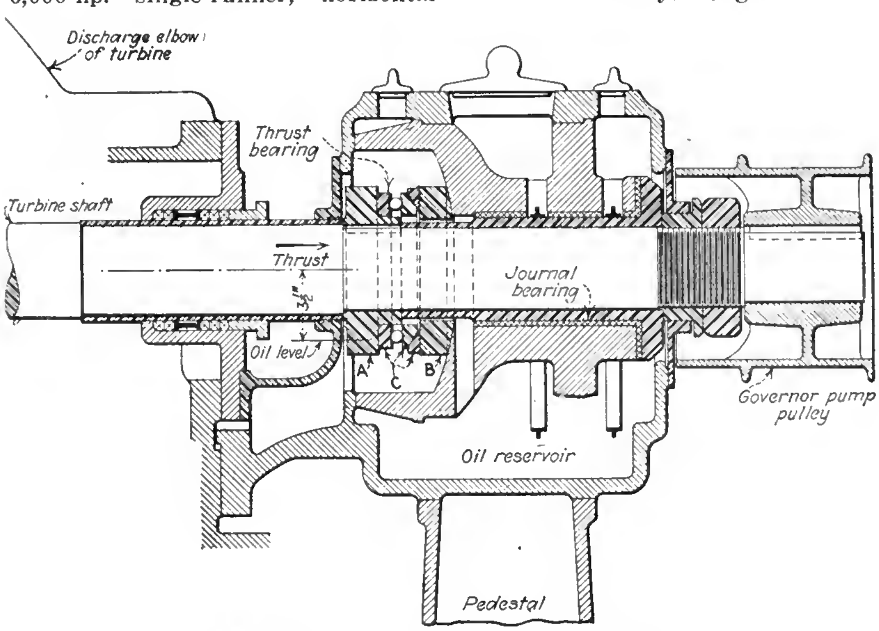
# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of
Generation and Distribution Equipment, and Methods of Economically Utilizing
Electric Service in Large Industrial Plants

## Ball Thrust Bearing Solves Trouble Given by Disk-Type Bearing

TROUBLE with a disk thrust bearing led to the substitution of a ball thrust bearing by the Portland Railway, Light & Power Company. The former type of bearing had proved unsatisfactory in connection with the reconstruction of a 6,000-hp. single-runner, horizontal hydraulic turbine. Early in 1922 the company decided to reconstruct this turbine for a capacity of 8,200 hp., having been assured by the manufacturer that with a modern design of runner, new wicket gates and a larger discharge quarter-turn and draft tube this additional capacity could be gained at an improvement in efficiency of from 5 to 7 per cent.

The change in quarter-turn necessitated a new thrust bearing to take care of the unbalance due to there being but a single runner. As soon as the new equipment was installed and the waterwheel put into operation trouble developed immediately in the thrust bearing. The new bearing furnished for the reconstructed wheel was of a modern design, consisting of one rotating and one stationary disk with babbitted face and self-aligning seat. Six weeks' time was spent in refinishing and making adjustments of the disk bearing, with the result that at the end of that time no reason could be found for the bearing not functioning as intended. The waterwheel unit was needed very badly for peak-load purposes, and no suggestions or recommendations were offered by the manufacturer to solve the difficulty. Urgent need of the unit demanded positive action. The disk bearing was laid aside and attention turned to other types of thrust bearings. A ball thrust bearing was found in local stock, and decision was made to try it as a solution of the trouble. With slight modification, parts were machined for adapting the ball thrust bearing, and the unit was placed in operation. The parts for adapting the ball thrust bearing were made, and the bearing was installed and operating within two days after it was decided to make a trial of it. The machine has since been in operation for nearly three months at from partial to full load with no trouble whatever. The total thrust on the bearing varies from about 6,000 lb. at no load on the unit to zero at about three-quarters load, beyond which point the thrust is practically neutral.




ADAPTING BALL THRUST BEARING TO SINGLE-RUNNER, HORIZONTAL HYDRAULIC TURBINE SOLVES DIFFICULT BEARING PROBLEM

The accompanying illustration shows in cross-section the general arrangement of the thrust bearing. The parts furnished locally to adapt the ball thrust bearing are indicated by *A* and *B*. It will be seen that part *B* has a spherical self-aligning seat. The ball thrust bearing, which also has a self-aligning washer, is indicated by parts marked *C* between *A* and *B*.

E. D. SEARING,
Construction Engineer.
Portland Railway, Light & Power Company,
Portland, Ore.

## Running Cables on Racks Sometimes Dangerous

IN BUILDINGS where there are a number of heavy wires or cables it has been the custom to carry these cables on racks. This arrangement is really an adaptation, used indoors, of the plan, used outdoors, of carrying the wires open on arms on the poles. Outside, the carrying of very heavy feeder lines on the poles is more and more being done away with and cables in underground ducts are taking the place of the former open wiring.

In many stations the cables are now carried in ducts, but in many others, even among those recently constructed, the old plan of open wiring has been followed. This open wiring is without doubt cheaper and permits of making alterations to the wires more easily. Another advantage claimed by some for supporting the cables on racks is that space is saved, although such a saving, if it amounts to crowding, may be a disadvantage.

While the saving of space in stations such as those noted in the article on page 1452 of the Dec. 30 issue of the ELECTRICAL WORLD is always desirable, when it can be done without resulting disadvantages, and is sometimes necessary, yet open wiring is not a good way to save space as its very compactness militates against its use. In case of trouble on one of the cables, particularly one of the lower cables, there is great danger of the arc, or flame

from burning insulation, spreading to adjacent cables and the trouble increasing until many, if not all, of them are involved.

If the cables are run in conduit as far as possible inside of the station, there is little likelihood of the trouble spreading from one cable to another, because, even if they are nearly as close together as they would be if run on racks, they will be separated by the fireproof and arc-proof walls of the ducts.

By running the wires in conduits inside of stations a fire hazard both to the cables themselves and to the building is done away with.

Westfield, N. J. G. H. McKELWAY.

# Extracts from Operating Code

By Field Editor Electrical World
New York, N. Y.

## Instructions for Starting Turbo-Generators

BEFORE starting turbo-generators it is important to see that the slip rings are clean, that the brushes are properly adjusted to them and that the brush rigging is tight, in order that there may be no resistance to the flow of current on account of faulty conditions at these parts. The field resistance is all cut in at starting to prevent the possibility of dangerous voltage as the speed of the machine approaches normal value.

The primary object of an air washer when used with a generator is to cleanse the cooling air for the generator, thus preventing the clogging of the air ducts and the deposition of dust on the windings. Besides reducing the heat-transferring ability of the windings, dust deposits and oil form adhesive coatings which it is difficult or impossible to remove. Where they are not entirely removed the oil attacks the insulation and shortens its life. From clean windings or iron, on the other hand, oil can easily be wiped. A secondary effect of the air washer is the raising of the humidity of the air nearly to saturation, since moist air has a higher specific heat than dry air and consequently will take away more heat from the generator windings with the same rise in temperature.

Following are the instructions for starting turbo-generators which have been specified by the operating code of the Philadelphia Electric Company:

TURBO-GENERATOR STARTING

1. Signal the engineer "slow."
2. After receiving a return signal from the engineer and allowing sufficient time for the turbine to warm up, signal "speed." The time to warm up depends upon how long the machine has been out of operation and upon its size. If the machine is cold, the time allowance should be at least one minute for each 1,000 kw. capacity.
3. When a bracketed exciter is used for excitation, close the exciter circuit breaker.
4. Energize the field, having the field resistance all cut in.
5. Start the air-washer pump and make sure that spray is being produced properly.
6. On receiving the signal "Load" from the engineer, answer it and proceed to synchronize and parallel the generator with the bus to which it is to be connected. Synchronizing methods will be given in later issues.
7. Load the generator at approximately 1,000 kw. per minute.

## Putting Boiler on the Line from Banked Condition

FREELY blowing the superheater before the boiler is put on the line prevents any accumulated water from passing into the steam mains. The plates of the clinker crusher pit are protected from injurious heat by covering them with ashes winged back from the grate. Where dump plates are installed they are dropped to start the run with a clean fire.

The definite procedure for putting a boiler on the line from a banked condition as outlined in the operating code of the Philadelphia Electric Company is given below:

PLACING BOILER IN SERVICE

1. Blow down the water-column gage glass; test the gages by opening the gage cocks and see that there is not over 1½ in. of water in the gage glass when putting a boiler on the line.
2. Open the superheated drains wide and allow them to remain open until damper and stoker adjustments have been made.
3. Wing the ashes back on the clinker crusher, or drop the dump plates.
4. Close the dump plates.
5. Put the long stroke on the lower ram, in cases where hand-dump plates are used.
6. Shut off the draft on the extension grate.
7. Proceed according to rules 2 to 13, inclusive, published in the Feb. 3 issue of the ELECTRICAL WORLD, page 282, under the title "Detailed Instructions for Boiler-Room Force."

# Points to Consider in Locating Meters

IN CHOOSING a meter location it is essential that the instrument be placed where its maximum accurate registering life can be obtained. Locations subject to vibration, dampness, dust and mechanical injury are to be avoided as far as possible. While the life and accuracy of the meter should receive first thought, its proper location as to convenience in reading, inspecting and testing must not be neglected.

Formerly many meters were wrongly installed, irrespective of the inconvenience caused the electric company, in order to comply with the desire of the customer to get the meter out of the way or to permit the contractor to save a little money on the wiring job. This leniency has resulted in meters being placed on porches exposed to weather, on stairways, in bathrooms, bedrooms, closets, coal piles, attics, over windows and doors and in many other inconvenient places varying in height from the floor level to 15 ft. above the floor.

Poor location of meters not only reduces the number read in a day, but at the same time causes undue annoyance to the customer and is the cause of most errors in reading, or even of guesswork on the part of the meter reader, who dislikes to take the time and trouble to see the dial clearly. Mistakes in meter reading are embarrassing to the company; often time and expense are necessary in rectifying them, and possibly the good will of the customer is lost. Wrongly placed meters also increase the cost of testing.

The aim of every company should be to see that its meters are installed in the proper location. The cellar is usually the logical place. Merely to place the meter in the cellar is not enough, however. It should be easily accessible, not less than 4½ ft. nor more than 6 ft. above the floor, and as near the service entrance as possible at a point where no obstruction is likely to be erected. If the cellar cannot be used, the next best place should be chosen. Where the building is under construction a fireproof cabinet for the meters can often be placed in the wall at an accessible place.

The best method is for the electric company to require the contractor to make application for a meter location on a form furnished by the company before any wiring has been

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| LEDGER NUMBER | CUSTOMER | CLASS OF POWER | JAN. 1ST – MAY 1ST | | | | | | MAY 1ST – SEPT 1ST. | | | | | | SEPT. 1ST – DEC. 31ST. | | | | | | ARTIFICIAL TEST | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DATE | K. W. | % REG. FOUND | % REG. LEFT | Remarks | BY | DATE | K. W. | % REG. FOUND | % REG. LEFT | Remarks | BY | DATE | K. W. | % REG. FOUND | % REG. LEFT | Remarks | BY | DATE | | | | | BY |
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| | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |

FIG. 1—LEDGER RECORD OF METER CONDITIONS ON DIFFERENT INSTALLATIONS

done. The company then sends an inspector to determine the location, records the exact spot designated for the meter on the form sent in by the contractor, and either notifies the contractor orally of the desired location or sends him a duplicate of the form he filled out. It is often convenient for the service location to be designated at the same time. The form filled in by the company's inspector is turned over to the service and meter departments to serve as a check when the meter is finally installed.

W. C. DEVIN,
Meter Department.
Chester Valley Electric Company,
Coatesville, Pa.

## Test of Relay and Circuit Breaker Mechanism

TESTING of relays may indicate whether they will operate satisfactorily in service, but it gives no assurance that the control circuit is intact or that the circuit-breaker mechanism will function as desired. Still, all of these parts must perform their duties jointly or the best relay will be useless. Hence a power company in the Southern States makes a practice of testing the combined relay, current transformers, control circuit and breaker-operating mechanism regularly with a portable transformer connected between the two disconnecting switches on each side of each circuit breaker, so as to include these components.

The testing transformer has a 110-volt primary and a low-voltage secondary with several taps, thus permitting full, double or triple-rated current to pass through any circuit breaker. The transformer was made from an old 2-kw. machine, only the original iron core being used. The windings were adjusted until the desired current values were obtained.

In making the tests a cycle counter is used to determine the time required between application of the test current and the completed opening of the circuit.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Meter Test Record

WHEN meters are tested on the customer's premises the conditions found and the adjustments made are too often left unrecorded, notwithstanding that the information may be of considerable value at a later date in meeting a customer's complaint, determining the necessary frequency of test or for another reason. With the inspection and test sheet reproduced herewith one large Southern company has been enabled to discuss intelligently any meter readings with its customers, and has besides been able to check its meter-test men and keep a record which is very helpful in establishing the required frequency of tests as well as the need or otherwise of changing meters. Though the information required may seem unduly elaborate, it

INSPECTION AND TEST SHEET Led. No.________

METER DEPARTMENT

DATE TIME STARTED COMPLETED DIFF.
CUSTOMER
LOCATION WHY TESTED
AMP. VOLTS MAKE TYPE DK. K
SER. NO. CO. NO. READING START
Answer in Affirmative with Check Mark—Negative, Cross FINISH
Are circuits going to meter O. K.? DIFFERENCE Checked O. K.
Condition of Meter, Transformers, and Connections, O. K.
Stop-watch reading r= s. K. W. H. P., r= s. K. W. H. P.
Mill Instruments reading Ind. Wm. Ammeter
Is normal load on? If not, how much load.
Do light and heavy sides of Meter and Test-meter run O. K.?

SERVICE TEST WITHOUT OPENING METER

| LOAD IN K. W. | % FULL LOAD | REVOLUTIONS TEST-METER | REVOLUTIONS METER | % REGISTRATION FOUND | % REGISTRATION LEFT | ADJUSTMENTS AND REMARKS |
|---|---|---|---|---|---|---|
| | | | | | | Change, if out of calibration over one per cent. |
| | | | | | | If Meter out over 2% and seems in bad condition, make artificial test. |

ARTIFICIAL TEST

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | Was Meter opened? |
| | | | | | | Did you clean off around Meter and cover? |
| | | | | | | Are Magnets and Disc clean? |
| | | | | | | Are Jewels, Shaft, and Pivots O. K.? |
| | | | | | | Are Gears meshed, hands tight, and in correct position? |
| | | | | | | Are Magnets and Adjustments tight? |
| | | | | | | Does Meter creep on shunts only? |

FINAL SERVICE TEST

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |

Are all Screws and Adjustments O. K.? Are all Connections tight and O. K.?
Check stop-watch reading r= s. K. W. H. P.
If less than before test, why?
Have you filled out all above at time of test? If not, why?
Test Meter No. Tested by Check by
Entered on Cards
Found Test-block Sealed Unsealed Left Test-block Sealed Unsealed
Found Meter Sealed Unsealed Left Sealed Unsealed Why?

FIG. 2—METER INSPECTION AND TEST RECORD

has been found that even an occasional use of the records has justified recording all the data listed.

In addition to this record a ledger of condensed data is kept, like that shown in Fig. 1, which enables a quick historical study of meter conditions on any customer's installation.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Relay Nomenclature of the Electric Power Club

RELAY nomenclature as in the following list has been recently adopted as recommended practice by the Electric Power Club. The complete list is to be inserted in the next edition of the club's handbook of electrical apparatus standards under the heading of "Nomenclature." The definitions of the various types of relays and qualifying terms should assist materially in furthering clarity in specifications:

### CLASSIFICATIONS OF RELAYS BY FUNCTIONS

*General.* — Where relays operate in response to changes in more than one condition, all functions should be mentioned.

*Electric Protective Relay.*—An electric protective relay is an intermediate device, equipped with contacts to open or close an auxiliary circuit, by means of which one circuit is indirectly controlled by a change in conditions in the same or other circuits.

*Overload Relay.*—An over-current relay in the circuit of a motor is one which functions at a predetermined value of the current to cause the disconnection of the motor from the line.

*Directional Relay.*—A directional relay is one which functions in conformance with direction of power, or voltage, or current, or phase rotation, etc.

*Power-Directional Relay.*—A power-directional relay is one which functions in conformance with direction of power.

Note.—This includes both unidirectional relays with single-throw contacts and duodirectional relays with double-throw contacts. The reason this name is preferred to "reverse power" is that the device is frequently used to function under normal direction of power. Furthermore, in some cases the normal condition of the system may permit power to flow in either direction. Relays for use in either alternating-current or direct-current circuits are to be classed as power-directional relays.

*Polarity-Directional Relay.* — A polarity-directional relay is one which functions by reason of a change in direction of polarity.

*Phase-Rotation Relay.* — A phase-rotation relay is one which functions by reason of a change in direction of phase rotation.

*Current-Relay.*—A current relay is one which functions at a predetermined value of the current. These may be either over-current relays or under-current relays.

*Voltage Relay.* — A voltage relay is one which functions at a predetermined value of voltage. These may be either over-voltage relays or under-voltage relays.

*Power Relay.*—A power relay is one which functions at a predetermined value of watts. These may be either over-power relays or under-power relays.

*Frequency Relay.* — A frequency relay is one which functions at a predetermined value of frequency. These may be either over-frequency relays or under-frequency relays.

*Temperature Relay.*—A temperature relay is one which functions at a predetermined temperature in the apparatus protected.

*Open-Phase Relay.* — An open-phase relay is one which functions by reason of the opening of one phase of a polyphase circuit.

*Differential Relay.*—A differential relay is one which functions by reason of the difference between two quantities such as current, or voltage, etc.

Note. — This term includes relays heretofore known as "ratio balance relays," "biased relays" and "percentage differential relays."

*Locking Relay.* — A locking relay is one which renders some other relay or other device inoperative under predetermined values of current, or voltage, etc.

*Trip-Free Relay.*—A trip-free relay is one which prevents holding in an electrically operated device such as a circuit breaker while an abnormal condition exists on the circuit.

*Auxiliary Relay.*—An auxiliary relay is one which assists another relay in the performance of its function and which operates in response to the opening or closing of the operating circuit.

*Signal Relay.*—A signal relay is an auxiliary relay which operates an audible or visible signal.

### GENERAL QUALIFYING TERMS

*Inverse Time.* — Inverse time is a qualifying term applied to any relay indicating that there is purposely introduced a delayed action, which delay decreases as the operating force increases.

*Definite Time.* — Definite time is a qualifying term applied to any relay indicating that there is purposely introduced a delayed action, which delay remains substantially constant regardless of the magnitude of the operating force. (For forces slightly above the minimum operating value the delay may be inverse.)

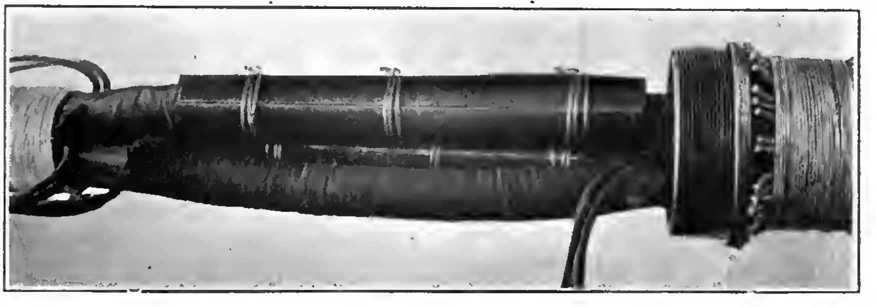
*Instantaneous.* — Instantaneous is a qualifying term applied to any relay indicating that no delayed action is purposely introduced.

*Notching.*—Notching is a qualifying term applied to any relay indicating that a number of separate impulses are required to complete operation.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

# Eight-Mile Cable Under San Francisco Bay

**Operated Successfully at 11,000 Volts by the Great Western Power Company—Method of Handling, Splicing, Testing and Laying Outlined**



JOINT SLEEVE SCREWED TO THREADED COLLAR CLAMPED BENEATH CABLE ARMOR WIRE

WHAT is believed to be the largest and longest submarine power cable in the United States for operation at 11,000 volts has recently been laid by the Great Western Power Company. The cable, approximately 8 miles in length, runs beneath San Francisco Bay from Pier 41, San Francisco, and connects with the mainland near Richmond, Calif. Many unusual features are embodied, both in construction and in the method of laying that was followed.

The main cable is of the three-conductor type, each conductor composed of thirty-seven tinned copper wires and each wire having a diameter of 0.1162 in., with a total area of 500,000 circ.mils and an outside diameter of the copper strand of 0.813 in. Each of these conductors was insulated with special high-grade rubber compound of $\frac{12}{32}$-in. radial thickness. Over this rubber insulation was wound, spirally, a rubber-filled tape. The conductors, after vulcanizing, were laid up into a cable, the three interstices of which were filled with saturated jute and three pairs of telephone conductors. The telephone conductors are composed of No. 14 A.W.G. stranded tinned-copper wires, insulated with special high-grade rubber compound to a $\frac{3}{32}$-in. radial thickness. After insulating, each

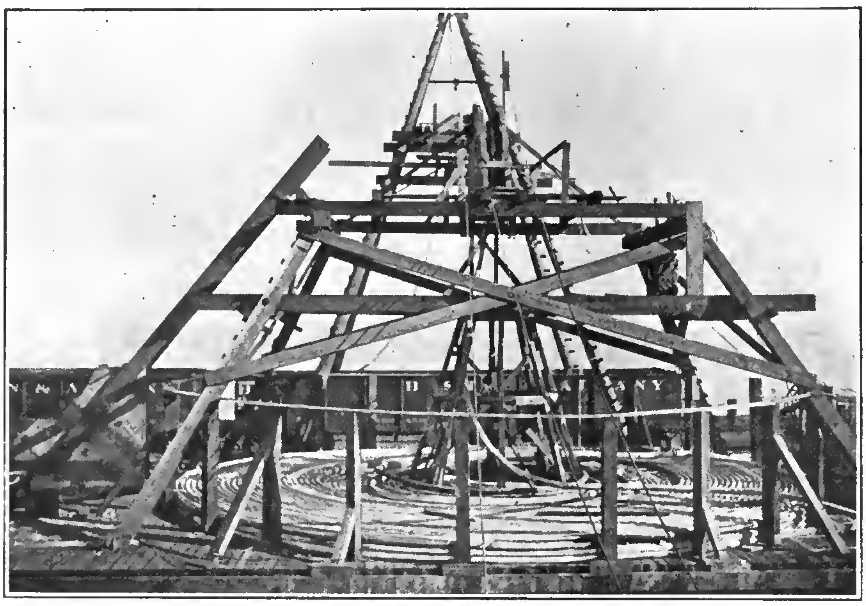
telephone conductor was spirally wrapped with rubber-filled tape and vulcanized, then stranded into three separate pairs, the interstices of which were also filled with saturated jute. After laying up the three main conductors, three pairs of telephone conductors and saturated-jute fillers, the cable received a serving of rubber-filled tape. Over this tape two servings of saturated jute were applied, laid on in opposite directions. It was then armored with forty-three galvanized-steel wires, each wire having a diameter of 0.244 in., making the outside diameter of the cable approximately 4½ in. The weight when completed was approximately 20 lb. per foot.

The shore ends were of similar construction, except that the conductors were composed of sixty-one tinned-copper wires, each 0.1109 in. in diameter, with an outside diameter of the strand of 0.998 in. and a total area of 750,000 circ.mils. The outside diameter over the armor, which in this case required forty-eight galvanized-steel wires, was 4.6 in. Over the armor was wound a saturated-marline serving, making a total outside diameter for the shore ends of approximately 5 in., with a total weight of approximately 24 lb. per foot. The length of the shore ends on the San Francisco end was 250 ft.; that on the Richmond end was 750 ft.

These cables were manufactured in Worcester, Mass., the deep-sea section being made up in lengths of approximately 5,000 ft. and coiled and shipped in gondola cars, this 5,000-ft. unit being the capacity of one gondola car.

The cable was tested in process at the various manufacturing stages at the mill, and then each carload received a final test for a period of five minutes while submerged in water at a test potential of 35,000 volts between each conductor and ground. While en route from Worcester, Mass., to San Francisco the different cars of cable averaged thirty days for the transcontinental journey and arrived in perfect condition.

Upon arrival in San Francisco the cable was joined into a continuous length and coiled on board a specially constructed barge designed to carry 1,000 tons. The method of coiling, jointing and laying the cable was developed by A. O. Hoeftmann and perfected during his period of service with the American Steel & Wire Company and in laying deep-sea transatlantic cables. A feature was the type of deep-sea cable joint employed. This, by its construction, permitted of easy passage over the guide sheaves, besides having practically the same tensile strength as the main cable and possessing great dielectric strength.



CABLE COILED ON DECK OF VESSEL WITH FACILITIES TO PREVENT FOULING WHEN UNCOILED RAPIDLY

In the making up of this joint the copper-stranded conductors were connected by means of a special copper sleeve, the rubber insulation being tapered off on each end of this sleeve and a special rubber tape wound on —in other words, it was filled in with rubber slightly thicker than the original insulation—after which half-round steel molds were clamped over this new insulation and then the joint was put into a bath of compound heated to the proper temperature and was vulcanized.

The cable was taken from the cars, jointed and coiled upon the deck of the cable-laying vessel in a circular coil 42 ft. in diameter and with an inner diameter of 12 ft., the coil being approximately 6 ft. high. After the construction work for laying equipment was completed and the cable jointed and coiled on board in a continuous length, a final test was made before laying.

The cable, while in process of laying, passed from the coil around a cone in the center and in an upward direction to a series of shrouded sheaves; then through a trough and through a number of lever-operated brakes to a shrouded stern-piece, over which it passed into the water. The varying depth of the water determined the amount of brake friction necessary to control the speed of the cable while the barge was being towed by three large seagoing tugs. After laying approximately 6 miles of cable through deep water and strong tidal conditions at the start from San Francisco to beyond Alcatraz Island, the shallow water necessitated changing from the large tugs to three of lesser draft.

The entire operation of laying was carried out most satisfactorily, the cable being under control at all times, and no difficulty was encountered in maintaining the course as originally planned. The total time for laying the cable was two hours and thirty-seven minutes, making an average speed of about 3 miles per hour.

The services of A. O. Hoeftmann and J. J. Morrison, cable engineers, and John Marlborough, expert cable jointer, were obtained from the American Steel & Wire Company to superintend the installation of this cable.

J. A. KOONTZ,
Electrical Engineer.
Great Western Power Company,
San Francisco, Calif.

## Grounding of Switchboard Instruments

WHERE meters and instruments are used with current and potential transformers, the Electric Power Club recommends that when the covers of the meters and instruments are connected to the secondary circuits and grounded the ground conductor need not be larger than a No. 12 B. & S. copper wire.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Marketing Central-Station Service

### Sales Possibilities Have Been Overlooked in an Effort to Lower Manufacturing Costs—How the New-Business Department Should Be Organized


By Glen R. Trumbull

Head of New-Business Department, A. E. Fitkin & Company, New York


IT HAS taken a long time for the central-station company to realize that fundamentally its problems are the same as those of any other manufacturer—after the product has been made it must be sold. For years we have been so beset with tremendous engineering problems that the marketing of kilowatt-hours has been slighted. We were so eternally busy trying to manufacture energy at the lowest possible cost that we forgot the equally vital need of selling it at a profit.

We have been, and some of us are still, too content and satisfied with the natural increase in business; we expect the public to come to us with their demands and needs. It is fortunate indeed for some of us that there has been such a natural increase; that the public is alive and desirous of buying that which we have to sell, otherwise some companies' output and earnings would remain at a standstill.

New-business operations to function successfully require a regularly organized department with a specialist at the head, one who is trained to concentrate on the develonment of all the possibilities for increased gross earnings in the big field which exists in all of our communities today. Every property, no matter how small, needs the services of at least one man. Such a man, picked with an eye to two cardinal requisites of a good new-business man—common sense and industry—will approach his problem in the following general manner. He will first make a complete survey of the community served —every house, store, factory and plant—to find out these essential facts:

Who owns the property?
What is being used for illumination?
What is being used for fuel?
Is the place wired?
Is there gas service?
Is the service alive or dead?
What appliances are installed?
Are they in good working order and being used?
For what is the property an immediate "prospect?"

There are many more questions which, if time permits their compilation, will give a still more complete picture of the new-business possibilities—who and what the prospects are.

In the residence district this survey will show the number of dead services—a class of business on which to make the first drive and which it is the ambition of every live manager to see reduced to zero. Dead services not only produce no revenue but actually cost money because of the investment in equipment lying idle. This survey will also show the number of houses on lines not using service, which is the next best bet in desirable business. From this survey can be anticipated the most profitable extensions, those requiring the least expenditure for the greatest number of new customers. Finally the exact number of "prospects" for appliances can be determined and the particular one for which each customer is a prospect.

In the commercial or business district this survey will bring out the present low standard of illumination, the lack of realization of the average merchant and store keeper of what an important factor good and efficient illumination is in the appearance of the store and its direct relation to the net results of the cash register.

#### Importance of Lighting

Lighting yields approximately 59 per cent of the total operating revenue of the average central-station company, although it comprises only about 23 per cent of the total load. When one considers this fact it becomes apparent why the importance and value of the central station's lighting business cannot be too strongly emphasized.

Merchants everywhere today are in a most favorable frame of mind toward good illumination. Few will deny the importance of illumination in drawing and holding trade, and competition is keen—a big factor in making the merchant eager to invest in anything within reason that will make his store conspicuous and bring in new buyers. And so it is with window lighting and signs.

The average merchant thinks of lighting in terms of profit to his store. He is most easily "sold" on the idea that better illumination, which to his mind always means brighter illumination, will bring more trade. Merchants who have installed better illumination and electrical advertising cite many specific results, such as greater profit, fewer returned goods, improved courtesy and more regular attendance on the part of salesmen, the better sale of slow-moving gooods, the speeding up sales, greater cleanliness and better reputation of the store.

#### Electrical Advertising Must Be Sold

Electrical advertising is not confined to Broadway. In every city in this country there are progressive merchants as keenly alive to the value of electrical advertising as those in the larger centers, but they have got to be approached, they have got to be told the story, they have got to be "sold" by the central-station man.

But here is one fact: The poorest advertisement for electrical advertising is an old dirty sign hanging over the central-station office. How can we expect to interest others in the kind of advertising which we have to sell if we don't present a shining example at our own place of business? A central-station sign ugly from need of paint, with a lot of burned-out lamps, is as bad as no sign at all, worse if anything—it's a constant reminder to any prospective purchaser of what his sign may look

like a little while after its installation. As for window lighting, ours should always be the last word in luminaires and in intensity — the brightest in town—a working demonstration to influence storekeepers to more and better lighting.

### The Central Station's Position on Appliance Sales

Merchandising is recognized as and proved conclusively to be one of the most important and necessary functions of a live and up-to-date central station. Failure to press to the fullest extent the natural advantage any electric light and power company possesses in this line over any form of so-called competition is as bad as failure to install a new boiler at the plant which will reduce the coal consumption 2 lb. per kilowatt-hour.

Customers look to the company for advice and help in their purchases of those appliances and apparatus using our service. They expect us to sell the highest grade manufactured and to display a good variety of the standard articles which they have come to recognize as necessary for their comfort and many of which have become indispensable.

But to merchandise successfully a central station must put its salesroom and display windows in the same class with those of the successful merchants of the community. They must be brilliantly lighted with attractive and suitable fixtures. Appliances must be tastefully displayed, windows should be artistically and frequently trimmed, courteous and prompt attention must be accorded to prospective purchasers, and, most important, everything must be kept clean. It is sad but true that the average central station which thinks it is merchandising invariably neglects a few and sometimes many of these essentials.

With the public in a purchasing frame of mind, eager to buy electrical devices, and the manufacturers co-operating on a scale unknown and unheard of in other lines of industry, the majority of the central stations of this country are indifferent to or laggard in grasping their opportunity. The manufacturers are today spending hundreds of thousands of dollars annually in national advertising, sales plans, advertising literature and the services of demonstrators and expert salesmen, but how many of us take advantage of this help?

Success in merchandising is dependent on logically and intelligently planned sales programs and the employment of real salesmen. These salesmen are the representatives of the company. No official or employee in the entire organization is of more importance than he who sells and places appliances in the homes. His importance does not consist in the mere ability to fill a house with appliances. It is his ability to show that home how to get the largest possible benefits and advantages through the use of electricity. This man should be more than a mere solicitor. He is one of those who form the contact between the company and the community and therefore a big link in the chain that binds the company to its customers. And that chain is no stronger than his standing in the confidence and good will of these customers.

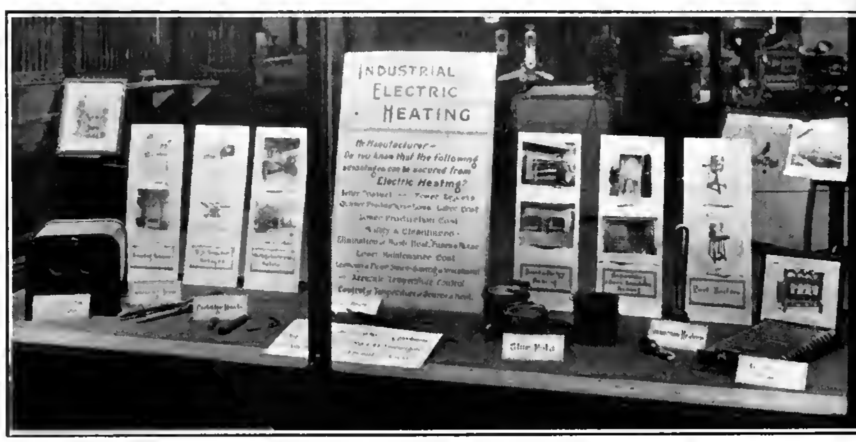
One thing more—there isn't such a thing as saturation, or even "near saturation," in public utility operations, least of all in new-business work. The history of one of the most successfully operated plants in this country—the one with the first regularly organized new-business department—in over twenty-five years shows a healthy increase in earnings year after year. The new-business department has never ceased its activities; it has grown larger and larger, and each year it continues to beat its record of the year previous. So it can be with every central-station company.

## Range Load Growing Fast in Chattanooga

During 1922 the Tennessee Electric Power Company connected 333 electric ranges in Chattanooga by offering a combined lighting and cooking rate and selling ranges on the installment plan. For the first 40 kw.-hr. it charges 9 cents a kilowatt-hour and for all consumption above that it charges 3 cents. The average domestic bill for homes using electric ranges is $6.91 per month. The ranges have been connected despite the competition of coal at $8 to $12 per ton and gas at $1.50 per 1,000 cu.ft. In selling the ranges the customers are required to pay 10 per cent of the price down and 10 per cent per month. E. D. Reed is general superintendent of the Chattanooga district.

## Promotion of Industrial Electric Heating Load

The accompanying window display of industrial heating apparatus was used recently by the New York & Queens Electric Light & Power Company of Greater New




WINDOW DISPLAY SHOWS INDUSTRIAL HEATING APPLICATIONS

York as a part of its program to inform manufacturers of the advantages of electric heating. Especial attention is being given by the company to the many applications of small units which in the aggregate mean a very considerable electrical load for the central-station company.

E. H. Hillock, industrial sales engineer of the company, plans to follow this display with additional exhibits at which other electrical apparatus about which industrial plants should be informed will be featured.

The commercial department of the New York & Queens Electric Light & Power Company foresees great possibilities for developing an industrial electric heating load in its territory, the latest addition being the installation of three electric brass furnaces, totaling 550 kw.

## Tenney Management Gives Inside Utility Facts

A NEW series of public-relations advertisements was started early this year by the Haverhill (Mass.) Electric Company and the Montpelier (Vt.) & Barre Light & Power Company, under the general management of Charles H. Tenney & Company, Boston. The object is to expand the messages conveyed in last year's historical press displays to dimensions giving the local publics a straightforward, clear conception of the differences between the management of a private business and the conduct of a public utility, showing the limitations existing as to profits in the ordinary sense of the word in the utility field and pointing out the bearing which state regulation has upon company administration and development.

Referring to the accompanying reproductions of six Haverhill advertisements as so far scheduled, No. 1 has for its keynote a "tie-in" between the 1922 advertisements and the new series; No. 2 sets forth the real meaning of regulation as relating to prices of industrial products and of electric service, and No. 3 contrasts the profits permitted in ordinary business with those limited to the form of a return on capital invested in a public utility. The right of money to a fair return in the utility field is set forth in No. 4, and in No. 5 the real meaning of regulation is brought home to the business man by assuming its application to his own affairs. In the sixth display the part profits play in building up a great automobile manufacturing business is contrasted with the limitation placed upon public utilities, which must obtain their expansion through the investment of new capital. The series will be continued for a number of months according to present plans.

### A new series of short talks

**On a matter of vital importance to every citizen**

FOR SOME TIME we have been telling you the story of the Public Utility—its origin, its purpose, its development in response to public need.

We now propose to tell you, in a series of short talks, how the Public Utility functions.

A Public Utility—just because it is a *public utility*—operates under conditions radically different from those that obtain in the ordinary private enterprise. Few people realize this fact. Yet it is a matter of vital importance to every member of the community.

It is our purpose, therefore, to tell you why a Public Utility differs from a private business, how it differs, and in what way this difference affects its relations with the public which it serves.

It is our hope that by presenting these facts we may help you to become better acquainted with this Company and with the problems that confront it in carrying out the task to which it is committed—furnishing a necessary service to this community.

HAVERHILL ELECTRIC COMPANY

### You may have heard this one

*But it's worth repeating. It illustrates an important point*

ONCE upon a time—not so many years ago—the directors of a newly organized company held a very important meeting.

They were deciding whether to charge $1 or $5 for a patented article which the company was about to put on the market.

All the evidence indicated that they could profitably market the article for $1.

Nevertheless, they set the price at $5 and maintained it at $5 until their patents ran out

This article undoubtedly saves its cost two or three times a year—and it lasts ten or twenty years. Therefore, men have asserted that the price was fair, that the inventor and the investors who made this article available to the public were entitled to a goodly return.

We do not venture to discuss the justification of that price. What we should like to point out is this:

*If that company had been a public utility, it could not have charged $5. The law would have prevented it.*

Massachusetts' Public Utilities are regulated by the state. The rates they charge are subject to the jurisdiction of the Public Service Commission.

HAVERHILL ELECTRIC COMPANY

### John Jones may make business profits

*A public service corporation may not*

JOHN JONES receives a good salary.

He has $10,000 invested in gilt edge securities.

When John Jones goes into business for himself he expects certain returns from that business. He expects to get his salary—for he is his own employee. He expects to get the same interest on the money invested in his business as he got when it was invested in other businesses.

But he expects something more. Naturally. If he gets only the same salary and the same return on his investment, he gains nothing by going into business.

This something in excess of operating expenses and interest on investment is called business profits.

When you buy shoes or tooth paste or theatre tickets or automobile tires, you pay operating expenses and investment charges *plus profits*.

But when you buy electric light or power, no part of your money goes for profits.

The Haverhill Electric Company, like all public utilities, is regulated by the state. Its rates are subject to the jurisdiction of the Public Service Commission.

The rate you pay for light and power is simply your proportionate share of the cost of supplying such service.

HAVERHILL ELECTRIC COMPANY

FIRST SIX OF A SERIES OF PUBLIC RELATIONS ADVERTISEMENTS

### Money, like men, works for profits or for wages

*In the public utility industry it must work for wages*

SOME men in business work for profits. These men may amass great fortunes. They take risks; but they are compensated for those risks by the opportunities for enormous returns.

Other men work for wages. Their remuneration is fixed. They can never amass great fortunes. On the other hand, so long as their services are required, so long as they render such services faithfully and efficiently, they are entitled to a sure and a fair return for their efforts.

Money is like men. Some money is risked for great profits. Money invested in private enterprises may earn 10 per cent or 100 per cent or 1,000 per cent.

But money invested in public utilities is on a wage basis. Its remuneration is limited by law. It is prohibited from earning business profits like money invested in private enterprises.

The money invested in the Haverhill Electric Company is necessary to provide light and power to the people of this community.

Since the service of this money is required, since that service is rendered faithfully and efficiently, since this money is prohibited from seeking profits like that in a private enterprise, since this money is therefore on a wage basis, is it not entitled—like any other wage earner—to a sure and a fair return?

HAVERHILL ELECTRIC COMPANY

### "Public Regulation"

*As applied to your business*

YOU frequently hear the expression "public regulation." But does that phrase really have any vivid meaning for you?

Let's see what it would mean if applied to your business.

Suppose some public authority told your company what product it might make, what quality of product it might offer for sale, what price it might charge, how much capital it might have invested in its business—then your company would be under public regulation.

Massachusetts' public utilities are regulated by the state. The character of the service furnished, the rates charged for that service, the securities issued to provide the necessary capital—all are subject to the jurisdiction of the Department of Public Utilities.

The very existence of a modern community depends upon service rendered by public utilities. Under public regulation, wisely and justly administered, the interests of the public utility and the public served are adequately safeguarded.

Because of such regulation, a public utility necessarily operates under very distinct limitations—limitations that are in marked contrast to the freedom which a private enterprise enjoys.

HAVERHILL ELECTRIC COMPANY

### What is an industrial genius?

*And who contributes to his greatness?*

A MAN starts a small business—making automobiles, let's say.

He sets a price on his product so that it pays all operating expenses, pays insurance and interest, pays dividends, allows for depreciation and contingencies, and leaves an excess of profits.

These profits, put into his business, permit him to operate on a slightly larger scale.

He continues this process of earning profits, putting them into his business, and operating on a larger and larger scale until he has built up a great industry.

That is a proper and admirable procedure. But let us not forget that the people who bought that man's products supplied the money necessary for the expansion of his business.

Let us bear in mind that a public utility is forbidden by law to follow that man's example.

Unlike the automobile business, the public utility cannot set a price on its service which will enable it to pay all costs of operation and in addition provide the money necessary for extending its plant.

HAVERHILL ELECTRIC COMPANY

# Appliance Load in Small Cities

## With Few Industrial Opportunities in Agricultural Sections, Residential Business Should Be Fully Developed—Increasing Lamp Wattage to Improve Lighting

By Arthur Huntington
Iowa Railway & Light Company, Cedar Rapids, Iowa

During the past few years central-station companies, particularly in the smaller cities and towns, have placed many appliances with consumers. The independent dealers also have made heavy sales of them. A study of the replacement sales leads to the belief that there must be many of these appliances that are not in use. In the case of the electric flatiron one property having a record of the sale of about forty thousand irons shows a replacement sales record that indicates a life for the irons in use of approximately twenty-five years. More than thirty thousand sales were made prior to 1918. This record extends over so long a period that the replacement sales should be on a normal basis, provided proper use of the irons is being made.

The indications are that the same condition exists where other appliances are concerned. The largest single factor in the situation is probably the fact that appliances get out of repair and are set on the shelf until a convenient time of repair that never comes. A trial of the plan of sending out a man whose only business is to ferret out and repair such appliances indicates that not only can such appliances be returned to service, but the man can make a good wage day in and day out.

### Increasing Lamp Wattage

Another plan for developing business in the same communities is to promote better lighting both in homes and stores. In the case of a small Iowa town a check on lamp sales revealed that the average size of incandescent lamps sold was in the neighborhood of 27 watts, while 10-watt and 15-watt lamps formed the largest part of the stock on the dealers' shelves. In many cases a large part of the population of these small communities comes from the farms, and in others electric lighting is a comparatively new thing. The customers when they discard oil lamps use incandescent lamps that give a great deal more light than the previous utensils, and until they are educated to it they have no appreciation of the value or comfort of really good lighting. That educational work is the job of the central station as a part of its commercial activities.

Another appliance that promises much in the small towns is the electric range. Experience in the smaller towns of Iowa indicates that the customs are such that even when the days of the year are shortest there is no serious overlapping of the lighting and cooking loads. It has also been shown that in these small towns a heavy range load can be handled with no increase in the cost of the distribution system over that of the haphazard system ordinarily used in supplying lighting customers. Application of engineering principles has accomplished this in cases where a deliberate development of the range business has been undertaken in small towns.

### Education of Customers

Central station companies' experience in the use of the range has extended over a long enough period to show that there is no serious obstacle to it from the cost standpoint. The biggest factor in this phase of the problem is the education of the customer to an intelligent use of the range. In the case of two small towns, one paying a 5.4 cent rate and one a 4.5 cent rate per kilowatt-hour, the revenue per range is practically the same and there is no dissatisfaction. Rates have cut less figure than proper education.

These three items may not appear to be big ones in the commercial policy of a central station. In sections where industrial developments are large they will be of less importance. But in the smaller cities in agricultural sections they form avenues along which the biggest development of the business must take place. Many small companies have spent time and effort in securing all the possible customers in their territory and have forgotten that use of service is the only means of building up the business. These three items form the biggest possibility of consumer development in much of the agricultural territory of the Middle West because there are no industrial developments from which to build up a power load. Experience indicates that in many small towns the consumers already connected can be profitably developed beyond the ordinary limits of consumption so that the company will receive more than would be received from the average ordinary new customer, for whom an additional investment would have to be made.

## What Other Companies Are Doing

**Indianapolis, Ind.** — A campaign to sell 2,500 shares of prior-lien stock of the Interstate Public Service Company was started by the company's investment department on Jan. 18. Prizes will be distributed to employees for the largest single sale, largest number of sales and for the greatest number of shares sold.

**Hartford, Conn.** — The Hartford Electric Light Company has arranged to alter the third and fourth floors of its office building to provide a dining room for the women employees and officers of the company. A pool room and rest rooms will also be provided.

**Franklin, Mass.** — During December the Union Light & Power Company's business in a territory with four thousand customers was in excess of $10,000, or over twice the business of December, 1921. During the past year this company has paid special attention to the development of industrial heating applications and heavy-duty types of electric range service for lunchrooms, new roadhouses, etc., and this work will be pushed this year with electric refrigeration.

**Greeley, Col.** — Colorado's third electrical home was opened here from Jan. 5 to 12 with an attendance of 5,027 during the eight days. The total cost to the electrical interests was less than $400. The individual cost per person inspecting the home was less than 7 cents and the total attendance represented 45 per cent of the population.

**Seattle, Wash.** — According to data presented at a recent convention of Stone & Webster, Inc., managers at Boston, employees of the Seattle division of the Puget Sound Power & Light Company oversubscribed a preferred stock allotment of $200,000 by 12 per cent in a campaign last year. The total number of employee subscribers was 1,240, despite the fact that the company had previously sold $668,000 of five-year 8 per cent notes to 2,000 employees.

# Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Power-Plant Extension.*—The Walsall Corporation (England) has increased its 14,000-kw. station at Birchills by adding a 5,000-kw. Brush-Ljungstrom turbo-alternator set. Several interesting tests on this set have been completed. The accompanying table shows the results obtained from the set over a test lasting six hours. For this test the load varied from 3,700 kw. to 5,415 kw., and the coal consumption was 1.92 lb. per kw.-hr. generated, its calorific value being 10,160 B.t.u. per lb. and the thermal efficiency 17.49 per cent.—*Electrical Review*, Dec. 29, 1922.

TEST ON 5,000-KW. BRUSH-LJUNGSTROM TURBO-ALTERNATOR SET

| | |
|---|---|
| Average load, kw. | 5,030 |
| Steam pressure, lb. per sq.in. | 166 |
| Steam temperature, deg. F. | 662 |
| Vacuum (barometer 29.95 in.), in. | 28.90 |
| Cooling water temperature: | |
| Condenser inlet, deg. F. | 49 |
| Condenser outlet, deg. F. | 61 |
| Average condensate per hour, lb. | 52,100 |
| Steam consumption, lb. per kw.-hr. | 10.36 |

*Steam Engineering Practice in Modern Central Stations.*—T. E. KEATING.—The upper limits of pressure and temperature for a central generating station are set by the materials commercially available and, with the exception of financial considerations, are determined wholly by conditions within the plant. For these reasons steam pressures and temperatures have not reached the stage of standardization prevailing in electrical units. This article discusses a few of the thermal and operating problems that are today under consideration by central-station engineers, explaining their influence on the economic generation of power in modern central stations. — *Electric Journal*, December, 1922.

## Generation, Control and Instruments

*On Booster Transformers.*—J. SAHULKA.—It is shown that if feeders are connected to a line and their voltage is to be increased or decreased with the aid of a booster transformer, it is sufficient to equip this transformer with a primary winding dimensioned for only the difference of the energy corresponding to the amount of "buck" or "boost."—*Elektrotechnik und Maschinenbau*, Dec. 24, 1922.

*A Magnetically Self-Locking Disconnecting Switch.*—VLADIMIR KARAPETOFF.—It has been found that the usual mechanically locked switch has been unsatisfactory in high-current work because of the high magnetic stresses set up. The author has developed several switches in which a magnetic field aids in holding the switch in place. This is accomplished by placing coils above and below the switch blades in such a manner that the flux tends to hold the switch in place.—*Sibley Journal of Engineering*, January, 1923.

## Transmission, Substations and Distribution

*Electrical Oscillations on Lines.*—LOUIS COHEN.—The subject of electrical oscillations on telephone, telegraph and power transmission lines is so large and complex that any new presentation which will help to make it more intelligible to engineers and perhaps facilitate the solution of the many problems involved should prove of value. It is claimed that the methods developed in this paper for the solution of this class of problems offer many advantages in the matter of directness and simplicity. A limited number of cases are worked out, but the method is applicable to the solution of many others.—*Journal of the Franklin Institute*, January, 1923.

*Heating of Polyphase Cables with Metallicized Sections.*—C. FELDMANN.—Polyphase cables have recently been used in America the individual conductors of which were covered with a layer of copper ribbon 0.1 mm. thick. It was found that such a cable had a smaller dielectric loss and carried more current than an equivalent cable without the copper ribbon. Similar cables with a layer of zinc or aluminum ribbons 0.03 mm. thick have been used in Europe. The author gives a simple approximate method for calculating the heat resistance of such a metallicized cable which permits of drawing conclusions as to its higher current-carrying capacity. The author illustrates his calculating method on six actually built metallicized cables, three with a copper and three with a zinc ribbon, and finds that the cables with the copper ribbon may carry 38 per cent more current and the ones with zinc ribbon 15 per cent more current than similar cables without these ribbons. The method for drawing isotherms for three-phase cables is given in an appendix.—*Elektrotechnische Zeitschrift*, Dec. 21, 1922.

## Units, Measurements and Instruments

*Power Losses in Insulating Materials.*—E. T. HOCH.—It is shown that a satisfactory measure of power loss in a dielectric is the product of phase angle and dielectric constant. Although the dielectric constant need not be explicitly considered in the design of condensers, it is important in such cases as the design of apparatus panels and vacuum-tube bases. The method used in measuring phase angle and dielectric constant is explained.—*Electrical Communications*, Vol. I, No. 2.

*Tables for the Calculation of the Inductance of Circular Coils of Rectangular Cross-Section.*—F. W. GROVER.—The tables presented in this paper are calculated from accurate formulas, more than one formula having been used wherever this was possible as a check on the results. The tabulated values are correct to one part in ten thousand, and even where a double interpolation has to be made, the error is less than one part in a thousand. If desired, curves can be constructed from the data of the tables, with, however, a sacrifice in accuracy. Examples are given to illustrate the use of the tables and formulas in practical cases, and the application of the tables to the calculation of the mutual inductance of coils of rectangular cross-section is treated and illustrated and the necessary formulas developed. The formulas on which the tables are based are collected for reference in an appendix.—*Scientfic Paper No. 455 of the Bureau of Standards.*

## Illumination

*Illuminating Engineering Society Paper.*—This issue of the *Transactions* includes six papers that were presented at the Swampscott convention last fall. An abstract of the following four may be found in the convention report in the Oct. 7 issue of the ELECTRICAL WORLD, pages 760 and 761: "Relative Performance of Tungsten-Filament Lamps," by J. W. Lieb; report of the committee on motor vehicle lighting, "Influence of Daylight Illumination Intensity on Electric Current Used for Lighting," by A. Smirnoff, and the report of committees on nomenclature and standards. The other two, "Direct Reading and Computing Attachment for Sphere Protometers," by B. S. Willis, and "Plotting of Spectrophotometric Data," by F. A. Benford, may be found abstracted in the Oct. 21 and Oct. 14 issues, pages 892 and 835, respectively.—*Transactions of the Illuminating Engineering Society*, January, 1923.

## Motors and Control

*Practice in Maintenance Work.*—E. H. HUBERT.—Among the questions answered in this survey of seventy-four industrial plants are what to include in the maintenance work, method of handling maintenance, frequency of inspection for different equipment, most frequent causes of motor failures, and the character and amount of parts and supplies to keep in stock for all maintenance work.—*Industrial Engineer*, January, 1923.

*Water-Pumping Station in Württemberg.*—O. GROSS.—A general description is given of a large water-pumping station for the supply of several cities. Its output is about 65,000 cu.m. of water per day, pumped to a high-

est level of 148 m. The station contains five sets of centrifugal two-stage pumps, each driven directly by a three-phase induction motor at 985 r. p. m. To give the greatest possible flexibility of service according to water requirements, each pumping set is of a different size, varying from 540 hp. to 1,500 hp. A section is shown of the largest pump. To be insured against a total breakdown in the case of a failure in the 50,000-volt, three-phase feeding line, a sixth pumping set is installed, driven by a Diesel motor.—*Zeitschrift des Vereines Deutscher Ingenieure*, Dec. 9, 1922.

*Electric Equipment of Oil Wells in Rumania.*—C. REY and M. WILFART.—The authors describe the drilling methods used in Rumania, the necessary tools and the average cost of a new well. Three-phase motors are used throughout. All switches and controlling apparatus are of the oil-submerged type such as is used in mine practice. As an example full details are given for a reversing controller to operate a wound-armature, three-phase, slip-ring motor. — *Revue Générale de l'Electricité*, Dec. 16, 1922.

## Heat Applications and Material Handling

*Welding as a Factor in Steel-Plant Maintenance.* — E. R. NORRIS. — The welding practice of the Pittsburgh Steel Company is described in this paper.—*Journal of the American Welding Society*, December, 1922.

*Better Methods of Handling Materials.*—F. E. GOODING.—Trends and developments in better methods of handling materials which may be adopted in industrial works to increase production and reduce costs are described. The author asserts that whenever reduction in costs and increases in production are being studied, or when it is desired to put production on a more even flow of work, with schedules and a dispatching system to route it through the plant, it is well to investigate all the available methods for handling materials. —*Industrial Engineer*, January, 1923.

## Electrophysics, Electrochemistry and Batteries

*Primary Cell with Air Depolarizer.*—M. FOURNIER.—During the war, when manganese bioxide became very scarce, a new primary cell for telegraph purposes was developed in France, known as the Fery cell. It consists of a glass vessel containing at the bottom a zinc plate above which hangs a large carbon block. A solution of ammonium chloride serves as electrolyte. During operation heavy chloride of zinc is formed around the zinc pole, while lighter $NH_4OH$ is formed along the carbon, rising to the surface of the liquid. The author claims that prolonged tests, extending over two years, showed a remarkable superiority of these Fery cells over the manganese batteries that had previously been generally used. To compare the Fery cell with two known manganese-type cells, one of each was closed over a 50-ohm resistance, and the voltages given in the accompanying table were observed.—*Revue Générale de l'Electricité*, Dec. 30, 1922.

| Type | Initial Voltage | Length of Test, Days | Voltage at End of Test | Voltage Drop per Ct. per Day |
|---|---|---|---|---|
| Carbon in porous container with zinc rod | 1.48 | 45 | 0.74 | 1.16 |
| Carbon in bag, concentric zinc cylinder | 1.52 | 45 | 0.76 | 1.11 |
| Fery cell... .... .. | 1.25 | 100 | 0.625 | 0.50 |

*Effect of Temperature on the Mechanical and Microscopic Properties of Steel.*—G. C. PRIESTER and O. E. HARDER.—An investigation to study the mechanical properties of steels at elevated temperatures, the properties of the same steels at ordinary temperature after they have been heated to various drawing temperatures and the correlation of these properties with the microstructure of the steels has been carried out by the authors. It was found that the properties of a low-carbon steel in the blue heat range are inherent to that temperature and not duplicated when the same metal is tested at room temperature after a corresponding tempering. The actual results are shown by suitable curves and tables.—*Chemical and Metallurgical Engineering*, Jan. 17, 1923.

## Traction

*A 400-Hp. Swiss Motor Car.*—For a combination adhesion and cog-rail road of 3-ft. 3-in. gage a special motor car of the "D" type is described in this paper. The 40-ton car rests on two trucks of four wheels each, with one motor of 100 hp. driving each of the four shafts with double reduction gearing. On the grades of 20 per cent (cog-rail sections) a speed of 4.3 m.p.h. is obtained by operating the four direct-current motors in two groups in series, running at 460 r.p.m; on 7 per cent grades (adhesion sections) all four motors run in parallel at 1,160 r.p.m. The tractive effort is 8,800 lb. per pinion on the rack section and 3,400 lb. on the adhesion parts. Five independent brakes and a magnetic rail brake are provided on the car. One of them is governor-controlled and sets automatically if speed exceeds a permissible maximum. With a train of 57 tons weight an amount of heat of over 30,000 B.t.u. has to be dissipated in the resistances from current regenerated from the motors on the down-grade haul. Why this large amount of energy is not fed back into the line is not apparent from the paper. The emergency magnetic rail brake, with a magnetic pull of some 8,000 lb., can stop a train of 77 tons running at 7 m.p.h. on the 7 per cent section within 55 yd. —*Bulletin Oerlikon*, December, 1922.

*Electric Traction Developments in 1922.*—The most notable development in electric traction in the United States during the past year was the decision of the Illinois Central Railroad to adopt the 1,500-volt direct-current system with overhead trolley for the electrification of the Chicago terminal district. Other activities in this country were confined largely to equipment orders. Greater activity has been shown abroad, such as the extensive electrification by the South African government railway, the electrification of the harbor railway terminals in Montreal and various projects initiated in Japan, England, Sweden, Norway, Switzerland and France. — *Railway Electrical Engineering*, January, 1923.

## Telegraphy, Telephony, Radio and Signals

*Practical Alternating-Current Radio Receiving Tube.*—H. M. FREEMAN.—A new tube has been developed for radio service which may be used in ordinary receiving and amplifying circuits with alternating current on the filament. A general description of this tube is given.—*Electric Journal*, December, 1922.

*Telephone Repeaters.* — BANCROFT GHERARDI. — A description of the various types of telephone repeaters which have been designed and their operating characteristics is followed by an account of the application of the telephone repeater to the telephone art.—*Electrical Communications*, Vol. I, Nos. 1 and 2.

*Signaling Apparatus for Substations.* —P. KANNENGIESSER.—The commonly used optical or acoustical signal systems light a lamp or sound a horn in case trouble occurs such as the opening of a circuit breaker, the overheating of a transformer or the discontinuance of the flow of cooling water. On proceeding to remedy the trouble the attendant switches off the light or stops the noise of the horn, often forgetting to readjust these devices again so that they will be ready for the next trouble. The paper describes an alarm system which resets the device automatically.—*A. E. G. Mitteilungen*, December, 1922.

*Observations of the Field Strength of the Horsea (England) Wireless Station.* —E. B. MOULLIN. — Many measurements are recorded of the strength at Cambridge of the signals from Horsea during September, 1921, in which the Vallauri method of measurement was employed. The field strength is deduced from the measured electromotive force of the signal, the effective height of the receiving aërial being determined experimentally both from the distribution of current in the aërial up-lead and by comparing the receptive power of the aërial with that of a loop. Incidentally, the measurements of effective height provide a very accurate verification of the law that for short distances the electromotive force set up in an aërial is in direct proportion to the frequency of the incident waves. It was found that at a wave length of 3,000 m. the Horsea signals suffer an absorption of 40 per cent.—*Institution of (British) Electrical Engineers*, December, 1922.

# Scientific and Industrial Research

**A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work**

*Conducted by* PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited apppeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

## Research Completed

### Bushing, Condenser Type, for 1,000,000 Volts.

The bushing for the one-million-volt transformer is more than 18 ft. high and weighs nearly 7 tons. The insulation consists of paper strip wound spirally on a 6-in. steel pipe. Layers of metal foil, also in strip form, serve to grade electrostatic stresses properly. The radial thickness of insulation is less than 18 in., and yet the bushing has been calculated to stand 2,000,000 volts for short intervals of time. Both ends are fitted with static shields in the form of torus rings, the upper one being 10 ft. in diameter. The part of the bushing in the air is surrounded by an insulating tube and the space filled with insulating gum.—*J. F. Peters and D. F. Miner, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

### Flash-Over Voltage, Effect of Surface Permittivity on.

Toepler has found (*Elektrotechnische Zeitschrift*, 1921, Vol. 42, page 1381) that under certain conditions the flash-over distance along a glass plate is proportional to the fourth power of the applied impulse voltage and to the 1.5th power of the capacitance of the plate per unit surface. To prevent flash-over the material of the plate must be of as low permittivity as possible and the thickness as great as possible, in order to reduce the flash-over distance with a given voltage. This relationship does not seem to be generally known and may prove to be useful in the design of high-voltage apparatus, especially for high frequencies.

### Friction Tape, Pinholes in.

Owing to imperfect impregnation, friction tapes often show pinholes, so that in cases where the tape is expected to have considerable insulating properties a sample should be held before a strong light to detect the presence of any great number of these holes. A maximum number of three holes is allowable per yard of tape, but a well-impregnated tape will usually have a much smaller number or none at all.—*Hydro-Electric Commission, Toronto, Ont.*

### Lighting, Direct Versus Indirect.

Experiments were made on twenty-six trained college seniors to determine the best intensity of illumination for reading. The average of the answers was 2.8 and 4.0 ft.-candles with the direct and indirect illumination respectively. It is thought that a greater intensity is needed with indirect lighting because the pupil of the eye contracts more because of the uniform illumination of the surrounding objects.—*William Kunerth, State College, Ames, Iowa.*

### Magnetic Field, Measurement of.

A two-electrode cylindrical tube is connected in multiple with a standard voltmeter and in series with a high resistance and a source of voltage. The tube is placed in the field and rotated until the voltmeter reading is a maximum. The direction of the field is then given by the direction of the axis of the tube, and its magnitude $H$ by the voltmeter reading $V$, according to the equation $H = (6.72/R)$ V, where $R$ is the radius of the anode. Fields from 20 to 500 gausses can be measured. By using a symmetrical tube and a polarizing field coil around it the range may be extended down to 0.1 gauss. *A. W. Hull, Research Laboratory, General Electric Company, Schenectady, N. Y.*

### Pyrometers.

A committee, with Dr. George K. Burgess as chairman, has devoted attention to improvements in pyrometry, including the measurement of the temperature of the bath of steel in open-hearth and electric steel-making processes. The industry cooperated in the experimental work. A symposium of fifty-seven papers was published in a separate volume by the American Institute of Mining and Metallurgical Engineers. This is considered the most important contribution to pyrometry since the invention of the Le Chatelier pyrometer.—*National Research Council, Engineering Division, New York City.*

### Transformer, 1,000,000-Volt.

A single-unit, 1,000-kva., 1,000,000-volt transformer for testing purposes has been built and tested. High-voltage coils are wound on concentric micarta tubes of increasing diameters and decreasing lengths. This automatically places the highest-voltage coil farthest from the grounded core. The distribution of stresses is similar to that in a condenser-type bushing. The coils on the two legs of the core are alternately connected in series to obtain a more uniform distribution of electrostatic field.—*J. F. Peters and D. F. Miner, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

### Wattmeter, Elimination of Correction for Phase Angle.

If both the current and the potential winding of a wattmeter are made of two sections which may be connected at will either in series or in parallel, two readings can be taken from which the correction for the phase angle in the potential winding can be eliminated. With this method more turns may be placed on the moving coil, making a more sensitive and robust instrument. Moreover, much more accurate readings can be obtained at low values of power factor and at high frequencies. For details see *Comptes Rendus*, 1922, Vol. 174, page 1007.—*H. Chaumot, Paris, France.*

[This method should be of interest in the measurement of dielectric losses.—EDITOR.]

### X-Ray Tubes, Crest Voltmeter for.

Of the crest voltmeters, of which the writer has made an extensive study, that of Fortescue, employing a condenser, a rotating commutator and a milliammeter at ground potential, is the only one found suitable for X-ray work. This meter, functioning directly, in the high-tension circuit, responds to every change in the secondary voltage due to any reason whatever.—*Munford Morrison, New York City.*

## Research in Progress

### Communication Over a 220-Kv. Transmission Line.

It is very essential that adequate and reliable communication be maintained between the larger generating and more important distribution centers. Where the distance of transmission is as great as it is to Pit River the investment in the ordinary metallic communication circuits runs into large sums. The ordinary wireless system of communication has many commercial disadvantages, but we hope, by the use of the wired wireless over our power circuits to establish, at a considerably lower cost, a system of communication that will materially reduce our investment.—*P. M. Downing, Pacific Gas & Electric Company, San Francisco, Cal.*

### Fuses, High-Tension, Repeating.

The writer is continuing to develop his system of high-tension repeating fuses for transformer stations and branch lines.—*L. M. Klauber, Consolidated Gas & Electric Company, San Diego, Cal.*

### Insulating Materials, Fundamental Study of.

A committee was organized under the chairmanship of Dr. F. B. Jewett, not for the purpose of developing new insulating materials nor to solve specific industrial problems, but rather to lay a foundation of fundamental knowledge of the phenomena on which solutions of practical problems can be based.—*National Research Council, Engineering Division, New York City.*

### Paints, Preservative.

We have under way an extensive series of tests, (a) to determine the lasting qualities of various pole and cross-arm paints; (b) to find the best pole preservatives, in particular for the protection of poles from white ants or termites; (c) we are making a study of paints and preservatives for general plant service, based on certain gas-plant residuals; (d) we are working on the perfection of the protective covering of steel pipe laid underground, particularly where corrosive soils are found.—*L. M. Klauber, Consolidated Gas & Electric Company, San Diego, Cal.*

### Sand, Inundated, Measurement of.

An investigation has been started to determine the feasibility of measuring sand for concrete in an inundated condition. With small additions of moisture, the quantity of sand in a given measure varies greatly with the amount of moisture. There is a reason to believe that with sufficient water in a measure to submerge the sand the quantity of sand becomes independent of the original moisture in it. A successful solution would insure uniformity in the proportioning of sand to cement and consequently uniformity in the strength of concrete. This is one of the most troublesome problems in the concrete industry—*Bureau of Standards, Washington, D. C.*

### Transmission at 220-Kv.

Our most important work is that in connection with the utilization of 220,000 volts for the transmission of power. This voltage being so much higher than any voltage ever before undertaken, its use involves a great deal of study and investigation.—*P. M. Downing, Pacific Gas & Electric Company, San Francisco, Cal.*

## Suggestions for Research

### Cables, Power Loss in Sheaths.

Sheath currents in single-conductor cables may reduce the carrying capacity of the cables by 10 or 15 per cent, the amount of the reduction depending upon the spacing of the cables, the thickness of the insulation and the size of the conductor. The losses in the lead sheaths must also be taken into consideration in calculating the efficiency of the transmission as they may be greater than the dielectric losses. The data heretofore published have been insufficient to make accurate calculations of these losses.—*A. I. E. E. Cable Research Committee.*

### Insulators, Pin-Type, Standardization of the Rating of.

A standardization of the rating of pin-type insulators on a basis of leakage distance, flashover and other physical characteristics, eliminating the nominal voltage rating, appears highly desirable.—*A. I. E. E. Committee on Transmission and Distribution.*

### Sphere Gap, Inaccuracy in Grounded.

In the *Journal* of the (British) *Institution of Electrical Engineers*, Vol. 57, page 223, Dr. Alexander Russell has pointed out certain discrepancies between the theoretical and observed values of the spark-over voltage when one of the spheres is grounded. A controversy between him and F. W. Peek, Jr., was published in the ELECTRICAL WORLD, Vol. 77, page 1427, and Vol. 78, page 469. The matter was not finally settled, and it would be of interest to perform the crucial experiments suggested by Russell at the end of his letter.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Canadian Plant with Large Electric Boiler Load

Work has begun on a 120,000-hp. development on the St. Maurice River in the Province of Quebec, Canada. The project will be owned by the St. Maurice Power Company, which is closely allied with the Shawinigan Water & Power Company of Montreal. A bond issue of $10,000,000 has just been floated by the company on the property.

The hydro-electric plant will be located at La Gabelle, about 6 miles below Shawinigan Falls. It will operate under a head of approximately 65 ft. and is scheduled for completion about October, 1924. The dam across the St. Maurice River at La Gabelle will back the water up to the tailrace of the hydro-electric plants at Shawinigan and will have special gates for use in time of floods.

At first a general load of 30,000 hp. will be available, and the remainder of the power generated will be used in electric boilers for making steam, for which there is a great demand in the pulp and paper mills of the vicinity. It is anticipated that power for this purpose can be sold at from $9 to $10 a horsepower-year, depending on the price of coal. Such a rate, it is said, will be sufficient to carry the fixed charges on the installation until other load can be obtained. The advantage claimed for such a disposition of the power is that it enables the full development to be made at once, the electric boilers being used to absorb all the idle power available. The water turbines will be built by the Dominion Engineering Works, Ltd., of Montreal. The engineering is in charge of Julian C. Smith, Power Building, Montreal, Canada.

## Lightning-Arrester Committee Sees Steinmetz Tests

The lightning-arrester sub-committee of the protective devices committee of the American Institute of Electrical Engineers held a meeting on Feb. 12 at the Schenectady works of the General Electric Company, witnessing tests of arresters in the general engineering laboratory test department.

There was a demonstration in which the Steinmetz lightning generator was used. The tests were made to show the effects of high and low discharge rates in an arrester. This test and others involved a maximum of 120 kv. at about 5,000 amp. making use of the Steinmetz apparatus. Blocks of wood were split by the Steinmetz artificial "lightning" during the test. Protection tests for a 15,000-volt insulator were also held. These showed that when the insulator was protected by a high-discharge-rate arrester the lightning discharged through the arrester, but when a low-discharge-rate arrester was used a flashover occurred. Another test showed the difference between testing lightning arresters with a high-frequency oscillator at the same voltage but rated at only about 0.75 amp. and testing them with the Steinmetz generator, the effect on different types of insulation being noted.

## State Chamber of Commerce Opposes Smith's Policy

Delegation to municipal bodies of the regulative powers over public utilities now exercised by the state, as proposed by Governor Smith of New York, is characterized as "reactionary" and a "retrogressive step opposed to the best interests of the people" in a report of a committee on public service approved by the Chamber of Commerce of New York State. The report points to nation-wide investments in public service enterprises in New York State aggregating a billion dollars. These investments, it says, were made in reliance on a system of just and impartial state regulation, and a return to old conditions would be a breach of faith and render it difficult for the utilities to raise new capital.

## New York State Commission Legislation Delayed

Following the introduction of the transportation bill favored by Mayor Hylan of New York, which aims to abolish the present Transit Commission appointed by Governor Miller for that city and substitute a Transportation Board appointed by the Mayor and controlled by the city's Board of Estimate, the main public utility commission bill of the new state administration was, according to announcement from Albany, to have been introduced into the Legislature on Wednesday of this week. After the bill was prepared, however, it was withheld for further conference, and it had not made its appearance up to the time the ELECTRICAL WORLD went to press.

This bill, as previously told in these pages, will aim to restore "home rule" in the control of utilities contained within city limits to all the cities of the state, permitting them to set up new governing bodies for this purpose, to utilize municipal bodies already existing, or, if they should so elect, to leave control with the state commission.

## Awards Under Coffin Foundation Soon to Be Made

Frank W. Smith, as president of the National Electric Light Association and chairman of the Charles A. Coffin prize committee of that body, has issued a letter to all central-station companies in the country inviting them to participate in the awards to be made under the terms of the Coffin Foundation as established by the General Electric Company and announcing further details. He says:

"The announcement, in so far as it refers to the central-station industry, is broadly interpreted by the committee as providing for the annual award of the Charles A. Coffin medal to the public utility operating company within the United States which during the year has made the greatest contribution to the development of the general use of electric light and power by the public and to the benefit of the industry.

"Every electric light and power company in the United States is invited to participate and urged to send to the undersigned committee a presentation of its activities and accomplishments covered by the field of the award.

"The committee suggests that among the factors which will be considered in making the award are the following: The particular initiative, skill and enterprise which have been manifested in popularizing the general use of electrical energy; accomplishments in the development of the efficiency of your organization, improvements in construction practice which have resulted in greater reliability of service, marked increases in the efficiency of generation and distribution, the adoption of special plans which have resulted in the largest percentage of increase in new customers, methods adopted of interesting customers in stock ownership, unusual efforts and accomplishments in popularizing and introducing domestic appliances, and extension of service to homes not previously wired and to rural communities.

"The first award of both the medal and the thousand dollars for the central-station company's employees' benefit fund will be made in the year 1923. The announcement of this award will be made at the annual convention of the N. E. L. A. in New York City, June 4 to 8.

"All statements must be in the hands of the committee by March 15. Kindly address these to the Charles A. Coffin Prize Committee of the National Electric Light Association at 130 East Fifteenth Street, New York City."

# A. I. E. E. Holds Two-City Meeting

**Chicago and New York Listen to Same Addresses Carried by Long-Distance Telephony—Large Attendance at Midwinter Convention in New York from All Parts of the Country**

WITH a surprisingly large attendance of members—approximately seven hundred had registered up to Thursday noon—from all portions of the United States, the American Institute of Electrical Engineers held a most successful and active midwinter convention at the Engineering Societies Bulding in New York this week. One of the outstanding features of the gathering was the joint session with Chicago on Wednesday evening, when two-way loud-speaking telephone installations were used at each city so that the two audiences, separated nine hundred miles, heard all the proceedings of the joint meeting. In addition, everything that was said at either end of the line was broadcasted. One thousand persons were present at the divided meeting.

At the various sessions of the convention papers of the high caliber usual at Institute meetings were presented according to a prearranged schedule, which allowed ample time for discussion. The smoker on Thursday evening and the annual dinner-dance on Friday evening were well attended and scored the customary success. The usual number of inspection trips were arranged for delegates and guests during and after the convention. Among these trips was one to the offices and plant of the McGraw-Hill Company, publisher of the ELECTRICAL WORLD and other technical papers, where delegates to the convention were entertained at luncheon on Thursday noon. Visits to New York power houses and telephone and broadcasting exchanges of the American Telephone & Telegraph Company were some of the other trips.

### PRESIDENT JEWETT'S ADDRESS

In opening the convention President Frank B. Jewett paid tribute to the ever-increasing effectiveness of electricity in the service of mankind. The extensive technical program of this convention, he said, was an example of the return to highly technical subjects in the last few years. This may be due to the necessary restriction of technical research and development during the war to certain channels, or it may be due to the opening of new fields to electrical application. In the communication field the great activity, the speaker thought, was chiefly due to the intense popular interest in radio.

Elaborating on the latter topic at Wednesday night's session, Mr. Jewett said in part: "We can hardly picture the limits of the effects and influences which will flow from the developments of electric science which have made this night possible. In truth, we are participants in a historical event and our children, nay even many of us, may see the agency we here use employed with mighty effects in controlling our collective relations in state and nation.

"Some one has said that the greatest political engine ever devised was the colonial town meeting, where every question of importance was debated and discussed in the open forum of all the citizens. Be that as it may, we are well aware that our best government today is found in those small political units where the town meeting in some form is feasible and still persists. It is only when we come to the larger units of city, state and nation that the limitations of common discussion of vital matters, which are imposed by sheer physical size, evidence themselves in cumbersome and inadequate substitutes for personal discussion and ofttimes in unsatisfactory results.

"May it not be that in this two-way working telephone, with its sensitive transmitters and loud-speaking receivers, we have the instrumentality for insuring a simpler and better ordering of our affairs—an instrumentality which will enable us to derive many of the benefits of the town meeting in the greater concerns of our national life? The mechanism which we are here using is one adapted to permit many speakers in many distant audiences to be heard by all who care to listen and take part in a common discussion.

"In voicing the opinion that this mechanism is destined profoundly to affect our political and economic machinery, I intend to convey no thought or picture of a pure democracy, but only of a representative form of government in which all questions that would be helped by oral discussion can be so discussed without restraint from the physical limitations of the human voice or of distance. They might be discussions between widely separated groups on some matter of common concern or between a designated representative and his constituents. We have here the successful realization of a dream dating back to the pioneer days of Bell himself, namely, the production of a loud-speaking telephone which would reproduce the human voice in stentorian tones and in many places simultaneously.

### ONLY DISTANT VISION LACKING

"We lack only direct distant vision to make this joint meeting one in very fact save only for the element of the personal proximity of those in attendance, and who among us is hardy enough to believe that this last limitation may not be removed within the lifetime of many of those now here?

"Fundamental and applied research are opening new doors daily in bewildering succession. When they open that last door which now prevents man from exercising at a distance all of his powers of personal intimate communication we will have another noteworthy meeting of this Institute.

"Tonight, however, we must be content with full powers of speech and hearing but with partially defective vision. So it comes about that you, Mr. Schuchardt, our vice-president in Chicago, and you, Mr. Rhodes, my vice-chairman, are each in a unique position, a position in which one of you is acting in place of the president at a meeting where the president himself is in attendance in his official capacity, and the other is acting similarly for the president in his capacity as presiding officer. Some day this may not be necessary, but for the moment we are really acting as the eyes of this great joint meeting and are transferring as best we can the functions of distant vision by means of human speech."

### TECHNICAL POINTS EXPLAINED

The technical aspects of the loud-speaking telephone were discussed in a paper by I. W. Green of the American Telephone & Telegraph Company and J. P. Maxfield of the Western Electric Company, who stated that the amplifying apparatus used last night was powerful enough to reach an audience of seven hundred thousand persons and that the electric power used by the loud-speaking telephones would be sufficient to operate all of the fourteen million telephone instruments in the country.

A second paper by W. H. Martin and A. B. Clark, read in Chicago, described the problem involved in attaching the loud speaker to long-distance telephone circuits. Both papers were discussed simultaneously before two audiences by J. J. Carty, vice-president of the American Telephone & Telegraph Company, speaking in New York, and B. E. Sunny, chairman of the board of directors of the Illinois Bell Telephone Company, speaking in Chicago.

After the discussion of these two papers W. B. Potter of the General Electric Company presented his observations on electric railway practice in Europe. This paper included a comparison of American and European rolling stock. He also gave a comprehensive description of the various methods of locomotive drive used in Europe, illustrating them with numerous slides. M. Le Blanc, a visiting French railway engineer, discussed this paper.

Reports of the six technical sessions of the convention will be presented at considerable length in next week's issue of the ELECTRICAL WORLD.

## Spring Convention of Institute at Pittsburgh

The spring convention committee of the American Institute of Electrical Engineers, in connection with the meetings and papers committee, has fixed the date of the Pittsburgh meeting as April 24-26. The headquarters will be at the William Penn Hotel. On the first day there will be afternoon and evening technical sessions, on the second day a technical session under the auspices of the protective-device committee in the morning and a visit to the Westinghouse plant at East Pittsburgh in the afternoon, and on the third day a morning program under the auspices of the electrochemical and

electrometallurgical committees and an afternoon session dealing with radio at which there will be papers presented on the applications of wireless to power transmission.

For the annual convention of the Institute, to be held at Swampscott, Mass., June 25-29, tentative plans are being formed by the committees in charge.

The Pacific Coast men have already prepared their program for the Del Monte convention on Sept. 25-28, as announced in the ELECTRICAL WORLD for Feb. 3, page 293.

## House Pursues Subject of Radio Monopoly

As an outcome of the discussion by the House of Representatives of the alleged monopoly of radio transmission by four large companies (see ELECTRICAL WORLD for Feb. 10, page 350), Representative White of Maine has introduced a resolution calling for investigation by the Federal Trade Commission of ownership and control of patents for the manufacture of radio apparatus, contracts or agreements for the sale or use of such apparatus tending to restrict or to fix prices, and agreements tending to give exclusive rights or special privileges in transmission or reception of radio messages.

The resolution has been referred to the committee on merchant marine and fisheries, which is favorable to it, and it is expected that it will be adopted by the House. Concurrence by the Senate would not be necessary.

## Federation Urges Leadership by Engineers

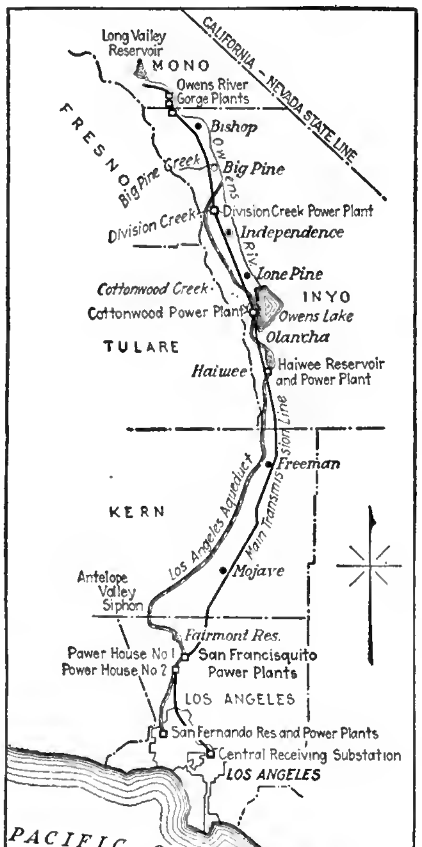
"For a century," declares the committee on industrial ideals appointed by the Federated American Engineering Societies, in a report recently submitted to the federation, "engineers have directed their energy toward the utilization of the physical forces and the materials of nature. The developments which they have brought about have created an epoch in human history. While these developments have been of inestimable benefit and modern society could not exist without them, they have introduced many public problems and social readjustments so closely related to the engineer's activities that it is increasingly evident he must assume an active part in their solution.

"Recognizing this growing need, the engineers of the country formed the Federated American Engineering Societies, primarily to place their knowledge and training at the public service on all public matters affecting engineering or affected by it. The Federated American Engineering Societies, therefore, speaking for the engineering profession, urges upon engineering colleges an increased attention to the social aspects of engineering activities and a broadening of their technical training in every way possible, to develop in engineering students the spirit of and a capacity for active leadership, not only in industry but in public affairs."

Prof. Joseph W. Roe, head of the department of industrial engineering at New York University, is the head of the committee on industrial ideals, of which the other members are Dean Cooley, Prof. C. F. Scott of Yale and J. C. Ralston of Spokane, Wash.

## Outline Map of Los Angeles' Proposed System

The map below indicates the territory to be covered by the hydro-electric system planned by the city of Los Angeles. The ultimate output to be delivered to the city from these developments is put at 205,000 hp., 105,000 hp. coming




from San Francisquito plants Nos. 1 and 2 and 100,000 hp. from all other plants. Further details are covered in the following tabulation:

| | Francisquito No. 1 | Francisquito No. 2 |
|---|---|---|
| Gross head, ft.......... | 943 | 562 |
| Maximum flow, sec.-ft... | 1,000 | 1,000 |
| Average flow, sec.-ft.... | 400 | 400 |
| Output at switchboard (at 1,000 sec.-ft. flow), hp. | 69,000 | 44,000 |
| Generating units, number. | 6 | 3 |
| Generating units, size hp. | 12,500 | 18,500 |

## Washington State Now Has Information Committee

Organization at Seattle of the Washington Committee on Public Utility Information has been announced, with E. H. Thomas, until recently publicity representative of the Puget Sound Power & Light Company, as director. The following utility companies are backing the new committee: Puget Sound Power & Light Company, Pacific Power & Light Company, Portland Railway, Light & Power Company, Grays Harbor Railway & Light Company, North Pacific Public Service Company, Olympia Light & Power Company, Stevens County Light & Power Company, and a number of other smaller companies.

In announcing its formation Mr. Thomas said:

"The purpose of the committee is to promote better relations between the utilities and their customers and to give the public such information as they may desire regarding the utilities and their organization and operation.

"Weekly bulletins to the press of the state will be one of the methods employed to give out information, but not the only one. We offer our services to interested patrons and citizens, and particularly to the newspapers, as an information bureau."

## Another Indiana Utility Commission Bill

The latest bill to be introduced in the Indiana General Assembly to curtail the authority of the Public Service Commission would permit municipal corporations to establish utilities when privately owned utilities providing the same service already exist without asking the commission for permission. This bill does not mention the fixing of rates, leaving that to the commission. A bill introduced previously along the same lines permitted the municipalities to fix rates also without interference from the commission.

## Underwood Seeks Action on Ford Proposals

With all the probabilities strongly against his success, Senator Underwood of Alabama, the Democratic leader of the Senate, is contending in the upper house that since Henry Ford's bid for Muscle Shoals was submitted as a result of a formal request from the government it should be accepted or rejected by this Congress. Business ethics, the Senator holds, demand that when bids are invited the bidders shall be told whether their proposals are accepted or rejected. He characterized the long-delayed action on the Ford offer as a cavalier way in which to treat any bidder.

Senator Underwood called attention to the fact that there no longer is any controversy about the completion of the Wilson Dam since each house has authorized the engineers to make the final contract for its completion. He pointed out that within three years at most a great electric plant will be ready for operation at Muscle Shoals, saying that the issue before Congress is whether it is to be operated by private effort or as a government institution.

The debate in the Senate was brought about by an amendment proposed by Senator Norris suggesting an appropriation of $2,000,000 for the installation of new machinery in Nitrate Plant No. 1, so that the plant could be used for experimental purposes. Senator Norris argued that such a proposal should not be objectionable to Mr. Ford since he

would have to conduct such experiments if his offer were accepted. The amendment was opposed on the ground that it would complicate the situation by additional expenditures, experimentation and contracts. The trend of the debate made it clear to Senator Norris that the amendment could not prevail, and he withdrew it.

## Defenders of Water-Power Act Attack Ford Plan

Herbert Knox Smith, Commissioner of Corporations under Presidents Roosevelt and Taft, and Philip P. Wells, secretary of the National Committee for Defense of the Federal Water-Power Act, have launched a broadside attack upon the Ford Muscle Shoals offer in a letter and pamphlet sent to members of the Senate and House of Representatives.

The letter, written by Mr. Wells, summarizes the arguments against the legislation favored by Mr. Ford's supporters as follows:

"The real vice of this scheme is not in the present money loss. Its real vice is that it smashes straight through the vital principles of the federal water-power act for the protection of the public.

"(1) It is a grant for one hundred years.

"(2) It provides for no rental payments whatsoever for the use of the site and only an absurdly small rental for the use of the works built with government money.

"(3) There is no provision whatsoever to prevent the making of excessive profits on the Ford company's actual investment nor to require any transfer of such excess to the public.

"(4) There is no regulation whatsoever of the distribution or use of the power.

"(5) There is no provision that it shall be used for public service.

"(6) The Ford company is not required in any way to contribute to the cost of storage reservoirs hereafter built upstream. Such reservoirs would enormously increase the value of the Ford company's site, and the government is now making a survey for such storage development."

With Mr. Wells' letter is inclosed a pamphlet by Mr. Smith bearing the title "Preserve the Federal Water-Power Act." In this pamphlet Mr. Smith does not mince his words. "Flagrant violation," "extraordinary special privilege" and "national insanity" are among the terms he applies to the Ford proposal.

## Electric Heat Exhibit in Edison Showrooms

The second of the series of special electrical exhibits which the New York Edison Company has scheduled for its Irving Place showroom will show the domestic, industrial and commercial uses of electric heat and will be held during the week of Feb. 19-24. Twenty-one manufacturers will exhibit.

## Electrical Supply Jobbers Discuss Competition

The future of the electrical supply jobbers' business, the value of their association and a talk on federal income taxes were the chief features of the two-day session of the Central Division of the Electrical Supply Jobbers' Association held at the Hotel Sherman, Chicago, this week.

Discussing the future of the business, N. G. Harvey, Chicago, felt that the change throughout the country in central-station sentiment toward jobbers would help in solving many jobbing problems. With these cordial relationships, together with the increase of building, he thought that the supply business during 1923 would be on the up grade.

F. D. Vanwinkle, Cincinnati, cited figures which showed that more houses were wired in his territory during the past two years than in the previous thirty. With an operating jobbing expense in 1922 of 17 per cent, Mr. Vanwinkle failed to see how it was possible to reduce his expense any lower for two reasons, first, because each item of this expense had been cut to the bone and, second, because salaries and materials would be higher in 1923.

The subject of competition was warmly discussed by W. R. Herstein, W. W. Low, H. F. Thomas, C. J. Litscher and Harry Downing. The general sentiment was opposed to price cutting, although competition sometimes played havoc with legitimate profit. Regarding compensation of salesmen, W. W. Low, Chicago, thought that a percentage of profit would be more beneficial to both the jobber and his salesmen than one on sales volume.

P. Oblinger, Indianapolis, declared that the jobbing business was here to stay, but that with each house it would be a case of survival of the fittest.

## O. E. L. A. New-Business Meeting

The new-business co-operations committee of the Ohio Electric Light Association will meet at the Deshler Hotel, Columbus, on Wednesday next, Feb. 21. Prof. H. B. Dates, Case School of Applied Science, will speak in the morning on "Public School Lighting," and Prof. F. C. Caldwell, Ohio State University, will lead a discussion on this subject.

Dr. M. Luckiesh is to present a paper on "Modern Lighting" during the afternoon session, which will be discussed by S. G. Hibben and J. B. Wilson. "Recent Progress in Rural Service" will be treated by D. L. Gaskill, secretary of the association.

# Commonwealth Edison's Newest Station

### Crawford Avenue Will Have Ultimate Rating of 400,000 Kw., if Not of 600,000 Kw.—Construction Begun and First Unit Will Probably Be Ready in Eighteen Months

FURTHER construction plans for its new South Crawford Avenue plant have been announced by the Commonwealth Edison Company of Chicago. The second generating unit of this 400,000-kw. station will have a rating of 50,000 kw. and will be manufactured by the Westinghouse Electric & Manufacturing Company. Like the 40,000-kw. Parsons unit, which was announced in the January 20 issue of the ELECTRICAL WORLD, this unit will have a high-and-low-pressure compound section. The third unit, not yet ordered, will be supplied by another American manufacturer.

Construction work on this site, on the east side of Crawford Avenue, extending south from West Thirty-third Street to the Drainage Canal, has been started, and the first generating unit will, it is expected, be in operation in August, 1924. Storage space for about 300,000 tons of coal is provided by the 72-acre plot.

With the station planned for ten units of from 40,000 kw. to 60,000 kw. each, the ultimate capacity will not be less than 400,000 kw. and, when finally completed, it may be around 600,000 kw. The main turbine hall will be 800 ft. long and 125 ft. wide. Five smokestacks in the completed station will extend 175 ft. above the boiler-room floor. They will be of steel and are to taper from the bottom to the top, with an inside diameter of 19 ft. Two rows of five boilers each will be connected to one stack. Since five boilers will provide steam for one unit, the total number of boilers in the entire plant will be fifty. These boilers are to operate at a steam pressure of 550 lb., giving a total steam temperature of 725 deg. F. Ample water facilities for condensing purposes will be obtained from the Drainage Canal, which comes from Lake Michigan.

This Crawford Avenue station will constitute the fourth great power-producing center of Chicago. To provide continuity of service the new station will be tied in by four 33,000-volt underground cables to the Calumet station, by two underground cables to Quarry and Fisk Streets and by two cables to the Northwest station. These tie lines will terminate at Crawford Avenue in an outdoor switching center.

The consulting engineers for the Crawford Avenue station are Sargent & Lundy, Chicago, while Merz & McLellan of London are acting in an advisory capacity on Unit No. 1. The engineering department of the Commonwealth Edison Company is handling the electrical features. Graham, Anderson, Probst & White are the architects.

## Death of Röntgen

**Famous Discoverer of X-Rays Dies at His Home in Munich in His Seventy-eighth Year**

THE discoverer of the X-Rays, Wilhelm Konrad Röntgen, died at his home in Munich on Saturday, Feb. 10, at the age of seventy-seven. He was born in Lennep, in the Ruhr district of Germany.

The discovery of the X-rays dates back to 1895. Many before Röntgen, while discharging electricity through vacuum tubes or highly exhausted tubes in the study of the action of electricity on gas, had produced X-rays without becoming aware of their presence. In this kind of experiment Sir William Crookes had developed the Crookes tube, but he did not detect the fact that this tube produced rays which penetrated matter and made it possible to see through solids. This discovery was left for the German scientist. When he announced it the X-rays were looked on as some new manifestation of energy. It has since been shown that they differ from ordinary light only in wave length. Visible light is of the order of a fifty-thousandth part of an inch in wave length while the X-rays have to be described in millionth and billionth parts of an inch.

Dr. Röntgen was fifty years old when he made his discovery. He received his early education in Holland and then went to study at Zurich, where he took his doctor's degree in 1869. He was director of the Physical Institute at Wurzburg when he discovered the X-rays. In 1900 Columbia University awarded him the Barnard medal for the greatest discovery in science of the previous five years. In 1901 he received the Nobel prize for physics. He received the Rumford medal of the Royal Society in London in 1896, jointly with Philip Lenard, who had conducted researches in the same subject.

## Brooklyn Edison Company Has Prosperous Year

The annual report of the Brooklyn Edison Company for the year ended Dec. 31, 1922, shows substantial increases in gross and net revenues over the previous year. The net income was $4,105,407, as compared with $2,772,420 the year before, and surplus for the year, after deducting dividends, contingency reserves and other charges, amounted to $972,364, against $255,-074.

A feature of the report was the increase in the holdings of stock by employees. The investment fund set up by the company in the interest of employees retains 8,795 shares of stock for the benefit of 2,757 employees, and in addition 454 employees hold individually 6,000 shares, making total holdings of 14,795 shares by employees, an increase of 300 per cent since 1916.

"The year was the most progressive in the company's history," President Sloan said in his statement. "During the year the company sold 381,232,300 kw.-hr., an increase of 55,467,782 kw.-hr. over the preceding year. New meters installed totaled 63,657, and power contracts for 60,000 hp., an excess of more than 50 per cent over the previous year, were secured. There were built and connected to the existing system 31 miles operating at 13,200 volts, 19 miles at 6,600 volts, and in addition 888 miles of distribution feeders and mains."

## Hartford Offers New Heating and Lighting Rate

Another two-part rate has been established recently by the Hartford (Conn.) Electric Light Company in connection with residential service, the new schedule being optional and available only for private household use, for lighting and the usual small domestic appliances in conjunction with an electric range and large water or air heaters. All ranges, heaters, etc., used on this schedule are subject to the approval of the company as to size and types, and the customer is required to arrange wiring for one or more meters as directed by the company, the readings of all meters being added together for billing purposes. Customers using this schedule guarantee an annual payment for energy of not less than 300 kw.-hr. for each kilowatt of apparatus charged for in the flat-rate portion of the schedule.

The schedule is as follows: (1) Flat rate, payable monthly, with (a) $1.44 per year per 100 sq.ft. of floor area plus (b) $24 per year for the first 4 kw. (or any part) and $4 for each additional whole kilowatt of installed load of range and each kilowatt of large water or air heater (minimum kw.), plus (2) energy at 2 cents per kilowatt-hour. The rate carries the coal clause applying to the company's power rates.

# Many Projects Before Power Board

**Spawning Grounds for Fish Prevent Erection of Dams in Alaskan Streams—Licenses Granted in National Forests—Damage Clauses Outside Commission's Jurisdiction**

NO LICENSES are to be granted by the Federal Power Commission for power projects on Anan Creek and the Kenai River in Alaska because it is held that high dams in these streams would result in damages to the fish industry entirely out of proportion to the value of the streams as power producers. Preliminary permits subject to the approval of the Bureau of Fisheries had been granted. Frank L. Bellain of Seward was the applicant for the Kenai River site, which was to have been used to furnish power for pulp and paper manufacture, and the Anan permit had been issued to the Alaskan Mine & Development Company, a Guggenheim interest. In each case, the commission believes, the applicants will be able to find equally desirable sites where dams would not interfere with spawning grounds.

A preliminary permit has been authorized, in accordance with the application of Frank I. Reed of Anchorage, Alaska, covering a power project on the Eklutna River, near Anchorage.

Favorable action was taken on the application of the Mokelumne River Power & Water Company of San Francisco for a preliminary permit covering a combined power and irrigation project on the South and Middle Forks of the Mokelumne River and the North Fork of the Calaveras River.

An extension of one year in the time limit of the preliminary permit of the Lower Niagara River Power & Water Supply Company of New York has been granted by the commission. The company received a preliminary permit on March 3, 1921, for a period of two years.

The preliminary permit of Mushen & Cronemiller of Lakeview, Ore., has been extended one year from May 25, 1923.

The preliminary permit of the Louisiana Gravity Canal Company of Alexandria, La., which was issued on Jan. 4, 1922, for a period of fifteen months, has been extended for a period of twenty-one months.

The preliminary permit issued R. G. McDonald of Williams, Cal., on June 15, 1922, covering a project on Convict Creek has been revoked on the ground that he has failed to carry out the engineering investigations and the stream gaging required.

A license covering the Narrows unit of the Ouachita River project of the Caddo River Power & Irrigation Company has been issued. The company, which has its domicile at Little Rock, Ark., holds a license covering two more important sites on the Ouachita, but has decided to begin with the smaller projects at the Narrows site, 11 miles below the others.

### Licenses in National Forests

Two transmission lines owned by the Summit Power Company of Denver have been licensed by the commission. The lines cross the Leadville National Forest. A license was authorized for the Nevada-California Power Company of Riverside, Cal., covering a transmission line in the Inyo National Forest, which will connect the company's Bishop Creek plant to the trunk line of the Southern Sierras Power Company. A license also was authorized covering a transmission line in the Whitman National Forest, to be used by the Beaver Gold Mining Company of Portland, Ore. A license was also issued to A. E. Humphreys of Denver covering a 15-hp. project in the Rio

Grande National Forest. Permission was given the Virginia-Western Power Company to overflow a few acres of the Natural Bridge National Forest at Balcony Falls, on the James River, Va.

The commission has authorized an amendment to the license issued the Utah Power & Light Company for its Soda Point project on the Bear River in Idaho which will permit it to relocate its dam and power house 1,200 ft. upstream to avoid leaking bedrock.

Formal protests have been filed with the commission by the Tennessee municipalities of Bristol and Bluff City and by the County of Sullivan against the application of the Holston River Power Company, covering three sites on the Holston River. The protest discloses that public development of that stream is in contemplation.

In response to a letter from Governor Hunt of Arizona urging prompt action on the Girand application for a license at Diamond Creek on the Colorado River, the commission has replied that action in the matter will be withheld pending the disposition to be made of the Colorado River compact.

The development of hydro-electric power in the vicinity of Louisville has been further complicated by the entry upon the scene of Indianapolis interests, which have filed a declaration of intention covering power development on the Cumberland River.

#### DAMAGES OUTSIDE COMMISSION'S SCOPE

The Salt River Valley Water Users' Association has been given to understand by the Federal Power Commission that it will not hold up development on grounds such as have been put forward by that association against the application of F. G. Baum for a preliminary permit covering a project on Black River. Were the commission to accede to the wishes of the Water Users' Association, it is held, the development of 6,000 square miles in the drainage area above the Roosevelt Dam would be stopped. Neither will the commission insert conditions as to damages. The whole question of damages, it is held, is outside its jurisdiction.

The board of regents of the University of Minnesota has formally petitioned the commission to issue no license covering the High Dam in the Mississippi unless it contain a provision that the university is to receive the revenue accruing from 15 per cent of the power sold and be safeguarded in the use of whatever volume of water it may require for hydraulic experiments.

Representatives of the States of Washington, Idaho and Montana, and of the Montana Power Company, have been invited by the executive secretary of the commission to appear before him on March 15 in connection with the Flathead Lake development proposed by the Rocky Mountain Power Company. The principal question involved is whether or not the power company should make full development of the storage or whether the Washington State authorities should be allowed to develop a part of it.

## Big Program in Ohio

**Electric Utilities Planning to Spend About $75,000,000 in the Next Three or Four Years**

A TENTATIVE program involving the expenditure in Ohio of more than $75,000,000 in the next three or four years for additional facilities in the generation and distribution of electricity is now under way. This program, part of which will be actually carried out this year, involves the establishment of a state superpower zone system that will link together most of the great central stations. Virtually every large city in the state will be affected. Lack of water for condensation purposes, particularly in the central part of the state, has been a large factor in leading to the superpower project.

Before the end of 1923 physical interconnection between the properties of the Cleveland Electric Illuminating Company, the Northern Ohio Traction & Light Company and the American Gas & Electric Company, operating through its subsidiary, the Ohio Power Company, will, it is thought, become an accomplished fact. Actual construction on this project is now well under way, as is also another interconnection that will link with this power zone the properties of the Ohio Public Service Company, already tied in through the Lake Shore Electric Railway Company with the generating plants of the Toledo Edison Company. This means that by fall a superpower system for the entire eastern half of the state and that whole portion lying along Lake Erie from Cleveland to Toledo will have been built.

#### SOUTHERN OHIO COMPANIES TO COME IN

In addition to this, engineers have begun calculations to determine how the properties of the Union Gas & Electric Company at Cincinnati may be "hooked up" to carry current up the state as far as Columbus. In this scheme is involved the problem of linking in the Dayton Power & Light Company, which serves many towns in the southwestern part of the state, and the Consolidated Light, Heat & Power Company of Huntington, W. Va., which serves communities in the southeastern part of Ohio as well as in West Virginia.

The superpower system for Ohio involves the expenditure not only of many millions for new generating stations but also of many additional millions for high-tension transmission lines. The maximum capacity of these lines for the present will be 132,000 volts, but before the entire development is completed this maximum will probably be increased in some instances to 220,000 volts.

Construction work under way this year in the building of new generating plants at Cleveland, Zanesville, Steubenville, Windsor and Beach Bottom, W. Va., together with high-tension transmission lines, involves a new capital investment of approximately $40,000,000 and means that the customers on the lines of the Cleveland Electric Illuminating Company, the Northern Ohio Traction & Light Company, the Pennsylvania-Ohio Electric Company, the Ohio Public Service Company and the American Gas & Electric Company, through its subsidiary, the Ohio Power Company, will be assured of adequate and uninterrupted service.

## New Transmission Line from Cleveland to Akron

Contract for a 132,000-volt transmission line to tie in the Cleveland Electric Illuminating Company with the Northern Ohio Traction & Light Company at Akron, Ohio, has been awarded. This undertaking involves an expenditure of approximately $750,000. The Cleveland company will construct the line as far as the southern boundary of Cuyahoga County. From that point to the South Akron substation the Northern Ohio will build the line. An addition is to be built to this substation which will include new transformers. At this point the high-tension line from Windsor, W. Va., ties in, giving the Ohio utility three sources of supply. The power demand upon the Northern Ohio Traction & Light Company is now almost up to the capacity of the Gorge plant and the supply from Windsor; but this new supply from Cleveland is bringing 25,000 kw. and will aid future development of Akron as well as provide a strong reserve for the needs of the future.

Steel towers 86 ft. high will be designed to provide for two circuits, although only one will be completed at the present time. The Akron load demand in 1915 was 16,500 kw. In 1922 it had risen to 45,000 kw., with an output of 232,000,000 kw.-hr.

## Nation-Wide Farm Radio Service Completed

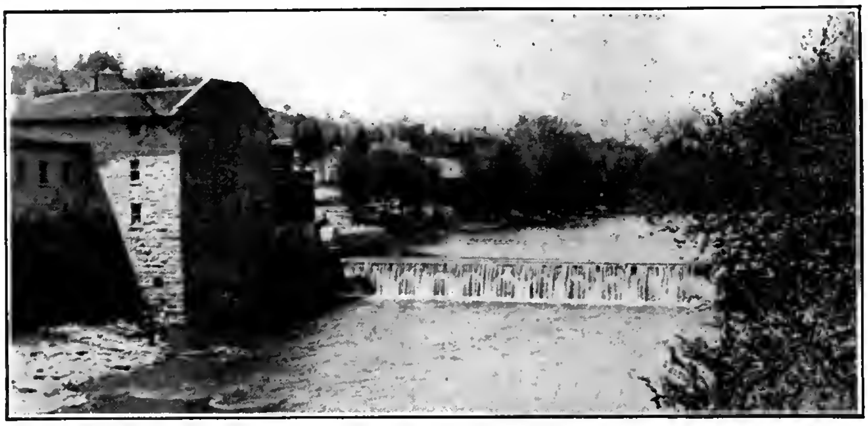
Completion of a radio communication service covering the entire United States has just been announced by the Department of Agriculture. The service includes market reports, weather information and crop data and insurance against losses due to unexpected storms. The service employs four high-power radio-telegraph stations of the Navy Department, five radio-telegraph and one radio-telephone installation of the Post Office Department and seventy-eight radio-telephone stations belonging to agricultural colleges, electric light and power companies, newspapers and other owners.

It is now possible, it is declared, to communicate with farmers in every section of the country, warn them of the approach of storms, advise them of the proper time to move produce so as to avoid flooding the market, and at all times keep them posted on agricultural topics of interest long before the news could reach them in the ways through which it has hitherto come.

## From Mill to Power House

**How a Hydro-Electric System Has Superseded Oldtime Hydraulic Plant in Iowa**

THE People's Electric Service Company of Elkader, Iowa, which has just been incorporated with a capitalization of $750,000 to succeed the Turkey River Power Company, affords an interesting example of a central-station system which has grown up on the site and in the territory of an oldtime gristmill. Its hydro-electric system is about fourteen years old and its construction began when a flower and feed mill which had utilized the waters of the Turkey River ever since 1849 was finally discontinued. The old mill had in its prime been one of the most important in the upper Mississippi Valley, shipping flour up and down the Mississippi. With the decadence of its business the proprietors, the Schmidt Brothers, turned their attention to hydro-electric power. Using the mill, built of rock from the river bluffs, as a power house and starting with a plant just big enough to supply Elkader, they gradually increased its capacity and extended their lines until at present there are thirty or more towns on the company's circuit and its high-tension lines run into four Iowa counties. A modern concrete dam has supplanted the old rock and log structure, and the interior of the mill is now being remodeled, the part formerly used for a flour storeroom being made over into a workroom, a storeroom for electrical supplies and an office and display room for fixtures and accessories. The company is now planning to reclaim another millsite on the Turkey River, south of Elkader, where a big four-story mill still stands, though it has long since ceased to grind and the dam has for the most part disappeared.



IOWA CENTRAL-STATION PLANT INSTALLED IN OLD MILL

## Oklahoma Operators Studying Combustion

A class in the combustion of fuel has been started by the city division of the Oklahoma Gas & Electric Company. L. C. Lichty, professor of mechanical engineering, University of Oklahoma, is conducting the course, which was worked out by J. F. Owens, vice-president and general manager; E. E. Hunter, superintendent of power plants, and W. J. Brown, chief engineer. The company bears half the expense and thus far forty-five men have enrolled. This class has been organized in fulfillment of the company's policy of establishing classes for its employees in various departments. Other classes are running in other divisions. The class in combustion will meet weekly for eighteen weeks.

## Brief News Notes

**Electrical Voting Once More Proposed at Washington.**—A bill providing for the purchase and installation of an electro-mechanical voting system in the House of Representatives has been introduced by Representative Kelly of Pennsylvania. The cost specified is not to exceed $300 per member, or $130,500.

**Another Projected Merger in New York State.**—The Northern Light & Power Company has applied to the New York Public Service Commission for permission to acquire all the capital stock of the Malone Light & Power Company and to merge the two companies.

**East Tennessee County May Build a Million-Dollar Hydro-Electric Plant.**—A bill introduced in the Tennessee Legislature authorizes an expenditure of $1,000,000 by Sullivan County, Tenn., for the construction of a hydro-electric plant. The bill also authorizes the county to purchase water-power sites and build dams along the Holston River. It is thought the bill will pass.

**Federal Ownership of All Wire and Wireless Lines Proposed.**—A bill proposing government ownership and control through the Post Office Department of all electrical means for the transmission of intelligence for hire has been introduced in the House by Representative Sinclair, Republican, of North Dakota. Only farmers' telephone lines and amateur radio operators would be exempted.

**Radio Connection from Berlin to Budapest.**—Early in January radio-telegraphic connection by means of the Siemens "radional" system was begun between Berlin and Budapest. This new system allows the hourly dispatch of from 150 to 200 telegrams. The messages are sent in the ordinary alphabet and interception is almost impossible. Results thus far have been encouraging.

**Another Iowa Utility Purchase.**—The Creston Electric Light Company has purchased the Lorimor Light & Power Company. Necessary papers are being prepared for the consolidation of the Creston company with the Southern Iowa Utilities Company of Centerville. Creston has now been connected with Centerville through the continuation of a 33,000-volt line from Mount Ayr.

**General Electric Bonuses.**—The General Electric Company has just paid approximately $1,100,000 in bonds as supplementary compensation to the employees of its various plants who have been with the company for five years or more. This sum represents 5 per cent of the earnings of these employees for the six months' period ended Dec. 31. Of the total sum the Schenectady works received approximately $400,000.

**Licensing Bill in New Jersey Senate.**—An act enabling municipalities to license persons, firms or corporations engaged in the business of electrical contracting for the installation of interior wires or apparatus for electric light, heat or power purposes has been introduced into the Senate of New Jersey. It aims to "fix responsibility upon the electrical contractor for the safe installation of interior electrical work."

**Central Illinois Public Service Company Grows.**—The number of communities served directly by the Central Illinois Public Service Company has been increased to a total of 195 by the purchase of the properties owned by the Abbott Light & Power Company, operated from Petersburg, Ill. New communities included in the Abbott group that are served directly are Petersburg, Mason City, Tallula, Pleasant Plains and Ashland. Energy is wholesaled to eight other towns.

**Portland (Ore.) Installing Automatic Telephones.**—The Pacific Telephone & Telegraph Company of Portland, Ore., has just cut over about twelve thousand telephones, involving three exchanges, from the manual to the automatic system. The success with which this was done is evident by the fact that the actual work of the cut-over began at 11:30 p.m. on a Saturday night and soon after midnight subscribers were getting service over the automatic system.

**International Chamber of Commerce to Meet in Rome.**—The second general meeting of the International Chamber of Commerce will be held at Rome on March 18 to 24. Four group sessions and two general sessions will discuss matters of finance, an equal number of sessions will deal with industry and trade, and two group sessions and two general sessions will take up transportation problems. American delegates

sailed on Feb. 10 and will cruise the Mediterranean, visiting Palestine.

**Indianapolis Competition to Be Fought in Courts.**—The Indiana Public Service Commission has denied the petitions of the Merchants' Heat & Light Company and the Indianapolis Light & Heat Company, both of Indianapolis, for a rehearing of the case in which the commission granted the Terre Haute, Indianapolis & Eastern Traction Company permission to construct transmission lines in Indianapolis and thus become a competitor of the other two companies. Court action is now sought by the protesting utilities.

**A National Museum of Engineering.**—A joint committee on a National Museum of Engineering and Industry appointed by the four big engineering societies is formulating in co-operation with the National Museum of the Smithsonian Institution at Washington a plan for a great museum similar in character to the South Kensington Museum at London, the Conservatoire des Arts et Métiers at Paris and the Deutsches Museum at Munich, but more comprehensive in scope. This plan contemplates a central institution with local branches in different sections of the country. Edward D. Adams and Charles L. Clarke are the representatives of the A. I. E. E. on the committee.

**Steel Company to Buy Energy from Utility.**—The Commonwealth Steel Company, Granite City, Ill., has contracted for electrical power from the Madison County Light & Power Company, which is distributing energy from the Union Electric Light & Power Company of St. Louis. The total load will be 3,470 hp. and service will begin March 1. The decision to purchase central-station power was reached after a thorough analysis had shown it to be more economical than the production of power in the present plant. The Commonwealth Steel Company has one of the five large steel foundries which make the St. Louis industrial district the largest open-hearth-steel foundry center in the world.

**Iowa College to Train Metermen in March.**—Plans have been laid for the fifth annual course for electric metermen, to be held at the Iowa State College, at Ames, from March 12 to 16, 1923. The course on alternating-current meters is divided into four sections, depending upon the standing and previous experience of the metermen. One of these courses will be designed especially for meter superintendents and managers, and such topics as the effect of phase angle and ratio upon correct registration, the testing and care of standards and the metering of farm lines will be treated. A direct-current-meter course of instruction will consider the operation of the commutator and mercury-type meters and the standards used for direct-current testing. Classes comprising groups of six or eight men will be held from 8:30 a.m. until 4 p.m., and the evenings will be devoted to a discussion of the day's work. No tuition fee is to be charged.

**Interstate Merger Completed.**—The seven Indiana utilities whose consolidation with the Interstate Public Service Company has been finally approved by the Indiana Public Service Commission were valued by the commission as follows: Hydro-Electric Light & Power Company, Connersville, $1,132,212; Hawks Electric Company, Goshen, $1,124,903; Middlebury Electric Company, $18,953; Winona Electric Light & Water Company, $516,436; Electrical Transmission Company of Northern Indiana, $55,863; Southern Indiana Power Company, Williams, $1,382,672; Indianapolis & Louisville Railway Company, $1,840,000. The commission also allowed the Interstate to issue $3,100,000 securities to take the place of $3,139,950 in securities now out against the properties and in place of $1,808,156 of bills payable against one of the companies. The valuation figures submitted by the company were accepted by the commission.

**Worcester Co-operative Course Successful.**—About a year and a half ago the Worcester (Mass.) Polytechnic Institute put into effect a co-operative arrangement whereby students electing to do so at the end of the junior year might enter into fifteen months' engineering experience under commercial conditions, returning to the institute for their senior year's work at the end of their field service. While the plan is still too new for the publication of detailed results, Prof. H. B. Smith, director of the department of electrical engineering, states that the evidences of experience from the standpoints of the operating companies, the students and the institute are alike entirely satisfactory. Nine men are now at work in the senior class who have returned from their fifteen months' outside work and eleven men from last year's junior class are now in industry and are expected to return next September. It is probable that a larger number will go out from the present junior class into industrial work next June.

**Starting Appraisal.**—By order of the state utilities commission the Tennessee Electric Power Company is starting an appraisal of its entire system, which includes the physical properties of the former Tennessee Power Company, the Chattanooga Railway & Light Company and the Chattanooga & Tennessee River Power Company, which were merged into the Tennessee Electric Power Company last October. Among the physical properties of the Tennessee Electric Power Company are the 50,000-hp. hydro-electric plant at Hales Bar on the Tennessee River, two hydro plants of 45,000 hp. rating on the Ocoee River, a 20,000-hp. steam plant at Parksville and a 4,000-hp. steam plant at Chattanooga. The company also owns about 511 miles of high-tension lines connecting the above plants and extending over the state. Railway property is owned in Chattanooga. Tie connections exist with the Aluminum Company of America, with the Georgia Railway & Power Company and through the latter with the Alabama Power Company.

# Associations and Societies

**Ohio Electric Light Association.**—The new-business co-operations committee of this association will meet at Columbus on Wednesday of net week, Feb. 21.

**American Institute of Mining and Metallurgical Engineers.**—In connection with the four-day meeting of this society in New York City next week there will be a banquet at the Waldorf-Astoria on Wednesday evening, at which the Italian Ambassador, Gelasio Gaetani, will speak.

**Hartness Voices National Interests of the Engineer.** — Speaking before the Pittsfield (Mass.) Section of the American Institute of Electrical Engineers at the annual banquet Feb. 2, former Governor James S. Hartness of Vermont emphasized the importance of a closer study of economics and public affairs by engineers of all branches of the profession and pointed out the opportunities before technical men in the education of the public to a better comprehension of the problems of industry and economics. W. P. White was toastmaster and two hundred attended.

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### Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

American Institute of Mining and Metallurgical Engineers—New York, Feb. 19-21.

Wisconsin Engineering Society—Feb. 22-24. L. S. Smith, College of Engineering, Madison.

American Physical Society—New York, Feb. 24; Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

Pennsylvania State Association of Electrical Contractors and Dealers—Lancaster, Feb. 28. M. G. Sellers, 1518 Sansom St., Philadelphia.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 14-15. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Institute of Electrical Engineers — Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—executivo committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association — San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

## Recent Court Decisions

**Damages from Overflow Due to Increasing Height of Dam.**—Grants of privileges to maintain dams over watercourses are to be read and construed in the light of the times and circumstances under which they are granted. So stating, the Kansas City Court of Appeals, in Cambest vs. McComas Hydro-Electric Company, sustained a verdict for the plaintiff, an abutting landowner, for damages due to the overflowing of his land through the raising of the height of a dam in the Platte River from 8 ft. to 15½ ft. The action of the company in raising the dam under a provision of an act of 1845 was found unwarranted in equity, and an assertion of the defendant that the abatement of the dam would cause loss to it out of proportion to the damage sustained by the landowner through its maintenance was declared not to be a valid defense. (245 S.W. 598).*

**Power to Limit Security Issues.**—The power of the Michigan Public Utilities Commission to fix the amount of the issue of stock and bonds and to fix it at the value of the property has been upheld by the Michigan Supreme Court in Hillsdale Light & Fuel Company vs. Commission. It was contended that if the commission finds that the property is reasonably required for the purposes of the utility and the funds are to be used for a lawful purpose, it is beyond the power of the commission to limit the amount of stock or bonds to be issued and that this question must be left to the judgment of the governing board of directors of the corporation. The court held that the purpose of the act involved was to prevent the overcapitalization of public utilities and that the amount of capital stock and bonds should correlate with the amount and value of the company's property. (189 N. W. 893.)

**Burden on Dependent to Establish Basis for Measurement of Compensation.**—To justify an award to a dependent widow or children, under the terms of the workmen's compensation law of Minnesota, of any amount in excess of the minimum there allowed, the claimant has the burden to supply by competent evidence the basis for the measurement thereof as limited by that statute. So holding, the Supreme Court of Minnesota, in Kreidler vs. Mahnomen Electric Light & Power Service Company, decreed that the plaintiff, whose husband, an electrician earning 80 cents an hour, was not regularly employed by the defendant but was fatally injured while temporarily working for the company, was entitled only to the minimum compensation fixed by the statute ($6.50 a week), the evidence failing to establish that the man ever continued even a week in the service of the defendant at one time. The contention that he worked as a contractor and not as an employee was, however, overruled. (191 N. W. 277.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

**Power Company Suable in County in Which It Overflowed Land by Dam in Another County.**—In Price vs. Ketchum and Georgia-Alabama Power Company suit was brought for damages to land caused by the overflow of a dam belonging to the power company, to which Ketchum, who, it was alleged, had failed to carry out an agreement with Price regarding the purchase of timber on the land in question, had granted permission to back water and overflow the tract. This flooding had, plaintiff contended, destroyed the timber, to which he still claimed title. The Court of Appeals of Georgia has reversed a judgment dismissing the action, this action having been based in part on the contention that the case could not be tried in the county where the damage was done inasmuch as the dam was in another county. The finding also holds that a provision of the deed regarding overflow of the land by a third party did not liquidate damages so as to prevent action. (115 S. E. 32.)

**Duty of Companies to Maintain Proper Insulation on Transmission Wires.**—Premising that it is the duty of a corporation that maintains and controls wires charged with electricity in a place where it is likely that persons will come in contact therewith to use reasonable care to maintain proper insulation, and that the test of liability to a particular person is whether injury to him ought reasonably to have been anticipated, the Court of Errors and Appeals of New Jersey affirmed a verdict for the plaintiff in McGinnis vs. Delaware, Lackawanna & Western Railroad Company. In this case the defendant corporation maintained a wire across a public highway 18 ft. or 20 ft. above the surface of the street. A workman driving piling in the street came in contact with the wire and was killed. Whether or not the defendant's wire was maintained by legislative authority and whether or not the work upon which decedent was engaged was done under a city permit did not appear. The court held that the jury might infer negligence from evidence tending to show want of reasonable care in the insulation of the wire; that the mere fact that defendant's wire was strung 18 ft. or 20 ft. above the surface of the street did not relieve it from liability, since from the appearance of the pile driver and the place, progress and duration of the work it was open to the jury to find that the defendant should have foreseen the danger and anticipated injury to the decedent; that the fact that the work in the street upon which decedent was engaged was being done without a permit from the city would not defeat recovery, since the absence of a permit did not contribute to the injury and there was nothing to show that the work unreasonably interfered with the rights of the defendant or others in the street, and that the fact that decedent worked in close proximity to the wire could not be said as a matter of law to be negligence barring recovery, since the evidence tended to show that the wire was apparently safe and that decedent was without knowledge of its dangerous character. (119 At. 163.)

## Commission Rulings

**That There Is Only One Customer Does Not Deprive a Public Service of Its Nature.**—In a complaint asking that the tariff schedule of the Carlisle Light, Heat & Power Company covering rates for furnishing live steam for industrial heating be stricken from the files of the Public Service Commission of Pennsylvania, on the ground that the complainant was in fact the only user of live steam, and that respondent in the particular service was not functioning as a public utility, the commission dissented from the latter assertion and dismissed the complaint.

**Idaho Commission on Expense of "Attaching Business."**—In arriving at a valuation of the property of the Pocatello Gas & Power Company for rate-fixing purposes, the Idaho Public Utilities Commission had this to say on the expense of getting new business as an element in "going value": "Under business development there is rightfully included the cost of attaching business. The record shows that there was expended the sum of $45,916.88 for the purpose of attaching business. The methods employed by the company in attaching business were somewhat peculiar, yet it was probably as good a method as any which could have been devised under all the circumstances then existing. It is not the province of the commission to criticise any reasonable method employed by the utility in attempting to attain the end sought. The evidence discloses that at such time something was necessary, and the company, acting upon its best judgment, has partially accomplished the purpose sought. The business of the company has not yet reached the stage where the value of the business developed justifies the allowance of the above amount. The evidence shows that this company has not as yet reached that point where it has been able to pay operating expenses, taxes and a reasonable return. However, the company is entitled to have included in its rate base a reasonable amount for the cost of business development. Under all the conditions presented in the case the sum of $10,000 is a reasonable allowance for business development, when considered in conjunction with the value of the business as a going concern, and the sum of $10,000 will be allowed with the going-concern value included therein."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

### B. I. Budd President Northern Illinois Company

Britton I. Budd, elected president of the Public Service Company of Northern Illinois, as was announced in the Feb. 10 issue of the ELECTRICAL WORLD, has been associated with the transportation business ever since he left school, at which time he took a situation in the surveying department of a steam railroad in Ohio. In 1893, during the World's Fair at Chicago, Mr. Budd was associated with the Intramural Railway. With the incorporation of the Metropolitan Elevated he saw Chicago's future transportation plans take real form, and when actual operation of that line was commenced in May, 1895, he obtained a position as clerk in the storehouse. With the Metropolitan his rise was rapid, for he soon became storekeeper, then purchasing agent and finally general manager. When Mr. Hetzler, president of the Metropolitan, left in 1910 Mr. Budd was elected president.

B. I. BUDD

In 1911 a consolidation of all the elevated lines in Chicago was brought about, and Mr. Budd was chosen president of the combined system. Besides being president of the Chicago Elevated Lines, he became president of the Chicago, North Shore & Milwaukee Railroad at the time of that line's reorganization in 1916. Mr. Budd will continue as president of both these organizations.

**Joseph S. Lessig** has been appointed local manager of the Winona Electric Light & Power Company at Warsaw, Ind., which was recently consolidated with the Interstate Public Service Company.

**Henry H. Russell**, for the past three years Southern district manager for the Edison Electrical Appliance Company, is now associated with Mitchell Vance, Inc., New York.

**Theodore B. Parker**, formerly assistant hydraulic engineer for the Utah Power & Light Company and later for the Electric Bond & Share Company, New York, has entered the hydraulic division of Stone & Webster, Boston.

**Robert E. Barrett**, well-known in New England hydro-electric circles, has been elected president of the Holyoke (Mass.) Water Power Company. Mr. Barrett was formerly on the engineering staff of the Turners Falls (Mass.) Power & Electric Company and for several years has been the active manager of the Holyoke company with the title of treasurer.

### C. L. Law Receives New Appointment

Clarence L. Law, for many years manager of the bureau of illuminating engineering of the New York Edison Company, has recently been appointed to the post of assistant to the general commercial manager, Arthur Williams. Mr. Law has been associated with the company since 1906, when he entered its service as special inspector. A year later he was made special agent and in January, 1910, he was made manager of the bureau of illuminating engineering. Notwithstanding the demands of his office, Mr. Law has found time for great activity in the affairs of the various organizations of the electrical industry. He is now serving as chairman of the metropolitan New York company section of the National Electric Light Association. He served two years as vice-president of the Illuminating Engineering Society, for five years was its general secretary and is now serving as one of its directors.

### A. E. Reynolds Goes to Springfield, Mo.

Albert E. Reynolds, who recently resigned as general manager of the United Traction Company, Albany, N. Y., and Hudson Valley Railway Company, Glens Falls, N. Y., subsequently announcing his association with E. N. Sanderson of Sanderson & Porter, president of the Federal Light & Traction Company, New York City, has been elected vice-president and general manager of the Springfield Gas & Electric Company and Springfield Traction Company of Springfield, Mo. This is one of the subsidiary companies of the Federal Light & Traction Company. He entered upon his new duties at the beginning of the month. He succeeds E. C. Deal, who resigned from the Springfield properties to become associated with the Electric Bond & Share Company of New York. Mr. Reynolds has had many years of experience in the utility field which amply qualify him for his new work.

### J. M. Barry Manages Alabama Company's Southern Division

J. M. Barry, who since the spring of 1921 has been assistant chief engineer of the Alabama Power Company, has been promoted to the position of manager of the southern division of the company, with headquarters at Montgomery. With the acquisition of the Montgomery electric service system, the possibilities of future hydro-electric development on the Tallapoosa River and the opportunities for expansion in the southern part of the state, this division has probably the greatest possibilities of growth existing on the entire system. As manager of the division Mr. Barry will have charge of all physical properties, public relations, commercial activities and operating and maintenance in that section.

J. M. BARRY

Immediately after graduation from college in 1910 Mr. Barry joined the Pacific Gas & Electric Company's underground department in Sacramento, Cal., where he stayed for two years, then becoming electrical engineer of the Northwestern Electric Company, Portland, Ore. From 1914 to 1917 he was chief of the San Francisco department of electricity, and during the next two years he was distribution engineer of the Great Western Power Company. In 1919 he became connected with the Alabama Power Company, where he had charge of the eastern division until 1921.

**Jerome Blaisdell** has resigned from the Depew & Lancaster Light, Power & Conduit Company at Lancaster, N. Y., and is now associated with the Central Michigan Light & Power Company at Alma, Mich.

### W. H. Taylor Elected Vice-President of Georgia Company

W. H. Taylor, formerly executive assistant of the Georgia Railway & Power Company, has been elected a vice-president of that company. Mr. Taylor is a widely known public utility executive, having been for seven years president of the Omaha Gas Company. Prior to his connection with the Omaha company he was with the United Gas Improvement Company as engineer in

W. H. Taylor

charge of the gas and electrical properties on the main line out of Philadelphia. He had previously served with the Fulton County Gas & Electric Company, Gloversville, N. Y., for a period of three years, where he was also engaged in engineering work. Previous to his association with the Georgia Railway & Power Company he was stationed in Philadelphia as an executive on matters of appraisal. Mr. Taylor is a graduate of the Stevens Institute of Technology, Hoboken, N. J.

**C. B. Merrick**, formerly in the inspection department of the San Joaquin Light & Power Corporation, has been placed in charge of the range department of the Valley Electrical Supply Company of Fresno.

**Joseph George Ramsden** is now a director of the Ontario Power Company of Niagara Falls, replacing Fred R. Miller, deceased, and D. Carmichael is vice-president of the company, replacing I. B. Lucas, resigned.

**Stanley Walton**, for thirteen years a member of the commercial department of the Pacific Gas & Electric Company and until recently sales manager of the gas and electric departments, has resigned to become sales manager of the Bonestell Paper Company.

**Thomas W. Wootton**, formerly connected with the Hydro-Electric Department, government of Tasmania, and later with the General Electric Company, has resigned to accept a position with the engineering department of the Adirondack Power & Light Corporation, Schenectady, N. Y.

**E. T. Fishwick**, general sales manager, has been appointed vice-president of the Worthington Pump & Machinery Corporation, New York, succeeding Frank H. Jones, who resigned.

**George W. Bernhard**, formerly manager of the northwestern district of the Great Western Power Company and special agent at Sacramento, has been named district manager at Oakland.

**Ernest Johnson**, formerly connected with the Holmes Electric Company, Fayetteville, N. C., is now associated with the Westinghouse Electric & Manufacturing Company.

**Jesse Huff**, formerly of the United States Patent Office examining corps, has resigned to become associated with the patent department of the General Electric Company at Schenectady, N. Y.

**A. J. Chapman**, formerly sales manager of the Gainaday Electric Company, Boston, has been appointed assistant sales manager of Beaudette & Graham, distributors of electrical household appliances in the same city.

**Ralph B. Coleman**, formerly in charge of the Chicago office of the Moloney Electric Company and also with the Electric Machinery Company, Minneapolis, for five years, has joined the forces of the Shakstad Electric Company, Sioux Falls, S. D.

**R. L. Bennett**, formerly sales manager of the Crystal Washing Machine Company, Detroit, and sales and advertising manager of the Air-Way Electric Appliance Corporation, Toledo, has been appointed general sales manager of the Berthold Electrical Manufacturing Company, Chicago.

**John Gribbel** of Philadelphia has been elected a member of the board of directors of the Cities Service Company. Mr. Gribbel is owner of John J. Griffin & Company, president of the Royal Electrotype Company of Philadelphia and the Athens (Ga.) Gas & Fuel Company, and vice-president of the American Railways Company of Philadelphia and the American Meter Company of Delaware.

**J. Fisher**, electrical engineer and contractor, was elected president of the Denver Association of Electrical Contractors and Dealers at the annual election held by that organization on Jan. 23. E. A. Scott was chosen as vice-president and H. Alex. Hibbard, a Denver manufacturer's representative, as secretary and treasurer. The three officers are members of the advisory board of the Electrical Co-operative League in that city.

**F. P. Cummings**, efficiency engineer of the Alabama Power Company, has been transferred to the position of commercial manager, where he succeeds F. D. Mahoney, who has joined the West Penn Power Company, with headquarters in Pittsburgh, Pa. Previous to Jan. 1, 1920, Mr. Cummings was operating manager of the Alabama Power Company for some time. Several years ago he was with H. L. Doherty & Company and, among other offices, held the position of commercial manager in Joplin, Mo.

### J. L. Longino Vice-President of Arkansas Company

J. L. Longino, who was formerly operating superintendent of the Arkansas Light & Power Company and has served as its secretary and treasurer since organization, has been made vice-president and general manager of the company. Mr. Longino was made manager about two years ago of the Pine Bluff Company, an associated public utility company, which operates the

J. L. Longino

street-railway, electrical and water services in Pine Bluff. He will continue to manage the Pine Bluff Company, but will be relieved of some details by L. B. West, the auditor. The secretaryship of the Arkansas Light & Power Company has been taken over by L. Garrett.

**E. F. Stoughton** has been transferred from the treasurer's office of the Stone & Webster organization to the Cape Breton (N. S.) Electric Company.

**C. E. Brigham**, who was associated with the National Radio Institute at Washington, D. C., for two years, and more recently with the Radio Testing Laboratories of the United States Navy, has been appointed research and designing engineer for C. Brandes, Inc., of New York City.

## Obituary

**Dr. W. French Smith**, president of the Mexican Telephone & Telegraph Company, died at his home in Somerville, Mass., Feb. 1, at the age of sixty-eight. Dr. Smith was well known in the metallurgical field aside from his interest in the development of foreign telephone service.

**John S. Connell**, sales representative of the Frank H. Stewart Electric Company, Philadelphia, died at Elmira, N.Y., on Wednesday, Jan. 31, while making a business trip. Mr. Connell had been associated with the company since 1907 and for a period of several years had served on the board of directors of the company.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Two Letters on Distribution

### A Jobber Writes that It Is Public Demand for Extravagant Service that Makes Our Distribution Too Costly— A Further Analysis

A RECENT editorial in the ELECTRICAL WORLD on distribution costs concluded with this statement:

> **"But the public demands relief. Will electrical men and other industries, we wonder, find ways to cut down their costs by co-operation among themselves, or will they wait until Congress is driven by public clamor to tackle the whole job with many ill-considered laws?"**

The following letter from a jobber in the West argues that the responsibility for reducing this cost lies more with the public than with industry—a not uncommon point of view.

Of the facts as cited in this jobber's letter, there can be no question. The point is: Can the matter safely be left to the public to correct, or must industry act in its own behalf? Also, how much does industry contribute in its turn to this condition? This thought is discussed in a letter of reply, further analyzing the issue and showing that the editorial and the jobber's thinking are really not at variance. But the man of the industry naturally thinks as a jobber, a manufacturer, and is apt to see his opportunity to influence in distribution costs restricted to the field of his present activities. Progress will only be made, however, when these men take hold to get the job done for the industry as well as for the public, no matter where the work must be performed.

*To the Commercial Editor of the* ELECTRICAL WORLD:

DEAR SIR: For some time I have been holding on my desk a reprint of an editorial published in the ELECTRICAL WORLD on Saturday, Nov. 25, 1922, entitled "Distribution—Who Will Cheapen It?" This editorial was, of course, written with the idea of constructive help, but I am wondering whether it does not hurt the electrical industry more than it helps. The last paragraph of your article asks a very pertinent question as to what will be done to cut down the cost to the consumer, but limits this solution more or less to the producer.

It is unfortunate for the electrical industry that electrical men are trying to establish ideas of merchandising that are so totally different from the methods used in merchandising other classes of merchandise used by the public. My particular point is that you bring out the fact that a labor-saving device costing the manufacturer $50 sells for $125. How about the pair of shoes that you happen to be wearing while you are reading this letter? It is my opinion that you will find the same discrepancy between the cost of manufacture and what you paid for the shoes, and the demand that you personally made for service has caused this wide discrepancy.

Recently I had the pleasure of visiting one of the largest certified milk-producing plants in this country, and the reason I am speaking of this is because it represents a commodity that is consumed every day and on which the distribution cost should be lower than it would be on any appliance such as the electrical industry has to offer. However, I found this concern was making a pretty fair profit on its investment, was delivering the milk via train and truck to a town 75 miles away, delivering it to the man who takes it to the door of the home, for 13 cents a quart. The householder pays 25 cents a quart for this milk. Of course, many of these householders would like to have that milk a little cheaper, but the demand is such that there is no trouble in getting 25 cents. The public has made that price by demanding that the milk be put up in fine glass bottles, thoroughly sterilized, with patent caps, delivered to the door of the home in nice, clean, well-kept wagons or automobiles, by men dressed in white uniforms, always spick and span; that the bills be collected at the end of the month, and that it shall have the many other things that go under the head of service.

I have no doubt that if the public in general were willing to go back to the time of my boyhood days, when the dairyman came to the back door with a great big can, measured out the milk in the cover of the can, and poured it into a bucket that my mother stood holding in the doorway, the milk could still be purchased at the same price that my mother paid for it, and that is about 5 cents a quart. Our family seemed to have thrived on that dreadful milk that was neither pasteurized sterilized or any other "ized," but since we are now all so afraid of the many bugs, germs and other things that might be in the milk, in the wagon or in the clothes of the driver, we must pay the price.

It may seem to you that it is a long step from milk to washing machines, but if you will stop a few of the many things demanded by the public in the way of service, there should be less difference between the bare cost of the merchandise and the selling price. The washing machine should or will last ten or fifteen years—the family cannot drink it up every day—which is another factor that must be taken into account in the final analysis of the retail price.

The only solution that I can think of is a general propaganda throughout the United States to train the public to realize that our ways of living today are all wrong—that we must go back thirty-five or forty years in our ideas and be satisfied with the conditions, conveniences and ideas of that time. If the public is going to keep on demanding what is considered "modern service," then that public must pay that bill—in other words, if one will drive the old, broken-down gray mare up to a decrepit-looking country store, knock the proprietor down and take away from him a washing machine without all the beautiful enamel and one that does not look like a baby grand piano, pay cash for it, and then not have to have a man sent out every thirty or sixty days to see whether it is oiled or not, I think your problem would be solved and the question in your editorial fully answered.

I do feel that it is a pity that the press and everybody connected with the electrical industry keep harping on the dreadful difference between the cost of production and the cost to the ultimate user, without a proper analysis of the other classes of merchandise. Very truly yours,

———————,
Vice-president.

MY DEAR MR. JOBBER: I agree with you entirely that the present "spread" on electrical devices is no greater than on shoes or clothes or milk or a dozen other lines that we can tell off on our fingers. In fact, it is not so great. I'll go you one further and say that the profit which electrical dealers and jobbers are making on many commodities is too small, far smaller than is earned for like service in other industries. But it is not profit that we are talking about, it is cost, and the general agitation through the country today in opposition to the present costs of distribution applies to food products, clothing and general manufactures no less than to electrical commodities.

The retail price of $125 on the indefinite appliance costing $50 to manufacture, which was cited as an example, is too great. But it is too great not because the agencies of distribution are making too much profit, but because the system of distribution by which they are operating is too costly. The purpose of the editorial was to say just this, that distribution is costing too much, that people are beginning to realize it and are demanding redress, and that it is better for the men of the industries affected to recognize this and do something to correct the situation than to let it ride until Congress undertakes to reform it with laws.

You are undoubtedly right in saying that the American public is demanding today an extravagant scale of service. The reason that the quart of milk sold at wholesale at 13 cents costs 25 cents delivered is because the public is buying not just a quart of

milk but also sterilization, patent caps and delivery in glass bottles by mean in clean, white uniforms who arrive in well-kept automobiles. They are purchasing not just milk but milk plus de luxe delivery, and this is true in our modern habits of buying most of our family supplies and in our personal purchases.

This is the cause of a good part of the present cost of distribution, but not all. Another part of it is our present system, wherein the dealer demands like extravagance in the service from the wholesaler and the wholesaler demands like extravagance in service from the manufacturer. This extravagance is expressed in small orders, excess varieties, wasteful packing and a dozen different other sources of unnecessary expense which come readily to mind.

Undoubtedly the public has forced a sizable part of this exorbitant distribution cost, but the electrical industry cannot sit back and say, "Because of this we will do nothing." For, in the last analysis, the public has the power and can do something about it itself through legislation, and the thing that they do may be the wrong thing. Therefore the electrical industry and other industries involved in the problem will be compelled to look the situation squarely in the face and take upon themselves the responsibility for influencing toward cheaper distribution in both these directions. That is, they must improve the economics of their own operations in so far as is humanly possible, and they must show the public clearly how great an element in the cost of commodities the modern standards of extravagant service which this generation is demanding have become.

We cannot passively sit back and wait for the public to find this out. Somebody has got to make this clear to the people and help them to see just how much of the price of goods is service and how much is commodity. And it would be far better for electrical men to undertake this job for their own protection than merely to deplore the condition and do nothing. I feel, therefore, that the industry itself has got to find the answer to the problem and to satisfy the public. It can do this in two ways—by introducing economies to eliminate existing costs that are excessive and by explaining more clearly to the people just what it is that makes up the cost of a commodity. Frankly, I do not believe the fact that similar conditions exist in other industries justifies any manufacturer or any jobber ignoring wasteful practice which he may be contributing to the high cost of distribution in his own business. I am sure that you will agree with me. Very truly yours,

——— ———,

Commercial Editor.

# High Cost of Inspection Inconsistency

## Some Pertinent Facts on the Excessive Variety of Switches Forced Upon the Industry by Lack of Uniformity in the Methods of the Inspectors

By T. J. Kauffman
Treasurer and General Manager
Square D Company, Detroit

If THE leaders of the electrical industry are earnest in their interest in the betterment of conditions now obtaining in the manufacture and distribution of electrical products, there is a worthy work for them to do in the reduction of the inconsistencies in inspection as it is practiced throughout the country. At the present time the requirements of the inspection authorities in different states and different cities vary so greatly that it places a costly burden on the manufacturer and the jobber of many devices that are used in the premises of the consumer and adds materially to the expense of an electrical installation.

No one who is not engaged in the manufacture or distribution of such a product can appreciate the effect of these conditions and the extent of the burden which it unnecessarily inflicts. The object is always the same, to reduce some hazard to life or property by giving extra protection against shock or fire. But the methods differ. The men who devise the methods have varying opinions and do not interpret either the requirements of the code or the local conditions alike. As a result there has grown up a great diversity of demands for special equipment, and the manufacturer who wishes to sell in these markets must prepare all their duplicating varieties and the jobber must stock them. It all wastes money.

Take the switch, for instance. There is a big variance of opinion among electrical inspectors here as to the application of the national electrical code. Atlantic City, N. J., requires that switches must have slate bases and will not permit the use of porcelain-base switches even for ordinary residence service. Porcelain-base switches prove satisfactory in all other localities as far as I am aware, even those localities adjoining Atlantic City; but they may not be used in Atlantic City. And so it goes.

There are throughout the large cities of the United States at least twelve different requirements, I am certain, for ordinary 30-amp. entrance switches of the inclosed safety type. If the manufacturer does not manufacture switches to meet all of these requirements, he is barred out of certain cities, and to the best of my knowledge no manufacturer does make a line of switches complete enough to meet all twelve requirements. For example, in the city of Buffalo a device is required which is not manufactured for any other city in the country that I know of. For a manufacturer to attempt volume production would be impossible. No one could take on the manufacture of this Buffalo device, because a plant organized for volume production could not handle the device to advantage.

Again, in some cities it is not permissible on three-wire grounded-neutral systems to use a switch with a blade or a fuse or both in the neutral. In other cities, however, three-pole switches with three blades and two fuses are required even though they are not required by the National Electrical Code.

In one city in Michigan the cover of an inclosed-switch box must be so hinged that it will not break a sign receptacle when the sign receptacle is placed at the bottom of the switch, used as a fuse block, even though the use of a sign receptacle in this manner is a direct violation of the code. In other cities they will not permit the use of an inclosed externally operated switch unless it has an interior locking-off device. Other cities require that the locking-off device must be on the exterior of the switch so that it is plainly evident to the user when the switch is locked off. Some cities specify special solder lugs on inclosed externally operated switches as small as 30 amp. in size.

### Disregard Code and Labor

Some of these requirements are due to the ideas of those in charge of meter installations for the utilities. In other cases they are due to the ideas of the electrical inspectors. While the inspectors are somewhat more uniform in their requirements, we have run into several cases where inspectors working for the Underwriters' Laboratories have refused to approve switches which are approved by the Underwriters' Laboratories for the services on which they were placed and although the switches bore the Underwriters' label. Another inspector refuses to permit the use of a solid neutral even though it is approved by the code.

It is not to be expected, of course, that industrial engineers can agree on a certain general type of safety switch for all purposes, but it does appear that a great deal of work will have to be done toward the adoption of some general type of service switch that will meet the approval of those in charge of meter installations

of large utilities and that will also meet the approval of the various inspectors who have jurisdiction over this kind of work.

Because of these conditions this company manufactures ten different kinds of two-pole, 30-amp., 125-volt service switches, whereas if the authorities would agree on the one best type and then all localities would agree to permit the use of that type it would only be necessary for us to manufacture the one type. This would save us a great deal of money, and as this saving would be passed along, it would eventually reach the consumer and would be of benefit to every one who has anything to do with the industry.

### Increases Cost

And so it is in many other lines where inspection requirements differ. If one type could be made that would be acceptable to all states and municipalities, manufacturers could put that number into quantity production and turn them out at a low price. As things stand, however, the volume is cut up into five, ten or twenty styles, all duplicating except in some superficial detail, and the overhead cost goes up both for the maker and the distributor.

In Massachusetts the Boston jobber must carry in stock a type of switch which is required in Boston. He must also carry in stock another switch which is almost the same but does not meet the Boston requirements, although it is commonly used in other localities surrounding Boston. He must, in addition, carry in stock a cheap inclosed switch to meet the requirements in localities where inclosed switches are specified with no particular type mentioned. Then he must have the old cheap switch to meet the demand in the localities where even inclosed switches have not as yet been required. It is not hard to see how this affects the Boston jobber.

Here is a matter of fundamental importance. The purpose of all these inspectors and all this legislation is to make the use of electric service safe, and the electrical manufacturer and jobber is ready to co-operate in every way. But when a safer way is found, by the very nature of the thing, it must be as safe in Oregon as in Pennsylvania. Therefore the industry should be permitted to make the safe switch without burdening its cost with a whole assortment of excess varieties. And the jobber should be permitted to stock and sell that switch without investing money and filling shelves with duplicating styles that slow down his turnover and increase the cost of distribution.

It is time that our associations, representing all branches of the industry—for all are concerned and should be interested—take up the task of reconciling these inspection inconsistencies. It will be a work of education, but the need is so urgent and the purpose so obvious and commendable that it should be possible to make rapid progress.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Conduit Boxes Are Plentiful

Notwithstanding the uneven stocks of rigid conduit reported from many sections, the supply of conduit boxes appears to be comfortably meeting current demands, and the recent price advance in pipe and other steel products has not at this writing been applied to this line of supplies. The increasing use of metallic conduit, both rigid and flexible, tends to develop a wider market for boxes; but so far it has been no very difficult matter to maintain adequate stocks in most quarters, though there is no ground for becoming careless in ordering when inventories shrink materially. There is nothing of a spectacular character about today's box demand as reported to this journal Monday. Contractor-dealers are the principal buyers, and jobbers are worrying over other topics than this.

## Instrument Demand Improving

Demand for electrical instruments is improving, according to several manufacturers in the field. A slight betterment in the automotive industry is reported, the orders from the farm-lighting plant makers are steady, the central stations are buying in fair amounts, and inquiries from boiler plants are growing. Stocks of general lines are normal, and makers state that special orders are being made up in satisfactory time. No trouble in deliveries of materials is reported. The present volume of business is expected to continue at a normal rate and, according to the leading manufacturers, can do nothing but improve when the heavier buying starts in the late summer or early fall months. Manufacturers are particularly optimistic over this year's business in view of the heavy construction programs and general business conditions.

## Chicago Collections Better

Some indications that collections among Chicago electrical jobbers are improving may be taken from their reports that a greater number of customers are taking advantage of cash discount terms. The volume of purchasers benefiting by cash payments within ten days is constantly growing. On an average the regular collections are running around forty-five to fifty days, which is much better than last year's.

Commenting on this situation, J. P. Wilson, credit manager Central Electric Company, declared that for the last three months of 1922 his collections had been the best of the entire year. The only item necessitating careful scrutiny as to credit rating, he maintained, was the radio business, which was not allowed to run over thirty days. Other jobbers report that the year ironed out many of the credit difficulties, so that conditions in the Middle West were much better than in 1921.

## Expect Firm Prices for Farm-Lighting Sets

Improved agricultural conditions throughout the country are expected to bring about a better market for farm-lighting plants during the summer months. Several large companies are planning extensive sales campaigns to educate the farmer in the money-saving features of the lighting sets in order to make 1923 a record selling year. It is also planned by companies to send many more demonstration sets mounted on light automobile trucks to the rural districts. The outlook in the southern districts is encouraging. Several well-known jobbers state that they are in receipt of many inquiries from farmers as a result of advertising in the newspapers, and that as soon as the roads are in better condition they will be allowed to close quite a few orders. This advertising offers from twelve to twenty installment payments. Manufacturers generally are of the opinion that prices will remain firm during the next three months.

## Tape Demand Reflects Steadiness in Wiring Field

A steady demand for tape, following a lull of short duration, appears to have set in. Local stocks have been meeting current requirements readily, but the market continues to be characterized by sharp distinctions in quality and price and accompanying spotty buying from particular localities. There is some discussion in manufacturing circles relative to price levels, some of the

newer comers into this field having quoted on bases which some of the older houses have questioned as insufficient to cover all charges properly belonging to this commodity in its journey from the raw-material stage to the distributor's shelf. Be this as it may, the importance of careful buying of tape for the particular service expected seems to be gradually getting more recognition, and the factor of quality is bound to grow in significance. Black tape is in much greater demand than white, and the striking success of interior-wiring campaigns the country over is sure to help the year's sales record in this line.

## Electrical Opportunities in China

### American Capital Needed to Aid in the Development of Industry and Transportation

"Despite unfavorable political conditions which show no indication of early improvement, commercially speaking, China is solvent," said Julean Arnold, commercial attaché to the American Legation at Peking, in a recent interview with a representative of the ELECTRICAL WORLD. "Once again, for the twentieth time in the past two decades, China's foreign trade shows an increase over the preceding year. Neither the domestic political condition nor the widespread depression of business in many parts of the world in 1922 breaks the continuity of the gradual upward development in foreign commerce. China's per capita debt is under $3, and the entire debt is no more than the funded debt of New York City. The number of Chinese banks in various trade centers is increasing, and important investments are being made in the country by Belgian, British and French interests.

Mr. Arnold pointed out that American trade with China has now reached about $200,000,000 per year, or a fourfold increase since 1900. The total American resident population is about 12,000. The popularity of central-station service is increasing by leaps and bounds, and in the cities where this service is in use the demand for electric lighting overloads the plants every four or five months. New facilities are constantly required. Outline lighting on the Nanking Road, at Shanghai, compares favorably with any American installation. Extensive additions to the station of the Canton electric lighting plant are now under contract.

The competition of cheap electrical supplies made in Japan and in Germany is a present handicap against American goods. Mr. Arnold commended the policy of the General Electric interests in China in refusing to produce cheap supplies in their China factory to meet the competition. It is believed that the quality of American electrical supplies will ultimately win their wide acceptance in China owing to the high regard the Chinaman has for established trademarks and proved goods.

DELINQUENT ELECTRICAL ACCOUNTS FOR JANUARY

| Branch and Month | Number of Delinquent Accounts Reported | Total Amount | Average Amount |
|---|---|---|---|
| Central Division: | | | |
| December, 1921 | 1,157 | $124,376.98 | $107.49 |
| December, 1922 | 1,104 | 126,342.89 | 125.84 |
| January, 1922 | 820 | 93,956.53 | 118.24 |
| January, 1923 | 809 | 88,811.52 | 109.78 |
| New York: | | | |
| December, 1921 | 434 | 58,840.00 | 136.00 |
| December, 1922 | 485 | 93,428.00 | 193.00 |
| January, 1922 | 325 | 48,429.00 | 150.00 |
| January, 1923 | 392 | 54,452.00 | 139.00 |
| Philadelphia: | | | |
| December, 1921 | 186 | 28,992.97 | 155.87 |
| December, 1922 | 183 | 19,307.58 | 105.51 |
| January, 1922 | 216 | 32,449.17 | 150.23 |
| January, 1923 | 212 | 30,786.13 | 145.22 |
| New England: | | | |
| December, 1921 | 44 | 8,484.25 | 192.82 |
| December, 1922 | 34 | 3,809.68 | 112.05 |
| January, 1922 | 3 | 454.48 | 151.49 |
| January, 1923 | 66 | 7,805.66 | 118.27 |
| Pacific Coast: | | | |
| December, 1921 | 23 | 2,677.74 | 107.72 |
| December, 1922 | 14 | 2,225.43 | 158.90 |
| January, 1922 | 16 | 2,002.00 | 125.12 |
| January, 1923 | 12 | 1,087.20 | 90.60 |

## Number of Delinquent Accounts Was Lower in January

Delinquent accounts as reported by the Electrical Credit Association show that the Chicago accounts were lowered by 295 over the year end. The average value of the January, 1923, accounts was $109.78 as against $125.84 for December, 1922. This was also lower than the January, 1922, accounts by eleven, with a lowered value of $8.46.

The New York territory also decreased its accounts during the same period from 485 to 392, with an average valuation of $193 and $139 respectively. In Philadelphia the January, 1923, accounts increased from 183 in December to 212, increasing the average valuation during this period from $105.51 to $145.22. The New England accounts changed from 34 in December to 66 in January, 1923, with an average increase in valuation from $112.05 to $118.27. Conditions on the Pacific Coast have improved, since the average accounts have been lowered during this period from $153.90 to $90.60. The list of delinquent accounts is as shown above.

## The Metal Market

### Major Non-Ferrous Trade Is Active—Lead Shortage Still Acute—Copper 15⅛ Cents

The major non-ferrous metal markets continue to show much activity. Copper is quoted at 15⅛ cents; the lead shortage is as acute as it has been for many weeks, while zinc has shown a slight softness in price. The tense European situation abroad has had no perceptible effect on prices of any of these metals, and domestic business is reported highly satisfactory by nearly all metal consumers. Domestic markets have been strong enough to permit them to behave independently of Europe.

NEW YORK METAL MARKET PRICES

| | Feb. 6, 1923 Cents per Pound | Feb. 13, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 15.00–15.12½ | 15.12½ |
| Lead, Am. S. & R. price | 8.00 | 8.00 |
| Antimony | 7.50 | 7.50 |
| Nickel, ingot | 30.00 | 25.00–30.00 |
| Zinc, spot | 7.00 | 7.05 |
| Tin Straits | 39.00 | 40.00 |
| Aluminum, 98 to 99 per cent | 22.00–23.00 | 23.00 |

### Copper and Brass Products

Copper, brass and bronze mills quote the following prices on brass and copper products:

Copper wire, 17.25 cents net, mill; brass wire, 19.5 to 21.5 cents; copper sheets, 22.50 cents; copper rods, 21 cents; brass rods, 17.50 to 21.62½ cents; sheet brass, 19.25 to 20.87½ cents.

## Porcelain Insulator Market Prospects Are Bright

A survey of the porcelain insulator market shows increasing activity and bright prospects for the coming summer months. A slight spurt in sales to the utilities was noted in the trading of last month, and this continues as strong for the first two weeks in February. Jobbers in the Middle West report that they are well stocked and can make deliveries for almost any amount. In the East stocks are fair but not plentiful. Most of the inquiries in the northern sections are for smaller lots, while the line construction programs in the southern districts demand larger amounts and quicker deliveries. Manufacturers are of the opinion that orders from the central stations and telephone companies all through the United States will soon start in heavier volume, and that sales for the next three months will be somewhat larger than they were for the corresponding period of 1922.

## Healthy Demand for Washers and Cleaners

Observation of retail sales indicates that washers and cleaners are rapidly getting into the staple class of electrical merchandise and that seasonal conditions are of decreasing importance in this branch of the trade. A

slight recession in demand followed the holidays, and stocks were gradually replenished during January in many quarters. Deliveries are hampered by railroad congestion, but by and large there are no serious shortages reported in this line at the moment. Competition is extremely acute in both washer and cleaner sales. It is doubtful whether recent price movements upward have cut materially into the demand, because of the widespread convenience of deferred payments in retailing this equipment. New methods of merchandising are proving effective, and the nation-wide tendency to equip the homes of workers within the central-station industry with appliances through commercial policies offering employees advantageous terms is bearing fruit in sales. The problem of domestic labor continues acute, and the outlook is bright for the year's business in these classes of equipment.

January of 1922 will show a most gratifying increase. The railroads are introducing new cars almost daily and shipments are much improved. Industrial equipment continues to be in strong demand. Small motors particularly are moving rapidly. Building operations here have absorbed a surprising amount of wire and fixtures, while the appliance dealers have not been idle. Washers and cleaner sales have exceeded the most generous estimate. Radio jobbers and dealers are capitalizing the revival of interest in the programs. Stocks are good. Collections are fair.

# The Week in Trade

**Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

DEMAND for electrical commodities throughout the United States is of a steady nature, stocks generally are reported normal and prices of wire and conduit are increasing. A sudden spurt in sales of materials entering into the repair and extension of central-station lines is noted. Meters are said to be selling in better volume. Motors in the smaller sizes are known to be active, most of these entering into the manufacture of fans. Commercial and residential fixture sales are increasing as a result of intensive campaigns in different parts of the country.

**Boston** Business is improving and railroad difficulties are the only serious obstacle at present to expansion of trade. Building contracts in New England during January totaled $22,770,000, a gain of 9 per cent over December and 42 per cent over January, 1922. Manufacturing continues active. Retail trade still feels the effects of severe weather. Prices are stiffening in tape and steel products. Stocks are short in rigid conduit, pole-line hardware and some sizes of small motors. Inquiries are very active this week in jobbing circles. Central stations are throwing more vigor into commercial developments and appliance sales are keeping up well. Vacuum tubes are scarce in some sizes and cross-arm purchasers are handicapped by delayed shipment conditions. Wiring contractors are extremely busy on residential work.

**New York** Business continues at a steady gait, and prospects for the coming spring months are thought to be excellent. Motors are selling actively. Renewed interest is being shown in the fixture market, where firm prices prevail. Meters during the week took on strength. Porcelain, high-tension equipment and wire also picked up considerably during the last few days. Jobbers report business a trifle better than it was the week before. Wiring contractors are busy on residential work.

**Baltimore** Demand for jobbers' stocks is reported only fair. A slight pick-up in the demand for porcelain, wire and pole-line hardware is noted. Residential and commercial fixtures are selling in better volume, and the prospects for this market during the coming summer and fall months are exceptionally bright. Stocks generally are normal and prices are firm.

**Atlanta** This section was visited by heavy sleet storms the early part of this week, resulting in heavy damage to telephone and local distribution systems and adversely affecting the high-tension lines of the power companies in Alabama. Service has been resumed, but heavy purchases will be made to replace the damaged lines. The improvement and expansion projects of the larger power companies are beginning to get under way, and this is reflected in the volume of sales. Shipments are lengthening and jobbers report low stocks in certain items. General increases in the price of copper wire and conduit are to be noted. Jobbers report business as satisfactory, and all indications point to this being a record year.

**Pittsburgh** The spirit of optimism is gradually increasing, although this is offset somewhat by the very low prices that are being quoted at some points. The work that is being given out to the electrical contractors is of a larger size in volume of dollars than for some time past. It is possible that the increase in price of various classes of material may cause a tendency to hold up some of the larger jobs. For instance, a job that was let during the past week showed that the last figures were 13 per cent higher than when figured with the materials at the lowest price. During the week conduit has again shown an increase, and it seems to be just about as scarce as ever.

**Cleveland** A decided upward trend in electrical business is evident, and it is believed that a comparison of January this year with

**Chicago** Few changes are noted. Present-day buying is steady, while a few jobbers report a seasonal slackening demand on staple materials. But all dealers are optimistic and feel that the year will bring even more business than 1922. Current demand for washing machines and vacuum cleaners has been fairly steady, the volume being determined by sales campaigns. Neither tape nor outlet boxes have given evidence of increased demand, and stocks are normal. Eastern freight embargoes are seriously worrying pole shippers.

**St. Paul-Minneapolis** Washers and cleaners are steady all around. Business is picking up a little over the slump that followed the holidays. Dealers are inclined to be conservative in buying, but city retail sales seem to be well up to normal. Agents for various lines report a steady business—not above normal, but better than was expected for this winter. Conduit boxes are active. Wiring is steady in both cities, as it has been all winter. Conduit stocks, particularly the small sizes, are still low.

**St. Louis** The building permits for the month of January, 1923, amounted to $2,560,326 against $1,119,530 for the same month in 1922, or an increase of approximately 127 per cent. It is interesting to note that while the total has increased there has been a decrease of 19 per cent in the amount of the permits issued for manufacturers and workshops as compared with that of the same month one year ago. The various motor manufacturers all report large sales in almost all lines, the orders being considerably in excess of the present production.

**Portland-Seattle** Much activity is being shown by inquiries about electrical equipment, particularly from the lumber industry. A greater program of electrical development than has been experienced for many years is either in progress now or will soon be started throughout the Northwest. Manufacturers report a slight reduction in transformer costs. The demand for large sizes is very heavy, and deliveries of them are not promised short of a period of six months.

# Demand, Supply and Price Trend of Eighteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Storage Batteries, Instruments
and Farm Lighting Plants

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Washers, Cleaners | Conduit Boxes | Tape |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boston** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Slow | Sdy. | Slow | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. |
| **New York** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Slow | Slow | Sdy. | Sdy. | Slow | Act. | Sdy. | Sdy. | Sdy. | Act | Sdy. | Sdy. | Act. | Sdy. | Slow |
| Supply | Nml. | Hi. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Inc | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm |
| **Baltimore** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Slow | Act. | Act. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slow | Slow | Slow | Slow | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy | Act. | Slow | Slow | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Inc. |
| **St. Paul-Minneapolis** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy | Act. | Act. | Act. | Slow | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Slow | Sdy. | Slow |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Slow | Act. | Slow | Sdy. | Act. | Sdy. | Act. | Slow | Sdy. | Act. | Sdy. |
| Supply | Nml. | Low | Low | Low | Nml. | Low | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Inc. | Inc. | Inc. |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. |
| Supply | Hi. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Hi. | Nml. | Low |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Inc. | Firm | Inc. | Inc. | Firm | Dec. | Firm | Firm | Firm | Inc. |

The local supply of distribution size transformers is normal. The demand for lead-covered cable, particularly paper-insulated, is active and deliveries cannot be obtained in less than ten months. Conduit stocks are still in a depleted condition, although new shipments are expected daily. Building construction, however, is so active that the demand for conduit continues to keep in advance of incoming stocks. A drop is reported in porcelain knobs and tubes. Prices on conduit are reported to be 5 to 10 per cent higher.

**San Francisco** Constructive efforts are being made by electrical manufacturers and jobbers to ascertain the best type of motor, cord, lighting or wiring for each particular industry. Very satisfactory are the Department of Agriculture reports of California's 1922 crop total, which constituted a record tonnage. Growers received $183,000,000 for field crops, $194,000,000 for fruit and $19,000,000 for vegetables and cantaloupes. Moreover, 1922, with nearly 15,500,000 cases, set a new record for fruit packing. These totals explain why prosperous retail conditions prevail throughout the state.

**Denver** Improved status of basic commodities is reflected in increasing electric equipment orders and in improvements and extensions to central-station service to accommodate new business. Inquiries and purchases from railroads and industrial plants are likewise increasing daily. Loca[l] jobbers' and manufacturers' stocks ar[e] meeting normal requirements, but slow deliveries rather than increases i[n] prices are preventing completion o[f] stocks for business anticipated in earl[y] spring.

**Salt Lake City** This week is "In[termountain Prod]ucts Week," and a big drive to stim[u]late interest in home products is no[w] in progress. Every department [of] manufacture is represented in th[e] campaign, and by lecture display a[nd] demonstration the economic doctrine [is] being proclaimed that local produc[ts] should have preference over their co[m]petitors, provided they offer eq[ual] value.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

### Milwaukee's Fixture Industry Seen by Foreign Delegates

The manufacturing, jobbing, wholesaling and retailing of electrical fixtures in Milwaukee is being studied by a delegation of lighting experts from London, Paris, Shanghai and Tokio who are making tours of inspection in the leading electrical centers of the country. Included among the many electrical manufacturing concerns in Milwaukee to be visited by the delegates is the Julius Andrae & Sons Company.

### Radio Corporation Patent Suit

Judge Augustus N. Hand, in the United States District Court for the Southern District of New York, has handed down decisions in three patent suits brought by the Radio Corporation for infringement of the De Forest audion patents by the manufacture and sale of vacuum tubes for radio purposes. In all three cases Judge Hand granted preliminary injunctions asked for. The first of these suits was that of the Radio Corporation of America against La France Import & Sales Company, Inc., and others manufacturing and selling a vacuum tube known as the "La France" detector and amplifier. The second suit was against Harry Rosenthal and others who are manufacturing and selling a vacuum tube detector and amplifier known as the "Perfection" tube. The third suit was against the Radio Guild, Inc.

### Atlanta Sales District of Westinghouse Lamp Meets

The annual meeting of the Atlanta sales district of the Westinghouse Lamp Company was held in Atlanta on Feb. 1 to 3, inclusive. This district embraces the Southeastern States, and a representative attendance of executives and salesmen was reported. The meeting was featured by discussions on sales promotions through merchandising and advertising mediums and the discussions of technical problems by the company's illuminating and commercial engineers.

### Mercury Company Increases Capacity to 7,200 Trailers

By the addition of a new one-story building, 100 ft. x 60 ft., the Mercury Manufacturing Company, Chicago, will be able to turn out 7,200 electric trailers per year, according to officials of that company. This additional space was used to simplify and unify production which has resulted by the addition of only a few more men.

Total sales for the year, according to a statement made by J. R. Beansley, general manager, ran about twice that of 1921. With large industries recognizing the problem of internal transportation as one of paramount importance, Mr. Beansley expects business for the coming year will increase steadily.

### G. E. Wins Preliminary Injunction in Incandescent Lamp Suit

The General Electric Company has been granted a preliminary injunction against P. R. Mallory & Company, Portchester, N. Y., manufacturers of tungsten wire, and the Save Electric Corporation, Brooklyn, manufacturer of incandescent lamps. These injunctions are based upon the General Electric Company's broad tungsten-lamp patent of Just & Hanaman and upon the Langmuir gas-filled lamp patent. Both of these patents have been sustained by the Circuit Court of Appeals in previous litigations. The effect of these injunctions will be to prevent defendants from continuing the manufacture and sale of their products, pending the final outcome of the litigation.

### Apex of Denver to Double Force in House-to-House Campaign

The Apex Distributing Company of Denver, which since its organization a year ago has maintained headquarters in a downtown office building, has leased half of the ground floor of the new Wilda Building, at 1437 Welton Street in that city. Plans have been completed for doubling the sales force with the intention of starting a house-to-house campaign covering every corner of the city.

### Wagner Electric January Sales Showed Large Increase

January sales of the Wagner Electric Corporation are reported by the company as 90 per cent greater than those of January, 1922, and the December sales were 60 per cent in excess of those of December of the previous year. Among the important contracts recently secured by the company are the complete electrical equipment of the Missouri Portland Cement Company for its local plant improvements, the complete motor installations of the new power plant of the Union Electric Light & Power Company at Cahokia, Ill., and the motors to be used in the electrification of the local plants of the N. K. Fairbanks Company, the Benjamin Moore Paint Company and the Alton Brick Company.

### Westinghouse Receives $500,000 Railroad Order

Because of a large increase in traffic, the Long Island Railroad, which handles probably the heaviest suburban traffic in the world, has just purchased from the Westinghouse Electric & Manufacturing Company forty motor-car equipments, twenty trail-car equipments and four baggage-mail-car equipments. The baggage cars will be equipped with Westinghouse type 308 D-7 field control motors and Westinghouse electropneumatic control. In order to take care of the increase in power demand when this new equipment is put into service, it has been necessary to increase the substation capacity of the railroad, and an order has been placed, also with the Westinghouse company, for one 4,000-kw. and one 3,000-kw., six-phase, 25-cycle, 650-volt converter with the necessary transformers. The entire order amounts to over half a million dollars.

### Allis-Chalmers Net Profits in 1922 Were $2,208,549

The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., manufacturer of electrical machinery, in an earnings statement for the fourth quarter of 1922, shows a net profit of $479,985.70. Sales billed amounted to $5,863,654.23. Detailed figures for the last three months of the year follow:

| | Sales Billed | Net Profit |
|---|---|---|
| October | $1,858,424.23 | $160,309.42 |
| November | 1,823,878.58 | 162,389.24 |
| December | 2,181,351.42 | 157,287.04 |
| | $5,863,654.23 | $479,985.70 |

In closing for the year 1922 there has been transferred to earnings an amount of $524,619.13, representing balance of reserves set aside in prior periods on certain contract guarantees which have since expired. These reserves are therefore now definite earnings, as is likewise $175,000 received in part settlement of a foreign contract.

The billing and net profit for the four quarters of 1922 follow:

| | Sales Billed | Net Profit |
|---|---|---|
| First quarter | $4,671,602.78 | $278,733.30 |
| Second quarter | 4,778,863.42 | 299,796.04 |
| Third quarter | 5,479,925.26 | 450,415.00 |
| Fourth quarter | 5,863,654.23 | 479,985.70 |
| Add for reserves transferred to earnings as explained above | ............ | 699,619.13 |
| | $20,794,045.69 | $2,208,549.17 |

### Reorganize Washing Machine Firm

Announcement is made that the Holland Manufacturing Company, Holland, Mich., manufacturer of electric washing machines and ironers, has been reorganized and now is known as the Holland Maid Company. The latter company has bought the land, buildings, machinery, stock and patents of the former concern, and is capitalized at $400,000.

## Foreign Trade Notes

PROPOSED RAILWAY ELECTRIFICATION IN BRAZIL.—In a message from the President of the State of São Paulo to the Congress of that state, according to *Commerce Reports*, credit to the amount of 1,297,418 milreis has been asked for the purpose of electrifying the Campos do Jordão Railway in Brazil. The railroad is a branch line, 50 miles long, extending north from Pindamonhandaba on the Central Brazil Railway. Energy to operate the road can be supplied by the São Paulo and the Rio de Janeiro electric companies. The system to be adopted will be either single-phase, 10,000 volts to 15,000 volts, or direct current at 1,200 volts to 3,000 volts.

EXTENSIONS TO THE ELECTRIC SYSTEM IN ROME, ITALY.—An appropriation of 20,569,100 lire was authorized by the Communal Council of Rome last June, according to *Commerce Reports*, for the purpose of extending the plants and system for generating and distributing electricity for the municipality of Rome. The work includes increasing the capacity of the flume at the central station of Castelmadama from a flow of 20 cu.m. to 25 cu.m. and the installation of turbo-generators at a cost of 2,500,000 lire; the erection of a 60,000-volt transmission line from Terni to Rome and a transformer station to carry the current received from the Visso station of the Alto Nera Company or from the commune's own generating station now under construction on the Nera, to cost about 12,700,000 lire; the installation of a new generator, boilers and auxiliary equipment in the central station at Montemartini, to cost 5,800,000 lire, and extension of distribution lines to furnish service to new consumers and to furnish more public lighting, at a cost of 1,500,000 lire.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Mexico (No. 5,349) for self-contained gasoline motor-operated electric plant for ranch house, to supply current for lamps and refrigerator, including gasoline engine, refrigerator and accessories.

Purchase and agency is desired in the Netherlands (No. 5,356) for high-grade electrical household appliances, especially washing machines, cookstoves, flatirons, teakettles, fans and refrigerators.

An agency is desired in South Africa (No. 5,358) for radio apparatus.

Purchase and agency is desired in Poland (No. 5,362) for wire for winding dynamos and apparatus for measuring electric current.

Purchase and agency is desired in Scotland (No. 5,363) for electric lamps for home and for motor cars, electric air pumps for automobiles, electric plants for home use, and wireless apparatus.

Purchase is desired in Mexico (No. 5,382) for one oil-engine generator set, 10 kw. to 12 kw., to operate on fuel oil.

An agency is desired in Norway (No. 5,402) for electrolytic copper of the usual size.

## New Apparatus and Publications

UNDERFEED STOKER.—The Sanford Riley Stoker Company, Worcester, Mass., has issued publication No. 61, describing the Jones "A-C" automatic underfeed cleaning stoker.

ELECTRIC REFRIGERATING MACHINE.—The Koldak Company, Springfield, Mass., is distributing a booklet in which it describes the new "Koldak" household electric refrigerating machine. This machine can be applied to any existing ice box.

ELECTRIC IRONER.—An electric ironer, "Du-All," has been put on the market by the Horton Manufacturing Company, Fort Wayne, Ind.

AUTOMATIC MIXER.—An improved-style mixer with the motor placed in the base has been developed by the Arnold Electric Company, Racine, Wis.

VACUUM SWEEPER.—An electric vacuum sweeper has recently been placed on the market by the Hamilton Beach Manufacturing Company, Inc., Racine, Wis.

ELECTRIC CLOTHES WASHER.—A vacuum-cup-type electric clothes washer has been developed by the Horton Manufacturing Company, Fort Wayne, Ind.

ELECTRIC DISHWASHER.—The Family Dishwasher Company, Black Earth, Wis., has placed on the market an electric dishwasher.

PUMPING COMPRESSOR.—A direct pumping compressor designed especially for gasoline filling stations has been placed on the market by the Kellogg Manufacturing Company, Rochester, N. Y.

BUFFING AND POLISHING MACHINE.—A direct-driven buffing machine equipped with roller bearings has been developed by the Cleveland Armature Works, Inc., 4,732 St. Clair Avenue, Cleveland.

SMALL TURBINE-GENERATOR SET.—The Moon Manufacturing Company, 108 North Jefferson Street, Chicago, has placed on the market a small turbine-generator set of 1½ kw. capacity.

ELECTRIC HEATER AND COOKER.—The Rogers Electric Laboratories Company, 2,015 East Sixty-fifth Street, Cleveland, has placed on the market an electric heater and cooker.

GENERATOR SET.—The Climax Engineering Company, Clinton, Iowa, has brought out a generator set consisting of a continuous-current generator directly connected to a four-cylinder gas engine, which is manufactured in sizes ranging from 15 kw. to 50 kw.

BATTERY CONTAINER.—A one-piece battery container made of an impregnated fiber composition has been placed on the market by the Ahlbell Battery Container Corporation, Waukegan, Ill.

BURGLAR-ALARM SYSTEM.—An improved burglar-alarm system has been developed by the Metropolitan Electric Protective Company, 233 Seventh Avenue, New York City.

AUTOMATIC TIME SWITCH.—An automatic time switch with an eight-day movement, designed particularly for furnishing artificial daylight in henhouses, has been developed by the A-A Manufacturing Company, 128 East Twenty-third Street, New York City.

ELECTRIC LAMPS.—The Localized Lighting Corporation of Ameleco, 540 West Fifty-eighth Street, New York City, has developed a typewriter lamp which can be attached to the back of the typewriter frame and which closes with the desk. The company has also brought out a lamp, "Han-D-Lite," which can be attached to the bed, chair or other places for concentrating the light directly on any special object.

DISHWASHER.—An electric dishwasher for the drainboard of the kitchen sink has been developed by the Milwaukee Dishwasher Company, Inc., Milwaukee.

COUNTERFEIT DETECTOR.—The Teller Manufacturing Company, 149 Broadway, New York City, has placed on the market a new electrical device, "The Teller," for the detection of counterfeit money and altered paper.

## New Incorporations

THE DORSET (VT.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of $10,000 by Edwin Lefebvre, Ernest West, William M. Batchelder and H. N. Williams, all of Dorset.

THE CYR ELECTRIC COMPANY, Van Buren, Me., has been incorporated with a capital stock of $10,000 to generate and distribute electricity in Cyr and Hammond plantations. The officers are: Elzear Papointe, president; Napoleon Papierre, treasurer, and O'Neil Lapierre, clerk.

THE ELEZABETHTOWN (ILL.) POWER & LIGHT COMPANY has been incorporated with a capital stock of $20,000 by George W. Ledbetter, Elisha L. Robinson, Earl T. Galloway and Earl C. Gaines, Jr.

THE PEOPLE'S ELECTRIC SERVICE COMPANY, Elkader, Iowa, has been incorporated with a capital stock of $750,000 to take over the property of the Turkey River Power Company. The officers are: F. H. Schmidt, president; William Allyn, vice-president; William C. Reimer, secretary and treasurer, and E. S. Gage, manager.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

PORTLAND, ME.—Electric traveling cranes and other electric equipment will be installed at the proposed new freight terminal of the Portland Terminal Company, to cost about $1,500,000.

CLAREMONT, N. H.—At the March town meeting the proposal to install a new lighting system in the business district will be submitted to the voters. The cost is estimated at about $25,000.

BELLOWS FALLS, VT.—The installation of an ornamental lighting system in the business district, to cost about $10,000, has been authorized.

SPRINGFIELD, MASS.—Electric power equipment will be installed at the plant of the Eastern States Refrigerating Company, Bridge Street, in connection with additions and improvements, to cost about $200,000.

PITTSFIELD, MASS.—The Pittsfield Electric Company has secured permission to issue $125,000 in capital stock, the proceeds to be used for extensions and improvements.

HARTFORD, CONN.—The Standard Mattress Company, 71 North Street, plans to erect an addition to its power house.

## Middle Atlantic States

ROCHESTER, N. Y.—The Rochester Gas & Electric Corporation has petitioned the Public Service Commission for approval of franchises issued by the towns of Victor, Mendon, Henrietta and Bloomfield and the villages of Holcombe and East Bloomfield granting the company permission to extend its electric lines to furnish electricity in those places. If the petitions are granted, the company plans to erect 12 miles of line in Henrietta and 8 miles in Holcombe and East Bloomfield. Contracts have already been drawn up for street-lighting systems in both towns.

SYRACUSE, N. Y.—Work will begin as soon as the weather permits on the construction of a new power house for the Crouse-Irving Hospital, to cost about $40,000. Dr. W. L. Wallace is the head of the institution.

BERKELEY HEIGHTS, N. J.—Electric power equipment will be installed at the local cold-storage insulation manufacturing plant of the J. H. Stone Corporation, in connection with rebuilding the portion recently destroyed by fire. The loss is estimated at $150,000.

ROOSEVELT, N. J.—Electric power equipment will be installed at the local plant of the Armour Fertilizer Works, 209 West Jackson Boulevard, Chicago, in connection with rebuilding of the portion recently destroyed by fire with loss estimated at $75,000.

BERNVILLE, PA.—The property of the Bernville Electric Light, Heat & Power Company has been purchased by Shower Brothers. The new owners, it is understood, will make extensive improvements to the system.

HOLTWOOD, PA.—Investigations, it is reported, are being made by the Pennsylvania Water & Power Company in connection with the construction of two additional hydro-electric generating units. The cost is estimated at $750,000.

INDIANA, PA.—E. G. House, operating the coal properties of the Manufacturers' Coal Company, Yellow Creek section, is planning to install electric power and mechanical equipment.

KEPLERS, PA.—The Binney & Smith Company, 41 East Forty-second Street, New York, is taking bids for the installation of a power house at its local plant. Lockwood, Greene & Company, 101 Park Avenue, New York, are engineers.

NANTICOKE, PA.—The Susquehanna Collieries Company, Commercial Trust Building, Philadelphia, will install electric power equipment in connection with the rebuilding of its local coal breaker, recently destroyed by fire, causing a loss of about $750,000.

FAYETTEVILLE, PA.—The plant of the Fayetteville Electric Light & Power Company has been purchased by the Potomac Public Service Company, Hagerstown, Md. The new owner will take possession June 1.

PITTSBURGH, PA.—The Duquesne Light Company has secured permission to acquire the following companies: Avalo Light, Ben Avon Light, Robinson Township Light, Neville Township Light, Emsworth Township Light, Stowe Township Light, Bellevue Light, Kennedy Township Light, Kilbuck Township Light, Haysville Light, Glenfield Light and Coraopolis Light companies. Extensions and improvements will be made to the systems.

PHILADELPHIA, PA.—Bids will be received by the United States Engineer Office, 815 Witherspoon Building, until Feb. 23 for one Diesel engine, with accessories and spare parts.

PHILADELPHIA, PA.—The Philadelphia Suburban Gas & Electric Company, West Washington Square, has issued $650,000 in bonds, part of the proceeds to be used for extensions in the Cromby electric plant, to increase the capacity from 10,000 kw. to 20,000 kw.

ANNAPOLIS, MD.—The Annapolis Public Utilities Company has been granted permission to change its name to the Severn Light & Power Company and extend its plants and system. Bonds for $700,000 will be issued, part of the proceeds to be used for the acquisition of plants at Laurel and Bowie and for additions and improvements to same.

BALTIMORE, MD.—The Baltimore & Ohio Railroad Company will install electric power equipment at its proposed grain elevator in the Locust Point section, to cost $4,000,000.

CUMBERLAND, MD.—The American Water Works & Electric Company has secured permission to acquire the Cumberland Edison Power Company. Extensions will be made to the plant and system.

ELKTON, MD.—The Susquehanna Power Company is preparing plans for the construction of a hydro-electric power plant at Conowingo, on the Susquehanna River, to cost about $600,000.

HAGERSTOWN, MD.—The Pennsylvania Railroad Company will electrify its local engine terminals.

BECKLEY, W. VA.—The installation of an ornamental lighting system on Main Street is under consideration. W. L. Foster is manager of the Beckley Electric Light & Power Company.

HUNTINGTON, W. VA.—The Mountain State Coal & Gas Syndicate, recently formed with a capital of $2,000,000, will install electric power and mechanical equipment at its local properties. Thomas W. Jones, Middleport, Ohio, is president.

RAINELLE, W. VA.—The East Rainelle Light & Power Company will build a transmission line from Rainelle to East Rainelle, to cost about $15,000.

FREDERICKSBURG, VA.—The Spottsylvania Power Company is planning to construct an auxiliary generating plant with initial capacity of 1,000 hp., using Diesel engines.

NORFOLK, VA.—Plans are being considered for replacing the present arch lamps on Granby, Main and Church Streets with pedestal lamps.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Feb. 27 for 4,200 ft. electric wire for the Mare Island Navy Yard (Schedule 465); for 1,000 ft. single conductor lighting and power wire for the Philadelphia Navy Yard (Schedule 487); also until Feb. 20 for 1,600 ft. of rubber-covered cable for the Hampton Roads Navy Yard (Schedule 182).

## North Central States

BAD AXE, MICH.—The Great Lakes Power Company plans to erect a transmission system to cover 175 miles, to cost about $500,000. Power will be furnished by the Marysville plant of the Detroit Edison Company.

BYRON CENTER, MICH.—The Wyoming Light & Power Company contemplates extending its service to Byron Center during 1923, provided that a right-of-way for a transmission line can be obtained between Byron Center and Wyoming Park.

ISHPEMING, MICH.—The Michigan Gas & Electric Company it is reported, will soon ask for bids for equipment for its proposed hydro-electric plant to be erected on the St. Joe River, near Mottville, to cost about $400,000. Holland, Ackerman & Holland, 53 West Jackson Boulevard, Chicago, are engineers.

AKRON, OHIO.—The Northern Ohio Traction & Light Company is planning to erect two new substations, one at Akron and the other in Ravenna.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until March 2 for substation switching equipment.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until Feb. 23 for one steam-jet ash conveyor and one 40-ton ash storage tank at the City Hospital.

CHICAGO, ILL.—The South Side Laundry Company, 2820 South Wabash Avenue, will build a power plant at its works, to cost $75,000. Ronnenberg, Pierce & Hauber, 10 South La Salle Street, are architects.

FORRESTON, ILL.—The Illinois Central Railroad Company, 135 East Eleventh Place, Chicago, has completed plans for the construction of a local power plant, to cost about $80,000.

OTTAWA, ILL.—The National Plate Glass Company, General Motors Building, Detroit, will build a power house in connection with proposed extension to its local plant, known as the Federal Plate Glass Company, to cost about $5,000,000.

PEORIA, ILL.—The Central Illinois Light Company is preparing plans for an electric power plant, to cost about $2,000,000.

GREEN BAY, WIS.—The Wisconsin Public Service Corporation, which is building an 8,000-hp. hydro-electric plant at High Falls, near Pound, it is stated, will begin work about April 1 on a hydro-electric development of the same capacity at Cauldron Falls, 10 miles north of the High Falls plant.

LA CROSSE, WIS.—Plans are being prepared by O. A. Merman, architect, Linker Building, for a power house, to cost about $125,000, and also for a nurses' home for the Lutheran Hospital.

LA POINTE, WIS.—Steps have been taken to organize a company, to be capitalized at $10,000, for the purpose of furnishing electricity for lamps and motors in La Pointe and nearby places. One of the first extensions contemplated is to supply electric service to Madelaine Island. Electricity will be purchased from a power plant for which plans are under way.

LUCK, WIS.—The Railroad Commission has granted the Luck Light & Power Company permission to issue $15,000 in capital stock, the proceeds to be used to purchase the local electric plant and system, owned by Anton K. Pederson, and for extensions to same.

MILWAUKEE, WIS.—The Pittsburgh Plate Glass Company has engaged Cahill & Douglas, consulting engineers, 217 West Water Street, Milwaukee, to prepare plans for a steam-driven electric generating plant, to cost about $135,000, for the Patton-Pitcairn division of the company. The equipment will include generators, engines, boilers, automatic stokers, fuel and ash-handling equipment, etc.

OCONTO, WIS.—The Northeastern Power Company, recently organized, has applied to the Railroad Commission for permission to issue $120,000 in capital stock for the purpose of acquiring the properties of the Oconto Service Company and the Peshtigo (Wis.) Electric Company.

OWEN, WIS.—Bids will be received by C. L. Johnson, village clerk, until Feb. 21 for an ornamental street-lighting system, to include 30 lamps, in connection with street paving. The Universal Engineering Company, Eau Claire, is engineer.

SUPERIOR, WIS.—At an election to be held April 3 the proposal to purchase the electric plant of the Superior Water, Light & Power Company, to be owned and operated by the municipality, will be submitted to the voters.

VIRGINIA, MINN.—The Water and Light Commission has applied to the Council for authority to issue certificates of indebtedness to the amount of $125,000 for the purpose of installing additional boilers in the water and light plant.

HIBBING, MINN.—The Oliver Iron Mining Company, Duluth, will install electric power equipment in connection with its proposed local screening and crushing plant, to cost about $600,000.

DES MOINES, IOWA.—A two-story heating plant, power house and laundry, to cost about $100,000, will be erected at the Methodist Hospital this year.

LE MARS, IOWA.—The Board of County Supervisors has granted the Iowa Light, Heat & Power Company permission to erect a transmission line from the town of Le Mars to Merrill.

SIOUX CITY, IOWA.—Tentative plans are under consideration by the Sioux City Gas & Electric Company for the construction of a new power plant, to cost between $2,000,000 and $2,500,000.

HOLDEN, MO.—Electrically operated pumping machinery will be installed in connection with improvements to the municipal waterworks system, to cost about $80,000. The Benham Engineering Company, Gumbel Building, Kansas City, Mo., is engineer.

POPLAR BLUFF, MO.—Electric power equipment will be installed in the proposed new ice-manufacturing plant, to have a capacity of 100 tons daily. F. A. Bacon is president.

SHERIDAN, MO.—The Maryville (Mo.) Electric Light & Power Company is planning to extend its transmission line from Parnell to Sheridan to furnish electrical service here.

BEATRICE, NEB.—The Black Brothers Company will build a hydro-electric power plant in the Blue Springs section for flour-mill and other industrial service, to cost $100,000.

PLATTSMOUTH, NEB.—Bids will be received by A. H. Duxbury, city clerk, for installation of an ornamental street-lighting system, to include seventy-one electroliers. Bruce & Grupe, Finance Building, Omaha, are engineers.

DIGHTON, KAN.—The City Council is considering the question of erecting a transmission line to connect with the municipal electric plant at Scott City to secure electricity to operate the local system.

PARSONS, KAN.—The Kansas Gas & Electric Company, Wichita, has started work on the erection of a power plant on the Neosho River, 10 miles from Parsons.

## Southern States

AHOSKIE, N. C.—The Town Council has contracted with a number of towns to supply electricity from the municipal electric light plant. The towns that are to secure the service will erect the transmission lines to the local plant.

MOUNT AIRY, N. C.—The North Carolina Granite Company is making inquiries for an engine-generator set of about 100 kw. capacity.

WADESBORO, N. C.—Plans for the new textile mill to be erected by L. D. Robinson, at a cost of $400,000, provide for a power plant.

BELTON, S. C.—The installation of an ornamental lighting system is under consideration.

GREER, S. C.—Plans are under way for extensions in the municipal electric plant to cost $10,000.

ATLANTA, GA.—The Southern Bell Telephone Company plans extensive improvements to its local system during 1923, to cost about $1,277,000, the larger portion of which will be used for laying underground and aërial cables to care for several thousand new applications for service.

DAVISBORO, GA.—The W. G. Warthen Produce Company will install a power house in connection with proposed plant extensions.

MILLTOWN, GA.—Steps have been taken to organize a company to be known as the Lanier County Power Company. The company will be capitalized at $300,000 and proposes to build a power plant at the foot of Lake Irma in Milltown. The cost is estimated at about $200,000. F. E. Hatch is interested in the company.

MIAMI, FLA.—The installation of an ornamental lighting system on Southeast Second Street and Southeast Second Avenue is under consideration.

JACKSONVILLE, FLA.—The City Council has passed an ordinance for extensions to the municipal electric plant, to cost $850,000. The ordinance provides for an expenditure of $250,000 in 1924, 1925 and 1926. Bids, it is understood, will soon be asked for. At present funds to the amount of $100,000 are available for the work.

CHATTANOOGA, TENN.—The Dixie Portland Cement Company will install electric power equipment at its plant in connection with additions to cost about $200,000.

JONESBORO, TENN.—Repairs will be made to the local substation of the Tennessee Eastern Electric Company recently damaged by fire. The loss is estimated at about $25,000.

NASHVILLE, TENN.—Bids will be received at the United States Engineer's office, Nashville, Tenn., until March 6 for one electric towboat.

ALICEVILLE, ALA.—The Pickens County Light & Power Company, recently organized, plans to install a power plant and system for local commercial service. J. V. Park is president.

EAST BIRMINGHAM, ALA.—The George C. Brown Company, Huntsville, Ala., plans to install a power house at its proposed local veneer plant, to cost about $100,000.

GLENDALE, ALA. — J. J. Harrison & Company, Florala, Ala., plan to install a street-lighting system in connection with the development of a 600-acre tract of land.

MONROEVILLE, ALA.—Extensions will be made in the municipal electric power plant, including the installation of new equipment.

GULFPORT, MISS.—The installation of an ornamental lighting system, covering twelve blocks, is under consideration by the city commissioner.

GULFPORT, MISS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 26 for the installation of electric lighting systems for each building; power and telephone conduits; outside electric distributing systems, including transformers, panelboards, fixtures, conduits, fiber conduits and wiring, at the United States Veterans' Hospital, Gulfport. (Specification No. 4,771, part IV.)

OKMULGEE, OKLA.—Electrically operated pumping machinery will be installed in connection with extensions and improvements to the municipal waterworks system, to cost about $150,000. T. J. Embree, Okmulgee, is engineer.

PONCA CITY, OKLA. — The Marland Refining Company will install electric power equipment at its local oil refinery in connection with proposed extensions.

TONKAWA, OKLA. — The Comar Oil Company will install electric power equipment at its proposed local refining plant, to cost about $150,000.

PORT ARTHUR, TEX.—A power house will be erected by the Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, in connection with its proposed new oil refining plant, to cost about $500,000.

SAN ANTONIO, TEX.—C. H. Alexander, 612 Houston Building, and associates plan to install a hydro-electric power plant. Inquiries are being made for waterwheels, generators, etc.

TAYLOR, TEX.—Plans are being prepared for the installation of an ornamental lighting system in the business section.

TEXAS CITY, TEX.—The Texas Refining Company, recently organized, will install a power house in connection with its proposed local refinery, to cost about $1,500,000. Alexander Smith, of Peabody, Houghteling & Company, 366 Madison Avenue, New York, bankers, is president.

SNYDER, TEX. — The Snyder Utilities Company contemplates additions and improvements to its power plant and system, to cost about $50,000.

## Pacific and Mountain States

BATTLEGROUND, WASH.—The Clarke County Light & Power Company plans to install a power plant and system for local commercial service.

HOQUIAM, WASH.—The Grindle Canning Company contemplates the installation of a one-story power house at its plant.

SPOKANE, WASH. — The Washington Water Power Company is planning extensions to its hydro-electric plant at Long Lake to increase the output by 22,500 kw., at a cost of about $250,000.

WALTERVILLE, ORE.—Extensions and improvements to the municipal electric light plant are under consideration by the Water Board. Cary A. McClair is manager.

IGO, CAL. — The California Bimetallic Company, operating local silver mines, will build a transmission line for electric service at its plant, to cost about $30,000.

OAKLAND, CAL.—The Neilson Packing Company will install electric power equipment at its proposed fruit-packing and refrigerating plant on Ninety-ninth Avenue, to cost about $300,000.

SANTA BARBARA, CAL.—The Southern California Edison Company will build a steel-tower transmission line in the Montecito section, 22 miles, to cost $200,000. Improvements will be made in the distributing system at Hanford, to cost $60,000.

SUSANVILLE, CAL.—The construction of an electrically operated railroad, 15 miles long, in the Eagle Lake section, for the purpose of hauling logs to sawmill, is under consideration by the Fruit Growers' Supply Company, First National Bank Building, San Francisco. Electricity to operate the proposed railway would be obtained from the local plant of the Lassen Electric Company.

ADAIR, IDAHO. — Extensions will be made to the power plant of the Montana-Idaho Power Company, to cost about $20,000. The output will be increased from 90 hp. to 250 hp.

NOGALES, ARIZ.—The Southern Arizona Power Company has been organized to take over and merge the Nogales Electric Light & Power Company and the Arizona Gas & Power Company. Extensions will be made in power plants and transmission systems.

DILLON, MONT.—The Union Electric Company has contracted with the Beaverhead Transmission Company for power supply. A 66,000-volt transmission line will be erected.

ALAMOSA, COL. — Work will soon be started on improvements to the local plant of the Colorado Power Company. New equipment, including a 750-kw. turbo-generator, new condenser and automatic stokers, will be installed.

DENVER, COL.—The United States District Court has ordered Ernest Stenger, receiver of the Denver Tramway Company, to purchase machinery and equipment for the main power plant of the company, the cost not to exceed $215,000.

MANITOU, COL.—The installation of an ornamental lighting system is under consideration by the Board of Trustees.

## Canada

COBALT, ONT.—Work will be started early in the spring by the Canadian Associated Goldfields on completing the development of its Windego Falls power scheme on the Blanche River, south of the Kirkfield field.

HAMILTON, ONT. — Surveys are being made by the Dominion & Power Transmission for a 5-mile, single-track electric railway from Hamilton to McKittrick Survey.

TORONTO, ONT.—The property committee has instructed Commissioner Chisholm to submit a report and estimate of cost of installing gooseneck standards mounted with nitrogen lamps on all main thoroughfares.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued Jan. 30, 1923)

1,443,439. Process and Apparatus for Introducing Electric Energy Into a Space of Action; G. T. Southgate, Washington, D. C. App. filed March 8, 1922. Electric furnace in which material acts as electrode.

1,443,451. Measured-Service Telephone System; A. Anderson, Chicago, Ill. App. filed Dec. 30, 1913. Automatically indicates elapse of talking time on automatic system.

1,443,469. Rheostat; J. Guthrie, Elyria, and J. W. Simmons, Cleveland, Ohio. App. filed Aug. 4, 1922. Carbon-pile resistance for vacuum-tube filament control.

1,443,494. Telephone Automatic Trunking Apparatus; T. G. Martin, Chicago, Ill. App. filed Jan. 17, 1907. Automatic trunk-selecting switch.

1,443,499. Brush Rigging; H. S. Pardee, Chicago, Ill. App. filed April 22, 1920. Single frame holds two sets of brushes 180 electrical degrees apart.

1,443,580. Electric Furnace; G. M. Little, Pittsburgh, Pa. App. filed March 23, 1921. Maintaining temperature of 2,500 deg. C. in resistor furnace.

1,443,581. Electric Resistance Tubular Furnace; G. M. Little, Pittsburgh, Pa. App. filed March 23, 1921. Employed to give green resistance rods initial baking.

1,443,583. Electrical Protective Device; P. MacGahan, Pittsburgh, Pa. App. filed March 13, 1918. Overload-protection relay.

1,443,590. Method of Supporting Resistor Mounting Plates; T. A. Reid, Pittsburgh, Pa. App. filed March 30, 1921. Electric resistance furnaces.

1,443,604. Jack Switch; E. E. Yaxley, Chicago, Ill. App. filed Oct. 16, 1922. Telephone cord jack.

1,443,613. Detective and Protective Device for Electric Cables; C. J. Beaver, Hale, A. F. W. Richards, Brooklands, and E. A. Claremont, High Legh, England. App. filed Oct. 30, 1919. Metal shielding between conductors provided at joints.

1,443,620. Telephone Transmitter; R. A. Engler, Evanston, Ill. App. filed June 23, 1919. Transmitter can be used in both wired and wireless telephony.

1,443,644. Rotary Electric Machine; K. Nobuhara, Muko-Gun, Hyogo-Ken, Japan. App. filed April 13, 1918. Cooling liquid in both stator and rotor but forced out of clearance space by gas.

1,443,645. Automatic Telephone System; W. T. Powell, Rochester, N. Y. App. filed Feb. 18, 1920. Talking connection extended through trunking switch individual to each line.

1,443,646. Automatic Telephone System; W. T. Powell, Rochester, N. Y. App. filed March 8, 1920. Conversational circuit extends only through non-numerical switches.

1,443,657. Insulator; L. Steinberger, Brooklyn, N. Y. App. filed Nov. 23, 1917. Different electrostatic capacity of successive units whereby more uniform distribution of stress is secured.

1,443,669. Electrical Connection; J. M. Andersen, Boston, Mass. App. filed April 4, 1921. Connection of apparatus to laminated busbars.

1,443,748. Lighting Fixture; W. R. Kahns and Karl Keller, Brooklyn, N. Y. App. filed March 28 1922. Portable lamp provided with shade that may be raised and adjustable sockets.

1,443,763. Circuit Maker and Breaker; G. L. Smith, Washington, D. C. App. filed May 10, 1920. Motor-vehicle signaling apparatus.

1,443,766. Control System for Electric Elevators; W. S. Smith, Cambridge, Mass. App. filed Aug. 3, 1918. Dual-control system, one automatic, the other manual.

1,443,797. Electrolytic Cell; C. W. Marsh, Greenwich Conn. App. filed Dec. 19, 1919. Construction of U and V type cells.

1,443,798. Welder's Tongs; R. Mattice, Philadelphia, Pa. App. filed July 7, 1921. Current cable fastened to handle end and passed down through center of tongs.

1,443,816. Electric Furnace; F. A. Fitzgerald, Niagara Falls, N. Y. App. filed Jan. 13, 1921. Arc type heated by radiation from single-phase arc.

1,443,873. Multiple-Roller Electric Transmission Trolley; G. Donham, Oakland, Cal. App. filed Dec. 20, 1921. Trolley collector made up of five wheels.

1,443,935. Resinous Product; L. Weisberg, Grantwood, N. J. App. filed Sept. 24, 1921. For molded insulating material.

1,443,936. Process of Making a Molding Composition; L. Weisberg, Grantwood, N. J. App. filed Sept. 24, 1921. Mixture of glycerol-polybasic acid resin and shellac.

(Issued Feb. 6, 1923)

1,443,984. Repeater Apparatus for Carrier Systems; L. Espenschied, Hollis, N. Y. App. filed June 19, 1919. Special high-frequency repeater operates in parallel with low-frequency repeater of communication line.

1,443,985. Signaling System; L. Espenschied, Hollis, N. Y. App. filed June 21, 1919. Simultaneous transmission and reception of radio signals by employing carrier waves of different frequency.

1,444,000. Electric Switch; H. J. Morey, Syracuse, N. Y. App. filed Oct. 4, 1918. Pull-chain lamp socket.

1,444,057. Grip Conduit for Electric Conductors; M. W. Bosley, Baltimore, Md. App. filed Jan. 20, 1921. Wooden moldings for house wiring.

1,444,084. Distributing Brush Holder for Magnetos with Two Simultaneous Sparks; P. J. R. Postel-Vinay, Paris, France. App. filed March 6, 1921.

1,444,113. Process for Plating on Non-Metallic Surfaces; E. F. Dietrich, Chicago, Ill. App. filed May 20, 1922. Metals permanently deposited on non-metallic surfaces by electroplating bath.

1,444,211. Time Recorder; T. Ross, Chicago, Ill. App. filed April 1, 1921. Driving and setting mechanisms of time recorders.

1,444,242. Spacing Appliance; A. A. Faust, Detroit, Mich. App. filed Aug. 11, 1921. Control of metal-working machines.

1,444,267. Electric Lantern; A. A. Pearson, Portland, Ore. App. filed Oct. 12, 1921. Adapted to railroad-yard work.

1,444,286. Means for Controlling and Regulating Electric Currents; T. L. Vaughn, Jr., Dunn, N. C. App. filed Nov. 30, 1921. Constant-voltage regulator for a group of lights.

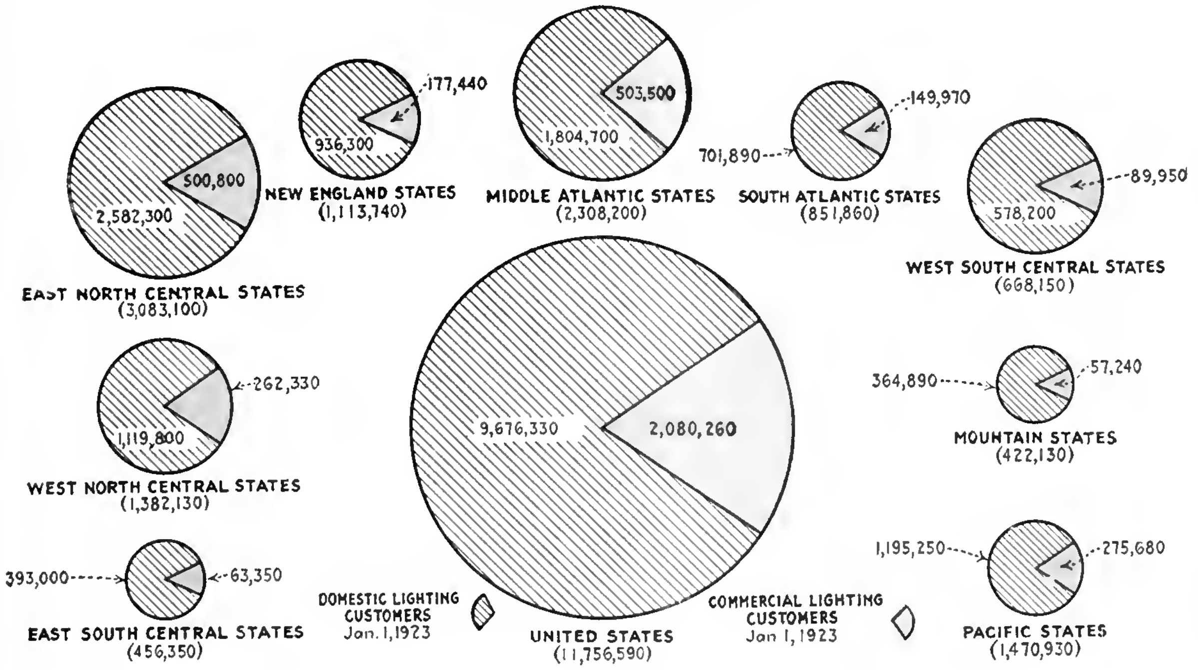
1,444,363. Brush-Holder Retainer; R. N. Baylis, Bloomfield, N. J. App. filed June 7, 1922. Pressed metal holder.

1,444,417. Multiplex System in Teledynamic Control; J. H. Hammond, Jr., Gloucester, Mass. App. filed Oct. 17, 1917. System for controlling several devices selectively from distance in response to radiant energy.

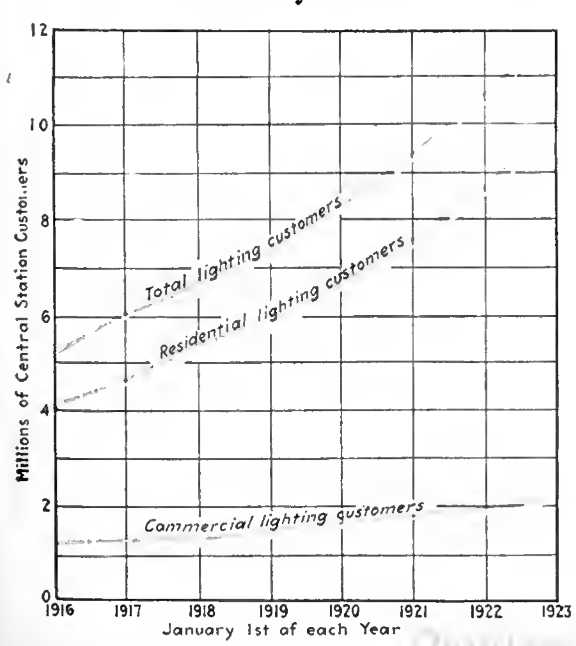
# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## Distribution of Central-Station Lighting Customers on Jan. 1, 1923—Comparison of Domestic and Commercial Lighting Customers by Sections




## Rate of Growth in Number of Lighting Customers Has Increased Year by Year

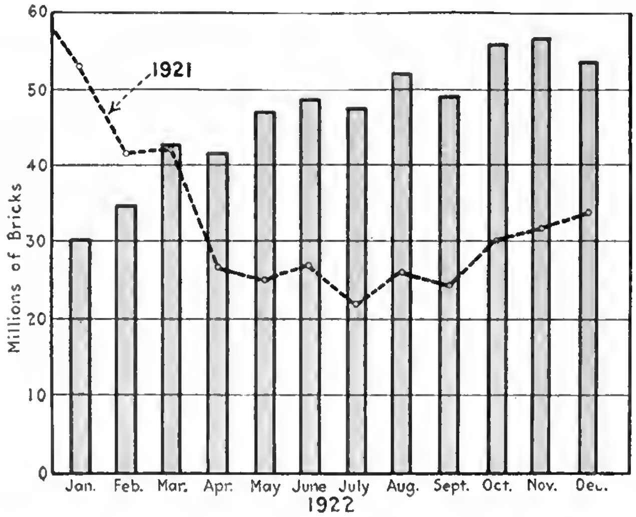



## The Significance of Growth

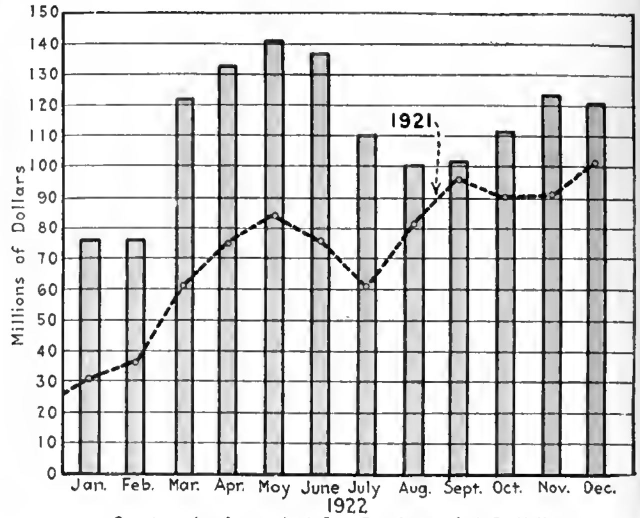
INDUSTRY grows in two ways. There is mushroom growth — an industry springs up over night as a result of some great and immediate economic need and sinks to comparatively small operations or into total oblivion after the emergency has passed. The world war brought many instances of this type of growth.

Then there is the development that is a cautious but steady advance — industry builded upon a carefully laid foundation and gradually intertwining itself into the very economic fabric of the country. Industry so buttressed will endure as long as the nation itself. And of such is the electric light and power industry. In age a mere infant among other primary industries, it has taken its place in the front rank of great enterprises and challenges all others in the service it is rendering to humanity.

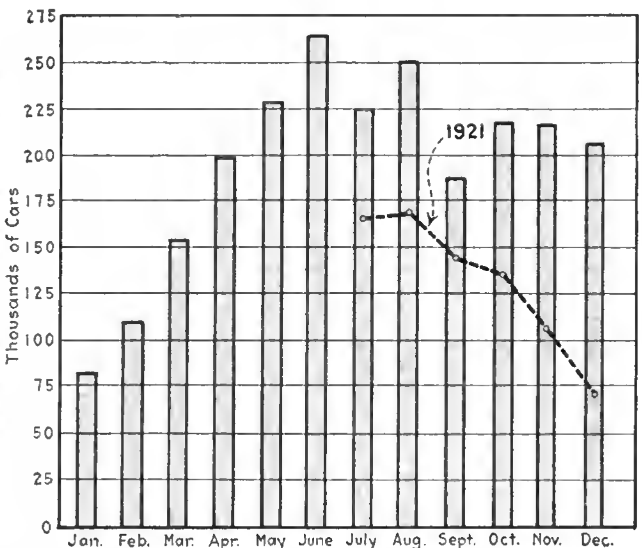
## How the Primary Industries Are Trending



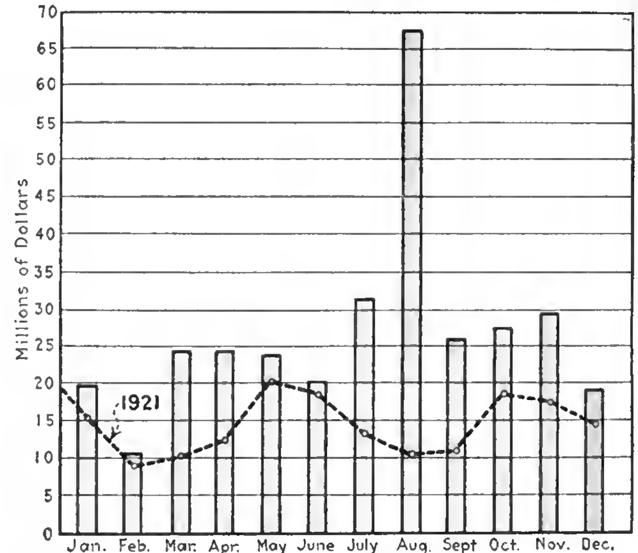

1922
Clay Fire Brick Production



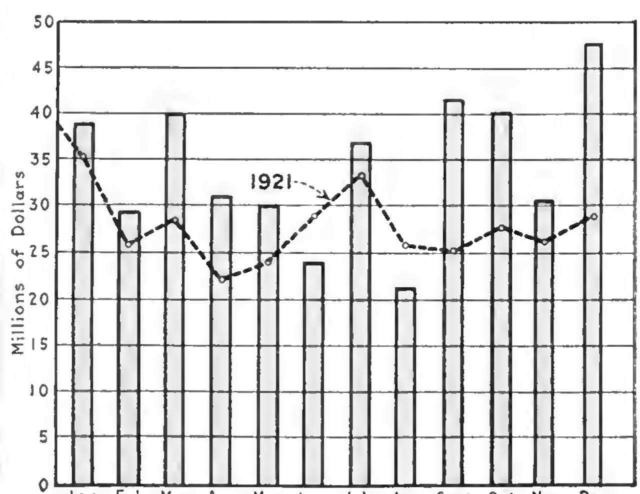

1922
Contracts Awarded for Residential Buildings




1922
Passenger Automobile Production




1922
Contracts Awarded for Industrial Buildings




1922
Fire Losses

## They All Agree

A STUDY of the prognostications of various statistical and economic bureaus on business conditions for 1923 bring out most vividly the optimism which is so prevalent in the business world today. All these students of economic trends agree that as a result of "the soundness of basic conditions and the strength of the favorable economic forces" business will continue to grow in volume at least during the first half of the year. The Harvard University Committee on Economic Research sums up the situation by the prediction of "further increase of wholesale commodity prices and continued expansion of business activity during the first half of 1923, with a strong probability that the upward swing will continue during the second half of the year."

# Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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# "Say It with Facts!"

BLESSED be the man who thinks and talks with facts! He is needed in the world today, where more time is being wasted and more money spent by doing things wrong than by not doing them at all. To the man with facts life offers greater resources, greater responsibilities and more satisfying achievements than at any period in history.

We are an impetuous generation. We like to make decisions, to set tasks and see them soon disposed of. Yet success depends on judgment, and, after all, judgment is only analysis of facts. Good facts produce good judgment. Therefore the man who gathers facts and gives them active use has knowledge and judgment superior to that of better minds that may rely on personal memory and experience. For he then has the guidance of the experience of all men.

TIME was when a man's personal observation was a pretty good guide to his work. His environment was small. His contact was limited to a few immediate influences. His work concerned himself and the few folk about him. His powers and his purposes were puny in contrast with the complex relationships of modern life. He could decide things on his own knowledge, for what he did was little to the world beyond.

But cottage industries are gone and village life is now expanded into national life, and local trade has come to be a very part of the commerce that serves all peoples and is affected by unseen conditions of far origin. Thus business has grown beyond the art and craft into a science, and when we say a science we mean that it is now founded on and sustained by facts. And there has grown up in the service of industry a great group of engineers, whose function it is to evolve, interpret, and apply these facts, by trained scientific thinking.

ANY modern industrial enterprise is like a ship at sea. The sea captain cannot look beyond the horizon, and so he uses maps of coast lines, readings of the sun, charts of winds and currents, laws of storms, his knowledge of his engines and his ship and makes decisions in accordance with these fundamental facts. The business executive ashore needs facts no less. But the situation lacks the element of personal risk, and so he and his men neglect to set a daily course by facts. They are inclined to guess and drift.

The electrical manufacturer and jobber, the central station, the contractor and dealer are all suffering today from lack of facts—facts on their cost of doing business, facts on the growth of market, facts on the value of different kinds of business, facts on competitive production, facts on distribution, facts on the relation of other primary industries to their own—all facts needed to help them serve. These facts must be sought out, compiled and made available that we may organize this mighty resource into each man's hourly work.

"Say it with facts!" It makes a good slogan. But the great need is first to get in hand more of these essential facts to think with. And for this vital contribution, industry looks to the engineer.

# George E. Quinan

*An authority on rural distribution and on safety codes governing transmission and distribution.*

ONE of the most important problems of power development in a sparsely settled country is that of rural distribution. As an authority on this subject as well as in the general field of safety codes governing transmission and distribution lines George E. Quinan, chief electrical engineer of the Puget Sound Power & Light Company, has a reputation equaled by that of few men. As chairman of various committees and a member of others in the National Electric Light Association and the Northwest Electric Light and Power Association, he has helped to direct both practices and policies along these lines.

Mr. Quinan was a graduate from the University of California with the class of 1903. Even at that time he had shown much ability as an original thinker in handling technical problems. He spent two years in general field work, in Spokane, Cœur d'Alène and on Puget Sound, helping to bring in the power from Spokane Falls which was to replace steam in the silver-lead mines of Idaho. In February, 1905, he became assistant superintendent of power with the Tacoma Railway & Power Company and the Puget Sound Electric Railway.

In 1911 he became the operating superintendent of the Seattle Electric Company's properties in Seattle. Two years later he advanced to the position of superintendent of light and power with the Puget Sound Traction, Light & Power Company, Seattle division, and two years after that he was engineer of the same organization. In July, 1919, he entered on his present duties as chief electrical engineer of the Puget Sound Power & Light Company, which controls all Washington State properties under the management of Stone & Webster.

Mr. Quinan has been a student of rates for electric service, particularly in their relation to costs. He has given considerable attention to regulatory codes relating to electrical construction, also to the inductive-co-ordination problem and the economic principles underlying the extension of service to rural communities, and is today working with others toward a solution of these problems. Among his recent interests has been the development of an alternating-current underground system of distribution in Seattle.

Mr. Quinan has had an active part in the preparation and development of accounting classifications. He was associated in the design and construction of the first plant in the West for burning pulverized coal under steam boilers. He is a fellow of the American Institute of Electrical Engineers, of which he has also served as local chairman.

# Editorial Comment

Electrical World, February 24, 1923

Volume 81

Number 8


## A Government Department Wakes Up

NOTWITHSTANDING all the work that has been done by the Illuminating Engineering Society and by others in the formulation of lighting codes, higher intensities of illumination are still the exception rather than the rule. Business people recognize the value of good lighting, and it is not uncommon to find show windows and stores well illuminated. Eight states have adopted factory lighting codes stipulating the minimum foot-candles required as a matter of safety in industrial plants, but municipal, state and national governments are slow to move. Street lighting, for instance, is far from adequate, although it is the one service that benefits every taxpayer. However, there is balm in Gilead. A ray of light has penetrated the Post Office Department and brought with it a consciousness of the economic advantages of increased illumination.

By the adoption of a standard system it was discovered that the efficiency of the postal workers was increased 4.4 per cent. It is therefore recommended that the Postmaster-General install this standard system of lighting in all post offices. If universally adopted throughout the United States postal system, the new lighting rule will effect a saving running into millions of dollars. We are not, however, so much concerned about this sudden manifestation of thrift on the part of the Post Office Department as we are about its recognition of the principles of proper illumination. Let us hope that this recognition will percolate through to other departments of the national government and on through state and municipal governments, so that the general average of civic illumination throughout the country will be heightened considerably. Certainly better illumination is sorely needed.

## Midwinter Convention of A. I. E. E. a Splendid Success

THE midwinter convention of the American Institute of Electrical Engineers has established itself as an occasion for interpreting and presenting to the electrical fraternity new discoveries and accomplishments in the theoretical aspects of electrical engineering. The convention of last week exceeded those of the past in the numbers attending, in the interest aroused by the program, in the diversity of subjects and in the number of papers presented.

Apparently there has been a rejuvenescence of interest in the theory of electricity, which can be attributed largely to the fact that the practical problems now facing the engineers in their larger engineering projects call for advanced theoretical knowledge to bring about their correct and economical solution. In many branches of the electrical industry renewed activity is noticed, and the effect of the war and the industrial depression no longer limit expansion and progress.

Conventions such as this which serve to interpret, to apply and to record technical advances in the art, and which strive to stimulate research through rendering public homage to the specialists, are valuable to the electrical industry in even greater degree than those which exist for social purposes or for discussing commercial or engineering practices. All who attended the midwinter convention must necessarily have been stimulated and keyed to a higher pitch through meeting the leading specialists in the industry and hearing them describe the technical developments in their fields.

The study of electrical phenomena, aside from its bearings on the material wants of man, affords a wonderful opportunity for masterly reasoning in applying the mind to intangibles. No other branch of science calls for keener or more intensive inductive and deductive reasoning, and no other branch so directly applies theory to practice. Notable work has been done in electrical science, but even today, as manifested in the paper by Dr. Carl Hering and the resultant discussion, there is far from general agreement as to the physical nature of electricity or magnetism. In spite of this fact, engineers and scientists have developed mathematical relations and stated fundamental laws which serve to give quantitative solutions to nearly every problem associated with the application of electricity. These accomplishments prove that the electrical engineer has a mind which recognizes and appreciates the reasoning and experimentation of specialists in the various fields, and the large attendance at the convention and close attention given the speakers give added weight to the assertion.

A feature of the convention this year was the many papers on communication. Radio and wire telephony have established new records, and the large audiences that heard the papers recounting these achievements proved that communication is no longer of interest only to a small group of specialists. The vacuum tube also showed still wider fields of application, these being brought out by the paper on the crest voltmeter and the lecture on the pallophotophone.

It was fitting that the first joint session of two bodies of engineers separated by nine hundred miles should have taken place at this convention. Chicago and New York electrical engineers discussed their problems together by the aid of telephone lines and "loud speakers," while many thousands of others, if they so desired, could also hear the program through the agency of a broadcasting station and home radio receiving sets. A new advance in the art of communication has been made, and its results on national social progress cannot be gaged. The next presidential campaign may find political leaders addressing 70 per cent of the people at one time by word of mouth and from one location, and perhaps members of this audience may question such speakers directly, independently of distance.

Metering has become a very complicated and rather

unsatisfactory field for engineers, but the papers at the convention brought out the fact that researches are under way which give promise of a simplification in mechanism and greater accuracy in measurements. Metering is a difficult field for engineers to obtain results in because it is so largely controlled by rate making—the engineers must produce meters to operate under complicated rate systems. It seems almost impossible—or at best very expensive—to construct any mechanism to take into account alike demand, off-peak conditions, kva., condition of balance, power factor and time. Much thought will be required to gain a correct solution of the problem.

In the realm of electrophysics the convention had some notable research contributions, and a great deal of interest, together with some amusement, was occasioned by the discussion between the disciples of Maxwell and their opponents. Controversial opinions may serve to bring out new quantitative facts which will advance the art.

In the matter of social features and visits and excursions to points of interest New York showed its many advantages for a winter convention. The large attendance attested the popularity of the location. On the whole, the midwinter convention just closed was the best ever held by the Institute.

### Transformers of Low Core Loss an Embarrassment

THERE has been a great deal of talk about the development of special low-core-loss transformers for use in rural electric service. Some tests made recently at the Iowa State College by Prof. Frank D. Paine indicate that transformers designed for low core loss introduce not only a low-power-factor problem that is undesirable from a system viewpoint but also a metering problem if master meters are used on such lines. The tests were made on a line operating at 2,300 volts and 25 cycles. Fifteen per cent of the energy shown by the master meter could not be accounted for. On a 1-kw. transformer tested the loss was found to be 16.5 watts, but the exciting current was 1.7 amp. on the low-voltage side, or nearly 20 per cent of the full-load current. The exciting current for the entire line was 3.2 amp. on the 2,300-volt side, and the full-load current during maximum demand was 6 amp. The power factor on the line during the day ran as low as 7 per cent. For about twenty out of twenty-four hours the power factor of the line was very low. The net result was the throwing of a large error on the master-meter readings.

The situation revealed in this case is an indication of the care needed in considering modifications of existing apparatus to meet new conditions. On the face of the proposal a transformer of low core loss seems reasonable for present rural electric service requirements and it has had some enthusiastic support. If it introduces other complications like those indicated, it may not be worth while to spend time and energy on the design of a new line which will also complicate the present transformer situation by adding another transformer to those already called standard. Both the manufacturers and the users have spent much time and energy in reducing distribution transformers to a basis that will keep the manufacturing situation within reasonable bounds. There should be a sound basis for the addition of any new types to the present list.

### How a City Gains by Better Street Lighting

ONE OF the certain benefits of better engineering is profit to all who are concerned. However pecuniary benefits may be divided, everybody wins in improved and more reliable service and in the consciousness of bettered conditions. An analysis, for example, of the effect of the improved street-lighting methods in Kansas City described in the Feb. 10 issue of the ELECTRICAL WORLD will bear out this statement. First of all, the city wins heavily in quantity and quality of lighting, especially when one reduces the situation to cost per candlepower-hour or its equivalent. This is encouraging of itself, but to it are added certain intangible assets which do not appear on any assessor's books but which must not be forgotten in the audit. A very large amount of service has been put underground, which not only greatly lessens the chance of the system being crippled by storm, but makes for a better-looking city, with a general increase of values. Not even the most hardened electrical man likes the appearance of overhead wires. They are an economic necessity in sparsely settled districts, where it is that or nothing. Abroad, under similar conditions, it is generally nothing, or its nearest approximation, paraffin. But when, as here, a decently economical underground system has been laid out overhead wires must go, with a chorus of "Good riddance!" In this case the distribution system adopted, with the constant-current transformers out of doors on the poles, makes it possible, too, to dispense with a large amount of what would otherwise be dead wire.

Aside from this gain in appearance, there is the effect in maintaining public order, which, as a result of experience, has been shown to be very important. In these days, when crimes of violence run rampant, the old adage that an arc light is as good as a policeman takes on a new significance. One rarely hears of a hold-up in the full glare of a street lamp—daylight crimes are familiar, but it is an unusual brand of thug who picks out a victim in the most conspicuous place on the street.

Good service at reasonable cost means plentiful lighting, and there are few better investments within reach of the community. And, as these recent schedules show, the investment is by no means heavy compared with the benefits conferred. In addition, in the Kansas City case, there is full provision for the taking over of the system by the city on a definitely stated basis. But, in point of fact, there is no reason to believe for a moment that the citizens want to take a chance on municipal ownership even on the very reasonable terms made possible. The contract leaves little room for dispute even in the often troublesome matter of depreciation, and, starting from the beginning of a new development, the original cost and the costs of additions are determinable.

What does the operating company gain? A better and more economically operated distribution system; a contract which, if disturbed at all, is affected only in ways known from the start, and, more than all, the confidence of the citizens that they are getting fair play and an honest accounting. Not one voter in twenty can form a clear idea of the merits of an old and often changed agreement. Here the voter can start fresh and see plainly that he is getting full value for his taxes. The sentiment of mutual fair dealing is the best security for the city and the best assurance of prosperity for

any operating company. It is feasible and profitable thus to play with the cards on the table, the only real stake being an open rivalry for the betterment of the city and prosperity of its industries, equally important in the long run for citizens and utility companies alike.

## Money Spent for a Good Cause

THE past week has witnessed scare heads in the daily press over the reports of and comments on legislative investigations in regard to expenditures by utilities necessitated in fighting vicious legislation. Particularly has this been true in California, where a special committee of the State Senate has been holding open sessions in San Francisco looking into the expenditure of money to defeat the proposed water and power act at the election last November. Virtually all of the prominent electric light and power men in that state have been called to testify before this committee, and it is a source of great gratification that they met the summons with complete frankness, although it was generally considered that they were not legally bound to appear.

Not only are they to be congratulated upon the frank presentation of the facts which they made, but also upon the firm stand they took in the matter of the use of their own money in proper ways to fight vicious legislation whenever it is threatened. This right they steadfastly insisted upon in view of the fact that the securities of more than a hundred thousand citizens of California are put in jeopardy by such attempts. Self-preservation has ever been recognized as the first law of nature, and in all things that make for or against the continued prosperity and usefulness of the electrical industry there is no exception to this law.

## Loop Distributing Circuits of Higher Voltage Needed in Some Places

THERE are some indications that the limit to the amount of power that can be distributed in a given city area from low-voltage street circuits is being reached. With greater and greater concentration of load in big buildings the problem of finding street room for either overhead or underground circuits is bound to become increasingly acute. In the past many companies have in congested districts followed the policy of leasing substation sites. Sometimes these have been basements of buildings so located that considerable areas could be served, and sometimes they were tracts of land on which structures were erected. But it is now not infrequently found difficult or impossible to lease building space, and where it can be leased the term of years is such that expenditures for substation equipment of any large capacity and provision for growth are economically impossible. The purchase price of land in such areas is on a basis that prohibits the acquirement of a large number of sites. As a matter of economic necessity it appears that a way must be found to decrease the number of circuits used for street distribution systems, the number of substation sites and the amount of substation apparatus, if any extensive development in the direction of load concentration in city areas is to take place in the future.

In one rather prominent case where a low-voltage direct-current substation layout is being revised the plans adopted were not carried into effect before new building projects in the area served created a problem that was solved only by taking the new building service from high-voltage alternating-current circuits that happened, for other reasons, to form a loop around the district. The lighting and general power service is in this case given through ordinary step-down service transformers, and the elevator service is provided with direct current through motor-generator sets. The direct-current substation rearrangement is being carried out in the district referred to because it will take years to eliminate the low-voltage distribution system, yet the plan and means for eventually supplying the whole service from high-voltage alternating-current circuits is provided and the low-voltage service will eventually be eliminated.

In another case the lack of room for overhead circuits is forcing the substitution of 13,200-volt circuits to serve industrial load that has hitherto been served at 2,300 volts. Similar instances could be cited in great number. The point is that radical changes in the method of approach to the problem of distribution in congested areas face the engineer. Nor will it pay to consider only the present problem; plans for such areas must be made with adequate consideration of probable development well into the future.

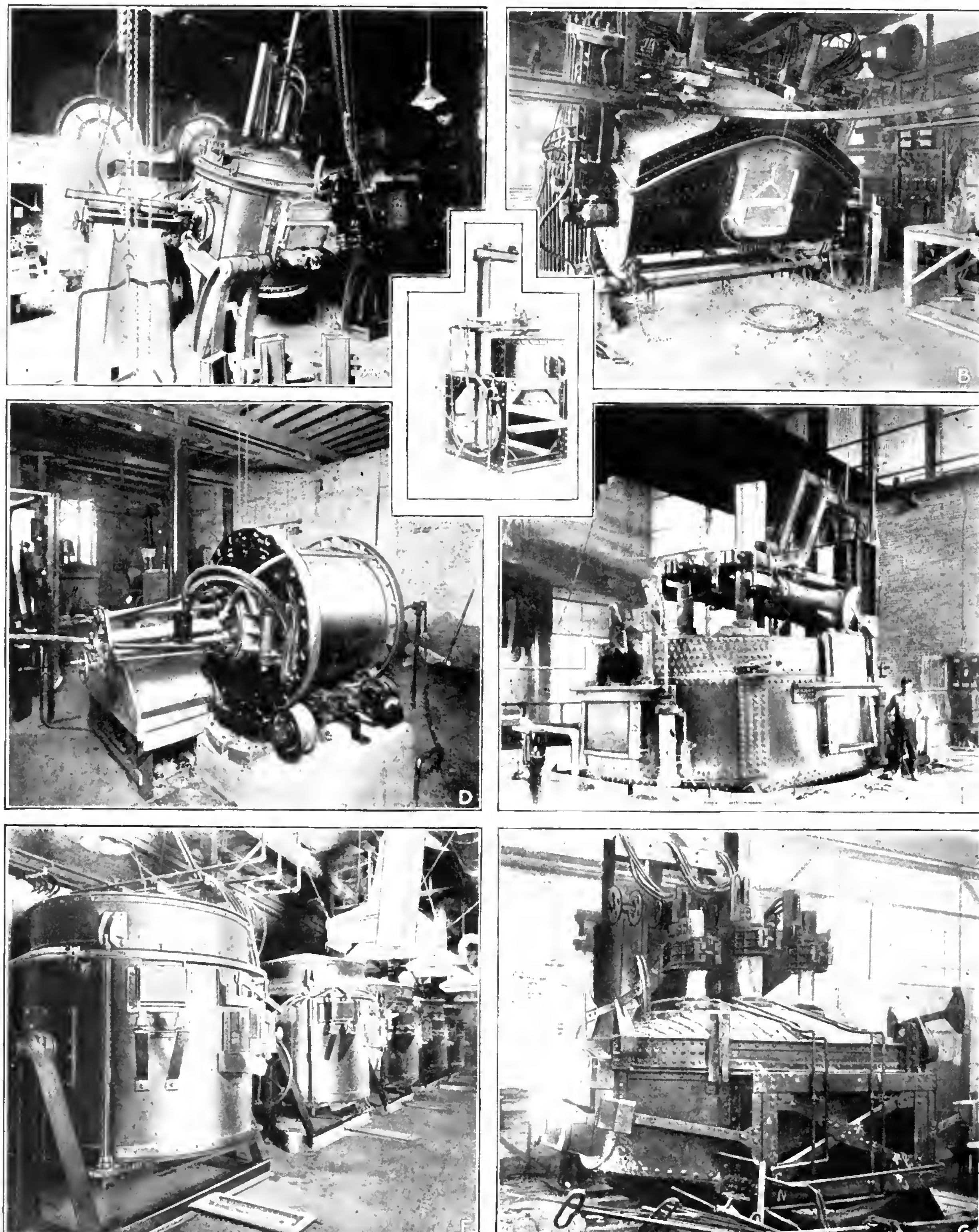
## Some Outstanding Problems of Line Insulation

JUST at present the insulation of lines for the extra-high voltages now coming along seems to develop slowly. We need higher mechanical qualities and higher dielectric strength if the future's demands are to be met. In particular we need to make more skillful use of the best materials that are available. The shielding or grading of strings of insulator disks so that the burden will be equalized is perhaps the most important step that can be taken immediately. Its usefulness has been well demonstrated, but full advantage of it has seldom been taken. It has been called "theoretical," or some similar attribute favored by the conservative as most derogatory to radicalism has been ascribed to it, although, on the other hand, it ought to be self-evident that it is unwise to load the entire burden of supervoltage on one or two elements of the string.

Apart from this feature of suspension design or disk arrangement, there should soon be advances in the strength and specific insulating qualities of the individual disks. Perhaps the most radical line of advance is toward the use of pure fused silica-quartz glass, instead of ordinary glass or even porcelain. Fused silica has, if homogeneous, very high insulation and mechanical strength, and on account of its low expansion it is remarkably free from annealing strains. Just what its best economic use may be remains to be seen —whether shorter strings should be used, or smaller disks, or composite strings with the silica bearing the heavy duty. Meanwhile there are promises of denser and more reliable porcelain which will presently play its part.

The one thing certain is that with the coming of supervoltage systems—and their tread is rather cautious —there will be need for every precaution against failure to deliver the goods, so that line building and insulation take on new importance. In such work question may well arise as to whether the several phases should not be carried on separate steel-pole lines instead of the ordinary system of towers carrying double circuits. The object to be sought is the utmost possible immunity from interruptions of service, quite irrespective of precedents, which are too often mere enemies of progress.

# Electric Furnaces Produce Quality Products




THE drastic specifications for materials, the elimination of waste in their production and the reduction in available labor for operation have given new impetus to the application of electric furnaces in melting and treating brass and steel.

Various types of furnaces are available and a great development and improvement has occurred in the control and regulating equipment so that the furnace now affords a splendid load for central stations. The photographs show several types of brass and steel furnaces. A is a Rennerfelt furnace for brass melting. B is a contact arc resistance furnace also used for brass melting, while C is a Repel-Arc type. D is a Booth rotating-type brass furnace. The Heroult furnace, E, and the Vom Baur furnace, G, are used in steel making, while F is a Bailey resistance furnace.

# Eleventh Midwinter Convention of the A. I. E. E.

### Large Attendance and Sustained Interest Mark the 1923 February Gathering—Papers Presented Recount Technical Advance Along Various Lines

THE eleventh midwinter convention of the American Institute of Electrical Engineers was, judging from the attendance and the spirit evinced in the meetings, one of the most successful ever held. The official registration was nearly 1,150, and many more attended the meetings, the smoker and the annual dinner-dance.

Altogether, six technical sessions were held, one Wednesday afternoon, two (parallel sessions) Thursday morning, one Thursday afternoon and one each on Friday morning and afternoon. A joint two-city, radio-broadcasted meeting was held Wednesday evening, as reported in these columns last week. A well-attended smoker was given Thursday evening, with the New York Section members as hosts. In addition to the entertainment features on this occasion C. A. Hoxie of the General Electric Company described and demonstrated the "pallophotophone," an arrangement for oscillographic record of speech, music or other sound to be transmitted later electrically by light-sensitive cells to various loud-speaking devices, radio transmitters or other instruments. The application of this pallophotophone to motion picture films was pointed out, the result being the "talking movie." The great advantage of the pallophotophone is the purity of record and voice reproduction, none of the inherent characteristics of microphones or wax records and other mechanical contrivances being involved. The pallophotophone works on the principle of recording on a moving film light beams from an extremely small mirror, mounted to follow the motions of a diaphragm on which the sound falls. This film is later passed in front of another light beam so as to affect the light falling on a "light-sensitive" cell, which in turn varies the current to correspond with the original voice waves. Audion tubes and other already familiar devices do the rest.

The dinner-dance on Friday night, which closed the convention, was the best attended in the history of this annual function, there being nearly six hundred guests.

In the following pages an extended report of the meetings is given, including abstracts of papers presented (most of which have already appeared, or will appear very soon in the Institute's *Journal*) and the discussions thereon.

## Wednesday's Session Devoted to Progress in Transmission and Distribution

The report of the cable research committee, which constituted the major part of the report of the transmission and distribution committee (E. B. Meyer chairman), was presented by D. W. Roper. He referred to the marked reduction in dielectric loss in cables, improvement in dielectric strength, reduction in thickness and increase of insulation resistance. It is now possible to get lead-covered cable with impregnated paper insulation and with a dielectric loss so low that the limiting temperature is that which will cause permanent deterioration of the insulation. To operate underground cables at the temperature specified by the A. I. E. E. rules, it would be necessary to operate them at such a very low current density that it would be uneconomical. Higher current densities would require operating the cables at temperatures considerably higher than those permitted by the Institute rules. However, this is being done already without signs of deterioration.

In the past there has apparently been considerable confusion between troubles caused by dielectric losses and troubles caused by dielectric stresses. Cable failures due to dielectric stresses are quite rare. Engineers are not in accord as to the maximum permissible dielectric stress nor as to which dielectric stress is the limiting feature in high-tension cable design and operation. They can, however, be guided by the stresses that exist in cables that have been in successful operation for a number of years.

From a comparison of insulation thicknesses on American and foreign cables it may be noted that the ordinary English practice is appreciably below the minimum recommended by any American manufacturer, and also that the recent thickness adopted by one English company for a 20,000-volt cable is 25 per cent below the previous practice and about 30 per cent below ordinary American practice. In Italy the high-voltage cables apparently have about the same thickness of insulation as is used in this country.

According to the best information obtainable, the English operating companies carry about the same load on various sizes of three-conductor cables as is customary in this country, but because of the improved facilities for radiating heat the maximum operating temperature of copper is about 50 deg. C. If cable bells are not to be the weak feature, they should be able to withstand as high overpotential stressing as the cable. If it is impossible to go materially above 200 kv. in a three-conductor cable bell, then a limit may be placed on three-conductor cables at about 40 kv.

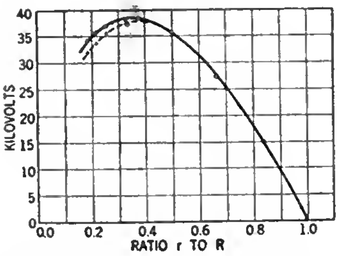
Leading American manufacturers have gradually changed from vegetable oil impregnating compounds to those with mineral-oil bases, and practically all are now using the vacuum process of drying and impregnating. One foreign manufacturer is using a thin transformer oil, but the lowest losses reported with its use are not materially below the minimum losses which have been reported by one American manufacturer using a mineral-base compound.

According to tests, it appears that if the impregnated paper insulation will withstand, say, a thousand double folds in an endurance test, then the cable will pass the bending test without difficulty.

Owing to the fact that the sheath current in single-

conductor cables may reduce the carrying capacity of the cables 10 or 15 per cent, the losses in the current in the sheath must be taken into consideration in calculating the efficiency of transmission.

Referring to the maximum voltages at which underground cables are being operated in foreign countries, Mr. Roper pointed out that while a number of them are rated at very high voltages, most of them are operating below rating. At least one of the cables, however, is operating at 33,000 volts, one three-conductor cable of this rating having been in operation since 1914. A single-conductor cable at Barcelona, Spain, has been in operation at 50,000 volts since 1914 without any cable failures except one caused by electrolysis. The highest-voltage cable in this country is a 30-mile section operating at 33,000 volts in Chicago. No failures have occurred since it was installed, but it has not been operated at the limiting voltage. Some new cable will be installed there shortly which will be operated at 44,000 volts, to serve as a station tie line permitting two-way exchange. The high-voltage joints will require 3-ft. to 4-ft. sleeves, necessitating special manholes.




RELATION BETWEEN RUPTURING VOLTAGE AND THE RATIO OF THE CONDUCTOR RADIUS TO THAT OF THE DIELECTRIC

The transmission and distribution committee report read by E. B. Meyer stated that the outstanding features of present overhead construction are the continued tendency toward higher voltages both in transmission and distribution and the improvements in construction methods as a result of standardization in the materials and design. In a general way it can be said that the manufacturers have made good their claims of several years past that insulators of the latest manufacture are not subject to the rapid depreciation which was the cause of such concern a few years ago. Engineers who have given the insulator much study believe that the insulator unit for 220 kv. should be larger so that the number of units may be reduced to about the same number as now is used for 100 kv.

It is interesting to note that the Southern California Company already has 27 miles of one of the Big Creek lines in operation at 280 kv. and 240 kv. for experimental purposes. Increased loads and areas covered have finally made evident the inadequacy of the customary 2,300-volt and 4,000-volt circuits for many distribution problems, with the result that 6,600, 11,000 and 13,200 volts and higher voltages are now entirely standard in many districts for purely distribution purposes.

With a relatively steady increase in density of Edison loads, it has been found desirable to increase the size of the meters and conductors to as large a figure as may be installed safely or as the existing ducts will admit. A very decided point in favor of cables containing pressure wires is that they permit the adoption of junction-box or terminal circuit breakers for automatic isolation of faults.

Considerable divergence of opinion exists regarding the type and size of cables to use in Edison mains, the location of boxes and the fusing of meters and mains. The use of direct potential rather than alternating potential for high-voltage stress with installed cables is being investigated by operating companies. Even where sufficient power is required to reduce the faults or failures so that the trouble can be located, the cost of the apparatus is said to be only about one-quarter of the cost of alternating-current testing equipment. Foreign investigations indicate that the ratio of direct current volts to alternating-current volts to produce the same test results should be two and a half to one, but American manufacturers up to the present time have not been willing to agree on a ratio higher than one and a half.

Foreign practice in transmission and distribution was also outlined.

### Apparent Dielectric Strength of Cables

Although a great many investigators do not believe in free ions in solids, said Robert J. Wiseman, it is remarkable how well computed results agree with experimental data, if it be assumed that they do exist and that the laws of ionization can be applied. The ionization theory has been applied by the author satisfactorily to all data made available so far. According to these comparisons, the author contends that the law $V = K_0 [1 + (a/\sqrt{r})]\sqrt{R}\, r \log R/r$ is applicable to all ratios of conductor radius to insulation radius.

Since there is no independent evidence of the free mobility of ions in solid dielectrics, Dr. J. B. Whitehead urged hesitation in explaining cable failure in terms of ionization theory. Despite the fact that the law has been found for breakdown of gases and a theory has been developed, no one is in a position to say exactly what takes place in the gas under these conditions. Therefore, with the inconsistent results obtained in cable research, one should be still more cautious in assumptions.

Mr. Davis maintained that greater variation in results was obtained by Wiseman's method than by Middleton's method, citing 60 per cent maximum variation for results with Wiseman's method and 19 per cent with Middleton's. Mr. Wiseman agreed that engineers should go slow in applying the theory of ionization to cables, but contended nevertheless that there is some agreement with this theory in cable breakdowns.

### Short-Circuit Currents in Power Networks

The merits and limitations of the short-circuit calculating table were discussed by O. R. Schurig, who considered its proper field of application, its accuracy and the methods of using it. Its chief field of application, said the speaker, is in making polyphase short-circuit current calculations required for the selection of oil circuit breakers, in the determination of relay settings and in the layout of distribution systems. It is not generally applicable to phase-to-phase short circuits or to phase-to-ground short circuits, on account of the unbalanced current division among the phases. These problems must be solved by calculation or by alternating-current tests.

The errors of the short-circuit calculating table are due to the neglect of capacity-charging currents and to dissimilar impendance angles occurring in the various elements of a network. The former is almost always negligible for polyphase short circuits, being smaller than 10 per cent for a three-phase short circuit occurring in an aërial line 200 miles from the generator.

In a great many systems the resistance component of all the impedance may be entirely neglected for short-circuit determination. This method, the reactance

method, generally gives erroneously high current values. The errors are safely below 20 per cent, and commonly under 10 per cent, under the following conditions:

(A) In systems in which circuit elements of dissimilar impedance angles occur in series connection only (*i.e.*, parallel-connected circuit elements having impedance angles less than 15 deg. apart), provided the circuit constants are within a definite range of the following character:

(1) Generating-station reactance not lower than distribution-system impedance and angle of the latter not lower than 30 deg.

(2) Generating-station reactance not lower than one-half the distribution-system impedance and angle of the latter not less than 45 deg.

(3) Generating-station reactance not lower than one-fifth of distribution-system impedance and angle of the latter not less than 55 deg.

(B) In systems not covered by (A), provided that all impedance angles are larger than 55 deg.

For systems not covered by the range of circuit conditions defined above, but having impedance angles not materially below 30 deg., the impedance method is preferable and gives errors well below 20 per cent and commonly below 10 per cent. The short-circuit current values are generally low. Cable systems with current-limiting reactors in some of the lines come within this class. While the impedance method is particularly suited to systems having parallel-connected circuit elements of widely dissimilar impedance angles within the limits stated, it is not a substitute for the reactance method in systems of type (A) and (B).

R. A. Doherty called attention to three major sources of error in using calculating tables for short-circuit calculation, namely, the generator reactance, the calculation tables and the use of decrement curves. He referred to the tables as a means of determining the most desirable distribution system and behavior of generators under transient conditions.

G. M. Armbrust referred to a new alternating-current calculating table developed in Chicago which is intended to enable study where large impedance angles are involved but is not intended to replace direct-current board.

### Qualitative Analysis of Transmission Lines Not Sufficiently Accurate

Basing his discussion upon a previous presentation by Percy H. Thomas, H. Goodwin, Jr., introduced the "critical load" as a means of qualitatively analyzing transmission lines and gave a simple formula for determining this load and the effect of variations of power factor, voltages, etc. The effect of various line constants upon the critical load were briefly discussed. Working from the critical load, a vector interpretation of the action of a long high-voltage transmission line was given. From this vector interpretation it is possible to predict certain essential operating characteristics of transmission lines. To show the applications, two practical examples were selected and solved.

Some of the properties of the critical load which are useful in analysis of transmission lines of present commercial lengths are as follows, the speaker said:

(1) The critical load when placed on a transmission line at unity power factor will be transmitted at unity power factor. The current will be constant throughout the line. The voltage drop will be the same as for direct current ($IR$). The power loss will be equal to the direct-current power loss ($I^2R$).

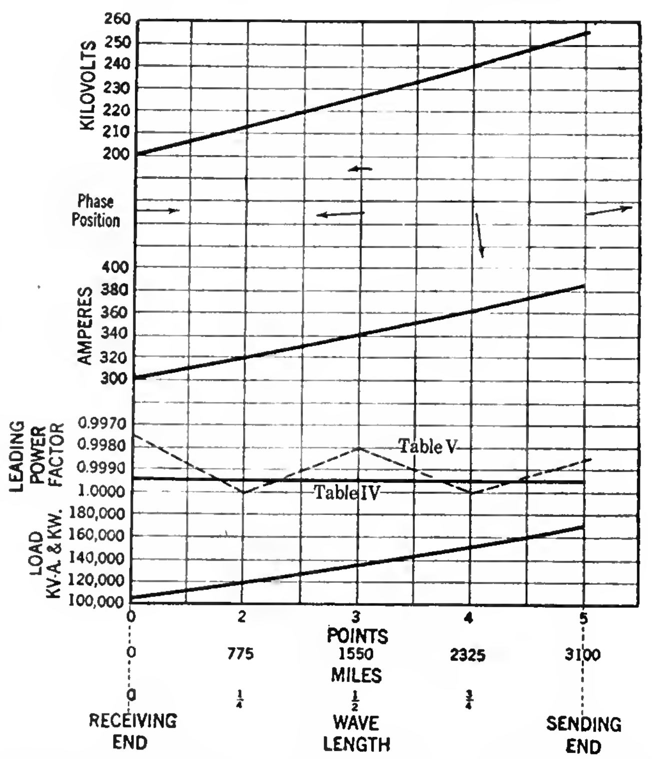
(2) If the kva. load is greater than the critical load, the power factor at the sending end of the line will always be more lagging than the power factor at the receiving end of the line.

(3) If the kva. load is less, the power factor will always be more leading than that at the receiving end of the line.

(4) If the load is the critical kva. but at a leading power factor, the power factor at the sending end of the line will be still leading but nearer unity.

(5) If the load is the critical kva. but at a lagging power factor, the power factor at the sending end will still be lagging but nearer unity.

From the formula for critical load, which is kva. $= 1{,}000\ E^2/\sqrt{L/C}$, it is evident that an increase in the




OPERATING CHARACTERISTICS OF A VERY LONG TRANSMISSION LINE SHOWING HOW THE POWER FACTOR VARIES WITH DISTANCE

capacitance of the transmission line will increase the critical load, whereas an increase in the reactance will decrease it. For lines of very high voltage the full loads will correspond quite closely to the critical loads, but light-load conditions often present greater problems than full load.

All of the discussion on Mr. Goodwin's paper was in the nature of requesting qualification of statements and proof of assumptions. R. D. Evans differed with the author regarding the conditions for most efficient transmission and stable operation, saying that conditions would be better at slightly lagging power factor rather than at 100 per cent power factor. Professor Karapetoff maintained that Mr. Goodwin should qualify his statements and prepare an appendix to accompany the paper proving the assumptions made. He pointed out that the critical load is dependent on the line constant as well as on voltage and current. Furthermore, the current is not the same at all points on the line and may be simultaneously lagging or leading, depending on the point at which it is observed. Dr. Steinmetz contended that the entire reasoning in Mr. Goodwin's paper is approximate, because it is based on the assumption that the surge impedance is equal to the square root of $L$ divided by $C$ instead of the square root of $X$ divided by $Y$.

Mr. Goodwin replied to these remarks by saying that for commercial lines the surge impedance differed only

a fraction of a per cent from the square root of $L$ divided by $C$ and that the rules for calculating the critical load apply only to commercial lines. He pointed out that the purpose of the paper was to determine electrical characteristics of the line and not the economics of the situation, which must depend upon Kelvin's law. The paper was intended only to show what loads can be placed on lines to give stable operation. At the critical load no synchronous condensers are needed on the system. If greater or less load is carried, then condensers or reactors will be required for loading the system. However, unless long high-voltage lines are operated at 100 per cent load factor they are not feasible, he contended.

### Kinematic Device for Calculating Long Transmission Lines

An ingenious kinematic computing device was displayed and described by Prof. V. Karapetoff which can be quickly set to represent vectorially the voltage and current of any point of a long transmission line with uniformly distributed constants and a given load. Its operation is based on the fact that the current or voltage at any point in a long transmission line may be represented by two vectors rotating in opposite directions and varying in length according to the fundamental differential equations of a line. The parts of the device are made to assume at will different positions corresponding to different points on the line. The constants of a line to be represented are adjustable and a complete set of performance curves can be obtained. Conversely, by a few simple trials, the best constants of a line and the necessary kva. of a synchronous condenser may be found to give the required performance characteristics. The current, the voltage and the power factor can be read directly from the device for any desired point of the line.

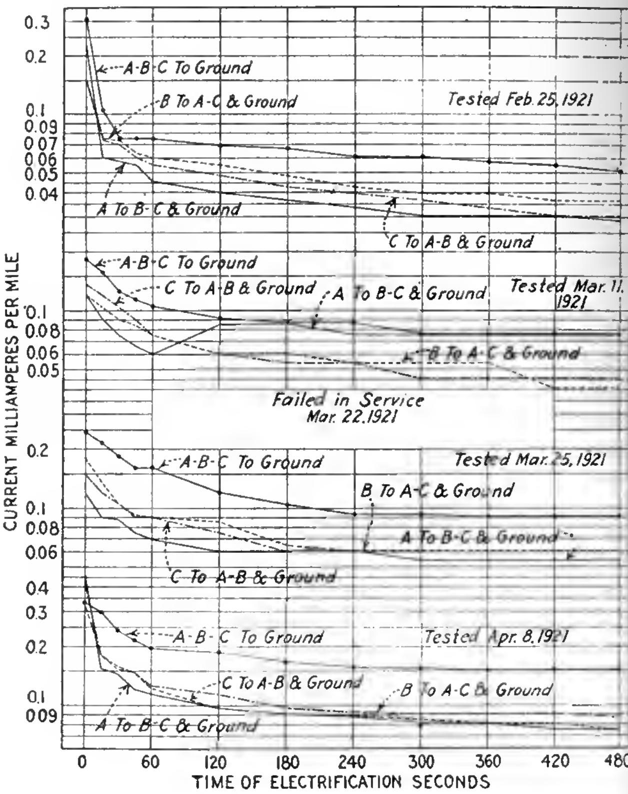
Two practical examples were calculated by this device and by means of hyperbolic functions of a complex variable, with very close agreement.

### Routine Testing for Impending Cable Deterioration

In an effort to develop a routine test which will serve to detect an impending fault in underground cables, the Philadelphia Electric Company has made use of the kenetron as the source of high-potential direct current. By means of it, declared Howard S. Phelps and E. Dean Tanzer, a large volume of data has been secured concerning the input current for a cable as a function of the time after complete electrification at a constant high potential. These data when plotted as curves show by their shape the condition of the cable insulation.

Curves showing a sharp decrease in the magnitude of input current during the first minute and a gradual but persistent rate of decay for the succeeding six or seven minutes indicate that the insulation is in an acceptable condition from the operating point of view. However, if the curves show little if any decrease or a persistent tendency to increase during the time interval of the test, it is an indication that the insulation has deteriorated to such a point that the cable may be expected to fail at an early date if retained in service. The degree of deterioration is indicated, first by the time which has elapsed in complete electrification before the increase occurs and, second, by the sharpness of the upward trend of the curve in any instance.

The value of this method of testing has been demonstrated by its actually having detected a considerable number of impending cable faults before they became a menace in operation. Additional refinements in the methods of measuring the input current for different classes of cables may be desirable. Further investigations are being carried on to determine the necessity.




PHASE "A" HAS AN INCREASED CURRENT AND CABLE FAILED IN ELEVEN DAYS. WHEN REPAIRED AND RESTORED TO SERVICE THE CURRENT SHOWED CHARACTERISTICS SIMILAR TO THOSE OF FEB. 25

Investigations of certain theoretical features are also being conducted, among them being oscillographic studies of the input current and voltage under test conditions.

Considerable interest was shown in the routine method of detecting impending cable faults as presented by Messrs. Phelps and Tanzer. J. L. Hayden pointed out that the method is particularly advantageous because it permits detecting gradual deterioration of the cable without subjecting it to extreme high-voltage tests and besides affords an opportunity for studying the internal action of the dielectric. However, he pointed out that the alternating-current tests have the advantage that they also indicate the dielectric loss.

D. W. Roper declared that this method has been applied in Chicago to the study of high-efficiency underground cable with low dielectric loss, but the studies have not been conducted long enough to reach any definite conclusions as yet. He brought out the interesting point that the initial current was about 150 times the final input current, indicating the need of more sensitive current measurement after the first few minutes if any upward trends in the curve are to be detected.

To show the reason for the change in the flow of current transient observed by this routine method of testing, Dr. C. P. Steinmetz gave a very interesting explanation of the phenomena which occurred in the dielectric. This explanation sustained Maxwell's theory

of dielectric absorption. In the perfect dielectric there is no slow transient, Dr. Steinmetz pointed out. In a non-homogeneous dielectric, however, the voltage gradient is distributed first inversely proportional to the specific capacities of the built-up insulation. Since the current is proportional to the voltage gradient, the dielectric resistivity and specific capacity, the current capacity cannot be the same in the different dielectrics unless the resistivities bear the same relation to the specific capacities in each dielectric. Hence the current must flow and establish charges which redistribute the voltage gradient. The speaker said that this method should therefore enable the investigation of components of dielectrics.

Regarding the difference between initial and final input current brought out by this test method, Mr. Tanzer said, in closing the discussion, that it may be necessary to have more refined methods of reading current on the more modern cables. He asserted that the inversion of the curve is the important factor, and not the difference between the initial and final currents. With refinements it may be possible to adapt this method to the testing of armature coils.

## Joint Session with Chicago on Wednesday Evening

The technical aspect of the loud-speaking telephone and the problem involved in attaching the loud speaker to long-distance telephone circuits were discussed in a joint session with Chicago Wednesday evening by means of two-way long-distance telephony with the aid of loud-speaking instruments. All the papers and discussions were broadcasted. In the first paper, by I. W. Green of the American Telephone & Telegraph Company and J. P. Maxfield of the Western Electric Company, Mr. Green presented the problem encountered in the development of electrical systems for amplifying the voices of public speakers and music and described the equipment as brought to a commercial state and now in use in the United States and various other countries. The system employs four units—a "pick-up" mechanism or transmitter unit, a preliminary amplifier, commonly called the speech input equipment, a second or power amplifier, and a receiver-projector unit for transforming the amplifier current back into sound and properly distributing it throughout the space to be covered.

In the second paper, by W. H. Martin and A. B. Clark, both of the department of development and research of the American Telephone & Telegraph Company, Mr. Martin, speaking at Chicago, presented the various applications of the public-address system with telephone lines, stating the requirements for the lines, the circuit arrangement used and the more important operating features. He also gave a detailed description of the system used on Armistice Day, 1921, when large audiences at Arlington, New York and San Francisco joined in the ceremonies attending the burial of the unknown soldier at the National Cemetery at Arlington, Va. The main requirements for using loud-speaking equipment on this type of work are that the apparatus shall transmit a sufficiently broad frequency range and that short pulses within this range be transmitted without introducing oscillations of their own. This is best accomplished by using non-loaded open-wire lines or extra-light-loaded cable circuits.

Both papers were discussed simultaneously before the Chicago and New York audiences by J. J. Carty, vice-president of the American Telephone & Telegraph Company; B. E. Sunny, chairman of the board of directors of the Illinois Bell Telephone Company, and E. B. Craft, chief engineer of the Western Electric Company. Mr. Craft pointed out that telephone development was one of the master elements in research and in the progress of humanity—an opinion strongly indorsed by Mr. Carty. Mr. Sunny, in Chicago, said that the A. I. E. E. is now reaping the benefits derived from the movements which it has so amply backed and spoke of the Edison medal as a help to development and effort.

### Observations on Electric Railway Practice in Europe

European practice regarding the type and character of rolling stock as compared with that used in America, the use of electric drive or locomotive, and the voltage used in the electrification of lines, was ably discussed by W. B. Potter of the General Electric Company, who has recently returned from an extensive trip in Europe. An interesting feature of European locomotives, he said, is the efficient condition in which they are kept. This is because the engineer operating the locomotive considers it as almost his personal property.

The compilation given here affords an idea of the extent of railway electrification throughout the world.

STEAM RAILWAY ELECTRIFICATION THROUGHOUT THE WORLD

| | Ronte, Miles | Number of Electric Locomotives | | Route, Miles | Number of Electric Locomotives |
|---|---|---|---|---|---|
| United States | 1,607 | 375 | Spain....... | 48 | 17 |
| Switzerland.... | 661 | 156 | Canada....... | 49 | 9 |
| France........ | 602 | 338 | Japan....... | 39 | 42 |
| Italy....... | 650 | 309 | Norway..... | 39 | 37 |
| Germany...... | 550 | 49 | Mexico..... | 30 | 10 |
| Sweden...... | 237 | 44 | Brazil........ | 26 | 16 |
| Cuba...... | 180 | 18 | China...... | 25 | 13 |
| Austria..... | 340 | 42 | Java....... | 25 | 5 |
| Africa..... | 174 | 77 | | | |
| Chile | 154 | 42 | Total....... | 5,565 | 1,611 |
| England....... | 129 | 12 | | | |

This table includes the steam railways which have been electrified or are in prospect of electrification, but not the steam railways on which multiple-unit trains are being operated exclusively or railways which were not formerly operated by steam. The mileage is less than 1 per cent of the railway mileage of the world. To bring about future electrification, Mr. Potter said, many engineering and economic problems must be solved and their solution demands the co-operation of all engaged in the furtherance of railway transportation.

## Telephone Subjects in One Parallel Session on Thursday

Special methods are required to maintain the necessary stability of telephone transmission when small-gage cable circuits are used to handle long-distance service over distances up to and exceeding a thousand miles, according to the paper by A. B. Clark on "Telephone Transmission Over Long Cable Circuits." Several factors involved in the transmission of voice currents over long toll cable circuits must be considered. Among these are "echo" effects, transient impulse and attenuations and corresponding amplifications. To eliminate "echo" effects any unbalance in the system must be very small and the loading of long lines must be made at points further apart than with shorter lines. Changes in attenuation caused by the effects of varying

temperatures on the resistance of the conductors may be regulated by means of automatic regulators placed at every third or fourth repeater station in order to keep the transmission levels within proper limits. The repeater gains are raised and lowered automatically by this regulator, thus overcoming the differences in attenuation caused by the temperature changes.

In discussing this paper, J. J. Pilliod emphasized the point that space must be conserved by using cables for telephone work. Illustrating this, he compared the space requirements for a 300-circuit telephone system. If these lines were placed overhead, it would require 69,000 lb. of copper per mile and ten pole lines. On the other hand, with a cable system only 15,000 lb. of copper per mile would be required, with no pole lines if placed underground and only one if placed on poles. He pointed out that with overhead construction the size of wire must be very much larger than that required for the actual telephonic transmission in order to meet weather conditions such as sleet storms, heavy winds, etc. With the cable systems all these conditions are eliminated.

TRANSIENT IN NO. 19 EXTRA-LIGHT-LOADED LONG DISTANCE TELEPHONE CABLE

### Theory of Electric Wave Filters Built Up of Coupled-Circuit Elements

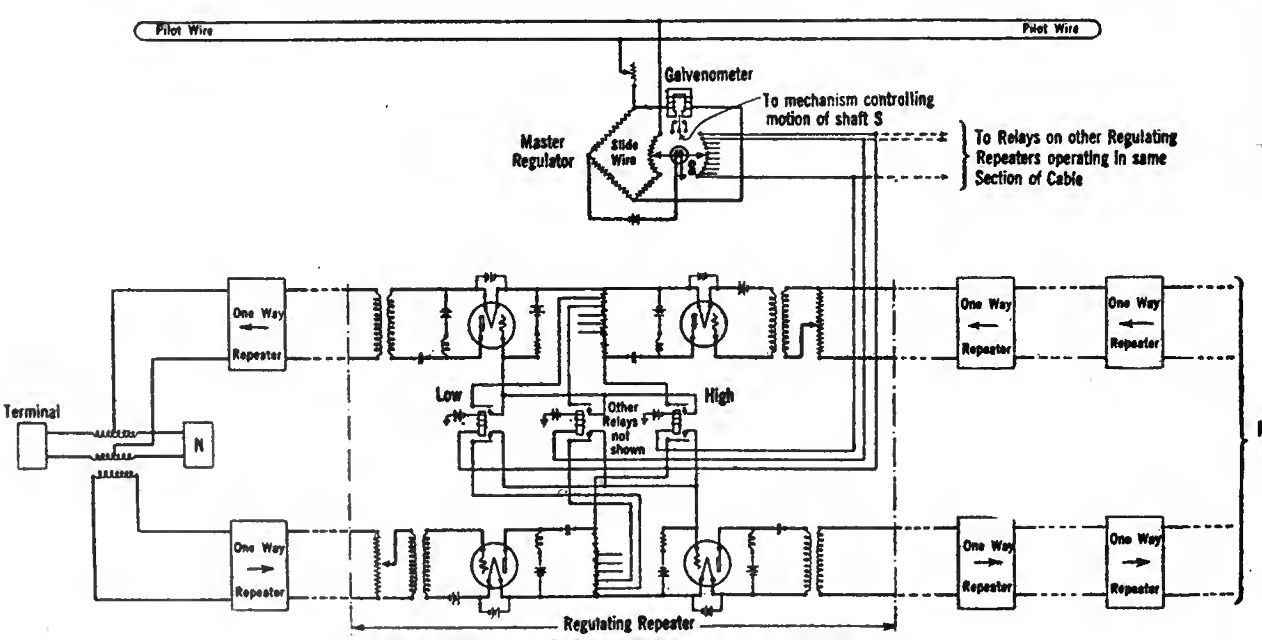
The problem of separating currents having frequencies which lie in a given band from currents of all other frequencies by means of wave filters, with particular reference to telephone circuits, was presented by L. J. Peters, who pointed out some new properties of certain types of systems built up of coupled circuits, showing how systems having preassigned characteristics may be built up in a rational way. Coupled circuit networks or filters are handled in a manner similar to those used in determining the properties of long lines with distributed constants. This method of treatment leads directly to the rational design of an electric system of a type which the older treatment of methods did not assume to exist. By proper termination and design sharp changes in the attenuation frequency characteristic can be employed to build up fiber networks of any type.

### A Diaphragmless Microphone for Radio Broadcasting

A glow discharge microphone dispensing with the diaphragm ordinarily employed with the carbon or condenser type of transmitter was described by Phillips Thomas of the Westinghouse Electric & Manufacturing Company. In this microphone the application of a moderately high direct potential between two electrodes separated a short distance in air, with enough series resistance to prevent formation of the usual type of heavy-current arc, causes the establishment of a low-current, high-voltage discharge having a characteristic glowing appearance. The current consumed is from 1 milliampere to 20 milliamperes at voltages ranging from 200 or 300 to 1,000. Among the advantages claimed are simplicity, durability, low impedance and high sensitivity in addition to elimination of the diaphragm.

A demonstration of the microphone was given, an operator in one of the rooms of the building speaking into the device and also playing various kinds of music. A loud speaker placed in the meeting room reproduced both the speech and music exceptionally well, with almost total absence of distortion. Adjustment of the modulation to correct the imperfections of the existing designs of head telephones and loud speakers may be readily accomplished with this microphone by varying the discharge distance between the electrodes.

Although this new microphone seems to be a very important development, R. J. Jones lamented the lack of information on the load capacity, linearity of response and physical efficiency of the device. The idea that the carbon condenser types of transmitters are un-




PILOT WIRE AUTOMATIC TRANSMISSION REGULATOR

suitable for radio broadcasting and telephone work was thought to be unjustifiable, as recent results vindicated these types, an instance being the very successful use of the carbon transmitter in the joint session of the Chicago A. I. E. E. with the New York session on Wednesday night. Mr. Jones said that there were three radio broadcasting stations using the condenser type, while about thirty were using the carbon type. In all, more than two hundred of the carbon type are in use in both telephone and radio work.

J. B. Taylor deplored the lack of uniformity in the names given to the various radio instruments.

In summing up his paper, Mr. Thomas said that actual operating data would shortly be available on the new microphone.

## A General Session on Railways and Power Equipment Was Also Held Thursday Morning

The second parallel session on Thursday morning was devoted to a series of three papers on railways, two on machinery and one on lightning arresters.

E. J. Blake presented a paper on the automatic train-control problem, indicating that most of the train-control systems are electrical or magnetic in their principle and operation. The Interstate Commerce Commission has commented on the need for some effective check on the functioning of human and therefore fallible engineers and has finally ordered automatic control installation on a large mileage of important lines.

The primary function of automatic control is to stop the train before it enters upon unsafe territory, but the author said that no automatic apparatus should relieve the engineer of complete responsibility for the safe operation of the train. It should act as a continuous check on the proper exercise of that control, intervening to stop the trains automatically only after the engineer has had ample opportunity to act and has failed. The train control device should not increase the hazards of operation in any respect, and the automatic control should place no avoidable restriction on the traffic capacity of the road. An effective argument in favor of automatic roadside signals has been the fact that they "keep the trains moving" and increase the traffic capacity.

The simplest automatic control, one which is in use on urban subway and elevated lines, is an air valve hung on the car truck near the rail level and stop arms operating in conjunction with the fixed signals in such a way that if a stop signal is displayed the stop arm is raised into the path of the air-valve handle and actuates it, thus making an emergency operation of brakes. This system naturally does not meet the requirements just mentioned. Modifications of this simple system involve principally electrical or magnetic controls of the air valve, the operation of these controls depending upon current flowing or not flowing because of the presence of other trains within the danger area. All of these, however, fail to give the necessary caution signal to the engineer at present given by the "distant" block of the roadside signals, but rather operate to stop the train in case of actual danger.

Another system, the author continued, known as the "continuous induction" system, is arranged to supply the indicating energy for the locomotive to the rails of the track circuit in the form of alternating current which is collected inductively on the locomotive. If the track ahead is clear, the detecting apparatus is continuously energized, but if occupied, or if the indicating current supply fails, the locomotive apparatus becomes de-energized and a brake application results.

The problem at the present time is to modify operating rules slightly to fit the limitations of the existing automatic systems, or more fundamentally to develop the automatic control systems in some way so that they will give adequate advance notice to the engineer but will ultimately operate to stop the train in case of human failure in the cab. "Thus," concluded Mr. Blake, "with automatic control in force, it seems likely that the future trend of signal development will be toward cab signals rather than roadside signals—first, because they are inherently capable of giving greater protection, and, second, because they involve less apparatus over and above that required in any case for the automatic control."

Frank J. Sprague declared that the most important tests of train control are now being conducted by the New York Central Railroad. The general requirements of train control were tersely summarized by the speaker, who declared that it must protect but not hinder train operation. Furthermore, apparatus used in train control should not function except when needed, if excessive maintenance cost is to be avoided. About four thousand different schemes have been submitted to the railroads, Mr. Sprague said.

### Automatic Substations and Single-Phase Regeneration Discussed

A discussion of the application and economics of automatic railway substations was the next paper, presented by L. D. Bale of the Cleveland Railway Company. This was the same paper which he presented at the Cleveland Section of the A. I. E. E. last April. Mr. Bale emphasized the economies from the standpoint of distribution efficiency resulting from a reduction in distribution copper on account of establishing a larger number of substation operating points. He dwelt also on the economy of operation without manual operation. He paid tribute to the effectiveness and reliability of the automatic operating equipment, but pointed to the fact that each and every application of this equipment will present a variation of control features by reason of new or different operating conditions. While his experience had been principally with railways, he said that the system was applicable also to Edison direct-current substations, to small hydraulic plants and various other kinds of installations.

L. J. Hibbard presented a paper on systems of single-phase regeneration for use with series-type commutator motors. Mr. Hibbard's paper was essentially a record of accomplishment in advancing the art of regeneration by single-phase motors. Single-phase regeneration is, of course, not new, but it is less advanced in its development than direct-current regeneration. Mr. Hibbard classified the various schemes of regenerative connection for single-phase motors as follows: (1) Series excitation; (2) self-excitation or cross-excitation; (3) shunt excitation; (4) separate excitation. The third and fourth classes have been commercially applied, but, according to Mr. Hibbard, no commercial applications of the first and second have been made as yet.

Mr. Hibbard then gave connections and diagrams for the various classes and discussed a particular method

devised by himself by which he is able to control the degree of regeneration and the power factor at which this regeneration occurs, the second point being the most striking in connection with the problem of single-phase regeneration. In his analysis of this method he developed a vector mechanism by which the various values and the phase relations of voltages, currents and fluxes could be shown graphically by different settings under the control of the operator.

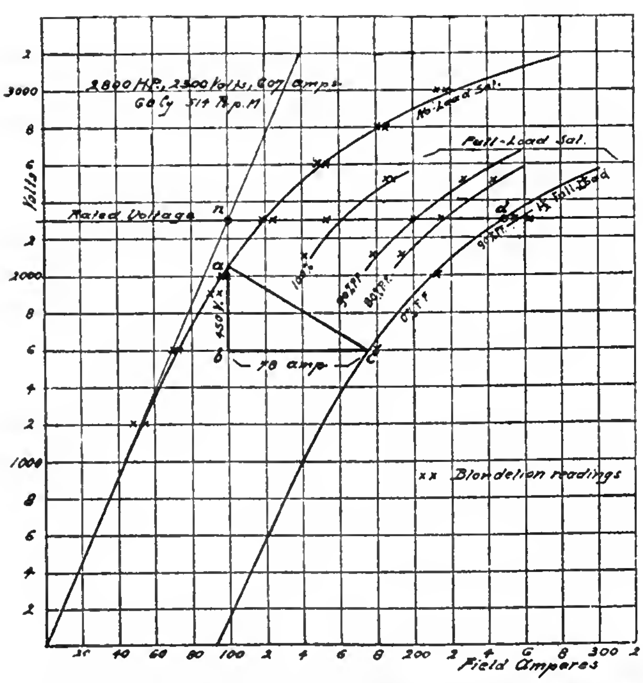
The chief comment on Mr. Hibbard's paper was to the effect that it did not cover commutation. Attention was called to the fact that both alternating-current and direct-current components must be commutated in a machine of the type considered during regeneration. One single way to reduce the alternating-current component is to reduce the flux. This can be done by connecting a reactor around the commutating poles. Shunt excitation is simpler than separate excitation but produces lower power factor, the speaker contended.

### A New Kinematic Device

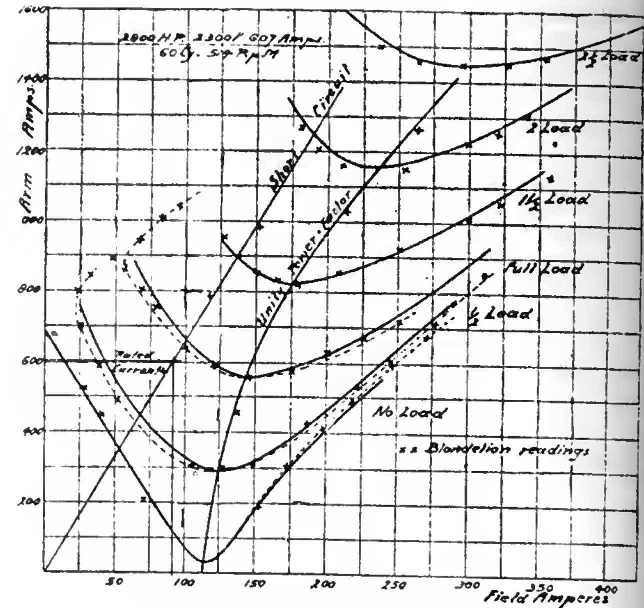
"The Blondelion" was the title of a paper presented by Prof. Vladimir Karapetoff. The "blondelion" is a kinematic device which enables one to compute the performance of a polyphase synchronous generator or motor. It is fundamentally a combination of movable and adjustable bars, linkages and straight and curved guides, and its purpose is to enable a designer to select the best electrical constants and a no-load saturation curve and to "test" a synchronous generator or motor before it has been actually built. There are also other auxiliary uses, such as to take the place of involved analytical and theoretical investigations and to replace circular diagrams, etc.

This "blondelion" is one of several kinematic devices developed by Professor Karapetoff, the others being the "secomor," the "indumor" and the "heavisidion," while still others are under preparation. The first two have already been described before the Institute and the third was described this year.

Professor Karapetoff explained his "blondelion" by




NO LOAD AND LOAD SATURATION CURVES ON A GENERATOR CHECKED BY THE BLONDELION BY CROSSES



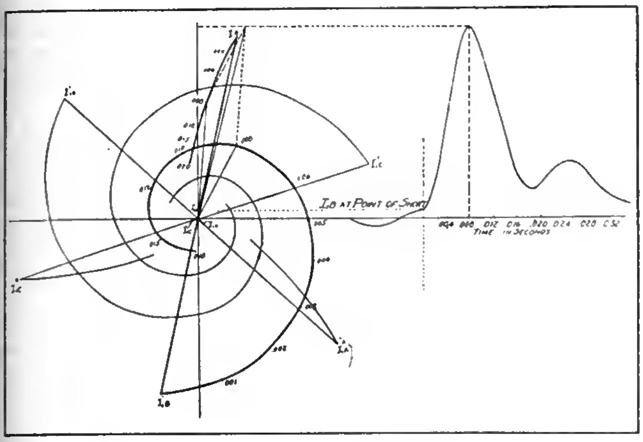

SHORT-CIRCUIT AND V CURVES ON A SYNCHRONOUS MOTOR CHECKED BY THE BLONDELION

an analogy. First he pointed out that it is fundamentally the linking up of four vectorial equations, represented by mechanical linkages, so that when one degree of freedom of motion of the device is allowable, then with any given set of conditions the desired answer may be found. His simple mechanical analogy he explained as follows: It would be possible to set up a scale of lengths of cylindrical tanks and a scale of diameters of cylindrical tanks and a scale of corresponding surface areas of tanks and devise a mechanism, pantographlike, which would, when one point is set at a given length and another has a given diameter, bring the third point to rest at the area of the particular tank; but obviously, if the point were set on a given area, there would be an infinite number of combinations of lengths and diameters to produce that area. Similarly, a scale of tank volumes might be set up to work in relation to the length and diameter scales the same way as the area scale, but again for any given volume there would be an infinite combination of lengths and diameters. However, if a combination mechanism to operate on all four scales were devised and one point were set at a given area and another point were set at a given volume, the other two pointers would together come to rest at one point of each scale, thus giving a definite length and a definite diameter.

Carrying this fundamental principle into the complex synchronous machinery field, Professor Karapetoff devised his "blondelion" to take into account all the variables of the characteristics of the machinery, and in such a way that it could give answers as to all the operating characteristics which one needs or would wish to know about the machine.

The accompanying figures show two sets of curves taken by test from a certain machine and also indicate various points on these curves as calculated by the "blondelion." These show the accuracy of the device.

Prof. W. V. Lyon presented a paper on "Transient Conditions in Electrical Machinery." This paper was essentially mathematical, Professor Lyon having reduced to simple mathematical form various equations of electrical machinery transients. He did this by the introduction of complex angles and complex angular



$R_1 = 0.0172$ $R_2 = 0.0455$
$L_1 = 0.00569$ $L_2 = 0.00996$
$\tau = 0.0483$
Taking into consideration the effective resistance
$m'_1 = 96 + j360$ $m''_1 = 60.4 + j17.5$
$I_{1B} = 90.5 \sin 85°$

$$i'_{1B} = I'_{1B}\,\epsilon^{-96t} \sin (360t + 258°)$$

$$i''_{1B} = I''_{1B}\,\epsilon^{-60.4t} \sin (17.5t + 78.3°)$$

FIG. 1—VECTOR DIAGRAM UPON WHICH NO LOAD ANALYSIS WAS BASED

velocities added to the complex vector representation hitherto employed. The paper, therefore, presented no particularly new theory with reference to the transients in machinery, but rather a new method of attack on the problem of their calculation.

Prof. A. E. Kennelly, in the absence of Professor Lyon, presented the paper, commending it as showing a method which was practical in its application. J. O'R. Coleman, a research associate of Professor Lyon, showed the results of tests which he had performed under the direction of the latter to check experimentally a part of the theory presented. The tests were performed on a General Electric 75-hp., three-phase, 900-r.p.m., 220-volt induction motor operated as a generator.

Mr. Coleman presented three slides. Fig. 1 gives the vector diagram upon which the analysis is based for the short circuit at no load. The vectors $I_{1B}$, $I_{1C}$, and $I_{1A}$ represent the current in the three phases just before short circuit, assuming that a short circuit begins just before $I_{1B}$ is at a maximum, the vectors being in the position shown. At this moment $I_{1B}$, for example, breaks up into two components, $I'_{1B}$ and $I''_{1B}$. After the short circuit occurs the terminus of the vector $I'_{1B}$ travels along the logarithmic spiral shown at the velocity of 360 circular radians per second and is damped at the rate of 96 hyperbolic radians per second, all based on 60-cycle operation. $I''_{1B}$ travels along its spiral as shown with a velocity of 17 circular radians and a damping rate of 60 hyperbolic radians per second. At any specific time the positions of $I'_{1B}$ and $I''_{1B}$ and their instantaneous lengths may be found, and their vector sum projected on the time axis gives the instantaneous value of current in phase B at that moment. Similarly the current at any other moment in any phase may be found.

An oscillogram was taken of the short circuit (see Fig. 2). It will be noted that the short circuit in phase C came for some reason just a little after that in phase A and B, and the calculation was based on a compromise time just before phase C was short-circuited. Fig. 3 shows the actual oscillogram compared with the calculated values as obtained from the vector diagram described. For phases A and B the agreement is very satisfactory, but for phase C there is a slight disagreement, doubtless due to the time lag of the actual short circuit in that phase.

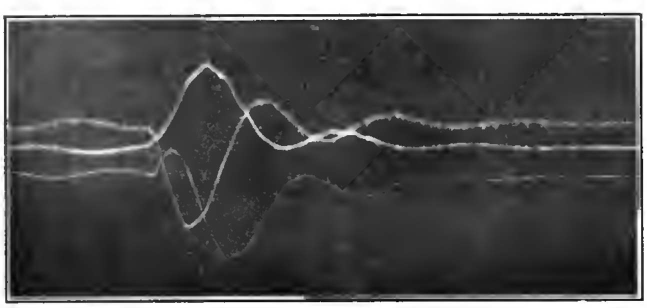
Thus, Mr. Coleman pointed out, the experimental results indicate that the calculated results are sufficiently close to be of practical use.

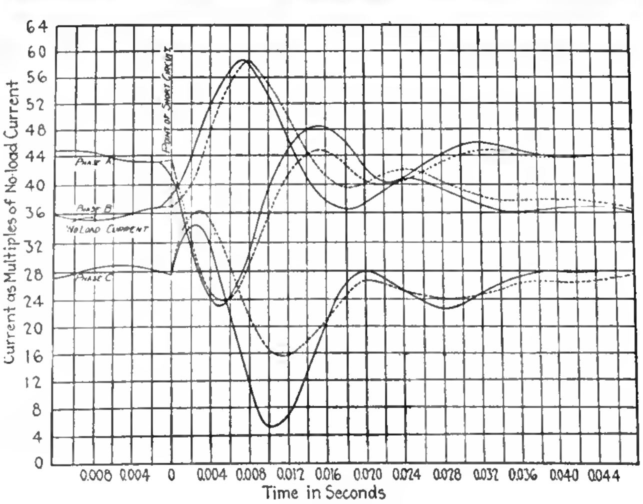
A desire to have the transients in transmission and distribution systems studied in a similar manner to that used with rotating machinery was expressed by D. W. Roper, who offered the system of the Commonwealth Edison Company for checking any theoretical or laboratory conclusions.

Prof. V. Karapetoff expressed the belief that Professor Lyon's method could be applied more extensively, but warned scientific men against working for approximate results. Accuracy should be the aim, he declared. For example, he referred to the mutual induction of primary and secondary coils in rotating machines, saying that it depends upon their relative position and hence is a function of time, $T$.

A paper by A. L. Atherton, entitled "1922 Developments in Auto-Valve Lightning Arresters," closed the session. Mr. Atherton said that his paper was primarily an outline of auto-valve lightning-arrester development, an outline of the progress of which was presented at the midwinter convention of 1922. In the issue of the ELECTRICAL WORLD for last week, page 385, an article by Mr. Atherton appears on the performance characteristics of these auto-valve lightning arresters. His convention paper was fundamentally a discussion of the theory involved in the development of the arrester and a record of the tests which had been made to determine some of their technical characteristics.

The auto-valve arrester received several commendations, but some questions were raised by E. E. F. Creighton as to how a glow discharge (on which the






- - - - - Calculated curve.
———— Oscillogram.

FIG. 2 (ABOVE)—SHOWS AN OSCILLOGRAM OF A SHORT CIRCUIT AND FIG. 3 SHOWS THE ACTUAL OSCILLOGRAM COMPARED TO THE CALCULATED CURVE

action depends) can be maintained at the current densities which occur; also, how the detonation accompanying a discharge at three times voltage can be withstood with the construction employed. Dr. C. P. Steinmetz commented chiefly on the advantages of using a large-capacity direct-current high potential to simulate lightning discharges and thus test arresters under conditions comparable with actual service. The time is rapidly approaching, he declared, when arresters can be tested for performance as accurately as rotating machinery. Attention was, however, called to certain obstacles that must be overcome first.

D. W. Roper reported that several of the auto-valve arresters had been subjected to service tests on the Chicago system in comparison with other types. Very favorable results were obtained with the new type, and more units are being placed on the system. The only auto-valve arresters that did fail protected their apparatus and then were damaged by the highest voltages recorded on the system.

In closing, Mr. Atherton emphasized that virtually the only failures of the auto-valve arrester have been due to flashover destroying the insulating enclosure. He also pointed out that this arrester is a high-speed device and shows no signs of internal impairment after discharging heavy currents successfully. No power current follows the discharge, indicating that the glow discharge, upon which the action depends, is maintained.

Commenting on the breakdown of the gaps involved in the auto-valve arrester, Dr. Slepian contended that until a gap becomes less than one wave length of light it cannot break down at less than 350 volts. Between plain electrodes the breakdown voltage is a direct function of the amount of gas between electrodes.

## Thursday Afternoon Devoted to Machine Switching and Radio

On Thursday afternoon a large audience listened to the presentation and discussion of three notable papers on communication. A paper on "Machine Switching Telephone Systems for Large Metropolitan Areas," by E. B. Craft, L. F. Morehouse and H. P. Charlesworth, was presented by Mr. Morehouse. This paper gave the historical development of communication methods, described the present A and B board manual operation, and then discussed the metropolitan application of the panel type of machine switching.

In discussing machine switching the authors pointed out that the functions to be performed by the telephone subscriber in getting a connection must be simple and easily understood. It must work efficiently and with accuracy and speed. The system must not require modifications in the existing rate structure which are otherwise not desirable. The system should employ, as nearly as practicable, the conventional numbering scheme. It should work with the existing telephone network, so that its introduction will not require wholesale number changes and extensive rearrangement or the abandonment of existing switchboards or other plant. Its introduction must, of necessity, be on a gradual basis and must be sufficiently flexible in design in order to care for growth and also for changing traffic conditions.

The authors then followed with a description of the routine of the machine-switching operation, as follows:

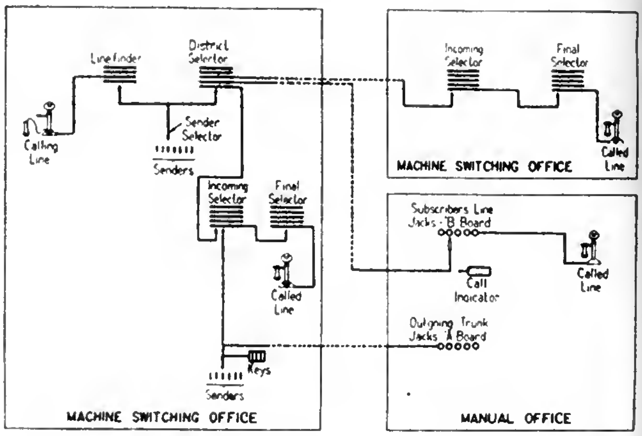
The progress of a call originating in a machine switching office is briefly as follows:

The line of the calling subscriber, who is assumed to be a subscriber in the Academy office, appears in a so-called "line finder" frame. When the subscriber's receiver is removed from the switchhook preparatory to dialing, the line is selected by a "line finder" and connected to an idle "sender" by means of a "sender-selector."

Upon completion of these operations, which take but a fraction of a second, the dial tone is sent out to the calling subscriber as previously mentioned. When the subscriber dials, electrical impulses on a decimal basis are transmitted to the sender, which receives and registers them, translating them in turn to the proper basis for the control of the selectors which are not operated on a decimal basis. The sender automatically causes the particular "district selector" which is permanently associated with the line finder originally used to select a trunk to the office desired.

Assuming that the call is for a subscriber in the same office, Academy, the trunk chosen will terminate at an "incoming selector" frame and the sender above referred to will cause the call to be routed through the incoming selector to a final selector, and thence to the particular line desired. When the connection is thus completed, audible signals will be sent back to the calling subscriber to indicate that the station is being rung or that the line is busy.

If the call had been for a subscriber in another machine switching office, namely, Pennsylvania, the call would be routed from the district selector to the office desired, either directly or through an "office selector" in case the total




SCHEMATIC DIAGRAM OF THE CONNECTIONS AND EQUIPMENT NECESSARY IN MACHINE SWITCHING

number of trunks to all offices is too large to be placed on the district-selector multiple. These trunks terminate on incoming selectors at the Pennsylvania office, which select the subscriber's line through final selectors, as described above.

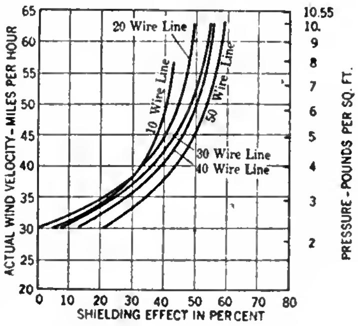
If the call is for a subscriber connected to, say, the Worth office, which is a manual office, the call would be routed from a district selector directly or through an office selector to the "B" board in the Worth office, where the number desired would appear in front of the operator at a "call indicator position" in the form of visible numbers on the keyshelf. The operator is advised of the trunk to which the call is connected by suitable signals, and the call is completed by plugging this trunk into the desired subscriber's line.

Calls originating in a manual office and intended for a machine switching office reach the machine switching office over trunks from the "A" operators in the manual office. At the machine switching end these trunks terminate in incoming selectors, which have access to the final selectors on which the subscriber's lines are located. The selectors are under the control of a special group of senders, and operators are provided with suitable keys for setting up in these senders the number of the desired subscriber. These operators at the machine switching office receive the information as to the desired number from "A" operators in the distant manual office, exactly as is done in the case of manual operation.

The paper then took up the detail apparatus and its functioning in bringing about the desired operation. Several prominent telephone engineers discussed this paper and elaborated on the engineering and development work required to produce the system, pointing out

the effect of the adoption of the machine-switching practice.

In a paper entitled "Wind Shielding Between Conductors of Telegraph and Telephone Lines," F. J. Howe gave a description of some very valuable tests made to evaluate the effect of wind on conductors. The experimental work may be summarized as to results by the conclusions of the paper:




VARIATION IN SHIELDING WITH WIND VELOCITY

1. The formula $P = 0.0025\ V^2$, in which $P$ is the pressure in pounds per square foot of projected area on cylindrical surfaces, and $V$ is the wind velocity in miles per hour, may be used in calculating wind pressures on *unshielded* ice-covered conductors.
2. A definite shielding effect exists between ice-covered telegraph and telephone conductors carried on the same cross-arm and closely spaced (about 12 in. center to center) as in modern telegraph and telephone practice.
3. A similar shielding effect also exists between such wires carried on different cross-arms spaced 2 ft. apart.
4. The amount of shielding on any number of wires increases with the wind velocity and vice versa.
5. The shielding at any wind velocity varies with the number of wires, increasing as the number of wires increases and vice versa.
6. On telegraph and telephone lines having conductors coated with ice ½ in. in radial thickness the total shielding effect at wind velocities corresponding to a pressure of 8 lb. per square foot, even allowing a 10 per cent reduction from the test results in order to compensate for possible inaccuracies, will run from a minimum of 39 per cent on a ten-wire line to as high as 51 per cent on a fifty-wire line.

In the discussion which followed Mr. Howe's paper there was general agreement that a valuable contribution had been made to a subject which had never permitted exact conclusions; yet it was pointed out that the allowances now used for wind shielding effects were on the safe side.

The last paper of the session was entitled "The Wave Antenna" and was by H. H. Beverage, C. W. Rice and E. W. Kellogg. It was presented by Mr. Kellogg. The paper was an elaborate theoretical treatise and afforded opportunity for a splendid treatment of a highly specialized subject.

The wave antenna is a new type of highly directive antenna used by the Radio Corporation on Long Island. It consists of two copper wires, 9 miles long, strung on poles, and it is said to receive transatlantic messages. This type of antenna is considered a marked advance in that it reduces interference and "static" and also is aperiodic and a good energy collector. A mathematical analysis of the performance of the antenna was given, with a description of accessory details.

The theoretical problems and practical accomplishments were dealt with by the authors in connection with the Riverhead antenna of the Radio Corporation and curves and oscillograms were used to bring out the phenomena associated with the action of the antenna.

By a process of balancing, it is possible to produce a "blind spot" or direction of zero reception, at any angle more than 90 deg. from the signal. One method of obtaining this result is by producing reflections of certain phase and intensity at the end opposite to the receiver. Reflections at the receiver end of the antenna, on the other hand, do not alter the directive properties of the antenna.

## Electrophysics Session on Friday Morning Has a Warm Discussion on Fundamentals

On Friday morning a group of five papers was presented under the auspices of the electrophysics committee. In the paper on "Dissymmetrical Electrical Networks" written and presented by Dr. A. E. Kennelly it was pointed out that the solution of complicated networks when symmetrical could very readily be obtained by replacing the network with equivalent $T$ or $\Pi$ lines. When the network is dissymmetrical the system can be replaced by two symmetrical systems and a terminal load, by two symmetrical leak systems and a leak load or by a new development of the author in which the solution is obtained by using angles, the geometrical mean surge impedance and the inequality ratio.

Prof. F. S. Dellenbaugh, Jr., in discussing the paper, pointed out that the methods indicated by Dr. Kennelly had a wide practical application. He cited an instance in which an engineer had taken a day to solve a network problem while a young student familiar with the method of Dr. Kennelly had solved the problem in half an hour. The system requires the use of hyperbolic angles, but is relatively simple as to mathematical operations and far quicker and more accurate than the method which involves the laborious application of the generalized Ohm's law.

The "Physical Interpretation of Complex Angles and Their Functions" was the topic of a paper by A. Boyajian. In this paper the author reduced to simple terms, meanings and usages many of the so-called complicated terms now used in angular calculations. He treated angles as percentages and pointed out that, for example, a 1 per cent line drop in phase with the voltage really was 1 per cent of a hyperbolic radian, which could be changed to degrees by multiplying by 57.7—i.e., 5.77 deg. In a similar manner a quadrature drop—for example, 1 per cent—is really 1 per cent of a circular radian, which could be expressed in degrees in a similar manner—i.e., 5.77 deg.

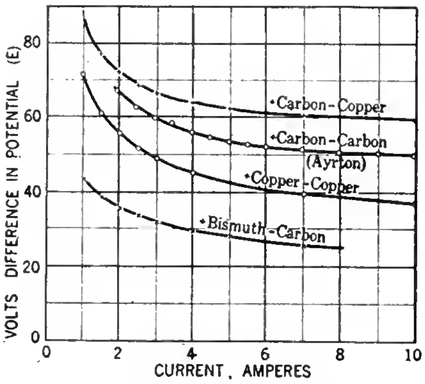
Prof. V. Karapetoff stated that Mr. Boyajian had made a valuable contribution to the literature by so clearly and lucidly interpreting mathematics of a complicated character. Dr. Kennelly also complimented the author, but pointed out that when dealing with hyperbolic angles rotation must be considered.

A notable paper entitled "Radiation from Transmission Lines," by Charles Manneback, was presented by Prof. F. S. Dellenbaugh, Jr. This paper dealt with the loss of energy due to radiation in low-frequency transmission lines and, taking exception to the opinion of Dr. Steinmetz, proved that radiation was negligible.

The problem, the author showed, involves a study of what might be called time-three-dimensional space transient, while the most complicated transients considered in electrical engineering are time-one-dimensional space transients. The distribution of current along the conductors of a line was shown to be a very close approximation to the actual, unknown distribution with regard to the possibly existing radiation. Then, from this assumption, the radiation of the system was calculated at a corresponding approximation and its amount found to be negligible compared with the heat dissipated in the line during the same time. From this it was concluded that the effect of the radiation

upon the attenuation and the distortion of the waves along the line must also be negligible, compared with the effect of the joulean losses.

An application to the steady radiation from a transmission line oscillating freely at one of its natural frequencies showed, even at very high frequencies, that the power radiated was negligible compared to the heat dissipated. For instance, a 100-kw. transmission line, No. 00 B. & S. wire, oscillating at 3,000,000 cycles per second, wastes by radiation only one-thirty-six-hundredth part of what is wasted by heat. The influence of this radiation on the attenuation and distortion of the traveling waves was thus found entirely negligible in engineering practice. Professor Karapetoff agreed with the author in his conclusions as did Dr. Slepian. Dr. Slepian pointed out that radiation occurred only when reflections were present and showed how Newton's law applied. Even with reflection present, the effect of radiation is negligible, he observed.




VOLT-AMPERE CHARACTERISTICS WITH THE ARC LENGTH CONSTANT

A paper entitled "A New Equation for the Static Characteristic of the Normal Electric Arc," by W. B. Nottingham, discussed the arc formed between any electrode materials and for any length of arc. The author found that if the length of the arc is constant, the equations of Aryton and Steinmetz can be written as

$$E = A + B/i^n,$$

in which $A$ and $B$ are constants dependent on the arc length and electrode material, while the exponent $n$ depends only on the electrode material and is found to be directly proportional to the absolute temperature of the boiling point of the anode material.

Using this equation as a basis, the author then studied the effect of arc length and developed a three-term equation for arc characteristics which checked well with many experimental observations. The author was highly complimented by several members on his contribution to research.

A paper that brought out spirited discussion was written and presented by Dr. Carl Hering under the title "Electromagnetic Forces: A Search for More Rational Fundamentals; A Proposed Revision of the Laws." The paper was premised on several experiments allied to the pinch and stretch effects and contained conclusions by the author that existing conceptions of electromagnetism were erroneous or at least subject to question. The author also presented a new generalized law based on the proposition that "in any system such motions will tend to take place as will reduce the potential energy of the system." The experiments were qualitative and the deductions of the author were to the effect that longitudinal forces due to magnetic fields were present. The author explained the force actions by use of the production of a counter-emf. and a connection between the flux and the conductor.

C. O. Mailloux opened the discussion with an attack on the Maxwellian system of mathematics and supported Dr. Hering's contention that investigation was needed. He indicated the possibilities of an investigation of the theory that magnetism was elastic in physical behavior and gave a fine résumé of the evidence and opinions which exist for present theories.

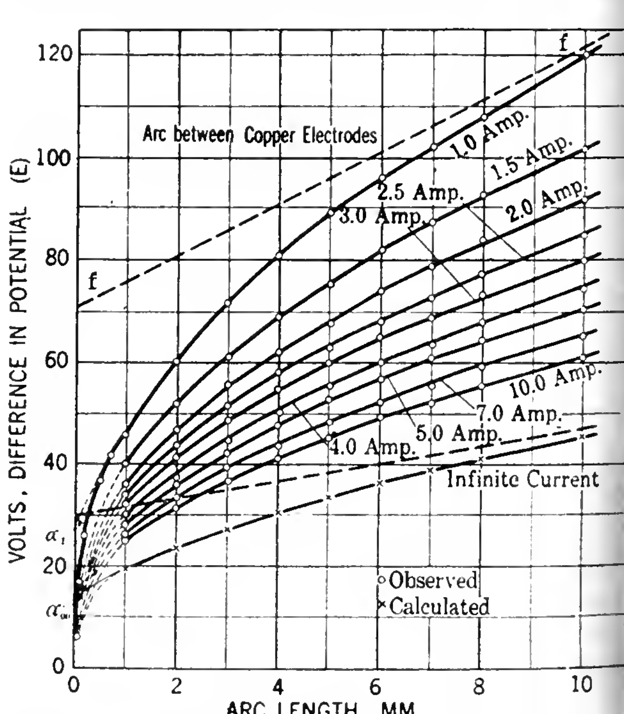
Professor Karapetoff pointed out just what Maxwellian and Kelvin mathematics represented and stated that the mathematics was a separate entity from the physical nature of electricity and magnetism. The latter is largely still theoretical, while the former gives quantitative and accurate results for all cases known in the paper. He indicated his belief that each of the experiments could be explained on the basis of complete and partial linkage changes and stated that the coefficient of self-induction was a quantitative criterion for determining the accuracy of the experiments.

Professor J. H. Morecroft agreed with Professor Karapetoff that the experiments were not conclusive because qualitative and said that they could all be explained by present laws. He indicated, as did Professor Karapetoff, an intention to carry out quantitative experiments of a similar character.

John Mills supported Dr. Hering in his contention that a revision of existing laws was necessary, but stated his belief that all the experiments could be explained on the basis of electronic effects and that flux and magnetism unnecessarily complicated the problem. Other discussion occurred without conclusive results, but the general opinion was expressed that the paper was stimulative to thought and valuable for its experiments.

### Effect of Minor Hysteresis Loops Approximately Calculated

In his paper on "Permeability," Thomas Spooner discussed the application of mathematics and graphs to determine the effect of minor hysteresis loops on the behavior of iron used in telephone transmitters, radio




VOLT-ARC LENGTH CHARACTERISTIC FOR DIFFERENT CURRENT VALUES

transformers and similar devices in which alternating current and direct current are superimposed. His paper showed the resultant equations and methods for getting approximate quantitative results.

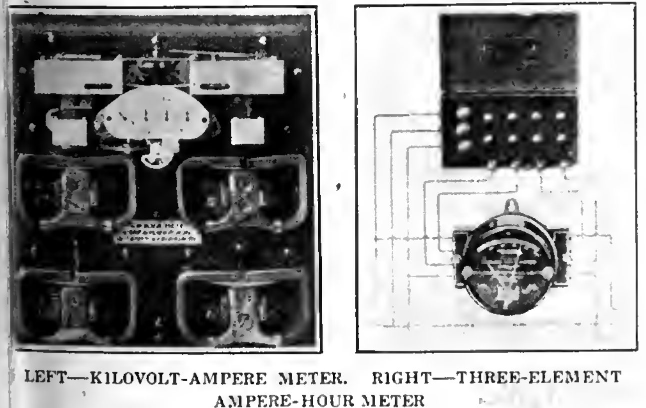
## Metering and Meters Discussed Friday Afternoon

In a paper entitled "Applications and Limitations of Thermocouples for Measuring Temperatures," by I. B. Smith, which was presented by title, the author summarized the practical applications of the device and the errors that may occur in use. He pointed out that the thermocouple was now greatly used in the precision measurement of the temperature of feed water, flue gases, bearings, windings, cables, etc., and that in these many uses care must be taken to eliminate errors. He discussed ten sources of error that may occur and pointed out how to eliminate or anticipate their effects. He then discussed rules and methods for measuring temperatures and showed the necessity for standardization if comparable results are to be obtained.

The use of thermocouples for measuring temperatures in underground cable systems has been very successful, according to E. D. Tanzer of the transmission department of the Philadelphia Electric Company. He described one instance where thermocouples were used in a 400-ft. duct line at intervals of 50 ft., with all the leads brought back to one point for reading the temperature value. In this way very accurate indications of conditions met with in underground systems can be obtained. A unique use of thermocouples was cited where a break in an underground steam main was located by making temperature tests throughout the length of a duct line running near the steam main, the location of the broken portion being indicated within a few feet by the abnormal temperature shown by the indicator.

G. H. Cole, in speaking of the inaccuracies encountered in the use of thermocouples, said that the greatest cause of trouble was in the contact drop at the thermocouple itself. He advocated that the leads be attached to opposite sides of the active material instead of on the same side.

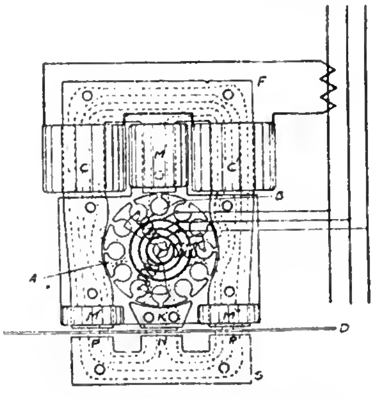
In a paper entitled "Volt-Ampere Meters," R. C. Fryer gave a résumé of meter developments and illustrated existing types as applied to metering kva. He tabulated the types as they involve different principles as shown in the accompanying table. Mr. Fryer then discussed each type and its application advantages and disadvantages and indicated a belief that the kilovolt-ampere meter will be on a plane with the kilowatt-hour meter in a few years.



LEFT—KILOVOLT-AMPERE METER. RIGHT—THREE-ELEMENT AMPERE-HOUR METER

P. A. Borden discussed the Lincoln-type meter, which is largely used in the system of the Hydro-Electric Power Commission in Canada, and said good results had been obtained.

In regard to a question as to actual meters on the market, Mr. Fryer stated that the meter manufacturers were prepared to give almost any kind of measuring instrument to the industry, but that the industry was as yet very undecided as to just what it wanted. This was brought about by the fact that so many different clauses relating to charges in billing for low power factor were in use. As stated in the original paper, of the 418 utilities in cities of 20,000 or over in the United States and Canada, fifty-nine companies have clauses considering power factor, and of these there are twenty different kinds.



ONE ELEMENT OF AN ANGUS THREE ELEMENT METER

The consensus of opinion seemed to be that accurate volt-ampere meters were very much needed and that developments in the past year on this type were very encouraging. Among those taking part in the discussion were Charles Fortescue and E. P. Peck.

TYPES AND MAKERS OF VOLT-AMPERE METERS

| | | |
|---|---|---|
| (1) Proper-phase-relation-type meters | Full range | Bodi (Westinghouse) |
| | | Angus (Esterline-Angus) |
| | Fixed range | General Electric |
| | | Lincoln |
| (2) Resultant-type meters | Full range indicating | Lincoln |
| | | Sangamo |
| | Full range integrating | Sperti-Bleeksmith |
| | | (Westinghouse) |

A notable paper entitled "The Measurement of Power in Polyphase Circuits" was presented by Charles Fortescue. It showed the necessity for reconsidering the present commercial trend in power measurements. Although meters and rate systems account for power factor and demand elements, unbalance is not considered and an inequitable application of power-factor penalties occurs in many cases. He stated that unbalanced effects were of the same order of magnitude as reactive kva. effects in many cases and showed that the consumer often was charged for reactive power or unbalanced power consumption brought about by other consumers' apparatus. He then introduced the sequence idea of power measurement and proposed a new method.

The proposal made was that the positive phase-sequence power output only be measured and the power charges be made on the basis of this measurement. It was further proposed that the unbalanced kva., which is the product of the positive sequence voltage and the negative sequence current, be measured either by means of a negative sequence ammeter, indicating or recording, or a kva. meter, and a charge made for the amount of unbalance. The user of symmetrical polyphase rotating machinery should then pay a lower rate, based

on the estimated cost of unbalance, and the consumer having unbalanced loads should be charged directly for the amount of unbalance he creates, or else should have his positive phase-sequence power rate increased, based upon the estimated cost of unbalance. Devices for measuring these quantities are being developed, the author said, and the outfit for making these measurements will be no more complicated than the present existing measurement devices. In fact, the tendency is toward greater simplicity.

In presenting the subject the author had no intention of suggesting how rates should be made, but merely wished to point out what factors enter into the question of equitable rates when the polyphase system is subject to unbalance.

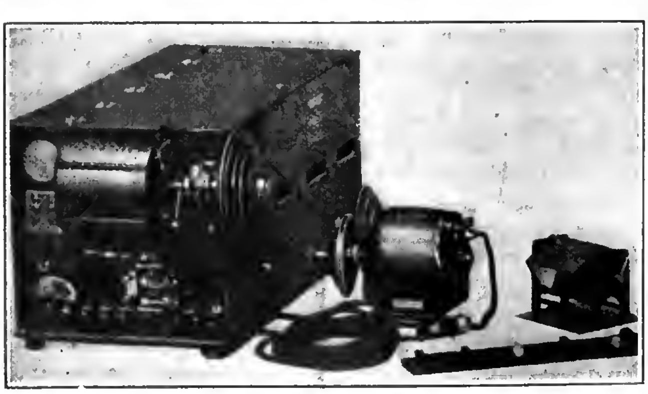
R. D. Evans discussed the paper and showed that metering devices could be made to measure sequence quantities. Standard instrument transformers and meters could be used, and in addition an auxiliary box containing the necessary network impedance. In his opinion, fewer meters would be required than with existing methods.

E. P. Peck said that any factors that cannot be readily understood by the power consumer cannot be used in billing a customer for the energy consumed. Consequently it is inadvisable to bring in a factor such as unbalance of load, particularly as this is not one of the main factors that affect the rates. Varying load factor, total load and the initial cost of equipment utilized in stations and the distribution systems are much more important. In his opinion, billing on a kva basis was one of the best methods, as this can be understood more readily by the general consumer.

Professor Karapetoff was also of the opinion that the rate basis must be easily understood. He explained a simple mechanical analysis that might simplify the problem of making the unbalanced condition understandable to the consumer.

### A New Type of Oscillograph

A paper that brought out a great deal of discussion was entitled "Expansion of Oscillography by the Portable Instrument." The author, J. W. Legg, described a portable oscillograph of a new type. The three galvanometer magnets are of the permanent type, and the resistors and shunts are in the oscillograph box. An incandescent lamp with arrangements for getting abnormal voltage for the time of film exposure and



GENERAL ASSEMBLY OF COMPLETE INSTRUMENT

the use of 110 volts alternating current or a storage battery for motive power are other distinctive features of the instrument. The author showed the many fields of application and presented oscillograms of typical cases. J. R. Craighead discussed the paper and asked several questions of the author in regard to heat radiation and the voltage range of the resistors, the insurance of lamp brilliancy when photographing transients, total weight of box, etc. He also said he had used the older type of oscillograph for many types of field

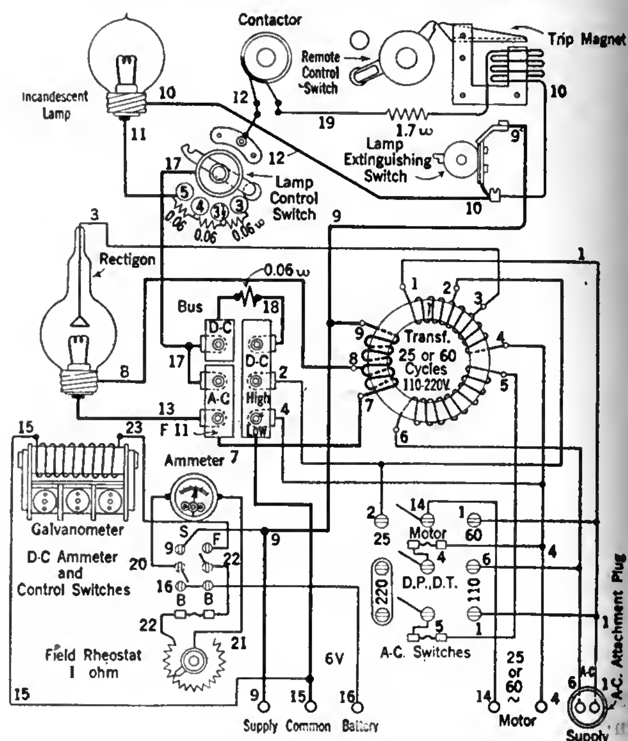



DIAGRAM FOR SUPPLY CIRCUIT FOR MOTOR, LAMP, ETC., IN OSCILLOGRAPH

applications. P. A. Borden gave examples of using oscillographs in logging camps, isolated power plants, under tents, etc., and said they were great assets to an operating engineer.

The use of tungsten wire in air as an element for producing the intense light necessary for the mirror and film was suggested by H. L. Curtis. The use of aluminum mirrors instead of silvered glass was also suggested. The great advantage of this would be that electromagnetic damping of the elements could be accomplished, thus doing away with the present use of oil for this purpose. A method of keeping silvered mirrors was suggested by E. D. Doyle. He had had very successful results in placing the elements in a glass bottle instead of in oil, placing a waxed paper around the stopper to exclude all injurious elements. Others taking part in this discussion were E. E. F. Creighton, Charles Fortescue, G. H. Cole and R. C. Fryer.

### A New Crest Voltmeter Developed

In a paper entitled "Measurement of Transients," F. E. Terman described a new type of transient-crest meter and listed applications suited to its use. The new meter utilizes the vacuum tube and goldleaf electroscope operations. It consists of a goldleaf electroscope in series with a rectifying device and an electron tube which enables the electroscope to charge but prohibits discharge. The charge that is captured in this manner is proportional to the maximum impressed potential, and where adequate insulation is possible will remain substantially undiminished for many seconds or even minutes after the transient has passed by.

The crest meter has already served successfully in

several investigations. The first application was the measurement of the potential of the sphere electrode of a high-voltage oscillator. The method followed consisted in measuring the charging current to the sphere by means of a shielded electroscope resting within this electrode. When combined with a second goldleaf acting as relay contact to give an alarm at a given voltage, the instrument is admirably suited for the study of transmission-system disturbances, for the observer need be tied no closer to the test than to remain within hearing distance of an electric bell. Such an application was made during four months of the past summer on a 110-kv. line belonging to the Pacific Gas & Electric Company in an effort to discover the cause of apparently unprovoked flashovers which this particular line experienced from time to time. Similar applications become evident as their need arises.

### Time and Voltage Must Be Considered

In discussing Mr. Terman's paper, Charles Fortescue stated that what was really needed for studying transient phenomena was a method in which the "voltage plus that of time" condition could be measured. The destructiveness of transients is not the result of the high voltage alone, but of a combination of voltage extended over time. Take, for example, transients set up in transformers when they are connected or disconnected from lines. Here the voltage maximum reaches three or four times the normal value, but damage is very seldom caused, because the duration of the transient is so short. In regard to the question of current lag in the electron tubes used in the device described, Mr. Terman stated that there was no lag whatsoever.

A paper on "Balance Methods in Alternating-Current Measurement" was presented by Perry A. Borden. The author pointed out the value of balance methods of measurement, discussed the different methods in a review of the subject and described how the methods were applied to measurements on an operating system. A fine bibliography of the subject formed part of the paper. This paper was discussed by Charles Fortescue, I. M. Stein and E. D. Doyle and the general opinion expressed that the methods outlined by the author could be used to advantage in many applications. The author was complimented on his thorough analysis of the subject and his good presentation of existing methods.

# Practical Data on Lightning

**Effect of the Disturbances in Twenty Transformer and Six Generator Failures and Seven Faults in Other Apparatus Related**

PRESENT-DAY apparatus for protection against dangers caused directly or indirectly by lightning are very incomplete and far from satisfactory, according to views expressed by Sigur Rump in the *Brown-Boveri Mitteilungen* for November and December of last year. He has undertaken an exact investigation of all lightning disturbances coming to his knowledge, developed a general theory of the cases and arrived at conclusions concerning the best protection for each trouble. A total of twenty transformer failures, six generator failures and seven faults on other apparatus were studied.

Flashovers in transformers appeared almost exclusively between coils or between layers—very rarely between turns—and occurred mostly when the transmission line lashed against ground. The end turns were damaged mainly in small transformers (below 70 kva.), while on larger machines the burn-out occurred most frequently toward the middle of the winding. Oil-immersed transformers suffered much less from flashovers, because many overvoltage disturbances are of a very transient character and because it takes an appreciably longer time to puncture a gap under oil than it takes in air. It was found that punctures between the end turns are due to waves with a steep front, while failures in the middle of the winding are caused by internal oscillations within the transformer. Failures between phases have never occurred. A hypothesis is developed to explain the generation of traveling waves with flat and with steep fronts along lines within the field of a thunder cloud. Only a direct hit into the line will, as a rule, cause waves with steep fronts, according to the article. An attempt is made to explain how internal oscillations occur in transformers and how electromagnetic pulsations in a winding may be responsible for a breakdown between coils at any part of the coil stack.

### Three Causes of Lightning Discussed in Detail

Three typical lightning cases which occurred in practical service are related, with all details. One caused an arcing ground, the second set off a train of steep front waves, and the third was a direct hit into a line. Experiences with high-tension lines seem to indicate that lines above 100,000 volts suffer rarely, if ever, from lightning troubles and do not need any protective apparatus. The magnitude of steep-front waves in plants of less than 100,000 volts may easily reach, and in many cases exceed, the flashover voltage of the line insulators. The best protection for these plants and lines would be the complete prevention of the occurrence of overvoltages, such as is afforded by one or more ground cables above and along the entire line, provided that steel towers are used. But this would be far too expensive. It has been tried in vain to block the passage against surges with small choke coils of the so-called "bedspring" type (inductance usually between 0.1 millihenry and 0.5 millihenry). In some cases these coils have even increased the electric stresses. Horn-gap arresters with a resistance in series have been suggested, but they were found to be useful only below 15,000 volts. Theoretical considerations proved that if the ohmic resistance of the gap is considerably larger than the wave resistance of the line, the protective value of the horn decreases to zero.

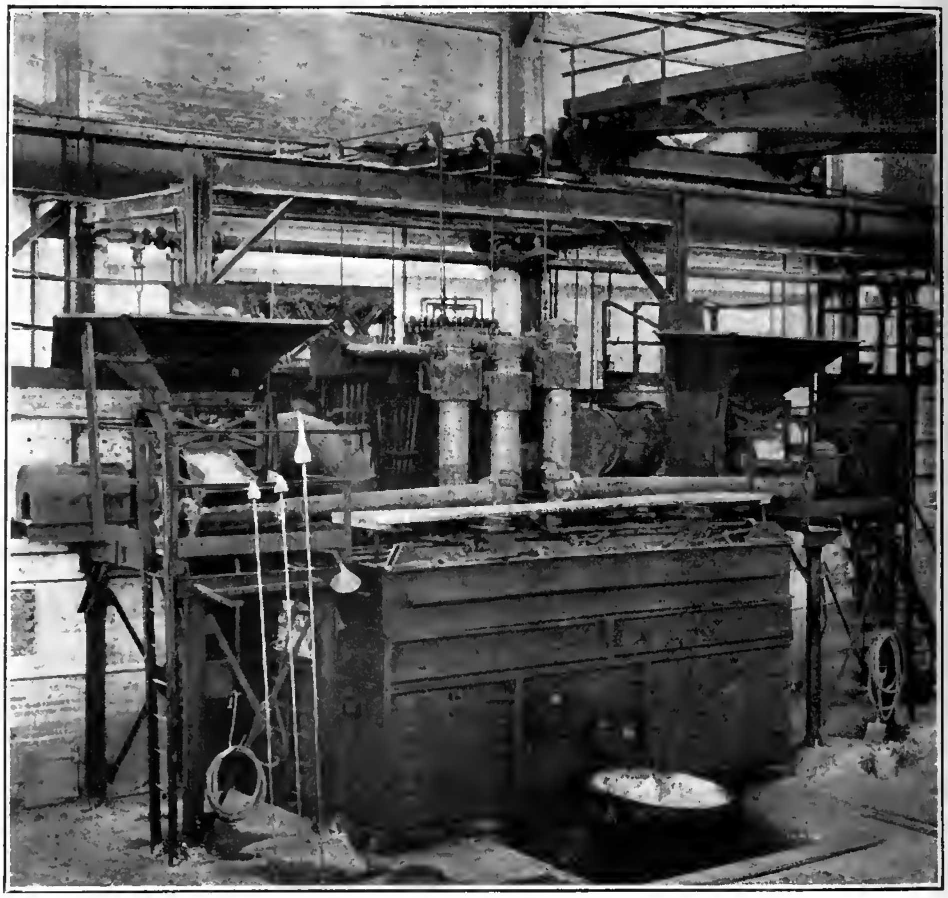
### Chemical Arresters Condemned

The chemical arresters are of little use, because their start depends upon the puncture of a solid dielectric, which takes too long a time to be of any value for quick transients. In many power stations feeding high-voltage lines nearby power consumers are frequently supplied directly with the generator voltage. This, the author points out, is a dangerous practice, because overvoltage troubles on these subordinate branch lines are apt to endanger the main generators. For such cases a one-to-one ratio transformer is recommended, acting merely as an insulating transformer. In the worst conditions possible an incoming overvoltage may burn out this small and inexpensive transformer, but it prevents harm to the costly main generators.

# Electric Furnace Makes Ferro-Vanadium

## Description of a New Electrometallurgical Process for the Reduction of This Material by Carbon—Operation Has Been Made Possible by the Development of a Type of Electric Furnace Different from Those Previously Designed

By B. D. SAKLATWALLA* and A. N. ANDERSON†



THE 80-TON, 4,000-KW. FURNACE USES THREE 12-IN. GRAPHITE ELECTRODES. ROLLERS PERMIT EASY MOVEMENT FOR RELINING OPERATIONS

BY A SERIES of experimental and analytical electrical developments it has been made possible to attain physical electric furnace conditions for the carrying out of a chemical reaction hitherto not commercially possible. Not only has this electric development substituted coke in place of expensive metallic reducing agents but it has also made feasible the reduction of low-grade raw materials. Probably in no other electric furnace operation are materials treated which carry not more than from 2½ to 3½ per cent of the element to be reduced and a commercial product obtained in a single smelting operation.

The commercial production of ferro-vanadium has until very recently been carried on by means of metallic reducing agents such as aluminum and silicon, the former as a self-propagating exothermic reaction without the aid of extraneous heat, the latter in an electric furnace. The cost of such metallic reducing agents has necessarily been excessively high. The attempt, therefore, to reduce vanadium by means of carbon seems natural, and such efforts date back to several years. Moissan as early as 1894 attempted to reduce vanadium in his electric furnace without success, obtaining a highly carbonaceous product, the major portion of it being a carbide. Efforts in this direction by others seem to have been equally fruitless.

The underlying reasons for the difficulty of reducing vanadium by carbon may be ascribed to two main factors—the high temperature of reduction and the great chemical activity of vanadium at such high temperatures. Further, vanadium exists in several forms of valency, producing different oxides with greatly varying degrees of refractoriness and reducibility. In working out a successful process these factors were kept in view and conditions established during the process such as to overcome the inherent deficiencies. The high temperature of reduction was met by designing a small crucible with close spacing of electrodes, causing a very high power input per unit of crucible section. To offset the chemical activity of the metal the furnace was so designed that the reduced alloy after it had been converted to the metallic state instantly left the high-temperature reduction zone into which the mixture to be reduced was fed. The property of changing valency and consequent variability of the oxide to be reduced was taken care of by carrying out the reaction rapidly and not allowing a gradual transition from a higher to lower oxides before ultimate reduction to the metal itself. The instantaneousness of reaction was achieved by producing an extremely localized high-temperature zone into which the mixture was directly fed.

The actual experimental work was started along these lines by building a small 100-kw. two-electrode furnace. The next step consisted of a 750-kw., three-phase, 60-cycle furnace, from which the commercial operation has been standardized to a 4,000-kw., three-phase, 60-cycle unit. The voltage originally employed on the experimental furnace was 30 at the start, which was later increased to 90, 110 and 170, and finally standardized

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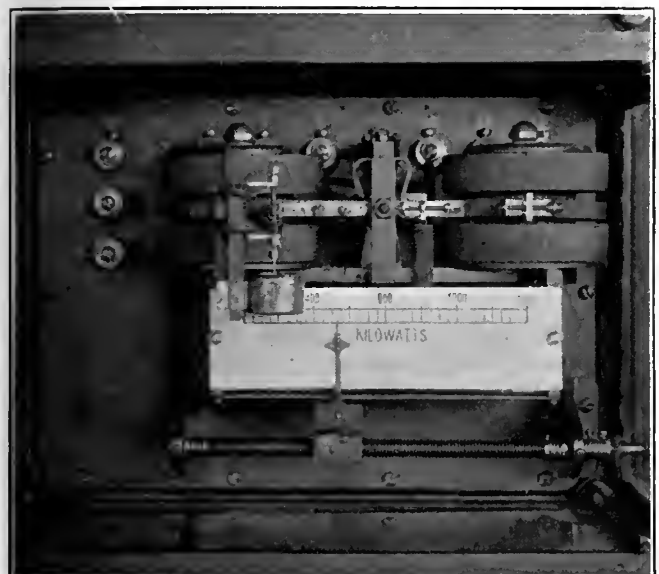
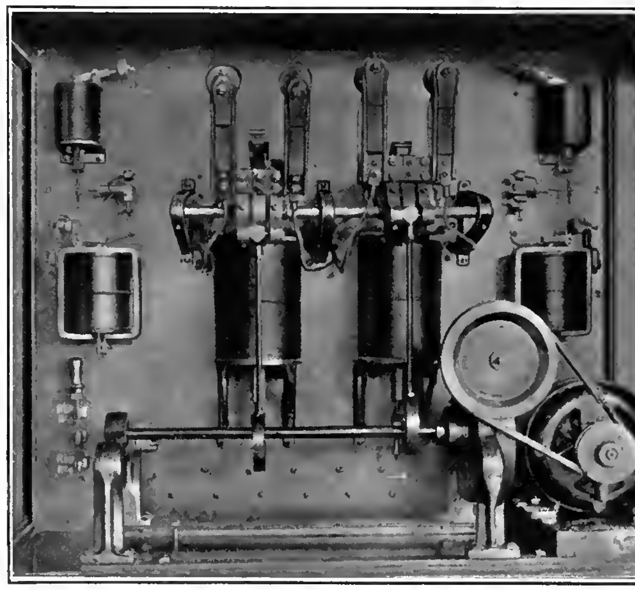
†Assistant general superintendent Vanadium Corporation of America.

at 220 volts on the commercial units. It was found that the increased voltage gave more efficient results. The first experimental furnaces were of the open type, which were later supplemented by a covered unit. On account of the high temperature prevalent in the operation, the cover is water-cooled by means of coolers built in between the brick courses. The feed is charged into the furnace in a pulverized and thoroughly mixed condition by means of two automatic feeders which deliver the material between the electrodes into the hottest zone of the furnace. The feed is continuous and its rate is regulated proportionally to the energy input in the furnace. The slag-forming fluxes are selected of such a nature as to possess electric properties enabling the electrodes to dip into the slag bath so that the arc will not be exposed but submerged.

The furnace shell is made up of cast-iron segments bolted together. The lining consists of a 4-in. layer of brick all around next to the shell, followed by carbon blocks and a rammed-in mixture of coke, tar and pitch, forming a total thickness of about 44 in. Tap holes are provided for metal and slag. The over-all dimensions of the 4,000-kw. unit are approximately 16 ft. 4 in. x 12 ft. 8 in. x 7 ft. 10 in. high. The total weight of the furnace together with cover is approximately 80 tons. The three electrodes used are graphite, 12 in. in diameter. As it was desirable to interrupt the continuity of the operation as little as possible, the furnace was placed on two sets of rollers at right angles to each other, so that when the furnace needed relining it was rolled out from its position and a spare one already lined rolled in in its place, thus obviating the necessity of leaving the electrical equipment idle. This change of furnace can be effected in less than two hours and helps keep up the load factor of the installation.

For the same reason an electrode holder was designed which would curtail the time of electrode changes. The holder used works on the friction-contact principle, eliminating all bolts, nuts or other tightening devices. It consists essentially of three members—(1) the outer casing of copper, forming a hollow water-cooled ring connected to the transformer leads and having a slight taper on the inside; (2) a copper ring fitting inside the water-cooled ring and having its outside surface tapered to conform to the inside surface of the first member; (3) bronze wedges which fit between the second member and the electrode. In operation the second member is applied to the electrode by means of the wedges, this taking place on the furnace-room floor, and the electrode thus provided is lifted with the crane and simply dropped in the water-cooled first member, making a friction contact by its own weight. The advantage of this device, besides saving time, is that it obviates the necessity of loosening or tightening bolts or other devices on the top of the furnace where the working conditions are disagreeable. Further, should the holder get hot, as the water-cooled outer ring and the graphite electrode do not expand, the only material that can expand would be the second member ring and the wedges, which would produce a tighter contact, instead of a looser one, as in the case of holders of the ordinary type.



ELECTRODES CONTROLLED BY KELVIN BALANCE

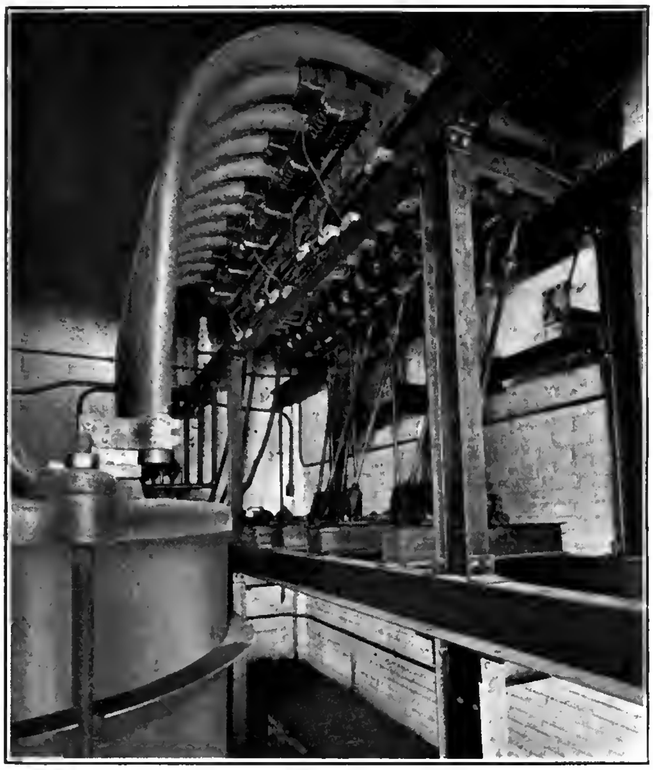
Voltage control is obtained by means of a watt balance of the Kelvin type. A watt fluctuation causes one of the contactors to close one of the auxiliary contactors, while the other auxiliary contactor continually opens and closes through the motor and cam mechanism. These devices control the electrode motors and give very accurate adjustments.

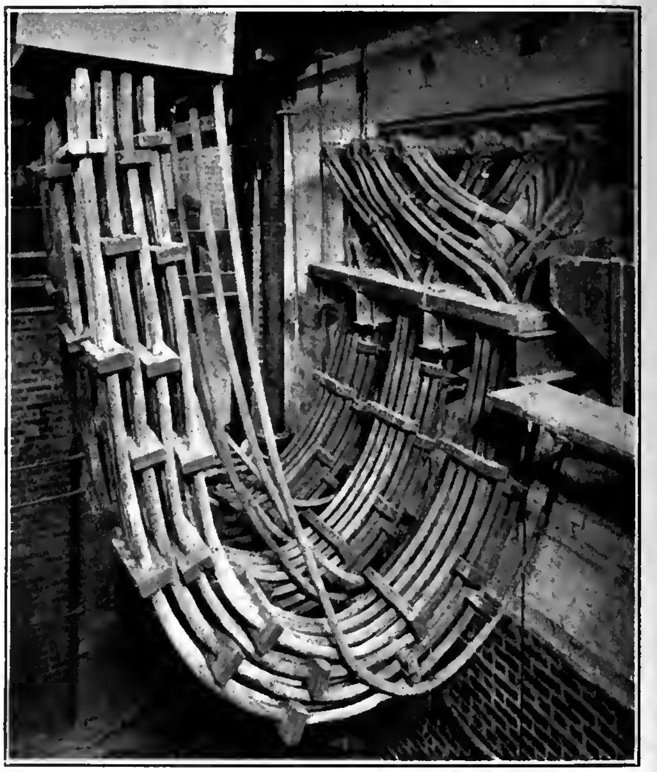
Owing to the feed being continuous and delivered immediately at the arcs under the electrodes, it is apparent that the change in electrical properties of the material at the arc will vary constantly. Combined with this, the fact that a very high temperature had to be constantly maintained to effect the reduction more or less instantaneously rendered it necessary to apply an automatic current-control system which would be capable of very close regulation, quick current rectification and high sensitiveness to very slight fluctuations. In order to keep the high temperature constant, it was considered necessary that any regulating device should not be actuated by either amperage or voltage alone but by both simultaneously effecting a true wattage regulation, thereby maintaining a truly constant energy input into the furnace. With these factors in mind the regulating mechanism described below was designed and constructed jointly by the authors.

The device consists in the main of two separate members, a watt balance and a control contact-making

mechanism. The watt balance is of the Kelvin type, consisting of a balance beam carrying a volt-actuated coil at each end balanced between two fixed ampere-actuated coils. At a predetermined wattage the beam coils are floating in balance. As soon as any watt fluctuation occurs the beam is inclined out of balance, making contact at a two-way contact point in one direction or the other, actuating from these contact points the other member of the device, namely, the contact-making mechanism operating the electrode motors. This latter mechanism consists of two opposite sets of contact arms, the one, in constant to-and-fro rocking motion, being driven through an eccentric mechanism by a motor, the other actuated by a relay magnet receiving its impulses from the watt balance and, when so actuated, meeting the rocking arms completing the neutral connected to the furnace. When the load in the furnace is balanced the magnetic pull on these relays is balanced and a contact-making switch in the watt-balance circuit is closed. Phase unbalance in the furnace load causes a corresponding disturbance in the relays, opening the circuit not affected by the disturbance because of potential differences between electrode and furnace bath, preventing movement of the electrodes unaffected by the disturbance, but causing the electrode affected to move in the direction required to restore balance, which, when reached, again closes the circuits. These magnets also function to prevent electrodes going too far into the bath or pulling out of it as the corresponding circuit opens for either direction.

In the operation of the regulating devices no direct





LEFT—TUBULAR CONSTRUCTION GIVES RIGIDITY WITH LESS TRANSMISSION LOSS FOR THE 60-CYCLE SUPPLY. RIGHT—FLEXIBLE CABLES ARE CONNECTED TO FURNACE TUBES AND THE USE OF SPACING BLOCKS PREVENTS SWAYING OF CONDUCTORS

circuit for operation of the electrode motor. The motion of the non-rocking arms is controlled by means of very fine adjustments which allow them to meet the rockers during the desired part of the arc described by them, the speed of the rockers at the same time being variable. By means of these regulations the period of contact of the arms and duration of circuit closing on the motors can be regulated to a great degree of nicety, avoiding unnecessary movement of the electrodes. Further, to facilitate quick regulation and restoration of balance in the furnace a "selective regulation" device is applied. When one of the electrodes is out of balance this device throws the other two electrodes out of the regulating circuit and holds them in their position while the unbalanced electrode finds its adjustment, thereby restoring right operating conditions in very much quicker time. The "selective regulation" device consists of magnetic relays, star-connected across phases, two magnets being present per phase for up-and-down motion of the electrodes, with a common current is used for relay or operating circuits. The current used for these purposes is that delivered to the furnace and at the voltage at which it is used in the furnace.

As the current input of the standardized units is rather high—namely, 4,000 kw. for 60-cycle current—care was taken in the layout of the secondary structure to minimize losses. Comparatively little has been published on conductors carrying heavy currents at 60-cycle frequency. The literature on skin effect has been confined chiefly to currents of high frequency, although this effect is admittedly present in conductors carrying large currents. To arrive at practical conclusions eight different systems of bus structure of combinations of flat strips and tubes were mathematically investigated. Results of these calculations offered two systems as the most promising, the one consisting of ¼-in. x 4-in. copper bars interlaced in 1, 2, 3 phase order, spaced ¼ in. apart, the other of 3-in. extra-heavy copper tubing interlaced and spaced 7 in. center to center. The flat-

strip system indicated a reactance volt drop of 0.6 per cent and a watt loss of 0.41 per cent; the tubing gave a calculated reactance volt drop of 2 per cent and a watt loss of 0.2 per cent. Both calculations were based on a current density of 800 amp. per square inch and current at 10,000 amp. to 12,000 amp. per phase. Wide differences in reactance-volt drops were found in the several systems, varying from 0.6 per cent at unity power factor to 35.5 per cent at a power factor of 60 per cent. The tubular construction was chosen because it promised less actual transmission loss than the other systems and offered a rigid and simple contrivance.

The transformer used is of the three-phase water-cooled type with a primary voltage of 22,000 and a secondary voltage of 224 at no load and 220 at full

The flexible cables are connected into the 5-in. tube in such a manner as to form the "delta" at this point, and the spacing of the flexibles is so arranged that leads carrying current of opposite sign are placed adjacent. This method is carried out throughout the entire system of cables, both with respect to leads carrying current to and from the same electrode and also with respect to adjacent leads between phases, so that the instantaneous current values are always opposite in sign. The flexibles are held in proper position and spacing throughout their length by means of spacing blocks. These blocks serve very materially to brace the cables against swaying motion without interfering with the up-and-down motion.

Results obtained by this system of heavy-duty 60-

SEPARATE CONTROL ROOM IS USED WITH PEDESTAL MOUNTING OF INSTRUMENT

load, the capacity being 4,000 kva. at 40 deg. rise and 5,000 kva. at 50 deg. rise in temperature. There are two secondary coils per phase, and leads are brought out in 1, 2, 3 phase order to the secondary terminal block. The conductors on the secondary side of the transformer, consisting of twelve 3-in. extra-heavy copper tubes, are led out through the transformer vault wall into the furnace room. A set of switches on these conductors enables "deadening" of the system extending into the furnace room, at the same time keeping the transformer "alive" for serving power for general plant operations. From these 3-in. copper tubes the current is led for each phase by means of sixteen 1,000,000-circ.mil asbestos-cored flexible copper cables into two extra-heavy copper tubes, 5 in. in diameter and 8 ft. long, running across the furnace to the electrode holder and carrying the cooling water to the holder.

cycle transmission were very gratifying, materially reducing the total impedance of the circuit. Actual tests were made at full load on the equipment, and the average of several determinations showed that the drop in potential from transformer terminal to electrode holder, the length of the leads being 50 ft., was only 3 volts, the power factor being 98 to 99.7 per cent and the total over-all efficiency, including transformer losses, 98.5 per cent. During these tests it was noticed that the highest power-factor and lowest voltage-drop readings were obtained when the electrodes were all of even length, and the worst results were obtained when one of the outside electrodes was more than 4 ft. longer than the rest. The impedance in the circuit rises on heavy overloads, the calculated reactance voltage drop reaching 17 per cent at 60 per cent power factor, thus tending to protect the equipment on overloads.

The entire control mechanism is placed outside the furnace room in a separate control room, the instruments being mounted on pedestals. The instrument equipment per furnace consists of an ammeter for each phase, a voltmeter, wattmeter, power-factor meter, frequency meter and watt-hour meter. On the first unit installed, in order to study the operation easily, all the instruments selected were of the recording type. The component of each furnace is protected automatically by overload and no-voltage relays which open oil circuit breakers. In addition, the incoming power lines, of which there are two sets, are equipped with oil switches automatically opened on overload and reverse current. Two sets of lightning arresters, one for each set of lines, afford further protection. All switches and operations of control are so equipped as to be changed instantly from automatic to hand manipulation.

The electrodes are controlled by motors provided with two speeds, the operating speed, 2½ ft. per minute, being readily alterable to a speed of 5 ft. per minute for changing electrodes or other similar purposes which often occur during the operation of furnaces of this character.

# Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

## The "Net Price Versus List and Discount" Argument

*To the Editors of the* ELECTRICAL WORLD:

The recent article in your "Manufacturing and Markets" section on "Net Prices Versus List and Discount" sets forth a line of argument that is quite familiar to the manufacturer whose product is handled through the electrical jobber. The fact that it has made no impression on the manufacturers is because the argument is fallacious. What the jobbers seem unable or unwilling to comprehend is that because they *buy* at list and discount they are not therefore compelled to *sell* at list and discount. They also seem to argue that because they buy fifty or a hundred articles at 50 per cent discount they are obliged to sell them all at 40 per cent discount, apparently trying to make it appear that it is easier to quote a separate net price on each of the fifty or one hundred articles than it is to separate the articles into, say, three groups according to the rate of turnover, quoting respectively discounts of 40, 25 and 10 per cent on the different groups as necessitated by conditions.

Let us consider further the second example mentioned in your article, namely, push-button switches. Our company does not manufacture this line of commodity, but let us suppose that the prices at which they are being sold today to the jobber are respectively 35 cents less 49 per cent for the single-pole switch and $2 less 27 per cent for the four-point switch. These figures are not far from the actual prices quoted today, and there is no doubt that the manufacturer has taken care of himself in the matter of turnover when he charges eight times as much for a four-point switch as for a single-pole switch. But what possible difference can it make to the jobber when it comes to his reselling these two devices whether he buys them at the abovementioned lists and discounts or whether he buys them respectively at $17.85 per 100 and $146 per 100, which are the "nets" of the above lists, and discounts? The single-pole switch is perhaps one of two articles which the jobber buys at 49 per cent, whereas the four-point switch is one of one hundred or more which the jobber buys at 27 per cent; but, as previously indicated, there is no obligation on the part of the jobber to sell at 15 per cent all of the articles which he buys at 27 per cent from the manufacturer.

Each jobber must determine his own turnover on every article. The manufacturer cannot do this for him. The manufacturer bases his selling price on total sales, but there are many articles which the manufacturer produces in large quantities that have a definitely localized demand. For instance, there are articles that are bought in large quantities in and around New York City and which are therefore logically resold by New York jobbers at a close price. But there is little demand and therefore a slow turnover on these devices in Dallas and San Francisco, and they should therefore be resold in those districts on a wide margin of profit for the distributor.

The real answer to this matter is that it is competition and not the manufacturer's practice that holds down the profit on electrical material. The law prohibits the jobbers from agreeing among themselves upon uniform selling prices. The jobbers would like to have the manufacturers set the resale prices, and jobber A would like to have a depth bomb set off under jobbers B, C, D, etc., whenever they deviate from the manufacturer's selling price (and incidentally select a "dud" to punish the transgressions of jobber A)—but this too is forbidden by law. The consequence is that a vast number of articles are sold on a margin of profit which is really sufficient only for a limited number of commodity items.

The question is a difficult one without doubt, but the remedy seems to be almost entirely in the hands of the jobbers themselves. Unless a considerable number of them can become accustomed to passing up orders which cannot be obtained at prices that show a profit, the remedy is probably a long way off.

F. V. BURTON.
Sales Manager.
Henry D. Sears,
Boston, Mass.

## Storage-Battery Locomotives in Service

*To the Editors of the* ELECTRICAL WORLD:

In your issue of Jan. 20 you have a very interesting article on ash-disposal systems. In one respect, however, affecting storage-battery locomotives, your article was misleading. At the Ashley Street station of the Union Electric Light & Power Company two storage-battery locomotives are in service. These machines are the original machines installed in 1916. The battery has thirty cells divided in two compartments, and it gives absolutely no trouble of any kind. One battery five years old is still in service, the other one having been replaced about two months ago. A gasoline locomotive is available but does mostly standby duty during peak load when it is necessary to run two machines. Our experience has been that if the battery is kept clean and charged properly no trouble will result.

EDWARD R. WHITAKER.
Union Electric Light & Power Company,
St. Louis, Mo.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Installing Directional Relays

POWER - DIRECTIONAL relays must operate in the predetermined direction under all classes of short circuits in addition to operating at a low voltage. The most severe test is a single-phase short circuit with a high percentage of reactance. In order to insure correct operation under all conditions, the manufacturers recommend that the relays be connected in such a manner that the current in each relay will lead the voltage across the voltage coil by a certain amount when the load on the line is at unity power factor, so that when a short circuit occurs, which will generally have a high percentage of inductive reactance, a high power factor will still be obtained and each relay will be sure to operate in the right direction.

In three-phase circuits a current lead of 30 deg. is the most easily obtained, and this is a safe value to use under practically all short-circuit conditions. If the current and voltage used for operating the relays are taken off the same point of the line, it is a comparatively easy matter to select the proper current to operate with a given voltage, but often it is found more practical to have the potention and current transformers connected on opposite sides of the power transformer, which makes it more difficult to trace the correct leads for the relays.

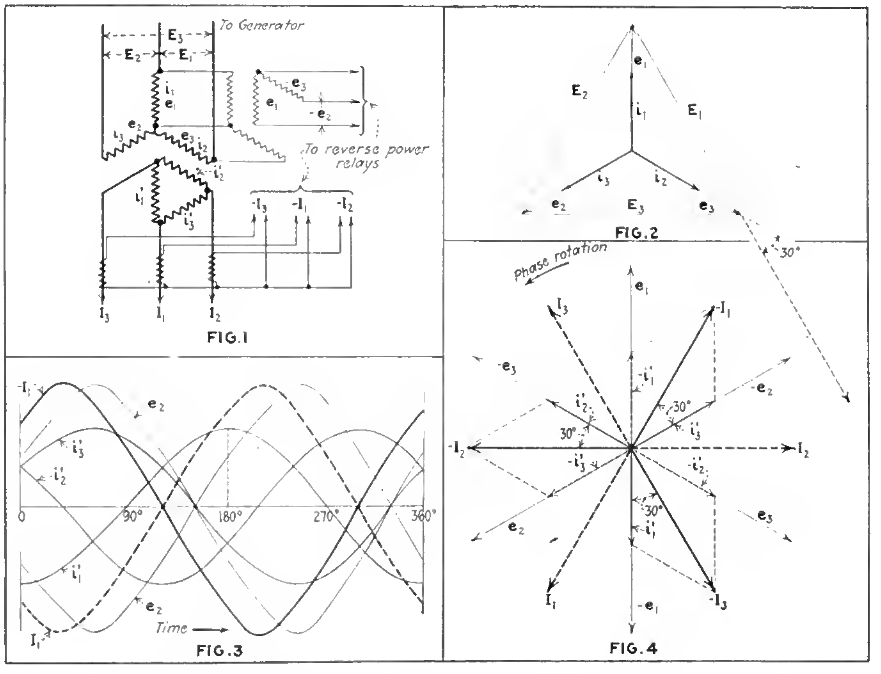
The connections of a power transformer connected star-delta, where it was desired to connect the potential transformers on the delta or low-potential side and bushing-type current transformers on the high-potential side, are shown in Fig. 1. The secondaries of the potential and current transformers were brought out for connecting to the power-directional relays to trip an oil circuit breaker in the outgoing line. The problem was to determine the proper current and voltage leads for each of the three relays.

It was, of course, necessary to know the phase rotation which was tested out and the primary power transformer leads properly marked. Fig. 2 was then drawn, giving the vector of the current and voltage at unity power factor on the primary side of the power transformer. For simplicity the arrows were drawn parallel to the respective transformer windings shown in Fig. 1. Here the voltage $e_1$, pointing vertically upward, is assumed at a maximum and is taken as the reference voltage.

The induced voltages and currents in the secondaries of all the transformers being taken as 180 deg. out of phase with the corresponding values of the primaries respectively, Fig. 4 was drawn, giving the phase position of the secondary voltages of the potential transformers and the secondary currents and voltages of the power transformer.

The phase position of the primary and secondary current in the current transformers represented in the diagrams by $I_1$, $I_2$, $I_3$ and $-I_1$, $-I_2$, $-I_3$ were also drawn. For example, it is seen from Fig. 1 that $I_1$ is made up of the vector difference of $i'_1$ and $i'_3$. The line $I_1$ $-I_1$ was thus located in Fig. 4. In the same manner the positions of $I_2$ and $I_3$ were determined. The curves of a few of the quantities shown in Fig. 4 are illustrated in Fig. 3.

It was now possible to select the pairs of leads going to each relay, $-e_1$ and $-I_3$ going to relay No. 1, $-e_2$ and $-I_1$ going to relay No. 2, and $-e_3$ and $-I_2$ going to relay No. 3. It was, of course, not necessary to trace the polarity of the leads from the transformers to the relays, as the current leads were connected in either direction and then the proper potential connection determined by means of a power-factor meter.




PROPER PHASE RELATIONS WHEN INSTALLING POWER-DIRECTIONAL RELAYS SECURED BY ANALYTICAL STUDY

R. RADER,
Assistant Engineer.
Puget Sound Power & Light Company,
Seattle, Wash.

## Terminal Modification That Eliminates Breakdown

ON ONE transmission system in the South considerable trouble with circuit-breaker terminals used to be encountered which has been entirely eliminated by a simple modi-

fication. The trouble was experienced only in connection with circuit-breakers that opened under overload frequently. All other circuit breakers with the same type of terminals (condenser type) gave satisfactory service. The trouble was apparently due to carbon deposit from the oil building up in the steps of the condenser bushings and eventually permitting arc-over between sections of the condenser.

Application of porcelain terminal boots filled with oil and sealed to prevent entrance of foreign matter remedied the trouble. Molded integrally into the porcelain boot is a metal base which is tapped on the inside to screw onto the lower end of the circuit-breaker terminal. To the lower side of the metal base is attached the circuit-breaker contact. The boot is filled with switch oil and a cork bushing clamped onto the top.

Seven switches the terminals of which have been so equipped failed thirty times in one year before modification, but have given no trouble attributable to the terminals since then—a period of eighteen months.

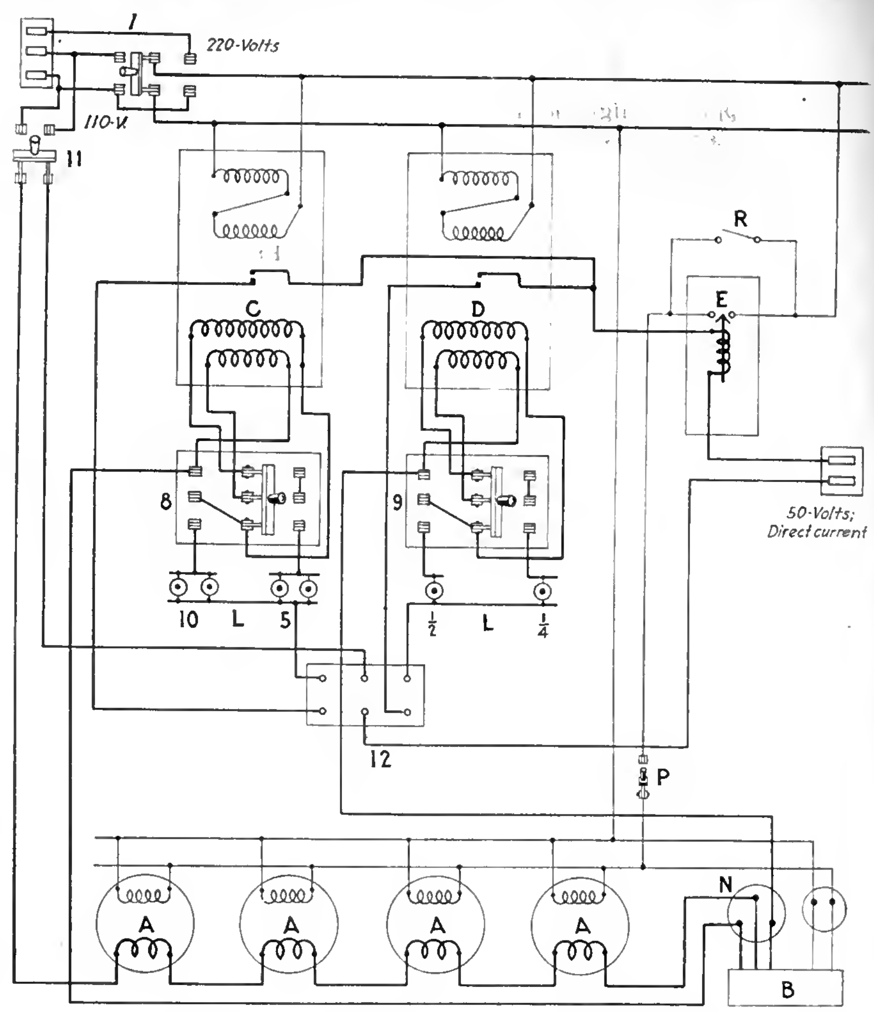
It is desirable to emphasize that this modification was not considered necessary on circuit breakers which open under overload infrequently.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Calibrating Five Meters Simultaneously

ALL meters, new and old, receive a pre-installation test at the laboratory of the United Illuminating Company in New Haven, Conn., and to facilitate this work and cut down time in testing smaller sizes a special board has been designed as shown in the accompanying illustrations. Five 5-amp. or 10-amp., 110-volt or 220-volt meters are tested at once. The board is equipped with spring points so that the weight of the meter under test makes the necessary circuit completions. Potential cords are snapped upon the test links with which all modern meters are provided. The equipment consists, in brief, of five vertical panels carrying the tested meters and necessary terminal blocks, a large panel carrying two master meters, switches and a contact-making relay in the center. This last receives impulses from the master meter in use at any particular time and transmits the impulses to the potential circuits of the meters under test and controlling the revolutions of the tested meters within a predetermined number of turns.

In the operation of the board, assuming that a lot of 5-110-I-14 meters are to be tested, the No. 7 potential switch (see key) is thrown for 110 volts. The master meters $C$ and $D$ are set for 110 volts, and the rotating standard meter $B$ is set. The load switches Nos. 8, 9 and 11 are thrown to the right, giving loads of 5 amp. full and ½ amp. light. The tester then throws switch No. 12 to the left, which puts full load on master meter $C$, all meters under test and standard meter $B$. After first checking the master meters with the rotating standard, the latter is removed and plug $N$ substituted to prevent any accidental short circuit affecting the standard. The master meter $C$ controls through relay $E$ the potential circuits of the meters $A$, $A$, $A$, etc., under test, so that these make three revolutions after the master meter makes four more revolutions; the $A$ meters make three revolutions again, and so on until all meters have been adjusted 100 per cent. Switch No. 12 is then thrown




TEST BOARD CONNECTIONS FOR TESTING FIVE METERS AT ONCE

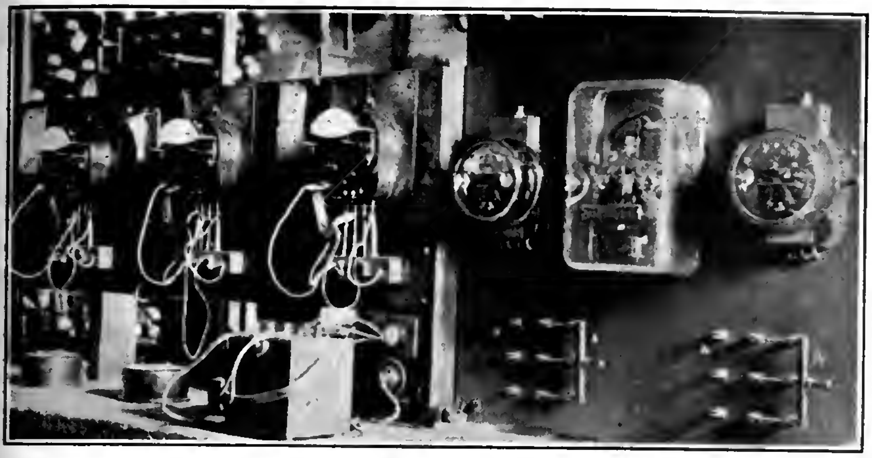
$A$—Meters under test.
$B$—Portable standard test meter used to set master meters.
$C$—Make-and-break master meter, 5 amp. to 10 amp., 110/220 volts.
$D$—Make-and-break master meter ½ amp. to ½ amp., 110/220 volts.
$E$—Relay for opening potential on meters under test.
$L$—Lamp-bank loads.
$N$—Three-pole plug receptacle for cutting in $B$, to be plugged with short-circuited plug when $B$ is not being used.
$P$—Single-pole switch for cutting out potential on $A$ and $B$.
$R$—Single-pole switch for cutting out relay, $E$.
7—Double-pole double-throw switch for potential circuit.
8—Triple-pole, double-throw switch for connecting coils of $C$ in multiple or series.
9—Triple-pole, double-throw switch for connecting coils of $D$ in multiple or series.
11—Double-pole, single-throw switch on current circuit.
12—Double-pole, double-throw switch for throwing meters under test on master meters $C$ or $D$ (located near operator).

*NOTES*

$C$—Master meter, three-wire, equipped with 5-amp. current windings arranged for series-multiple connection, and with potential windings arranged for both 110-volt and 220-volt circuits. Meter provided with special make-and-break mechanism for controlling the potential circuit of meters under test, arranged so that the potential is on such meters during three revolutions of master meter and off during four revolutions of master meter.

$D$—Master meter, three-wire similar to $C$, except the current windings, which are ½ amp., arranged for series-multiple connection. This meter makes twenty revolutions to one of meter under test.

$E$—Special relay, one end taking the impulse from whichever master meter is in use. The other end transmits the impulse to the potential circuits of meters under test.



ALL METERS OF THE UNITED ILLUMINATING COMPANY OF NEW HAVEN, CONN., RECEIVE PRE-INSTALLATION TEST

to right to apply the light load and the master meter $D$ is used.

The number of meters tested in a given time depends on how the meters average as to accuracy and what adjustments are required. With new meters needing very little adjustment we have been able to test and stock 100 to 150 and sometimes as high as 200 per day. This board can be controlled by one man, using two men to help with meter covers when rushed. As to the accuracy of the master meters $C$ and $D$, these can be set to make the standard stop on zero continuously. In fact, an error of one-tenth of 1 per cent can be adjusted. Practically all types of meters can be tested by the board, which has given complete satisfaction since its installation by the company.

R. S. HINMANN,
Meter Department.
United Illuminating Company,
New Haven, Conn.

# Extracts from Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Instructions for Operating Boiler Accessories

WHEN dumping fires in boilers the rear dampers must be opened and the forced draft closed to prevent a flareback of the fire on account of the accumulation of gases. The ash spray should be opened to prevent excessive formation of gas in the ash pit and the burning out of the brick lining. Excessive formation of these gases may be prevented by dumping the plates in sections. Rules 8, 9 and 10 of "Detailed Instructions for Boiler-Room Force" (ELECTRICAL WORLD, Feb. 3, page 282), referring to inspection, rapidity of dumping and the handling of large clinkers, also apply to this section. The following instructions have been abstracted from the operating code of the Philadelphia Electric Company:

1. Cut off the forced draft.
2. Open the back dampers wide.
3. Stop the stoker.
4. Open the ash-spray valve.
5. Dump the plates in sections.
6. Reduce the rate of water feed, if necessary.
7. Clean the fires, being careful not to throw good coal down with ashes. If there is much coke over the top of the clinker, close the dumps before hooking out the clinker.
8. Raise the dump plates.
9. Adjust the forced and stack drafts for load.
10. Start the stoker.
11. Shut off the ash-spray valve.

Fuel economy and low stoker maintenance costs result, in a large measure, from proper operation of the clinker-crusher apparatus. Continuous operation is very necessary. Stopping the crusher while the stoker continues to push ashes to the crusher pit may cause the ash to fuse to the stoker parts of the crusher pit and burn them, while a speed higher than required may grind the ash entirely away and produce an empty crusher pit. Any burning fuel which may then fall into the crusher pit is liable to damage these parts.

1. Operate the clinker crusher continuously, according to the conditions of the fire, by adjusting the speed to keep two feet of ashes over the crusher. Do not start and stop.
2. The crusher doors should be set to the proper opening by the boiler engineer when the boiler is off and should not be changed without his knowledge or the knowledge of the water tender or boiler operator. Any change made in the opening must be reported to both the engineer and the shift superintendent.
3. The boiler engineer should make inspection every morning and evening.

In operating soot blowers on boilers, economizers and induced-draft fans the blower manifold line should be warmed up and drained of moisture which may form in it previous to blowing tubes in order that dry steam only will be blown into the tube nest. Moisture will cause soot to adhere to tube surfaces.

### SOOT BLOWERS ON BOILERS AND ECONOMIZERS

1. See that the drains on the soot-blower supply manifold are open.
2. Crack the main steam valve and blow the water out of the manifold.
3. Close the drain.
4. Open the main steam valve wide.
5. Open the soot blowers in rotation, beginning with the first pass.
6. As the unit is being blown, rotate the blower between the stops provided on the main wheel or on the hand wheel.
7. After blowing, close the main steam valve to the manifold.
8. Open the drain on the manifold and leave it open.

### SOOT BLOWERS ON INDUCED DRAFT FANS

1. The fan should be running at lowest speed when soot blowers are opened.
2. See Rules 1, 2, 3, 4 and 7, above.

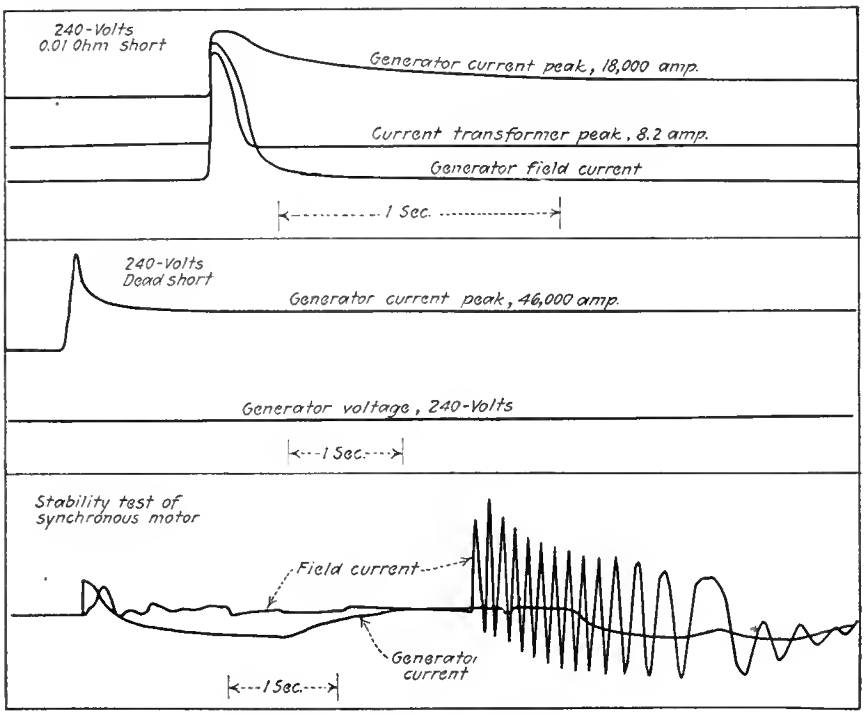
## Turbo-Generator Operation

WHEN shutting down a turbo-generator the load should be reduced to a low value to prevent a sudden rush of load from being thrown upon other machines, which might disturb the voltage of the system. The power factor should be adjusted to unity in order to reduce the amount of current passing through the machine to a minimum for the load carried, thus causing a minimum disturbance to the other machines when the main oil switch is opened. Reducing the field current to a minimum after the main switch is opened will prevent a bad arc from forming when the field circuit is opened. The successive steps in shutting down a machine follow:

1. Signal "Stand by."
2. When the "Stand by" signal is answered, reduce load to a low value.
3. Adjust the power factor to unity.
4. Signal "Stop."
5. After receiving an answer and upon noting a further decrease in the wattmeter reading, showing that the throttle has been closed on the proper machine, open the main and bus oil switches simultaneously.
6. Reduce the field current to a minimum.
7. Open the field-break switch.
8. When a bracketed exciter is used for excitation open the exciter circuit breaker.

## Favorable Test Results on Automatic Substation

A COMPLETE service restoration test with oscillograph records was made on the 1,800-kw. synchronous motor-generator set and automatic switching equipment recently installed by the Union Electric Light & Power Company of St. Louis. The test was successful in every detail of performance of the motor-generator and functioning of the automatic switching equipment. This is one of the first automatic motor-generator sets for Edison three-wire service to have performed completely a service restoration test under conditions more severe than are likely to be met in commercial operation. A noteworthy feature of this installation is that this severe test fails to disclose a necessity for making any changes whatever in the motor-generator set itself and nothing more than adjustments was needed in the automatic switching. These adjustments were made after the oscillograms shown were taken.




FEAR OF INTERRUPTION OF SERVICE ELIMINATED BY EXTENSIVE TESTS ON 1,800-KW. AUTOMATIC STATION

Top—When terminals of generator were shorted through 0.01 ohm, the current rose to 18,000 amp. Relays then operated and inserted 150 ohms in field circuit, which reduced the generator current as shown by the oscillographic record.

Center—After a dead short circuit the machine was still ready for operation.

Bottom—Stability test, consisting of loading machine, opening high-tension feeder and then closing after two and one-quarter seconds and noting effects.

The equipment comprises standard types of motor and generator. The generator has compensating pole-face windings, is of the shunt-wound type and is separately exited from a directly connected exciter. No differential or other special windings are employed.

The automatic control is equipped with a complete regulating equipment and with quick-acting generator-field control for short-circuit conditions. Means are also provided for pulling the motor back into step after a serious surge on the alternating-current supply system without having to drop the load entirely. The tests were made to determine the adequacy of these protective and operating features.

Arrangements were made to short-circuit the generator through various values of resistance, starting with 0.01 ohm and reaching a value as near zero as could be obtained with a 6-in. x ¼-in. copper bar. The short circuits were thrown on with a knife switch closed by a heavy weight. Oscillographic records were obtained of all tests, some of which are reproduced herewith.

At no time were the direct-current breakers opened until the completion of any one test. The short circuit was thrown on and allowed to remain until the load on the generator had been reduced to 125 per cent full-load amperes by the functioning of the constant-current regulator. In one of the first tests, with the terminals of the generator shorted through 0.01 ohm, the current rose to 18,000 amp. The current transformer in the main direct-current circuit had a normal ratio of 10,000-5 on alternating current, and the current in the secondary of this transformer on this test reached a value of 8.2 amp. This current trips the short-circuit-detecting relay, which functions to insert an auxiliary resistor of 150 ohms into the generator field circuit.

In another test the generator was short-circuited under extreme conditions, the circuit resistance being not more than that of 12 ft. of 6-in. x ¼-in. copper bar. The generator current reduced rapidly, following the functioning of the field control. On the short circuit the generator delivered 46,000 amp. (7,200 amp. being full load) and was in condition for continuous operation. The relatively low value of short-circuit current is obtained by the arrangement of the compensating pole-face windings. There is only a momentary spit at the generator brushes at this extreme overload. The regulator was ready to restore the generator to normal voltage when the short circuit was cleared.

In a motor stability test the generator was loaded through the test resistance to approximately 125 per cent full load. The high-tension feeder was opened at the generating station. The generator being heavily loaded, the speed dropped rapidly. After an interval of two and one-quarter seconds the feeder was reclosed. Violent oscillations occurred to the motor-field current, the highest reaching nearly three times normal. Three-quarters of a second after the alternating-current feeder was reclosed the motor-slip relay operated to reduce the generator load. The motor, thus momentarily lightly loaded, pulled quickly into synchronism.

The tests, according to the engineers of the Union Electric Light & Power Company and the Westinghouse Electric & Manufacturing Company, by whom they were made, show that with a machine of similar characteristics and a control to perform the same functions, no fear need be felt that an interruption to service will be caused.

The use of such equipments should reduce the necessity for large stand-by batteries since the major use of such batteries is to tide over heavy surges on the alternating-current system and to permit of quick restoration of service.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Hydraulic Valve Operated by Automobile

AN EFFICIENT labor-saving device used on a large hydraulic valve which is seldom operated and which does not warrant the installation of electric drive is illustrated herewith. This is used on a 48-in. gate valve on our Lahontan power house, which is leased from the government. It consists of a U-shaped

INFREQUENTLY OPERATED VALVE DOES NOT WARRANT ELECTRIC DRIVE

piece of metal spanning the hub and held against opposite spokes on the rear wheel of the automobile. This piece is in turn fastened to the pinion-gear shaft operating the hydraulic valve.

H. SHIELDS,
General Superintendent.
Nevada Valleys Power Company,
Lovelocks, Nev.

## Generator Breakdown from Loose Laminations

HAVING had several breakdowns of certain generators about twelve years old, one Southern company made a careful study to determine the cause. These generators had been rebuilt, an operation in which the laminations had been restacked and reclamped. It was found that the old composition-metal finger plates which held the laminations together had been stressed beyond their elastic limit and had bent back, allowing the laminations to vibrate very badly.

This vibration gradually wore away the insulation on the bar-wound coils, but a short circuit did not ensue within the windings until two coils became grounded.

By replacing the old finger plates with new steel ones and clamping the laminations tightly the repetition of this trouble has been avoided so far.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Transformer Dielectric Tests Amplified

THE standard values for insulation test voltages on distribution transformers other than small air-cooled transformers and on power transformers were amplified by the Electric Power Club at the fall meeting at Asheville, N. C., and became effective Jan. 1, 1923. The standards now cover in greater detail the requirements for high-potential test guarantees applying to transformers having single-voltage ratings above 4,500 to 50,000 inclusive. The requirements are given in the accompanying table and in the following paragraphs:

DIELECTRIC TESTS ON TRANSFORMERS

Transformers intended for Y connection shall have their test voltages determined by the line voltage and not the leg voltage.

Dielectric tests shall be made as follows: (a) Between high-voltage and low-voltage windings. (b) Between high-voltage winding and the core. (a) and (b) may be made at the same time by connecting the low-voltage winding to the core. (c) Between the low-voltage winding and the core.

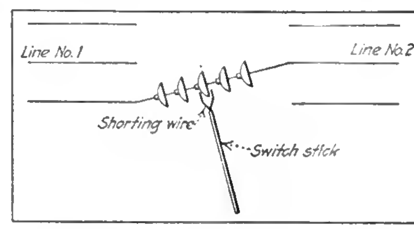
The time of application for each test shall be one minute. Measurement of voltage in making dielectric tests shall be in accordance with A. I. E. E. Sections 2358 to 2370 inclusive.

Transformer oils shall be capable of withstanding at commercial frequencies 22,000 volts between 1-in. disk terminals spaced $\frac{1}{10}$ in. apart.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Phasing High-Voltage Lines Without Instruments

WHEN two high-voltage lines from the same source are brought together it is necessary to phase out before paralleling. This phasing may be done with a string of strain insulators and an ordinary switch stick. A string of strain insulators containing one more insulator than would be required on the line is used. The string is temporarily connected to any leg of each line. Then, with the current on, "short" out one of the center insulator units with a V-shaped wire on the end of a switch stick. If a heavy discharge is noted on "shorting" the insulator the string is connected to




STRING OF STRAIN INSULATORS USED TO PHASE OUT HIGH-TENSION LINES

phases of different polarity. If a very slight discharge or none is noted, the string is connected to the same phase. By repeating this process with each phase a definite phasing out is obtained, and the results are very positive.

When the two lines are brought together at a switch structure, it is very easy to mount the string of strain insulators below the line and connect to the "hot" wires by switch sticks.

T. W. SNELL,
General Superintendent.
Coast Valleys Gas & Electric Company,
Salinas, Cal.

TRANSFORMER DIELECTRIC TEST REQUIREMENTS FOR HIGH-POTENTIAL GUARANTEES

High-Voltage Winding to Low-Voltage Winding and Core

| Maximum High-Voltage Rating, Full Winding or Taps | Test Voltage |
|---|---|
| Below 550 | 4,000 |
| 550 to 4,500 inclusive | 10,000 |
| Above 4,500 to 50,000 inclusive | Twice the highest rated voltage* of the high-voltage winding plus 1,000 volts. |
| Above 50,000 | Twice the normal voltage† of the circuit to which the high-voltage winding is connected plus 1,000 volts. |

Low-Voltage Winding to Core

| Maximum Low-Voltage Rating, Full Winding or Taps | Test Voltage |
|---|---|
| 1,500 and below | 4,000 |
| Above 1,500 to 4,500 inclusive | 10,000 |
| Above 4,500 to 50,000 inclusive | Twice the highest rated voltage* of the low-voltage winding plus 1,000 volts. |
| Above 50,000 | Twice the normal voltage† of the circuit to which the low-voltage winding is connected plus 1,000 volts. |

*For transformers having single-voltage ratings a value 5 per cent above the rated voltage shall be used as the basis of the high-potential test.

†In systems of circuits employing transformers the normal voltage of the system or circuit is defined as the highest-rated voltage of the secondaries of transformers supplying the system or circuit. This voltage rating applies to all parts of that particular system or circuit.

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## Allocating Service Cost in Rates

**Schedule Fitted to Consumer, Demand and Output Costs as Shown by a Preliminary Hypothetical Analysis— A Small-Town Example**

BY HERBERT B. DWIGHT
Electrical Engineer Colorado Public Utilities Commission, Denver, Col.

THE more one studies the annual reports of electric utilities the more apparent is the truth of the statement that, in general, rates for service are not established with due consideration to the costs of rendering the service. This is contrary to the first principles of state regulation. Numerous examples are found where one or more classes of service are paying at, or less than, the cost of production. Fair return on the investment, taxes, depreciation reserve fund allowance and other general costs, and sometimes part of the cost of production, are paid from the revenues of other classes of service. Consideration given to off-peak business, exceptional load factor, competitive service and so on cannot be made to justify these low rates to favored classes of service. There is only one answer. Every utility should make such a complete analysis of all the fixed and variable costs of rendering service that these can be fairly allocated to each class of service and then rates formulated which will make the charge to each consumer vary in direct proportion to the varying costs. Proper consideration can also be given in these rates for load factor, off-peak business, etc., by determining the value of each of these factors, present and future, in the costs of production and then making suitable allowance.

The analysis preliminary to the formation of rates may be made as exhaustive as the size of the utility and the variety of service may justify. That such analysis is worth while for even a very small utility is amply illustrated by the town of Sedgwick, situated in the extreme northeast corner of the State of Colorado. This is a municipal electric utility serving a population of about four hundred. Whether an electric utility in so small a community was warranted is beside the question. The important feature is that the analysis was made and rates established in accordance therewith which have fully proved their worth from every standpoint.

It happens that this town, in a burst of enthusiasm, contracted with some Eastern company to install a complete distribution system and a 6,600-volt transmission line 16 miles to the town of Julesburg, which operates a municipal plant. At the town limits of Julesburg wholesale power was available. After the installation was nearly completed rates were considered. Assistance of the commission was sought and an analysis was made. From the analysis it appeared that rates must be abnormally high or the town would have to support the utility in part from town funds. Rates were established in line with the results of the analysis. Every one appears to have been satisfied, and the annual reports show that the revenues and expenses have been about as predicted. This analysis has been used frequently as a pattern for others and is a distinct improvement over the old method of compiling the rates of utilities in several towns considered similar and then using the average of the compilation. This old method has been the usual one, no relation between costs and revenues being considered. It was a grand combination of faith and hope—faith that the other utilities had made a proper study of their rates and hope that the revenues would prove adequate.

Preliminary to the analysis, it was necessary to study the Sedgwick situation and from the facts developed and from the data of other similar utilities estimate the various factors needed, such as operating expenses, number of consumers in each class, the probable average consumption of each class and their participation in the system peak. The known cost of wholesale power at Julesburg was 6 cents per kilowatt-hour. The part of the investment in the combined electric and water system used for the electric service was estimated at $25,000.

It should be further noted that in electric utility operation there are investments and operating costs which wholly or in part increase and decrease in proportion to the changes in the number of consumers served. Others vary in proportion to the demand the consumers produce at the time of the system peak, and still others vary directly with the average load produced. These investments, resulting investment costs and the operating costs are allocated to the proper one of these three groups.

TABLE I—ALLOCATION OF ANNUAL INVESTMENT AND OPERATING COSTS

| | Consumer's Cost 18 Per Cent | Demand Cost, 62 Per Cent | Output Cost, 20 Per Cent | Total, 100 Per Cent |
|---|---|---|---|---|
| Investment | $4,500.00 | $15,500.00 | $5,000.00 | $25,000 00 |
| Investment costs: | | | | |
| Interest on bonds, 5 per cent | $225.00 | $775.00 | $250.00 | ....... |
| Depreciation reserve fund, 4 per cent | 180.00 | 620.00 | 200.00 | ....... |
| Profit, 3 per cent | ........ | .......... | 750.00 | ....... |
| Sub-total | $405.00 | $1,395.00 | $1,200.00 | $3,000.00 |
| Operating costs: | | | | |
| Power purchased | ....... | ....... | $3,000.00 | $3,000.00 |
| Distribution and general | $157.50 | $542.50 | $175.00 | $875.00 |
| *Sub-total | $157.50 | $542.50 | $3,175.00 | $3,875.00 |
| †Total costs | $562.50 | $1,937.50 | $4,375.00 | $6,875.00 |
| ‡Total costs exclusive of depreciation reserve fund and profit | $382.50 | $1,317.50 | $3,425.00 | $5,125.00 |

* Operating expenses only.
† Total costs, including profit, interest on bonds and depreciation reserve fund allowance.
‡ Total costs, excluding profit and depreciation reserve fund allowance.

TABLE II—ALLOCATION OF TOTAL COSTS TO CLASSES OF SERVICE

| Class of Service | *a*—Includes Depreciation Reserve Fund Allowance and Profit on Sales | | | | *b*—Exclusive of Depreciation Reserve Fund Allowance and Profit on Sales | | | | *c*—Operating Costs Only, All Other Cost Excluded | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Consumer's Cost | Demand Cost | Output Cost | Unit Charge | Consumer's Cost | Demand Cost | Output Cost | Unit Charge | Consumer's Cost | Demand Cost | Output Cost | Unit Charge |
| Residence lighting: | | | | | | | | | | | | |
| Fifty customers (63.3 per cent) | $356.06 | | | | $242.12 | | | | $99.70 | | | |
| 30 per cent participation in peak | | $581.25 | | | | $395.25 | | | | $162.75 | | |
| 9,000 kw.-hr. load (23.0 per cent) | | | $1,006.25 | | | | $787.75 | | | | $730.25 | |
| Charge per customer | (0.59) | (0.97) | (1.68) | $3.24* | (.40) | (.66) | (1.31) | $2.37* | (.17) | (.27) | (1.22) | $1.66* |
| Equivalent average rate | (0.0396) | (0.0646) | (0.1118) | 0.216† | (.0269) | (.0439) | (.0875) | 158† | (.0111) | (.0181) | (.0811) | 0 110† |
| Business lighting: | | | | | | | | | | | | |
| Twenty customers (25.3 per cent) | 142.31 | | | | 96.78 | | | | 39.80 | | | |
| 50 per cent participation in peak | | 968.75 | | | | 658.75 | | | | 271.25 | | |
| 8,400 kw.-hr. load (21.4 per cent) | | | 936.25 | | | | 732.95 | | | | 679.45 | |
| Charge per customer | (0.59) | (4.04) | (3.90) | $8 50* | (.40) | (2.74) | (3.05) | $6 19* | (.17) | (1.13) | (2.83) | $4.13* |
| Equivalent average rate | (0.0169) | (0.1153) | (0.1115) | 0 244† | (.0115) | (.0784) | (.0873) | 0.177† | ( 0047) | (.0323) | (.0809) | 0.118† |
| Power: | | | | | | | | | | | | |
| Eight customers (10.1 per cent) | 56.81 | | | | 38.63 | | | | 15.91 | | | |
| 19 per cent participation in peak | | 368.12 | | | | 250.32 | | | | 103.08 | | |
| 17,205 kw.-hr. load (43.9 per cent) | | | 1,920.62 | | | | 1,503.58 | | | | 1,393.82 | |
| Charge per customer | (0.59) | (3.84) | (20.01) | $24.44* | (.40) | (2.61) | (15.66) | $18.67* | (.17) | (1.07) | (14.52) | $15.76* |
| Equivalent average rate | (0.0033) | (0.0214) | (0.1116) | 0.136† | (.0022) | (.0145) | (.0874) | 1.04† | (.0009) | (.0060) | (.0810) | 0.088† |
| Municipal lighting: | | | | | | | | | | | | |
| One customer (1.3 per cent) | 7.31 | | | | 4.97 | | | | 2.05 | | | |
| 1 per cent participation in peak | | 19.38 | | | | 13.18 | | | | 5.42 | | |
| 4,600 kw.-hr. load (11.7 per cent) | | | 511.88 | | | | 400.72 | | | | 371.48 | |
| Charge per customer | (0.61) | (1.62) | (42.66) | $44.89* | (.41) | (1.10) | (33 39) | 34 90* | (.17) | (.45) | (30.96) | $31.58* |
| Equivalent average rate | (0.0016) | (0.0042) | (0.1113) | 0.117† | .0011 | .0029 | .0871 | 091† | (.0004) | (.0012) | (.0808) | 0.082† |
| Total costs from Table I | $562.50 | $1,937.50 | $4,375.00 | | $382 50 | $1,317.50 | $3,425.00 | | $157.50 | $542.50 | $3,175.00 | |

* Per month. † Per kilowatt-hour.

After a study of the details concerned, it was determined to be fair to use 18 per cent of the totals for the consumers' cost, 62 per cent for the demand cost and 20 per cent for the output cost for the Sedgwick situation, except that all of the operating cost for wholesale power belongs in the output group.

Summaries of the analysis used in the rate study of the Sedgwick municipal electric plant are shown in the accompanying tables.

Table I shows the preliminary allocation of the investment, investment costs and operating costs to one of the three groups.

Table II shows the subsequent allocations to classes of service under three conditions—(a) that the revenues return all the costs and a small profit; (b) that they return only the interest on bonds in addition to actual operating costs, and (c) that they return only operating expenses. In the last column of each will be found the net results of these compilations. There are shown the average monthly bill to be paid by the consumers of each class and the average price that would result per kilowatt-hour used.

From Table IIa it was apparent that the rates needed and proper would be excessive. This result is proof that this investment was not justified in so small a community with its thinly scattered business. Therefore, a suitable rate schedule was formulated which would have an average effect between those shown in b and c, and the town would expect to provide part of the interest on bonds and the depreciation reserve fund out of the town funds. Such practice is not advocated, but in this case cannot be avoided. It is, moreover, apparent that, from the relative proportions of each group of the costs for a class of service, it is possible so to proportion the sliding-scale features of the rate and the minimum charge that the effect sought by the rates will be obtained. The net rates based on the allocation of costs in Table II are shown in Table III.

In conclusion, it may be noted, as shown from the annual report following a year and eight months of operation, that there has been a decided increase of the business in each class of service over that predicted at the beginning of operations. The increase for all classes amounts to 50 per cent, and the number of consumers increased from 79 to 109. This proves the suitability of the

TABLE III—RATE SCHEDULE ADOPTED

| | Cents |
|---|---|
| Residence lighting: | |
| First 3 kw.-hr. per "active room" per month, per kw.-hr. | 18 |
| Next 3 kw.-hr. per "active room" per month, per kw.-hr. | 9 |
| All over 6 kw.-hr. per "active room" per month, per kw.-hr. | 6 |
| Minimum per month, $1.50 | |
| Business lighting (optional for residence consumers): | |
| First 15 kw.-hr. per month, per kw.-hr. | 18 |
| Next 15 kw.-hr. per month, per kw.-hr | 16 |
| Next 20 kw.-hr. per month, per kw.-hr. | 14 |
| Next 50 kw.-hr. per month, per kw.-hr | 12 |
| All over 100 kw.-hr. per month, per kw.-hr. | 10 |
| Minimum per month (three lights or less), $1 50 | |
| Minimum per month (all over three lights), $2.50 | |
| Power: | |
| First 20-kw.-hr. per hp. connected per month, per kw.-hr. | 10 |
| Next 20 kw.-hr. per hp. connected per month. per kw -hr. | 9 |
| All over 40 kw.-hr. per hp. connected per month, per kw.-hr. | 8 |
| Minimum per hp. connected per month, $1 00 | |
| Municipal lighting: | |
| All energy used per month, per kw.-hr. | 9 |

TABLE IV—COMPARISON OF HYPOTHETICAL AND ACTUAL RATES, 1921

| | Actual Kilowatt-hour Sales | —Revenues Derived by Use of— Table II*b* | Table II*c* | Actual Rate Schedule |
|---|---|---|---|---|
| Residence lighting | 12,326 | $1,959.83 | $1,358.33 | $1,992.07 |
| Business lighting | 10,453 | 1,860.63 | 1,239.73 | 1,729.08 |
| Power | 26,538 | 2,759.95 | 2,319.42 | *2,574.70 |
| Street lighting | 5,181 | 611.36 | 430.54 | *466.29 |
| Total | 54,498 | $7,191 77 | $5,348.02 | $6,762.14 |
| Actual operating expenses and interest charges | | 6,822 08 | | 6,822.08 |
| Actual operating expenses only | | | 5,222.08 | |
| Excess | | $369 69 | $125.94 | |
| Deficit | | | | $59 94 |
| Percentage | | 5 42 | 2 41 | 0 88 |

* These items corrected to agree with the schedule. The town did not follow the schedule for municipal service.

rates in effect. The average rate per kilowatt-hour paid by each class of service has remained over two periods of operation almost exactly the same as predicted from the rates used. Furthermore, by applying the average rates shown in Table II to the actual twelve months' consumption per class the necessary hypothetical revenue to pay the operating expenses compared with actual operating expenses shows only 2.41 per cent error. Using Table IIb, in the same manner, a comparison of hypothetical and actual results may be made with reference to operating expenses plus interest on bonds. This comparison shows an error of 5.42 per cent, which is larger than it would be if the plant had not been built somewhat in excess of present requirements. A comparison showing the results of this study is given in Table IV.

Finally, it should be remembered that this hypothetical study and the resulting prediction as to consumption, operating expenses and the effect of the schedule were made prior to the completion of the system, and over nearly two years' operation the results have been practically as predicted.

## New York Edison Holds Sign Exhibition

The second annual electric sign exhibition under the auspices of the New York Edison Company was held during the week of Jan. 29 to Feb. 3 in the showroom of the company. This was the first of a series of specialized electrical exhibits which the company has scheduled for this year as announced in the ELECTRICAL WORLD for Jan. 13.

Twenty-six manufacturers of electric signs and sign accessories accepted the Edison company's invitation to display their wares, and at the close of the week all reported that the show had been productive of considerable new business. A partial view of the exhibit is shown here. Many urged that the show be extended into the second week, but as other things had been planned for the showroom and as the heating show is scheduled for the week of Feb. 19 it was impossible to do this.


PARTIAL VIEW OF NEW YORK SIGN SHOW

## The Wireman and His Central Station

INTERDEPENDENCE of the electrical contractor and the electric light and power company was emphasized by C. J. Russell, vice-president and general manager of the Philadelphia Electric Company, at a recent meeting of the Electrical Conference in that city. Speaking on the subject "The Wireman and His Central Station," Mr. Russell called attention to the fact that the wireman was born ahead of the central station inasmuch as long before central stations were built the wireman was very busily engaged in installing signal wiring such as bells, annunciators, etc., which was much more complex than the electric wiring of today in the ordinary house. He pointed out that in the early days it was necessary for the central station and the wiring contractors to recruit their mechanics from the then existing trades and that some of the best wiremen in central stations in those days had learned the trades of cabinetmaking, carpentry and plumbing.

Mr. Russell brought out the fact that the central-station company manufactured and distributed its product, but that it is utilized in the home and the factory entirely by means of the contractor and his wiremen and for that reason it is his central station. He also stated that during 1922 there were 32,000 old houses wired in Philadelphia and this number is expected to be exceeded during the present year. Mr. Russell suggested that the way in which the stock of the electrical central station was being sold, and with the rate of interest earned, it would not be a bad idea for the contractor and his wiremen to own some of this stock, making it still more his central station.

## What Other Companies Are Doing

**Jefferson Barracks, Mo.** — The new United States Veterans' Hospital at Jefferson Barracks, Mo., to be completed about March 1, 1923, will have a thoroughly modern electrical equipment. A 13,200-volt substation has been provided to supply energy from the Union Electric Light & Power Company of St. Louis. The total lighting load will be about 85 kw. and the connected power load will be approximately 120 hp. In addition to the light and power loads there will be installed electric cooking equipment consisting of the following: Three hotel ranges, 75 kw.; one broiler, 15 kw.; one bake oven, 25 kw.; fourteen domestic ranges (for officers' quarters and nurses), 95 kw.; eight hot plates, 4 kw.; miscellaneous other equipment, 6 kw.; total, 220 kw. The total electric load in the hospital will be approximately 400 kw.

**Illinois.**—A number of electric range demonstrations have been staged this winter by the Public Service Company of Northern Illinois in its various districts with good results. Special preparations have been made in each case. In addition to advertisements in the local papers, invitations were sent out extensively. The effect was to draw out a good attendance, a great many people driving in from small towns a dozen or more miles distant. A number of sales were made and an active "prospect" list obtained.

**Indianapolis, Ind.** — Total merchandise sales by the Interstate Public Service Company during 1922 showed an increase of $74,981, or 50.7 per cent over the sales for 1921.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Control of Corrosion by Deactivation of Water.*—F. W. SPELLER.—The study of corrosion is confined particularly to corrosion under water, where the amount of oxygen present is limited to the solubility of that gas in water, and to soil corrosion, in which the ratio of moisture to available oxygen varies considerably. It includes corrosion of interior pipes, tanks, economizers, boilers and other closed water systems which form an important part of building and power-plant construction. The main factors which control the rate and distribution of corrosion of iron in water are amount of oxygen in solution, temperature, quantity and velocity of flow, quality of water and contact with electro-negative material. The author describes some of the protective coatings that have been applied to pipes and that are advantageous to prevent corrosion, giving various methods of de-aërating water and types of apparatus used to remove oxygen.—*Canadian Engineer*, Jan. 9, 1923.

*Wind-Driven Electric Power Plant.*—R. BOSSELMANN.—A feature of the suggested arrangement is the combined use of a mechanical and an electrical regulator, the former maintaining nearly uniform speed, the latter constant voltage of the driven compound-wound dynamo. Both regulators are described in detail. It is claimed that the plant will operate without any attendance, save an occasional bearing inspection.—*Elektrische Kraftbetriebe und Bahnen*, Dec. 10, 1922.

*Vapor-Refrigerating Condensers for Steam Turbines.*—F. C. EVANS.—In order to improve the economy of steam turbines by the further reduction of the back pressure, cooler condensing water must be provided or some other cooler condensing substance used. Present-day custom is to produce low temperatures artificially for various refrigerating processes. The author's investigations are along these lines, with the purpose of finding out whether it would be economical from a thermal standpoint to place cooling coils of a refrigerating system in a steam condenser to reduce back pressure on the steam turbine.—*Sibley Journal of Engineering*, December, 1922.

*Northwest Station Increasing Stoker Capacity.*—Forced-draft chain grates, replacing natural-draft stokers in the Northwest station of the Commonwealth Edison Company, Chicago, have given the increase in the steam supply necessary to meet new demands. Operation normally is at 200 per cent of rating and 300 per cent for boilers during peaks. Ordinary daily range in combustion rate is from 35 lb. to 50 lb. of coal as fired per square foot of grate per hour, with an extreme maximum up to 55 lb. A description of the new stokers is given.—*Power*, Jan. 9, 1923.

## Transmission, Substations and Distribution

*Automatic and Semi-Automatic Substations for Electric Railways.*—C. A. BUTCHER.—A general review of the subject with illustrations to show the sources of savings which result from non-manual switching forms the substance of this paper, presented before the Central Electric Railway Association, Louisville, Ky., Jan. 18. The author points out that full automatic control in general appears preferable.—*Electric Railway Journal*, Jan. 27, 1923.

*Influence of a Three-Phase Line Upon a Nearby Low-Voltage Line.*—E. NATHER.—The paper describes a mathematical and graphical method of calculating the potential induced in a low-voltage wire carried parallel to a high-voltage three-phase line, for which the author claims greater simplicity than the known purely mathematical methods.—*Elektrotechnik und Maschinenbau*, Dec. 24, 1922.

*Reinforced-Concrete Poles.*—E. MARÉCHAL.—It is suggested in this paper that reinforced-concrete poles be built from standard pieces made by series manufacture in special shops, these pieces being shipped to the places where the poles are to be erected. Here they can be assembled in a number of different pole types or even used to construct small transforming stations. Formulas are given to calculate the safe section of the concrete beams for different wire pull and tower height. Attractive appearance, long life and cheapness are among the chief advantages claimed for the towers.—*Revue Générale de l'Electricité*, Dec. 23, 1922.

## Units, Measurements and Instruments

*Short-Circuit-Proof Current Transformers.*—C. SCHRADER.—The paper describes in much constructive detail the short-circuit-proof "one-turn" or "bar-type" current instrument transformers. They are being made from 50 amp. to 3,000 amp. in a number of standard sizes, all for a secondary current of 5 amp. As the name implies, these transformers have a primary winding of only one turn, so that short-circuit forces, no matter how large they may be, can result in no destructive action. The secondary turns are arranged around an annular laminated iron core, placed concentrically around the primary bar. The unusually low values of 50, 70, 100 and 150 amp. for this type of measuring transformers are explained as follows: For the operation of relays only, where no accuracy is required, a bar type may be used for as little as 50 amp. For the operation of a single wattmeter as small a type as 200 amp., may be used with sufficient accuracy. For the operation of a watt-hour meter, or all other instruments requiring high accuracy no bar-type transformers smaller than 300 amp. to 500 amp. are recommended. These instrument transformers have been standardized with insulations up to a maximum of 300,000-volt test tension.—*Elektrotechnische Zeitschrift*, Dec. 14, 1922.

*Automatic Depth Recorder as an Aid to Navigation.*—LIEUT. S. G. LAMB.—An apparatus which determines depth soundings by utilizing the reflection of sound waves from the sea bottom is described. The principle on which the apparatus works is briefly as follows: The time interval between making a sound wave on board ship, such that the wave is transmitted to the water through the skin of the ship, and the reception of the reflected wave from the sea bottom is accurately measured and the depth is calculated from this interval, the velocity of sound in sea water in feet per second having previously been determined.—*United States Naval Institute Proceedings*, January, 1923.

## Motors and Control

*Electrical Equipment in Large Mail Terminal.*—R. G. LOCKETT.—Push-button stop and start, interlocking control and indicator lamps are features of the system of dispatching mail in the Union Station at Chicago, Ill. The author confines his discussion to a description of the electrical equipment of the conveyors, motor and control circuits and control boards.—*Railway Electrical Engineer*, January, 1923.

*Power Problems of Rolling Mills.*—A. H. DYCKERHOFF.—Oftentimes it is found that motor ratings are seemingly out of proportion with the rolling-mill duties generally practiced and that mills of apparently the same character are driven by motors of different capacity. There are several reasons for such a condition, among which are extraordinary expectations and ambitious tonnage demands and the indefiniteness of the future rolling schedules. These demands cannot be satisfied without certain sacrifices involving high first cost of motor and control, inefficiency, low power factor and inability of line and generator to deliver power. The author stresses the overpowering of mills and the resulting influence of power factor.—*Iron Age*, Jan. 4, 1923.

*Synchronizing Motors Under Full Load.*—DR. FRAENCKEL.—Synchronous motors, capable of starting under full load, have a polyphase wound rotor with collector rings and brushes leading to the starter. After starting, direct current is applied to the slip rings

and the motor changes its character from straight induction to a synchronous type. The paper contains theoretical and practical data on the exact starting conditions of this type of motor and describes what influence the position of the rotor has upon the starting conditions at the instant of applying the direct current. An automatic synchronizing device is mentioned which closes the direct-current switch at the most suitable instant. Finally an approximation method is given to calculate the smallest excitation for a given motor load. A number of oscillograms are reproduced which show a very close check between the calculated and actually observed values. — *Brown-Boveri Mitteilungen*, December, 1922.

*Individual Drive of Milling Machines.*—K. MELLER.—Several examples of modern individual motor drives for milling machines are given with the purpose of showing the great advance in the design of such drives made in the last twenty-five years. For large milling machines a multi-motor drive is advocated, so that the cutter is driven by the main motor and the feeding device by a second smaller motor. An electrically operated interlocking mechanism is then required to prevent collisions between the two independent motions. As an example, showing to what an extent such multi-motor drive can be carried out successfully, a photograph of a large milling machine with three motors for cutting and four motors for feeding is shown.—*Siemens Zeitschrift*, December, 1922.

## Illumination

*Terminal Lighting Development on the New Haven Railroad.*—G. F. JOHNSON.—Railroad yard lighting is primarily space lighting, with the following problems injected, namely, the presence of deteriorating gases, movable cars causing shadows, lack of clearance between tracks to place poles, the prevention of glare that will interfere with the operation of the trains through or near the yards and the interference of the overhead propulsion current wires. Improved illumination in several of the yards on this road is the result of much study and experiment and is briefly discussed.—*Railway Electric Engineer*, January, 1923.

## Heat Applications and Material Handling

*Coal-Handling Plant.*—M. DRUEY.—The paper describes a coal handling and conveying crane for a French mine which is unusual on account of its size. It consists of a double-portal traveling crane with a combined span of 523 ft., made up of two symmetrical halves with a span of 261 ft. each. Each half is independent of the other and has a traveling clamshell bucket of 5 tons capacity (including weight of bucket). Double rope drive is used for closing and opening the bucket. For the three motors three motors of 5½, 28 and 445 hp. are provided, all for direct current and 250 volts. A special low-speed drive permits an exact stop of the large structure at any desired point. A locking device prevents the crane with its large surface from being moved by wind. A complete wiring diagram of the crane is given.—*Bulletin Oerlikon*, November, 1922.

*Electric Steel Industry After Ten Years.*—E. F. CONE.—No marked increase in capacity and no outstanding developments marked the progress of the American electric steel industry during 1922, according to the tenth yearly review made by the author on this subject. The number of new installations registered during the last year is the smallest in the history of the industry. A tabulated review shows that the total number of installations has expanded in ten years to 407 furnaces. This table, which is included in the original article, shows where each furnace is installed, its number and size, make, and the product made.—*Iron Age*, Jan. 4, 1923.

## Traction

*Investigation of the Properties of Chilled-Iron Car Wheels.*—J. M. SNODGRASS and F. H. GULDNER.—This bulletin presents two additional phases of the investigation of the properties of chilled-iron car wheels conducted at the University of Illinois. The investigation had for its object the determination of the strain which may occur within a car wheel and the limitation of present designs with the view of improving the chilled-iron car wheel and making it more satisfactory under present and future service requirements. The first part of the bulletin contains a report of an extension of the tests previously reported in Bulletin No. 129 and discusses the strains existing in a 33-in., 840-lb. arch plate wheel when subjected to the combined effect of mounting, static load and side-thrust pressures. The remainder of the bulletin deals with a series of tests made to determine the ultimate strength of the car-wheel flange.—*Bulletin No. 134 of the Engineering Experiment Station, University of Illinois.*

*The Sydney Tramway System.*—This system is owned and operated by the New South Wales government and last year carried nearly a million passengers a day. The traffic problems include street congestion in the business district and transportation of large crowds to races and other various popular outdoor events in Sydney.—*Electric Railway Journal*, Jan. 13, 1923.

*Distribution for Direct-Current Railway Service.*—E. SORELLI.—The system consists of centralizing the distribution of electrical energy by feeding the lines with machines installed in one unique substation and supplying two different tensions. The lower tension (about 1,200 volts) is directly connected from the substation to the contact wire, and the higher one (about 1,600 volts) from the same substation to the end of each line. The distance covered by each line is about 20 miles. This would compensate the losses all along the lines and maintain the voltage practically constant. This system has had a practical application in Italy and has worked out very satisfactorily.—*Elettrotecnica*, Nov. 5, 1922.

## Telegraphy, Telephony, Radio and Signals

*Loaded Long-Distance Cables in Europe.*—P. E. ERIKSON.—The author outlines briefly some of the achievements in the field of long-distance cable telephony in Europe. When the demands of additional circuits arose several of the progressive telephone administrations in Europe turned their attention to the paper-insulated long-distance cable. The countries which first gave this question serious consideration were Great Britain, Holland, Italy, Sweden and Switzerland. The results obtained by each of these countries are described.—*Electrical Communications*, Vol. 1, No. 2.

*Standardization of Inductors at Radio Frequencies.*—The method of measuring the apparent inductance at any radio frequency of a fixed or variable inductor is described. The apparatus consists of a variable condenser, a wavemeter standardized in terms of frequency or wave length, a thermo element and galvanometer, a current square meter, several non-inductive resistors of known resistance and a source of undamped, unmodulated waves. The observations consist of the readings necessary for standardization in terms of frequency or wave length of the circuit composed of the standardized condenser, the inductor to be measured and connecting leads spaced well apart and as short as is possible without bringing the coil to within about 10 cm. of the condenser. A limited supply of this letter circular is available to persons who have actual use for.—*Letter Circular No. 76 of the Bureau of Standards.*

## Miscellaneous

*Bibliography and Patents on Electrical Insulating Material.*—In connection with the Bureau of Standards investigation of the properties of certain types of electrical insulating materials, a rather comprehensive bibliography of papers, books and periodicals has been prepared. An examination of the United States patents covering insulating materials and method of manufacture, and particularly materials of the phenolic type, has also been made. Since a considerable demand has arisen for copies of these, they have been issued in mimeographed form as Letter Circular No. 50, "Bibliography of Books and Titles of Periodicals on Properties and Uses of Insulating Materials," and Letter Circular No. 51, "Lists of the More Important United States Patents Covering the Materials and Methods of Manufacture of an Insulating Material." A copy of either will be sent on request to any persons who can show an actual need for them as long as the limited supply lasts.—*Letter Circulars Nos. 50 and 51 of the Bureau of Standards.*

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Pact Waits on Arizona

**Still Hope She Will Accept Colorado River Treaty Without Reservations—Colorado Will Follow**

TELEGRAPHIC advices from Phoenix received in Washington as the ELECTRICAL WORLD closes its forms are to the effect that Arizona will ratify the Colorado River compact without nullifying reservations. Sentiment has changed decidedly during the last few days as the pressure of public opinion has become more and more felt, and it seems certain that a majority of the members of the Arizona Senate will vote for ratification rather than assume responsibility for the defeat of the ratification bill now before them, which would have the effect of delaying indefinitely any important development of the river. It is also stated that the Senate will eliminate the three reservations which the House committee has proposed, even if the House should pass the bill with those reservations intact.

Since it is believed very generally that Colorado, the only other state of the seven affected which has not ratified, will act quickly once it is assured that Arizona will ratify, there still is a chance for the sitting Congress at Washington to ratify the compact and put it into effect.

### The Proposed Reservations

The reservations proposed by the committee of the Arizona House of Representatives provide for the payment of $5 per horsepower-year on all power generated in Arizona, that Mexico's rights to water be restricted to 2,000,000 acre-feet, and that the Gila River be eliminated from consideration. It is very evident that any ratification with reservations is tantamount to no ratification. It is contended by those interested in the development of the river that no effort should be made in this indirect manner to interfere with ratification. It is believed that the reservations themselves are the outcome of misunderstanding. The state can place the $5 royalty tax at any time, and it is apparent that it should be carried in a separate bill; nor is it within the jurisdiction of a state to suggest what the federal government shall do in a matter of international relationships, while to eliminate the Gila is entirely contrary to the spirit of the compact—Colorado would have just as much right to adopt a reservation eliminating the Grand.

The opposition in Arizona to ratification has come from three groups. The principal opposition has been from those misunderstanding the results that the adoption of the compact would bring. It is this group that now has been largely won over to ratification. A second group apparently is actuated by selfish political motives. The third group is that which favors municipal ownership.

## Electricity, Again Blamed for Fire, Again Acquitted

Twenty-seven inmates and attendants lost their lives in a fire which broke out last Sunday in an asylum for the insane on Ward's Island, in the East River at New York City, and Monday's newspapers attributed the blame to "uninsulated wires." Wednesday morning's papers, however, contained the tardy assertion that the official investigators had "united in eliminating electrical wiring as the cause of the fire," which was the second in two weeks. The chief electrician testified that all the lamps in use in the building were burning after the fire started.

## President Harding Approves Reorganization Plan

The joint congressional committee on reorganization of the government departments has received from President Harding an outline of the reorganization plan recommended by the President and the Cabinet. The outstanding recommendations are as follows:

1. The co-ordination of the military and naval establishments under a single Cabinet officer as the Department of National Defense.
2. The transfer of all non-military functions from the War and Navy Departments to civilian departments, chiefly Interior and Commerce.
3. The elimination of all non-fiscal functions from the Treasury Department.
4. The establishment of one new department, the Department of Education and Welfare.
5. The change of the name of the Post Office Department to Department of Communications.
6. The attachment to the several departments of all independent establishments except those which perform quasi-judiciai functions or act as service agencies for all departments.

These general proposals are followed by a detailed list of suggested changes and transfers in the respective departments as now constituted. It is highly improbable that any bill founded on these recommendations can be reported to the present Congress, which expires on March 4.

## Three Utility Bills Now In

**The New York Administration Aims to Abolish the Present Commission and Aid Public Ownership**

THREE bills embodying the plans of the state administration for utility control were introduced into the New York Legislature on Monday of this week. One of them legislates the present Public Service Commission, composed of five members with terms of ten years, out of office and creates a new commission, composed of three members to serve for six years. This measure abolishes the law passed during Governor Miller's administration whereby the commission was authorized to increase or reduce a rate of fare or charge by a public utility fixed by franchise agreement. It also strikes out the authority of the commission to establish temporary rates pending a hearing requested by a utility.

There is some question as to whether the object of this measure, to restore former contract rates, has been accomplished, since the legislation of 1921, by implication, abrogated all existing contracts and repealed all special and general laws and since the measure now presented has failed specifically to mention such abrogated contracts or to re-enact any statute that might have been so repealed.

### Municipal Ownership Favored

Under one of the two other bills, an amendment to the general city law, all municipalities throughout the state are endowed with the broadest powers to "own, establish, construct, acquire and operate" public utilites of all kinds. The Board of Estimate in New York City and the common councils of other cities, with the consent of the Mayor, under the terms of this bill would determine the policy of their respective municipalities. There is no provision for a popular referendum.

Existing utilities "or any part thereof" may be acquired by condemnation and the necessary expenditure involved met either by taxation or through a bond issue. The bill does not affect transit facilities in New York City already provided for in Mayor Hylan's transportation bill, but it relates to all other classes of public utilities in the city.

The third bill eliminates from the Public Service Commission law all references to the New York City Transit Commission, which is to be abolished, and makes the law conform in other respects to the New York City transportation bill now pending.

## Lessons of Eagle Rock Fire

**Need for Care in Placing 60,000-Volt, Oil-Filled Lightning Arresters—How Service Was Restored**

THE disastrous fire which occurred at the Eagle Rock substation of the Southern California Edison Company on the evening of Jan. 8 owing to the explosion of a 60,000-volt oil-filled lightning arrester indicates that considerable care must be used in installing such arresters. It is probable that if in this case the arresters of this type had been placed exterior to the substation or if arresters which contained no oil had been used much of the damage would have been avoided.

The fire started at 9 o'clock in the evening, when a set of 60,000-volt aluminum-cell lightning arresters blew up. It is thought that there was a short circuit on one of the lines, but it is not known whether there was an external short or whether the failure of the arrester itself was the short. When the arrester blew up it spilled burning oil in all directions throughout the 60,000-volt lightning-arrester room. This caused the other arresters to become overheated, and they in turn boiled their oil out, which resulted in a more intense fire. It is also probable that some of the arrester tanks overturned. The fire burned out the windows between the 60,000-volt arrester room and the riser wells of the transformers and lines, and the smoke from this burning oil went to the fourth and fifth floors of the substation building, collected around the 150,000-volt bus and burned under the ceilings of these floors.

The 150,000-volt arresters were in a gallery above the 60,000-volt arresters. There were windows between this gallery and the riser wells as well as behind the 150,000-volt arresters. These windows burned out, and the heat, which was very intense, set the arresters on fire or caused them to blow up. The two 150,000-volt buses were damaged to such an extent that it was necessary to replace most of the porcelain insulators, porcelain disconnecting switch supports and parts of the bushings of the 150,000-volt switches. None of the major equipment in the substation, such as the transformers and synchronous condensers, was damaged. The control board was also uninjured. The transmission line to the substation was left in first-class condition. The section of damaged 150,000-volt bus between the transmission line and the transformers was the chief loss. The total damage will probably not exceed $100,000, which is considerably less than the half million first reported.

### How Service Was Restored

To restore service the Big Creek power-house transformer connections on the high-tension side were changed from 150,000 volts Y, with grounded neutral, to approximately 80,000 volts delta. At Eagle Rock the transmission line was disconnected from the bus, a few temporary poles were set and Big Creek was fed directly into the 60,000-volt system just outside of Eagle Rock substation, thus supplying Southern California. The only crippling of service was on the 15,000-volt railway supply at the time of the morning peak on the next day, and this condition was remedied within a few hours.

It was found that "foamite" was of considerable value in fighting an oil fire, and steps are being taken to install such fire-fighting equipment in all of the principal stations on the system. At present the station is operating under normal conditions on the Big Creek line, with one 150,000-volt bus at Eagle Rock in first-class condition. It was necessary to use the delta, 80,000-volt connection at Big Creek for only about five days before Eagle Rock was sufficiently repaired to permit of 150,000-volt grounded Y operation on the Big Creek line. Fortunately none of the 220,000-volt auto-transformers or other 220,000-volt equipment in the process of installation at Eagle Rock was damaged.

## Public Relations Main Theme at Albuquerque Meeting

Better public relations was the theme that dominated the ninth annual convention of the New Mexico Electrical Association, held on Feb. 12 and 13. While there were a large number of papers and addresses dealing with the technical and business sides of the public service industry, it was noticeable that even these were tinged with one thing or another concerning the building of public good will.

The convention was held in Albuquerque and the attendance was the largest in the history of the association. The manufacturers, jobbers and dealers, as well as the central-station companies, were largely represented, delegates coming from as far east as Chicago, as far south as El Paso, as far west as San Francisco and as far north as Denver. As a result of the discussions growing out of the various addresses and papers on public relations, this phase of the public utility industry will receive the attention of all of the universities in New Mexico.

Those who delivered addresses or read papers were: B. C. J. Wheatlake, General Electric Company, Denver; J. E. Moorhead, Mountain States Telephone & Telegraph Company, Denver; C. A. Winder, Southwest General Electric Company, El Paso; Dr. John D. Clark, State University of New Mexico; George E. Lewis, executive manager Rocky Mountain Committee on Public Utility Information, Denver; Prof. R. W. Goddard, State College of New Mexico; J. F. Dostal, Colorado Springs Light, Heat & Power Company, and M. Nash, an electrical contractor of Albuquerque.

E. A. Bradner of the Las Vegas Light & Power Company, Las Vegas, was elected president of the association, to succeed D. E. Bent of the Tucumcari Light & Power Company. Charles E. Twogood of the Albuquerque Light & Power Company was re-elected secretary.

## News from the Capital

**Radio Bill Doomed in Senate—Ford Bill Not Reported Out—High Dam License Waits on Minnesota**

FROM the Washington bureau of the ELECTRICAL WORLD news comes that the radio bill is dead. The Senate committee on interstate commerce has decided definitely to take no action on the measure which already has passed the House of Representatives. Senator Underwood, the Democratic leader, takes the position that the bill is too important and too far-reaching to be rushed through in the closing days of Congress, when it is impossible to scrutinize it carefully and to conduct the public hearings which he deems necessary.

The failure of this legislation, along with the legal decision which has overthrown the present methods of restraint, leaves radio communication practically uncontrolled. Secretary Hoover says that he will search for authority to follow a temporary policy, but he is doubtful whether those concerned would undertake the necessary new instrumentation which would have to accompany a change of wave lengths, when there could be no guarantee as to the permanency of the new plan.

### Ford Bill Not Reported

By a vote of six to thirteen the House rules committee refused on Monday to report out a resolution giving Henry Ford's offer for Muscle Shoals right of way in the House. This precludes consideration of Muscle Shoals legislation at this session unless a majority of the House votes to override the rules committee.

### Status of High Dam

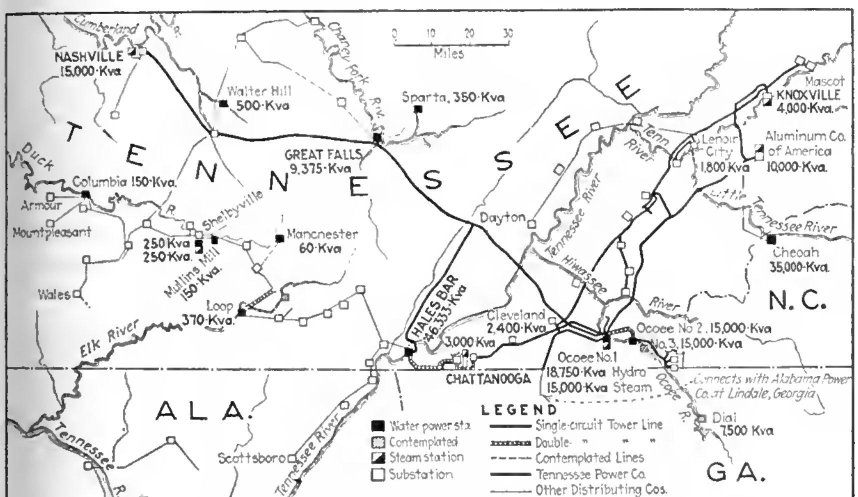
Advices received at Washington from St. Paul are to the effect that the Minnesota Legislature is not likely to adopt the bill authorizing the Municipal Electrical Corporation or the city of Minneapolis, or both, to issue bonds to put in the power project at the High Dam on the Mississippi. Apparently a majority of the members of the Legislature feel that the placing of a power business which would amount to $1,000,000 a year at the disposition of a city council which changes each two years would not make for economical operation and would result in costly power.

The Federal Power Commission will not act in this matter until the Legislature takes definite action or adjourns without having taken action. It will then determine promptly, it is believed, who shall have the license. It will apparently be a question of determining whether it shall go to the Northern States Power Company or to Henry Ford, and there is a very generally held opinion that the license will go to the Northern States Power Company, as the water-power act places the use of power sites for public utility purposes above their use for private industries and this policy has won the favor of the Federal Power Commission in previous cases of similar character.

# Electrical Progress in Tennessee

### Expansion Program of Tennessee Electric Power Company Includes Additions at Nashville, Chattanooga, Great Falls and Other Places—Selecting Site for New Steam Plant

LOAD is increasing so rapidly on the system of the Tennessee Electric Power Company that it has already ordered a 12,500-kva. turbo-generator for the steam plant at Nashville to bring its rating up to 27,500 kva. and is contemplating other additions. Among the company's problems are the best method of increasing the 10,000-kva. hydro-electric development at Great Falls, on the Chaney Fork River, and the best location for a new steam station probably of 15,000 kva. to 20,000 kva. rating. The installation of switches are to be installed during February or March at Parksville, and some of the high-tension switches are being modified to give better rupturing performance. Among the chief changes being considered are stronger tanks, heads and tie rods on some switches, mufflers and explosion chambers on others and new bushings on still others. Since some of the switches are not adapted to bushing-type current transformers, an oil-immersed shunt has been devised for activating the tripping circuit.



TENNESSEE SYSTEMS MERGED INTO THE TENNESSEE ELECTRIC POWER COMPANY

a 7,500-kva. synchronous condenser at Chattanooga to improve voltage regulation is another project. A 120,000-volt circuit will be built from Cleveland to Knoxville, giving duplicate service at 120 kw. At Great Falls there is the opportunity of increasing the head 30 ft. to 35 ft. and thereby improving the chance to add a 15,000-kva. waterwheel generator, making a total of 25,000 kva.

Three sites for a steam plant are being considered, near Hales Bar, or at Chattanooga on the Tennessee River, or at Knoxville. The most advantageous point would be at Hales Bar, because plenty of condensing water would be available, coal could be transported by barge, and besides the plant would back up the Hales Bar hydro-electric plant during the dry season and during high backwater. Furthermore, no new transmission line would be needed.

Other water-power sites remain to be developed on the Ocoee River, but from an economical standpoint they remain in the future. Additional power facilities are also expected after the completion of the 110,000-volt line which the Georgia Railway & Power Company contemplates from Lindale, Ga., to the Tennessee-Georgia state line to connect with a line to Chattanooga.

Switching facilities are being improved. Entirely new low-tension

About eighty thousand insulators are being replaced by others of the same make but of a more modern type. To determine which shall be changed the "buzz stick" method is being used and the insulators are being changed with the circuits "alive."

Between Cleveland and Copper Hill, where no telephone lines exist, carrier-current communication will be utilized.

## European Engineers Take Note of Joint Committee

At a meeting of the executive committee of the Joint Committee for Business Development held in New York on Feb. 15 it was announced that requests had been received from nearly thirty cities asking assistance in the formation of local leagues or clubs.

Messrs. Lane, Marshall and Goodwin were appointed a committee to prepare a display for the Joint Committee at the N. E. L. A. convention in June.

William L. Goodwin of the Society for Electrical Development reported that the society's first monograph, "Building Residence Lighting Business," would be completed about the middle of March. "Useful Information for Architects and Builders," he said, will be ready in April, and other booklets are being prepared. These include "Customers Versus Population," "Advertising Service for Electric Homes," and "Organizing and Conducting an Electric League."

A. K. Baylor, chairman of the wiring department, reported that he had prepared a paper on wiring for the General Engineering & Management Corporation and that it had been sent to all the officers of that organization. The booklet being prepared by the heating and melting department, of which C. K. Nichols is chairman, will soon be ready.

S. E. Doane of the National Lamp Works of the General Electric Company spoke of the conditions in the European electrical industry which he studied during his recent trip abroad. He said that he had heard of the work of the Joint Committee as far east as Hungary, and that the European engineers were amazed at what had been accomplished in this country. He predicted that before long foreign countries will send electrical missions here to study our methods.

## Alabama Utilities Must Open Their Books

Public utilities in Alabama must open their books to the Public Service Commission of the state at any time that body requires, under a bill just signed by the Governor. Any person appearing for the public in a valuation case may apply for a rehearing and appeal to the courts from any decision of the commission. Heretofore only the company could apply for a rehearing or appeal from the commission's ruling.

The law is a result of the contention by the Alabama Power Company and the Mobile Gas Company that the commission had no right to grant a rehearing after a tentative valuation had been fixed. Both companies declined to submit books on the ground that no cases requiring such inspection were pending.

## Los Angeles A. I. E. E. Hears About Ceramics

Before the February meeting of the Los Angeles Section of the American Institute of Electrical Engineers, Frank H. Riddle, president of the American Ceramic Society, and Dr. J. A. Jeffery, president of the Champion Porcelain Company, read papers, Mr. Riddle dealing entirely with ceramic development of porcelain insulators and Dr. Jeffery discussing modern methods of firing high-voltage porcelain. Both speakers referred to the discovery of silaumite, which Dr. Jeffery stated eventually would replace the clay now imported from England in forming the principal body for porcelain. Silaumite, he said, is mined at the present time exclusively in California and it is found within 50 miles of Bishop. So far as known, there is no other place in the United States where this mineral is to be found. At least this is the only commercial deposit of which there is now any knowl-

edge. Mr. Riddle said his companies had 500,000 lb. of silaumite in Detroit at the present time for porcelain making. This mineral, though discovered only two years ago, is revolutionizing porcelain for long-distance transmission purposes, he declared.

"As mined at present," said Mr. Riddle, "many difficulties are met with. It is brought to the railroad by burros and then shipped to Detroit. The present supply is adequate and there is a strong possibility in the not distant future of building a plant of large proportions on the Pacific Coast. Before any such step is undertaken, however, more experimental work must be prosecuted. We are still developing an electrical fire kiln to carry loads twenty-four hours."

Both speakers asserted that the Pacific Coast buys in one year in insulators approximately what the rest of the United States buys in two years.

# To Improve Lighting of Post Offices

### Expert Investigation Carried Out Under Federal Direction Brings Recommendations for Standard System All Over Country Insuring 10 Foot-Candles on Working Plane

ESTABLISHMENT of a standard system of lighting in all post offices has been strongly recommended in a report just submitted to the Post Office Department by the Office of Industrial Hygiene and Sanitation of the United States Public Health Service. This report, the result of an elaborate survey conducted at the special request of Postmaster-General Work, maintains that millions of dollars will be saved through increased speed in the work of postal employees provided that a complete change is effected in the illumination of workrooms of post offices throughout the country.

Virtually all the work performed in post offices with the exception of that of laborers depends primarily upon the use of the eyes, making the question of illumination of paramount importance in decreasing or increasing its rapidity and accuracy. Conducting a thorough and technical study of lighting over a long period of time at two representative post offices, one modern and the other of the old type, the experts observed almost five thousand postal workers employed constantly in handling the mails both under artificial and natural light.

They found that illumination in many post offices was low in intensity and unsatisfactory in quality. In some instances it fell below the requirements provided by the state code of laws and below the artificial light furnished employees in private industries doing similar work. A study of the relationship between the volume of illumination and the strain on the eyes of workers revealed the fact that there were more eye defects among employees working under the average illumination of 2 to 3 foot-candles in the old post office than under the 3 to 4 foot-candles in the new post office. Sorting and separating mail in the basements of post office buildings was especially discountenanced except in extreme emergencies.

#### Speed Increases 4.4 per Cent

In the speed and accuracy tests it was found that for the letter separators there was an average increase in speed, or decrease in the times of separation, of at least 4.4 per cent when going from 3.6 to 8 foot-candles. Assuming that the same relative increase of speed would prevail in all the divisions of the post office where these tests were made under the same relative increase in illumination, an annual net saving, after deducting increased cost for lamps and energy, of about $109,000 was indicated in this post office alone.

#### Intensity of 10 Foot-Candles Needed

The investigations recommended that there should be installed in the general workrooms and offices systems of totally inclosing units of the diffusing or light-directing type, giving a general intensity when first installed of 10 foot-candles everywhere on a horizontal working plane 45 in. above the floor. All local lighting should be done away with.

The lighting unit to be installed in the general workrooms of the post office should be of such quality of glass and of such shape and size that its surface brightness at any point would not exceed 2.5 cp. per square inch when used with an incandescent lamp or other source of light emitting 3,100 lumens. This unit should have an output of at least 80 per cent of that of the clear lamp and a spherical distribution of its candlepower such that at least 8 per cent of the light emitted by the clear lamp would be emitted by the unit through the zone from 0 deg. to 30 deg., at least 28 per cent from 0 deg. to 60 deg., at least 48 per cent from 0 deg. to 90 deg., and at least 25 per cent from 90 deg, to 180 deg.

The lighting unit for the offices of the post office should be of such quality of glass and of such shape and size that its surface brightness at any point would not exceed 2 cp. per square inch when used with an incandescent lamp or other source of light emitting 3,100 lumens. This unit should have an output of at least 80 per cent of that of the clear lamp and a spherical distribution of its candlepower such that at least 8 per cent of the light emitted by the clear lamp would be emitted by the unit through the zone from 0 deg. to 30 deg., at least 23 per cent from 0 deg. to 60 deg., at least 43 per cent from 0 deg. to 90 deg., and at least 35 per cent from 90 deg. to 180 deg.

Both the units for the general workrooms and the offices should be such in number and so spaced that the brightness of the units measured in lumens per square foot would not be more than one hundred times as great as the intensity of the illumination, measured in foot-candles, produced by them on a horizontal plane 45 in. above the floor.

Recommendations on the care of the lighting system and a disquisition on modern methods of illumination are included in the report.

## Solidarity Theme of Pacific Coast Supply Jobbers

The quarterly meeting of the Pacific Division of the Electrical Supply Jobbers' Association, held at Del Monte, Cal., Feb. 8-10, was the largest which the records of the association show. The sessions were in charge of Chairman C. E. Wiggin, and, besides the jobbers, an unusually large registration of manufacturers and representatives of other electrical interests took place.

The open meeting of Feb. 10 was in charge of E. O. Shreve, San Francisco manager of the General Electric Company. R. A. Balzari, Westinghouse Electric & Manufacturing Company, spoke on "Business Courtesy," and W. R. Alberger, vice-president San Francisco-Oakland Terminal Railways, dealt with the problems of electric railway business.

The principal discussion of the meeting centered around a chart, designed and presented by E. O. Shreve, describing a proposed co-ordination of the different electrical clubs, leagues and societies to promote a greater solidarity of interest in the mutual problems of public utilities, with particular reference to their bearing upon the electrical industry.

## Oklahoma Gas & Electric Is Friend in Need

Fire on Saturday afternoon, Feb. 10, completely destroyed the electric light plant of the Minnesota Light & Power Company at Cushing, Okla. As soon as the seriousness of the blaze was seen the Mayor of Cushing called up J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Company, at Oklahoma City, and asked for aid in restoring service. Response was instant, and superintendents and crews of the Oklahoma Gas & Electric Company were rushed to Cushing from various division headquarters. Emergency lines were strung to the circuit of the Shaffer Oil & Refining Company, just outside of Cushing, which is served from the Oklahoma company's transmission line. As a result, Cushing suffered little inconvenience from the loss of the plant. Storekeepers were able to transact their usual Saturday night business, and even residential districts were in part supplied with lighting.

Much appreciation of this prompt assistance has been expressed in Cushing, whose people would without it have probably had to wait months for the resumption of electrical service.

## University of Minnesota's Claim on High Dam

The claim of the University of Minnesota to 15 per cent of all power that may be developed at the High Dam, built by the federal government across the Mississippi between Minneapolis and St. Paul, has been already referred to in the Electrical World. This claim is supported by a resolution passed by the regents of the university at the instance of Governor Preus of that state. The Governor's stand is based on the agreement entered into when the dam was begun. A corporation of three members was then formed—the Mayors of Minneapolis and St. Paul and the chairman of the board of regents of the University of Minnesota. The general understanding was that the three corporations, two municipal and one educational, were entitled to share the power equally.

The city of St. Paul favors turning the power over to Ford. Minneapolis business men also favor that policy, although the city administration does not. Both groups ignored the probable attitude of the University of Minnesota until Governor Preus came forward with the resolution showing that had it not been for university expert advice the dam never would have been built at a point making the development of water power available. Furthermore, the resolution says, the University of Minnesota is co-operating with the federal government in many experiments requiring power and is the only state university situated close to power that is still under the government's control.

The power available at the high dam will range from 2,500 kw. to 10,000 kw. according to the time of year and has been estimated by electrical engineers at 18,000,000 kw.-hr. a year. Supporters of the Ford plan have maintained that the university could not use more than 1 per cent of the power and that Ford plans erection of a large electrical experiment plant at the dam and is willing to give faculty and students the use of this plant.

The university regents have authorized architects to go ahead with plans for a new electrical engineering building to cost $300,000, and it is planned to begin work in the spring. The university is also just completing a large and finely equipped mines experiment and ore-testing station, and much electrical power will be required for its operation.

## Million-Volt Laboratory to Be Finished by March

Construction work on the high-voltage laboratory at the California Institute of Technology is progressing rapidly, and it is expected that the building will be completed by the first of March. The laboratory will be used jointly by the institute and the Southern California Edison Company.

In the laboratory will be installed a million-volt transformer to permit electrical engineers to obtain high voltages for experimental purposes. The Edison company engineers plan to conduct high-voltage tests in connection with their work in transmission. Dr. Robert A. Millikan will use the high voltage in his work on the constitution of atoms.

The million-volt transformer is one designed by Prof. R. W. Sorensen of the institute and will be in four units. In addition to the transformer there will be Poulsen arc equipment, which will be used to obtain high voltages at high frequencies.

## New U. S. Army Dredges to Be Completely Electrified

An illustration of the growing tendency to use electricity on shipboard is provided by the four hopper dredges designed by the United States Engineer Corps and being built by the Sun Shipbuilding Company, Chester, Pa. Electricity will propel these ships and steer them, operate the dredging pumps and all auxiliary machinery, supply heat in winter, cool breezes in summer and ventilation at all times, furnish hot water and do the cooking. There will be no fires of any kind.

The main engines of each dredge will be three 1,000-boiler-hp. McIntosh & Seymour Diesel engines, each of which will be directly connected to a 700-kw., 500-volt direct-current generator of 150 r.p.m. These generators will furnish the power for operating the propellers and the dredging pump. Each dredge is to be propelled by twin screws, and each propeller is to be directly connected to an 800-hp., 480-volt direct-current motor of the double-armature type. The speed of these motors can be varied from 90 to 110 r.p.m. The main dredge pump is to be driven by a 750-hp., 480-volt direct-current motor which has a speed variation of from 135 to 160 r.p.m. The windings of both generators and motors will be impregnated with moisture-resisting compounds and inclosed by protecting covers. Forced ventilation will be provided by small motor-driven blowers. Among the motor-driven auxiliary machines on each dredge are twenty-five auxiliary pumps, two air compressors, the steering gear, a windlass, two capstans, two winches, two hopper-door openers, the ladder hoist and the refrigerating machine. The control of almost all of these motors is to be of the automatic type.

Included in the electrical equipment of each dredge are to be eighty-eight electric room heaters, ranging from 1,000 watts to 5,000 watts each in capacity, three 5,000-watt water heaters for each hot-water boiler, twenty-three electric fans and two electric ranges of 22-kw. rating each. The auxiliaries will be supplied with current from two auxiliary Diesel-engine-driven 150-kw., 250-volt generators and also from a 150-hp. motor-generator set which can be supplied with power from the generator operating the dredge-pump motor.

All of the electrical equipment on these dredges is being supplied by the Westinghouse Electric & Manufacturing Company.

## N. E. L. A. Appoints Convention Committees

Announcement has been made at the headquarters of the National Electric Light Association of the appointment of the following chairmen of sub-committees in connection with the annual convention in New York City next June: Inspection trips, Philip Torchio; preparation, printing and delivery of entertainment programs, Clarence L. Law; golf, H. M. Edwards; theaters, William J. Clark; local transportation, Col. J. Stillwell. Godfrey N. Atkins will be master of transportation. The hotel committee, it is reported, has its work well in hand.

## Northern States Power Is Spending $5,000,000

As part of its recently announced eighty-million-dollar ten-year hydro and steam power construction and development plan, the Northern States Power Company will soon start work on a new terminal substation in Minneapolis to serve the downtown and northwestern sections of that city. The new substation, together with connecting and necessary distributing lines, will cost approximately $1,000,000.

In addition to this, foundations are ready at the Riverside station of the company in Minneapolis for installation of three new 1,360-hp. boilers which have been ordered and are expected to be in operation this year. The cost will be about $500,000. Work also is under way to increase the coal and ash handling capacity of the Riverside station.

A 4,000-hp. steam turbine has been ordered for the Fargo (N. D.) plant of the Union Light, Heat & Power Company division of the Northern States Power Company. This, with the necessary additional boiler capacity, will cost approximately $300,000. It is expected that the installation will be completed next fall.

Total construction now under way at the Northern States Power properties amounts to about $5,000,000.

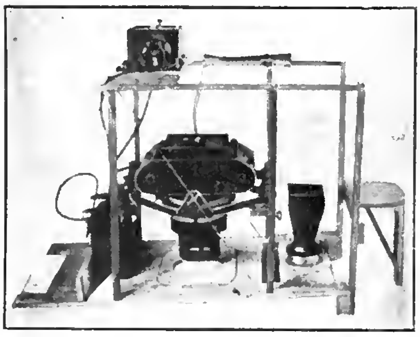
## Purchase of Utilities at Montgomery Approved

Formal approval of the purchase by the Alabama Power Company of the properties of the Montgomery Light & Traction Company, the Montgomery Light & Water Power Company, the Alabama Traction Company, the People's Ice & Electric Company and the Power Transmission Company, all of Montgomery, Ala., was contained in an order issued last week by the Alabama Public Service Commission. The purchase price is $6,200,000, but this price, the commission sets out, is not to affect any value which the commission may place on the properties for rate-making purposes. In addition to approving the purchase of the Montgomery utilities the commission also granted the power company's petition for authority to sell $4,000,000 worth of bonds,

the proceeds to be used in improvements and extensions by the power company and to meet outstanding obligations. Both the Montgomery Light & Water Power Company and the Montgomery Light & Traction Company are to be taken out of the hands of the receiver immediately.

## Hydro-Electric Survey by Airplane in South

The Alabama Power Company is preparing to survey the section of Alabama through which the Tallapoosa River flows by means of the airplane photographic method. The work of surveying will begin about the middle of March. The plane which will be used is a Breguet bombing type biplane, carrying five passengers, a pilot and 600 lb. of equipment. It is driven by a 300-hp., twelve-cylinder V-type Renault motor, which gives a maximum flying speed of 135 miles per hour, and is the same type of ship that is now used in the London-Paris passenger service.



CAMERA USED FOR TOPOGRAPHICAL SURVEY WITH VIEW TO POWER DEVELOPMENT

The company plans to use a camera of the Eastman K-1 type, with a single focal lens of 10 in., a 12-in. mapping cone, Venturi vacuum tube, power battery, speed-control unit and view finder. This camera will be mounted over an aperture in the cockpit of the plane on a special vibrationless support and contain a film 75 ft. long, sufficient for 100 exposures. In order to obtain photographs on the desired scale of 800 ft. to the inch, it will be necessary for the plane to fly at an altitude of approximately 9,600 ft. above the area to be photographed.

The result will be a map free from the blunders common to ordinary maps and showing a wealth of detail which it would not be possible to obtain by land surveying except at a prohibitive cost. Only sixty to seventy-five actual hours of flying are estimated to be necessary to complete the work, though two weeks to four months may be required, depending on weather conditions. The company estimates that it would take a land surveying company at least eighteen months to do the same work if that force were no larger than the one to be employed for the air survey, which will consist of about seventy office and field men. A saving of about 50 per cent is expected.

# Brief News Notes

**A Big Doherty Project.**—A permit granted by the Federal Power Commission to the Empire District Electric Company of Joplin, a Doherty property, foreshadows a 60,000-hp. hydro-electric project at Table Rock, near Branson, on the White River, where a great reservoir will be formed. The projected plant will be complementary to the one installed at Powersite, Taney County, ten years ago.

**Hagerstown May Sell Light, but Not Power.**—Thirteen taxpayers of Hagerstown, Md., who instituted injunction proceedings to restrain city officials from building a new municipal electric plant at a cost of $300,000 because the officials failed first to secure consent of the Maryland Public Service Commission, have obtained a court ruling that the city officials had no authority to erect a plant to generate electricity and sell it for power purposes, although they had the right to manufacture and sell electricity for lighting purposes. The city will carry its contention to the Maryland Court of Appeals.

**Bonds for Kahokia Plant Authorized.**—The Illinois Commerce Commission has granted the East St. Louis Light & Power Company authority to issue $11,000,000 5 per cent bonds to be used in the acquisition of the Kahokia Power Company plant, now under construction at East St. Louis. The project also embraces acquisition of the properties of the East St. Louis & Suburban Company and the East St. Louis Railway. The corporate name of the East St. Louis Light & Power Company is to be changed to the Union Electric Light & Power Company of Illinois.

**Power Merger of Arizona Plants.**—The Southern Arizona Power Company has been organized with a capital of $1,500,000 for the purpose of taking over the Nogales Electric Light & Power Company and the Arizona Gas & Electric Company, both of which operate plants at Nogales, Ariz. Prominent capitalists of Los Angeles and southern California are financing the new corporation. A large sum, it is reported, will be expended in extensions and betterments of the existing plants. Eventually power may be brought from northern Arizona to supply Nogales and the mining and other industries in its neighborhood.

**An Electrical Department in Builders and Architects' Journal.**—The Joint Committee for Business Development has made arrangements with the *American Builder Magazine*, Chicago, for a department in that publication, beginning with the March issue, devoted to electrification of all buildings. The *American Builder* is a handbook for those who plan and build and has a circulation of 55,000 copies a month, going to builders and architects in all parts of the United States and Canada. The new department in this newspaper will describe the complete electrification of twelve model homes with wiring layouts, lighting-fixture arrangements, use of appliances, etc. Decorative possibilities of lighting will be developed.

**Industrial Lighting Exhibit at Montreal.**—Under the auspices of the Electrical Co-operative Association of the Province of Quebec an industrial lighting exhibit has been held this week at Montreal, three demonstrations daily being given by S. G. Hibben of the Westinghouse Illumination Bureau, New York City.

**Milan Served by Interstate.**—The Interstate Public Service Company has signed a contract with the owners of the electric light company at Milan, Ind., to furnish energy from the company's plant at Aurora, Ind. Milan, with only 1,000 population, has recently built a new sanitarium which is completely electrified. A three-phase, 13,200-volt line to Aurora is being built.

**State Ownership Bill in Wisconsin.**—Legislation to bring about ultimate state ownership of privately owned and operated electric light and power companies in Wisconsin is sought by a bill which provides for the conservation and utilization of water sites by the state to develop electric power. This bill carries an appropriation for a survey of potential or undeveloped water-power sites in the state and prohibits the leasing or giving away of natural resources that may develop power.

**Northern Indiana Power Company Organization.**—The organization of the Northern Indiana Power Company, which has been noted in the news columns of the ELECTRICAL WORLD, is formally announced as follows: The consolidation takes in the Indiana Railways & Light Company, Wabash Water & Light Company, United Public Service Company, Noblesville Heat, Light & Power Company, Roann Light & Power Company and Sheridan Water, Light & Heat Company. Joseph H. Brewer, Grand Rapids, Mich., is the president of the new company. The other officers are: Vice-president and general counsel, L. J. Kirkpatrick; vice-president and treasurer, Harry R. Ellis; vice-president and general manager, Phil. H. Palmer. The Roann properties come under the management of the Wabash office and the Sheridan properties under the Noblesville management.

**Sleet Storm Puts Alabama Company on Its Mettle.**—Almost the whole construction department in the Birmingham district of the Alabama Power Company turned out to help the operating department clear up line and telephone breaks caused by a heavy sleet storm early in the month. The failure of a steel tower between Bessemer and Magella badly crippled the service in Birmingham. Temporary service was restored in record time by stringing the 110,000-volt "A" line to convenient trees until the steel tower could be replaced. The efficiency of the relay system was also demonstrated as every line that

sent in a trouble report was properly cleared and not a single faulty relay operation was recorded. The company's radio broadcasting station was used to advantage in reporting the load and voltage every half hour to the generating plants and primary substations.

**Buffalo Improves Street Lighting.**—A new circuit of 200 inverted magnetite-arc lights has been installed for a distance of several miles along Niagara Street, Buffalo, by the Buffalo General Electric Company. This company has contracts for placing 800 street lamps of the same type in the business district of Buffalo during 1923.

**Milwaukee Utility Buys New Property.**—The Milwaukee Electric Railway & Light Company announces that it has acquired the plant and other equipment of the Dousman Electric Light & Power Company, 33 miles west of Milwaukee, from L. J. Bischel. The consideration was not made known.

**Potsdam (N. Y.) Central-Station Company Extends Service.**—The St. Lawrence Transmission Company of Potsdam, N. Y., has completed a 24-mile, three-phase, 22,000-volt high-tension transmission line from Potsdam to Waddington for distribution and municipal lighting in Waddington, Madrid and Chipman and for distribution along the route.

**How to Pay Off the War Debts.**—A Pittsburgh engineer has submitted a plan to the Canadian government for utilizing the waste power of Niagara Falls to pay the war debts of the world. He asserts that with the co-operation of Canada, Great Britain, Belgium and the United States this can be done in twenty-five years. He would simply dig two tunnels 80 ft. in diameter and 25 miles long between Lake Erie and Lake Ontario. Utilizing the 250-ft. head thus gained, he would generate 5,000,000 hp. of electrical energy a day and sell it within a radius of one thousand miles for an average price of $82 per horsepower-year. The engineer-philanthropist is sure the thing could be done for two hundred million dollars.

**Storage Capacity in Utah.**—Flood control through regulation of the storage capacity in reservoirs on the Sevier River is proposed by R. E. Caldwell, Utah State Engineer, who has compiled tables showing that in the nine years ending with 1921 the annual flow of water into the Piute Reservoir was sufficient to fill that reservoir during the months of January, February, March and April in seven of the nine years. The stream measurement data on the stream show conclusively that the larger flood season comes in May and June. Thus it appears advisable to empty the reservoir completely in January of each year and gradually to build up the storage from the floodwaters, preventing the river from overflowing its banks. Mr. Caldwell's plan is that the reservoirs on the lower Sevier shall build up their storage during the first few months of the year and the upper reservoirs utilize the waters during the later season.

**Southern Indiana Security Issue.**—Issuance of $3,266,900 of securities and $400,000 in 7 per cent preferred stock by the Southern Indiana Gas & Electric Company, which has its main office in Evansville, has been authorized by the Indiana Public Service Commission. The amounts will be used to replenish the company's treasury, for repairs and extensions made and to be made and to retire outstanding stocks and bonds. The bond issue will bear 6 per cent and mature in twenty-five years. The company spent about $800,000 last year for machinery and extensions.

**Dissipating Clouds with "Electric Sand."**—Precipitation has been caused and clouds have been made to disappear in a series of experiments conducted at McCook Field, Dayton, Ohio, according to a widely recorded announcement made by the experimenters, Prof. Wilder D. Bancroft of Cornell University and L. Francis Warren. The experiments were made with the co-operation of the Army Air Service. The clouds were made to disappear and precipitate their moisture by the dropping of electrically charged grains of sand upon them from airplanes, according to the experimenters. Professor Bancroft and Mr. Warren assert that the process will be of great value in the commercial world, as fogs over cities, harbors and flying fields can be made to disappear, thereby insuring safety to travel and transportation. They do not contend that in every instance rain or precipitation can be produced, as all clouds do not contain sufficient moisture.

# Associations and Societies

**National Safety Congress to Be Held at Buffalo.**—The National Safety Council will hold its national safety congress for 1923 at Buffalo on Oct. 1 to 5, according to announcement by W. H. Cameron, managing director.

**Butte Electrical Men Organize.**—Members of the electrical industry in Butte, Mont., have recently formed the Electric Club of Butte, to promote the personal welfare of the members and to improve electric service for the public. M. E. Buck was elected president, H. M. Latham vice-president, K. M. McNeill secretary, and W. C. Medhurst treasurer. The club has rooms in the Montana Electric Building.

**March Section Meetings of the A. I. E. E.**—The following Institute section meetings have been scheduled for March, 1923: Boston, March 13, "Design of Transformers and Other Features of Queenston Plant," by M. E. Skinner, and "Trend of Power Transformer Development," by M. O. Troy; Detroit-Ann Arbor, March 16, associated technical societies' meeting; Philadelphia, March 12, "Recent Developments in Thermionic Tubes," Saul Dushman; Pittsfield, March 1, "Behind the Screen with the Movie Makers," Rowland Rogers; Worcester, March 15, "The Development of Illumination," W. D'A. Ryan.

**Pacific Coast A. S. M. E. to Discuss Water Power.**—The first Pacific Coast regional convention of the American Society of Mechanical Engineers will be held in Los Angeles on April 16 to 18. H. A. Barre, electrical engineer for the Southern California Edison Company, will present a paper on "Mechanical Features in Design of Long-Distance Transmission Lines on Hydro-Electric Systems," and Robert Sibley, Pacific Coast consultant for the McGraw-Hill Company, one on "Industrial and Electrical Development on the Coast."

**American Physical Society.**—For the meeting of this society at Columbia University, New York City, today (Feb. 24) papers of electrical interest are scheduled as follows: "Dispersion of Light by an Electron Gas," by Leigh Page, Yale University; "The Cause of Ionization in the Carbon Arc," by K. T. Compton, Princeton University; "The Contact Electricity of Solid Dielectrics," by Harold F. Richards, Princeton University; "Duration of Resonance Radiation in Mercury Vapor," by Harold W. Webb, Columbia University; "The Change in the Emf. Between a Metal Plate and a Solution After Being Suddenly Brought Into Contact," by R. D. Kleeman and R. H. Bennett, Union College.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Pennsylvania State Association of Electrical Contractors and Dealers—Lancaster, Feb. 28. M. G. Sellers, 1518 Sansom St., Philadelphia.

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 14-15. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Wills, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

American Society for Testing Materials—Atlantic City, June 25-29.

## Commission Rulings

**Suspension of Operation Not Justified by Failure of Competing Company to Furnish Energy.**—The suspension of operation by a public service company having a permit to operate should not, the Wisconsin Railroad Commission held in barring out the Badger Public Service Company from Calumet (ELECTRICAL WORLD, Dec. 2, page 1237), be excused as a justifiable or involuntary suspension on the ground that the failure to serve is due to the failure of a competing company to supply energy. The Wisconsin law, the commission asserted, regards each utility as a separate and self-sufficient entity.

**Rates for Traffic Lights.**—A flat rate for traffic light service, used by municipalities in streets and highways for the guidance and regulation of vehicles, was approved by the Michigan Public Utilities Commission for the Detroit Edison Company. Usually, the company stated, only one lamp is required at each traffic location. This lamp burns all night and is commonly allowed to burn continuously to save the trouble and expense of turning it on and off. The company held that the cost of making such installations was prohibitive and that they did not fall under any commercial classification. Ordinarily these lamps are not connected with street-lighting circuits. In cases where they are so connected the commission took note of the fact that the company applies the street-lighting rates.

**Proper Charge for Rural Service.**—The Badger Utility Company recently filed an application with the Wisconsin Railroad Commission for permission to establish a rule providing for a connecting charge of $110 for farmers desiring service from its high-tension line who did not take a share of stock at the time the line was built. Granting this petition, the commission said: "We must bear in mind that rural electric service as we know it now is not, as a general thing, capable of supporting the full cost of the service including a return on the capital, and, consequently, unless the rural customer is to pay a part or all of the construction cost, the service either will not be furnished or customers residing in cities and villages must make up the loss, or the loss must be carried by the utility. It is not fair to assume that utilities will generally extend service into rural districts at a loss nor that local customers should be required to make up that loss. Consequently, if the rural districts are to have electric service, rules must be approved which will provide proper conditions under which lines shall be constructed so that the service can be self-supporting. A refusal to approve the rule in this case might or might not adversely affect customers who desire to receive service from the line in question, but it would almost certainly have the effect of putting the company in a position where it could not afford to furnish extensions for other rural customers and where it is quite likely that the commission could not order the furnishing of such extensions since the failure to have a proper connection charge would mean that the extensions could not produce enough revenue to meet the cost of service."

**Invasion of Territory.**—The Morris & Somerset Electric Company brought complaint against the Commonwealth Electric Company and sought to prevent the authorization by the New Jersey Board of Public Utility Commissioners of the issue of securities by the latter company, charging that the Commonwealth company was infringing on the territory of the complainant. It appeared that the Commonwealth company had contracted to supply electrical energy to the Millburn Electric Company for distribution and for that purpose had agreed to construct a 33,000-volt transmission line to bring energy from its Morristown plant to the Millburn company's wires and also to supply twenty-nine customers along the route. The Morris & Somerset company claimed that this business belonged by right to it, but the board confirmed the Commonwealth company's contract and authorized the securities, holding that an electric utility which has extended into territory nearer to another utility's system than to its own should not be ousted when the other utility has made no effort to develop the territory and when there is not sufficient disparity in the cost of service to justify such action.

**Municipality Ordered to Lower Rates.**—Ordering a reduction of 25 per cent in the power rates made by the Borough of Vineland for customers outside the borough limits, the New Jersey Board of Public Utility Commissioners said: "As a part of the borough's electric operating revenue deductions no taxes are included, and in comparing its cost of operation with a private corporation an allowance for taxes should be made. In the case of privately operated electric utilities these amounted in 1921 to approximately 9 per cent of the gross revenues. An allowance should also be made for a higher cost of administration or management, inasmuch as almost invariably in the case of a municipal plant not all of the time of every municipal officer properly assignable to the operation thereof is charged as a part of the operating expenses. If no consideration were given to these two items in fixing rates to be charged the consumers of electrical energy would be getting all of the benefits accruing to the borough from the operation of the electric plant as a municipal undertaking. These benefits belong to the taxpayers as such and not to the consumers of electrical energy as such. In order to be fair to the former, the net return should be sufficient to include the amount which in the case of a private undertaking would be paid out for taxes and higher administration expenses."

## Recent Court Decisions

**Assumption of Risk by Lineman Using Hook Without Safety Catches a Question for Jury.**—In French vs. Southwestern Telegraph & Telephone Company, an action to recover damages for the death of a telephone company employee who fell while descending from a platform built on a high pole to ground by means of a hand line, because a hook by which the hand line was suspended from a wire slipped off the wire, the question of whether he assumed the risk of using this hand line, though the hooks were open and had no safety catches to prevent them from slipping from the wire, was held by the Court of Civil Appeals of Texas to have been rightly left for the decision of the jury, and a verdict for the plaintiff was therefore upheld. (245 S. W. 997.)*

**Ordinance Granting Franchise Fixing Maximum Charge a Contract.**—The Supreme Court of Nebraska has declared, in City of University Place vs. Lincoln Gas & Electric Light Company, that an ordinance reciting "that, in consideration of the rights and privileges granted herein, the grantees shall have a right to charge not in excess of $1.50 per 1,000 cu.ft. of gas," etc., which was accepted by the company, constituted a contract the obligation of which may not be impaired by either party. Whether or not the state, by the exercise of its paramount authority to regulate rates which may be charged by public utility corporations, could intervene upon a showing that the rate fixed by the contract was unreasonable or confiscatory was not decided. (191 N. W. 432.)

**Powers of Oklahoma Commission.**—From an order of the Oklahoma Corporation Commission directing the Oklahoma Natural Gas Company to furnish natural gas to the Chickasha Gas & Electric Company for distribution the first-named company appealed to the Oklahoma Supreme Court. Reversing the commission's decision, that court holds that where a public utility has undertaken and professes to serve the inhabitants of certain cities and towns within the state the commission has power, within constitutional and reasonable limitations, to compel such utility to serve all inhabitants thereof who may apply for such service, but that the commission is without power to compel a public utility to furnish its product to a community which it has not undertaken or professed to serve and which it is under no obligation to serve, since to require the utility to serve such community would be tantamount to the taking of private property for public use without just compensation. (211 Pac. 401.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## Learned and Hecht Vice-Presidents Northern Illinois

John G. Learned and Julius L. Hecht, who have been elected vice-presidents of the Public Service Company of Northern Illinois, as was an-anounced in the Feb. 10 issue of the ELECTRICAL WORLD, have been identified with the electrical industry for a number of years. In 1898 Mr. Learned became associated with the Chicago Telephone Company, now the Illinois Bell Telephone Company, and on leaving that company two years later he became a salesman for the Commonwealth Edison Company. In 1905 he resigned from that organization to become general contract agent for the North Shore Electric Company, where he remained until 1911, when the company became part of the Public Service Company of Northern Illinois. At that time he was made general contract agent for the northern and western divisions, and in August of the following year he was made assistant to the vice-president of the company in charge of the commercial, advertising and right-of-way departments. Later he was made commercial and new-business manager, which position he held at the time of his recent promotion. Mr. Learned will continue in charge of the same division.

Julius L. Hecht has been general superintendent since 1921. He was graduated from the Massachusetts Institute of Technology in 1904, and the following year he became construction engineer for the North Shore Electric Company. In 1907 he was made mechanical engineer in charge of stations. In 1915 he was appointed superintendent of electrical production for the Public Service Company and in 1921 assistant to the vice-president in charge of operation with the duties of general superintendent, the position he held at the time of his promotion to the vice-presidency. Mr. Hecht will have charge of the engineering and operation departments.

**John O. Montignani**, formerly engineer of electric distribution and division superintendent with the Rochester Gas & Electric Corporation, is now associated with the Westchester Lighting Company, Mount Vernon, N. Y., as assistant electrical engineer.

**Harold P. Dayton**, who for three years has been the assistant treasurer of the Haverhill Gaslight Company, has been transferred to a similar position with the Truckee River Power Company at Reno, Nev. The Reno company is under the management of Stone & Webster, Inc., and serves an extensive territory in the western part of the state. Mr. Dayton has been associated with the Stone & Webster organization since 1914 and was a traveling auditor for several years before going to Haverhill.

## Director of Washington Committee on Utility Information

E. H. Thomas, who has been placed in charge of the newly organized Washington Committee on Public Utility Information as director, with offices in the Henry Building, Seattle, is a newspaper man of broad experience, covering a period of twenty-seven years. He was formerly managing editor of the Seattle *Post-Intelligencer*.

E. H. THOMAS

In addition he has had eight years' experience in public utility publicity work, having been publicity director for the Puget Sound Power & Light Company.

As Mr. Thomas sees it, the committee of which he is the director exists to furnish accurate information and facts about the public utility business to any citizen or group of citizens. The long experience which he has had as an active newspaper man has taught him the things in which the public are interested, and his previous association with public utility work has furnished him with a fund of information as to the sources contained within the utilities themselves for obtaining material that has a popular appeal and at the same time is grounded on facts.

**Ralph E. Thurston**, manager of the Putnam (Conn.) Light & Power Company, became manager of the Danielson & Plainfield Gas & Electric Company on Feb. 1. Mr. Thurston retains the managership of the Putnam utility.

## B. C. Edgar Merger Company's General Manager

B. C. Edgar, who was vice-president and general manager of the Chattanooga Railway & Light Company and the Tennessee Power Company before they were merged with the Chattanooga & Tennessee River Power Company into the Tennessee Electric Power Company, retains his former title in the merger company. Mr. Edgar is also associated with the Nashville Railway & Light Company and at one time was assistant general superintendent of the Columbus (Ohio) Railway, Power & Light Company. W. C. Campbell remains with the new company in the capacity of assistant to the vice-president and general manager. The engineering and operating department of the new company retains most of the engineers who were with the component companies, but in slightly different capacities. J. A. Longley is general superintendent in charge of all engineering and operation of the power and transmission department, H. Crumbliss, Jr., chief civil engineer, J. R. Anderson, chief hydraulic engineer, George W. Christians and O. J. Miller electrical and mechanical engineers on new development work, E. C. Williamson electrical engineer on all other work than that of new development, M. M. Roddey superintendent of operation, and F. R. Atkins superintendent of power and substations. E. D. Reed remains as general superintendent of the Chattanooga district, which is the largest single center of energy utilization. H. B. Whitman is assistant general superintendent of both departments.

E. H. Lewis, who has recently been appointed general superintendent of the St. Louis County division of the Union Electric Light & Power Company and general manager of the St. Louis County Gas Company, became associated with these organizations in 1915, when he joined the engineering and sales departments. In 1920 Mr. Lewis became assistant treasurer of both companies, and one year later he was appointed treasurer of the St. Louis County Gas Company. He filled this office and that of assistant treasurer of the Union Electric Light & Power Company until his recent promotion.

L. F. Leurey, consulting electrical engineer of San Francisco, was elected to the office of president of the San Francisco Electrical Development League at the election held at the annual meeting on Feb. 12. The present secretary-treasurer, J. W. Mahoney, of the General Electric Company in the city, was re-elected by the members of the league. A. U. Brandt, electrical engineer, San Francisco division of the Pacific Gas & Electric Company; D. I. Cone, protection engineer of the Pacific Telephone & Telegraph Company, San Francisco, and C. Todt, Pacific States Electric Company, were named as the new members of the executive committee of the electrical association.

## P. B. Postlethwaite Vice-President of Wagner Electric Corporation

Preston Barr Postlethwaite, one of the newly elected vice-presidents of the Wagner Electric Corporation, has been associated with that organization since 1909, when he took its apprentice course. In February, 1910, he went to the Cincinnati office as a salesman, where he became branch manager in 1913 and district manager in 1915. Mr. Postlethwaite was called to the Wagner Electric factory at St. Louis in November, 1916, to organize and take charge of the service department, and three years later he also took over the automotive department. His experience as vice-president of several subsidiary companies of the Wagner Electric Corporation made him the natural choice for the vice-presidency of the newly formed Wagner Electric Corporation. Mr. Postlethwaite was born in Huntington, Pa., and is a graduate of Pennsylvania State College.

**J. L. Stannard** of San Francisco was named chief engineer for the construction of the first unit of Tacoma's new five-million-dollar Lake Cushman power project.

**William Seiple**, until recently an official of the Indiana Street Railway Company, is now associated with the Pennsylvania Power & Light Company in the Wilkes-Barre district.

**L. H. Ames** is the new superintendent at the Muscle Shoals plant of the Alabama Power Company, succeeding C. B. McManus, who was recently promoted to the position of manager of the western division.

**Norris C. Husted**, who has been a sales engineer for Hubbard & Company for the past five years, has been made manager of the Hubbard Pressed Steel Company, Niles, Ohio, a subsidiary of Hubbard & Company.

**Homer G. Hall**, who has been covering the territory in the Madison (Wis.) section for the General Electric Company for many years, has severed his connections with that company to become associated with the Julius Andrae & Sons Company of Milwaukee.

**F. O. Evertz**, superintendent of the electrical department of the Ohio Inspection Bureau, was recently elected president of the Western Association of Electrical Inspectors. Mr. Evertz has been an active member of this body and has served as vice-president and a member of the board of directors

**T. T. McLemore** has replaced E. R. Wall as division superintendent of the western division of the Alabama Power Company. Mr. Wall resigned to accept a position with the power department of the Birmingham Railway, Light & Power Company. W. M. Craven will act as assistant division superintendent.

**Chief Justice E. E. Corfman** of Salt Lake City, for six years head of the Utah Supreme Court, has been appointed by Governor Mabey as a member of the Public Utilities Commission of that state to fill the vacancy caused by the recent death of Judge A. R. Heywood. Judge Corfman has been a prominent member of the legal profession in Utah for many years.

**Clifford G. Hillier** has been appointed manager of the merchandising department of the Westinghouse Electric & Manufacturing Company, New England office, with headquarters in Boston. He succeeds F. L. Nason, who has been appointed assistant manager of the central station department of the Boston office.

## C. J. Stoll Works Manager Hawthorne Plant of Western Electric

C. J. Stoll has been appointed works manager, to remain in Chicago, upon the transfer to New York of the executive headquarters for the Western Electric Hawthorne plant. After obtaining his degree of electrical engineer from

C. J. Stoll

Penn State College, Mr. Stoll joined the Western Electric Company in 1903. He received charge of its new-apparatus design department in 1905 and six years later became head of the manufacturing branch of the Western Electric shop in New York. In 1912 he went to Belgium as shop superintendent of the Antwerp branch, returning to America a year after the war had started. Since that time he has been operating superintendent, technical superintendent and assistant general superintendent of the Hawthorne works.

**John P. Crowley** of St. Paul was recently elected vice-president and general manager of the St. Croix Power Company, Somerset, Wis.

**Kempster B. Miller** has resigned as general manager of the North Electric Manufacturing Company, Gallion, Ohio, to enter the consulting engineering field in Pasadena, Cal.

**W. M. Casey**, who has been superintendent of transportation for the International Railway Company of Buffalo, has gone to Atlanta to become superintendent of the Georgia Railway & Power Company.

**O. D. Allen** has been appointed manager of the Coghlin Electric Company, Worcester, Mass., electrical supply jobbers and contractor-dealers.

**Augustus C. Smith**, sales manager of the Buffalo General Electric Company, was elected chairman of the electrical group of the Chamber of Commerce of Buffalo.

**William T. Walker** has recently become sales manager and vice-president of the Jeannin Electric Company, Toledo, manufacturers of single-phase motors. Mr. Walker was formerly connected with the autombile industry.

**Renshaw Borie** is now associated with McClellan & Junkersfeld, Inc., in their work of engineering, construction and management and is in charge of their Philadelphia office.

**W. J. Jockers**, sales manager of the St. Paul Electric Company, was made vice-president and a member of the board of directors at a recent meeting of that body. Mr. Jockers will continue in his capacity as sales manager in addition to his new duties.

**Cloyd M. Chapman**, who has been active in the work of the American Society of Testing Materials and the American Concrete Institute, has become affiliated with Dwight P. Robinson & Company, Inc., as consulting materials engineer.

**C. F. MacMurray** has replaced J. S. Dales as president and general manager of the Colon Electric & Ice Supply Company, vice-president and general manager of the Ciá Panamena de Fuerza y Luz and of the Ciá Panamena de Telefonos and general manager of the Panama Electric Company. Mr. MacMurray was graduated from Syracuse (N. Y.) University in 1906, and previous to occupying his present position he was manager of the Colon Electric & Ice Supply Company.

**James L. Mahon**, who for seven years has held the position of advertising manager of the P. A. Geier Company of Cleveland, was appointed merchandising manager of that company on Jan. 1. With Carl M. Randel, director of sales, he will be in charge of the merchandising policies of the company's entire electrical output. Prior to his connection with the Geier company, Mr. Mahon was with the Buckeye Lamp Division, a branch of the National Lamp Works of General Electric Company, and he was also for some months an officer of the Carpenter-Kingston Advertising Company of Cleveland. For the time being Mr. Mahon will continue to supervise the company's advertising in addition to his new duties.

# Obituary

**Patrick C. Fitzpatrick** of Springfield, Mass., an electrical contractor since 1891 and one of the longest established in that section of Massachusetts, died Feb. 3 in St. Petersburg, Fla., at the age of sixty-three.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Used Machinery—A New Industry Asset

**How It Has Shaken Off the Blight of the Second-Hand Idea and Come to Be an Economic Service to the Central Station**

By Frank MacGovern
MacGovern & Company, New York

MEN of industry are rapidly developing a new mental attitude toward power equipment and other machinery that has been used and has come again into the market. The blighting influence of the term "second-hand" is being shaken off, and as "used machinery" it is taking its place in the market with all the respect due to legitimate goods when openly sold to people of standing in the community by concerns of unquestioned responsibility.

The stigma of the "second-hand" idea is not hard to trace back to the early days when trade was principally confined to crops and domestic animals, jewels and works of art, clothing and implements for personal use. Crops and animals, jewels and art objects were freely bartered and lost no value in changing hands. But personal effects naturally were depreciated with personal use and contact and were sold at a sacrifice more because their "social standing" was impaired than because of actual decreased value. They were called "second-hand" and the term has carried a taint. Buy a horse or a cow from any one and you pay its worth, but a thing called "second-hand" is expected to be priced down because of the bad name.

### Influence of the Used Car

The automobile brought new thinking on the subject, because people were continually buying new and better cars and here were their old cars still good for service. So other people have bought them until there is no social stigma today in buying a "used" car—which may, in fact, be a rebuilt car—and we do not even call it "second-hand." True, used cars have been greatly depreciated in price, but the improvement of automobiles has been very rapid and the element of style influences the demand in a degree out of all comparison with more standard types of machinery. As a matter of fact, there has been very little change in the design of electrical machinery during the last eight years or more. There have been very few exceptions, the conspicuous case being the large sizes of turbine, in which there has been improvement in efficiency.

Frank MacGovern

Therefore the fact that the equipment may be a few years old has no effect upon it. Its efficiency and its worth depend not upon its age but its condition.

The stresses of the war have brought this same kind of a change in the attitude of industry toward used machinery. During the great need any piece of available "used" machinery was eagerly grabbed up for the value that was in it. And with the end of the war and the arresting of plant expansion a large quantity of machinery was thrown on the market, by the government and by manufacturers, some unused, some used but little, and its intrinsic value was so palpable that it has all been accepted as "used" and not "second-hand" equipment and has been bought according to its worth at what price negotiation could develop but without direct depreciation for any loss of "social" standing.

The great war plants at Hopewell, Nitro, Nashville and other points were dispensed in this way. Moreover, a great deal of absolutely new machinery has been brought onto the market, through a variety of causes, which must be sold by owners other than the original manufacturers, and this equipment too is sold by the used-machinery dealer. A recent spectacular example was the 20,000-kva. power plant which the government erected at Edgewood Arsenal. This plant has within the month been acquired by my company. There were two turbines with condensers and auxiliaries aggregating 17,500 kw., a complete switchboard with bench control of remote-operated oil breakers, 8,230 hp. in boilers with stokers, superheaters and soot blowers, and all the other equipment going to make up a complete power plant.

The electrical and power machinery has already been resold to the Denver Tramways Company, thus bringing to the Denver company the opportunity to purchase an extensive new equipment at a price which would have been far greater but for the services of the used-machinery dealer.

This extensive equipment had never been installed, but twelve years ago there would have been some hesitation on the part of the purchaser to buy equipment of this importance without a manufacturer's guarantee. The reputation of this used-machinery dealer has become so stabilized, however, because of the large amount of used equipment that is being sold, that the fact that this machinery is not absolutely new is no longer any serious obstacle to its resale and utilization.

### How Used Machinery Market Helps

But the vicissitudes of peace and progress are greater than the urgencies of war when it comes to electrical machinery. The growth of the industry is constantly forcing the abandonment of used machinery. Light and power companies are constantly buying new and larger machines and releasing smaller units,

which are bought by industrial plants or other utilities. Private plants are abandoned by companies that decide to take on central-station service. This equipment thereby becomes available to industry and can be acquired at considerably less than the first cost. In small stations this often makes possible the taking on of additional load in waiting business that could not be immediately financed if new apparatus at the full price had to be purchased.

The maintenance of an established market for used machinery, therefore, renders an economic service of great value to the industry. It establishes a place to sell used machinery and a place to buy it, and the dealer contributes also a further service of adaptation, for he rebuilds machinery, changing the voltage or some other desired detail or combining two machines into a motor-generator set as the customers' needs require. Another important service comes in the matter of deliveries, for in these days when manufacturers are sold far ahead of their capacity to produce, used machinery can be secured to meet emergencies.

This often makes possible the taking over of a private plant, for the ability of the central station to secure the load often hinges on the satisfactory sale of the installed machinery. Often it assists the enlargement of an industrial plant in the same way.

### Responsibility Makes Safety

One of the old obstacles to the sale of used equipment was the feeling that it was buying a "pig in a poke," but those days have passed. The business has been lifted to a dignified position by the development of used-machinery firms whose standards are of the highest and whose responsibility is ample.

The value of a boiler is established by the insurance certificate that covers it. The value of a turbine, an engine or other equipment can be established by experts. The responsibility of the firm that sells the used machinery is a matter of record and reputation.

Buying from a dealer whose good name and ample resources stand behind his guarantee is no less safe and profitable than buying from the maker of the apparatus. Therefore the resale of used machinery has grown into an established business of great volume in recent years and is resulting in a service to the central stations and industrial plants of this country of inestimable value.

There is hardly a prominent central station or important manufacturing concern in this country or in Canada that has not purchased used power equipment within the last dozen years, and the sales to smaller companies are large. The used-machinery business, in short, has won social standing and shaken off the damning influence of the old second-hand idea. In so doing it has become a distinct asset to the electrical industry.

# Export Business for the Electrical Jobber

**Some Definite Advice as to Existing Opportunities and the Methods by Which Foreign Trade May Be Developed by the Wholesaler**

By R. A. Lundquist
Chief Electrical Equipment Division, United States Bureau of Foreign and Domestic Commerce

Many instances exist where buyers in the less developed markets of the world cannot place large orders and where their requirements cover only a few each of numerous items. There are generally no regular import merchants with stocks of electrical goods in such places, and American electrical jobbers in strategic locations can well afford to cater to that class of trade, which is now often handled through indirect channels that do not tend to develop the possibilities that exist.

Again, it often happens that a foreign electrical dealer who normally does business in considerable volume through a general export house or other channels may urgently need a particular class of material or may want a modest mixed order of rather technical items shipped promptly. Such cases occur regularly in the electrical trade where a consumer calls for something out of the ordinary, and they present real opportunities for jobbers who can fill such orders without delay. It is a question of service largely—service rendered with promptness, efficiency and a full understanding of what is wanted—and the purchaser is willing to pay a margin to the jobber for that service. The smallness of the order and the limited quantity of individual items involved do not make such business attractive to manufacturers, but it should be profitable to jobbers, since it will invariably exceed in amount the average domestic order.

The business done by general export houses has been confined mainly to rather staple lines purchased in fair quantities from manufacturers, with the export houses acting as buying agents and shippers for the foreign customers. Much of such existing business will remain in the hands of general export firms in view of the fact that such items are frequently a part of a considerable order for mixed lines of merchandise, and that the business connections are of long standing. However, while general export houses do handle small miscellaneous orders of purely electrical goods, they are seldom prepared to fill promptly orders involving more or less technical items, nor are they in a position usually to seek such business aggressively from the foreign buyers. Their field lies largely in dealing with manufacturers on behalf of foreign clients who anticipate their requirements well in advance and who therefore buy in reasonably large quantities.

### The Promising Field

Canada is so closely bound up with our domestic merchandising that others of our neighbors present more promising fields. Mexico, the Central American republics, the West Indies, and to some extent a few of the northern countries of South America, offer the best prospects for the class of trade first discussed. There are no electrical importers who cover these countries throughout, and the electrical dealers and electric lighting companies in outlying places often do their buying of American supplies through indirect non-technical channels, though it must be said that more efficient means are usually provided for European goods.

Where prompt service is the controlling factor, or where special items are needed in small quantities, jobbers are able to sell goods to larger markets still—to Australia, New Zealand, China, India and to most of South America. This latter class of business is, of course, not steady, but it is worth while catering to.

Jobbers cannot afford to spend a great deal of money to open up ac-

counts in markets that promise only a limited volume of business. Catalogs sent to a hand-picked list are probably the most efficient means of approach, but the way for sending such catalogs should be paved by well-prepared letters describing the activities of the company and courteously requesting permission to do so. Unsolicited catalogs mailed to foreign firms, upon which they may be required to pay duty—and not infrequently short postage—are a source of irritation. Duties on catalogs should be arranged for by the sender, if possible, but at any rate the foreign firms should be informed as to what is to be sent them and under what conditions. One point that the jobber should emphasize is that he is purely a wholesaler and that he is seeking business on the basis of service—shipment from stock, assortment of items in quantities that will meet the needs of the buyer, and technical understanding of his requirements.

Business connections in outlying countries should be put on a more personal basis than is common in this country. Circular letters should be avoided so far as possible. Announcements of new lines or of special opportunities should be made in a more quiet manner than usual for the American trade. The foreign buyer wants to be kept advised of all new developments in the electrical field, but he appreciates them most fully when they are outlined to him in concise and courteous terms and with complete information.

Jobbers catering to foreign trade should make specific and uniform arrangements with their overseas customers regarding cable messages and their charges. A foreign firm which cables for quotations is not satisfied with a price list by mail. Cable messages, even when well coded, are expensive, and the charges may be all out of proportion to the volume of the particular transaction to which they pertain, but a policy can be determined upon that will be just to both buyer and seller. In the long run they are part of the margin the foreign buyer pays for prompt service, and he will hardly cable unless his needs are urgent and will bear the expense.

### SELLING TERMS

Foreign electrical dealers and central-station companies with which jobbers can establish connections will not as a rule ask for better terms than do American buyers of the same class. Upon beginning relations most foreign buyers are willing to establish credits with bankers in the port of shipment so that the goods will be paid for when the draft, with the documents attached, is presented at a bank. Where other terms are suggested for initial orders or where business relations have been in effect for a reasonable period, and sixty or ninety days' time is desired by the customer, it is always possible to obtain credit ratings from the usual commercial sources or to get insurance against the credit risk if advisable. Where goods are sold to established customers on such terms, the jobber will usually be able to discount the drafts through his usual banking connections.

There are certain specified routine details to be attended to in shipping goods abroad, there are various difficulties in language to be met, but on the whole the so-called intricacies of foreign trade disappear before common sense. The foreign buyers of electrical goods are reasonable business men with a good knowledge of what they want and with a willingness to play fair. Much of their business will continue to go direct to manufacturers and some to general export houses, but there is a certain portion of it that should and can fall to the electrical jobber.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Atlanta Collections Better

Jobbers in Atlanta report January collections as unusually good, even above optimistic estimates, with one jobber stating that his February collections are on a par with those of January. Another jobber, however, states that there seems to be a tendency on the part of his customers to pay more slowly than in the prior month. As a whole, collections in north and middle Georgia are in better shape than in the southern portion of the state.

An encouraging sign is that an increasing number of purchasers are taking cash discounts, a year ago these purchasers being unable to pay on even a sixty or ninety-day basis. Credits are still extended with care, but on the whole it can be said that credit is being extended on a less stringent basis than has been the case for some time. The experience of 1920, however, will serve to make credit men quite conservative in opening up new credit lines.

## New England Storage-Battery Trade Good

Sales of storage batteries are being maintained in New England on a scale promising better business this year, and while delivery conditions cause some anxiety, recent factory enlargements are helping to meet the current requirements of this and other sections of the country. Replacement orders are coming in well, and of late increased interest has been shown in road trucks and in industrial electrics. A prominent distributing house looks for an excellent year in lighter delivery-wagon battery sales, especially in the laundry and bakery fields.

Fair business is reported in radio batteries, notwithstanding the extending use of dry cells in some receiving sets. The season has not yet opened in starting and lighting batteries. Increasing applications of batteries are apparent in railroad car-lighting service. Stocks are none too large, and some shipments are being made on a four weeks' basis for varied battery service. Prices have shown a tendency to increase slightly in a few lines lately.

## Fixture Sales Are Improving

Observation of the demand for fixtures so far this year gives ground for optimism, and if prices continue fairly stable, jobbers and dealers handling this business intelligently should secure an excellent turnover. For months the demand for portable lamps has been active and growing, and the general improvement of business conditions throughout the country has been accompanied by decisions to build new homes and to refurnish old residences and install better lighting in industrial and mercantile establishments. The work of such an organization as the Bureau for Better Illumination at Boston and the increased emphasis being placed upon illumination engineering in central-station circles are bearing fruit.

The desire to move accumulated stocks has resulted in some quarters in price cutting, but it is believed this is affecting only a small proportion of the total volume of business. The popularity of styles is a potent factor in this branch of the trade, and nothing like saturation in design development is in sight. Unquestionably the recent discoveries in Egyptian archeology will be reflected in the design of high-grade illumination equipment, and the use of electric lighting in the actual investigations in the Valley of the Kings represents only the initial contact of the electrical material market with this epoch-making research.

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | \$0.0303 | \$0.0296 | \$0.0247 |
| Cold finished shafting, per lb. | 0.0397 | 0.0378 | 0.0336 |
| Brass rods, per lb. | 0.1804 | 0.1742 | 0.155 |
| Solder (half and half), per lb. | 0.2617 | 0.2425 | 0.2075 |
| Cotton waste, per lb. | 0.1181 | 0.1175 | 0.106 |
| Washers, cast iron (½-in.), per 100 lb. | 4.33 | 4.33 | 3.83 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.11 |
| Machine oil, per gal. | 0.349 | 0.36 | 0.40 |
| Belting, leather, medium, off list | 49% | 49% | 46% |
| Machine bolts, up to 1-in. x 30-in., off list | 51⅓% | 51⅓% | 64⅔% |

## Important Data on Electrical Industry for 1921

The Department of Commerce has just announced that, according to reports made to the Bureau of the Census, the value of products of establishments primarily engaged in the manufacture of electrical machinery, apparatus and supplies amounted to \$833,986,000 in 1921, as compared with \$997,968,000 in 1919 and \$335,170,000 in 1914, a decrease of 16.4 per cent from 1919 to 1921, but an increase of 148.8 per cent for the seven-year period from 1914 to 1921.

In addition, electrical products to the value of \$49,003,000 in 1921, \$65,558,000 in 1919 and \$24,262,000 in 1914 were reported by establishments classified in other industries. Electric washing machines, glass and porcelain electrical supplies, electric signs and electric lighting fixtures have been classified under other industry captions, and statistics of their production will be included with those for "washing machines," "glass," "pottery," "signs and advertising novelties" and "gas and electric fixtures."

Of the 1,333 establishments reporting products valued at \$5,000 and over in 1921, 220 were located in New York, 166 in Illinois, 161 in Ohio, 116 in Pennsylvania, 113 in New Jersey, 105 in Massachusetts, 73 in California, 60 in Connecticut, 54 in Wisconsin, 49 in Indiana, 47 in Missouri, 40 in Michigan, 16 in Minnesota, 13 in Washington, 12 each in Kentucky and Rhode Island, 11 in Maryland, 8 in New Hampshire, 7 each in Colorado, Iowa, and West Virginia, 6 in Oregon, 5 in Nebraska, 4 in Texas, 3 each in Louisiana, North Carolina and Virginia, 2 each in Alabama, District of Columbia and Oklahoma, and 1 each in Forida, Georgia, Kansas, North Dakota, Utah and Vermont.

Four states reported products valued at more than \$100,000,000 each. Illinois, the leading state in 1921, produced 20.2 per cent of the total value of products in that year, New York 17.9 per cent, Pennsylvania 13.9 per cent, and Ohio 12.3 per cent.

In January, the month of maximum employment, 187,075 wage earners were reported, and in July, the month of minimum employment, 149,697, the minimum representing 80 per cent of the maximum. The average number employed during 1921 was 161,204 as compared with 212,374 in 1919 and 118,078 in 1914.

The general statistics for 1921, 1919, and 1914 are summarized in the table. The figures for 1921 are preliminary and subject to such change and correction as may be found necessary from a further examination of the original reports.

ELECTRICAL MANUFACTURING DATA—1914-1921

| | 1921 | 1919 | 1914* |
|---|---|---|---|
| Number of establishments | 1,333 | 1,315 | 874 |
| Persons engaged | 201,952 | 271,912 | 144,712 |
| Proprietors and firm members | 580 | 473 | 368 |
| Salaried employees | 40,168 | 59,065 | 26,266 |
| Wage earners (average number) | 161,204 | 212,374 | 118,078 |
| Salaries and wages | \$309,936,000 | \$336,369,000 | \$109,098,000 |
| Salaries | 115,996,000 | 98,180,000 | 35,291,000 |
| Wages | 193,940,000 | 238,189,000 | 73,807,000 |
| Paid for contract work | 925,000 | 1,218,000 | 291,000 |
| Cost of materials | 344,070,000 | 425,098,000 | 154,728,000 |
| Value of products | 833,986,000 | 997,968,000 | 335,170,000 |
| Value added by manufacture† | 489,916,000 | 572,870,000 | 180,442,000 |

*Statistics for establishments with products valued at less than \$5,000 are not included in the figures for 1921; 126 establishments of this class reported 117 wage earners and products aggregating \$351,000 in value. For 1919, however, data for 89 establishments of this class, reporting 80 wage earners and products valued at \$253,000, and for 1914, data for 156 such establishments, with 204 wage earners and products valued at \$440,000, are included in all items with the exception of "number of establishments."

† Value of products less cost of materials.

## U. S. Business Men to Meet British

One thousand business men from this country will join one thousand business men in Great Britain next spring in London, at a conference to promote the development of trade between the two countries, and to try to solve economic problems in which both countries are interested. This was announced recently by F. A. Wilson-Lawrenson, president of the Civitan Club, at a luncheon meeting at the Hotel Astor.

## Credit Situation in Portland and Seattle Reported Easier

Collections in the Portland-Seattle territory when compared with those of one month ago are easier with the exception of contractor-dealer accounts. One failure is reported in the retail trade this week and many dealers are having trouble to meet their obligations. However, jobbers and contractors are prospering, while the dealers are experiencing competition from the department stores and other small general stores in outlying districts. Outstanding accounts throughout the Northwest average forty-five days.

## The Metal Market

### Consumers Continue Extremely Active—Every Week Sees Further Expansions Indicated

Metal consumers continue extremely active, and all metal sellers are highly optimistic for the future. Every week sees further expansions indicated, and it is hard to see why the current year will not be a banner one for practically all non-ferrous metals. Most of the activity is confined to domestic business, but it is felt that a corresponding foreign demand for metals, although likely to be delayed longer than was expected, is nevertheless sure to develop. This foreign demand may finally arrive just in time to take up any slack in domestic business. The copper market at last seems to be permanently on the upgrade; lead is as strong as ever; tin is advancing again, and zinc has again taken a turn for the better.

NEW YORK METAL MARKET PRICES

| | Feb. 13, 1923 Cents per Pound | Feb. 20, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 15.12½ | 15.12½ |
| Lead, Am. S. & R. price | 8.00 | 8.00 |
| Antimony | 7.50 | 7.50 |
| Nickel, ingot | 30.00 | 30.00 |
| Zinc, spot | 7.00 | 7.05 |
| Tin Straits | 39.00 | 40.00 |
| Aluminum, 98 to 99 per cent | 22.00–23.00 | 23.00 |

Copper has shown surprisingly little tendency to linger at the 15-cent delivered level, which was supposed to be rather a stumbling block. Since Friday no copper has been obtainable at that price unless the consumer was extremely favorably situated. Sellers are not anxious to sell further ahead than April without getting a premium, as they feel that the price tendency will continue upward. At the same time, many producers are well sold ahead for the next three months, so the situation is fundamentally sound. Refinery deliveries in January were well over 200,000,000 lb. and are said to have been, with one exception, larger than those of any other month since the war.

The telephone and telegraph and electrical industries generally continue extremely active and are taking extraordinarily large tonnages of copper.

### Copper and Brass Products

Copper, brass and bronze mills quote the following prices on brass and copper products:

Copper wire, 17.25 cents net, mill; brass wire, 19.5 to 21.5 cents; copper sheets, 22.50 cents; copper rods, 21 cents; brass rods, 17.50 to 21.62½ cents; sheet brass, 19.25 to 20.87½ cents.

# The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

HEAVY snows and the colder weather have delayed deliveries in the New England and Western States, with the result that wiring supplies, especially conduit, are noticeably lower than three weeks ago. Some labor demands are causing delays in new construction, which in turn may affect the now healthy demand for all commodities entering into these projects. The rising price of copper has already caused several upward revisions in quotations for wire. The influenza epidemics in large cities are causing an increase in the demand for open-air heaters and heating pads. Other appliances, noticeably flatirons, toasters, cooking appliances and small ranges, are receiving more attention in orders from the dealers. Porcelain, poles and pole-line hardware are selling in better volume in view of the contemplated expansions and repairs to be made by central stations, telephone companies and railways in the next few months. Second-hand-motor dealers are said to be prospering, while much activity is noted among the manufacturers of smaller sizes of motors for spring deliveries to fan makers, who anticipate a very active season. Meters also have taken on increased interest. Much competition prevails among the commercial-fixture manufacturers who are carrying on extensive sales campaigns and who are doing some price cutting. Radio dealers report buying during the past few weeks as decidedly active.

**Boston** Business continues to improve, although it is handicapped severely by railroad conditions and extreme winter weather. Deliveries are giving much trouble all over New England. Central-station outputs continue to grow and appliance sales are healthy. Building and engineering contracts in New England for the week ended Feb. 13 totaled $3,900,300 against $1,882,100 a year ago. Labor shows a tendency to demand concessions unfavorable to business expansion in the building trades, but conditions are not yet acute. Jobbers report great activity in inquiries and stocks are rather spotty. In some sizes galvanized rigid conduit was practically unobtainable here Monday. More interest is being shown in electric vehicles for lighter delivery service. Sales of motor and control equipment for industrial power applications are better than for many months. Some fixture purchases are delayed by cold weather.

**New York** Jobbers and manufacturers' agents report a steady demand for all central-station equipment in view of repairs and extensions which will start when the warmer weather sets in. Increases in copper prices has caused some strengthening in the wiring market, while some stocks are lowered due to poor transportation and shortages of raw materials. Lamps are moving in slower volume than one week ago. Commercial-fixture demand is somewhat slower. Motors in the larger sizes are moving in quick succession from the second-hand dealers' stocks. A steady call for heating appliances and electric warmers is reported following the cold days of last week. Collections are reported to be improving.

**Baltimore** A general slight tendency to increased business in various commodities is reported by the dealers, which, although encouraging, is not taken too optimistically. Most of the houses still remain well stocked, although not overstocked. There are several big electrical installations to be made in this section at the beginning of spring. On the whole, the prospects at the present time are encouraging. The contractors as well as the jobbers are looking for a large spring business in school buildings and residences. The market as a whole is firm.

**Atlanta** Reports indicate very little change in general conditions since last week. Deliveries are slow, but there have been no shortages as a result with the exception of conduit. Prices of conduit and wire continue to climb. All jobbers report business as satisfactory. One of the largest jobbers has placed orders on manufacturer for fan supplies 50 per cent in excess of last year's orders, and, judging from the number of fan contracts signed for future delivery, this will be the biggest season ever seen in fans. Business in storage batteries continues good. This is a reflection of the improved financial condition and mental attitude of customers in this section, many cars that have been in storage now being operated again. The outlook in this line is particularly bright and prices are generally on the increase.

**Pittsburgh** Business generally is good. The confidence of the jobbers is being restored, consequently stock orders for standard material are becoming more prevalent. This air of confidence is also being manifested among the dealers to a great extent. It is estimated that the city of Pittsburgh is behind two and one-half years in its building program, consequently a continued increase in business due to building activities is looked for. In the outlying territories one of the large central stations is putting on an extensive house-wiring campaign which is bringing excellent results. The contracts for wiring are in turn being turned over to various contractor-dealers in the towns in which this particular station operates. This is producing a spirit of harmony and co-operation between the central stations and contractor-dealers.

**Cleveland** Little change has occurred in the market during the past week. Armored cable is in strong demand and so is conduit, with ample stocks and fair deliveries. Commercial fixtures are slower, but firm prices prevail. Although motor sales show no perceptible decrease the demand lessened slightly with firm prices. Storage batteries are active and a few jobbers report desirable orders. Farm-lighting plants are being pushed by advertising, but they are being met with rather indifferent results. Building operations are extensive, despite a recently adopted conservative policy of banks and mortgage brokers, and plans for spring include many large projects. Controversy over a gas franchise and colder weather have promoted the sale of heating appliances to a degree and central-station power sales are in greater volume. Industrial-equipment jobbers are busy. A shortage in radio tubes is reported. Transportation is becoming less difficult. Collections are in better shape.

**St. Paul-Minneapolis** Business is somewhat unsettled. Lighter orders by dealers show uncertainty compared with the confidence of a week ago. Buying for future use on rising market is slowing up. Cold weather and heavy snows are slowing up construction. Retail buying is poor. However, in spite of upset conditions, business is 50 per cent ahead of last year and spring prospects are good. January business is better than February.

**St. Louis** A feeling of optimism pervades all branches of the industry since the passage of the $87,000,000 bond issue for civic improvements. The recent cold snap, followed by melting snow and rain, has caused an unusual amount of sickness, resulting in a large demand for heaters and heating pads at a time of year when the sale of these appliances might normally be expected to decrease. Electrical jobbers report continued good business. The shortage in conduit continues, that in enameled conduit being acute. The market for motors continues active with low stocks. Radio buying continues active. Dealers in electrical refrigerating equipment report sales greater than for the corresponding period last year with bright prospects for the spring. Prices show an upward trend and collections are good.

**Denver** Upward trend on copper prices is showing reaction in house wiring, although several cars of wire recently received have been sold at less than manufacturers' present price because of conditions under which they were purchased. Volume of sales reported from southern part of state

# Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Conduit Boxes, Signal Apparatus and Rectifiers

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Radio | Storage Batteries | Instruments | Farm Lighting Plants |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boston** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Slow | Slow | Slow | Slow | Sdy. | Sdy. | Act | Act. | Act. | Act. | Sdy. | Act. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml. |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **New York** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Sdy. | Sdy. | Sdy. | Act | Sdy. | Sdy. | Act. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Hi. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Baltimore** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Act. | Act. | Slow | Act. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Inc. |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Slow | Slow | Slow | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Low | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy | Act. | Slow | Slow | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Firm | Inc. | Inc. |
| **Twin Cities** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Sdy. | Sdy. | Act. | Slow | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Act. | Sdy. | Act. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Slow | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Slow | Slow | Sdy. | Act. |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Slow | Act. | Slow | Sdy. | Act. | Sdy. | Act. | Slow | Act. | Slow | Sdy. | Slow |
| Supply | Nml. | Low | Low | Low | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Slow | Slow | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow |
| Supply | Hi. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml | Low | Nml | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Inc. | Firm | Inc. | Inc. | Firm | Dec. | Firm | Firm | Firm | Firm | Inc. |

and New Mexico indicates more rapid improvement than in northern sections. Country banks are becoming more liberal with credit, although collections from electrical contractors have not improved in the same degree. New construction has been hampered by a few days of cold weather.

## Salt Lake City

A slight revival of interest in radio is reported with prospects of fair activity in the spring. Indications of big construction activity in railway extension, electrical lines and business blocks look brighter as spring approaches. Contractor-dealers are already finding steady employment with new installations and a fair market for electrical materials.

## Portland-Seattle

One of the heaviest snowstorms in recent years visited the Northwest last week, creating considerable damage to electric lines in the Puget Sound District. Business was slowed up for a couple of days, but the week's volume was not materially changed. Sales continue active and prospects for a good year are most favorable. January jobbing business was about 15 per cent and central-station generation about 20 per cent ahead of a year ago. Although the lumber output is above normal, new business continues to lead production by at least 25 per cent. Copper is stiffening. The rather striking drop in porcelain knobs and tubes reported last week was apparently due to a temporarily competitive condition existing in this locality.

## San Francisco

Retail store business is improving. Building was slackened somewhat during storms early in the month, but present fine weather has brought it back toward the peak. Special attention is being paid to industrial exploitation in all large cities, and the steady though unobtrusive growth of the past ten years is now suddenly expanding very noticeably. Collections are still averaging somewhat over sixty days, but early improvement is expected. Stocks in general are well maintained, and there are few shortages because of the steady and well-assorted demand. Water shipments are increasing.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Westinghouse Plans Large Chicago Warehouse

The Westinghouse Electric & Manufacturing Company is to erect a seven-story manufacturing and warehousing plant, 500 ft. x 240 ft., on West Pershing Road and Leavitt Street, Chicago. This construction work will be the largest in the central district since the erection of the four government warehouses in 1918. Besides the facilities for manufacturing switchboard panels and recharging equipment, this new building will serve as central and local distribution offices and eventually the sales offices for the Western territory. The building will consist of four units. The first, now under construction, will front 240 ft. on Pershing Road and extend back 130 ft. The concrete for the fifth floor is now being poured. Four thousand square feet of the second unit will also be built at the present time, although the entire second unit is not expected to be completed until 1924. This building will contain 960,000 sq.ft.

## Ohio Brass Appointments

The Ohio Brass Company, Mansfield, Ohio, manufacturer of high-voltage porcelain insulators, announces that Thomas Jones, formerly with the Electric Appliance Company, has joined its sales force and will make his headquarters in Dallas, Tex. The company also announces that L. M. Keating, who has been connected with its home sales office for a number of years, has been transferred to outside sales and will have his headquarters in El Paso, Tex.

## Correction of Error in Incandescent Lamp Suit Story

In the Feb. 17 issue of the ELECTRICAL WORLD, page 425, a statement appeared to the effect that the General Electric Company had been granted a preliminary injunction against P. R. Mallory & Company, Inc., Port Chester, N. Y., manufacturers of tungsten wire, and the Save Electric Corporation, Brooklyn, N. Y., manufacturer of incandescent lamps, which would have the effect of "preventing defendants from continuing the manufacture and sale of their products pending the final outcome of the litigation." It is found that this information was erroneous.

The facts are that the injunction under the Just and Hanaman patent was suspended ninety days as to both companies pending trial of the case, and that the injunction under the Langmuir patent was suspended as to the Save Electric Corporation pending the trial of the case in so far as relates to certain contracts with the city of Chicago and the state and city of New York.

As to P. R. Mallory & Company, Inc., furthermore, the proceedings have no effect upon any of its foreign sales or any of its business in contacts and other products. P. R. Mallory is restrained only from selling alleged tungsten wire for use in this country in the manufacture of the so-called "gas-filled incandescent electric lamps," which would constitute an infringement of claims 4, 5, 12 and 13 of the Langmuir patent.

## Detweiler and Bell Incorporate as Manufacturers' Agents

Paul G. Detweiler and Stewart S. Bell have filed papers of incorporation in Connecticut as the Detweiler-Bell Company, manufacturers' agents, and will begin business March 1 in the Liberty Building, New Haven, Conn. This company will sell its products through jobbers.

Stewart Bell operated one of the first central stations in Massachusetts. He has been connected with the Westinghouse Electric & Manufacturing Company at Boston, with Stuart-Howland Company, Boston, and lately in Boston for the Moloney Electric Company. Paul G. Detweiler was district manager for the Franklin Electric Manufacturing Company at Hartford, Conn., and manager of lamp sales and illuminating engineering for the firm of Hessel & Hoppen Company, New Haven, Conn.

# To Co-operate in Building Locomotives

Announcement has been made that the General Electric Company and the American Locomotive Company have effected an arrangement to co-ordinate their effort in the design and manufacture of electric locomotives for use on steam and electric railways.

The co-operation of the engineering and manufacturing facilities of these companies will doubtless result in improvements in design and construction and economies in manufacture and render improved service to railway companies. This arrangement between the two companies has been brought about in a large measure by the increased interest and business in railway electrification in the United States and abroad, particularly within the last year, and in anticipation of a large volume of work in the immediate future. A recent survey of the locomotive department of the Erie Works of the General Electric Company indicates that at present there are a larger number of orders from different customers than has been the case at any time since the beginning of the World War. Foreign business appears even more active than domestic. Spain, France, Chile, Japan, Mexico and South Africa are engaged in extensive projects, while other countries, including Italy and Great Britain, are seriously considering large-scale electrifications.

For a number of years the American Locomotive Company and the General Electric Company have collaborated in the development of electric locomotives. The Locomotive company has applied its knowledge and experience in the locomotive building art particularly to the design of the mechanical elements in the fabrication of which its manufacturing facilities were utilized, while the knowledge and experience of the General Electric Company were applied to the design of the electrical elements.

It is the satisfactory results of this collaboration which has led to the more formal relationship just announced, both companies believing that progress in the art can be most effectively assured by such means. The arrangement relates only to co-operation in design, development and manufacture and does not comprehend any financial relationships between the two companies.

## Edward Miller Company Bought by Rex Cole and Associates

The well-known fixture firm of Edward Miller & Company, Meriden, Conn., has been purchased by Rex J. Cole and associates, and with it will be merged the Duplexalite Corporation and the Duplex Lighting Works of the General Electric Company, which will thus be discontinued as separate companies, the combined business being operated under the name of Edward Miller & Company of Meriden, Conn., with Rex J. Cole as president and Max Schwarz as vice-president and general manager.

Edward Miller, Jr., will continue as chairman of the board, and other officers are: Vice-presidents, Guy P. Norton and I. B. Miller; treasurer, Samuel McNabb; secretary, Hewitt Warburton; assistant secretary, L. A. Frost.

The Edward Miller company was founded in 1844, and in the early days manufactured oil lamps, later adding gas-lighting products, and finally entering the electrical field, where it has become one of the large manufacturers of portable lamps and lighting fixtures.

The Duplexalite offices in New York City will be discontinued and headquarters moved to Meriden. Meanwhile the Edward Miller offices on Park Place, New York, will be enlarged, and other branch offices will be maintained in Chicago, Cleveland and San Francisco.

## Foreign Trade Notes

ELECTRICITY FOR EAST FLANDERS, BELGIUM.—Plans are being prepared by the commission recently appointed by the Provincial Council of East Flanders whereby the devastated districts will be supplied with electricity by next winter. Power will be supplied by the province and distributed by the communes to the consumers. Communes not located in the devasted regions will also be served.

PROPOSED ELECTRIC SYSTEM IN FRANCE.—Application for a concession to supply electricity for light and power in twenty-one communes in the Syndicat Intercommunal de Méligny-le-Grand, Department of the Meuse, has been made by the Compagnie Lorraine d'Electricité, Nancy. The Société Co-operative Agricole d'Electricité de la Region d'Hattencourt has petitioned for a concession to furnish electricity in twenty-three rural communes in the Hattencourt district, Somme Department. Application has also been made by another co-operative agricultural association for authority to supply electricity to thirty-two communes in the district of Montigny-sur-Halluce, in the same department. Steps which have been taken to develop the water power of the River Tinée in the Canton of Nice having proved successful, the Tinée Hydraulic Commission has reported favorably on the projects to develop the water power of the Saint-Etienne Laos, Bancairon and Corbaisse Falls. The work will be done by the Société de l'Energie Electrique du Littoral Mediterranéen. The scheme proposed by Lucien Neu and Louis Schowb, consulting engineers, Enghien, to develop 2,500 kw. on the River Doube for the city of Aesançon, to cost about 5,000,000 francs, has been adopted.

APPLICATION FOR CONCESSION TO SUPPLY ELECTRICITY IN THE YONNE AND NIEVRE DISTRICTS, FRANCE.—Application has been made by the Société d'Etudes des Chutes de la Cure et des Chemins de Fer Electriques de l'Yonne (Cure Falls and Yonne railway schemes) for a concession for the distribution of electricity for public service in the Yonne and Nièvre Departments. The concession includes the four departments of the Yonne, Nièvre, Côte-d'Or and Haute Marne. A power plant of 6,000 kw. capacity has already been built at Langres, and the concession includes the connection of this station with those of the Cure by a 60,000-volt transmission line. The cost of the project is estimated at 23,300,000 francs. Under the terms of the concession a minimum of 35 km. of railway line must be constructed within five years and 150 km. within ten years. As a result of these plans applications for state concessions have already been placed for a 20,000-volt transmission line from Sens to Auxerre by two companies, and for another extending from Langres to Chatillon-sur-Seine, Montbard, Cure and Auxerre. It has been decided to adopt the three-phase system.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in France (No. 5,422) of electric automobile trucks.

Agency and purchase is desired in Italy (No. 5,481) for electric recording pyrometers, elapsed-time recorders, electric time switches, electric impulse clocks, water-level recorders and electric signal systems.

An agency is desired in Norway (No. 5,490) for cables and wires for power plants and electrical intallations.

WATER-TUBE BOILERS FOR POWER PLANT, SYDNEY, AUSTRALIA.—Tenders will be received until May 23 by the Railway Commissioners for eight water-tube boilers with accessories for the White Bay power house, Sydney, for the New South Wales government railways and tramways (Specification 575).

TELEPHONE EQUIPMENT FOR AUSTRALIA.—Tenders will be received by the Postmaster-General's Department, Melbourne, Australia, until April 10 for 686 tons of bronze wire and 500,000 paper jointing sleeves; also until April 17 for 595 timing clocks for trunk calls and 400,000 copper jointing sleeves. Tenders will be received by the Postmaster-General's Department, Adelaide, Australia, until April 18 for telephone apparatus.

ELECTRIC EQUIPMENT FOR PUMPING PLANT FOR BRISBANE, AUSTRALIA.—Tenders will be received by the Metropolitan Water and Sewerage Board, Brisbane, Australia, until June 26 for equipment for pumping plant, including a 140-kw., 440-volt direct-current electric generating unit.

TELEPHONE AND TELEGRAPH MATERIAL FOR TASMANIA. — Tenders will be received by the Postmaster-General's Department, Hobart, Tasmania, until April 9 for telegraph and telephone materials, including magneto bells, timing clocks, detectors, mouthpieces, lamps, etc.

PROPOSED EXTENSIONS TO THE MUNICIPAL ELECTRIC PLANT AT SHANGHAI, CHINA. — Plans are under consideration, according to *Commerce Reports*, to increase the output of the municipal electric plant at Shanghai, China, to 180,000 hp. The present capacity of the plant is said to be about 105,000 hp.

## New Apparatus and Publications

ELECTRIC REFRIGERATOR. — A new household electric refrigerator outfit has been placed on the market by the Motorfrigerator Company, Lansdale, Pa.

HOUSEHOLD CABINET REFRIGERATOR.—The Universe Corporation, 341 East Ohio Street, Chicago, has placed on the market a new electric refrigerator, known as "Polaris."

PLURAL PLUG.—The Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, has brought out a new edition of the No. 92 original two-way plug, known as the "One-to-two" plug.

AUTOMATIC TIME SWITCH.—An automatic time switch for henneries, known as the "Cackle" time switch, is being distributed by A. Hallberg, 73 Murray Street, New York City.

ELECTRIC FAN.—A new electric fan for household use has been placed on the market by the Kendrick & Davis Company, Lebanon, N. H.

ELECTRIC APPLE-PARING MACHINE. —An electric motor-driven apple paring and coring machine for hotels and restaurant kitchens has been placed on the market by the Goodell Company, Antrim, N. H.

ELECTRIC WAXER SCRUBBER AND POLISHER. — A new machine has been developed by the Kent Company, Inc., Rome, N. Y., for sandpapering, scrubbing, waxing and polishing floors by electricity.

TIME SWITCH WITH CLOCK. — The Tork Company, 8 West Fortieth Street, New York City, has placed on the market a new time switch with clock, known as the "Tork Clock."

ELECTRIC WASHING MACHINE. — A new wringerless washing machine has been placed on the market by the Savage Arms Corporation, Utica, N. Y.

ELECTRIC HEATING PAD.—An electric heating pad, known as "Blue Bird," has been developed by the Charles Electric Garments Company, 1614 West Washington Street, Los Angeles, Cal.

FRACTIONAL-HORSEPOWER MOTORS. —A new line of fractional-horsepower motors of the split-phase type has recently been developed by the Robbins & Myers Company, Springfield, Ohio.

ELECTRIC REFRIGERATING MACHINE.—The Coldak Company, Springfield, Mass., is distributing a booklet in which it describes the new "Coldak" household electric refrigerating machine. This machine can be applied to any existing ice box.

## New Incorporations

THE LINDALE (TEX.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $5,000 by R. F. Tarbrough, W. R. Eason and others.

THE APPOMATTOX (VA.) LIGHT & POWER COMPANY has been chartered with a capital stock of $25,000. The officers are C. A. Hancock, president, and C. W. Smith, secretary.

THE CONSOLIDATED POWER & LIGHT COMPANY, Huntington, W. Va., has been incorporated by C. L. S. Tingley, Walter W. Perkins and Henry P. Megaree, Philadelphia; W. R. Power and T. M. Hays, Huntington. The company is capitalized at $5,000,000 and proposes to take over the holdings of Consolidated Light, Heat & Power Company.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

MILO, ME. — Arrangements have been made whereby the transmission lines of the Milo Electric Light & Power Company and the Central Maine Power Company, Augusta, will be permanently connected for the purpose of an interchange of power.

PORTLAND, ME. — The Cumberland County Power & Light Company is reported to be considering doubling the capacity of its new steam-power plant at Knightville.

BOSTON, MASS.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 6, for 15,000 ft. of flexible conductor lighting and power wire, for the local navy yard (Schedule 523).

CAMBRIDGE, MASS.—Power equipment will be installed by the National Biscuit Company, Tenth Avenue, New York, in connection with its proposed local baking plant, to cost about $250,000.

NEW BEDFORD, MASS.—The installation of ornamental lamps on Borden, Anthony and Grove Streets is under consideration by the committee on street lights. The cost is estimated at $2,448.

WORCESTER, MASS.—A power plant will be built in connection with an addition to the Worcester Hahnemann Hospital, 261 Lincoln Street, to cost about $300,000. Kendall, Taylor & Company, 142 Berkley Street, Boston, are architects.

BRIDGEPORT, CONN.—The City Council is considering the installation of an ornamental lighting system on Broad Street and Stratford Avenue.

MERIDEN, CONN.—The local car barns and shops of the Connecticut Company were recently destroyed by fire, causing a loss of about $150,000.

NEW BRITAIN, CONN. — The question of improving the street-lighting system, especially in the outlying sections of the city, is under consideration by the Board of Public Works.

ROCKVILLE, CONN.—The Public Utilities Commission has instructed the Rockville-Willimantic Lighting Company to extend its electric lighting service through the villages of Forestville, West Stafford and Orcutts, the work to be completed by June 15.

TORRINGTON, CONN.—A petition has been presented to the Borough Council by the merchants and property owners for the installation of an ornamental lighting system in the business section of East Main, Water and South Main Streets.

WATERBURY, CONN. — Arrangements are being made by the Connecticut Light & Power Company for the erection of about 75 miles of high-tension transmission line for the distribution of electricity generated at its new plant, which is being constructed at Devon on the Housatonic River.

## Middle Atlantic States

ALBANY, N. Y.—Electric power equipment will be installed in the addition to the plant of the Simmons Machine Company, 985 Broadway, to cost about $250,000.

BUFFALO, N. Y.—A luminous magnetite street-lighting system will be installed on Fillmore Avenue from Seneca to Best Street.

BUFFALO, N. Y.—The City Council has appropriated $10,000 for the installation of overhead electric traffic controls for use in regulating the traffic on Main Street.

ITHACA, N. Y.—The Associated Gas & Electric Company, operating the Ithaca Gas & Electric Company and other utility properties, contemplates increasing its capital from 150,000 shares to 210,000 shares, no par value, the proceeds to be used for extensions and improvements.

NEW YORK, N. Y.—The National Biscuit Company, Tenth Avenue and Fifteenth Street, plans to build a power house to cost about $150,000.

NEW YORK, N. Y.—Bids will be received by the Superintendent of Light Houses, Staten Island, until Feb. 26, for six switchboards (Proposal 14,220).

NIAGARA FALLS, N. Y.—G. A. Strain, receiver for the Niagara Falls Gas & Electric Company, is planning extensions and improvements.

POTSDAM, N. Y.—A power plant will be built in connection with the proposed paper mill to be built by a company now being organized by Hollis W. Martin, Norwood, N. Y. It will cost about $110,000. T. L. Tomlines, City Bank Building, Syracuse, is engineer.

WATERTOWN, N. Y.—The proposal to issue $365,000 in bonds to develop the water power at Delano Falls for municipal purposes will be submitted to the voters on Feb. 24.

DELAWARE, N. J.—The Metropolitan-Edison Company is preparing plans for a hydro-electric power plant, to cost about $750,000.

SUMMIT, N. J.—Bids will be received by the Board of Education until March 5 for electric work and equipment in the proposed addition to the Washington School, North Summit. P. W. Lyall is secretary of the board.

DRUMS, PA.—The Pennsylvania Power & Light Company will build a transmission line from Kis-Lyn to Drums, also from White Haven to Mountain Top.

KITTANNING, PA. — Plans are being drawn for a power house at the local Community Hospital, in connection with a new hospital building to cost $250,000. Crow, Lewis & Wick, 200 Fifth Avenue, New York, are architects.

NEW CASTLE, PA.—The Carnegie Steel Company, Pittsburgh, will build an addition to its local power house, including improvements in the present plant, to cost about $200,000.

OIL CITY, PA. — The Penn-American Refining Company will build a power plant at its local works, to cost $95,000. The Rust Engineering Company, 311 Ross Street, Pittsburgh, is engineer.

SHAMOKIN, PA. — The Pennsylvania Power & Light Company contemplates extending its service to Gowen City in the spring.

ZELIENOPLE, PA.—Electrically operated pumping machinery and other motor-driven equipment will be installed in connection with the proposed water filtration plant, to cost about $150,000. Hudson & Myron, Wabash Building, Pittsburgh, are engineers.

HUNTINGTON, W. VA.—The Consolidated Power & Light Company, recently organized to take over property of the Consolidated Light, Heat & Power Company, plans extensions to the system.

WASHINGTON, D. C.—Bids will be received by the Supervising Architect, Treasury Department, until March 2 for the furnishing and installing electric lighting fixtures in the post offices at Apalachicola, Fla.; Charleston, W. Va.; Eureka, Utah; Front Royal, Va.; Vinton, Iowa, and the United States post office and court house at Buffalo, N. Y.

## North Central States

BAY CITY, MICH.—Bids will be received by the Water Commissioners until March 5 for electric and power wiring, heating and ventilating, etc., for the waterworks plant, to cost about $150,000. Frazier, Sheal & Ellms, B. F. Keith Building, Cleveland, are engineers.

DETROIT, MICH. — The Detroit-Edison Company contemplates the erection of a new steel-tower transmission line.

LIMA, OHIO. — The Lima Locomotive Works contemplates rebuilding the portion of its power plant, recently destroyed by fire, with a loss of about $30,000.

MARIETTA, OHIO.—Work has started on the installation of a new turbo-generator and boilers in the Riverside plant of the Monongahela Power & Traction Company.

CHAMPAIGN, ILL.—Improvements are contemplated by the Urbana & Champaign Railway, Gas & Electric Company during 1923, to cost about $40,000.

BIRON, WIS.—Failing to make satisfactory arrangements with the city authorities of Stevens Point, the Consolidated Water Power & Paper Company has decided to locate in Biron. It will erect a two-story building, oxer 400 ft. long, to house its plant. Plenty of power is available here, but electrical equipment will be necessary to connect the hydro-electric units with the new equipment.

COON VALLEY, WIS.—The Coon Valley Electric Company plans to rebuild its entire lighting system, including changing the service from direct to alternating current. New equipment, including switchboard, motors, transformers and generator, will be required.

DOUSMAN, WIS.—The plant and holdings of the Dousman Electric Light & Power Company have been purchased by the Milwaukee Electric Railway & Light Company. Extensions and improvements, it is understood, will be made to the local system by the purchasing company.

EAU CLAIRE, WIS. — The Wisconsin-Minnesota Light & Power Company contemplates the purchase of heavy copper wire (to cost about $45,000) to be used on its high-tension transmission line between the hydro-electric plant at Wissota and Stillwater, Minn. It is proposed to increase the wires on the towers from four to seven.

EVANSVILLE, WIS.—The Council has decided to install an ornamental lighting system, consisting of thirty-six standards, during the coming year.

MILWAUKEE, WIS. — Preparations are being made by the Milwaukee Electric Railway & Light Company for the erection of a high-tension transmission line between Vernon and Big Bend.

MILWAUKEE, WIS.—Backes & Pfaller, 217 West Water Street, architects and engineers, have been engaged to prepare plans for a five-story hospital addition, a boiler house and power plant and other buildings, for the Misericordia Hospital, 2224 Chestnut Street. New equipment, including boilers, engine, generators, ice machinery, etc., will be required. The cost is estimated at $165,000.

ONTARIO, WIS.—Negotiations are under way between the Ontario Electric Light & Milling Company and the City Council for extension to the street-lighting system.

WAUSAU, WIS.—The committee on lighting has recommended to the City Council the installation of street lamps at numerous intersections in the city.

LITTLE FALLS, MINN. — The Little Falls Water Power Company contemplates the erection of a transmission line from Lastrup to Onamia, Wahkon and Isle.

MINNEAPOLIS, MINN.—The South Minnesota Gas & Electric Company has issued $1,750,000 in bonds, part of the proceeds to be used for extensions and improvements.

RED WING, MINN.—Bids, it is reported, will soon be asked for the installation of a municipal electric power plant, to cost about $350,000.

MUSCATINE, IOWA — Bids, it is reported, will be called in March for the construction of a municipal electric power plant. Arthur L. Mullergren, Firestone Building, Kansas City, Mo., is engineer.

SIOUX CITY, IOWA.—The Sioux City Gas & Electric Company is planning to place all wires in the downtown business section of the city underground. Arrangements are also being made by the company to supply electricity in about seventy-five towns in northwestern Iowa. The erection of the transmission lines to furnish the service is already under way.

PLEASANT HILL, MO.—The West Missouri Power Company contemplates extensions and improvements to its system, including the installation of new equipment. The company recently increased its capital from $750,000 to $1,400,000.

ST. JOSEPH, MO. — Electric power equipment will be installed at the proposed woodworking plant of the Collier-Adams Manufacturing Company, Fourth Street and Mitchell Avenue, to cost about $100,000.

ST. LOUIS, MO.—Bonds to the amount of $8,000,000 has been voted for the installation of a street-lighting system in all parts of the city; also $1,000,000 for a municipal electric power plant and mechanical building for civic service. W. Frank Carter is chairman of the committee on civic needs.

ST. LOUIS, MO.—Contracts will soon be awarded for prism lamps and concrete standards on Watson Road and Clara Avenue, to cost about $35,000. R. Toensfeldt is city engineer.

FREDONIA, KAN.—An election will be held on Feb. 27 to vote on the proposal to issue $150,000 in bonds to establish a municipal electric light and power plant. C. R. Schiek is engineer.

KANORADO, KAN. — Bonds to the amount of $25,000 have been voted for the installation of a local electric distributing system and a transmission line. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

LEAVENWORTH, KAN.—Elecric power equipment will be installed at the local plant of the Bonner Portland Cement Company, Kansas City, Mo., in connection with extensions and improvements, to cost, about $1,500,000.

LEAVENWORTH, KAN.—A power house to cost about $35,000 will be erected at the new public school on Third Avenue, to cost about $110,000. The Board of Education is in charge.

WASHINGTON, KAN.—The installation of an ornamental lighting system in the business district is under consideration.

WICHITA, KAN.—The Derby Refining Company will install electric power equipment in connection with additions to its local oil refinery, to cost about $300,000.

## Southern States

CLINTON, N. C.—The Tidewater Power Company, Wilmington, will build a transmission system to Clinton, by way of Warsaw, about 68 miles, to cost about $130,000.

MOUNT AIRY, N. C. — Electric power equipment will be installed in the proposed ice-manufacturing and refrigerating plant to be erected by the Carolina-Virginia Growers' Association. J. B. Sparger is president.

MURPHY, N. C. — The North Carolina Iron & Mining Company, Andrews, will install electric power and mechanical equipment for a new washing and crushing plant at its properties.

ROUGEMONT, N. C.—W. A. Carver is making inquiries for a generator, 75 hp. to 100 hp.

GREAT FALLS, S. C. — The Republic Cotton Mills, Inc., will build a power house, 42 ft. x 47 ft., in connection with a new mill, to cost about $150,000. J. E. Sirrine & Company, Greenville, are engineers.

MOLINO, FLA. — The Jacobi Lumber Company contemplates rebuilding its lumber works, including planing mill and power house, recently destroyed by fire, causing a loss of about $200,000.

BRISTOL, TENN.—A bill has been presented to the State Legislature by Senator D. A. Barger authorizing the city of Bristol to issue $500,000 in bonds for the purpose of establishing a municipal electric light plant.

KNOXVILLE, TENN. — The Cherokee Spinning Company will install a substation at its proposed mill to cost about $400,000.

NASHVILLE, TENN. — The Hermitage Portland Cement Company, Chattanooga, will build a power house at its proposed local plant, to cost about $500,000.

PARIS, TENN.—Extensions and improvements to the municipal electric light and water plant, to cost about $100,000, are under consideration. W. J. Holman is manager.

ATHENS, ALA.—Electric power equipment will be installed in the ice-manufacturing and refrigerating plant to be built by the Athens Ice & Coal Company, for which plans have been prepared.

COLLINSVILLE, ALA. — The Collinsville Light & Power Company contemplates extensions to its plant, including the installation of new equipment.

SAMSON, ALA.—The municipal electric light and water plant has been purchased by the Pea River Power Company, Troy. The new owners will take over the property at once and will erect a transmission line from Elba to supply electricity to operate the local system.

OXFORD, MISS.—Bids will be received by the Board of Aldermen and Mayor until March 15 for an engine, generator and switchboard equipment for the municipal electric and water plant. Proposals will be received for either oil-engine or steam-engine equipment. T. M. Early is superintendent of water and light plant.

BEAUMONT, TEX.—The Beaumont Sash & Door Company will install electric power equipment in connection with its proposed local plant, to cost about $65,000.

CORPUS CHRISTI, TEX.—Plans are under consideration for the installation of a municipal underground conduit system.

DALLAS, TEX.—Bids will be asked at once for the installation of an ornamental lighting system on Jefferson Street, Oak Cliff section.

## Pacific and Mountain States

EPHRATA, WASH. — The Washington Water Power Company contemplates the election of a transmission line to Quincy, about 18 miles.

OLYMPIA, WASH. — A franchise has been granted to Charles G. Hawson, Olympia, for the erection of a transmission line in the Pleasant Glade district for commercial light and power service.

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 13, for 7,300 ft. of telephone cable for use at the local navy yard (Schedule 521); bids will also be received for 3,600 ft. of fiber conduit and 2,200 ft. wood conduit (Schedule 522).

SEATTLE, WASH.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 14, for one electric traveling crane for use at the local navy yard (Specification 4755).

WENATCHEE, WASH.—The Wenatchee Placer Gold Mining Company contemplates the installation of a power plant at its properties.

ASTORIA, ORE.—The Union Oil Company, San Francisco, Cal., will build a power house in connection with its proposed local oil plant, to cost about $500,000.

LOS ANGELES, CAL.—Ordinances have been approved providing for the installation of street-lighting systems on Pacific Avenue, Seventh and Fourteenth Streets, San Pedro district.

LOS ANGELES, CAL.—The installation of an ornamental lighting system on Arden Boulevard and on El Centro Avenue is under consideration.

LOS ANGELES, CAL.—A power house will be erected by the Mexican Petroleum Company, 120 Broadway, New York, in connection with its proposed refining plant in the San Pedro section, to cost about $6,000,000.

LOS ANGELES, CAL.—Ordinances have been approved for the installation of ornamental lighting systems on Canal Avenue, from Anaheim to D Street, and on Washington Street, from Hobart Boulevard to Eighth Avenue.

PITTSBURG, CAL. — Electric power equipment will be installed in the proposed addition to be erected by the Columbia Steel Corporation, consisting of five buildings, to cost about $200,000.

SAN DIEGO, CAL.—Plans for the proposed cotton mill to be erected in San Diego by the California-Pacific Textiles, Inc., to cost about $600,000, include a power plant. W. A. Golden is president.

VENICE, CAL.—The Council is considering the installation of an electrical distributing system, to cost about $100,000.

ASPEN, COL.—The Belle Marie Mining & Milling Company is planning to build a new plant in the spring, including mining and mill buildings, and power house, to cost about $275,000. A. J. Petelinz, 426 Grand Avenue, Milwaukee, is architect.

CANON CITY, COL.—Improvements will be made to the boiler room of the local plant of the Southern Colorado Power Company, to cost about $20,000.

DENVER, COL.—Bids will be received at the office of the United States Reclamation Service, Denver, until March 13, for one 1,000 kva., vertical alternating-current generator, complete with exciter; four 333 kva., single-phase, self-cooled transformers; three 10 kva. single-phase, self-cooled transformers; switching apparatus, etc.

ROSWELL, N. M.—The City Council is considering the purchase of the plant of the Roswell Public Service Company, to be owned and operated by the municipality.

## Canada

VANCOUVER, B. C.—The British Columbia Electric Company has purchased a site for an addition to power plant of its subsidiary, to cost about $90,000.

PETERBORO, ONT. — The Hydro-Electric Power Commission of Ontario is preparing plans for the development of the water powers of dams Nos. 8 and 9 on the Trent River, which will be used to augment the power supply of Peterboro.

STOUFFVILLE, ONT.—A committee has been appointed to negotiate with the Hydro-Electric Power Commission of Ontario with a view of securing hydro-electric service for this village. A transmission line (11 miles long) to connect with the Yonge Street line would have to be erected.

TIMMINS, ONT.—An agreement has been reached between the Ontario government and the Hollinger Mining Corporation whereby the latter will begin work on the construction of a hydro-electric development at Island Falls. The plans provide for a development of 16,000 hp. at a cost of about $3,000,000.

QUEBEC, QUE.—An additional power development of 7,500 hp. is reported to be under consideration by Price Brothers & Company, Ltd.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued Feb. 6, 1923)

1,444,425. ELECTRIC REGULATOR FOR INTERNAL-COMBUSTION ENGINES; H. Ogden, Westcliff-on-Sea, England. App. filed May 22, 1922. Control of engine driving welding generator prevents excessive sudden loads.

1,444,434. INSULATOR SUPPORTING PIN; L. Steinberger, Brooklyn, N. Y. App. filed Nov. 6, 1918. Cross-arm pin having coiled spring for screwing into insulator.

1,444,438. ELECTRODE STRUCTURE; W. C. White, Schenectady, N. Y. App. filed Aug. 7, 1918. Construction of grids for electron discharge relays or amplifiers of pliotron type.

1,444,454. LAMP SOCKET; W. L. Brooks, Schenectady, N. Y. App. filed Oct. 27, 1920. When lamp is withdrawn circuit is automatically closed through socket.

1,444,458. DYNAMO-ELECTRIC MACHINE; V. H. Greisser, Spokane, Wash. App. filed Oct. 21, 1921. Method of ventilation.

1,444,494. SILENCER FOR TELEPHONES; S. T. Cohane, Hartford, Conn. App. filed Feb. 15, 1922. Attachment for transmitter to cut out extraneous sounds.

1,444,495. ELECTRIC MOTOR; C. Z. Coleman, San Francisco, Cal. App. filed Oct. 28, 1921. Laminated core rotor.

1,444,524. MAGNETIZING DEVICE; E. S. Pridham and P. L. Jensen, Oakland, Cal. App. filed April 28, 1920. Device for making permanent magnets without breaking magnetic circuit.

1,444,555. TELEGRAPH RELAY; C. J. Rogers, Morris, Okla. App. filed Feb. 7, 1920. Differentially wound transmitting coils for use on "leaky" lines.

1,444,561. ELECTRIC BATTERY HEATER; J. E. Schraeder, Crookston, Minn. App. filed Jan. 12, 1922. Device for heating storage batteries before dismantling them for repairs.

1,444,584. ELECTRIC FURNACE HAVING RESISTOR DOME; G. H. Clamer, Atlantic City, and J. R. Wyatt, Camden, N. J. App. filed Nov. 20, 1920. Utilizes both reflected and radiated heat from upper furnace walls.

1,444,605. CARRIER-WAVE SIGNALING SYSTEM; R. A. Heising, Millburn, N. J. App. filed Jan. 21, 1919. Method of signaling through successively modulated currents.

1,444,620. AIR-MOTOR-DRIVEN GENERATOR; E. Lunn, Chicago, Ill. App. filed Sept. 12, 1921. Wind-driven generator for charging airplane batteries.

1,444,621. ELECTRIC HEATER; L. F. Lynn and J. D. Lewis, Tacoma, Wash. App. filed Feb. 16, 1922. Air preheated by passing through shell surrounding element before coming into contact with element.

1,444,685. SIGNALING SYSTEM AND RELAY THEREFOR; R. M. Hopkins, Rutherford, N. J. App. filed July 5, 1919. Burglar-alarm system for vaults.

1,444,716. TROLLEY WHEEL; A. C. Van Hooydonk, Monroe, Mich. App. filed May 12, 1922. Two wheels mounted on movable hub.

1,444,742. SIGNAL; F. Guenther, San Mateo, Cal. App. filed Jan. 18, 1921. Alarm to indicate to automobile driver that doors are not properly closed.

(Issued Feb. 13, 1923)

15,538 (reissue). CONTROL DEVICE FOR WIRELESS SIGNALING; E. H. Colpitts, East Orange, N. J. App. for reissue filed Feb. 14, 1918. Current flows in amplifier tubes only during time signal impulses are sent.

15,539 (reissue). TELEGRAPHY; T. B. Dixon; New York, N. Y. App. for reissue filed May 3, 1922. Amplifying telegraphic signals transmitted through cables.

15,540 (reissue). MEANS FOR TRANSFORMING MECHANICAL VIBRATIONS INTO ELECTRICAL VIBRATIONS; L. de Forest, New York, N. Y. App. for reissue filed July 13, 1921. By thermionic tubes.

1,444,777. IMPULSE TRANSMITTER FOR AUTOMATIC TELEPHONE SYSTEMS; J. G. Blessing, Chicago, Ill. App. filed Jan. 26, 1920. Subscriber compelled to remove his finger before dial returns to normal position.

1,444,781. TELEPHONE EXCHANGE SYSTEM; G. Deakin, London, England. App. filed May 26, 1919. Call metering device for automatic telephone system.

1,444,787. ELECTROLYTIC APPARATUS; W. E. Greenwalt, Denver, Col. App. filed June 11, 1920. For the production of hydrogen sulphide and sponge lead.

1,444,804. PUSH-BUTTON SWITCH; F. Sauczuk, Brooklyn, N. Y. App. filed Dec. 8, 1919. For apartment-house announcers.

1,444,805. VOICE-CURRENT TELEPHONE REPEATER; A. B. Smith, Evanston, Ill. App. filed March 5, 1919. Method of switching voice-current amplifier from trunk line to repeat in one direction to connections which adapt it in opposite direction.

1,444,827. CONTROLLING SYSTEM FOR MINE-BLASTING OPERATIONS; S. F. Bridwell and J. F. Kennedy, Terre Haute, Ind. App. filed May 25, 1921. For selectively firing blasts within mine by electricity.

1,444,830. TRANSMISSION CONTROLLING APPARATUS; C. S. Demarest, Brooklyn, N. Y. App. filed Aug. 9, 1919. For controlling operation of four-wire repeater circuits.

1,444,858. SWITCH BOX; G. B. Wadsworth, Covington, Ky. App. filed Oct. 11, 1917. Safety box in which switch must be turned before exposing fuses.

1,444,886. SPEED INDICATOR FOR AËROPLANES; E. W. Rounds, Washington, D. C. App. filed July 30, 1921. Chronograph for recording the ground speed of aëroplane while taking off or landing.

1,444,887. METHOD OF PRODUCING PURE IRON BY ELECTROLYSIS; A. Schwiete, Frankfort-on-Main, Germany. App. filed May 31, 1922. Electric current acts on slightly acidulated solution of ferrous chloride.

1,444,939. ELECTRIC FURNACE; T. A. Reid, Pittsburgh, Pa. App. filed April 25, 1921. Support of resistances in furnaces.

1,444,940. RESISTOR-SUPPORTING MEANS; T. A. Reid, Pittsburgh, Pa. App. filed June 3, 1921. For electric furnace.

1,444,947. CONTROL APPARATUS; A. H. Candee, Pittsburgh, Pa. App. filed Oct. 30, 1918. Emergency braking equipment for electric railway vehicles.

1,444,948. ELECTRIC FURNACE; C. H. Carpenter, Wilkinsburg, Pa. App. filed April 23, 1920. Container for the material acts as resistor.

1,444,958. ELECTRIC HEATER; F. W. De Luchi, Oakland, Cal. App. filed Feb. 13, 1922. Electric room heater.

1,444,961. ARC-LAMP ELECTRODE; H. B. Eynon, Lakewood, Ohio. App. filed June 11, 1919. Negative projector electrode composed of three forms of carbon.

1,444,962. ARC-LAMP ELECTRODE; H. B. Eynon, Lakewood, Ohio. App. filed June 11, 1919. Negative projector electrode consisting of carbon shell, graphite core and intermediate filling of powdered graphite.

1,444,980. ELECTRIC FURNACE; W. E. Moore, Beaver; H. F. Alter and E. A. Hanff, Pittsburgh; J. R. Eckley, New Kensington, Pa., and F. Wright, Newport, Ky. App. filed Sept. 5, 1919. Electric arc furnace of rocking type.

1,444,983. TROLLEY BASE; W. Schaake, Pittsburgh, Pa. App. filed Oct. 9, 1920. Construction of trolley-pole base.

1,445,019. ELECTRIC WATER HEATER; J. Joeschke, Berlin, Germany. App. filed May 5, 1922. Connected directly to water faucet.

1,445,025. STORAGE-BATTERY SYSTEM; S. E. McFarland, Los Angeles, Cal. App. filed Nov. 5, 1919. Any portion of battery can be used while charging.

1,445,072. TERMINAL BOX; W. L. Cook, Chicago, Ill. App. filed Nov. 20, 1919. Telephone board for use with underground cables.

1,445,089. TROLLEY GUARD AND FINDER; P. J. Kelley, Detroit, Mich. App. filed Oct. 23, 1922. Enables quick raising of pole into contact with wire.

1,445,120. MULTIPLE INCANDESCENT ELECTRIC LAMP; N. Wise, New York, N. Y. App. filed Feb. 7, 1919. When one filament is burned out second is used.

1,445,141. SIGNALING SYSTEM; B. W. Kendall, New York, N. Y. App. filed Dec. 18, 1916. Multiplex telephony by means of modulated carrier currents.

1,445,149. FLOOR-LEVEL STOP FOR ELECTRICALLY OPERATED ELEVATORS; E. R. Leigh, Philadelphia, Pa. App. filed Sept. 22, 1917.

1,445,169. DENTAL FILM HOLDER; H. G. Ralph, Edenton, N. C. App. filed Feb. 14, 1921. For holding X-ray films.

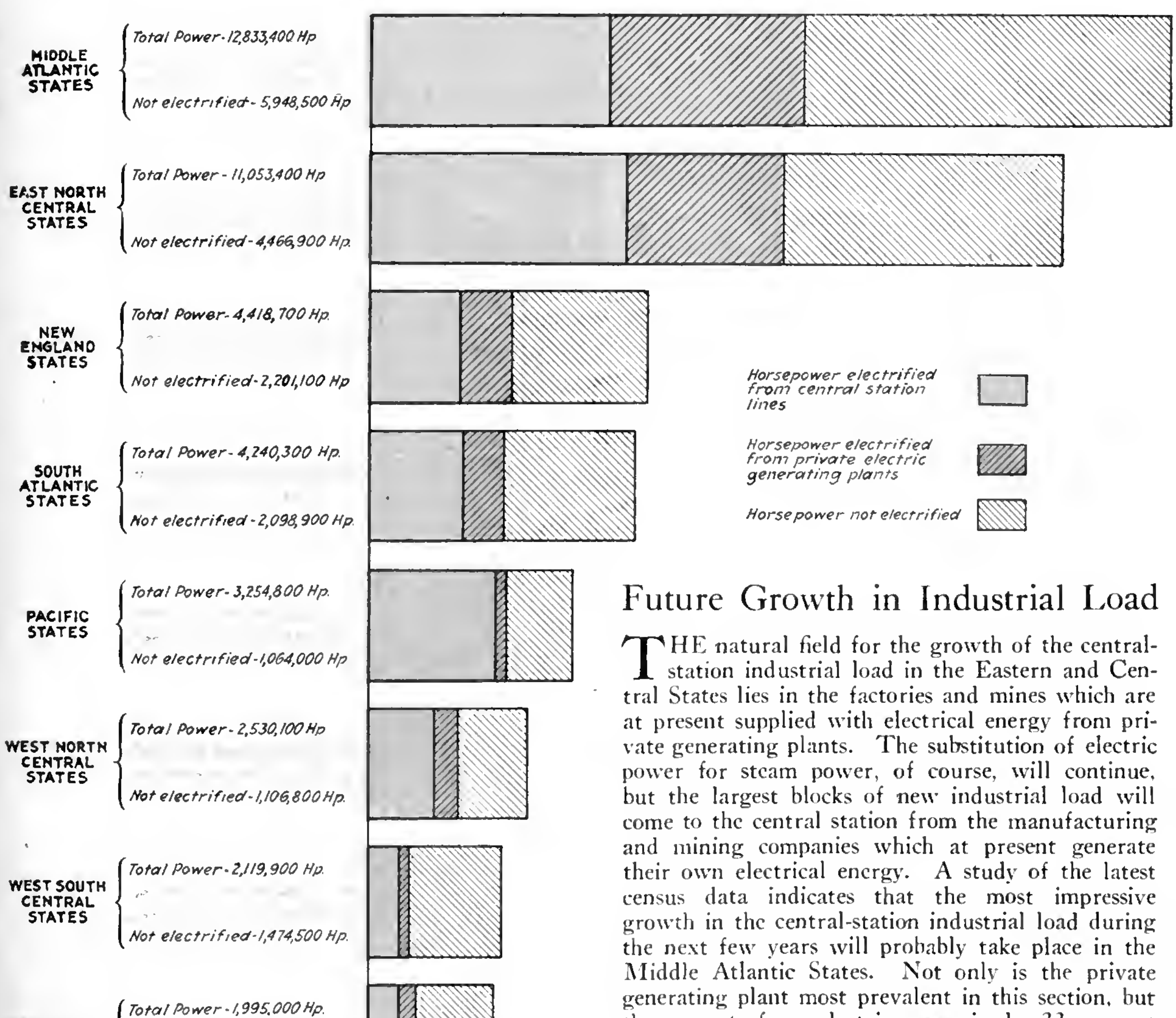
1,445,178. FEEDER CLAMP FOR OVERHEAD-TROLLEY SYSTEMS; P. G. Schwarz, Indianapolis, Ind. App. filed Dec. 22, 1919.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## Extent to Which the Mills, Factories and Mines of the Various Sections of the Country Are Electrified

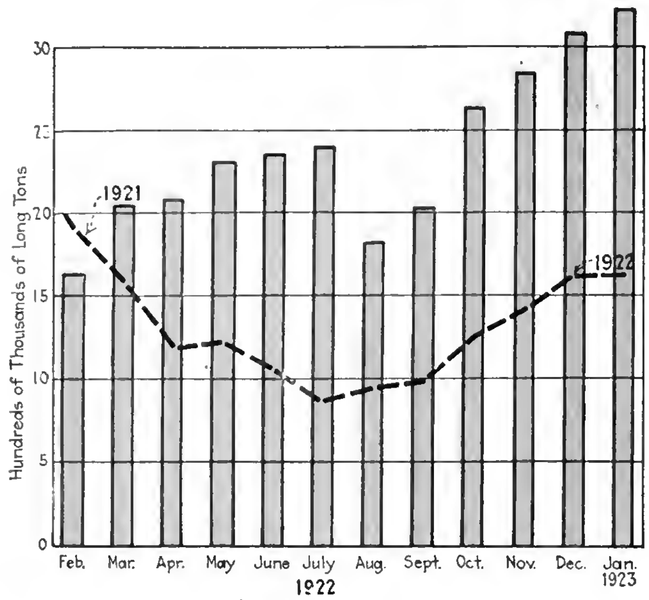
(Data as of Jan. 1, 1920)



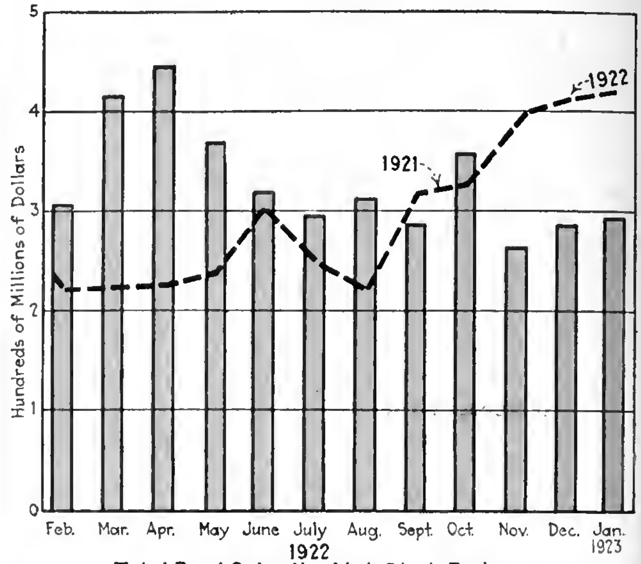

### Future Growth in Industrial Load

THE natural field for the growth of the central-station industrial load in the Eastern and Central States lies in the factories and mines which are at present supplied with electrical energy from private generating plants. The substitution of electric power for steam power, of course, will continue, but the largest blocks of new industrial load will come to the central station from the manufacturing and mining companies which at present generate their own electrical energy. A study of the latest census data indicates that the most impressive growth in the central-station industrial load during the next few years will probably take place in the Middle Atlantic States. Not only is the private generating plant most prevalent in this section, but the amount of non-electric power is also 33 per cent in excess of that existing in any other section of the country. The central stations of the Far West, on the other hand, will be compelled to build up their industrial load either by the conversion of steam drive to electric drive or by the electrification of new mills and mines plus the ever-growing irrigation load.

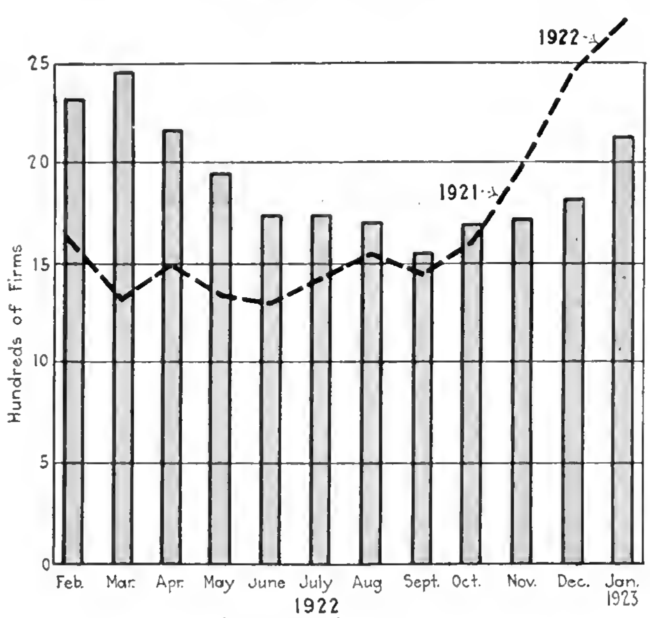
# How the Primary Industries Are Trending



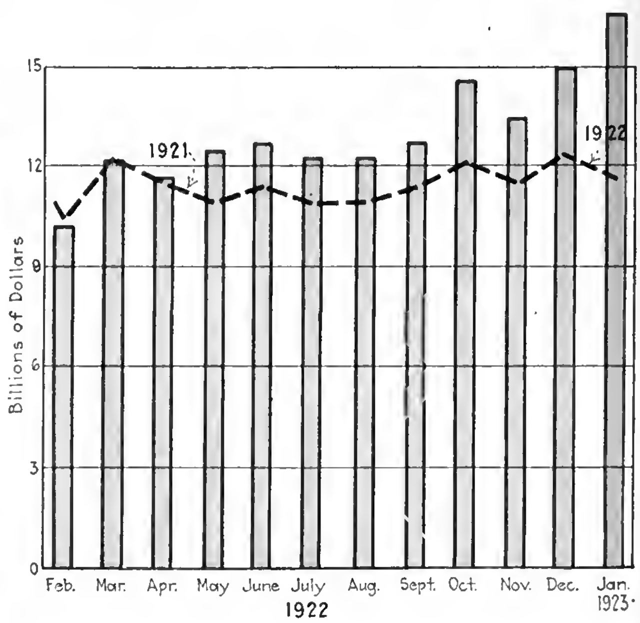
Pig-iron Production



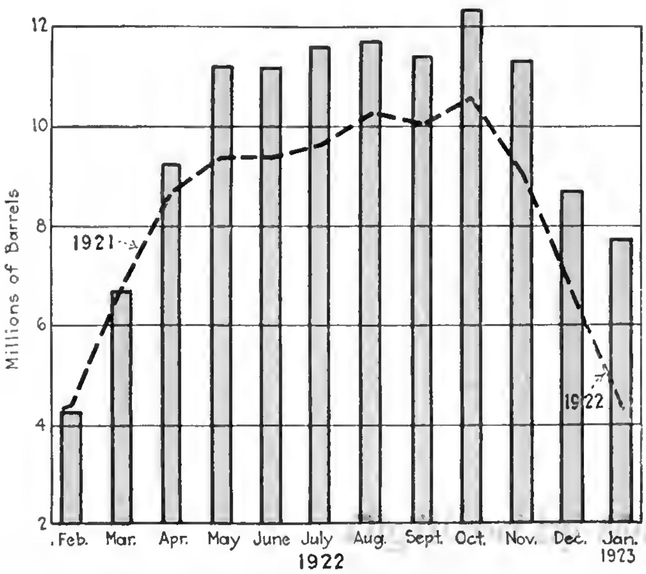
Total Bond Sales, New York Stock Exchange



Business Failures



Bank Clearings
(Outside of New York City)



Portland Cement Production

## Bank Clearings Indicate Prosperous Conditions

ONE of the most significant indices of general prosperity during January was the unusual bank clearings reported for that month. Many prominent economists and statisticians consider bank clearings outside of New York City as the most reliable barometer of the growth of American business. The figure of $16,562,000,000 reported for January represents the largest bank clearings outside of New York City reported since March, 1920, and data available indicate that it is the third largest figure ever reported for any one month. The January clearings increased 42.5 per cent over January, 1922.

Pig-iron production continued to climb during January, being almost double the production reported for January last year. A study of the growth in pig-iron production for many years in the past indicates that the production during January was about 5 per cent higher than the production which would normally be expected for that month.

Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

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# The More Vital Credit

EVER since men turned from warfare as a normal occupation and became engrossed in industry and business, credit has been enthroned on high. Security, opportunity and prosperity have been maintained not by the sword, but by the greater resources of peace—service, fair dealing, responsibility, capital. And out of capital and character men have also built credit — which brings the privilege of calling to their needs the capital of others, lodged in the bank as a common fund for the use of industry.

And so the executive of every public utility, of every manufacturing enterprise and of every jobbing, contracting or retail merchandising or other business strives to establish credit at the bank. He realizes that the good will and confidence of the bank are greater assets to him than all his money on deposit. He knows that with the bank behind him he can expand and grow and meet his troubles when they come. But he forgets sometimes that *it is even more important to cultivate credit with the public than with the bank.*

CUSTOMER ownership of securities is a demonstration of the awakening of business men to the significance of this great truth. Public utilities are selling their stock to their consumers that people may become interested in utility problems and concerned with the prosperity of the public service corporations of their communities. Manufacturing companies are assisting their employees to purchase shares that self-interest may develop loyalty and promote thrift among them. Men are suggesting that the tribulations of the railroads could be ended by the sale of their securities to their employees and to the shippers and passengers whom they serve. It is dawning upon our minds that the public has an interest in and an influence upon the affairs of all individuals and all business enterprises.

Public sympathy with its purposes, public approval of its methods, public confidence in its product, public respect for the character of its personnel, public good will toward its activities, public pride in its success — these are great resources for any business. In short, this intangible but very present thing that can best be called *credit with the public* is an asset as valuable as, even more valuable than, credit at the bank.

THERE is a great thought in this that should be pondered well by the executive of every central station and every other electrical business. It should be well taught to all employees. It should be a guiding principle in all their work, clearly expressed in their relations with their customers.

For the entire electrical industry is virtually founded upon our great utility services, publicly regulated and more and more publicly owned. Credit with this public is therefore absolutely vital.

# Thomas Addison

*An inspiring example to all electrical men and an executive who has built up the electrical industry in the West.*

SIX years after the Thomson-Houston Company had in 1884 made a spectacular start on the Pacific Coast by installing an incandescent lighting system at Sacramento Dr. Thomas Addison of Chicago came to take charge of the Western branch of the company. The first electric railway of California was under construction at San José at the time, and the first duty of Dr. Addison—who had entered the new electrical field after eight years of practice as a graduated physician—was to oversee the installation of Thomson-Houston equipment. From that time on his story may be said to be the story of the growth of a great company. Its Western branch passed through the phases of amalgamation with the Edison General Electric Company and its change to its present form under his direction. From being an organization confined mainly to the handling of generating equipment, it expanded into the field of motors and became a factor in the growth of irrigation as a power-company load, making its contribution as well to the rapid industrial development of the Coast.

Dr. Addison, who was born in Courtland, Mich., was graduated from Bellevue Medical College with the class of 1877. In 1885 he forsook his profession to take employment with the United States Electric Company of Chicago, and in 1888 he accepted a position as apparatus salesman with the Thomson-Houston Company at that city. When the Western branch of the company was reorganized in 1890 he was selected to go to San Francisco as local manager. Two years later he became Pacific Coast manager of the General Electric Company, and this post he has filled for more than thirty years.

Dr. Addison's great contribution to electrical progress has not been confined to the advancement of his own company. He has taken an active part in the upbuilding of other branches of the industry besides his own and has shown a warm interest in the formation of local technical and commercial organizations and their development to their present importance. His sympathetic encouragement has been an active factor in the cultivation of such new fields as electric pumping in irrigation or, more recently, the advance of electricity into the oil fields.

For twenty years he acted as chairman of the board of trustees of the State Normal School of San José, and at one time he was a director of the Berkeley National Bank. He is a man of wide interests and a member of many associations and clubs. "The Doctor," as he is affectionately called, is often termed the father of the industry in the West.

# Editorial Comment

Electrical World, March 3, 1923

Volume 81 Number 9

### oad Factor Versus Diversity Factor

N HUNTING for load-factor business the tendency too frequently is to bait the hook with a ridiculously w energy rate. This policy is short-sighted, especially the case of steam-operated systems, because load fac- r is desirable at all times provided it is obtained from stem diversity factor. Diversity factor forms the rnerstone of the electric light and power business. ypical examples of two systems, each fitted for the rticular kind of load it carries and neither of them pable of carrying the load of the other profitably, will iffice to illustrate the point.

The system of the Niagara Falls Power Company is e finest example of hydro-electric development in the untry. That is to say, it has abundant water, needs steam reserves and consequently operates at low cost. he yearly load factor of the system approaches 100 per nt. During 1922 the company generated considerably ore than two billion kilowatt-hours, and its gross in- me was more than six million dollars. It does a ad-factor business. The Commonwealth Edison Com- my, on the other hand, furnishes an excellent example an efficient steam-driven system. Its output, while t quite so large as that of the Niagara Falls Power mpany, nevertheless was more than two billion kilo- att-hours last year. From the sale of this energy income was approximately forty million dollars oss. Of course, it costs more to generate electricity Chicago than it does at Niagara Falls; but that is t the point we wish to make. We merely compare a pical and excellent load-factor system with a typical d excellent diversity-factor system. The Hydro-Elec- ic Power Commission of Ontario furnishes another ample. Although the provincial commission buys wer at, say, $30, the local Hydro systems sell for, say, 0. In the first case twenty-four-hour power is in- lved (load factor), whereas the local community sells ght-hour power two or three times over (diversity ctor).

### ake Your Business Office Conspicuous

WHY is it that many central-station companies make their business offices and display rooms so conspicuous? In some cases it seems as if an actual tempt is made to keep these places hidden. Recently man who had business with a central-station company a city in which there is competition with a municipal ant inquired at a retail electrical merchandising store to the location of the office of the private company d received directions which led him to the municipal- ant office. It was here that the location of the office the private company was ascertained. The first rection might have been a result of misunderstand- g; but inquiries from a traffic policeman and from several persons in small stores using electric light revealed ignorance or brought directions to the municipal office.

After a half hour of wandering, the building, in which there are two utility business offices, was found. Its front was dominated by a flaming electric sign belonging to a totally unrelated business. From across the street it was almost impossible to read the small window signs on each utility office window, and it would have been easy to pass both offices on the same side of the street without seeing them. Both, however, were attractively arranged, and the reception of the inquirer was courteous and all that could be asked.

In noticeable contrast with these inconspicuous quarters numerous signs, electric and otherwise, advertising other businesses could be seen in every direction from the entrance to the building. Despite the fact that the municipal office was in an out-of-the-way place, it had an electric sign that could not be missed, and at another point in a conspicuous location was an enormous electric sign advertising the municipal-plant service.

Except that there is competition in this particular instance, the situation can be duplicated in altogether too many other places. Such central stations seem to be like the physician who will not take his own medicine or the cobbler who cannot provide his own family with shoes. There is something fundamentally wrong with business policies of this sort. The business office of the utility ought to be at least as conspicuous as any business enterprise in town.

### An Electrical Giant Makes Its Bow to Industry

PLATO said that society arises because different men are better skilled to supply different wants and thus the wants of each are supplied by mutual arrangement and division of labor. It might well be said today that industry progresses because electricity becomes more and more applicable to the supply of its needs and permits it to conform more nearly to the statement of Adam Smith that division of labor is the chief cause of improvement in its productiveness.

With untiring persistency, electricity is invading every industry and, through its flexibility, ease of control, safety and adaptability to every need of the industrial process, is eliminating waste, increasing production, bettering working conditions and changing production methods. This unceasing invasion is unprecedented in industrial history and yet is so universal and so gradual that it is difficult to record decisive victories in its progress. What is required is a record of the state of electrification in the different industries at intervals which afford data for making comparisons over a period of time.

In this issue of the ELECTRICAL WORLD a very complete, new all-electric paper mill is described, with detail

tabulations of all the electrical equipment and with statements of the engineering reasons for its selection and installation. The magnitude of the project, with its 65,000 hp. in motors, necessitated the use of a greater number of pages than are usually devoted to one article, but the fascinating story of paper making, in the opinion of the editors, makes the article unusually interesting. The recording of the electrical statistics of this great paper mill should serve a good purpose. The story is typical of the electrification existing or coming into being in many other industries.

In its engineering features the paper mill is most interesting from the control standpoint. The paper machine presents a control problem for engineers whereby precise adjustments of speed over a wide range of speeds are required on a group of direct-current motors operating on the same machine but without mechanical connection. Faced with this problem, the engineers of the several manufacturing companies obtained solutions which have all been applied with success. An incidental outcome lies in the fact that the same type of control has been found applicable in several other industries.

In its other engineering features the paper mill is chiefly of interest because of the magnitude and number of the motors required and because the power factor of the complete installation is so well controlled by the battery of large synchronous motors. This installation should surely pave the way for similar paper mills in localities where hydro-electric power and forests are found and can be put to good use. In many localities similar to Three Rivers water powers are wasting their energy because they are distant from settled communities, and these should be used to serve industries—for example, the paper industry—until settlement and progress provide other loads.

## Codes of Ethics Are Aids to Higher Professional Standards

THE engineer has long prided himself on his professional standards and has jealously built and guarded his reputation for fair dealing on a plane of high integrity, honor and ethics. On the whole, however, he has been unduly reticent in telling his fellowmen about his ideals and aspirations, his qualifications and characteristics. Men in other lines of professional and business life have recently been active in telling the public how good they are—at least, they have been organizing and "cleaning house" and otherwise arranging affairs to show the people that the conduct of their business is above public or private reproach. As a matter of fact, the art of being good had so far progressed that the American Academy of Political and Social Science was able about a year ago to collect "codes of ethics" from every calling on earth—except the ministry!

However, the issuing this week of a reprint of the "Code of Principles of Professional Conduct" adopted by the American Institute of Electrical Engineers in 1912 calls to mind that, although the engineer has been somewhat quiet about this work, he has been effectively at it for over a decade. The civil engineers adopted a code in 1914 and the mechanical engineers in 1922; the mining engineers still say that the Bible is good enough for them! It should be a point of pride with the electrical engineers that their code was the predecessor—and has served as a pattern—of the other engineering codes. The original impetus was President S. S. Wheeler's address on "Engineering Honor" in 1906, after which committees began to formulate the code as it now stands.

Among professional societies in particular these codes of honor have become important factors in upholding high ideals in the constantly broadening relations of the various groups. The simple statement of desirable professional procedure and attitude has been very helpful, particularly to the younger members of the professions. The American Institute of Electrical Engineers, when the subject was raised again last year, gave evidence of its satisfaction by reaffirming its 1912 code, saying that it "had served its purpose effectively during the past ten years," and by directing its code committee to examine into practices of members which may be regarded as prejudicial to the welfare of the Institute. That the committee has done this effectively in two or three instances is sufficient proof of the desirability and appropriateness of the code.

## Automatic Equipment Does Not Replace Human Intelligence

OCCASIONALLY an engineer or operator with experience that seems to back his opinion rises to declare that some type of automatic installation is going completely to displace the human element in a particular field of electric plant operation. Such declarations, for instance, have been heard about the automatic substation. An examination of the facts usually discloses that a successful installation has been made under a certain set of conditions and does almost all that the enthusiastic individual claims for it, incidentally showing the existence of a broad field of application for its use; but this field comes far short of comprehending the entire range of conditions met with in plant operations of the general character under discussion.

An examination of the application of automatic equipment in the industrial field discloses many types that seem almost to do their own thinking, so marvelous are the results. Such equipment, however, is designed to go through a given cycle of operations. If that cycle does not occur, the machine ceases to function and human hands must be ready to take hold and start the operation anew. Automatic equipment of any type in an industrial establishment merely performs mechanical operations and increases the amount of work that one human being can do by freeing him of things that require no intelligence to perform or that can be reduced to a pure mechanical cycle. This principle is true in the application of automatic devices in the substation or generating plant.

In a recent discussion that finally led to the question of automatic operation in the generating room a prominent engineer said that he expected in the future to see many operations now manual carried on automatically. He mentioned the synchronizing of machines as an example of the type of operation that can be reduced to a mechanical cycle. This, in his belief, will eventually eliminate the human factor from performance of a kind where mental aberration or accident to the operator may prove serious and allow the attendant to look after routine operation as well as the abnormal occurrences which require human intelligence to correct. The idea back of this expression of opinion was that the constantly increasing concentration of power in huge plant units is such that the operator must be relieved of every manual operation possible and left to see the

apparatus is functioning properly. There are more operations to be performed than the human brain can be safely burdened with, and mechanical or electrical devices must be used to increase its power of accomplishment by confining its activities to the operations that actually need thinking power. This is the principle from which the design and installation of automatic plant equipment should be viewed. Its application will many times produce a part of the plant which will not require the physical presence of a human workman for long periods of time. In many other cases it will merely supplement human efforts. It will never completely replace human intelligence.

## Advocates of Superpower Systems Have Lesson to Learn from South

IN MOST discussions of proposed superpower systems the greatest obstacle to accomplishment seems to center around the financing of such a system, the contractual relations and the supervision of operating procedure. The delay seems to be due not so much to technical difficulties as to the inability of the companies concerned to agree on arrangements that will be mutually satisfactory. On these phases of the subject the central-station companies in the Southeastern part of the country have taken the lead.

When the growth of industry and demand for power in this section began to exceed the electric service facilities which each individual company could provide separately, the executives got together. Despite the fact that the extreme tips of the system to be interconnected were more than 900 miles apart, there was no talk of 220-kv. transmission lines, and there still seems to be no need of them. Physically, about the only thing that had to be done was to extend and reinforce certain lines strategically situated between systems and provide sufficient transformer and switch capacity to handle exchange energy. Contractually, it was found necessary merely to agree upon a common frequency, a fixed rate for hydro-electric energy, a sliding-scale rate for steam power, the charge for transferring energy over any system to an adjacent one, and the necessity of one load dispatcher having supervision over all the interconnected systems so far as interchange is concerned. Aside from these preliminaries there were practically no other agreements except a gentlemen's understanding that if one company needs energy and another can furnish it there will be an interchange of power.

No supervoltage lines were required because in transferring power from one extreme side of the system to the other the energy is relayed. For example, if the Yadkin River Power Company desires power, the Alabama Power Company may deliver it to the Georgia Railway & Power Company's system, which will utilize it in the portion of its system nearest Alabama. In turn it will deliver energy from that portion of its system nearest the Carolinas to the Southern Power Company, which will relay the energy in the same manner to the ultimate user. To allow for line loss, each company requires that a fixed percentage over the power to be transferred be delivered to it.

In building the lines to interconnect the adjoining systems there was no quibbling over who should pay for them. Each company paid for the portion of the line within its own state or recognized service district, realizing that it would benefit as much by the interconnection as the adjacent system and also that the line might open up new markets for power.

Rates for power are plain kilowatt-hour rates without complications such as power factor, load factor or demand clauses. The wattless load is distributed by the central-system load dispatcher by asking one company or another to raise or lower its voltage.

In other words, every one entering the superpower system recognized that he would benefit by receiving power when sorely needed or by selling surplus power, and that hence some inconveniences or apparent inequitable division of expense would have to be accepted.

The best proof that these arrangements are agreeable to all is that the Southern superpower system has been operating as such for several years and is still in active existence and that no marked changes have been made in the agreements. The companies admit that improvements can be made, such as still further to reinforce some tie lines and tie transformers or circuit breakers to permit greater exchange of energy without unstabilizing synchronous operation, to make additions or changes which will prevent excessive fluctuations in frequency, to improve relay protection, and so forth. However, all these problems are being attacked already. The unanimous conclusion of the companies is that they are more than satisfied with their superpower system and the method of operation.

The experience and practice of this Southern group of companies should serve as an example to other sections of the country and should also make a worth-while study for politicians who are ranting about adequate utilization of water power for the benefit of the people.

## Carrying the Annual Meeting to All the People

THE broadcasting by radio of the proceedings of the annual stockholders' meeting of the Commonwealth Edison Company last Monday was an interesting and significant innovation in utility public relations. About fifteen hundred stockholders attended the second annual meeting at which provision had been made for a large popular attendance. But, since there are now 28,499 shareholders, this left 27,000 persons who for various reasons were not actually present, although no less concerned. There are, besides, the 610,000 customers of the company who are interested in both the welfare and the activity of this public service corporation. Normally, many of both groups would gain some knowledge of the meeting from the report in the morning papers, but in addition, this time, radio was utilized to bring practically into the audience all those who cared to "listen in" to what was being said and done by the gathering in "Customers' Hall."

It was, of course, a gesture, but it means much. The broadcasting of President Samuel Insull's address, of recommendations from the board of directors for the authorization of a twenty-million-dollar increase in capital stock and of the action of the meeting in indorsing this recommendation was the acknowledgment by the utility not alone of the right of shareholders to be informed and to participate but of the interest and concern of the general public also. It was a graceful and deliberate expression by one of the most important central-station companies of its responsibility to all of its stockholders and to all the people.

## Shawinigan Power Makes Paper

HYDRO-ELECTRIC power is applied to do all the work required in the production of 275 tons of "news" paper each day in this 100 per cent electric mill of the St. Maurice Lumber Company at Three Rivers, Canada. Electricity is particularly well fitted for the operations required in paper making and, since water power and forests are usually found associated with each other, the electric paper mill works under the most economical production conditions and develops natural resources.

# A New All-Electric Paper Mill

By A. H. WHITE* and
R. H. ROGERS†

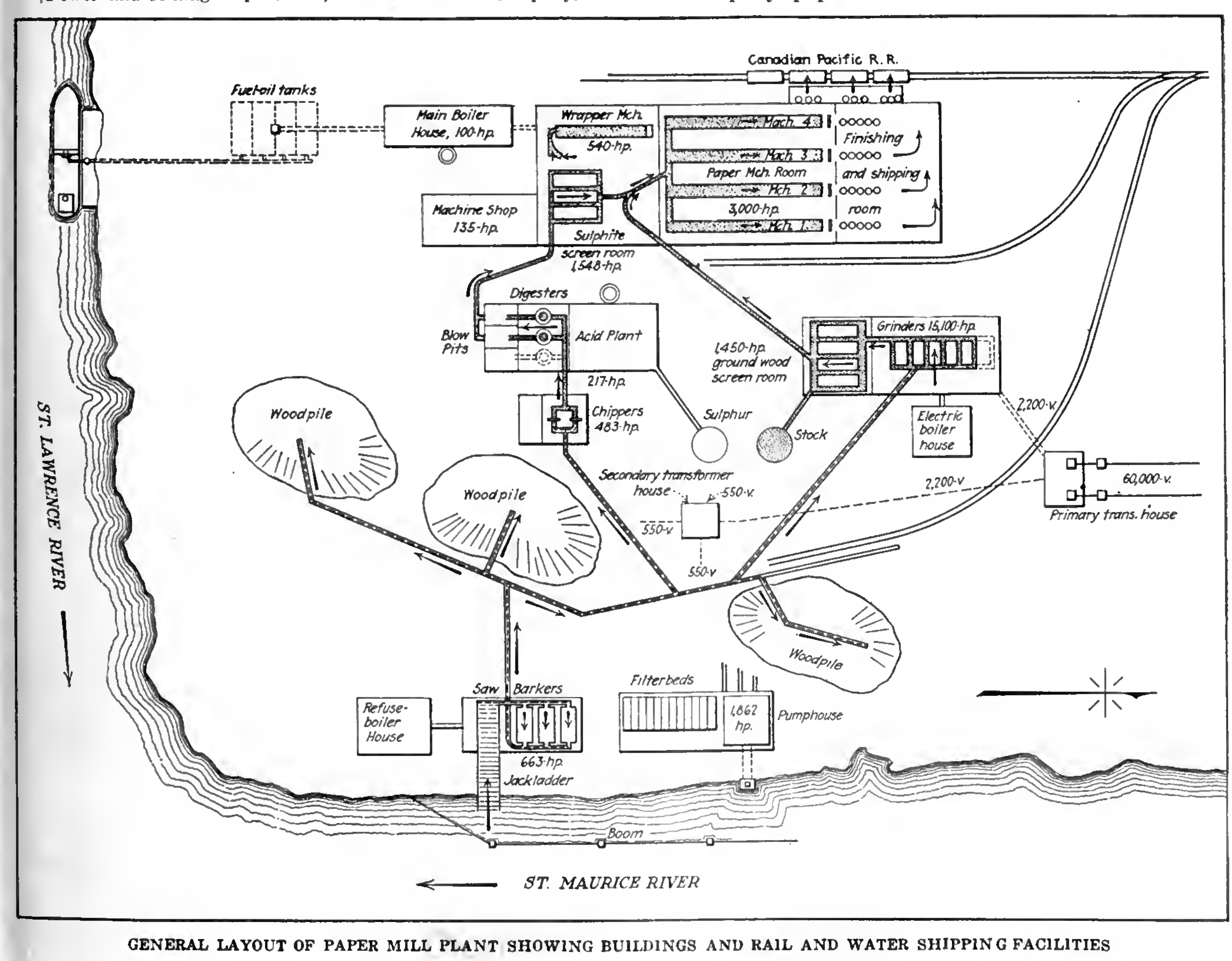
**Process Requirements Governing the Selection of Motor, Control and Electrical Equipment for the Electrification of Paper Mills—Installation Details for 65,000-Hp. Motor Drives and Description of Electrical Material-Handling Equipment Required in the Production of Paper**

SAMUEL DE CHAMPLAIN, as he was exploring from Quebec toward the Great Lakes, discovered a broad river coming into the St. Lawrence from the north, divided at its mouth into three channels by two islands. He founded a settlement here in 1634 and called it Trois Rivières, the Three Rivers of English-speaking people. That it is a strategic point for the production of pulp and paper is proved by the number of successful mills in the vicinity and the rapid, healthy growth of the city since their coming. The St. Maurice River, clear and broad, taps the great forests of the north and furnishes the vehicle that brings the logs to the saws. Its energy, converted at Shawinigan Falls and Grand Mère, not far from its confluence with the St. Lawrence, furnishes 275,000 kw. of hydro-electric power to neighboring industries. The clearness of its water materially aids in the production of a "bright sheet," and steam boilers fed from the St. Maurice show the sustained efficiency that can come only from an ideal feed water.

The transportation facilities here, midway between Montreal and Quebec, are excellent. The St. Lawrence furnishes a water route for incoming pulp wood and for finished paper to Great Lakes ports, Atlantic Coast and European cities during seven months of the year. Fuel-oil tankers steam up from the sea to dock and discharge to mill storage tanks. The canal route via Lake Champlain furnishes a much-used outlet directly to New York City. The Canadian Pacific Railroad with ample sidings keeps the local industries in touch with the whole continent.

In such a setting is the newest mill of the International Paper Company, known as the St. Maurice Lumber Company paper mill. It is the business of this

*Chief engineer the International Paper Company.
†Power and Mining Department, General Electric Company.



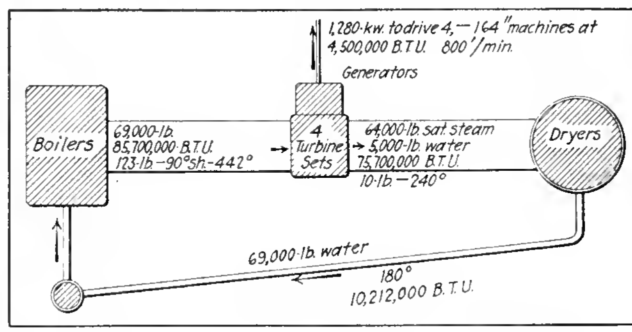

GENERAL LAYOUT OF PAPER MILL PLANT SHOWING BUILDINGS AND RAIL AND WATER SHIPPING FACILITIES

plant to produce news paper composed of about 75 per cent mechanical (ground-wood) pulp and 25 per cent chemical (sulphite) pulp, made from logs that average about 60 per cent spruce and 40 per cent balsam.

The four 164-in. paper machines, to which the whole organization and structure are subservient, were put in production in the past summer—the last one in August. They are already making over 275 tons of "news" per day, and their ultimate capacity, after the installation of the seventh grinder unit and the third digester, will be more than 300 tons per day. The present daily production represents more than 1,200 acres of paper, or a sheet 12½ ft. wide and 875 miles long, turned out at the rate of over 36 miles per hour.

One ton of "news" as now being produced at this mill (based on one month's figures) requires a little over a cord of wood, 1,347 kw.-hr. of hydro-electric power, 7.21 tons of steam produced by 3⅛ barrels of fuel oil for mill heating, pulp cooking, paper drying and for direct-current electric power for driving the paper machines; fifteen man-hours of labor and supervision, and five and a quarter minutes for production.

The logs, 13 ft. to 16 ft. in length, are sawed and barked during the summer months, and the surplus

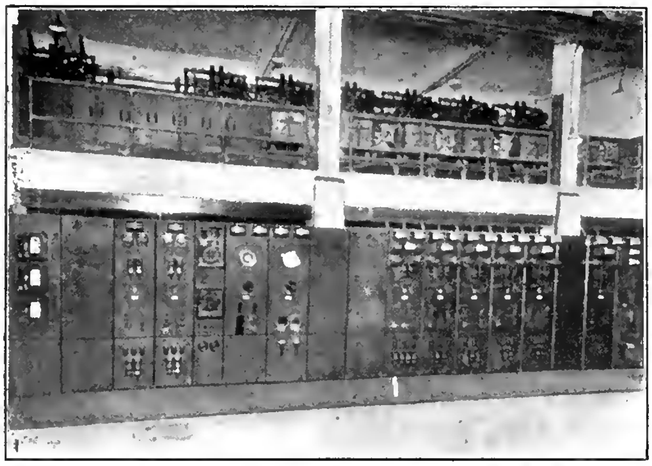


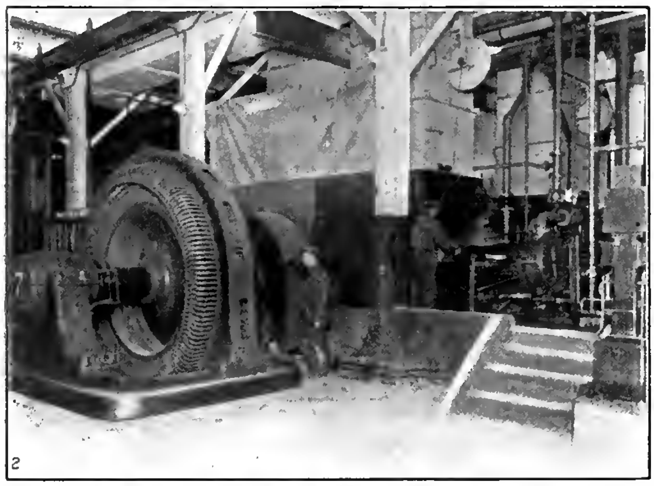

HOW THE HEAT IS DISTRIBUTED IN THE STEAM CYCLE USED IN THE MILL

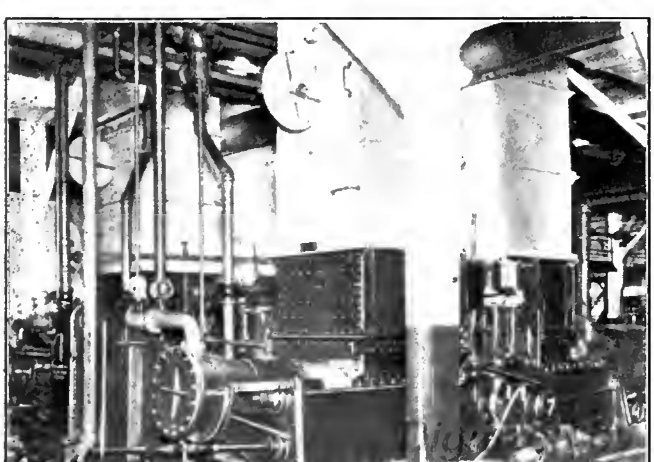
over current demand up to 66,000 cords can be stored for winter. The four fuel-oil tanks hold 150,000 barrels, or more than six months' supply of Mexican residue. Two transmission lines and transformer banks can furnish 24,000 kw. of hydro-electric power. The pump and filter plant has a capacity of 20,000,000 gal. of filtered water per day. The main boiler house can turn out more than 6,000 boiler-horsepower continuously.

The outstanding feature of this mill is the extent to which electric power is used, together with the novelty of many of its specific applications. Every application of power is electric, and it is the only 100 per cent electric paper mill in the industry.

Two 60,000-volt, 60-cycle, three-phase transmission lines come from the north to the main transformer house at the northern limits of the mill yard. Six single-pole, 600-amp., 110,000-volt disconnecting switches lead to the two three-phase, four-tank, 60,500/72,500-volt lightning arresters, which are of the electrolytic outdoor type. Six 600-amp. cylindrical suspension







**Synchronous Motors Grind the Wood**

No. 1. Main switchboard in ground wood mill controls six synchronous motors aggregating 14,400 hp.
No. 2. Hydraulic rams force the logs against the synchronous motor-driven grinder. At right is automatic motor load regulator which is actuated by hydraulic pressure.
No. 3. Six of the seven 2,200-volt, 2,400-hp. synchronous motors which drive pulp grinders.
No. 4. Every three hours a stone-burring lathe is automatically brought into operation without stopping production. The toothed wheel in the magazine feeding pulp grinders registers the cords of wood fed to machine.

outdoor choke coils are interposed just outside the 100,000-volt wall bushings. After going through two 600-amp., 66,000-volt, triple-pole, single-throw, remote-control oil circuit breakers the voltage is stepped down from 66,000 to 2,300 by means of six 4,000-kw. oil-insulated and water-cooled transformers.

Well protected in a room at the end of the transformer house is the four-panel instrument board, where the incoming power is metered on the 2,300-volt side of the transformers. The instruments installed are watt-hour meters, indicating and curve-drawing wattmeters, indicating voltmeters and ammeters, ground detectors for the cable system and an indicating power-factor meter. On these panels are also mounted all necessary instrument protective devices. The entire equipment of this main transformer house was furnished by the Canadian Westinghouse Company with the exception of the transformers, which were built by the Westinghouse Electric & Manufacturing Company.

A tunnel 150 ft. long takes 2,300-volt power from the main transformer house to the switch house alongside the wood grinder room, where there is a connected load of 15,100 hp., with another 2,400-hp. unit on order. The conductors through the tunnel are eight three-conductor, 1,000,000-circ.mil, 2,300-volt cables.

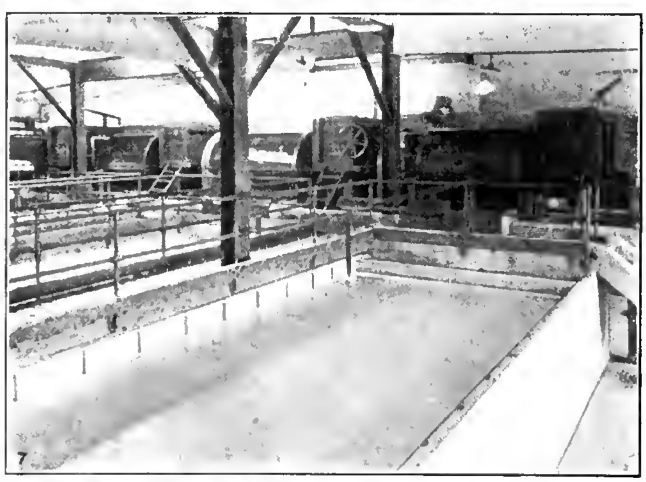
### Secondary Transformer House for Mill Supply

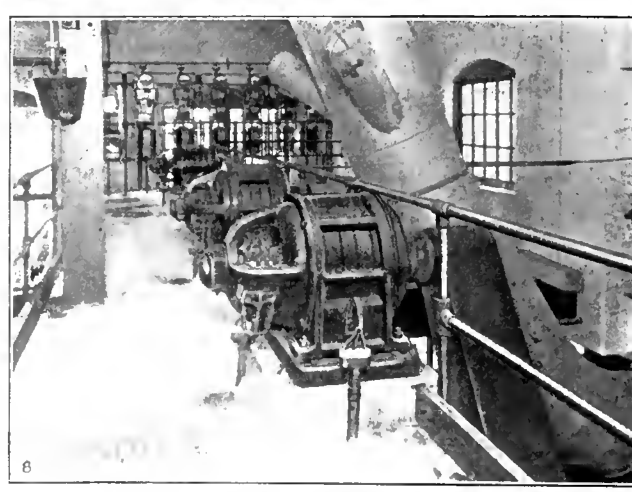
There is a secondary transformer house located conveniently for general distribution to the mill and connected to the main transformer house, 960 ft. away, by two sets of twelve 4-in. ducts with manholes about 150 ft. apart. Twelve ducts each contain a three-conductor, 600,000-circ.mil, 2,300-volt cable; five ducts each contain a three-conductor, 300,000-circ.mil, 600-volt cable, and another contains a two-conductor, No. 2/0 cable for 125-volt direct-current switch control.

The secondary transformer house steps the 2,300-volt circuit down to 550 volts for general distribution throughout the mill and yards. There are mounted here twenty-four 1,200-amp., single-pole, single-throw, 2,200-volt disconnecting switches, twelve 4,000-amp. similar switches and two 2,000-amp. automatic solenoid-operated oil circuit breakers. The transformers are four in number, rated at 2,000 kw. and 2,200/600 volts, and are single phase, oil-insulated and water-cooled. The fourth transformer can be phased in with any other two. There is a 10-kw., 550-110/220-volt lighting transformer installed here, as well as a battery-charging set and a storage battery for switch operation.

Protection is provided by twenty-eight 600, 400 and 300 amp., triple-pole, single-throw, oil circuit breakers, very neatly and conveniently connected and mounted. Eighteen switchboard panels carry curve drawing and indicating instruments for metering the power to various mill divisions.

Four principal lines of ducts radiate from this secondary transformer house and branch off as required to serve the widespread areas of motor applications. The aggregate length of 4-in. ducts, including spares,



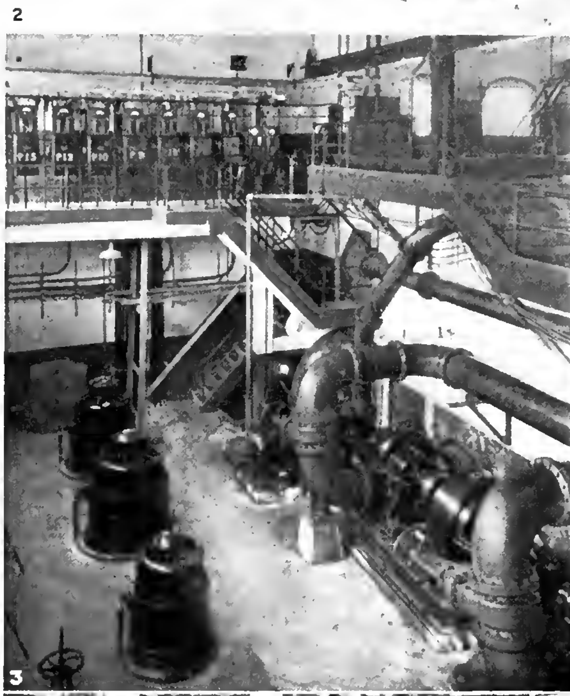


**Grinding Wood and Cleaning Pulp**

No. 5. One of two 220-ft. conveyors above charging floor in ground wood mill for distributing logs to service piles.
No. 6. From the 200 service piles the logs are placed in the magazine grinders from the charging floor in the ground wood mill.
No. 7. In the screen room there are four Sherbrooke revolving screen knotters in the rear of four rifflers each having eleven submerged dams for extracting sand.
No. 8. Six motors of 15 hp. each drive the deckers. Controllers, meters and switches are in the background.

# Conveying Equipment for Logs and Water Pumping Station






No. 1. There are over 3,000 ft. of outside conveyors of the cable type. This conveyor comes from the wood preparing plant. In the distance is a stacker.

No. 2. This "Jack Ladder" conveyor handles 16,000 logs per day from the river to the saws.

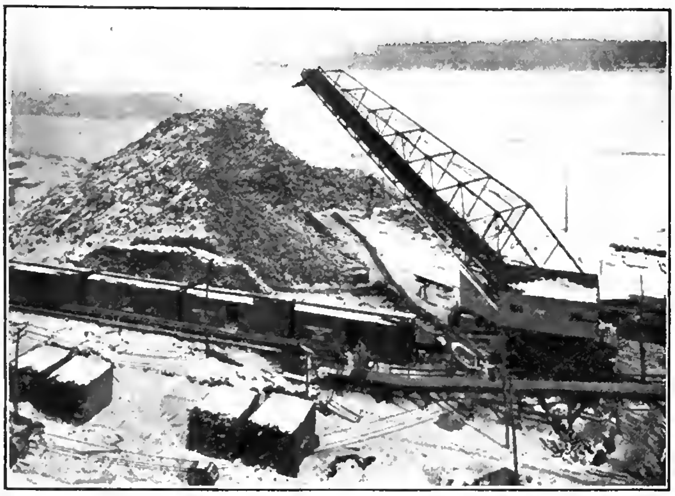
No. 3. In a pump pit below the river level motor-driven pumps furnish water for the filter plant and mill. The control equipment is located above high water.

No. 4. A portable conveyor driven by a 15-hp. motor reclaims logs from storage and takes them to the permanent conveyor for delivery to chipper and grinder buildings.

No. 5. Group of five deckers chain driven from a line shaft. Six of these groups of pulp thickeners are in the ground wood screen room.

No. 6. One of two pairs of high and low pressure pumps for the grinder hydraulic jacks. Compensators are shown at right.

CHIP SCREENS GRADE THE CHIPS AND RETURN OVERSIZE CHIPS TO THE CHIPPERS



LOGS RECEIVED BY RAIL ARE HANDLED BY A STACKER AND CONVEYOR SYSTEM

installed is 15 miles, with access through about thirty-five manholes.

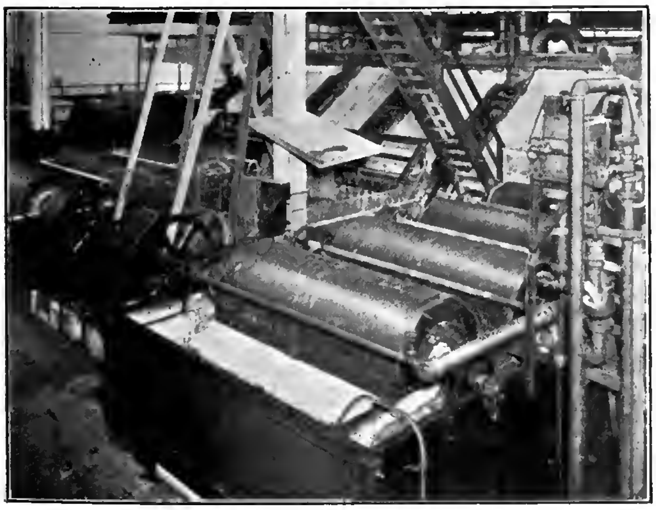
The connected three-phase, sixty-cycle induction motor load totals 34,000 hp. in about 400 motors, practically all controlled by oil switches and compensators or drum controllers so installed that the motor and its connected load is in sight from the control point. An important detail here is that all fuses are eliminated.

Three electric-steam generators are being erected in a separate boiler house close to the 2,300-volt grinder-room switch house. These boilers will have a combined capacity of 1,200 boiler-horsepower and can take 12,000 kw. They will have two functions. They will make available to the mill in the form of steam, at no extra cost other than overhead, the "below-peak" energy that would otherwise be paid for and not used. This procedure, of course, reduces the fuel consumption at the main boiler house to that extent. On Sundays, or at any other time of light steam demand, the 1,200 boiler-horsepower of the electric-steam generators will make it possible to shut down all the oil-fired boilers.

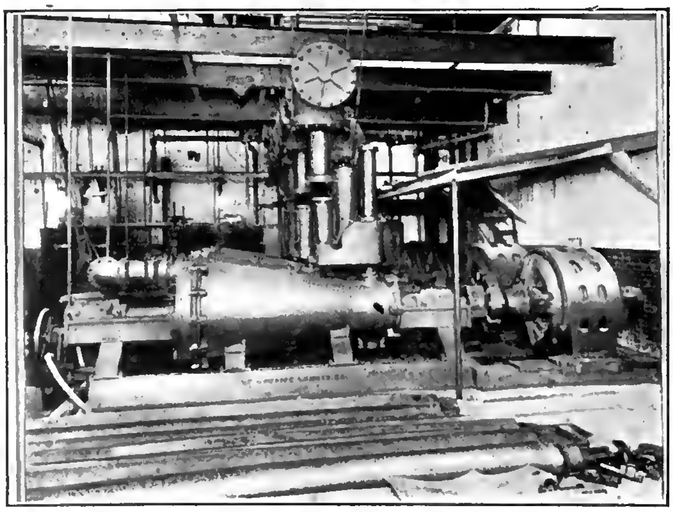
A log boom anchored to piers off shore harbors the logs floated down from the logging camps, and from this inclosure they are hauled sidewise in close formation on a multiple chain conveyor or "jack ladder" to the saws, which can be elevated out of the way of ice during the winter. At the head of the jack ladder they are transferred to another multiple-chain conveyor, which is equipped with jaws that hold securely the individual logs and carry them past the three "slasher" saws that cut them into 4-ft. lengths.

As the 4-ft. logs, end to end, leave the saws, they fall onto a conveyor which takes them endwise to the barking drums, of which there are three. These are huge tumbling barrels having straight-channel iron staves with 2-in. openings between. The drums are mounted horizontally. Both ends are open, and the logs are continually fed into one end and are continually falling over the stationary dam across the other end. The drum is rotated, and at the same time a spray of water is played on the logs. The bark is rubbed, beaten and washed from about 90 per cent of the logs in this process, and those imperfectly barked are returned by a conveyor to the same drums.

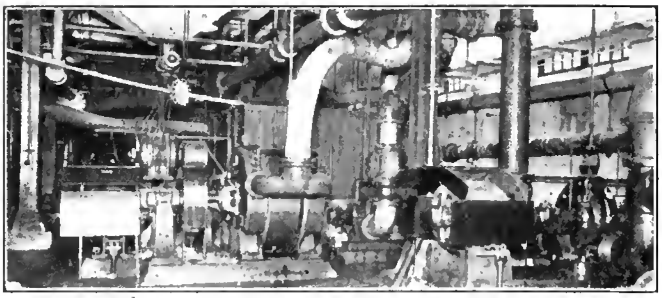
A maximum of 16,000 logs, together measuring more than 50 miles in length, has been drawn from the river, sawed, barked and delivered to the yard conveyors in a day by this wood-preparing plant. The barked logs are then taken in charge by the yard system of cable conveyors, which convey them to the three piles,



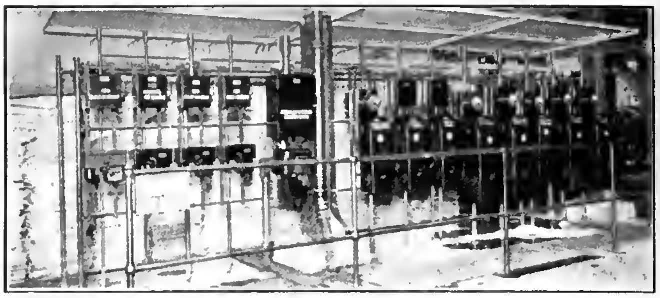
IN THE SULPHITE SCREEN ROOM ARE FIVE INCLINED SCREEN PULP THICKENERS AND TWO WASHERS



AS A RESERVE IN THE SULPHITE SCREEN ROOM ARE FOUR MOTOR-DRIVEN JONES-JORDAN ENGINES



MOTOR-DRIVEN VACUUM AND CENTRIFUGAL PUMPS ARE REQUIRED



COMPENSATORS AND SWITCHES FOR CONTROLLING PAPER MACHINE AUXILIARIES

stack, reclaim and deliver them to the sulphite and ground-wood departments. These cables aggregate 3,000 ft. in length in ten outdoor units.

The motor controllers and protective devices are concentrated in a special control house from which all the conveyor drives can be seen. The control units and instruments are thus protected from vibrations and shocks that they would be subject to if mounted on the conveyor structure.

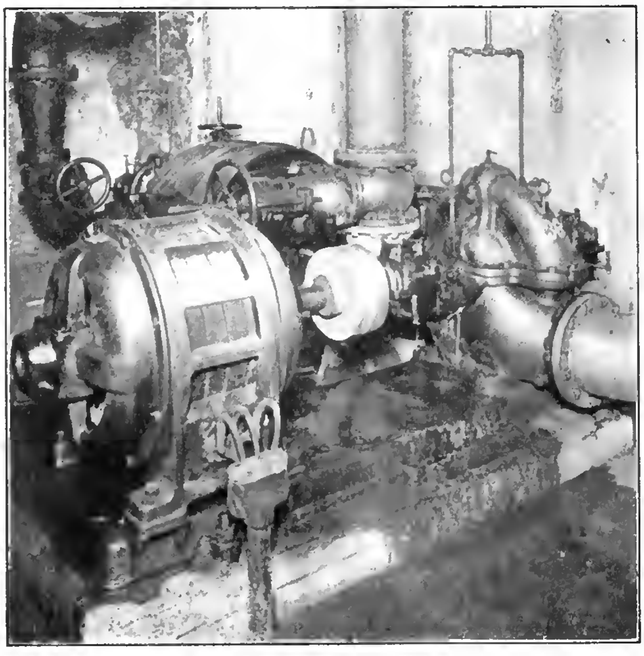
The barking drums listed in Table I and all the yard conveyor motors in Table II are, it will be noted, of the wound-rotor type on account of the very heavy starting duty with which they are at times confronted. This is especially true of the yard conveyors, which may have to start with a full load of logs or when impeded with snow and ice. Drum controllers are used in the secondary windings with overload oil switches in the primary windings, thus avoiding the use of fuses.

### Pump and Filter Plant for Water Supply

For supplying the enormous amount of water necessary for paper production a pump and filter plant is installed at the river bank. The pump pit contains ten pumps with a combined capacity of 55,800 gal. per minute, or enough to supply a city of 700,000 population. The raw water and fire pumps are below the low-water level of the river. The protective devices, meters and control elements are installed on a gallery overlooking the pit, and they are thus above any danger of flooding. Power is supplied from the secondary transformer house, about 150 ft. away, through three three-conductor, 300,000-circ.mil, 600-volt cables and two three-conductor, 200,000-circ.mil cables. The twenty sand-filter beds occupy an extension, 40 ft. x 180 ft., and they can filter 20,000,000 gal. of river water a day.

The service rendered by this pumping plant is vital, and the pump-pit environment is so exacting from the electrical standpoint that this equipment received the most critical attention in its selection and installation.

The two electric fire pumps are supplemented by a steam fire pump designed for 1,500 g.p.m. against a head of 280 ft. Wherever it is possible the pumps are so designed and connected that they can pump to the fire mains. Cross-connection with the city provides for mutual protection. The whole rotating weight in the vertical pumps is carried on suspension bearings at



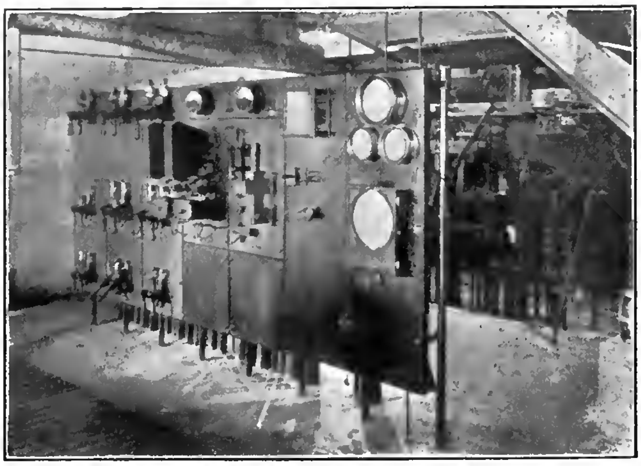
MOTOR-DRIVEN CENTRIFUGAL PUMPS ARE REQUIRED FOR HANDLING WHITE WATER AND STOCK

TABLE I—ELECTRIC MOTOR DRIVES IN WOOD-PREPARING PLANT

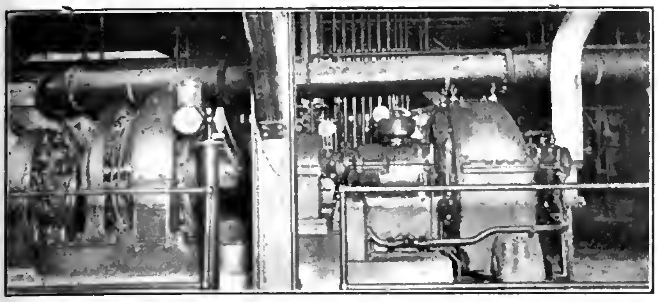
(Total connected load, 663 hp., 550 volts, alternating current.)

| | |
|---|---|
| Log haul, three saws and knife barker: | |
| Belts; one 100-hp., 690-r.p.m., squirrel-cage. | C. W.* |
| Conveyor saws to barker: | |
| Gears; one 25-hp., 860-r.p.m., wound rotor. | C. W. |
| Three barking drums: | |
| Belts and gears; three 150-hp., 690-r.p.m., wound rotor. | C. W. |
| Conveyor return logs to barkers: | |
| Gears; one 10-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Conveyor, wide for bark: | |
| Gears: one 25-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Conveyor logs to yard conveyor: | |
| Gears; one 10-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Conveyor from knife barker to yard conveyor: | |
| Gears; one 25-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Conveyor bark and sawdust to boiler house: | |
| Gears; one 15-hp., 860 r.p.m., squirrel-cage. | C. W. |
| Saw sharpener: | |
| Gears; one 3-hp., 1,800-r.p.m., squirrel-cage. | Cr. Wh.† |

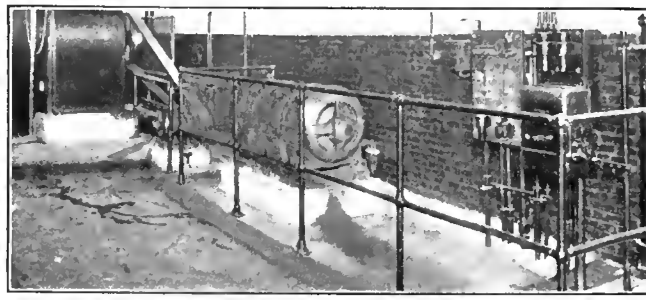
*C. W. indicates Canadian Westinghouse. †Cr. Wh. indicates Crocker-Wheeler.



FRONT AND REAR OF CONTROL PANELS FOR PAPER MACHINE TURBO-GENERATOR SETS



TURBO-GENERATOR SET FOR DRIVING PAPER-MACHINE EXHAUSTS. STEAM PAPER DRYING



MOTOR-GENERATOR SET AND CONTROL UNITS FOR REWINDER MOTOR ON A PAPER MACHINE

the tops of the motors. These bearings have never required adjustment.

The main boiler house lies along the railroad siding between the machine room and the fuel tanks near the southern extremity of the yard. A battery of eight 500-hp. B. & W. water-tube oil-fired boilers extend in a single row down the center with a clear clean space all around them. An inclosure at the north end contains the active electric and the stand-by steam boiler-feed pumps, the fuel-oil pumps and the steam-turbine-driven 180-kw., 550-volt alternating-current emergency generator which is used for lights and machine shops should the hydro-electric power be interrupted.

About 30,000 gal. of fuel oil is being used per day to generate about 5,800 boiler-horsepower from seven boilers at 1.66 load factor. The normal boiler pressure is 125 lb., 95 deg. F. superheat, and the evaporation rate is 14 lb. actual, 15½ lb. equivalent. The draft is 0.1 in. of water, $CO_2$ content of flue gases 13 per cent, and temperature of the flue gases 550 deg. F. The output of two boilers is required for heating the mill in winter. The feed water is admitted at 205 deg. F. from the dryers without heating and is made up from soft filtered river water.

As before stated, the mill product — "news" — is composed of approximately 25 per cent chemical pulp and 75 per cent mechanical pulp; hence the logs leave the storage pile by two routes to meet finally in the mixing system. The sulphite process produces about 1,200 lb. of air-dry sulphite fiber per cord of wood. It may be noted that being floated down the river, tumbled through the barkers and then onto and out of the storage piles so thoroughly mixes the spruce and balsam logs that there is practically no variation in the quality of product, actual checks at the conveyors over several hours having shown that the proportions vary less than 2 per cent.

In the sulphite process the cleanest logs are selected at transfer points in the conveyor system and sent to the chipper building. Here they may be washed in a drum similar to the drum barkers but shorter; then, if knots or discolored spots remain, such logs receive special treatment on a knife barker.

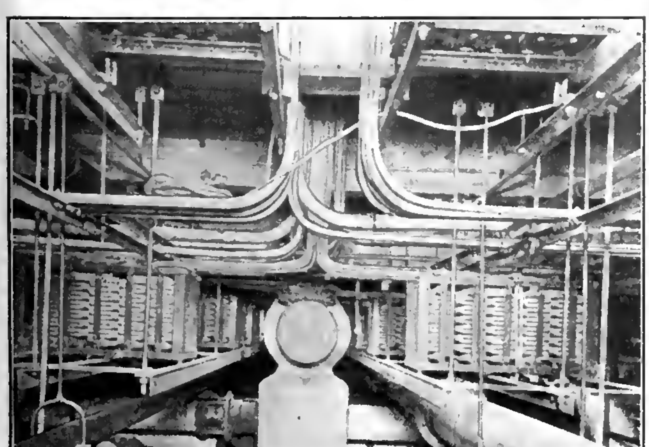
The thoroughly cleaned logs now go to the chippers,

TABLE II—ELECTRIC MOTOR DRIVES ON YARD CONVEYORS

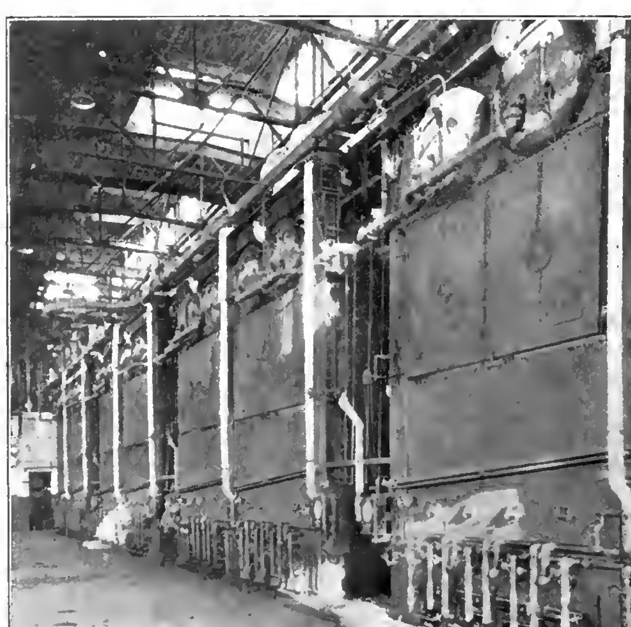
(Total connected load, 360 hp.; 550 volts, alternating current.)

| | |
|---|---|
| Wood-preparing plant to storage system: | |
| Gears; one 35-hp., 860-r.p.m., wound rotor. | C. W.* |
| To south pile: | |
| Gears; one 25-hp., 860-r.p.m., wound rotor | C. W. |
| To middle pile: | |
| Gears; one 25-hp., 860-r.p.m., wound rotor. | C. W. |
| To north pile: | |
| Gears; one 50-hp., 860-r.p.m., wound rotor. | C. W. |
| Along north pile: | |
| Gears; three 35-hp., 860-r.p.m., wound rotor. | C. W. |
| Three stackers: | |
| Gears; three 50-hp., 860-r.p.m., wound rotor. | C. W. |
| Portablo conveyor: | |
| Gears; one 15-hp., 860-r.p.m., wound rotor. | C. W. |
| From storage system to chipper building: | |
| Gears; one 25-hp., 860-r.p.m., wound rotor. | C. W. |
| From storage system to grinding floor: | |
| Gears; one 50-hp., 860-r.p.m., wound rotor. | C. W. |

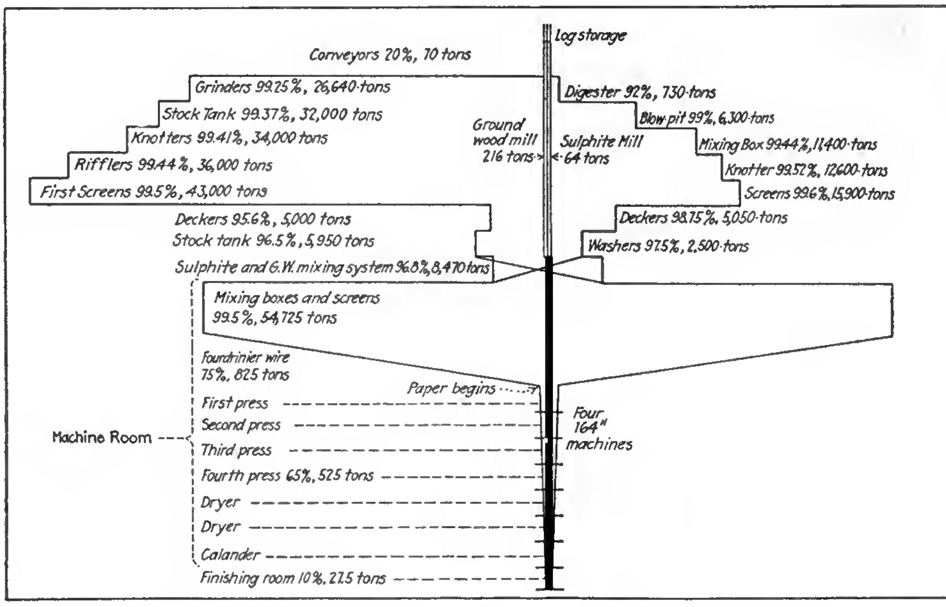
*Canadian Westinghouse.



RESISTORS AND CONDUITS UNDER MACHINE ROOM FLOOR. DRYER JACKETS AT RIGHT AND LEFT



IN THE MAIN BOILER HOUSE ARE EIGHT 500-BOILER-HORSEPOWER OIL-FIRED BOILERS

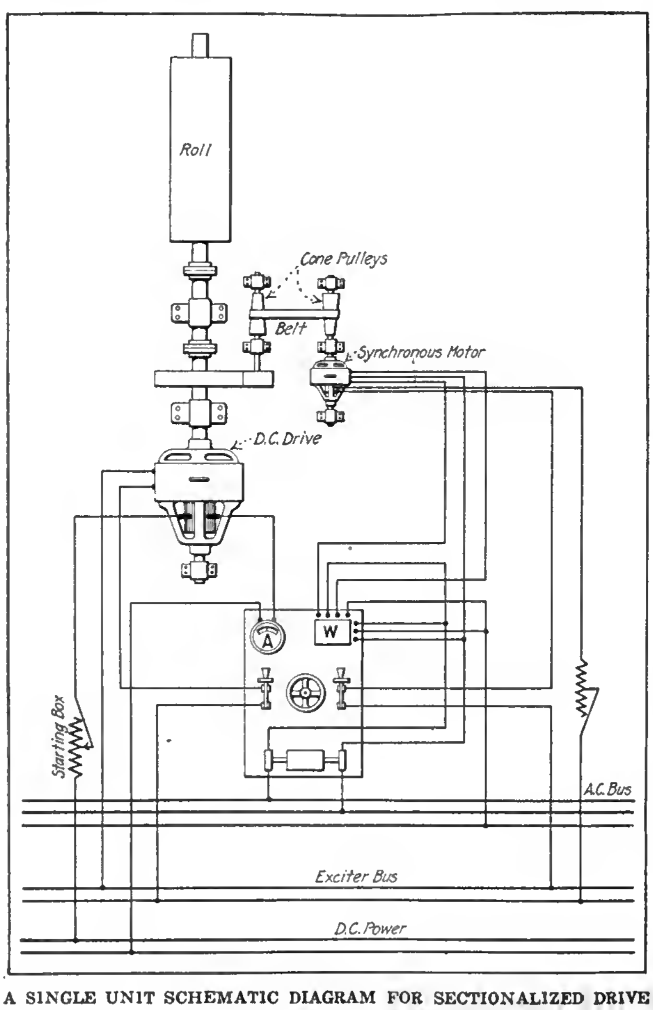



SCHEMATIC OUTLINE OF THE PRODUCTION PROCESS FROM LOGS TO PAPER

of which there are two, each taking its quota. The chipper is a heavy 7-ft. disk carrying three radial blades set as in a plane. The logs by ones, twos or threes, according to size, are fed down a chute at an angle of 45 deg. with the disk, and they are rapidly reduced to chips the size of "small change."

Conveyors take these chips to the tops of large inclined oscillating screens which allow the suitable sizes to fall through onto a conveyor, while the larger pieces slide over a low dam down a chute to the rechipper or "hog" for resizing, whence they return to the screens. Fine particles of the nature of sawdust are blown out and go to the refuse-burning boiler house. The acceptable chips cross over to the digester house on a belt conveyor.

The washing drum and chippers in Table IV are of the wound-rotor type on account of the heavy starting duty. The drum may have to start up with a heavy load of logs in place, and the chippers are characterized by their flywheel effect, which imposes a heavy starting duty.




A SINGLE UNIT SCHEMATIC DIAGRAM FOR SECTIONALIZED DRIVE ON PAPER MACHINE

The chip bin is a huge steel-supported wooden trough just above the digester-charging floor with slide-controlled openings directly over the digesters. By swinging large funnels around on hand cranes, the chips can be discharged into the two digesters, each taking about twenty cords in twenty-five minutes for a feeding.

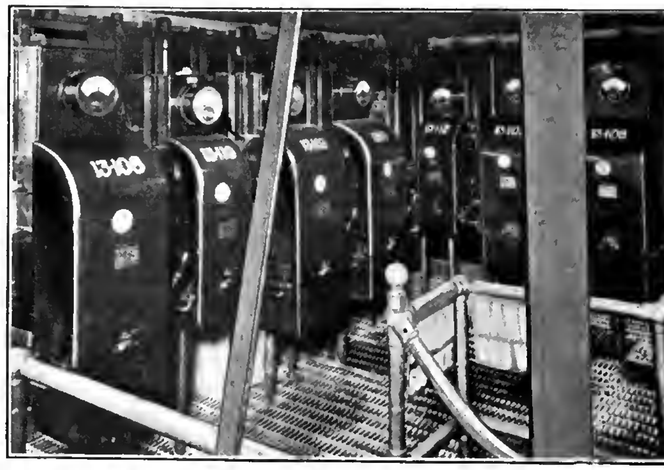
The "acid" building alongside is arranged for preparing and storing quantities of bisulphite of lime. This is made by first melting and then burning sulphur in rotary furnaces and combustion chambers. The resulting sulphur-dioxide gas is water-cooled and forced upward through high towers that are packed with limestone. A supply of water trickles down through the limestone and combines with the gas to form the bisulphite of lime, which is recirculated through the towers before being stored in huge vats.

The digesters are vertical steel tanks with conical top sand bottoms and lined with acid-resisting bricks and mortar. After being filled with chips about 25,000 gal. of bisulphite of lime is pumped in, taking twenty minutes.

Steam is admitted at the bottom, and the pressure gradually mounts to 70 lb., with a resulting temperature of 316 deg. F. The steam flow practically stops after two hours, but the "cook" is continued for over five hours, taking about 250 boiler-horsepower-hours per ton of air-dry pulp. The process of selective digestion lasts about eight hours and is for the specific purpose of digesting the ligneous and resinous binders without harming the cellulose ($C_9H_{10}O_5$) fibers that go into the paper. At the end of the "cook" the contents of the digester are blown into a covered concrete "blow pit," which has a perforated bottom through which the waste liquor drains off to the sewer. The steam and gas fumes pass off through high baffled towers called vomit stacks, which are designed to prevent the escape of pulp. The pulp is now thoroughly washed in the blow pits for several hours until practically nothing remains but the silky unbroken fibers of cellulose.

When the stock leaves the digesters it is 92 per cent water, and it becomes 99 per cent water while being washed in the blow pits. It now goes to a 35,000-gal. stock tank, which stores up enough to convert the intermittent discharges from the digesters into a continuous

EIGHTEEN FLOW METERS ARE ELECTRICALLY RELAYED FROM EIGHTEEN DEPARTMENTS USING STEAM



COMPENSATORS ON GALLERY OVER GROUND-WOOD PUMP PIT TO CONTROL SEVEN PUMPS

process beyond the tank. Horizontal-shaft agitators in this tank keep the contents from settling.

From the tank a steady flow goes through a mixing box, which by the addition of white water from an extracting process further along doubles the volume. A rotary screen of the type called a knotter extracts the coarser clots and fiber bundles, and a still further refinement takes place in the improved rotary meshed-drum "first" screens, which pass only the individual fibers through very narrow slits. The rejected material from the knotters and first screens passes through a "second" screen, which returns the valuable portion to the main stream back of the first screens and sends the coarser parts to the wrapping-paper department.

The stock now cascades down five steep meshed thickeners into tanks in which revolve partly submerged screen thickener drums. The excess water falls through the inclined screens or passes to the inside of the drums, while the pulp adhering to the outside of the drums falls over dams and flows to the soft-stock tank below. The thickeners reduce the water flow from 2,900 g.p.m. to about 400 g.p.m., which leaves the stock about the consistency of thin porridge. The extracted white water goes to a tank, to be worked back into the system in various ways. The screens and thickeners are in a belted group drive with other miscellaneous machinery.

A sulphite soft-stock tank, with a capacity of 45,000 gal., is equipped with a horizontal-shaft agitator to prevent separation. A small addition to this stock comes from two inclined "save-alls" which give the white-water tank overflow a last screening before it goes to the sewer.

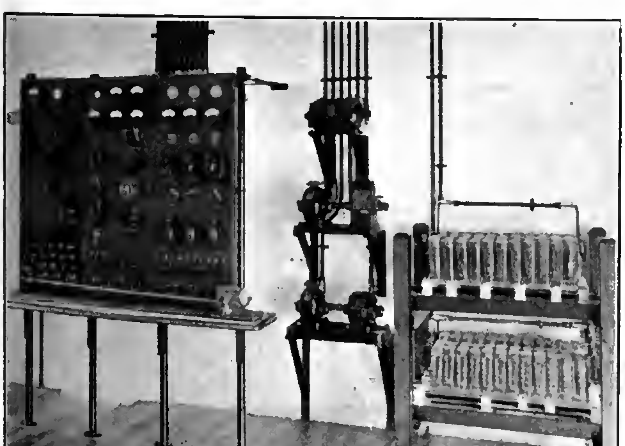
The extreme simplicity of "squirrel-cage" motors make them ideal where the starting duty is comparatively light and where no speed variation is required. They are started with compensators, and in many cases a meter is added to indicate the load. All the motors are protected without the use of fuses.

### THE MAKING OF GROUND-WOOD PULP

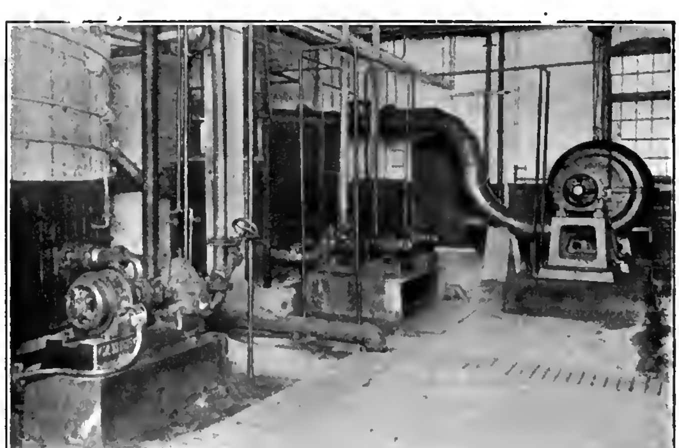
Interest in the ground-wood department centers about the grinders, for here is the heaviest draft on electric power and the greatest material transformation, all carried on with relentless energy and yet with just that skill and delicacy that produce unvaryingly the balance between quality and quantity which goes so far to uphold the mill's production record.

Six General Electric 2,400-hp., 2,200-volt synchronous motors, backed by their switchboards, oil-switch cells, starting compensators and exciter motor-generator sets, form the most imposing array of power in the mill.

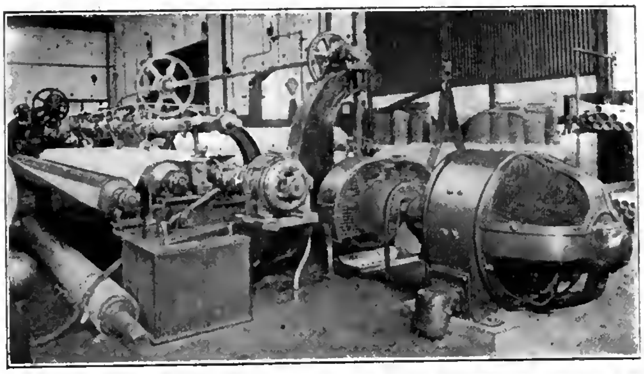
These synchronous motors are designed to allow for a large leading power factor even at fractional loads. As their load far outweighs all the induction motors combined, the power factor for the mill is exceptionally high and is under control through field regulation of the synchronous motors.

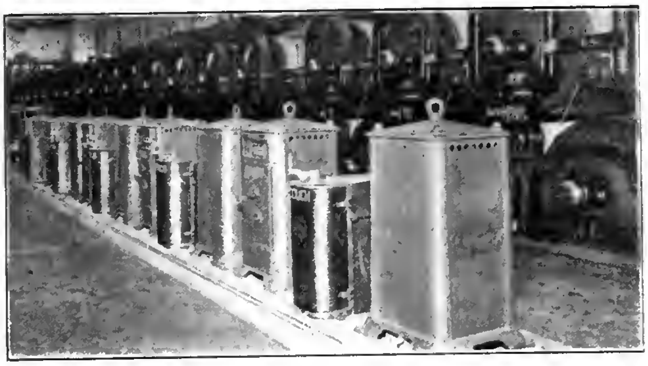


A 25-VOLT STORAGE BATTERY SYSTEM ENERGIZES ABOUT 4,800 CIRCUITS FOR TELEPHONES, FIRE ALARMS, WATCHMEN'S STATIONS, ETC.



AUXILIARIES IN THE SULPHITE ROOM MUST HAVE LEAD FITTINGS AND ACID-PROOF CONSTRUCTION TO PREVENT THEIR DETERIORATION





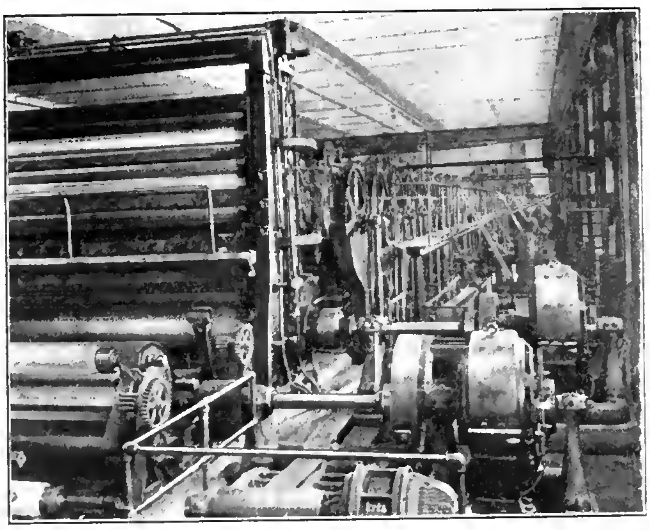
**Many Motors Operate the Paper Machine**

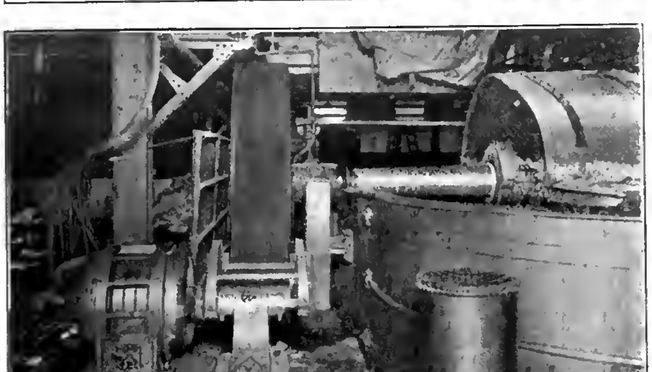
Upper view: An alternating-current motor drives the slitter and a direct-current motor with speed control is used on the rewinder.

Second view: Drum controllers and panel housings for wet end of a paper machine.

Third view: Each of the nine sections of the paper machine has its own motor drive.

Lower view: Motor-driven broke beater for two paper machines using Lenix belt drive.





Wood grinding furnishes an ideal load for synchronous motors as the grinders have light starting load when the pressure is relieved. They have a constant load characteristic regulated by an automatic device, and the total load is so great that the power factor for the whole plant is kept at unity. It is of interest to note that the induction motor load alone has a power factor of 72 per cent.

These synchronous motors are started by reduced voltage-tap compensators, and the power factor is controlled on the individual motors by their field rheostats. The motors are designed for 72 per cent leading power factor and 96.2 per cent efficiency at full load.

Each 2,400-hp. motor is direct-connected to the end of a shaft that carries two grindstones 60 in. in diameter by 54-in. face, thus making twelve stones in all. The seventh set, which will make fourteen stones, is being installed.

The grinders are of the Watrous magazine type—i.e., the wood is fed into vertical chambers that reach to the charging floor, where they are kept filled from wood bins that are in turn kept replenished by the conveyor system. The 4-ft. logs are laid in the magazine parallel to the shaft, making two compact stacks per stone in the magazines with the stone between them at the bottom. The logs that lie alongside the stone on either side are forced against the stone by hydraulic pistons until they are ground away. When the pistons have completed their strokes, they automatically withdraw, allowing more logs to fall into the vacant spaces, when the relentless forward travel of the pistons begins again. The withdrawal of the pistons is accomplished by the low-pressure 50-lb. water system, while the grinding pressure is applied by the 190-lb. water pressure, using, however, only about 150 lb. in service.

Without water the wood would burn and the stones would burst from heat; therefore some 6,000 gal. of white water is flushed over the twelve stones, serving to bring the ground wood away as pulp which is over 99 per cent water. Even so, the heat generated evolves a great amount of steam. This, however, is ejected by an ingenious system which leaves the department unusually clear. In the side of each magazine is a toothed wheel which is turned as the wood sinks toward the stone, and registers the cords of wood ground.

Provision is made for burring the stones at regular intervals by means of a built-in hydraulic burring lathe, without interfering with production, and a light burring at three-hour intervals is said to give very uniform results. Each stone, consuming about 900 hp., grinds 17 tons of air-dry pulp per twenty-four-hour day, and the pulp is of such high quality that refining processes usually resorted to are omitted in this mill.

The pulp after leaving the grinders passes through

TABLE III—ELECTRIC MOTOR DRIVES IN PUMP HOUSE
(Total connected load, 1,862.5 hp.; 550 volts, alternating current.)

| | |
|---|---|
| Two 10-in., 2,000-g.p.m., 120-lb.-head fire pumps: | |
| Direct; two 200-hp., 1,200-r.p.m., squirrel-cage. | G. E.* |
| Two 20-in. vertical 10,000-g.p.m., 35-ft.-head pumps, river to filters: | |
| Direct; two 125-hp., 514-r.p.m., squirrel-cage. | G. E. |
| One 16-in. vertical 6,000-g.p.m., 35-ft.-head pump, river to filters: | |
| Direct; one 75-hp., 720-r.p.m., squirrel-cage. | G. E. |
| One 10-in. 1,800-g.p.m., 140-ft.-head pump, river to mill: | |
| Direct; one 100-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| Two 18-in. 10,000-g.p.m., 120-ft.-head pumps, filters to mill: | |
| Direct; two 400-hp., 1,200-r.p.m., wound rotor. | G. E. |
| One 10-in. 4,000-g.p.m., 120-ft.-head pump, filters to mill: | |
| Direct; one 200-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| One filter washer and air pump: | |
| Direct and chain; one 30-hp., 900-r.p.m., squirrel-cage. | G. E. |
| Screen washer: | |
| Gears; one 7½-hp., 1,140-r.p.m., squirrel-cage. | C. W.† |

*General Electric. †Canadian Westinghouse.

inclined sliver screens having a large area, leaving the slivers on the surface, from which they are raked by chain-operated scrapers.

A tank holding 96,000 gal. receives the raw stock, together with the return of useful stock from the second screens further down the line. Still more white water is added in the knotter mixing box before the stock goes to the four improved Sherbrooke rotary-screen knotters. Fiber bundles and other overlarge units are washed off the upper inside surface of the drums and pass to the wrapper-machine system, as was the case in the sulphite department.

The stock now flows into long rifflers, which are fitted with submerged baffles to arrest sand from the stones and other heavy impurities. Four improved rotary first screens further refine the stock while they discharge undesirable matter to the second screens for a rescreening.

A battery of thirty deckers thickens the stock by removing all but about one-tenth of the water. This is done by rotating meshed drums partly submerged in the stock. The water runs into the drum and away to the ground-wood white-water tank, while the pulp left on the surface is scraped off and passes to the concrete cavelike ground-wood soft-stock tank, which holds 890,000 gal. A reserve tank can take 750,000 gal.

### Waste Water Leaves Mill Practically Clear

The white water extracted from the pulp in both divisions and the overflow from the circulating system in the paper mill proper go to their respective white-water tanks. The sulphite tank gets a great quantity from the paper-mill tank, and the ground-wood white water is augmented by a small quantity from the same source. This water all contains valuable pulp, and both divisions make use of "save-alls" to recover a major portion of it. The ground-wood "save-alls" discharge pulp to a "save-all" stock tank, thence to the main soft-stock tank. The water with reduced pulp content passes to the "save-all" white-water tank, thence back into the system by way of the grinders, the sliver screens and the first screens.

In the sulphite department the "save-alls" discharge the recovered pulp directly to the main soft-stock tank. The reduced white water goes in a small part to the mixing box, to the first and second screens, while the major part goes to the sewer at the rate of about 20,000 tons per day. This is practically the only outlet of any size from the system, and by this time the water is practically free from pulp.

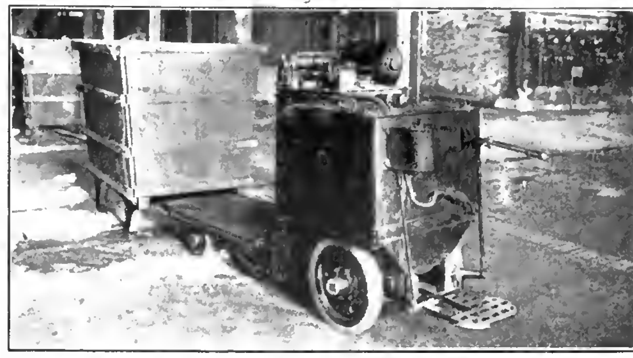
### The Two Kinds of Pulp Are Now Mixed

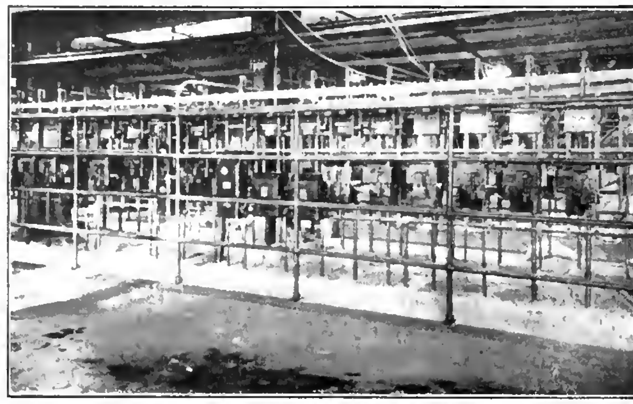
The pulp from both soft-stock tanks as it starts on its way to the mixing system has its consistency regulated by an automatic system which continually samples the flow and admits white water in such quantities as are

TABLE IV—ELECTRIC MOTOR DRIVES IN CHIPPER BUILDING
(Total connected load, 453 hp.; 550 volts alternating current.)

| | |
|---|---|
| Washing drum: | |
| Belts and gears; one 50-hp., 860-r.p.m., wound rotor. | C. W.* |
| Knife barker: | |
| Belts; one 50-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Conveyor to chippers: | |
| Gears; one 25-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Two chippers: | |
| Belts; two 125-hp., 690 r.p.m., wound rotor. | C. W. |
| Two chipper screens: | |
| Belts and gears; one 50-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Rechipper, blower and log splitter: | |
| Belts; one 25-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Chipper-knife grinder: | |
| Belts; one 3-hp., 1,710-r.p.m., squirrel-cage. | Cr. Wh.† |

*Canadian Westinghouse. †Crocker-Wheeler.





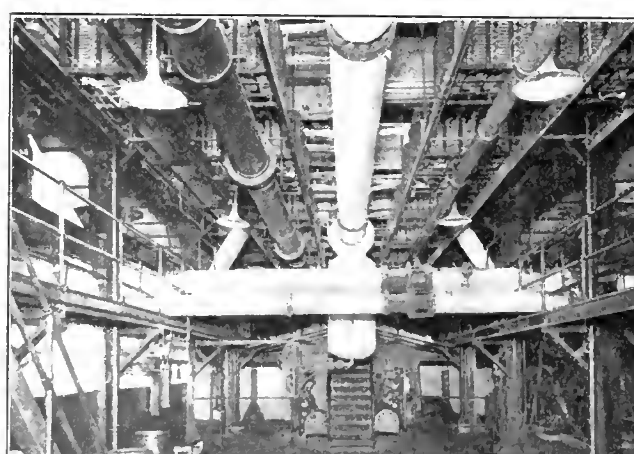
**Each Paper Machine Is a Unit**

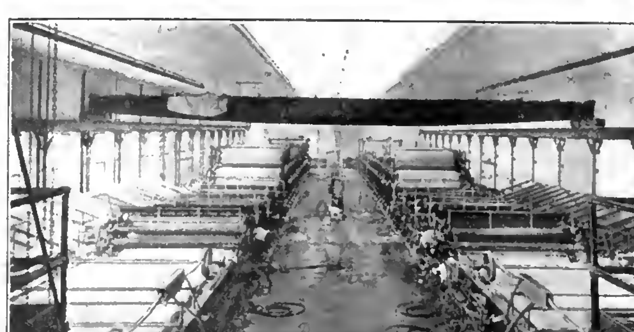
Upper view: A Lakewood elevating electric truck for carrying wet broke to broke beaters.

Second view: Switches and compensators for auxiliaries and paper machine sections.

Third view: Resistors and conduit in basement under dryers. Control panels for turbo-generators in center background.

Lower view: Bagley and Sewell 164 in. paper machines. Control units in center opposite dryers. Both machines making paper at 800 ft. per minute.





needed to keep the flow at a uniform consistency of 96.5 per cent water for the sulphite and the same for the ground-wood stock.

The two streams meet in the mixing system, wherein uniform heads are held against adjustable orifices. The heads are automatically held so that the two streams add 25 per cent and 75 per cent, or whatever other proportion is desired, to the whole. Incorporated with this unit are the feeds for the solution of alum and for the blue color. Both the Trimbly and Allen consistency regulators and the mixing system mentioned above are highly ingenious machines controlled by continuous-running fractional-horsepower motors whose importance in the general process is much greater than their sizes would indicate.

### Another Screening Process Follows

The two machine chests that next receive the "stuff" hold 225,000 gal. From here the stuff is pumped to four constant-level stuff boxes which have return overflows.

TABLE V—ELECTRIC MOTOR DRIVES IN DIGESTER AND ACID BUILDINGS
(Total connected load, 217.5 hp.; 550 volts alternating current.)

| | |
|---|---|
| Chip conveyors from chipper building: | |
| Gears; 10-hp., 570 r.p.m., squirrel-cage. | C. W.* |
| Chip bucket elevator to chip bin: | |
| Gears; 35-hp., 860-r.p.m., wound rotor. | C. W. |
| Chip conveyor over chip bin: | |
| Gears; 15-hp., 900-r.p.m., squirrel-cage. | G. E.† |
| Two rotary sulphur burners: | |
| Gears; one 10-hp., 690-r.p.m., squirrel-cage. | C. W. |
| Gas blower to acid towers: | |
| Direct; one 10-hp., 900-r.p.m., wound rotor. | G. E. |
| One 2½-in. 250 g.p.m., 110-ft.-head water to acid towers: | |
| Direct; one 15-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| One 2½-in. 250-g.p.m., 110-ft.-head pump, acid to acid towers: | |
| Direct; one 15-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| Two 2½-in., 250-g.p.m., 50-ft.-head pump, acid to storage: | |
| Direct; two 7½-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| Two 8-in., 1.600-g.p.m., 65-ft.-head pumps, acid to digester: | |
| Direct; two 40-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| Acid tower elevator: | |
| Geared; one 10-hp., 900-r.p.m., wound rotor. | O. F.‡ |
| Digester building elevator: | |
| Geared; one 10-hp., 900-r.p.m., wound rotor. | O. E.‖ |
| Ventilating fans: | |
| Three 5-hp., 1,800-r.p.m., squirrel-cage. | C. W. |

*Canadian Westinghouse. †General Electric. ‡Otis Fensom. ‖Otis Elevator.

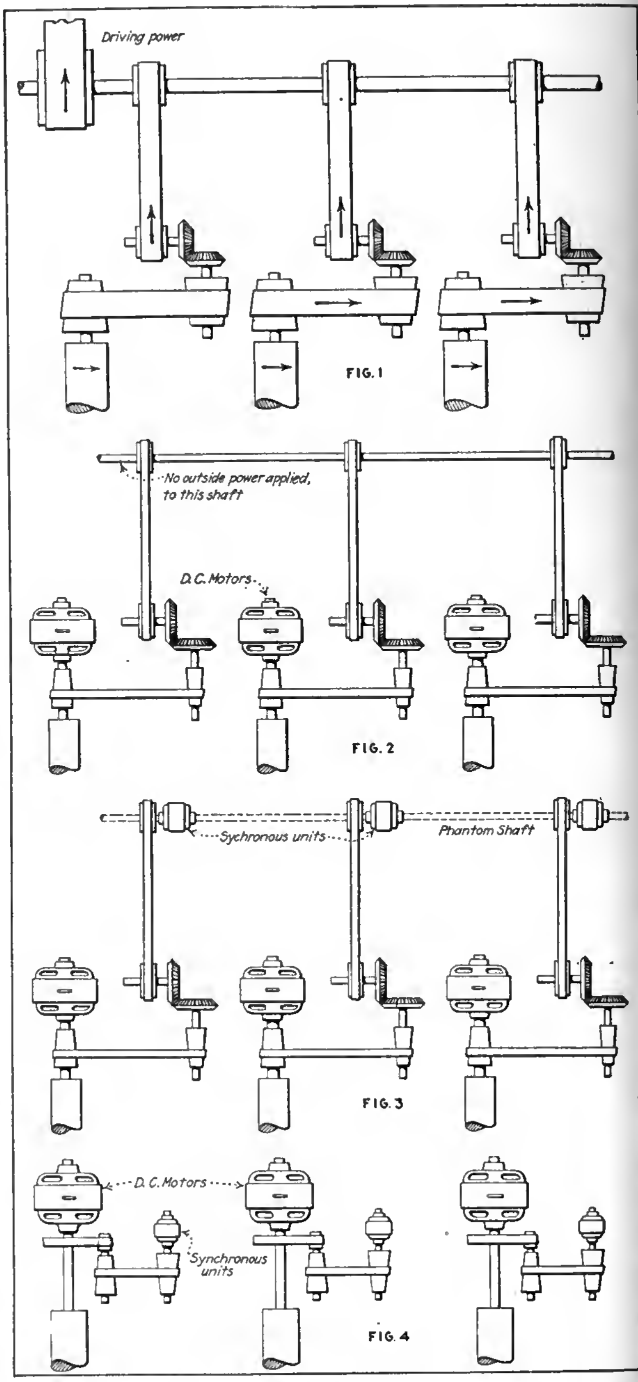
Next in order are the four mixing boxes, where the 1,600-g.p.m. flow is boosted to 14,000 g.p.m. by the circulating white water, about 64,000 tons being passed through the four machines every twenty-four hours. Each paper machine is preceded by three inward-flow rotating Bird screens which remove the last traces of undesirable matter and thoroughly agitate the fibers to insure a uniform quality of paper.

The tailings from the Bird screens go to second screens, where the rejected material is removed by hand and the material passed goes back to the paper machines.

The four Bagley & Sewell 164-in. paper machines are placed side by side in the machine room, which is 175 ft. wide and 320 ft. long. They are driven by the General Electric Company's sectionalized electric drive, using direct-current motors which take their current from a turbine-generator for each paper machine.

### Paper Machines Have Sectional Drive

One paper machine is made up of nine independent sections, which, however, are intimately related as to speeds in linear feet per minute. These speeds, though slightly different for each section, are required to be maintained in precise adjustment in order to produce an unbroken sheet of uniform quality. At a speed of 800 ft. per minute the "stuff," 99½ per cent water, is converted into specification paper containing 10 per cent water in forty-five seconds. It is a race between the




THE EVOLUTION OF PAPER MACHINE DRIVE FROM ALL MECHANICAL TO SECTIONALIZED ELECTRICAL

water content on the one hand and gravity, suction, pressure and heat on the other hand.

The first section is the Fourdrinier wire, an endless belt of fine brass mesh the width of the machine. It runs around two rolls about 50 ft. apart, one of which, the couch roll, is driven by a directly connected motor. The upper surface of the "wire" is supported by a number of small table rolls, and near the couch roll and inside of the couch roll as well are installed a number of suction boxes extending the entire width in which a vacuum of 10 in. to 16 in of mercury is maintained.

A uniform stream of stock about ⅝ in. deep the entire width of the wire belt is poured on with a velocity practically equal to that of the wire. During the three seconds that elapses while passing to the couch roll the greater part of the water falls through the wire mesh

and the fibers are left in a felted sheet, which is further compacted by the forcible extraction of water as it passes over the suction boxes.

At the couch roll the deposited fibers have become paper. This is still 75 per cent water, but it has sufficient strength to withstand the strain of being peeled from the wire, whence it passes over an open space unsupported to the wool-felt-carrying member of the next section, which is the first press.

It can readily be seen that the speeds of these two sections must be adjusted with microscopic accuracy in order that the delicate web may not be overstretched on the one hand or not be carried away fast enough on the other hand. Through the press sections, of which there are four in series (three in use), each with its motor drive, the paper is carried on wool-felt between rollers under heavy pressure. The top rolls are made of polished granite with the pressure further augmented by compounded levers carrying weights. The bottom roll of the first press is provided with a vacuum box. These presses reduce the water content from 75 per cent to about 66 per cent, during which process the strength of the sheet is very materially increased.

The next unit, by far the largest and heaviest of all, is the dryer section, which consists of forty-four finished revolving cast-iron drums each 5 ft. in diameter by 13½ ft. long and heated by the exhaust steam from the turbine. This steam still holds about 88 per cent of the heat that it contained as it came from the boilers. The drums are all geared together and are fitted with a canvas belt having a total length of more than 600 ft. and as wide as the machine, since it must carry the paper. Means are provided for extracting the condensate from the rolls and returning it for boiler feed. The rate and extent of drying is controlled by adjusting the back pressure on the turbine. This section requires two motor drives on account of the great length of the train of gears.

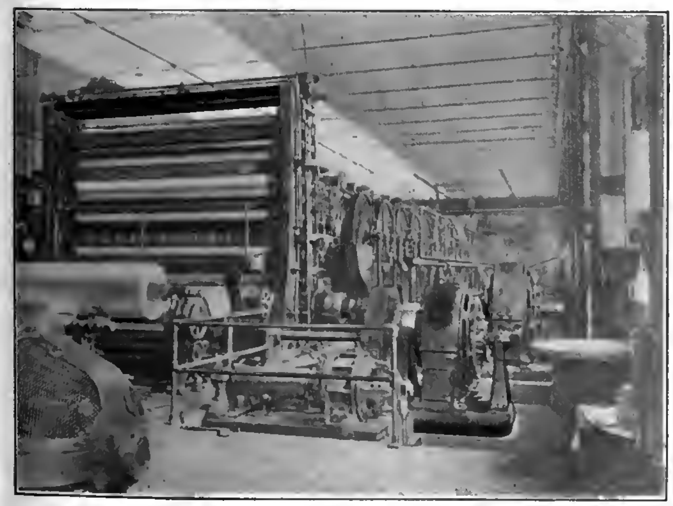
There is also provided an auxiliary alternating-current drive for this section with a large gear reduction which is used for convenience in starting or for low-speed operation of the drives. The combined weight of all the rolls in this section is 375 tons and the starting duty is very high, principally owing to bearing friction. About 15,000 lb. at 1 ft. radius is required to start the section after a shutdown of a few hours. The mass inertia prolongs the starting load, as the 375 tons of revolving parts are made up almost entirely of 5 ft. drums. The section can be started by the direct-current motors alone by a special switching arrangement which puts the two motor armatures in series, thus relieving the load on the turbine generator. The alternating-current motor for starting and running up to 80 ft. per minute allows for the adjustment and renewal of "felts" or repairs on Sunday without operating the 500-kw. direct-current turbine.

TABLE VI—ELECTRIC MOTOR DRIVES IN SULPHITE SCREEN ROOM

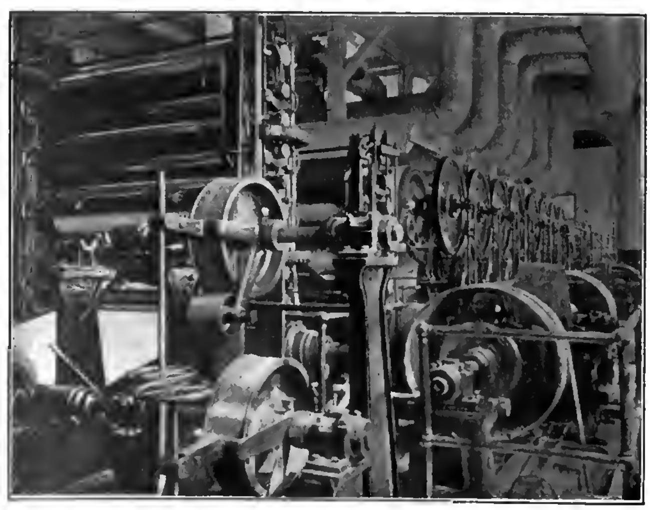
(Total connected load, 1,440 hp.; 550 volts alternating current.)

| | |
|---|---|
| One 10-in., 1,800-g.p.m., 135-ft.-head, white water to pits: | |
| One 100-hp., 1,800-r.p.m., squirrel-cage. | G. E.* |
| One agitator blow-pit soft-stock tank: | |
| One 25-hp., 690-r.p.m., squirrel-cage. | C. W.† |
| One knotter screen: | |
| One 5-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Three first screens and one second screen (rotaries): | |
| One 150-hp., 790-r.p.m., squirrel-cage. | G. E. |
| One 5-in. 500-g.p.m., 160-ft.-head pump, white water shower to screens: | |
| One 40-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| One 10-in., 2,500-g.p.m., 45-ft.-head pump, white water to screens: | |
| One 42-hp., 1,200-r.p.m., squirrel-cage. | G. E. |
| One 10-in., 3,865-g.p.m., 20-ft.-head pump, stock screens to washers: | |
| One 40-hp., 720-r.p.m., squirrel-cage. | G. E. |
| One 3-in., 300-g.p.m., 200-ft.-head, pump, showers to washers: | |
| One 24-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| Four sulphite stock washers, four drums each: | |
| One 25-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Two agitator, screen-room soft-stock chests: | |
| Two 25-hp., 690-r.p.m., squirrel-cage. | C. W. |
| One 1,360-g.p.m., 25-ft.-head pump, white water to "save-alls": | |
| One 15-hp., 1,200-r.p.m., squirrel-cage. | G. E. |
| One 600-g.p.m., 28-ft.-head pump, "save-all" stock to tank: | |
| One 10-hp., 900-r.p.m., squirrel-cage. | G. E. |
| One agitator, sulphite soft-stock tank: | |
| One 10-hp., 720-r.p.m., squirrel-cage. | G. E. |
| One 620-g.p.m., 41-ft.-head pump, sulphite stock to mixer: | |
| One 20-hp., 1,200-r.p.m., squirrel-cage. | G. E. |
| Two stock consistency regulators: | |
| Two 0.1-hp., 1,750-r.p.m., squirrel cage. | R. & M.‡ |
| Color pumps: | |
| One 5-hp., 690-r.p.m., squirrel-cage. | C. W. |
| Mixer for G. W. stock, sulphite stock, alum and color: | |
| One 0.5-hp., 1,750-r.p.m., squirrel-cage. | R. & M. |
| Beater for sulphite laps: | |
| One 50-hp., 690-r.p.m., wound rotor. | C. W. |
| Wet machine No. 1: | |
| One 50-hp., 690-r.p.m., wound rotor. | C. W. |
| Wet machine No. 2: | |
| One 50-hp., 860-r.p.m., wound rotor. | C. W. |
| One 2½-in., 250-g.p.m., 50-ft.-head pump, showers to wet machines: | |
| One 7.5-hp., 1,800-r.p.m., squirrel cage. | G. E. |
| Four Jordans: | |
| Four 150-hp., 327-r.p.m., squirrel-cage. | G. E. |
| Screen room fan: | |
| One 5-hp., 1,730-r.p.m., squirrel-cage. | C. W. |

*General Electric. †Canadian Westinghouse. ‡Robbins & Myers.



PAPER MACHINE FROM DRY END SHOWING MOTORS ON CALENDER REEL AND REWINDER



WRAPPER MACHINE FROM DRY END SHOWING LINE SHAFT THROUGH CONE PULLEYS

TABLE VII—ELECTRIC MOTOR DRIVES IN GROUND WOOD MILL

(Total connected load, 15,100 hp.; 2,300 volts alternating current.)

| | |
|---|---|
| One conveyor cross-connecting long conveyors over charging floor: | |
| One 10-hp., 690-r.p.m., squirrel-cage. | C. W.* |
| Two conveyors, 220 ft. long over charging floor: | |
| Two 25-hp., 900-r.p.m., squirrel-cage. | G. E.† |
| Cut-off saw charging floor: | |
| One 5-hp., 1,800-r.p.m., squirrel-cage. | Cr. Wh.‡ |
| Ventilating fan charging floor: | |
| One 7.5-hp., 720-r.p.m., squirrel-cage. | C. W. |
| Air compressor: | |
| One 2-hp., 1,800-r.pm., squirrel-cage. | G. E. |
| Two heater fans, grinding room, 15,000 cu.ft. per minute: | |
| Two 5-hp., 1,800-r.p.m., squirrel-cage. | C. W. |
| Heater-fan grinder building: | |
| One 15-hp., 900-r.p.m., squirrel-cage. | G. E. |
| Heater-fan screen room: | |
| 15-hp., 690-r.p.m., squirrel-cage. | C. W. |
| Ventilating fan, grinder floor: | |
| One 5-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Two motor-generator exciter sets for grinder motors: | |
| Two 350-hp., 1,200-r.p.m., 2,200-volt | G. E. |
| Two 225-kw., 1,200-r.p.m., 125-volt direct-current generators, | G. E. |
| Two oil pumps for grinder load regulators: | |
| Two 2.5-hp., 1,200-r.p.m., 110-volt, direct-current. | G. E. |
| Grindstone trimmer: | |
| One 10-hp., 900-r.p.m. wound rotor. | G. E. |
| Two 3-in., 266-g.p.m., 404-ft.-head, four-stage pumps, high pressure: | |
| Two 50-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| Two 480-g.p.m., 201-ft.-head pumps, low-pressure grinder, jack water: | |
| Two 50-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| Six two-stone magazine grinders: | |
| 2,652-kva., 240-r.p.m., 2,200-volt synchronous. | G. E. |

(Total connected load, 14,150 hp.; 500 volts alternating current.)

| | |
|---|---|
| Two sliver screens: | |
| One 15-hp., 720-r.p.m., squirrel-cage. | G. E. |
| One 6,300-g.p.m., 41-ft.-head pump, white water to grindstone: | |
| One 100-hp., 1,620-r.p.m., squirrel-cage. | G. E. |
| One 252-g.p.m., 97-ft.-head pump, 'save-all," white water to grinder showers: | |
| One 100-hp., 1,200-r.p.m., squirrel-cage. | G. E. |
| Four rotary knotters: | |
| One 10-hp., 860-r.p.m., squirrel-cage. | C. W. |
| Two 14-in., 5,000-g.p.m., 57-ft.-head pumps, stock to knotters: | |
| Two 100-hp., 900-r.p.m., squirrel-cage. | G. E. |
| One 3-in., two-stage, 300-g.p.m., 200-ft.-head pump, filtered water shower and first screen: | |
| One 25-hp., 1,180-r.p.m., squirrel-cage. | G. E. |
| Two second screens: | |
| One 50-hp., 750-r.p.m., wound rotor. | G. E. |
| Thirty deckers in groups of five: | |
| Six 25-hp., 600-r.p.m., wound rotor. | G. E. |
| One 2,400-g.p.m., 83-ft.-head pump decker, white water to tank: | |
| One 75-hp., 1,200-r.p.m., squirrel-cage. | G. E. |
| Two white-water pumps to "save-alls": | |
| Two 7.5-hp., 570-r.p.m., squirrel-cage. | C. W. |
| One 6-in. 98-ft.-head pump, "save-all," stock to decker stock tank: | |
| One 30-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| One 1,700-r.p.m., 60-ft.-head pump, "save-all," white water to screen showers: | |
| One 40-hp., 1,800-r.p.m., squirrel-cage: | G. E. |
| One 10-in., 25-ft.-head pump, rejections from fine screens: | |
| One 30-hp., 900-r.p.m., squirrel-cage. | G. E. |
| One pump rejections from second screens to wrapping machine system: | |
| One 100-hp., 720-r.p.m., squirrel-cage. | G. E. |
| One vertical 80-g.p.m., 25-ft.-head pump, sump pit to sewer: | |
| One 5-hp., 1,300-r.p.m., squirrel-cage. | C. F.‖ |
| One 1,350-g.p.m., 96-ft.-head pump, stock to mixing system: | |
| One 50-hp., 1,200-r.p.m., squirrel-cage. | G. E. |

*Canadian Westinghouse. †General Electric. ‡Crocker-Wheeler. ‖Canadian Fairbanks.

The paper now goes to the calender, which is made up of ten polished steel rolls in a vertical stack, with a 100-hp. motor directly connected to the bottom roll. The paper goes to the top of the stack and passes in and out between the rolls to the bottom, where it emerges a bright, smoothly finished sheet of paper.

The reel just beyond the calender rolls up the product into units weighing about 1½ tons. While not affecting the nature of the paper, this unit has also to be intimately tied in as to speed with the other sections. The entire course through the paper machine takes about forty-five seconds.

These reels of paper are lifted by means of an electric parallel-motion hoist to stands, from which the paper is run through the slitter, which trims off the edges and slits the paper into two or more parts. The rewinder now rewinds the paper on paper tubes with metal ends that are adapted to the printing presses on which the paper will be used. It is usual to make two 73½-in. rolls, each weighing about 1,400 lb. The rewinder is driven by a 30-hp. motor with speed control by means of a rheostat in the field of an alternating-current-motor-driven direct-current generator in the basement. The trimmings from the sheet and other "broke" resulting from various causes are put through a beater in the basement, which reduces the wet or dry broke to pulp that can be returned to the system at the machine chest.

The commercial rolls are now taken to the finishing

TABLE VIII—ELECTRIC MOTOR DRIVES FOR ONE OF FOUR 164-IN. PAPER MACHINES

(Total connected load, 488 hp.; 550 volts, alternating current.)

| | |
|---|---|
| One 2,900-g.p.m., 56-ft.-head pump, stock from chest to mixing box, common to 4 machines: | |
| One 60-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage. | G. E.* |
| One 2,000-g.p.m., 28-ft.-head pump, suction white water to mixing box: | |
| One 25-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One 4,800-g.p.m., 40-ft.-head pump, stock to machine screens: | |
| One 75-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| Four rotary machine screens: | |
| Four 5-hp., 600-r.p.m., 550-volt, A.C., squirrel-cage. | C. W. |
| One 1,000-g.p.m., 70-ft.-head pump, fresh water to showers: | |
| One 30-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One Fourdrinier shaker (not used): | |
| One 1-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| Two Nash vacuum pumps, Fourdrinier suction boxes and couch suction box: | |
| Two 100-hp., 720-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One turbine-generator set for driving nine sections of paper machine: | |
| One 500-kw., 900-r.p.m., 330-volt, D.C. generator. | G. E. |
| One 35-kw., 900-r.p.m., 125-volt, D. C. exciter. | G. E. |
| One Fourdrinier section drive at couch roll: | |
| One 150-hp., 136-r.p.m., 245-volt, D.C. | G. E. |
| One 20-hp., 857-r.p.m., 210-volt, synchronous unit. | G. E. |
| One Nash vacuum pump, first press suction roll: | |
| One 100-hp., 750-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One first press drive: | |
| One 100-hp., 143-r.p.m., 245-volt, D.C. | G. E. |
| One 20-hp., 857-r.p.m., 210-volt, synchronous unit. | G. E. |
| Three second, third and fourth press drives: | |
| Three 50-hp., 151.3-r.p.m., 245-volt, D.C. | G. E. |
| Three 20-hp., 857-r.p.m., 210-volt, synchronous units. | G. E. |

(Total connected load, 630 hp.; 245 volts, direct current.)

| | |
|---|---|
| One dryer (two-motor drive): | |
| Two 100-hp., 150.1-r.p.m., 245-volt, D.C. | G. E. |
| One 20-hp., 857-r.p.m., 210-volt, synchronous unit. | G. E. |
| One dryer (starting and slow running) "kicker": | |
| One 30-hp., 1,800-r.p.m., 550-volt, A.C., wound rotor. | G. E. |
| One calender drive: | |
| One 100-hp., 147.7 r.p.m., 245-volt, D.C. | G. E. |
| One 20-hp., 857-r.p.m., 210-volt, synchronous unit. | G. E. |
| One fan for broke from calender to broke heater: | |
| One 15-hp., 1,150-r.p.m., 550-volt, A.C., squirrel-cage. | C. W.† |
| One calender-roll hoist gear: | |
| One 10-hp., 900-r.p.m., 550-volt, A.C., wound rotor. | G. E. |
| One reel drive: | |
| One 30-hp., 98.5-r.p.m., 245-volt, D.C. | G. E. |
| One 20-hp., 857-r.p.m., 210-volt, synchronous unit. | G. E. |
| One reel hoist: | |
| One 3-hp., 1,200-r.p.m., 550-volt, A.C. | N. W.‡ |
| One slitter drive: | |
| One 3-hp., 1,200/900-r.p.m., 550-volt, A.C., wound rotor. | G. E. |
| One fan to blow trimmings from slitter to broke beater: | |
| One 3-hp., 1,750-r.p.m., 550-volt, A.C., squirrel-cage. | C. W. |
| One motor-generator set for rewinder drive: | |
| One 50-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One 32-kw., 1,200-r.p.m., 250-volt, D.C. | G. E. |
| One rewinder drive: | |
| One 35-hp., 330-r.p.m., 245-volt, D.C. | G. E. |
| One hoist for rewinder: | |
| One 3-hp., 1,200-r.p.m., 550-volt, A.C. | N. W. |

*General Electric. †Canadian Westinghouse. ‡North West.

room, where they are securely protected by heavy wrapping paper made from the rejections of the sulphite and ground-wood mill.

### SECTIONALIZED PAPER-MACHINE DRIVE AN ACHIEVEMENT OF NOTE

Sectionalized motor drive for a paper machine presents one of the most exacting and complex of the thousands of special applications of electric motors to industrial arts.

(a) In order to compete it must use less power, must save space and must cost less to maintain than the conventional mechanical line-shaft drive.

(b) In order to operate successfully it must allow for a wide range of speed in paper production. It must be easily adjusted for "stretch or draw" between the sections and must hold that adjustment unchanged either by creepage or hunting. It must enable the operator to slow down or stop any section without disturbing the others. All its members and attendant control features must be sturdy and self-reliant to operate where inspection is possible only at 160-hour intervals.

All these rigid specifications are met on these machines as they have been on many others.

### OPERATION.

The General Electric sectionalized drive is operated in the following manner. In the basement below each paper machine there is installed a 500-kw. direct-current-geared turbine-generator shaft. The line voltage determines the rate of production on the paper machines and is 185 volts for 800 ft. per minute, with a workable range from 500 ft. to 1,200 ft. per minute. This voltage is controlled from the machine room by a chain-operated rheostat in the 500-kw. generator field. The turbine speed and the exciter voltage are held constant.

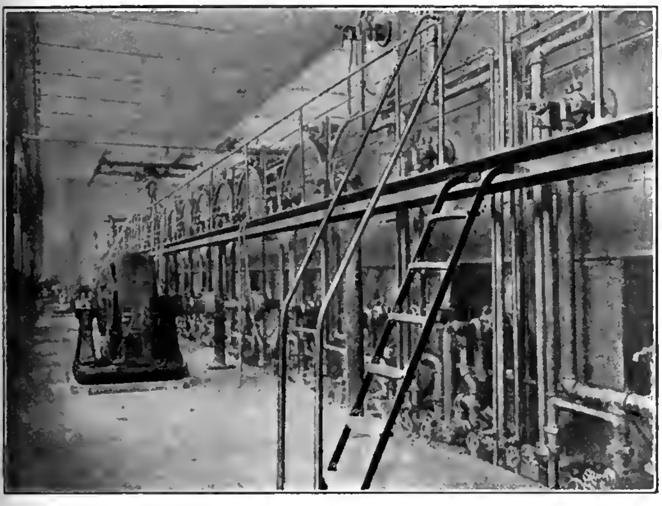
The motors driving the various sections have their fields energized by the 125-volt exciter. They are large, low-speed units designed for about 150 r.p.m. at 245 volts so as to avoid the interposition of gears. The couch roll and calender stack each take a 100-hp. motor, while the presses each take a 50-hp. motor, the dryer two 100-hp. motors and the reel a 30-hp. and the rewinder a 35-hp. motor, all of the shunt-wound interpole type.

With the exception of the rewinder motor and the second motor on the dryer, each motor is accompanied by a 20-hp. synchronous motor—or generator, as the case for the moment may be—and these synchronous tie-in units are all connected to a common three-wire, three-phase bus to which nothing else is connected. Their fields are energized from the 125-volt exciter. These synchronous units are belted through cone pulleys to the direct-current motors, with the exception of the first dryer motor. In that case the cone pulleys are dispensed with as the speed of this unit is taken as par and the "stretch and draw" of the other sections are regulated to this base speed.

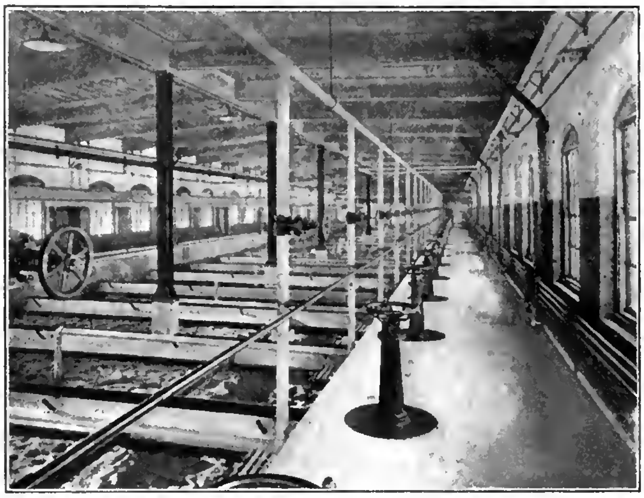
The effect of these synchronous units tied in as they are is similar to that of a great flywheel which can be neither delayed nor hurried. With all the motors running, any direct-current motor and the section it drives may be adjusted as to speed by moving the belt along on the cone pulleys. If the direct-current motor field strength is right, the synchronous unit will be simply idling, as indicated by its ammeter. Should the direct-current motor be inclined to run faster, the synchronous unit becomes a generator giving energy to the other similar units which for the time may be performing as motors. This puts a restraining load on the direct-current motor and effectually holds it in line. Conversely, if a direct-current motor is inclined to slow down, its attached synchronous unit would supply aid as a motor again, effectually holding the section in line.

These guide units can aid or hold back up to 40 hp. each, and by occasional hand adjustment of the direct-current motor-field rheostats these exchanges of loads can be kept near to zero. Little attention is paid to the loads on these units, however, and the meters bear only a center mark and outside limit marks. Any change in the load on one unit affects the other eight by only one-eighth of the change. The belt shifter is brought through to the front of the machine, and the machine tender can change the speed of a section by a fraction of 1 per cent with the assurance that it will hold that place until he makes a further change.

When it is necessary to slow down or stop an individual section, the ordinary drum controller is resorted to, and its first step disconnects the synchronous unit from the common bus. Thereafter the section is controlled in the ordinary manner. After the section is brought up to normal speed the synchronous unit is tied in by



DRYER SECTION OF PAPER MACHINE SHOWING 100-HP. D.C. DRIVING MOTOR



TWENTY SAND FILTER BEDS HAVE A CAPACITY OF 20,000,000 GAL. PER DAY

TABLE IX—ELECTRIC MOTOR DRIVES COMMON TO THE FOUR PAPER MACHINES
(Total connected load, 633 hp., 550 volts, alternating current.)

| | |
|---|---|
| Two broke beaters: | |
| Two 50-hp., 720-r.p.m., 550-volt, A.C., wound rotor. | G. E.* |
| Two agitators in broke-stock chests: | |
| Two 5-hp., 690-r.p.m., 550-volt, A.C., squirrel-cage. | C. W.† |
| Two 6-in., 800-g.p.m., 57-ft.-head pumps, broke stock to machine chests: | |
| Two 25-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| Two air compressors: | |
| Two 100-hp., 690-r.p.m., 550-volt, A.C., squirrel-cage. | C. W. |
| Four machine-room heater fans: | |
| Four 25-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| Four machine-room heater fans: | |
| Four 15-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| Four finishing-room heater fans: | |
| Four 3-hp., 1,120-r.p.m., 550-volt, A.C., squirrel-cage. | C. W. |
| One pump, hot-water return from heating system: | |
| One 15-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| Two wet broke-truck battery chargers: | |
| Two 3.5-hp., 1,150-r.p.m., 550-volt, A.C. | E. P.‡ |
| One finishing-room rewinder. | |
| One 25-hp., 860-r.p.m., 550-volt, A.C., wound rotor. | C. W. |
| Two elevators between finishing and shipping departments: | |
| Two 27-hp., 600-r.p.m. | O. F.‖ |

*General Electric. †Canadian Westinghouse. ‡Electric Products. ‖Otis Fensom.

TABLE X—ELECTRIC MOTOR DRIVES IN WRAPPER-MACHINE DEPARTMENT
(Total connected load, 335 hp.; 550 volts, alternating current.)
(Total connected load, 105 hp.; 240 volts, direct current.)

| | |
|---|---|
| Two 6-in., 700-r.p.m., 25-ft.-head pumps, wrapper-stock beater: | |
| Two 10-hp., 900-r.p.m., squirrel-cage. | G. E.* |
| One stock beater: | |
| One 50-hp., 750-r.p.m., wound rotor. | G. E. |
| Two Claflin refiners: | |
| Two 75-hp., 430-r.p.m., squirrel-cage. | C. W.† |
| One Jordan: | |
| One 100-hp., 400-r.p.m., squirrel-cage. | G. E. |
| Agitator in stock chest: | |
| One 15-hp., 690-r.p.m., squirrel-cage. | C. W. |
| One turbine-generator set: | |
| 100-kw., 1,200-r.p.m., 240-volt, D.C. | G. E. |
| Constant-speed line-shaft drive: | |
| One 30-hp., 775-r.p.m., 230-volt, D.C. | G. E. |
| Variable-speed line-shaft drive: | |
| 36/75-hp., 400/1,000-r.p.m., 240-volt, D.C. | G. E. |
| Vacuum pump: | |
| 7.5-hp., 1,800-r.p.m., squirrel-cage. | G. E. |
| Exhaust fan: | |
| One 15-hp., 690-r.p.m., squirrel-cage. | C. W. |

*General Electric. †Canadian Westinghouse.

TABLE XI—ELECTRIC MOTOR DRIVES IN SHOPS
(Total connected load, 174 hp.; 550 volts, alternating current.)

| | |
|---|---|
| One line shaft and blacksmith blowers: | |
| One 10-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage. | G. E.* |
| One line shaft, machine shop: | |
| One 15-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One pipe threader: | |
| One 5-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One ventilating-fan machine shop: | |
| One 10-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One welding set: | |
| One 7.5-hp., 1,800-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One planer: | |
| One 10-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One shaper: | |
| One 5-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One keyseater: | |
| One 5-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One drill press: | |
| One 5-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One roll grinder: | |
| One 10-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| Two 5-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage. | G. E. |
| One pipe cutter: | |
| One 10-hp., 860-r.p.m., 550-volt, A. C., squirrel-cage. | G. E. |
| Two line shafts, pattern shop and carpenter shop: | |
| Two 30-hp., 860-r.p.m., 550-volt, A.C., squirrel-cage. | C. W.† |
| Two heater fans, pipe and machine shops: | |
| Two 5-hp., 1,720-r.p.m., 550-volt, A.C., squirrel-cage. | C. W. |
| One elevator, machine shop: | |
| One 25-hp., 900-r.p.m., 550-volt, A.C. | A. B. S.‡ |
| One concrete mixer: | |
| One 15-hp., 1,140-r.p.m., 550-volt, A.C. | Wag.‖ |
| One air compressor, portable: | |
| One 1-hp., 725-r.p.m., 550-volts, A.C. | Wag. |

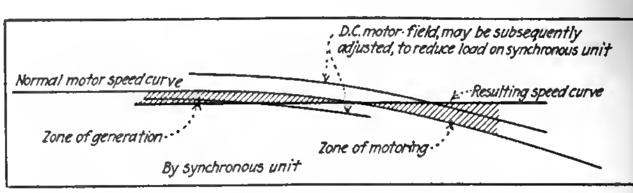
*General Electric. †Canadian Westinghouse. ‡A. B. See. ‖Wagner.

pushing a button at the controller. Should the motor-overload circuit breaker open, it also disconnects the guide unit.

After a complete shutdown, as, for instance, to put in a new Fourdrinier wire, all the sections can be restarted, brought up to speed and tied in as fast as the controllers can be handled. The tying in by the synchronous units does not require any special manipulation, as, being belted to their respective sections, they are always so closely in accord that there need be no delay on their account.

As previously mentioned, the wrapper machine takes the rejected material from the ground-wood screen room and sulphite screen room and converts it into heavy wrapping paper, making about 10 tons in eight hours. The stock passes through beaters and Jordans and then to the wrapper-machine room. The wrapper machine is of the cylinder type and is driven by two motors, one on the constant-speed line shaft carrying auxiliaries and one on the variable-speed shaft driving the paper machine itself. These are both direct-current motors operated by a turbo-generator set which carries 30 lb. back pressure in order that the steam may have sufficient heat to dry this very thick paper.

The shop machinery is driven both in groups through line shafting and with individual motors connected to machines. There are blacksmith, machine, pipe, carpenter and pattern shops and a roll-grinding room fully equipped to handle all routine work of mill maintenance.




RANGE OF MOTOR PERFORMANCE IN THE SECTIONALIZED PAPER MACHINE DRIVE

The lighting of this mill is particularly well distributed and was laid out with a view to economy without sacrificing light where light is needed. There are about 1,200 tungsten lamps averaging 100 watts and actually running from 75 watts to 200 watts. They are fed by open conduits, using condulets for outlets, and are all equipped where practicable with 18-in. white enameled reflectors. The lighting load is about 120 kw.

In this mill, the only one 100 per cent electrified mill in the paper industry, may be found practical applications of electric power in many forms. The pumping of water and stock forms a large percentage of the load, and the combined output of the pumps is about 140,000 gal. per minute. A reference to the diagram showing the water content in the materials as they pass through the various operations will indicate how important these units are. The grinding of wood on such a wholesale plan by electric motors, while not new, is so well worked out here that it is worthy of considerable study. Only in very recent years has it been considered feasible to grind wood other than by direct application of water power. The hundreds of wide scattered auxiliary units of every conceivable type could certainly not be located so conveniently or operated so economically with any other form of power transmission than electric motor drive. Finally, the sectional motor drive of the paper machines themselves is a very fine development of special industrial engineering and works out very much to the satisfaction of the trade.

# Lansing to Have Architecturally Uniform Lighting System

## Plan Whereby Every Paved Street Will Ultimately Be Lighted from Ornamental Underground-Fed Standards—Five Classes of Illumination Adapted to All City Streets

By OSCAR E. BULKELEY
*Superintendent Board of Water and Electric Light Commissioners*

LANSING, the capital of Michigan, will be the first city in the United States to have an architecturally uniform system of street-lighting units. A comprehensive scheme which will provide eventually for the illumination of every paved street by ornamental, underground-fed standards has been adopted, and the first 350 units are now being installed. The lighting plan was formulated by the writer in consultation with illuminating engineers of the General Electric Company and was an outgrowth of a general feeling of dissatisfaction with the existing boulevard lighting system, which is not only poorly designed but inefficient. It was realized that the time was opportune for a change, while the investment in the existing lighting system was still comparatively small, while no great loss would be involved in replacement, and before making a substantial additional investment for extending the system. This was especially true since the contemplated extensions included the most important thoroughfares in the city.

The scheme adopted divides the illumination into five classes according to types of streets and their lighting requirements, as follows: The principal business streets, the secondary business streets, the main boulevards and thoroughfares, the secondary residential streets, the parks, plazas and other open places.

The standards and lighting units on all streets will be of the same architectural family and will harmonize in design with one another and with their surroundings. Thus the distressing variance in types that is so often noticeable where a city's lighting equipment has been acquired piecemeal will be absent in Lansing. On the contrary, a novel and very pleasing uniformity in appearance will characterize the plan.

This installation will be the first in which the design, known by some as the Saratoga unit, will be produced in alabaster rippled glass, this pattern having heretofore been restricted to globes having a diffusing surface. This will give an added element of distinctiveness to Lansing's new system.

### INTENSIVE LIGHTING ON BUSINESS THOROUGHFARES

Intensive lighting will be used in the main business sections of Washington and Michigan Avenues. In these sections standards 20 ft. from ground to light source, carrying two form 12 "Novalux" units with medium alabaster rippled globes and canopies, each equipped with a 10,000-lumen (1,000-cp.), 20-amp. series tungsten lamp are proposed. In the bases of the standards will be installed type IL transformers with taps that will permit the future use of 15,000-lumen (1,500-cp.) lamps. This transformer raises the 6.6-amp. line current to 20 amp. Not only will this provide for the use of the more efficient high-current lamp, but it will effectively insulate the pole from the high voltage of the underground circuit and protect the lamp from line surges. The standards are to be spaced from 110 ft. to 135 ft. apart and opposite each other. At present the business district is inadequately lighted by obsolete cluster-type standards, although there are now installed nearly double the number of standards contemplated in the new lighting system.

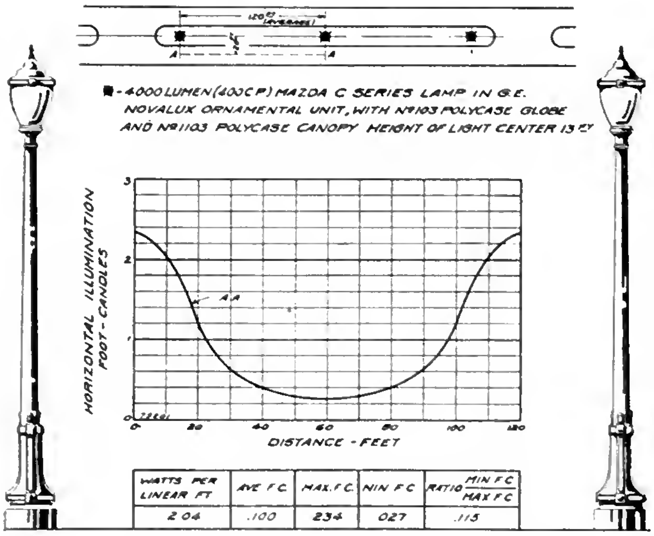
Similar units to those just described will be installed along secondary business streets, with the difference that only one unit to a standard will be used. The standards will be approximately 15 ft. from the ground to the light source. On the more important secondary streets and on the principal streets beyond the two-light standards 10,000-lumen (1,000-cp.) lamps are planned. In other locations 6,000-lumen (600-cp.) lamps, with provision for the use later of 10,000-lumen lamps, will be used.

### SPACING OF UNITS AND STAGGERING OF STANDARDS CONFORM TO STREET WIDTHS

The spacing of the units on these secondary streets will vary with the width and importance of the street. On the narrow ones the standards will be staggered, with one every 55 ft. or 75 ft. On wide streets the standards will be placed opposite one another at intervals of from 100 ft. to 125 ft. as this staggering will produce better illumination.

The main boulevards and thoroughfares are the principal routes for incoming and outgoing traffic and hence demand lighting that will make it possible to drive an automobile through them at a moderate speed without the use of bright headlamps. In these installations 4,000-lumen (400-cp.) tungsten lamps in form 8 "Novalux" "Polycase" glassware will be used, mounted on a King Manufacturing Company's standard of French design, providing for a height of 13 ft. to the light source. The spacing will be approximately 100 ft. at street intersections, increasing to a maximum of 140 ft.

Pennsylvania Avenue is an example of a broad boulevard having a grass parkway in the center ornamented




| WATTS PER LINEAR FT | AVE F.C. | MAX. F.C. | MIN F.C. | RATIO MIN F.C / MAX F.C |
|---|---|---|---|---|
| 2.04 | .100 | .234 | .027 | .115 |

LIGHT DISTRIBUTION CURVE AND DATA ON INTENSITIES FOR A TYPICAL UNIT

with shrubs and flower designs, on either side of which is a paved driveway. There will be a single row of the boulevard-type standards placed on the center line of this parkway. There is, however, a section of this boulevard south of Main Street where trolley tracks will be placed in the central parking. There the lighting standards will be installed along the sidewalk curb, for the reason that if the units were mounted on the double-bracket trolley poles in the parking, there would be an objectionable shadow on the street side of the

BOULEVARD-TYPE STANDARDS LEND ATTRACTIVENESS TO A CENTER PARKWAY WITH SHRUBS AND FLOWER DESIGNS

trolley cars, especially when a car stopped to discharge or take on passengers.

The IL transformer used with these standards will have a tap which will permit the use of a 6,000-lumen (600-cp.) lamp when increased traffic in certain locations necessitates such a change.

For the secondary residential streets the same standard as that to be used for the boulevard lighting, except that it will be a little shorter, will be employed. It will be equipped with the same lighting unit and a 2,500-lumen (250-cp.) tungsten lamp. The standards will be installed at intervals of from 100 ft. to 150 ft. of street.

### Boulevard-Type Lighting for Drives Will Be Utilized

The main park drives will be equipped with lighting of the boulevard type, and minor roads and walks with standards like those used in the residential districts. Plazas, playgrounds, etc., will be considered from the standpoint of their individual needs and requirements and will be lighted accordingly. Each will be treated as a special installation.

The details of this entire plan have been approved, although its realization in the business district will require the active co-operation of the merchants located there.

When the installation is complete Lansing will have more than a modern and highly efficient lighting system. On account of the uniformity of the types of standards and lighting units selected, the general appearance of the city will be greatly enhanced. Clearly, it will be a progressive step toward the "city beautiful" and will harmonize completely with the city plan which was recently developed for Lansing. Furthermore, the plan is elastic in that it provides for the use of more powerful lamps in any of the standards as the future needs of the city may require.

The installation on Pennsylvania Avenue has been completed and is shown in the accompanying illustration. Groups of ten standards each are connected to individual 2.4-kw. type SL transformers which are fed by existing series street-lighting circuits.

### Details of Cable Construction and Installation Costs

A single conductor No. 8 B. & S. boulevard lighting cable for 600 volts service is used. The cable has 1/16-in varnished-cambric insulation surrounded by a lead sheath of 1/16-in. thickness, which in turn is covered with 100-lb. jute yarn not less than 5/64 in thick, thoroughly impregnated with a hot asphaltum compound. Every length of cable was tested for five minutes on an alternating electromotive force of 3,000 volts, and a 15-ft sample of each length was subjected to a test of 6,000 volts. This is the specification for what is known as 1,250-volt cable.

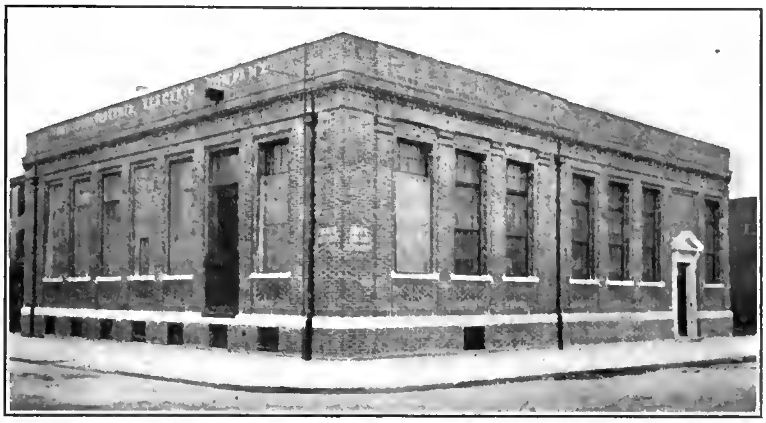
For the installation of eighty-seven of the 13-ft standards, equipped with 400-cp. lamps, the cost for labor is $28.60, material $81, a total of $109.60 per standard. This includes the standard, lighting unit underground cable, type SL transformer and their installation, but does not include any charge for the existing series circuits to which the SL transformers are connected or the constant-current transformers at the station. The cost is considered moderate for so excellent an installation.

# Alternating-Current Substation Design

## Method Adopted for Distribution at 13,200 Volts, Three-Phase, and 2,400 Volts, Two-Phase, Three-Wire—Ample Reserve Capacity and Simplicity in Layout Are Features

By R. A. HENTZ
*Assistant Engineer Electric Design and Construction, the Philadelphia Electric Company*

THE Philadelphia Electric Company has recently put in service two new alternating-current substations to meet the increasing load demand. One of these, known as the Race substation, supplies, along with two older substations, the load of the West Philadelphia residential district. The other substation, known as the Federal substation, supplies, together with an older substation, a combination industrial and residential load in South Philadelphia. These two new substations are very similar in their general characteristics, and a description of one would to a great extent apply to the other. Each is supplied from the generating stations at 13,200 volts, three-phase, 60-cycles, part of the energy being distributed at this voltage and the rest being transformed to 2,400 volts, two-phase, three-wire for other distribution circuits.



EXTERNAL APPEARANCE OF SUBSTATION HARMONIZES WITH SURROUNDING BUILDINGS

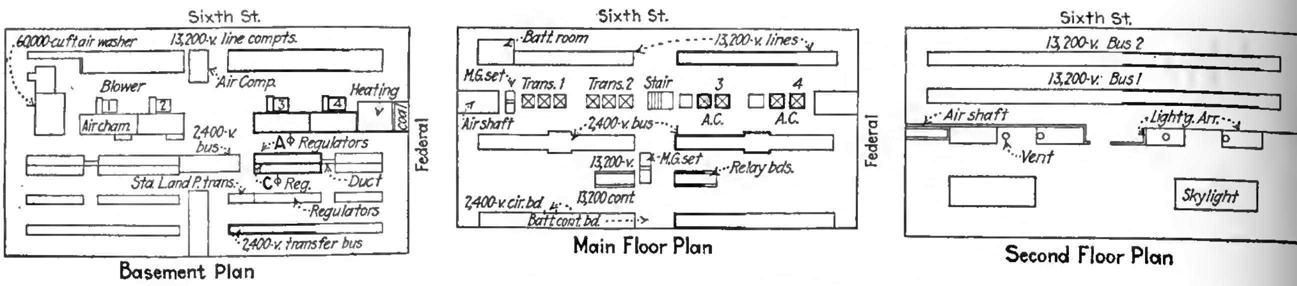
In each substation provision is made for the installation of four banks of transformers, each of 7,500 kva., two of which have been installed and supply the present load requirements. As one of these is a reserve bank, the ultimate rated station capacity is considered to be 22,500 kva. Provision is made in both of the substations for ultimately changing the distribution from 2,400 volts, two-phase, three-wire, to 2,400/4,150 volts, three-phase, four-wire, if it should ever be deemed advisable, at which time the station capacity would be increased 50 per cent by the addition of a third 3,750-kva. transformer to each bank.

The accompanying single-line diagram and cross-sections indicate the general features of the design of this station. It will be noted that double sectionalized buses are provided on both the 13,200-volt and the 2,400-volt system, thus permitting the operation of the station in four entirely separate groups if desired. Provision is made for the installation of reactors on 13,200-volt lines, the Federal station being designed for reactors on any feeder (incoming or outgoing) as well as on the transformer banks. At the Race substation it was felt that reactors on outgoing distribution lines only would be required, and therefore such provision was made only on every third 13,200-volt section.

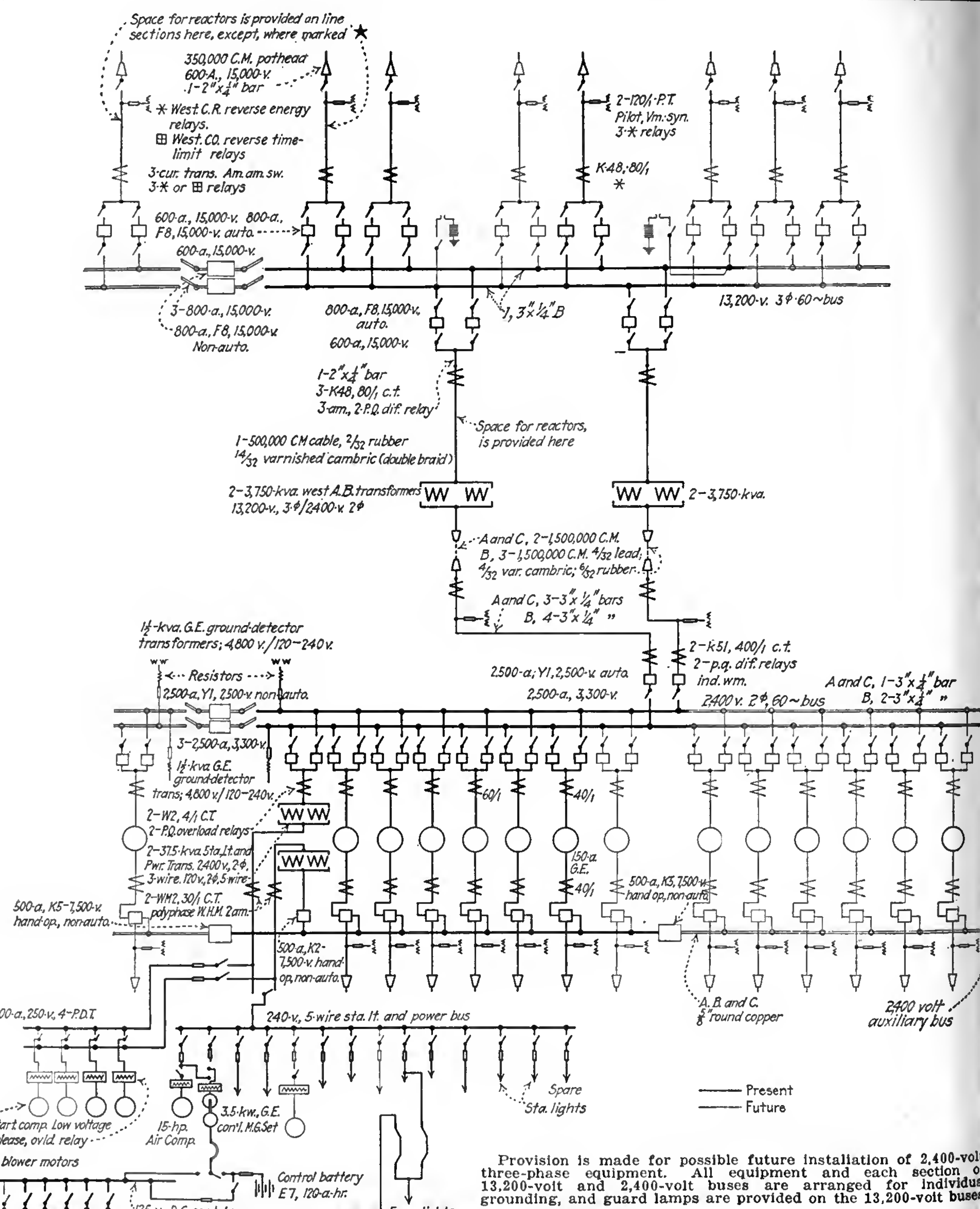
There are two oil circuit breakers (one for each bus) provided on each 13,200-volt circuit, switches of the



PLENTY OF CLEARANCE AND PRECAUTIONS TO PROTECT OPERATORS ARE FEATURES OF THE INSTALLATION




FLOOR PLAN OF SUBSTATION, SHOWING GENERAL ARRANGEMENTS




Provision is made for possible future installation of 2,400-volt, three-phase equipment. All equipment and each section on 13,200-volt and 2,400-volt buses are arranged for individual grounding, and guard lamps are provided on the 13,200-volt buses.

ARRANGEMENTS MADE FOR A DUPLICATION OF EQUIPMENT IN THE FEDERAL SUBSTATION

[C]ondit F-8 type being installed at Fed[e]ral and General Electric H-203 type [a]t Race. The incoming lines are pro[t]ected by Westinghouse CR reverse [e]nergy relays and the outgoing by [W]estinghouse CO overload relays.

## [S]COTT CONNECTION USED TO OBTAIN TWO-PHASE

The transformers, which were fur[n]ished by the Westinghouse company, [a]re Scott-connected for three-phase [t]wo-phase transformation and are [p]rotected by double-coil differential [r]elays. In line with the practice [o]f the company these transformers [a]re of the air-blast type. Condit-[t]ype "Y-1" oil circuit breakers rated [a]t 2,500 amp. are installed on the [l]ow-tension side of these transformer [b]anks, and 500-amp. Condit "D-13-B" [s]olenoid-operated oil-circuit breakers [o]n the 2,400-volt distribution circuits. [P]rovision has been made for the instal[l]ation on these circuits of 250-amp. 10 [p]er cent induction regulators. For the [p]resent units of both 150-amp. and [2]00-amp. are being used. Protection is [a]fforded these circuits by instantane[o]us overload relays, and in the Race [s]ubstation an experimental installation [o]f circuit reclosing relays is now being [t]ried out. It provides for the immedi[a]te reclosing of any circuit that has [t]ripped a given number of times (prob[a]bly three), after which the oil circuit [b]reaker will remain open. If the short-[c]ircuit current at times of initial or [a]ny subsequent opening is excessive, [t]he reclosing equipment will be ren[d]ered inoperative.

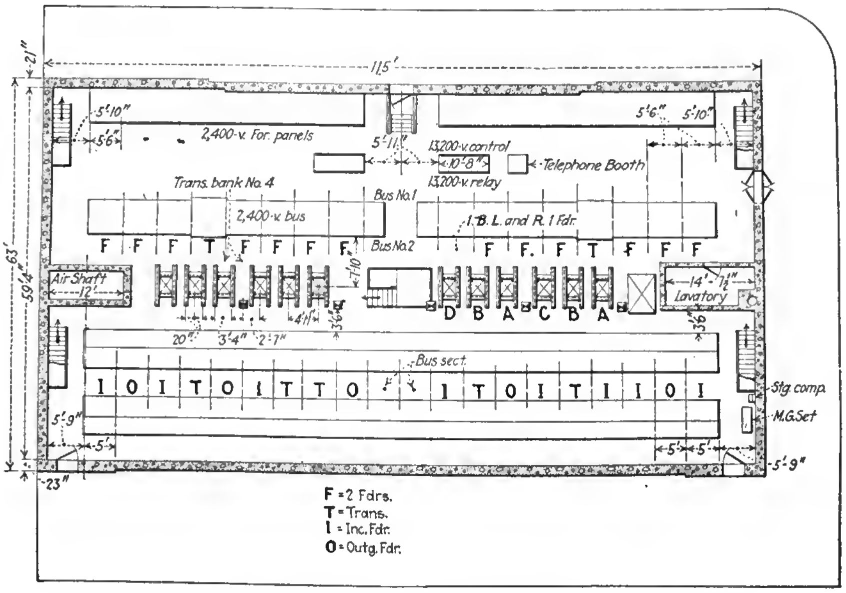
A transfer bus is provided whereby any distribution circuit can be transferred to the section supplying any other circuit in event of a failure of the oil switch or regulators of the first circuit. This transfer bus is sectionalized into four parts.

The station power and lighting supply is obtained through two 75-kva. transformer banks, one being a reserve. They supply the four motors driving the 12,000-c.f.m. Sturtevant No. 75 "Silentvane" blowers, a 100-c.f.m. Worthington air compressor, a 3½-kw. control motor-generator set, a sump pump and station lighting. The control, which is 125 volts, is supplied from the above motor-generator set which floats across a sixty-cell Electric Storage Battery Company "E-7 Exide" storage battery.

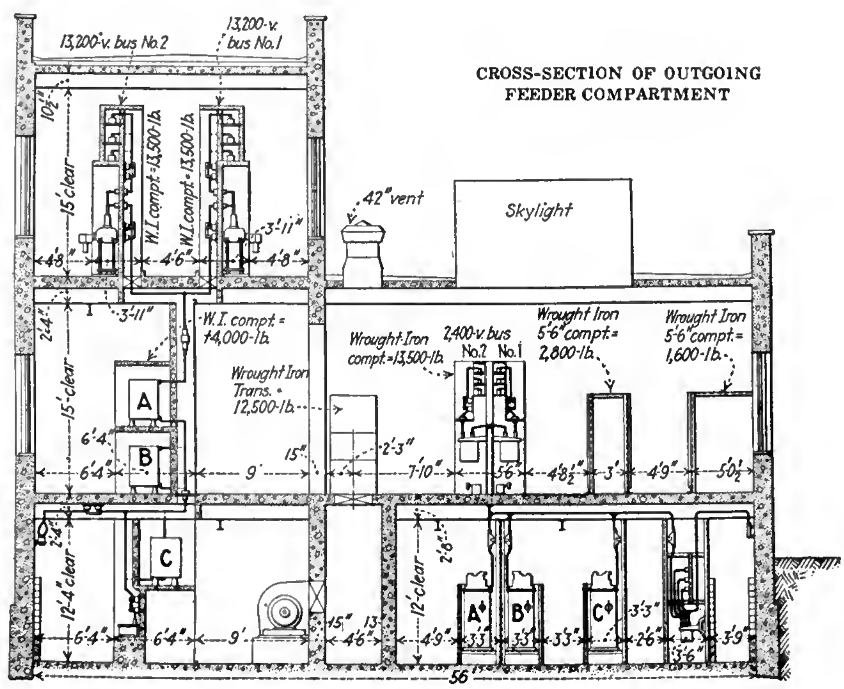
## SPECIAL FEATURES OF DESIGN

Among the features incorporated in the design of both of these stations may be mentioned the following:

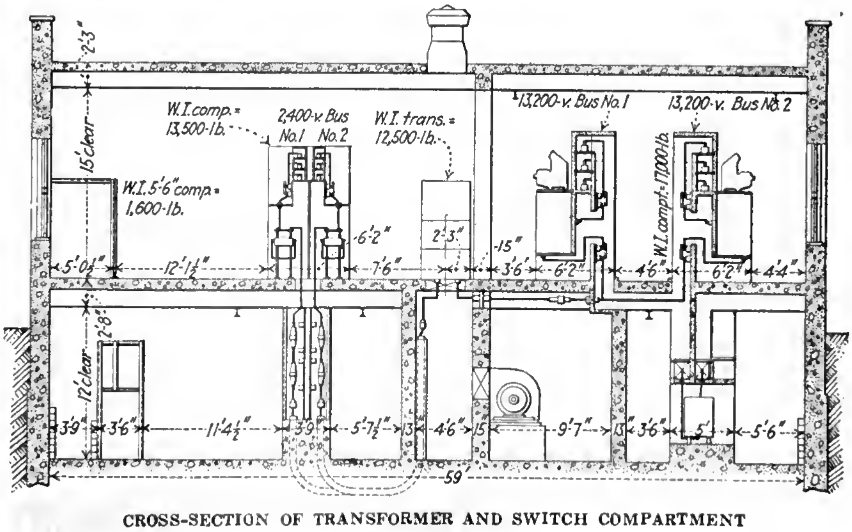
1. All 13,200-volt compartment doors




MAIN FLOOR LAYOUT WITH DIMENSIONS




CROSS-SECTION OF OUTGOING FEEDER COMPARTMENT




CROSS-SECTION OF TRANSFORMER AND SWITCH COMPARTMENT

are locked in order to make it impossible for any maintenance or construction men to get into any of these compartments without the knowledge of the station operator, who alone carries the key. When the particular compartment to be worked on has been blocked and opened, locks on all other compartments, which are exactly similar in appearance, prevent the unwary man from getting into them in error.

2. The 13,200-volt sections are provided with what are known as disconnecting switch guard lamps. These lamps, inserted in the compartment walls near the disconnecting switches, are controlled by the oil-switch mechanism and indicate by being lighted that the oil switch is open and that the disconnecting switches may be pulled, thus minimizing the chance of the operator accidentally opening a disconnecting switch under load.

3. A very effective system of marking the individual

RACE SUBSTATION WAS COMPLETED IN 104 DAYS

compartments, both 13,200-volt and 2,400-volt, is provided. This consists of small metal targets which project from the compartment barriers, indicating the line dividing one feeder section from another. The separation of circuits is further emphasized by painting broad red lines between sections.

4. Telephone drop signals are installed which indicate any occurrence that should be brought to the immediate attention of the operator, such as tripping of any transmission or distribution lines or transformers, failure of air pressure on transformers, etc. A small ball which normally shows a black face rotates so as to show a red one, at the same time ringing a distinctive bell which cannot be confused with the door or telephone bells.

5. All 13,200-volt and 2,400-volt lines enter and leave the stations underground, and where the circuits are aërial connections are made to the lines at nearby terminal poles. The ducts inside of the substation are flexibly arranged so that cable in any one of them can be brought to any compartment.

6. In order to facilitate the work of the underground department in installing new cables or repairing damaged ones, arrangements are made so that any of the three leads from the pothead can be very easily connected to either of the three jumpers which extend to the oil switches and bus, thus allowing the underground department to make its cables splices in the best possible way, irrespective of phases, the cables being finally phased out in the substation where the correct connections are made.

7. The psychology and economy of a bright, cheerful station is recognized in the design, and ample windows and skylights flood the entire station with daylight. The walls (above a man's height) and ceiling are painted dead-white.

### Future Expansion Made Possible

It may be of interest to note that work was started at the Federal substation by the demolition of an old church building on June 5 and the station finally put in operation on Oct. 22—118 working days being consumed from time of starting to completion. At the Race substation, which is slightly smaller on account of the fewer number of reactors provided for on 13,200-volt lines, work was started on June 26 and the station put in service Oct. 29—104 working days being consumed. As can be seen from the photographs, these stations are of a pleasing appearance and constitute a desirable addition to the neighborhood.

In both cases only about one-half of the ultimate building was erected, which allows for the installation of seven 13,200-volt lines, two transformer banks and fourteen 2,400-volt distribution circuits. These sections will care for the load served for a few years to come, thus postponing a heavier investment in building until such time as it is actually required.

## Bureau of Mines Cites Advantages of Electric Brass Melting

THE theoretical advantages of electric brass melting are summarized by the United States Bureau of Mines in one of its recent publications as follows:

1. Melting may take place in a neutral or reducing atmosphere, thus minimizing loss of metal by oxidation and improving the quality of the product through freedom from oxides.

2. Metal of crucible quality may be obtained without the use of crucibles.

3. Melting may take place in a tightly closed chamber, or at least in one free from the constant passage of the products of combustion of fuel, and thus losses of volatile metals such as zinc and lead may be reduced. Contamination by sulphur from fuel is avoided and a better product obtained.

4. In some types of electric furnaces the temperature may be more readily controlled than in fuel-fired furnaces.

5. In some types of furnaces the molten metal is thoroughly stirred, thus giving a uniform product, even with large heats.

6. There is no handling or storage of fuel, such as coke, coal or oil, and no ashes have to be removed. The cost of power can be accurately predicted over longer periods than the cost of fuel.

7. Working conditions about the furnaces are less dangerous to health and safety of workmen, provided that suitable types of furnaces are chosen.

8. The above advantages may be obtained in furnaces of larger capacity than can be used satisfactorily in the fuel-fired crucible types, with resulting greater uniformity of product, lower labor cost and increased production.

# How 2,214 Old Houses Were Wired

## Preliminary Survey of Territory — Formulation of Sales Plan — Organization of Employees Into Selling Force — Total Cost of Six Weeks' Intensive House-Wiring Campaign

By RALPH G. WEBBER
*Central Maine Power Company, Augusta, Me.*

IN A TERRITORY such as that served by the Central Maine Power Company, comprising more than 140 cities, towns and municipalities scattered over an area of several hundred square miles, there are bound to be a good many unwired houses along the lines. Last year it was decided to put on a campaign to connect these houses to the lines at the least possible selling cost and without making a heavy investment in extensions.

The company had no definite records of these unwired houses, and to see what sort of campaign could be worked out a survey was first made. The superintendent of each of the company's twelve districts was asked to make a close estimate of the number of unwired homes in his territory which could be reached by a service loop or by setting one pole. By riding around the streets and roads and in some cases making estimates it was learned that there were more than seven thousand unwired homes right along our distribution lines which were without electric service. What a splendid field for more and better business! Here were our logical customers burning odorous oil lamps right under our noses.

### The Plan of Attack

With this information it didn't take us long to decide that the main attack of our advertising plan would be "direct by mail." Inasmuch as the superintendents had proved to their own satisfaction that they had a lot of unwired homes in their fields, it was a fairly reasonable request to ask them to furnish the head office with the names of the occupants of these homes. Blank "prospect" cards were sent to every superintendent with the request to furnish the name of the occupant of each unwired house and to state whether he or she was the owner; also, the street and number of the house and whether the house could be served with a service loop or by setting one pole.

While this information was being gathered, we formulated the sales plan, devising ways to put our offers before the "prospects" and the most practical way to reach them by personal salesmanship.

In order to give a visual example of what could be bought for certain prices, four popular-priced combinations were made up to be installed by the company's own crews of inside wiremen. They were listed as follows:

1. *Combination at* \$15.—Flatiron outlet and ceiling outlet for kitchen; entrance, ground and complete installation ready to use. Easy terms of \$5 a month.
2. *Combination at* \$25.—Three fixtures, one each for the kitchen, dining room and sitting room, to be installed on one floor; all complete, ready to turn on the lights. Terms, \$5 down, \$5 a month.
3. *Combination at* \$33.75.—Single drop lights for kitchen and hall; two-light fixtures for dining room and sitting room. Terms, \$8.75 down, \$5 a month.
4. *Combination at* \$50.—Drop lights for kitchen, hall and two upstairs bedrooms; two-light fixtures for living room and dining room; complete equipment ready to use. Terms, \$10 down and \$5 a month.

These four combination offers were illustrated and described on a four-page folder (5½ in. x 8½ in.) folded twice to go into a standard No. 5 government envelope.

To drive home the message of electrifying the home, two series of three letters each were written. One series was worded for the home owner, the other for the renter. As the prospect cards carried information as to whether the occupant owned or rented the house, it was an easy matter to separate the cards and have the correct series mailed to each class of occupant. The home-owner series of three letters all emphasized the advantages of electricity, the low prices and the popular combinations.

The first letter was addressed to the woman of the house, the second to the head of the family, while the third did not particularize. With each letter a booklet or folder was inclosed. With the first letter a folder illustrating various electric appliance needs was inclosed, with the second the booklet "Electricity in Your Home" (issued by the N. E. L. A.), and with the third went the folder illustrating and describing the special offers. The series attempted to present a climax in buying appeal. The appliance folder portrayed the "by-advantages" of electricity in the home; the N. E. L. A. booklet showed the elegance, luxury and convenience of the home electric, and the third brought it "down to cases" and showed just how any family that could spare from \$15 to \$50 could have electricity.

To drive home the sales message with sledgehammer force the three letters were mailed out at intervals of every other day—the entire series in six days. Three letters on the same subject, from the same company, it was thought, ought to be enough to force favorable attention. They were. With the first and last letters in the series a return post card was inclosed which asked a representative of the company to call.

### Renters Present a Different Problem

In approaching the occupant of a rented house the sales problem was entirely different from that encountered in soliciting business from the occupant who owns his home. The landlord in Maine apparently figures on doing just as little as he can in the way of repairs or betterments and charging as much rent as the tenant can bear. The tenant appreciates the situation and is reluctant to approach his landlord, well knowing that \$50 worth of improvement may mean a \$5 raise in the monthly rent.

The series of letters aimed at this class of prospects was written with the idea of bringing the renter and owners together on some sort of a working basis. With the owner the point was made that vacant houses were

becoming more numerous and that the owner of improved property would be able to get first choice of tenants. One of these letters is reproduced.

### General Advertising

Although it was fully realized that newspaper advertising would shoot wide of the mark, it was thought best to tie in the direct mail campaign with general publicity. Accordingly, when the campaign opened, the fifteen-dollar combination offer was featured in the papers throughout the territory. Near the close of the campaign one other advertisement was used to remind prospects that they had only a few days more in which to take advantage of the cut in prices. In addition every window of our thirty-two stores in some way carried the message to electrify. All our motor trucks throughout the territory carried banners with appropriate slogans.

*(Form Letter Addressed to Landlords)*

**Isn't It Worth While to Keep Your Property "Up"?**

Have you noticed the general tendency toward increased building activity?

The opinion seems to be gaining ground that instead of a housing shortage we shall soon be facing a housing surplus.

Roger Babson, the famous business observer, feels that there is now a pronounced drift toward an oversupply of new "rents."

Under such changed conditions won't old and unimproved dwellings be hard to rent? Won't tenants be more apt to pick the improved buildings?

Shrewd landlords are apparently anticipating these conditions by improving old dwelling places so that they can compete with the new ones.

Electric service is one of the first improvements installed. Nothing else can add a like comfort to the home. One of the first questions that home renters ask is: "Has the house electric lights?" Electric service means not only lights but electric irons, fans, appliances for cooking and vacuum cleaners.

To the tenant these electric comforts mean satisfaction, convenience, a pride in the home and a willingness to pay the rent cheerfully.

To the landlord "electrified rents" mean improvement of property, keeping the property on a par with that of other "rents" that do have all such conveniences, a greater ease in renting, and the opportunity to ask a greater rental.

During the next few weeks you will have an opportunity to wire your property at special low prices—the lowest prices since 1916 or 1917.

If you wire up now, you will increase the value of your property and make your tenants too comfortable to think of moving.

The inclosed postcard will bring a representative to explain the special wiring proposition that we are now making.

Central Maine Power Company,
George S. Williams,
General Superintendent.

The fundamental secret in achieving success in the campaign lay not in the series of letters, not in the popular-priced offers, nor yet in any magic of the printed word, but in real "honest-to-goodness," face-to-face salesmanship. Left to their own fate, the letters would have made but a slight impression on the persons in the seven thousand unwired homes. Of the post cards inclosed with the letters only about 1 per cent were returned. No organized sales force was in operation, districts were widely scattered, employees knew little or nothing of the company plans. So, to make the publicity really forceful, a campaign of education had to be carried out among the employees themselves. Employees had to be "sold" on the campaign just as thoroughly as the prospects. To do this the company took every employee into its confidence, told exactly what the plans were and how it expected to proceed to achieve results.

First in the series of publicity matter directed toward the employees was an issue of the company house magazine, *The Exciter*, which was devoted almost entirely to an explanation of the campaign. In a straightforward story we told the employee that his success and that of the company were one and inseparable. We pointed out that his bread and ours were buttered on the same side. The machinery of the campaign was explained and a simple sales talk on house wiring was published.

By the time the issue of *The Exciter* was in the hands of the employees a series of district meetings was started. The superintendent of each district was asked by the general superintendent to assemble his metermen, inside wiremen, clerks and all others who could be spared for soliciting to listen to an explanation of the plan. At the district meetings the series of prospect letters was shown to the employees. The function of each letter was explained, as was the ease with which a sales talk could be made.

As part of every combination offer of $25 and more a free flatiron was included. The gift of the iron was reserved for the salesman to make. If, after the regular sales talk had been made there was any hesitancy to sign the contract, the salesman was instructed to say:

"Mrs. Jones, if you will take this combination now, I am authorized to make you a present of a regular 'six-seventy-five' flatiron." It proved to be a good "clincher" for the sale.

In a great many cases the contract could be closed without resorting to the offer of the iron. In such cases the flatiron was included as a gift of appreciation "in order that the new customer might more quickly learn some of the advantages of having electricity in the home."

### Quotas Promote District Pride

In order to get a fair basis of comparison of the work done by the different districts the number of unwired homes, as previously determined by the superintendents, was set up as a quota or bogey. Each district in this way was put on as near an equal footing as an accurate count of unwired homes could make it.

Pride of district in most companies is as potent a stimulus to sales as pride of country is to patriotic effort. And nothing stimulates sales effort more than a few prizes. As a final incentive to action, three prizes were offered—$50, $30 and $20—for the three districts which should score in one-two-three order in percentage of quota sold. Fifty dollars was also put up for reward of individual selling records.

When the series of letters had been mailed to prospects and when all the employees had received their instructions real action began. A telegram or telephone message was sent to every superintendent to start his work of solicitation. Every district started at scratch on a given date.

The campaign was scheduled to continue for a month. The big problem was to see people as fast as the letters were mailed. Speed was urged and in part maintained by frequent bulletins, telephone messages and telegrams to all districts showing the progress of the campaign

The standing of each district was figured, and at times various sales suggestions were incorporated in the bulletins. Interest and enthusiasm were thus kept at a high pitch.

It would not be true, however, to say that every district jumped into a run at the start. On account of lack of solicitors some districts lagged behind. Help was sent to these districts in the form of a flying wedge of salesmen. Ex-wiring solicitors and salespeople recruited from other departments were routed from district to district, as the need required, to stimulate and help the campaign.

At the end of four weeks the campaign had netted 1,200 contracts and showed no signs of diminution. The time was accordingly extended two weeks, by the end of which a total of 2,214 contracts had been obtained. This represented sales of 34.9 per cent of the possible estimated business. The district selling the greatest percentage of its quota reached 66.6.

At the close of the campaign the company had nearly two thousand contracts on its books. This condition presented still another sales problem. No matter how long a person had lived without electricity, as soon as he had decided to buy he wanted the lights instantly.

In order to hold the business a letter was sent about a month after the close of the campaign to customers whose wiring would be delayed. In this letter it was explained that the company's offer had been so popular that wiring crews were swamped with work. As a result of this letter and with a little explanation on the part of the local superintendent not a contract was canceled.

In giving 2,214 as the total number of contracts obtained it is only fair to say that in it is included the ordinary growth that would come without extra solicitation, as well as a few contracts brought in by contractor-dealers.

### CAMPAIGN COST ABOUT $1,800

The cost of advertising, soliciting, prizes and all other expenditures of the campaign was less than $1,800. The contracts for wiring which the company executed brought in gross business of $80,000 and put an added load on the company lines that will bring in an annual revenue of not less than $25,000. In passing it might be noted that most customers selected the fifty-dollar combination plus additions which would average $60 or more.

In the plan of campaign as outlined here there is nothing that any central-station company with a number of unwired houses along its lines ought not to be able to do with good results. Every company has meter readers, stock clerks, wiring solicitors and stenographers. They can be made into an efficient sales force, if it is made easy for them to sell, by offering attractive prices, and by paving their way with advance advertising matter. About all that was new in the Central Maine campaign was the application of old ideas to a new selling plan. Intensive use of the mails, low-priced combination offers, personal selling under a quota basis, easy time payments and the free gift of a flatiron were the outstanding points.

# December Output Over 5,000,000,000 Kw.-Hr.

## Total Gross Revenue from Sale of Energy During Last Month of 1922 Was $107,600,000, an Increase of 6 per Cent for Twelve-Month Period

REPORTS received by the ELECTRICAL WORLD for the month of December from central generating and distributing companies representing 77 per cent of the installed generator rating of the country indicate that four new records were established by the industry during the month. The total sales of energy during the month was 5,200,000,000 kw.-hr., which exceeded the former high monthly figure, set during November, by 5.4 per cent. In addition, the average daily output was 167,958,000 kw.-hr., which exceeded the previous record, also made during November, by 4,738,000 kw.-hr. The second set of record figures reported by the industry for the month of December is to be found in the revenue received from the sale of energy. The total gross revenue from the sale of energy was $107,600,000, which exceeded the former high monthly revenue, reported during November, by 6.3 per cent. Moreover, the average daily revenue from the sale of energy during the month was $3,474,000, which exceeded the former record, made during November, by $101,000.

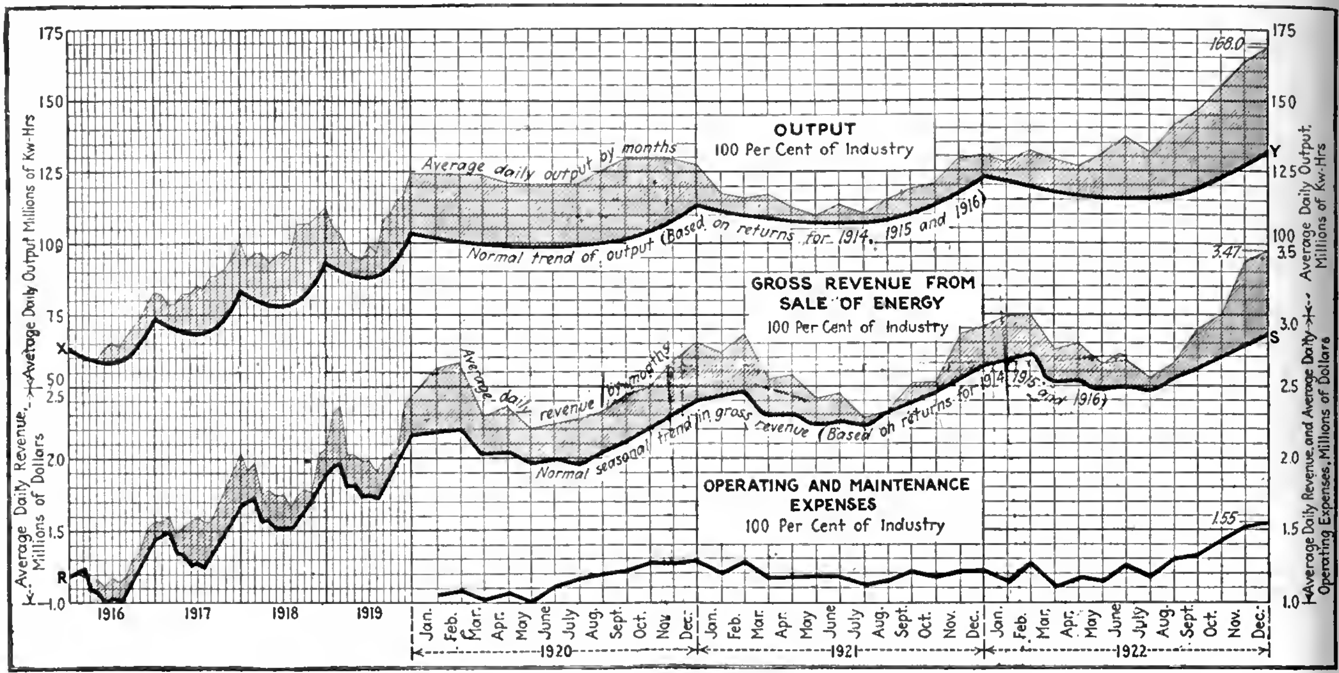
It must be remembered in studying these data on central-station output that they do not represent the actual amount of energy consumed during December, but the amount of energy actually sold by various distributing companies, some of which was sold to other public utilities for resale and so is counted twice in the resulting tabulation. Similarly, the gross income does not represent the amount paid to the central-station companies by the actual consumers of electrical energy generated during the month, but includes also payments made by one public utility to another public utility for energy which was in turn resold to the actual consumer. Both these transactions are necessarily included in the ELECTRICAL WORLD tabulation as representing the actual operations within the industry.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, shows that the net earnings per dollar spent for operation and maintenance were less than reported for December, 1921. The operating ratio reported for December, 1922, by companies having steam plants only, taken in the aggregate, was 49.3 per cent, against 48.3 per cent for De-

TABLE 1—CENTRAL STATION RETURNS FOR THREE MONTHS

| Mos. | Percentage of Installed Ratings Represented | Kw.-Hr. Output (Companies Reporting) | | | Percentage of Installed Ratings Represented | Revenue from the Sale of Energy (Companies Reporting) | | |
|---|---|---|---|---|---|---|---|---|
| | | 1922 Thousands | 1921 Thousands | Per Cent Increase | | 1922 Thousands | 1921 Thousands | Per Cent Increase |
| Oct... | 82 | 3,922,493 | 3,171,675 | 23.6 | 76 | $70,710 | $61,024 | 15.8 |
| Nov.. | 81 | 3,966,256 | 3,211,271 | 23.5 | 75 | 75,911 | 65,197 | 16.3 |
| Dec.. | 77 | 4,009,216 | 3,202,470 | 25.2 | 71 | 76,489 | 65,900 | 16.0 |

| Mos. | Percentage of Installed Ratings Represented | Operating and Maintenance Expenses (Companies reporting) | | | Operating Ratio | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Steam Plants | | Hydro Plants | | Combined Systems of Steam and Hydro | |
| | | 1922 Thousands of Dollars | 1921 Thousands of Dollars | Per Cent Increase | 1922 | 1921 | 1922 | 1921 | 1922 | 1921 |
| Oct... | 62 | 27,781 | 23,260 | 19.5 | 52.1 | 51.1 | 28.9 | 27.8 | 48.8 | 47.7 |
| Nov.. | 62 | 28,304 | 26,069 | 8.6 | 50.4 | 50.2 | 24.3 | 25.0 | 46.0 | 45.2 |
| Dec.. | 59 | 28,316 | 23,577 | 20.2 | 49.3 | 48.3 | 29.7 | 27.7 | 48.8 | 46.1 |




cember, 1921. This increase is undoubtedly due in large measure to the higher cost of coal this winter than last winter. Although in July, 1922, the operating ratio for the same companies was 55.3 per cent and in August was 56.6 per cent, such a decrease in operating ratio between winter and summer months is to be expected on account of the relatively higher percentage of low-revenue industrial energy sold during the summer months.

Every section of the country except the South Central States reported energy consumption over that of November. In New England the cotton mills reported a record number of active spindles, calling for increased energy consumption. The Atlantic Section reported by far the largest increased energy consumption over November. This was probably a reflection of the continued growth in pig-iron production, which during December was almost double the production reported for December, 1921. A high degree of activity in the Southern cotton mills also added to the energy consumption of the Atlantic section. Energy demand in the North Central section appears to have been almost the same as during November, despite the advancing season and consequent increased lighting requirements.

## Great Susceptibility to Electric Shock in Panama

ONE of the peculiarities of Panama is the deadliness of electricity in that region. Voltages of 110 to 220 in former days repeatedly caused fatal accidents. Since construction days on the canal the Government has provided ample safety appliances, and few deaths now occur notwithstanding that all operating equipment on the canal except the Panama Railroad is electrically driven.

The reason for the abnormal susceptibility to shock, explains R. Z. Kirkpatrick, president of the Engineers' Club of the Canal Zone, is probably climatic. Almost daily precipitation keeps shoe soles moist and standing places are likely to be damp. Again, the temperature and humidity of the air are such that perspiration is almost constant, giving an excellent chance for the full transmission of current on contact. Another point is that physical vitality is lower in the tropics and electric shock is therefore more easily effective in stopping the action of the heart.

In four cases of electrocution Mr. Kirkpatrick personally saw in the Canal Zone, with no voltages above 500, prompt efforts at resuscitation failed.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

| Month | Percentage of Installed Ratings Represented | New England States 1922 Thousands | New England States 1921 Thousands | New England States Per Cent Increase | Percentage of Installed Ratings Represented | Atlantic States 1922 Thousands | Atlantic States 1921 Thousands | Atlantic States Per Cent Increase | Percentage of Installed Ratings Represented | North Central States 1922 Thousands | North Central States 1921 Thousands | North Central States Per Cent Increase | Percentage of Installed Ratings Represented | South Central States 1922 Thousands | South Central States 1921 Thousands | South Central States Per Cent Increase | Percentage of Installed Ratings Represented | Pacific and Mountain States 1922 Thousands | Pacific and Mountain States 1921 Thousands | Pacific and Mountain States Per Cent Increase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KW.-HR. OUTPUT: | | | | | | | | | | | | | | | | | | | | |
| Oct. | 80 | 297,362 | 251,833 | 14.1 | 80 | 1,408,629 | 1,128,973 | 24.8 | 82 | 1,305,808 | 1,058,870 | 23.4 | 64 | 201,756 | 160,261 | 25.8 | 97 | 706,346 | 571,738 | 23.5 |
| Nov. | 78 | 312,988 | 248,457 | 26.0 | 78 | 1,440,751 | 1,163,312 | 23.8 | 81 | 1,318,588 | 1,073,114 | 23.6 | 64 | 212,739 | 159,917 | 33.1 | 97 | 681,190 | 566,471 | 20.2 |
| Dec. | 80 | 337,890 | 255,177 | 32.4 | 76 | 1,510,678 | 1,217,027 | 24.2 | 74 | 1,249,161 | 993,377 | 25.7 | 62 | 208,452 | 163,828 | 26.2 | 93 | 703,035 | 573,061 | 22.6 |
| REVENUE: | | | | | | | | | | | | | | | | | | | | |
| Oct. | 80 | $7,055 | $6,370 | 10.7 | 74 | $26,361 | $22,453 | 17.4 | 69 | $22,130 | $18,716 | 18.3 | 64 | $4,652 | $4,136 | 12.5 | 97 | $10,512 | $9,319 | 12.8 |
| Nov. | 78 | 7,757 | 6,878 | 12.8 | 73 | 28,577 | 24,359 | 17.3 | 69 | 23,659 | 20,037 | 18.2 | 62 | 5,022 | 4,330 | 16.0 | 96 | 10,896 | 9,593 | 13.6 |
| Dec. | 80 | 8,429 | 7,089 | 19.0 | 71 | 29,483 | 25,922 | 13.7 | 62 | 22,166 | 18,495 | 19.9 | 61 | 5,096 | 4,407 | 15.6 | 93 | 11,315 | 9,987 | 13.3 |
| OPERATING EXPENSES: | | | | | | | | | | | | | | | | | | | | |
| Oct. | 52 | $2,387 | $2,023 | 17.9 | 55 | $9,209 | $7,695 | 19.7 | 54 | $10,608 | $8,567 | 23.8 | 63 | $2,397 | $2,096 | 14.4 | 95 | $3,703 | $3,412 | 8.5 |
| Nov. | 52 | 2,545 | 2,161 | 17.7 | 54 | 8,942 | 7,804 | 14.5 | 57 | 10,540 | 8,468 | 24.4 | 62 | 2,597 | 2,178 | 19.3 | 94 | 3,680 | 3,537 | 4.1 |
| Dec. | 51 | 2,785 | 2,005 | 38.9 | 53 | 9,458 | 8,116 | 16.3 | 51 | 9,447 | 7,388 | 27.7 | 61 | 2,592 | 2,170 | 20.8 | 92 | 4,034 | 3,898 | 3.5 |

## Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

### National Aspects of Niagara Falls Developments

*To the Editors of the* ELECTRICAL WORLD:

It is a fortunate thing that the complexity of electrical engineering problems is so generally recognized that there is little danger of the disastrous results which would ensue were those who had not given the subject sufficient study to undertake their solution. It is unfortunate that the far greater complexity of the problems of economics and sociology is generally ignored. This tendency is well illustrated in an otherwise able article by Frank G. Baum in the ELECTRICAL WORLD of Jan. 27, 1923, by the following extracts:

"To attempt to find a local demand for the whole of these large [hydro-electric] powers, as was done at Niagara, . . . is uneconomic and unsound for the industry and from a standpoint of national stability. For to be stable we should have the industries of the country diversified and spread out over the country as much as possible, building up the smaller communities as well as the large centers. At present places like Niagara . . . have much cheaper power than obtains in the smaller cities and towns. This does not make for a healthy growth of the states and nation. We need a transmission system which will take the power from the large producing centers and more nearly equalize power conditions in small and large cities. . . . It is not sound practice to allow all the water powers of Niagara to be used locally to the advantage of a few industries, but part of the power should be required to flow out into the smaller cities to help them prosper. . . . In that way we will spread out the advantages of water power among more people, and this will in turn create a more favorable opinion for the logical development of water power and transmission systems to meet the needs of the states and the nation."

Passing over the rather absurd implication that there are no transmission lines in the Niagara district and without attempting to analyze Mr. Baum's solution of the complex economic and sociological problems involved in the use of hydro-electric power, it may be worth while to point out a few elementary facts which must be considered before even an approximation of the true solution is arrived at.

Starting with the assumption that it is desired to "spread out the advantages of water power" as widely as possible among the people, the problem is: How can this be done? A superficial view might lead to the solution offered by Mr. Baum—the building of transmission lines which will distribute the hydro-electric power over as large an area as possible. But the recognition of the complexity of a problem of this kind should serve as a warning that a superficial study will not yield the true solution. Now, while it may be perfectly true that the solution of the problem found by the Pacific Gas & Electric system in California is a good one, it does not follow that a different solution at Niagara Falls is a bad one, because the conditions are by no means the same in the two places. Indeed, a study of the results shows that the Niagara Falls hydro-electric development has been more successful in finding a way to spread out the advantages of water power than has the system in California. This does not by any means mean that the Californian development is subject to adverse criticism, because the more widespread distribution of the benefits which can be derived from Niagara Falls is due in great part to geographical conditions. While a large proportion of the water power of Niagara—not by any means all, as Mr. Baum implies—is used locally in the form of electrical energy, the ultimate advantages of this use are spread all over the United States, and indeed the world, and are not confined, as the superficial investigator might suppose, to a few industries.

The mischief is that many farmers, dwellers in small towns and villages, and even some electrical engineers, cannot see how the energy of Niagara Falls can be made to benefit the people except by an electrical transmission line. These critics do not complain of the concentration of the blast furnaces about the great coal fields of the United States, they do not deplore the use of coal by the blast furnace as an unsound practice followed for the advantage of a few local industries. They realize that it would be the height of folly to insist on the distribution of the coal over the country so that every village and small town could run its own blast furnace, for they know that it is to the advantage of the whole country that iron and steel should be produced where they can be manufactured most economically. But our critics do not realize that the country needs ferro-alloys, abrasives, fertilizers, chlorine and the hundreds of derivatives of electrochemical and electrometallurgical industry which cannot possibly be manufactured as cheaply as they are now unless they are near the source of a great hydro-electric plant, and that this in turn must be within economical distance of the places where the products are used. In other words, they are unable to see any method of distributing the advantages of a water power like Niagara Falls except by means of a 220,000-volt transmission line. Yet when the fruit grower of California is destroying insect pests, which otherwise would ruin his crops, with cyanide; when the cotton grower is fertilizing his fields with cyanamide; when the health statistician files his figures showing the enormous decrease in typhoid fever throughout the United States or in the Panama Canal district due to the use of chlorine in purifying drinking water; when the farmers in all our great farm lands drive their tractors and the passengers travel in coaches, running on rails, drawn by locomotives, all built in great part of steel manufactured with ferro-alloys and fashioned with artificial abrasives; when the miners going down into the mines, and thousands of families in isolated places where there is no gas and no electricity, light their acetylene lamps—they are realizing consciously or unconsciously the advantages of Niagara Falls.

It would be impossible in a short space to consider even briefly the economic and sociological reasons which fully justify the large use of hydro-electric powers like that of Niagara for electrochemical and electrometallurgical industries and to show that this use does not involve fostering a few favored manufacturers at the expense of the states and the nation; but this brief note may at least do something toward arresting dangerous misconceptions which are apt to be formed in the minds of the people by a careless *obiter dictum*.

Niagara Falls, N. Y. FRANCIS A. J. FITZGERALD.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Economy in Furnace Wall Construction

MODERN boiler-room practice imposes duties on furnace walls and linings that were formerly considered impracticable. Consequently the quality and manner of installing these linings is receiving well-merited attention. The purchase of high-grade refractories is a good investment, but the conditions under which different parts of the furnace will operate should be studied.

For example, a survey of the interior of a furnace in active operation, which may readily be made with the aid of an optical pyrometer, will disclose certain "hot spots" that explain why some grades of firebrick do not stand up well under service. One such survey recently made on a furnace disclosed a temperature in excess of 3,000 deg. F. over a horizontal zone, about in the center of the side walls of the combustion chamber and the rear bridge wall under the mud drum of a Stirling boiler. The temperatures shaded off to about 2,400 deg. on either side above and below this point. Other parts of the same furnace at the same time were operating at temperatures below 1,800 deg. This furnace will be relined with at least two grades and possibly three grades of firebrick.

Considerable trouble is sometimes experienced with chipping or spalling. This may be caused by unequal expansion of the brick, especially in stand-by steam plants on a hydro-electric system where rapid changes of temperature due to sudden changes in load are encountered. The writer has had experience with a number of Dutch-oven furnaces in the steam stand-by plants of the Portland Railway, Light & Power Company, where sawmill refuse is burned. In these large flat-arch tiles are hung. These tiles were laid about ¼ in. apart with high-temperature cement between them, but only in the outer half of the joint, the inner half next to the fire being left open. Since the inner face of the tile was subjected to more rapid changes in temperature, it expanded and contracted more rapidly than the outer portion. The open joint permitted this expansion to take place freely, with the result that after two years' use under the most extreme conditions of stand-by service only one tile has lost its edge, and this was caused by the careless handling of a firing tool. The accompanying halftone shows the appearance of this arch when first installed and indicates quite clearly the open joints between the faces of the tile.

CHIPPING AND SPALLING OF FURNACE BRICKS PREVENTED BY LEAVING ¼-IN. OPENING BETWEEN FACE OF BRICKS IN FURNACE ARCH

Another detail in connection with this arch construction has resulted in lower maintenance costs. The main I-beams holding up the arch extend beyond the brick side walls and are supported by steel channel columns erected against the outside furnace walls. These channels bear the entire weight of the arch, relieving the outside walls from any stresses except those due to their own weight. The two years' service from these furnaces have shown the side walls to be in a much better state of preservation than is the case with furnaces where the side walls carry the entire weight of the arch. This form of construction also permits any part of the side walls to be removed for repairs without disturbing or shoring up the arches.

H. S. BASTIAN,
Assistant Engineer.
Portland Railway, Light & Power Company,
Portland, Ore.

## Motors and Appliances in Dusty Places

SEVERAL important revisions of clauses in the National Electrical Code relating to the protection of motors and appliances in dusty locations have been recommended by the electrical committee of the National Fire Protection Association. These proposed changes after final revision are to be incorporated in the 1923 edition of the code and are given in part below:

Rule 8 (f), amend to read:

"Motors having brushes or sliding contacts exposed to combustible dust must be placed in separate dust-tight rooms, or non-combustible housing pro-

vided with effective ventilation from a source of clean air.

"In places where combustible dust is thrown into suspension in the air in sufficient quantity to produce explosive mixtures, such as in flour mills, grain elevators, etc., or where it is impracticable to prevent dust or flying materials collecting in dangerous quantities on or in motors, all motors shall be either of the totally inclosed type or shall be placed in separate dust-tight rooms or non-combustible housings. Such rooms or housings shall be effectively ventilated from a source of clean air."

Rule 31 (a), amend to read:

"In places where combustible dust is thrown into suspension in the air in sufficient quantities to produce explosive mixtures, dust-tight fixtures inclosing lamps and sockets shall be used. Such fixtures should be supported by conduit hangers or chains to prevent any strain on the wires. Wires should have rubber insulation not less than $\frac{3}{64}$ in. thick."

Rule 25 (a), paragraph to be added: "Electric heaters shall be so located that dust or flying material will not collect on them in dangerous quantities."

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

# Extracts from Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Automatic Voltage Regulation for Generators

THE type KR system of automatic voltage regulation employs a booster which can be inserted in the circuit between the generator field and the individual exciter or the excitation bus. The field of this booster is supplied from a booster exciter, whose field in turn can be varied automatically not only in strength but in direction, having a continuous range from a maximum positive to a maximum negative value.

The booster-exciter voltage, and consequently the booster voltage, will vary in accordance with the strength and direction of current in the booster-exciter field; and the booster voltage will either buck or boost the excitation voltage and so give double the range of regulation for the same capacity of regulating machine. By means of a Tirrill regulator the alternating-current coil of which is connected to the bus whose voltage is to be regulated, together with suitable resistors and other auxiliary apparatus, the booster-exciter field current is varied in such a manner that the proper boost or buck is applied to the generator field circuit to maintain the desired bus voltage.

When it is desired to change from automatic to non-automatic regulation on a generator equipped with this system, it is essential to close the booster short-circuit breaker before opening the booster circuit breaker to prevent opening the generator field circuit. Below are given the directions for starting a booster, changing from one booster to another, changing regulators and taking a booster out of service, as outlined in the operating code prepared by the Philadelphia Electric Company:

### STARTING A BOOSTER TO OPERATE ALONE

1. Start the booster motor-generator.
2. Start the booster-exciter motor-generator.
3. Close the booster circuit breakers.
4. Open the booster short-circuit circuit breaker.
5. Close the double throw alternating-current potential switch to the bus whose voltage is to be regulated.
6. Select, by means of the direct-current potential plug, the booster which is to supply direct-current potential for the regulators.
7. See that the switch marked "differential relay" is closed.
8. Examine the regulator and see that all the switches connecting the booster exciter field, selected in No. 6, to the regulator are closed.
9. Close selector switch of regulator.
10. Close the field switch of the booster exciter.

### STARTING A BOOSTER AFTER ONE OR MORE ARE IN OPERATION

1. Start the booster motor-generator.
2. Start the booster-exciter motor-generator.
3. Close the booster circuit breakers.
4. Open the booster short-circuit circuit breaker.
5. Examine the regulator and see that the switches connecting the incoming booster to the regulator are closed.
6. Close the field switch of the booster being put into operation.
7. If necessary, make a slight adjustment in the value of the R-3 resistance to permit satisfactory parallel operation.

### CHANGING FROM ONE BOOSTER TO ANOTHER

1. Open the field switches of all booster exciters in service, opening last the switch of the booster to which the direct-current potential plug has been connected.
2. Change the direct-current potential plug to the booster from which it is desired to supply the control potential.
3. Close the field switches of all booster exciters in service, closing first the one to which the direct-current plug is now connected.

### CHANGING REGULATORS

1. See that the differential relay switch of the incoming regulator is closed.
2. Examine the incoming regulator and see that the switches connecting it to the booster-exciter field which is to supply the direct-current potential are closed. (See Rule No. 6, "Starting a Booster to Operate Alone.")
3. Open the field switches of all booster exciters in service, opening last the switch of the booster-exciter field to which the direct-current potential plug has been connected.
4. Change the selector control switch of the regulator in service to the incoming regulator.
5. Close the field switches of all booster exciters in service, closing first the one to which the direct-current potential plug is connected.

### TAKING A BOOSTER OUT OF SERVICE

1. Adjust the generator field rheostats so that the booster voltage is reduced approximately to zero.
2. Open the field switch of the booster exciter.
3. Close the booster short-circuit circuit breaker.
4. Open the booster circuit breakers.
5. Shut down the booster-exciter motor-generator.
6. Shut down the booster motor-generator.

# Redesigning Furnaces for Iowa Coal

OWING to an increased demand for power during the war central stations using high volatile Iowa coal were forced to consider improved methods of increasing their boiler ratings. Since Iowa coal has a volatile content of 36 per cent as against 16 per cent for Virginia coal, it is evident that a furnace designed for Virginia coal cannot successfully burn coal from Iowa. Fortunately a bulletin* had been published which showed that the furnace volume depended upon the excess air, the rate of combustion and the kind of fuel used. It also showed that since the rate of combustion or the number of pounds of fuel per square foot of grate surface per hour increases, the volume of the furnace must be increased proportionately.

The first stoker installation investigated followed generally the stokers designed for Illinois coal, but the ignition rates were low with consequent lower efficiencies. The first arch in the Cedar Rapids plant of the Iowa Railway & Light Company cleared the bridge approximately 24 in. in the center of the furnace and

*Bulletin No. 135 of the Bureau of Mines, entitled "Combustion of Coal and Design of Furnaces," by Henry Kreisinger, C. E. Augustine and F. K. Ovitz.

about 10 in. on the sides. Since the boilers were set approximately 8 ft. from the floor to the lower row of tubes, a limited combustion volume resulted. The only virtue of the peculiar installation of flat arches parallel to the grate was that it was cheaper to construct than the older sprung arch and that the maintenance was also lowered.

As a result of these combustion-area investigations the arches at the rear end of the stoker were raised slightly. This immediately resulted in increased boiler ratings and improved evaporation rates. Then, as these arches wore out in service, the angle between the arch and the grate was increased step by step until finally the rear row of arch tiles was tangent to the bottom of the boiler header. Since it was not possible from an economic standpoint to tear down the boilers and raise them up, other means had to be devised to increase the furnace volume. A modified form of bridge wall was designed to deflect the heat from its surface forward to the feed grate of the stoker.

The next step was to build an "L"-shaped arch, the long portion of the "L" being parallel to the grate and as high up from the grate as the physical dimensions of the boiler would permit. The vertical portion of the "L" was extended downward until it cleared the grate by approximately 18 in. It was made only long enough horizontally to meet the feed grate in order to secure sufficient surface of highly heated firebrick to assist in the ignition of the coal.

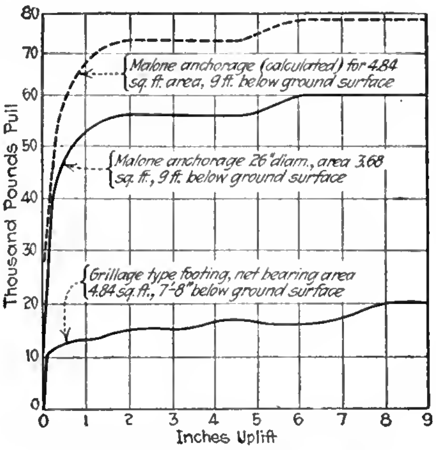
Before this arch development occurred evaporation rates of 5 lb. of water per pound of coal and boiler ratings not exceeding 110 to 125 per cent of nominal capacity were prevalent. Today the evaporation has increased to 6 lb. or 7 lb. of water per pound of Iowa coal while the boiler ratings have risen to 200 per cent and 250 per cent of rating.

Along with these changes the gas velocities have been lowered, thereby reducing the amount of ash carried in suspension from the fuel bed and with a corresponding reduction of trouble from slag formation on the tubes. The larger furnace volume with lower gas velocities gives less blowpipe effect on the boiler tubes, with a resulting reduction in the boiler tube maintenance.

JOHN M. DRABELLE,
Mechanical and Electrical Engineer,
Iowa Railway & Light Company,
Cedar Rapids, Iowa.

## Anchorage for Overhead Line Structures

A METHOD has been developed in connection with a new type of footing for the anchorage of transmission towers and other overhead supports which not only materially increases the security and life of such anchorages over those made of wood or steel buried immediately in the ground without concrete protection,




RESISTANCE TO UPLIFT OF MALONE FOOTING COMPARED WITH ORDINARY GRILLAGE

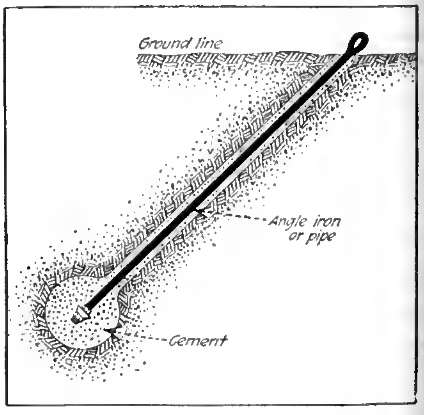
but also largely reduces the construction expense. This new anchorage, although a rather radical departure from past practice, has been sufficiently tested, both as to method and type, to assure its success, at least under the earth conditions that are usually encountered.

In May of last year the writer was assigned to take charge of the construction of a heavy steel-tower transmission line, 110 miles long, to connect two sections of the transmission network of the Kansas Gas & Electric Company in central and southeastern Kansas. Soil explorations were immediately started to determine the conditions to be met in designing tower anchorages. This survey developed the fact that over about 80 per cent of the entire ground to be traversed by the line there would be encountered formations of flint bearing limestone of sufficient hardness to make excavations for earth grillages difficult and expensive, but, on the other hand, of such an erratic and faulty nature as not to be reliable for the grouting of anchor bolts into drilled holes. With the aim of making an asset of this liability, efforts were directed to the development of an efficient tower anchorage which would successfully meet all of these rather unusual conditions and at the same time be adapted to any other conditions likely to be encountered, such as dirt, rock, boulders or combinations of these materials, and capable of being cheaply and quickly installed even in frozen ground.

A series of experiments developed the method and type of anchorage called the Malone anchorage. The installation of this anchorage is simple, the first operation consisting of boring a relatively small hole, or drilling this hole if in rock, and discharging within the hole at the desired depth below the ground surface a selected quantity of explosive. This expands a cavity in the dirt or rock of a size dependent upon the quantity of explosive and density of the material. An experimental hole, permitting inspection, is shown in one of the accompanying illustrations.

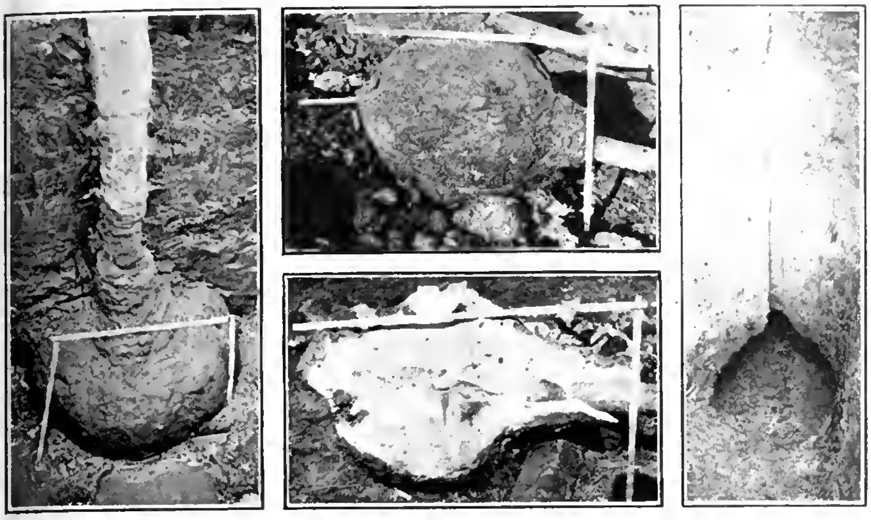
A specially designed column or tension member (frequently formed from angle iron or pipe) is inserted in the hole in correct position, with concrete poured or forced around it in the hole up to the ground surface or to any other desired height. When the concrete is sufficiently set up, the anchorage is ready for the attachment of the structures.

Some of the novel characteristics of the Malone anchorage result from the fact that the force from the explosion subjects the walls of the cavity to a high pressure which compresses the soil immediately adjacent, thereby greatly increasing its strength and resistance.




CONCRETE ANCHORAGE USES VARIOUS STEEL FORMS FOR CENTER

Beginning in June, a series of uplift and compression tests were conducted upon about fifty experimental anchorages. These experiments were sufficiently diversified to establish for the entire range of ground conditions encountered along the transmission line the sizes and types of anchorages required to carry the



VIEWS OF MALONE CONCRETE ANCHORAGE AS IT APPEARS IN PLACE, BROKEN OPEN AND HOLE WITH BULB WITHDRAWN

requisite loads both in tension and in compression. Analysis of the results of these tests brought out many features pertinent to this method of anchorage of which advantage is taken in its application. Among these, as applied to steel transmission towers, the following are of particular interest:

1. Extensive economies resulting from lower cost of material, lower cost of hauling and assembly, reduction in labor requirements, reduction of time element with attendant savings, and lessening of damage to crops and of injury to or loss of live stock sometimes caused by animals falling into open holes excavated for grillage footings.
2. The safe bearing value with this anchorage in compressed soil is well in excess of the accepted practice with undisturbed soil.
3. The rigidity of the column member is materially in excess of that which would be expected from the application of formulas developed for unsupported columns.
4. The earth being highly compressed during the process allows the application of a large percentage of its ultimate load before any movement of the anchorage occurs.
5. Essentially the same values are obtained for uplift and for compression, showing that the effective resistance to uplift is determined by the penetration of the "bulb" through the compressed earth rather than by lifting the conventional "cone of earth."

The accompanying curves show the results of comparative uplift tests upon a Malone anchorage with "bulb" 26 in. in diameter and a steel grillage tower footing of the usual type having an area more than 30 per cent greater. There is also shown a calculated curve corrected to the basis of equal areas. This test was made in clay ground that is normally firm, but saturated, and the grillage footing curve brings out the reduced holding power and tendency to flow of this class of ground when disturbed and tamped.

To give a comparative idea of the material and labor required for the Malone anchorage versus the usual grillage tower footing set in dirt, figures are given in table above.

| | Malone Anchorage | Grillage Footing |
|---|---|---|
| Quantity of earth excavated, cu.yd. | 0.04* | 4 |
| Quantity of steel, lb. | 60 | 220 |
| Quantity of concrete, cu.yd. | 0.25 | 0 |

*Hole 5 in. in diameter and 8 ft. deep.

While a comparison on the basis of actual cost is not available, it is estimated that on standard towers the saving will run from one-third to one-half the cost of the grillage footing as installed by the open excavation method.

Applications of this anchorage are already being made in permanent construction as footings for steel transmission towers and guy anchors for wooden poles and other flexible supports used in transmission work.

A. W. Malone,
Construction Manager.
Phoenix Utility Company,
New York, N. Y.

## Cable Test Equipment Placed on Motor Trailer

HIGH-VOLTAGE dielectric tests on cables and insulators are made in the field by the Edison Electric Illuminating Company of Boston with the equipment shown in the accompanying illustration. The motor truck at the left carries an induction motor which can be operated at 2,300 volts or 4,000 volts, driving a 100-kva., single-phase generator with a voltage range of zero to 2,300, besides the necessary control-panel installation. It is connected by cable with the trailer truck, which carries an 800-kva. transformer and an 800-kva. reactor in parallel with the low-tension side of the former. The transformer secondary range is zero to 30,000 volts. By this equipment the capacity load of the cable under test can be balanced, with corresponding reduction in generating requirements. Four to six men including chauffeur are required on tests.

Field Editor Electrical World.
Boston, Mass.

APPARATUS USED BY BOSTON EDISON COMPANY IN MAKING FIELD TESTS

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## Inspections for Better Service

### At Small Cost, Service Has Been Improved by Adjustment of Minor Causes for Complaints, Repairs to Appliances and Suggestions for More Economical Operation

WITH a large system extending over a wide area, such as that of the Consumers' Power Company in Michigan, service to the residential customer frequently does not receive the same attention as that of the commercial or industrial customer because the operation of household equipment is not of a complicated nature. Quite often, though, because of some local condition, the service may not be entirely satisfactory to the customer, or some of his appliances may be out of repair, and yet he will neglect to call upon the company to remedy the trouble. Such conditions mean decreased revenue for the company and sometimes result in misunderstandings and loss of the customer's good will.

With this in mind the Consumers' Power Company has inaugurated a plan of house-to-house inspection to uncover dissatisfaction on the part of the customer, make repairs and adjustments to household appliances and suggest ways of improving the use of the service. The method of conducting the inspection is interesting, and its results are particularly significant as they typify conditions which may exist among the customers of any central-station company. The Consumers' company operates both electric and gas utilities, and the reports of the inspection of gas installations are also included because of their value to combination companies.

Preliminary to making the house-to-house canvass of customers the inspectors were first thoroughly schooled in the various departments, such as meter trouble, appliance repairs and billing, in order that they might be familiar with various conditions which arise and be capable of making repairs or adjustments or answering questions or complaints. As the term implies, an inspection was made of every house adjacent to the gas or electric distribution system. The primary function of the inspection was to render a service to the customer and not to sell appliances or equipment, and the inspectors were instructed that they should not attempt to sell anything even if it was specifically asked for by the customer. In the latter case a salesman is notified of the "prospect."

The inspector presents to the customer a card of introduction with his personal signature. This card explains fully his mission and introduces him as a representative of the company. While this may seem to be a formality, it was greatly appreciated by the customers in that it was a means of identification and they had the name of the inspector if they desired to ask for additional information.

In order to simplify the work of the inspector, cards were prepared which listed the chief appliances to be inspected, repaired or adjusted if necessary, and a record was made of the conditions found. The electrical inspection card is shown here.

Upon entering the house, after presenting his card of introduction, the inspector records accurately the name and address of the customer, noting the general type and use of the building. The service is inspected, low-hanging wires, loose brackets and number of customers supplied being noted, and anything needing repair is reported immediately to the service department. The standard safety cabinet, if any, and the meter are then inspected, with particular attention to the safeness of the installation, open wiring or anything that might prove to be a hazard. The meter number and index readings are recorded.

Fuses are removed and inspected to make sure that the customer is properly protected. Many cases have been found in which coins, nails and heavy wire have been used for fuses. Customers' comments are also reported, whether favorable or unfavorable. These comments, if they are unfavorable, and any direct complaints are either investigated and the trouble corrected at the time by the inspector or are referred to one of the departments, which issues an order for the necessary work to be done. An inspection is also made of all appliances, and minor repairs, such as to broken cords, sockets and loose conections, are made where nec-

Form EG16-445

| Name and Address | INSPECTION CARD<br>General<br>Date Inspected................ Inspected by................<br>......Family Appt. Double House........... Rooming House.............<br>Boarding House.................. |
|---|---|

**ELECTRIC INSPECTION**

Service Connection Installed? Yes.... No... Condition of Service Connection ..........................
Number of Customers on this Service Connection? ................. Is house wired? Yes.... No....
Are Fixture installed? Yes... No... Is Standard Safety Box installed? Yes... No.... Sealed. Yes.... No....
Is Meter installed? Yes... No.... Company Meter No. ..........................
Meter Index.................... Main Line Fuses: Size.. ..... Amp. Condition ..........................
Is Electric Service Satisfactory? Yes... No... If not, give reason ..........................
State customers' comments ..........................

**APPLIANCES**

| Description | Yes | No | Kind, Size, Condition and Adjustments Made |
|---|---|---|---|
| Flat Iron | | | |
| Vacuum Cleaner | | | |
| Washing Machine | | | |
| Toaster | | | |
| Sewing Machine | | | |
| Heater | | | |
| Percolator | | | |
| Lamps and Fixtures | | | |
| | | | |
| | | | |
| | | | |

FORM OF CARD USED FOR ELECTRIC INSPECTION

essary. In the event that the appliance must be taken to the shop the nature of the trouble is explained and the approximate cost given. Then with the customer's consent the repairs are made.

Each day the inspection cards are turned over to the district manager, and he or some one delegated by him checks them over carefully, noting condition of meters and services and seeing that all major repairs necessary are made. The chief clerk next checks the cards with the ledgers, noting whether the name, address, meter number, meter reading and other ledger records are correct. The cards are then filed in permanent card files for future reference, particularly by the commercial department in laying out sales plans and building up "prospect" lists for new business.

It has been found that the inspection is rendering a great service to many of the customers, in that low-voltage conditions have been improved, service wires repaired, dangerous meter conditions corrected, gas and electric appliances repaired and adjusted, fuses of proper capacity installed and complaints of various conditions answered.

Out of the 35,230 inspections made, there were 13,590 individual repairs or adjustments made or complaints answered. Many of these were of minor importance. However, it is evident that the results being obtained fully warrant the expenditure and that from 20 to 25 per cent of the customers are receiving a service which is a direct benefit to them in the use of gas and electricity.

The accompanying summary shows in detail the result of the inspection as of Dec. 1, 1922.

SUMMARY OF HOUSE-TO-HOUSE INSPECTION

Total number of inspections made 35,230

| | Combination Properties | Straight Electric Properties |
|---|---|---|
| Number of inspections made | 18,835 | 16,395 |
| Number of inspectors working | 15 | 7 |
| Average inspections per man per day | 14 | 23 |
| Average cost per inspection, cents | 38 | 20.5 |
| | Gas | Electric |
| Number of lost meters found | 2 | .. |
| Defective or improper size meters | 45 | 35 |
| Number of inaccurate meter numbers corrected in ledgers | 74 | 87 |
| Inaccurate meter readings reported | 18 | 34 |
| Poor meter connections | 155 | 118 |
| Cases of theft | 4 | 26 |
| Services not in use | 510 | 714 |
| Lost services found | 46 | .. |
| Service wires to be repaired | . | 639 |
| Gas service—cleared | 139 | .. |
| Repaired | 17 | .. |
| Too small | 8 | .. |
| Regulator trouble | 204 | .. |
| Service brackets loose | . | 396 |
| Houses piped or wired but no service supplied | 14 | 134 |
| Lights flickering | . | 225 |
| Poor service—poor pressure | 281 | . |
| Low voltage | | 443 |
| Safety cabinets installed | .. | 10,410 |
| Safety cabinets seals broken | .. | 1,109 |
| Appliance trouble | 2,997 | 1,223 |
| Lights | 130 | .. |
| Customers dissatisfied with service | 127 | 565 |
| Customers stating they are satisfied | 5,774 | 19,567 |
| No fuse protection | .. | 735 |
| Fuses renewed | .. | 2,523 |
| Complaints—against employees | 6 | 21 |
| On shut-off notices | 5 | 6 |
| On reading meters | 16 | 39 |
| On bills | 565 | 1,287 |
| On delivering bills | 23 | 25 |
| On installation of safety cabinets | .. | 1 |
| Number of houses not using service | 2,380 | 4,154 |

**Inspector's Introduction Card**

TO OUR CUSTOMERS:

The bearer will present to you credentials showing his name, company badge and his photograph, identifying him as a representative of this company.

With your permission, he will examine your gas and electric appliances and make, without charge, the minor repairs and adjustments that may be necessary to make their use more satisfactory to you.

His call is solely in the interest of better service. He is not a salesman and has nothing to sell.

If you will give him the opportunity, we feel sure the adjustments he will make and the advice he will give you will be helpful to you.

CONSUMERS' POWER COMPANY.

Presented by ..................

## Cost of Electric Pumping in Oil Fields

COMPARATIVE data prepared by the San Joaquin Light & Power Corporation on the use of electricity in the oil fields of Kern County, California, show that the cost of electric pumping is much less than by any other method. With 3,000 wells being pumped electrically from the lines of this one power company, the figures cover a wide range of possible variation in conditions and represent a true comparison of electric, gas and steam engine drive.

The lump operating costs without details for individual oil-well installations for one division of a large oil-producing company are per day per well as follows: Electric drive, $1; gas-engine drive, $2.16; steam-engine drive, $5. These figures are based on the installation of individual electric motors or gas engines at each well, or the installation of one steam boiler serving fifteen individual steam engines, each driving one well.

The motors used in oil-well operation are two-speed, rated at 15 hp. or 30 hp., the lower rating being used for pumping and the higher rating for pulling, casing and drilling. The average load when pumping in one particular district is about 6 hp. At present prices of oil, the operating cost of steam installations is the same whether oil or natural gas is burned under the boiler.

## Cleveland, 1922, Appliance Sales Were $15 per Customer

CONCRETE evidence of the value of co-operation between the central station and the contractor-dealer in building up a large volume of appliance business is revealed in a survey recently made in Cleveland. While the Cleveland Electric Illuminating Company does not engage directly in merchandising, it gives its whole-hearted support to all of the activities of the city's electrical interests. As has been noted from time to time in the ELECTRICAL WORLD, the company has participated in electrical home exhibits and has joined with the dealers and electric shops in formulating and carrying out sales programs. How well this has worked out is shown in the accompanying tabulation of information concerning eighty-five electric shops in Cleveland.

Analyzing these figures briefly, G. E. Miller, sales manager of the Cleveland Electric Illuminating Company, says:

"The data given cover only so-called electrical shops—that is, contractor-dealer stores—and do not include or make any allowance for sales made by our large stores, hardware stores, drug stores or automobile supply houses, all of which sell more or less electrical merchandise; in fact, the large stores are selling large quantities. I have just had a report of one of the stores which, in a special sale, sold 243 washing machines in one day and on another day sold fifty-nine mangles. Another large store had special sales on washing machines running as high as from fifty to sixty washing machines per day.

"I have made the statement, which I believe is very conservative, to the effect that the sale of domestic appliances in Cleveland in 1922 was in excess of $3,000,000, not including in that figure lamps, electric fixtures, wiring material, sockets and so forth. That is approximately $15 per residence consumer in the territory and approximately $3.40 per capita.

DATA ON APPLIANCE SALES IN CLEVELAND ELECTRIC SHOPS*

| | |
|---|---|
| Number of appliance dealers | 85 |
| Total space devoted to display of electrical merchandise, sq.ft. | 53,095 |
| Number of display windows | 145 |
| Frontage of all dealers' windows, ft. | 1,592 |
| Number of salesmen—in stores | 145 |
| Number of outside appliance salesmen | 254 |
| Total number of appliance salesmen | 399 |
| Average number of appliances sold each month | 7,039 |
| Total for one year | 84,468 |
| Value of appliances sold in 1922 | $2,765,406.00 |

*Not including department-store sales or sales made by other than electrical stores.

"You will note that the total number of appliance salesmen is given as 399, in addition to which it is safe to assume that there are probably fifty more, or say a total of 450 men, whose entire time is devoted to the retail sale of electrical equipment in Cleveland and its suburbs. To get another picture of what this sales effort means—if we were to assume that these men were working at the ridiculously low figure of $125 per month, this represents a payroll of $675,000 per year. Obviously, they would have to sell much more than $3,000,000 worth of merchandise to warrant any such outlay for sales effort."

## Operating Costs of Municipal and Private Plants

ANALYSIS of the operating costs of privately owned and municipal utilities in Indiana, compiled from annual reports filed with the state Public Service Commission, show that the operating costs of the municipal utilities is far greater than that of the other class, according to a statement made at the commission offices.

In the statistics compiled private and municipal electric utilities are compared. The disposition of each $100 of revenue is shown. The municipal utilities pay much more for coal than the private concerns. More also is paid for wages and salaries

| | Private | Municipally Owned |
|---|---|---|
| Salaries | $3.41 | $3.68 |
| Wages | 14.35 | 18.58 |
| Material used on repairs | 3.82 | 6.09 |
| Fuel, current, steam | 25.94 | 36.24 |
| Other operating expense, including depreciation | 16.41 | 8.85 |
| Total above | $63.93 | $73.44 |
| Taxes | 7.68 | *000 |
| Total operating expense | $71.61 | |
| Balance applicable to interest, dividends, surplus, etc. | 28.39 | 26.56 |
| Total | $100.00 | $100.00 |

*Municipally owned utilities do not pay taxes, these being an added tax burden to the citizens of the city served.

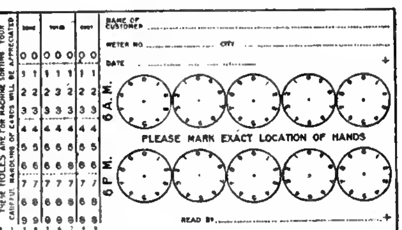
by the municipal utilities, which are to some degree mixed up with politics.

Out of each $100 of revenue received by electric utilities the privately owned company spends $63.93 for operating expenses, whereas the municipally owned utility spends $73.44. The figures are based on the reports for 1921.

The accompanying table shows the difference in costs for various items. It will be noted that very little has been set aside by the municipal plants for depreciation.

## A Check on Registration of Power Meters

ON AN extensive system like the Southern Power Company's, which serves industrial loads, it is very important that some check be kept on the registration of meters between the regular monthly calls of the meter readers, otherwise the failure of a meter to record may entail serious loss to the company. Furthermore, since the company sells




POST CARD USED FOR RECORDING METER INDEX

both primary and secondary power (primary power being power for twelve months of the year and secondary power that which may be provided for less than twelve months upon proper notice), it is desirable to ascertain whether a consumer is complying with his contract. Consequently the Southern Power Company has required (by contract) all its industrial consumers to mail their meter readings regularly on a post card like that reproduced herewith. When these are received they are punched on a Hollerith machine according to zone, substation and consumer number for automatic sorting. After being sorted the readings are transferred to permanent records for the purposes formerly mentioned.

While these cards may not be used in exactly the same way by all companies, it is possible that they can be used by companies serving sparsely settled teritories to reduce the cost of meter reading. With these readings received monthly it might be necessary only to send a meter reader around every three months to consumers whose bills are comparatively small. It is possible too that the punching system might be arranged to permit using the cards for directly billing the customers; that is, for stamping the amount due on the customer's bill.

## What Other Companies Are Doing

**Oklahoma City, Okla.**—To facilitate the supervision of its properties west of Oklahoma City, a western division of the Oklahoma Gas & Electric Company was established on Jan. 1, to take in all the properties in the Enid and El Reno divisions. The Oklahoma City division will comprise the properties in Oklahoma City, Moore, Norman, Britton, Bethany and Yukon.

**Boston, Mass.**—Utilities operated by Charles H. Tenney & Company sold electrical appliances in 1922 to the amount of about $420,000, the total gas and electric appliance sales being approximately $700,000. As a slogan for 1923 on total appliance sales, these companies have adopted the phrase "A Million or More—Before '24." Cyrus Barnes is general sales manager.

**Louisville, Ky.**—The Kentucky Utilities Company's lighting-fixture sales during the year 1922 amounted to $30,191.77. The fixtures were sold under a consignment arrangement for twenty-two of the company's offices. This business was done with a stock of $6,000 in fixture samples. Selling assistance was also furnished by the fixture jobber.

**Chicago, Ill.**—Plans for a series of active campaigns dealing with electric appliances in familiar use are being perfected by the retail merchandise sales department of the Public Service Company of Northern Illinois. It is intended to continue the policy of arranging in advance every detail of the advertising and publicity which will characterize the sales, extending this to the point of arranging in each salesroom a prominent display of the article or articles involved. The idea which was followed out last year aided materially in obtaining results in 1922, which showed an increase of 66 per cent over the sales of the year previous. The advantage of pushing appliances most in use at the particular season has been demonstrated and the lesson learned will be heeded.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Siphon to Maintain Constant Water Level.* — F. HEYN. — The author describes a siphon which automatically takes care of the maintenance of a steady and predetermined water level in a dammed river. Because of the peculiar shape of the cross-section of this siphon it fills itself with water and starts to operate without any attendance. It would appear that such an apparatus could be used only on very small water plants, but the author states that one of these siphons will be installed at a new Bavarian hydro-electric station capable of passing 110 cu.m. of water per second.—*Elektrische Kraftbetriebe und Bahnen,* Dec. 24, 1922.

*Development of Stokers.*—The January issue of the *A. S. M. E. Journal* contains three papers dealing with the various types of stokers that have been developed for the firing of boiler furnaces and that were presented at the annual meeting of the society. They are "The Development and Use of the Modern Chain Grate," by T. A. Marsh; "Overfeed Stokers of the Inclined Type," by G. I. Bouton, and "The Design and Operation of Underfeed Stokers," by H. F. Lawrence. A fourth paper, "Tests of a Large Type W Stirling Boiler," by P. W. Thompson, is also included. Abstracts of these four papers may be found in the convention report published in the ELECTRICAL WORLD for Dec. 9, on page 1288. —*Mechanical Engineering,* January, 1923.

*Electric Drive for Turbine Auxiliaries.*—J. M. DRABELLE.—The author gives the rating of the electrically driven turbine auxiliaries in the Iowa Railway & Light Company's power station, describing their automatic features and giving operating data from the results obtained. He strongly advocates driving power-house auxiliaries with electric motors in preference to any other method.—*General Electric Review,* January, 1922.

## Generation, Control and Switching

*Paralleling Troubles.*—J. GEIGER.—The author reports two rather unusual experiences with the parallel operation of alternators. In one case where a steam turbine-generator was operating in parallel with a belt-driven generator the pointers of the ammeter and wattmeter of the latter were swinging periodically between normal values and twice normal values, and this was found to be caused by a resonance phenomenon of the instrument systems with the periodic knock of the belt lock upon the generator pulley. In the second case a Diesel motor power plant, with units of 100 kw. to 1,000 kw., operated in parallel with a 1,000-kw. steam turbo-generator. The instruments of the Diesel plant indicated periodically very heavy overloads, while the meters of the steam plant were quiet. The cause was found in the totally different character of the speed regulators used in the two plants. The regulator of the turbine was rather sluggish, while the oil motors had very sensitive regulators. In case a slight increase of load came on, the combustion motors responded much more quickly than the steam turbine and carried therefore temporarily a much higher load. An addition of oil dash pots to the regulators of the Diesel motors brought complete remedy for this trouble.—*Elektrotechnische Zeitschrift,* Jan. 4, 1923.

## Transmission, Substations and Distribution

*New Disk-Type Insulator.*—A. VAUPEL.—A cap-type chain insulator is described, very similar in outer shape to the recently developed "sphere-head" insulator. But the fastening of the rod within the head of the insulator is accomplished by means of a number of peculiarly arranged small iron pieces, assembled obliquely and concentrically around the rod. No cement is used. Comparative data for four types of insulator are given in the table. —*Elektrotechnische Zeitschrift,* Jan. 18, 1923.

| | Hewlett | Cemented-Cap Type | Sphere-Head Type | New Type |
|---|---|---|---|---|
| Puncture under oil, in kv.. | 100 | 130 | 160 | 180 |
| Mechanical strength, in kg. per sq.cm....... | 3,500 | 3,500 | 5,000 | 5,830 |

*Cement Bases for Wooden Poles.*—T. PANSERT.—This paper describes a method developed by M. Ponsolle of providing cement bases for wooden poles. The base consists of a cylindrical cement tube, conical on the inside and about 3 m. in height. The pole rests with its tapered end within the conical part of the tube, and its outside diameter is somewhat smaller than the inside diameter of the base tube, so that there is free access of air and ready drainage of water, both tending to prevent premature decaying of the pole butt. Wedge-shaped spacers hold the pole concentrically. A similar but two-part cement tube is described, to be used on poles already set. The method has been tested since 1908 and has been found to be both cheap and effective.—*Revue Générale de l'Electricité,* Jan. 20, 1923.

*Static Condensers for Power-Factor Correction.*—R. E. MARBURY.—Correction of power factor with static condensers, fundamentals of condenser design, factors of safety adopted and the application of static condensers to power lines are the main subjects discussed.—*Electric Journal,* February, 1923.

## Units, Measurements and Instruments

*Simplified High-Potential Test of Insulating Materials.*—G. J. MEYER.—To permit quick routine testing of pieces of insulating material a small handle with two point contacts spaced 5 mm. apart is described. The points are connected to a source of 3,500 volts to 4,000 volts, and are placed upon different parts of the piece under test. Perfect material will stand the test without any sparking or burning, while defective or moist pieces will cause a surface arc between the points. It is explained how the character of the burn gives a clue as to the nature of the defect in the material. The method has been used successfully for several years by the Dr. Paul Meyer Company in testing insulating materials intended for use on 500-volt work.—*Elektrotechnische Zeitschrift,* Jan. 4, 1923.

## Motors and Control

*Small-Capacity Synchronous Motor.* —L. SCHÜLER.—A series of small self-excited synchronous motors, in capacities from 3 kw. to 22 kw., is described. The motors have a wound armature, to which is connected a commutator for the direct current excitation and three collector rings. The armature receives the line current through the slip rings, while the stator is connected to the starter. The commutation is claimed to be sparkless even at high overload start or run. The motor starts under full load as an asynchronous motor, synchronizes quickly, and runs then as a synchronous motor with all the advantages of that type. At a load exceeding the normal rating the rotor falls out of step and runs as an induction motor until the load decreases, when it assumes synchronous speed again. This change is not noticed save for a drop of the power factor from unity to about 80 per cent. The advantages claimed are that the efficiency is slightly above that of an equivalent induction motor, the current consumption is about 15 per cent less, the iron losses are lower and the cost is about 20 per cent to 25 per cent higher. The latter item is partly compensated by the higher output which the motor gives when running as a synchronous unit.—*Elektrotechnische Zeitschrift,* Jan. 4, 1923.

*Maintaining Electric Railway Motors.* —J. S. DEAN.—Particular care should be used when replacing field coils in motors to insure that they are connected properly and that the correct

polarity is obtained. Various methods for testing are given.—*Electric Railway Journal*, Jan. 20, 1923.

### Illumination

*Use of Artificial Illuminants in Kinema Studios.*—L. A. JONES.—The subject is treated under the following two divisions: (a) the study of the characteristics of photographic materials and their response to different forms of radiation, and (b) the effect of light and radiation on the human eye. The first part is given over to a definition of photographic terms and units and an estimation of the effect of various illuminants in photographic work. The second part is devoted to the possibilities of injury to the eye of workers in kinema studios through radiation of harmful qualities or excessive intensity.—*Illuminating Engineer*, Vol. 15, Nos. 9 and 10.

*Specifications Governing the Acceptability of Electric Tail Lamps for Motor Vehicles.* — Specifications have been drawn up by the committee on motor-vehicle lighting of the I. E. S. and the lighting division of the standards committee of the Society of Automotive Engineers. They have been drawn to apply only to illumination by electric lamps of opaque registration number plates for use on automobiles, trucks, and motor cycles.—*Transactions of the I. E. S.*, February, 1923.

### Heat Applications and Material Handling

*Electric Heating of Rivets and Forgings.*—J. SAUER.—This paper describes the latest types of stationary and portable rivet heaters, with interesting curves on the efficiency, the power factor and the energy consumption of the apparatus. To estimate the energy required to heat a certain piece of steel, the author gives the formula $Q = 0.11 \times G \times t$, wherein $Q$ denotes heat energy in kilogram-calories (1 kw.-hr. = 864 kg.-cal.), $G$ is the weight of the piece in kilograms, $t$ is the desired temperature, and 0.11 is the specific heat of steel at 1,000 deg. C.—*A. E. G. Mitteilungen*, December, 1922.

*Arc Welding.*—O. H. ESCHHOLZ.—The author reviews the recent progress of arc-welding activities. Fusion welds, mechanical working, arc phenomena, penetration and high-speed welding are considered. Tables included give the rate of metal deposition, maximum welding speed for ½-in. plate using butt joints, and maximum welding speed for ½-in. plate using lap joints.—*Journal of American Welding Society*, January, 1923.

### Electrophysics, Electrochemistry and Batteries

*Durable Insulating Oils.*—C. J. RODMAN.—In searching the entire field of inorganic and organic liquids only a few liquid dielectrics were found to be adapted to insulation purposes, such as the use of oil in transformers, switches, lightning arresters, etc. Those compounds most nearly meeting the requirements are a small number of mineral oils, known as paraffine and naphthene hydrocarbons. The best commercial oils are derived from petroleum crudes and have very good physico-chemical characteristics.—*Electric Journal*, February, 1923.

*Apparatus for Determination of Magnetic Properties of Short Bars.*—M. F. FISCHER.—A description is given of the apparatus and methods developed for the magnetic testing of single specimens 10 cm. long and 0.6 cm. in diameter. As the magnetic properties of small samples are difficult to measure directly, a method has been adopted which involves the comparison of the test bar whose properties have been previously determined by calibration with several standard bars. The accuracy attainable with this method is entirely satisfactory, the errors in most cases being less than 5 per cent.—*Scientific Paper, No. 458 of the Bureau of Standards.*

### Traction

*Reducing Lubrication Costs.*—H. M. ROBINSON.—Methods of lubrication and amount of lubricant used on various types of motor and journal bearings on the rolling stock of the Northern Texas Traction Company and Tarrant County Traction Company, Fort Worth, Tex., are recounted. Cost of rolling-stock lubrication per thousand car-miles, amount of oil needed for car and regular inspection, oiling schedule for cars, etc., are given in tabular and curve form.—*Electric Railway Journal*, Jan. 20, 1923.

*Electric Railways Crossing Swinging Bridges.* — G. VALLECCHI. — When an electric railway crosses a swinging bridge the continuity of the line must be assured at all times. This article explains how the author solved this problem recently in Taranto, Italy, by feeding the contact wire and rails exactly to the two shafts where the two parts of the bridge swing. These two points are permanently connected together and in contact with the two branches of the railroad on either side of the river by means of cables. Swinging contacts, flexible or shiftable, are absolutely avoided, and no special assistance is required.—*Elettrotecnica*, Nov. 15, 1922.

### Telegraphy, Telephony, Radio and Signals

*Alternating-Current Telegraphy* with *Acoustical Frequency.*—F. LÜSCHEN.—The unreliable operation of single-wire telegraph lines and the inductive interference caused by high-voltage lines, and specially railway feeders, made it necessary to rebuild the telegraph lines for double-wire cable, as has been done with telephone lines. The considerably increased cost of such double lines was counteracted by their multiple use. A new system of multiple telegraphy with alternating currents of different frequency is described. This system permits "Pupinized" lines, such as are used for telephone service, to carry simultaneously six telegraphic messages with six different frequencies between 400 cycles and 1,700 cycles per second. Specially adapted electron tubes act as oscillators, amplifiers and rectifiers at voltages equal to those customary in telephony. The Siemens rapid machine telegraph, with perforated paper ribbon, gives a speed of six hundred to seven hundred letters per minute for each of the six messages. At the receiving end the usual band filters, each tuned for its particular frequency, separate the six codes again. The author enlarges upon the many difficulties which had to be overcome to make this system operate reliably. It is installed on the cable between Berlin and the Rhineland.—*Elektrotechnische Zeitschrift*, Jan. 4 and 11, 1923.

### Miscellaneous

*Developments in the Electrical Industry During* 1922.—JOHN LISTON.—Although progress in the electrical industry was mainly along established lines, there was a well-defined tendency in practically every phase of construction of electrical apparatus to concentrate the generation, transformation and distribution of electrical energy in units of greater capacities and with higher guaranteed efficiencies than in previous years. This is illustrated in one instance by the increase in transformer sizes, as shown in the accompanying table.

AVERAGE UNIT SIZE OF POWER TRANSFORMERS IN KVA.

| Year | Self-Cooled | Water-Cooled | All Types |
|---|---|---|---|
| 1919 | 1,175 | 4,325 | 2,150 |
| 1920 | 1,325 | 3,175 | 2,175 |
| 1921 | 1,575 | 4,150 | 2,750 |
| 1922 | 1,700 | 6,000 | 3,750 |

The maximum rating for steam-turbine generator sets was advanced to 62,500 kva. and that for waterwheel generators to 65,000 kva. The first electrically propelled ferryboat was placed in service last summer. Automatic station practice made further technical and commercial gains, with a steady increase in the unit capacities of the equipments and improvements in the design of the small-sized but very important devices which make automatic operation not only feasible, but fully as reliable as hand operation. Among other items of interest in widely varying fields were a new type of induction furnace for melting non-ferrous metals, the production of a highly efficient steam generator for use where surplus electrical energy is available, the "pallophotophone" for recording and reproducing sound, the 30-kw. incandescent lamp, radio and power tubes of unprecedented capacity, and further development of the million-volt testing set for commercial and research work. The review is forty-five pages long, amply illustrated. — *General Electric Review*, January, 1923.

# News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

## Lieb on Coal Situation

**How the Threatened Harm to Utility Operation from Fuel Scarcity May Be Combated**

SPEAKING before the regular monthly luncheon of the New York Electrical League on Wednesday of this week, John W. Lieb, vice-president New York Edison Company and chairman of the joint fuel committee representing the national electric light and power, electric railway and gas associations, which has been an active factor in obtaining fair treatment for the utilities during and since the coal strike, gave a comprehensive résumé of the whole fuel situation as it affects the utilities and especially the central-station companies dependent on steam operation. After sketching the importance of these utilities in the life of the nation, Mr. Lieb dwelt on the imperative necessity of their obtaining an adequate supply of good coal if their service to the public is to be maintained. Such a supply, he pointed out, has been placed in jeopardy by the changes recent years have brought in the coal-mining industry. From 1910 to 1920 there was an increase of 154 per cent in the number of mines, with only 37 per cent increase in output. As a result, in 1921 the average number of days in which individual miners worked was only 149. This whole condition not only increased overhead and hindered efficient collection and distribution of coal by the railroads but led directly to the strike. The strike was speedily complicated by the troubles with the railroad shopmen. The ultimate result to the utilities has been scarcity of fuel supply, enormous increase in cost and deterioration of quality, with attendant injury to furnaces, lessening of efficiency and forced reduction of storage. With 20 to 40 per cent of the total operating cost and 70 to 80 per cent of generating cost due to coal, the steam-electric utilities were harder hit by the situation than any other industry. Their coal contracts have proved of little value during emergencies unless they are protected by priority orders.

### What Are the Remedies?

Mr. Lieb then turned to the remedies for the grave ills to which the fuel situation has given rise. He advocated more extensive storage by the railroads and at the mines themselves, which would permit the miners to work with greater steadiness. The more general use of electric machinery by mines would also be of much benefit; at present only half of them use electric coal-cutting machinery and the total mine power supplied by central stations is only 880,000 hp. The value of generating stations at the mouth of the mine when sufficient water can be had, the feasibility of pumping coal to market and the advantage that would follow the construction of superpower transmission lines were dwelt upon in turn, and the high economy of great central stations like the one at Hell Gate, which produces a kilowatt-hour on 1.35 lb. of coal, was alluded to.

Expressing his determined opposition to government ownership and operation of mines, Mr. Lieb declared himself in favor of continued private ownership with government regulation such as utilities are subject to.

Mr. Lieb spoke to a large gathering, including many prominent executive officers of public utilities.

## Fight to Abolish the Utah Commission Fails

A determined fight made by stageline companies and other opponents of the Utah Public Utilities Commission to bring about its abolition was frustrated this week, when a bill to accomplish that end was killed in the Legislature. A number of other bills concerning the duties and powers of the commission are now before the Legislature.

## Rumored Merger of McKinley and Studebaker Interests

Persistent and apparently well-founded rumors in the financial district of New York point to a change in the control of the Illinois Traction Company and its consolidation with the so-called Studebaker group of utilities into a two-hundred-million-dollar company. The Illinois Traction Company, of which Senator William B. McKinley is president and H. E. Chubbuck vice-president executive, is one of the largest holding companies in the United States, operating—besides 600 miles of electric railway—light and power companies and gas plants in cities of Illinois, Iowa and Kansas. The Studebaker properties are embraced in the system of the North American Light & Power Company, of which Clement Studebaker, Jr., of South Bend, Ind., is chairman of the board and William A. Baehr of Chicago president and general manager. The company, incorporated in Maine in 1915, owns and controls subsidiary operating companies in the light and power field serving a population of more than 300,000 in 104 communities in Missouri, Ohio, Illinois and Oklahoma.

## Culminating New York Bill

**New Administration Measure Meant to Insure City Control of Utilities Within Boundaries**

AN ADMINISTRATION bill embodying sweeping "home rule" provisions for the regulat..n of public utilities and held to be even more significant than the measures described in the ELECTRICAL WORLD last week (page 467) was introduced in the New York State Legislature on Tuesday of this week. This measure has been drawn in accordance with recommendations contained in the Governor's first message and confers almost mandatory jurisdiction upon all cities of the state to regulate their own public utilities—mandatory in the sense that every city will assume such jurisdiction unless by a resolution of its governing board approved by the Mayor it shall elect to have the public utilities within its border regulated by the Public Service Commission of the state. The newly created bodies are to be called "city public utilities commissions." Their term of office and compensation are left to the judgment of the governing board of each city, which may, if it see fit, require an existing city body or officer to act as such a commission.

### Liberal "Home Rule" Provided

This is the measure giving to upstate cities power to deal with local transit, gas and lighting companies. It applies to all public service utilities in New York City except transit. The bill has twice been withdrawn for amendment, once at the suggestion of corporation counsels from the upstate cities. Now it is said to be in such shape as to be satisfactory to the larger upstate cities, especially Buffalo and Syracuse. Its notable feature is that it allows local regulation of all of that portion of a utility lying wholly within a city, with power reserved to the State Public Service Commission to establish and enforce rates or charges for through services rendered, whether alone or in conjunction with any other corporation, by any utility not wholly within a city; to prescribe a uniform system of accounts, to require the filing of schedules and tariffs, or to approve the issuance of stocks or bonds by all public utilities.

The political possibilities of the application of the proposed law are said to be many, and it is predicted by competent critics that, if the bill becomes law, there will be much conflict of jurisdiction between the state body and the local utility commissions, much that

the companies affected will place their own interpretation on and much that the courts will be called upon to determine. It is even said that, instead of the problem being solved, there is a possibility that in many cities the upshot will be no real regulation at all.

The public service committee of the State Senate will on March 14 hold a hearing on the bills previously introduced for the regulation of public utilities.

# New Central-Station Use for Radio

**Commonwealth Edison Company Broadcasts Its Annual Report—Fifteen Hundred Stockholders at Meeting—Dividends and Surplus for 1922 More than $6,250,000**

WITH an attendance of approximately 1,500 stockholders, overflowing into the corridors, and a radio audience of unknown proportions comprising stockholders, customers and any others who cared to "listen in," the Commonwealth Edison Company destroyed all chances of charges of secrecy at the annual meeting of its stockholders held last Monday afternoon at 5 o'clock. The entire proceedings of the meeting were, in accordance with advertisements in Saturday and Sunday newspapers, broadcasted from the Westinghouse Electric & Manufacturing Company's radiophone station on the Edison Building. It is not yet known over how wide a territory outside the city the proceedings were heard. The matter sent out included the formal proceedings of the meeting and the address of President Samuel Insull. This is believed to be the first instance in which any attempt has been made to broadcast such matter.

President Insull said that there were 600,000 shares of stock entitled to vote at the meeting, of which 451,906, or slightly less than 80 per cent, were represented personally or by proxy. Of these 90 per cent are owned in Chicago and another 5 per cent in Illinois outside of Chicago. Ninety-six per cent of the stockholders own 90 per cent of the outstanding stock. Mr. Insull gave the number of stockholders as 28,489. Of 7,098 employees, 1,129 of whom were added last year, Mr. Insull said that one in three is a stockholder.

The revenue of $43,107,955 for the year 1922 shown in the company's annual report is an increase of nearly $6,000,000 over 1921. Mr. Insull gave the budget for plant expenditures for the coming year as $23,000,000. Approximately $3,500,000 is to be spent on the new Crawford Avenue station now under construction, $7,500,000 in finishing the Calumet station and $500,000 to $600,000 on other stations. It is estimated that the following approximate amounts will be spent on other items: Substations, $3,000,000; conduits, $2,000,000; underground cables, $1,250,000; overhead construction, $3,000,000; meters, $1,300,000 to $1,400,000, and miscellaneous items, $800,000. Mr. Insull estimated that the total expenditure for the coming five years would be in the neighborhood of $100,000,000. He prophesied that the company would have almost 1,000,000 kw. in plant capacity by 1925.

*Attention!*

**Commonwealth Edison Company Stockholders and Customers**

*Radio to Broadcast Stockholders Meeting, 5 P. M., Monday, February 26, 1923*

The annual meeting of the stockholders of the Commonwealth Edison Company will be held at 5 p. m., Monday, February 26th, in Customer's Hall, Edison Building, 72 West Adams Street.

We have today approximately 27,000 stockholders as well as 615,000 customers. Because of the great growth in number of stockholders and the desire of the management that all be as closely informed as possible in regard to the company's affairs, the radio will be utilized to broadcast the proceedings of the annual meeting of stockholders.

This will be good news particularly to those stockholders who will be about their housework at five o'clock or who may be out of the city and unable to attend.

The entire proceedings will be broadcasted from Station KYW of the Westinghouse Electric & Manufacturing Company located on the roof of the Edison Building.

Promptly at 5 P. M., Central Standard Time, the meeting will open. The annual address of Mr. Samuel Insull, President, will directly follow the formal reading of minutes of the previous meeting, the counting of stockholders' votes and disposal of formal motions.

Customers of the Company are also invited to "listen in" as Mr. Insull will undoubtedly have something interesting to say about the future.

This is the first time in the history of any corporation that a meeting of the stockholders has been thrown open to the general public via radio. The Commonwealth Edison Company will be pleased to hear from stockholders, particularly those living at distant points, as to the success of this undertaking.

*Commonwealth Edison Company*

ADVERTISEMENT IN CHICAGO NEWSPAPERS

SUMMARY OF FINANCIAL REPORT

| | | |
|---|---|---|
| Electric operating revenues...... | | $43 107,955.71 |
| Electric operating expenses (Including amortization and depreciation, $3,287,211 67). | | 28,418,946.77 |
| Net electric operating revenues.... | | $14,689,008.94 |
| Other charges: | | |
| Uncollectible operating revenue...... | $165,147 46 | |
| Taxes assignable to electric operations. | 3,400,000.00 | |
| Municipal compensation........ | 1,283,883.12 | 4,849,030.58 |
| Net operating income | | $9,839,978.36 |
| Other income | | 687,564.92 |
| Gross income | | $10,527,543.28 |
| Deductions from gross income.. | | 1,202,946.50 |
| Balance ........ | | $9,324,596.78 |
| Interest on funded debt | | 3,048,222.01 |
| Available for dividends. | | $6,276,374.77 |
| Dividends paid.......... | | 4,602,416.00 |
| Balance carried to surplus. | | $1,673,958.77 |

### THE ANNUAL REPORT

The electrical operating revenue of the company, the annual report showed, totaled $43,107,955.71, with electric operating expenses (including amortization and depreciation of $3,287,311.67) amounting to $28,418,946.77. The net income available for dividends after all interest items were paid was $6,276,374.77, of which $4,602,416 was paid out for such purposes and $1,673,958.77 carried to surplus. An increase of $1,600,000 in the cost of operation due to the coal strike during the year occurred, but was more than offset by the profit derived from the very large increase in operating revenue. In all 73,321 consumers were added to the company's lines in 1922, making a total at the end of the year of 610,303. The total energy generated in 1922 was 2,225,443,000 kw.-hr., as against 1,928,272,000 kw.-hr. in 1921. The maximum load was 600,000 kw., as against 526,000 kw. in 1921, or an increase of about 14 per cent. The free delivery of lamps, which had been curtailed during the war, was resumed last February.

The issuance of $12,000,000 additional capital stock and the action of the board of directors in recommending the authorization of an increase in capital stock from $80,000,000 to $100,000,000 were reported, and the latter recommendation was acted on formally.

## Prosperous Year for Illinois Public Service

The annual report for the fiscal year ended Dec. 31, 1922, shows that both the operating revenue and the net income of the Public Service Company of Northern Illinois were substantially increased over 1921. With an increase in customers from 118,304 in 1921 to 133,600 in 1922, the gross operating revenues also increased from $12,213,315.93 to $13,712,094.90. Last year's net income available for dividends was $1,835,470.27 against $1,579,535.65 in 1921. The surplus for 1922, after deducting dividends, a depreciation account of $670,660 and other charges, amounted to $446,372.52, as against $275,262.65 in 1921. The company's total operating revenues from gas, electricity, heating and water service showed an increase of $1,498,778.97 over the year 1921. The report contains details of plant extensions, which are to include the new plant at Waukegan and 30,000-kw. additions at the Joliet station and a review of the new substations and transmission lines constructed during the year.

At the stockholders' meeting on Feb. 26 it was voted to increase the capital stock of the company by 50,000 shares of 6 per cent preferred stock, par value $100, and 100,000 additional shares of common stock without par value, to be on a parity in all respects with the present outstanding stock of the company. This will be issued as needed during the coming year.

## Standard Gas & Electric Has Best Year

Figures given out by H. M. Byllesby & Company show that the Standard Gas & Electric Company in the twelve months ended Dec. 31, 1922, had the most successful year in its history. A preliminary earnings statement for the period indicates that the company had a balance of earnings of $1,386,457 after deduction of all expenses, interest charges, taxes, preferred dividends and amortization and other reserves. This is the equivalent of 13.07 per cent on the common stock of the company outstanding. In the previous year the balance for the common shares, after all charges, was $1,080,980, or 10.19 per cent.

## New Trial Ordered

### Litigation Between Southern Power Company and North Carolina Mills Sent Back to County

THE power-rate case in which North Carolina cotton mills are fighting the Southern Power Company, which has attracted great attention in that territory, was last week remanded by the Supreme Court of North Carolina to the Cleveland County (N. C.) court for retrial. This case hinges on the reasonableness of the rates prescribed by the North Carolina Corporation Commission, and the controversy started in November, 1920, when the power company applied to the commission for an increase of rates and abrogation of existing contracts and received permission to charge 1.25 cents a kilowatt-hour for primary power in the amount of 50,000 kw.-hr. a month, with an increasing or diminishing charge for less or greater amounts, and 1 cent for secondary power on the same basis.

A large number of cotton mills accepted the ruling of the commission, but appeals were taken to the county court by twenty-three of them, divided into three groups holding long-time contracts which had been set aside. One of these groups subsequently sought to withdraw from the suit, a mistrial resulted, and the case was brought before the Supreme Court. This body in ordering a retrial declared the appeal to it to be "fragmentary and premature," but went on record to the effect that the rate question involved is intrastate and not interstate, that no discrimination lies in the fact that the Southern Power Company may sell power cheaper in South Carolina than in North Carolina, and that there is no valid objection to the Corporation Commission's basis for rate fixing.

## Ohioans Discuss Lighting Problems

Conservation of school children's eyesight is one of the greatest present-day illuminating engineering problems, according to Prof. H. B. Dates, Case School of Applied Science, Cleveland, who read a paper on public-school lighting before the new-business co-operations committee of the Ohio Electric Light Association at Columbus on Feb. 21. Although the average cost of good school lighting would not run over one-half of 1 per cent of the total school expenses, this expenditure would do much to allay defective vision in pupils, he said. He told of the installation of six units 16 in. in diameter in the 900-sq.ft. schoolrooms in Cleveland, where 150-watt bulbs are used. Professor Dates found this type of equipment to give the best average results with an intensity of 5 to 8 foot-candles.

Prof. F. C. Caldwell, Ohio State University, felt that more attention should be given to the esthetic values of school lighting.

Dr. M. Luckiesh of Cleveland lamented the fact that fixture designers are too ambitious in selling designs rather than the idea of illumination itself. With most of the present-day equipment copied after antique designs, he declared that there was not a single 1923 model which would serve effectively as an illuminating medium.

Progress in rural service was discussed by D. L. Gaskill, Greenville, who saw a growing tendency on the part of the farmer to prefer the minimum charge for service rather than a fixed charge added to the cost of energy at urban rates. This seems to be due to the fact that with the minimum charge the farmer can use as much energy as he desires, whereas the fixed charge leaves a doubt in his mind as to what kind of service he is paying for.

A meeting to adopt plans governing rural-line rates will be held in Columbus on March 29.

## Hoover for Nitrate Production at Muscle Shoals

Secretary of Commerce Hoover, appearing recently before the appropriations committee of the House of Representatives, announced that he favored development of Muscle Shoals for making nitrates, although he was against government operation.

"I should like to see Mr. Ford do it if that would suit anybody," the Secretary said. "I do not know whether Mr. Ford's terms are the terms Congress ought to adopt. I could not speak as to that, but I would like to see anybody who has capital take Muscle Shoals and turn nitrates out of it tomorrow."

It was brought out that the United States has paid nearly $1,000,000,000 for Chilean nitrates since the Civil War, and the Secretary said that as a protective measure "we ought to do something for our own relief." He added that there was 4,000,000 hp. on the Colorado River in Arizona that he "would like to see turned into the manufacture of nitrates."

## Public Relations Program for New England Men

Seven addresses bearing upon public relations are scheduled for a luncheon and afternoon meeting of the New England Division of the N. E. L. A. at the Hotel Vendome, Boston, March 8. The luncheon will be served promptly at 12:30, after which the following program will be carried out: "Public Relations in Theory and Practice," by R. H. Newcomb, executive assistant Boston & Maine Railroad; "Co-operation by and with Our Educational Institutions," by M. S. Sloan, president Brooklyn Edison Company; "Employees' Clubs," by H. T. Edgar, Stone & Webster; "Women's Public Information Committee," by Miss G. M. Thibodeau, Malden Electric Company; "Publicity," by C. L. Edgar, president Boston Edison Company; "Knowing Your Contractors and Dealers," by George W. Hurn, resident manager Haverhill Electric Company.

## Nebraska Legislature Wants Ford to Develop Power

A resolution passed on Feb. 16 by the House of Representatives of Nebraska requested Henry Ford to make an industrial survey of the hydro-electric power of that state and to engage in its development, "pledging him the most cordial support from our government, state and municipal, and from our people." The resolution continued: "Resolved, That we urgently request the members of Congress from the State of Nebraska to support the passage of the Ford tender for Muscle Shoals before March 4, 1923, so that a precedent can be set for similar developments in Nebraska."

In response to this resolution United States Senator G. W. Norris, conspicuous for his opposition to the Ford proposal, sent a reply containing this among other statements:

"The resolution frankly states that the reason why you want the Nebraska members of Congress to support the Ford offer as to Muscle Shoals is 'so that a precedent can be set for similar developments in Nebraska.' The reason you give for the support of the Muscle Shoals proposition is one of the many reasons why I have been opposed to the acceptance of Mr. Ford's offer for Muscle Shoals. The acceptance of the Muscle Shoals offer, as you truly state in your resolution, would be a precedent which would be used as a basis for similar action all over the United States, and as a result we would give the control of the development of hydro-electric energy from our navigable streams over entirely to corporations of wealth without retaining any control or regulation whatsoever for the benefit of the people at large."

## Wisconsin Utility Men Get Ready for Convention

Nearly a thousand public utility men are expected to gather in Milwaukee on March 21 to March 23, when for the first time in the history of Wisconsin electric light and power representatives will unite with street railway and gas company delegates in a convention to be held by the Wisconsin Utilities Association, founded a year ago. The joint session will be addressed by President J. P. Pulliam, Milwaukee; C. R. Phenicie of Green Bay, chairman of the Electrical Section; B. W. Arnold, Oshkosh, chairman of the Electric Railway Section; James P. Barnes of Louisville, Ky.; John B. Malig of New Haven, Ind., and others.

Subjects already arranged for the electrical sessions include the safety code, rural extensions, automatic substations and inductive co-ordination. The sales and accounting sections will hear W. T. Bracken, Beloit, on "Selling the Commercial Department to the Employees"; W. E. Derwent on "Manufacturers' Relations to the Sales Department," and Inman P. Marking on "Customers' Meter Reading."

## New England Tie Lines

### Hartford and Springfield Soon to Be United by a 66,000-Volt Line—Large Energy Contracts

RAPID progress toward the wider interconnection of New England central-station and power systems is under way notwithstanding the severe winter conditions lately experienced. One of the most important tie lines to be built in the near future will interconnect the South Meadow station of the Hartford (Conn.) Electric Light Company with the 66,000-volt system of the Turners Falls (Mass.) Power & Electric Company at Agawam. This line will also tie the plants of the Hartford company and the United Electric Light Company of Springfield, Mass., together. As the Turners Falls system is interconnected with the New England Power Company's system, and the latter with the Boston Edison and Narragansett (Providence) systems, and as the Hartford company is interconnected with the Connecticut Power and Connecticut Light & Power systems, the completion of the Hartford-Agawam line will close the gap between various central stations in southern New Hampshire, in Vermont, on the Atlantic seaboard and in central New England and the properties in southwest Connecticut, leaving Maine as the only New England state pursuing a policy of isolation in electrical generation and transmission.

Important contracts for the sale of energy have lately been closed in the eastern Massachusetts region involving either the enlargement of existing facilities or the provision of new supplies. The Eastern Massachusetts Street Railway has arranged to buy local energy from the Lynn Gas & Electric Company, and the Edison Electric Illuminating Company of Boston has agreed to supply 10,000 kw. to the Eastern Massachusetts Electric Company, instead of the previous 3,000 kw., the latter company operating a tie line between Revere, Malden and Salem, Mass., and serving various Tenney companies at the north of Boston. An interconnection will shortly be made between the Salem Electric Lighting Company and the plant of the Beverly Gas & Electric Company, recently acquired by the Tenney interests, with probable early curtailment of generating functions at the small and less efficient Beverly station.

At a recent hearing in the Boston Edison rate case it was stated that an investigation is being made by the Boston Edison company and the Boston Elevated Railway Company relative to the feasibility of purchasing Edison service in case the proposed electrification of the Shawmut branch of the New York, New Haven & Hartford Railroad is undertaken. Another interconnection about to be effected is between the Boston Edison system and the Cambridge (Mass.) Electric Light Company, with an initial supply of 3,000 kw. to the latter.

## Europeans Impressed with Boston Lighting Bureau

So impressed were the members of the European "lighting mission" to the United States with the equipment and work of the Bureau for Better Illumination maintained in Boston that the establishment of an enterprise of this sort under the auspices of one or more technical societies in Great Britain will be taken up on the return of the vistors. The mission, which came to the United States late in January, is composed of W. E. Bush, British Thomson-Houston Company, London; H. Maisonneuve, Cie des Lampes, Paris; K. J. Corkery, China General Edison Company, Shanghai, and C. F. Johnston, International General Electric Company, London.

EUROPEAN LIGHTING MISSION VISITING IN BOSTON AND THEIR GUIDES

Left to right, front row—W. E. Bush, British Thomson-Houston Company; K. J. Corkery, Shanghai, China; H. F. Wallace, Boston; H. Maisonneuve, Paris. Back row—J. Danielson, Boston; H. H. Magdsick, Cleveland; G. L. Alexander, Schenectady.

# Electricity in Southern Cotton Mills

MORE than 60 per cent of the cotton-mill spindles in the territory served by the Southern superpower system—and there are nearly fourteen million in that territory—are operated on purchased power, according to a survey made recently by J. E. Sirrine & Company, engineers, Charlotte, N. C. Another interesting thing is that 5,250,000 of these spindles are served by the Southern Power Company. The 8,369,300 spindles which are operated on purchased power are owned by five hundred mills having an annual energy consumption of 683,233,000 kw.-hr. and an indicated load of 296,625 kva. From 80 to 100 per cent of the power for spindles is sold on a primary basis, while from 4 to 20 per cent is sold when power is available.

SURVEY OF CONDITIONS ON SOUTHEASTERN SUPERPOWER SYSTEM, WHICH SUPPLIES POWER TO 8,369,300 COTTON SPINDLES
(Made by J. E. Sirrine & Company, Engineers, Charlotte, N. C.)

| | Southern Power Company | Alabama Power Company | Georgia Railway and Power Company | Tennessee Electric Power Company | Columbus Power Company | Central Georgia Power Company | Carolina Power & Light Company and Yadkin River Power Company | All Others | Total Reported |
|---|---|---|---|---|---|---|---|---|---|
| Kva. installed: | | | | | | | | | |
| Hydro-electric.... | 244,400 | 83,000 | 84,700 | 100,000 | 30,000 | 24,000 | 26,500 | 30,550 | 623,150 |
| Steam........... | 36,500 | 70,800 | 21,500 | 45,700 | 9,000 | 3,000 | 6,925 | 15,000 | 208,425 |
| Kva. under construction: | | | | | | | | | |
| Hydro-electric........ | 131,250 | 80,000 | 54,500 | ........ | ........ | ........ | ........ | ........ | 265,750 |
| Steam................ | 56,250 | ........ | ........ | 15,000 | ........ | ........ | ........ | 15,000 | 86,250 |
| Economical undeveloped hydro power (kva.) | 1,000,000 | 1,000,000 | 225,000 | 750,000 | 60,000 | 120,000 | ........ | 60,000 | 3,125,000 |
| Spindles in territory.... | 8,922,500 | 1,434,624 | 1,045,000 | 125,656 | 838,496 | 385,664 | 1,098,280 | ........ | 13,848,219 |
| Mills buying power...... | 271 | 39 | 20 | 46 | 33 | 20 | 59 | 12 | 500 |
| Spindles on purchased power.. | 5,250,000 | 850,000 | 389,220 | 113,568 | 650,000 | 227,312 | 859,200 | 30,000 | 8,369,300 |
| Total kilowatt-hours sold in 1921...... | 620,000,000 | 370,470,231 | 178,202,725 | 304,571,731 | 90,280,387 | 52,464,900 | 104,344,305 | 105,000,000 | 1,825,000,000 |
| Total kilowatt-hours sold to cotton mills in 1921............ | 421,000,000 | 60,195,542 | 48,964,350 | 10,468,398 | 60,355,729 | 17,327,730 | 56,922,043 | 25,000,000 | 683,233,000 |
| Total indicated cotton-mill load on purchased power (kva.)... | 170,000 | 25,600 | 14,651 | 6,560 | 30,310 | 8,800 | 30,704 | *10,000 | 296,625 |
| Percentage on primary power....... | 90 | 100 | 85 | 96 | ....... | 80 | 95 | 80 | 90 |
| Percentage on secondary power...... | 10 | ...... | 15 | 4 | ....... | 20 | 5 | 20 | 10 |

## Hell Gate Still Grows

**A 35,000-Kw. Generator and a 35,000-Kva. Frequency Changer Will Augment Installation of 150,000 Kw.**

WITH the placing in service on Feb. 3 of a fourth turbine at the Hell Gate station, the initial installation at the United Electric Light & Power Company's ultra-modern generating plant on the East River, New York, was completed. This made a total installed capacity of 150,000 kw., which is one-half of the 300,000 kw. ultimate capacity. Already it is found necessary to increase the equipment further, and in the fall of this year an additional 35,000-kw., 25-cycle unit will be added. This unit is similar in a general way to those of the same frequency now in service and is being supplied by the General Electric Company. It will operate at 1,500 r.p.m. and will supply energy at 11,400 volts. This turbine will be arranged to bleed steam at two points to heat the feed water through the use of closed heaters. It will exhaust into a 50,000-sq.ft. Worthington condenser of the same general type now in service on two of the units. To drive this turbine there will be installed three boilers of 15,500 sq.ft. heating surface each, to be furnished by the Springfield Boiler Company. A change from the first installation of boilers furnished by this company has been made in the tube arrangement to allow for the addition of economizers. In the present installation a drop leg in the header allows for the superheater to be placed above the lower six rows of tubes. In the new installation the tube bank, instead of being twenty rows high, will be sixteen high with the superheater on top. A 13,824-sq.ft. economizer will be installed for each boiler. The economizers and the superheater are being furnished by the Power Specialty Company.

The stoker arrangement is also being changed from that of the original installation. The present boilers are each fired by two fourteen-retort, seventeen-tuyère stokers discharging into a central clinker-grinder pit. Each of the new boilers will be fired by a single fourteen-retort, thirty-three-tuyère stoker. The present sluicing arrangement of taking care of the ashes will be retained. These stokers are furnished by the same company that supplied the original installation, the American Engineering Company. Certain minor changes will be made in this new equipment as compared with the present installation, keeping pace with the advance in the art during the past year. For the new boilers it will be necessary to build another smokestack, the steel foundation for which has already been laid. The building was originally built for the complete installation of 300,000 kw., except that only that part of the electrical gallery was built which was necessary for the present equipment. This electrical gallery building at present consists of a service building at one end with four switch sections and one control gallery section. Each of the switch sections houses the switching equipment for one generator and twelve feeders. There will now be installed and equipped three more switch gallery sections of the same general design.

In order to make available the reserve generator capacity of the 60-cycle system for the 25-cycle system, and vice versa, a 25,000-kva. frequency changer has been purchased. This unit will run at 300 r.p.m. and will consist of one 60-cycle, 13,800-volt, three-phase alternator and a 25-cycle, 11,400-volt, three-phase alternator on a single shaft and with four bearings. On the same shaft will be installed a 25-cycle, 11,400-volt wound-rotor induction starting motor and a 115-kw., 250-volt direct-current exciter. A 17,000-kva., 14,000-volt, three-phase, 25-cycle transformer is connected between the stator of the 25-cycle unit and the rotor of the 60-cycle unit. This is the largest unit of its type that has been built, and its operation is looked forward to with interest. It is approximately large enough to act as reserve for the loss of the largest generator on either system. A separate building is being built to house this unit together with its transformers and oiling equipment.

A further addition to the equipment at Hell Gate station will consist of a bank of five three-phase, 12,000-kva. outdoor transformers which will be used to supply service to territory in Brooklyn and elsewhere.

# Refunding Figures in February Financing

ELECTRIC light and power public utility issues of bonds and stocks during the month of February amounted to $57,811,600, representing an increase of more than 88 per cent over February, 1922, but a decrease of more than 19 per cent as compared with January of the present year. Two ten-million-dollar issues swelled the month's total, a large part of which was for the purpose of acquiring or redeeming stocks or bonds already outstanding. Only nine of the eighteen securities listed represent applications for strictly new capital. The rise in popularity of preferred stock, which was one of the features of the trend of financial affairs in 1922, is still apparent. Long-term securities continue to predominate, and the rate of return yielded the investor, 6.25 per cent, though higher than in January, is still low.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN FEBRUARY

| Name of Company | Amount of Issue | Period, Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Connecticut Light & Power Co. | $4,500,000 | .. | Cumulative preferred stock | To retire floating debt and for construction | 7 | 100 | 7 |
| Southern Indiana Gas & Electric Co. | 1,000,000 | 24 | First lien and refunding mortgage gold bonds, series B | Refunding and to reimburse for expenditures | 6 | 92 | 6.65 |
| Alabama Power Co. | 4,700,000 | 28 | First mortgage lien and refunding gold bonds | Additions, to retire floating debt and other purposes | 5 | 89½ | 5.75 |
| Ohio State Power Co. | 290,000 | 12 | First mortgage gold bonds of 1915 | Construction | 6 | 97½ | 6.30 |
| Southern Minnesota Gas & Electric Co. | 1,275,000 | 19 | First lien and refunding mortgage gold bonds, series A, sinking fund | To retire bonds and reimburse for expenditures | 6½ | 98½ | 6.60 |
| Monongahela-West Penn Public Service Co. | 6,770,000 | 5 | First lien and refunding convertible gold bonds, series A | To retire bonds | 6 | 97.89 | 6.50 |
| Charlestown Gas & Electric Co. (Mass.) | 200,000 | 20 | First mortgage gold bonds, series A | Refunding | 5 | 104½ | 4.65 |
| Electric Bond & Share Co. | 1,000,000 | .. | Cumulative preferred stock | General corporate purposes | 6 | 97½ | 6.15 |
| Pacific Gas & Electric Co. | 10,000,000 | 30 | First and refunding mortgage gold bonds, series C | Additions and extensions | 5½ | 98½ | 5.60 |
| St. Maurice Power Co. (Que.) | 9,026,600 | 30 | First mortgage sinking-fund gold bonds | Additions and extensions | 6½ | 99½ | 6.55 |
| Pennsylvania-Ohio Pwr. & Lt. Co. | 1,000,000 | .. | Cumulative preferred stock | To reimburse company for property expenditures | 7 | 93½ | 7.49 |
| Lake Sunapee Power Co. (N. H.) | 200,000 | 20 | First mortgage sinking-fund gold bonds | Additions | 6 | 94½ | 6.50 |
| Oklahoma General Power Co. | 1,000,000 | 29 | First mortgage gold bonds, series A | Additions | 6 | 92 | 6.23 |
| Continental Gas & Electric Co. | 2,000,000 | 25 | Refunding mortgage bonds, series A | Additions and extensions | 6 | 95 | 6.40 |
| West Missouri Power Co. | 1,350,000 | 20 | First mortgage gold bonds, series of January, 1923 | Refunding and new capital | 6 | 98½ | 6.13 |
| Philadelphia Co. | 10,000,000 | 15 | Convertible debenture gold bonds | Refunding | 5½ | 92½ | 6.25 |
| East Penn Electric Co. | 2,500,000 | 30 | First mortgage and refunding lien gold bonds | Additions | 6 | 97 | 6.20 |
| Indiana Service Corp. | 1,000,000 | 27 | First and refunding mortage gold bonds, series A | Additions and extensions | 5 | 88¼ | 5.88 |
| Total | $57,811,600 | | | | | | |

## Growth of Niagara Falls Power Company Continues

The annual report of the Niagara Falls Power Company puts its total output of electrical energy for 1922 at 2,252,248,525 kw.-hr., placing the company once more in first place among American power companies in production of electrical energy. This output compares with 1,855,120,000 kw.-hr. in 1921, when the company occupied second rank, and to its peak output of 2,328,326,000 kw.-hr. in 1920.

Earnings applicable to dividends after all charges including amortization were $2,394,407, an increase of $415,814 over 1921. There was no remarkable change in the current assets or liabilities as compared with 1921, the former being $6,789,174, an increase of $398,813 over the previous year, while current liabilities increased $282,757 to $1,831,379, leaving net liquid assets, as of Dec. 31, $4,957,789. Accumulated surplus amounted to $2,136,761.

During the year under the customer ownership plant the company sold to employees and consumers $3,664,300 7 per cent cumulative preferred stock.

The transforming station at Echota, which forms the center of the upper Niagara River power territory, was completed during the year and has a capacity of 200,000 kw. The new transmission line to Buffalo, which is carried across the Niagara River in two places on high steel towers, was also completed and the tunnel which is to supply water from the upper river has been bored through in full size for more than three-quarters of a mile. Other additions made to the plant during the year consist of three hydro-electric units, each of 70,000 kw. capacity, placed in the gorge of the lower river, which will be operated with water brought from the pool above the falls. It is expected that one of these units will be put into service in time for the seasonal peak load this coming autumn and the other two early in 1924.

## Niagara Falls Power Tunnel Almost Completed

Official announcement has just been made that the pressure tunnel from Port Day to the edge of the high bank of the Niagara River at Niagara Falls, N. Y., is nearing completion. This tunnel will carry the water for the new extension to the power development of the Niagara Falls Power Company, and it is expected that water will be admitted by the first of April. The tunnel is believed to be the largest water-power tunnel ever constructed, and the company wishes to afford engineers an opportunity to inspect it before it is put into service. With the co-operation of the Read-Coddington Engineering Company, which is the contractor for the work, an opportunity will therefore be given to engineers to visit the tunnel at any time between March 20 and April 1. It is requested that those desiring to make this inspection will send their names to the Niagara Falls Power Company, mentioning the date on which they would like to visit the work.

## Maryland Utilities Association Organized

Permanent organization of the Maryland Utilities Association has just been effected at Baltimore by a gathering of utility men numbering 170. Electrical, gas and water-supply men took part in the movement, which is designed for the interchange of ideas, discussion of problems and education of the public.

Officers of the new organization are as follows: President, Emory L. Coblentz, Frederick; vice-president, Charles O. Culver, Salisbury; secretary and treasurer, H. T. Connolly, Annapolis.

## Chamber of Commerce Takes Vote on Trade Bodies

Trade associations were the subject of a referendum submitted to its membership on Tuesday of this week by the Chamber of Commerce of the United States. Organizations representing practically all industries and branches of commerce form an important part of the chamber's membership, and a "yes or no" vote was taken on whether because of "their numerous useful and important functions of obvious propriety" trade associations should exist for each important branch of industry and commerce and on various subsidiary propositions affecting their control and functions.

It is pointed out in the committee report accompanying the ballots that "there is a long list of functions which trade associations perform in the interest of their members and of the community at large. These functions are illustrated by the standardizing and safeguarding of the quality of goods, the reducing of waste in manufacture and distribution, the promotion of trade, both domestic and foreign, and the upbuilding in scores of other ways of industry and commerce." In its report the committee opposes government control of trade associations.

## Coal Commission Asks More Funds to Finish Work

Although it still had $85,000 on hand, the President's fact-finding coal commission applied to Congress last week for a further appropriation, asserting that since the sum just named would be entirely inadequate to carry its investigations to a conclusion the commission was prepared to suspend its work on March 4 unless further funds were granted and to return the amount unexpended. The commission held that too many inconclusive investigations of the coal industry have already taken place and that unless the present one could be made thorough there was no use in going on with it. The sum desired by the commission and for which it guaranteed real results was $400,000. With this sum it proposed to send 250 men and women investigators into the coal fields to gather first-hand information on living conditions and everything affecting the fuel situation at the source.

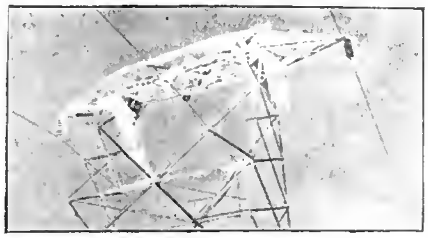
The coal commission has been made the recipient both of much matter in the nature of propaganda and of a great mass of helpful data. Among other things, its attention has been called to a widely held belief that coal operators have not made sufficient use of engineering skill. The record is said to be clear that expenditures for engineering talent and advice represent an insignificant portion of the expense of coal-mine development—very much in contrast with the amount expended for engineers in metal mining.

## Lightning-Arrester Committee in Steinmetz's Workshop

Left to right—E. R. Seymour, L. T. Robinson, D. W. Roper, F. L. Hunt, M. G. Lloyd, J. B. Taylor, E. E. F. Creighton, J. R. McFarlin, V. E. Goodwin, A. H. Sweetnam, F. B. Davenport, W. F. Hudson, R. T. Wagner, A. H. Perham, J. P. Fish, H. H. Bailey, E. H. Burger, members of A. I. E. E. committee and General Electric officials.

## Fog-Ice Deposit on Transmission Line Over Cascade Range

THE transmission line which Stone & Webster, Inc., are building across two mountain ranges to supply the Wenatchee Valley with power from the Puget Sound Power & Light Company's system is not yet complete, but some sections of the line have already withstood severe weather conditions. The accompanying picture was taken where the line crosses the Cascade Mountains at an elevation of 3,900 ft. A series of cold clear days last November were accompanied by moist winds blowing up from the lower canyons. When this moist air reached the cold zone at the higher elevations the moisture instantly congealed on contact with any solid object. The fog-ice hung from the conductor in icicles as long as 24 in. and several inches thick. When the picture was taken the ice had fallen from the conductors, but the peculiar formation of low-density ice on the tower can be plainly seen. The picture was furnished by W. D. Shannon, under whose supervision the line is being built.



FOG ICE ON TOP OF TRANSMISSION TOWER

## Engineering Foundation Re-elects Rand Chairman

Announcement has been made by the board of directors of the Engineering Foundation, which is directing a national program of industrial research in co-operation with the National Research Council, of the re-election as chairman of Charles F. Rand of New York, who is treasurer of the American Institute of Mining and Metallurgical Engineers. Other officers elected are: First vice-president, Edward D. Adams; second vice-president, Frank B. Jewett; treasurer, Joseph Struthers; assistant treasurer, Henry A. Lardner.

Alfred D. Flinn was re-elected a director of the Foundation. Dr. W. F. M. Goss was elected to the board to succeed George M. Basford, and Col. Arthur S. Dwight was named a director to succeed Edwin Ludlow. Other members of the board for the ensuing year are George H. Pegram, Bancroft Gherardi, Silas H. Woodard, Prof. Arthur L. Walker, John H. Barr, H. Hobart Porter, David S. Jacobus, Prof. Herbert M. Boylston, E. Wilbur Rice, Jr., Elmer A. Sperry and J. Vipond Davies.

## General Electric's New Plan for Employee Investment

To further investment by employees of the General Electric Company in the securities behind which the company stands a new plan has been worked out and the General Electric Employees' Securities Corporation has been organized. The new corporation will issue 6 per cent bonds to employees on the installment plan, paying an additional 1 per cent on them as long as the holder remains in the employ of the company. Seven of the fifteen members of the board of directors will be representatives of the employees, elected by the bondholders. Each $10 par value of such bonds of the new corporation will have one vote for these directors. Eight directors will be named by the company. The new corporation will issue $5,000,000 of 6 per cent fifty-year bonds and 10,000 shares of no-par-value capital stock. The proceeds from the sale of the stock and the bonds will be invested by the company in the securities of light and power companies and of holding companies in which the General Electric Company itself is financially interested. In other words, the idea of the investment trust will be followed, with the employees as participators in the profits through their holdings of the securities of the trust itself.

## Brief News Notes

**"Home Rule" for Fort Wayne Defeated.**—The Indiana State Senate has defeated by a vote of thirty to thirteen a bill designed to remove from the jurisdiction of the Public Service Commission all utilities owned by the city of Fort Wayne, introduced at the request of the city officials.

**St. Louis Bond Issue Carried.**—St. Louis will soon enter into an era of physical transformation and development as a result of the voters' approval on Feb. 9 of twenty of the twenty-one proposed items of the municipal bond issue for civic improvement. The sum voted aggregates $87,372,500 and includes $8,000,000 for a city-wide electric lighting system.

**"Home Rule" for Wisconsin Cities.**—The judiciary committee of the Wisconsin State Senate has, without a dissenting vote, recommended for passage a bill calling for submission to the people of a proposed constitutional amendment to give all cities of the state home rule in the control of public utilities. The amendment has already passed one session of the Legislature and if again approved will be submitted to popular vote next year.

**Annual Report of Metric Association.**—At the recent annual meeting of the American Metric Association, held at the Massachusetts Institute of Technology on Dec. 30, 1922, and reported in ELECTRICAL WORLD for Jan. 6, page 59, the name of the association was changed to Metric Association. The report of the meeting has now been published and is procurable from the association's office at 156 Fifth Avenue, New York City.

**Plant at Perryville (Mo.) Sold.**—The electric light plant at Perryville, Mo., a town of 2,000 people, which has been operated under the outlying-plants division of the Union Electric Light & Power Company, has recently been sold to Felix B. and Preston T. Holcomb, who also own and operate the Pike County Electric Company at Bowling Green, Mo. The purchasers will increase the capacity of the Perryville plant from 50 kw. to 100 kw.

**To Boost Washington Electrically.**—Ambitious plans to make the nation's capital also the electrical industrial center of the country are being advocated by the Electrical Contractor-Dealers' Association of Washington. Interests representing an approximate investment of $100,000,000 are involved, and the announced plan is to have Washington's electric interests stand as a co-operative unit devoting its efforts to "electrifying America."

**Another Pennsylvania Merger.**—The Northwestern Electric Service Company of Pennsylvania, with headquarters at Erie, has acquired by merger the People's Incandescent Light Company of the same city as well as three electric railway companies—the Northwestern Pennsylvania Railway, the Northwestern Connecting Railway and the Crawford County Railways. The new consolidated company is capitalized at $2,000,000 and will supply light, heat and power as well as trolley service.

**Proposed Tax of 10 per Cent on Oklahoma's Electrical Utilities.**—A tax of 10 per cent on the gross receipts of all companies engaged in the transmission or sale of gas or electricity is one of the provisions of a measure to tax public utilities recommended to the Oklahoma Legislature by Governor Walton. Telegraph and telephone companies he would tax to the amount of 15 per cent and street railway companies 10 per cent. The California law which Governor Walton cites in support of his plan taxes electric and gas utilities only 7 per cent.

**Muskogee Construction Proceeding Rapidly.**—Construction work on the new Muskogee plant of the Oklahoma General Power Company is being rushed in order to complete the intake condensing-water tunnels before the spring rise of the Arkansas River. If these tunnels can be completed and ends walled in before this period, the completion of the entire project by Aug. 1 is assured. The excavation for the tunnels is about 35 per cent completed, according to George F. Phythian, construction superintendent, and construction work on the foundation about 25 per cent. The capacity of the new plant will be 22,500 kw., divided between a 15,000-kw. and a 7,500-kw. unit. The 15,000-kw. unit will have a condenser cooling surface of 31,000 sq.ft., with a pump capacity of 40,000 gal. of water per minute.

**Municipal Plant Reduces Rates.**—A flat reduction of 20 per cent in the rate for electrical energy supplied to Bellefontaine, Ohio, by the municipal plant has been authorized by the City Council, effective March 1. The new rate for lighting purposes will be 8 cents flat; for power, a sliding scale from 5 cents down to 3 cents, with the 10 per cent discount for payment before the tenth of the month retained. The reduction was authorized after the report showed that the plant could be operated at a profit on these rates, based on earnings in 1922.

**Cedar Falls Turbine Shows High Efficiency.**—Tests on the 20,000-hp. Pelton single-overhung reaction turbine at the Cedar Falls extension plant of the city of Seattle have just been completed. This plant was placed in service in June, 1921, but for reasons beyond the control of either the city or the manufacturer final testing was delayed until a week or two ago. Notwithstanding that it has been in service for more than a year and a half, the unit was found to be in perfect operating condition, the absence of vibration being particularly noticeable. Water measurements were made by a weir installed permanently as a part of the power-plant equipment. A very satisfactory efficiency curve was obtained, the maximum exceeding 92 per cent.

**A Memorial to Niagara Power.**—City Engineer W. B. Bennett of Niagara Falls has advanced the idea that a suitable power memorial should be built on the state reservation at Niagara Falls to portray to the millions of visitors that come there yearly the importance of the hydro-electrical development now under construction. It is proposed to erect a duplicate of a section of the big water tunnel which the Niagara Falls Power Company is carrying a mile under the city of Niagara Falls. This tunnel reproduction would be about 100 ft. long, 32 ft. high and 32 ft. wide across the horseshoe, the height and width of the actual tunnel. The face of the memorial would be ornamental, representing the face of a cliff, but inside the tunnel would be lined in the same manner as the real one. The plan is to lead one of the reservation roadways into the model tunnel so that tourists could drive through it.

**H. P. Davis Has Broadcasting Plan.**—H. P. Davis, vice-president of the Westinghouse Electric & Manufacturing Company, who has been called the "father of broadcasting," has suggested a plan for the establishment of a national broadcasting service. He thinks that a federal regulating body should be formed along public service commission lines, and that two classes of broadcasting stations should be recognized—national and local. In the first class Mr. Davis would include a limited number of stations of considerable power with wave lengths arranged so that they will not interfere at any point and located where program material will always be available. These stations could transmit on the present wave lengths of 360 m. or 400 m. and also on a wave length that can be relayed. To the local stations should be given wave bands that will permit existing receiving apparatus to tune in on them, but these wave bands should be separated sufficiently from the national stations to allow no interference.

**Los Angeles Utility's Earnings Increase 31 per Cent in 1922.**—In a report to stockholders just issued by the Pacific Lighting Corporation, of which the Los Angeles Gas & Electric Company is a subsidiary, an increase in electric sales in 1922 of 31.1 per cent over 1921 is shown. During the year there was a net gain in electric meters of 12,875 and 487 miles of wire was added to the system. The large increase in both the gas and electric departments necessitated large additions to the manufacturing and distribution systems. The net capital expenditures amounted to $10,908,476. The Pacific Lighting Corporation at the end of the year had neither a floating nor a bonded debt. The Los Angeles Gas & Electric Corporation had a net bonded debt of $23,905,500, an increase for the year of $6,937,500. It had floating liabilities, practically all of which were for current items, of $2,405,931, and had current assets amounting to $3,573,499. On the same date there were cash and bonds in its sinking funds amounting to $1,059,912.

# Associations and Societies

**Middle West Division, N. E. L. A.**—The annual convention of this geographic division has been set for St. Louis April 11 and 12.

**Canadian Electrical Association.**—This association will meet for its thirty-third annual convention at the Mount Royal Hotel, Montreal, on June 20.

**American Electrochemical Society.**—H. W. Gilette of the United States Bureau of Mines will give a talk on "The Electric Furnace in Non-ferrous Metallurgy" at the meeting of the Pittsburgh Section of the American Electrochemical Society on Thursday evening, March 8.

**Missouri Men to Hold Convention on River.**—The Missouri Association of Public Utilities will hold its next convention on May 24-26 on a Mississippi River steamboat starting from St. Louis at 8 p. m. May 23, going up the Mississippi and Illinois Rivers to a point above Peoria, Ill., and reaching St. Louis on the return trip at 5 p. m. May 26.

**Columbus Forms Illuminating Section.**—The first meeting of the newly formed Columbus Section of the Illuminating Engineering Society was held at the Engineers' Club on Feb. 20. Ward Harrison, president of the national organization, spoke. The officers of this section are: Chairman, G. F. Evans; secretary, R. C. Moore; members of the board, Prof. F. C. Caldwell, G. A. Sulzer and K. A. Piez.

**Next Foreign Trade Convention to Be Held in New Orleans.**—The tent national foreign trade convention of th National Foreign Trade Council wi be held this year in New Orleans May 2 to May 4, according to offici announcement. As in former year leading foreign traders from every pa of the United States and every line industry, as well as a considerable nur ber of business men from foreig countries, will be in attendance at th convention. The main theme of th convention will be "European Cond tions as Relating to World Trade."

**Southwestern Division, N. E. L. A.**—Among the speakers scheduled for th convention of the Southwestern Ge graphic Division of the N. E. L. A., be held at Oklahoma City on March to 16, are Executive Manager Ayle worth and W. J. Canada, of N. E. L. headquarters; A. K. Baylor, chairm of the national wiring committee; Bri Gen. G. H. Harries, vice-president H. Byllesby & Company; J. W. Gleed, re resenting the Bell telephone interest Earle W. Hodges of Arkansas, a possibly S. M. Kennedy, vice-preside Southern California Edison Compa Governor Walton of Oklahoma wi make the opening address.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 F t National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Balling, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 14-15. R. V. Prather, 305 Me Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Stieglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

Middle West Division, N. E. L. A.—St. Louis, April 11-12. H. M. Davis, Bankers' Life Bldg., Lincoln.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 27 Rialto Bldg., San Francisco.

Canadian Electrical Association—Montreal, June 20. Louis Kon 65 Mill College Ave., Montreal.

## Commission Rulings

**Invasion of Territory.**—Under this eading there was printed in this column st week an account of a dispute beveen the Morris & Somerset Electric ompany and the Commonwealth Elecic Company which was adjudicated the Board of Public Utility Commisoners of New Jersey. By an inadertence the facts of the case were just eversed. It was the Commonwealth lectric Company which brought the omplaint against the Morris & Somerst Electric Company, the latter comany being the one which had a contract ith the Millburn Electric Company, nd the decision of the utility commison was in favor of the Morris & omerset company, the complaint of e Commonwealth company being disissed. The trend of the commission's ecision was correctly given.

**Oregon Commission Orders Adoption Parts of National Electrical Safety ode.**—The Public Service Commission f Oregon has determined that "all les previously adopted by it governing verhead and underground construction hould be annulled and canceled, and at the 'Definitions of Special Terms' Sec. 1), 'Rules Covering Methods of rotective Grounding' (Sec. 9), 'Rules or the Installation and Maintenance f Electrical Supply Stations and quipment' (Part 1) and 'Rules for the nstallation and Maintenance of Overead and Underground Electrical Suply and Signal Lines' (Part 2) of the lectrical Safety Code are in all repects adequate, just and reasonable nd should be adopted in lieu thereof." t has therefore ordered all public tilities within its jurisdiction which re affected by the sections of the code ited to comply with their provisions.

**Close Account of Utility Expendiures Maintained by California Comission.**—In line with its policy of eeping a close account of the expenitures of all public utility corporations n the state, the California Railroad ommission has ordered that utilities ith a gross annual operating revenue f $100,000 or more shall report the ames and titles of all officers or emloyees receiving a yearly salary of 5,000 or more, together with the mount of their expense accounts and ny contingent fees and a statement of heir duties. The same rule is applied o utilities whose gross income is beween $25,000 and $100,000 except that he minimum salary to be reported is ade $3,000. All utilities in these two lasses must file a statement showing or each of the years 1920, 1921 and 922 the total of donations, subscripions and contributions of all kinds and he total payments to attorneys, both of aid totals to be distributed to acounts as charged on the utilities' books uring 1920, 1921 and 1922. In addition they are ordered to file a statement showing the amount of cash they had for all purposes on Dec. 31, 1922, the names of banks or other financial institutions with which such cash was deposited and the rate of interest received, and the amount of cash in the treasury.

**No Universal Rule to Apply to "Going-Concern" Value.**—Declaring that the "going-concern" value of every business and of every utility depends on the features of that particular utility, the Alabama Public Service Commission, in its recent valuation of the property of the Alabama Power Company, declared: "If it has cost the company nothing to produce its business, if it has no valuable organization of employees or established credit, if it has not gone to any expense in advertising, soliciting or demonstrating for the purpose of educating the public to the use of the company's facilities, its going-concern value is bound to be affected thereby. The commission cannot therefore accept as sound a percentage basis of arriving at the going-concern value of this company."

**Falling Prices as They Affect Rates.**—Denying a petition of the Central Illinois Light Company for increased gas rates, the Commerce Commission of Illinois said: "These are abnormal times and we are dealing with rates for the future. The commission must therefore take cognizance of the fact that since the filing of the application for increased rates there has been a material reduction in the price of commodities that enters into operating costs." Holding that, with the exception of fuel, the trend of operating costs for material and labor is downward, the commission went on: "Moreover, the burden of making up the losses brought about primarily by the world war ought not to fall wholly on the company's patrons; in other words, part of this loss ought to be borne by the company. . . . Present economic conditions are temporary, are constantly varying toward pre-war levels, and therefore it would be inexpedient to predicate rates thereon."

**Getting at Value of Flowage Rights and Dam Site.**—In its valuation of the property of the Wisconsin-Minnesota Light & Power Company to be taken over by the city of Rice Lake, Wis., and run as a municipal electric plant the Wisconsin Railroad Commission found the valuation of the water-power development, including dam site and flowage rights, one of extreme difficulty as the range of estimates was very wide and was further involved by the operation of storage reservoirs on the headwaters of the river. For the company, a total value of the water power, including storage and land, as high as $237,000 was claimed. The city engineer pointed out that it was assumed that the storage reservoir above Rice Lake would be entirely filled and emptied once a year and called this a very doubtful assumption. He also alleged an unsatisfactory condition of the dam. Rejecting a steam-plant comparison and using one based on oil-burning equipment, he arrived at a water-power value of $35,000, including flowage rights and dam site. On a basis of purchase of energy on transmission lines from another company he reached a value of $20,000. His final conclusion was that $30,000 was adequate for the water-power value, including flowage and dam site. The commission finally concluded that the water-power value, including flowage rights and dam site, should be placed at $55,000. Severance damages to the power company running from $12,000 to $15,000 were found proper by the commission.

## Recent Court Decisions

**Commission Order Requiring Installation of Water Meters Overruled.**—In Elizabethtown Water Company vs. Board of Public Utility Commissioners of New Jersey an order of the board requiring the water company to install meters was overruled as unreasonable, because, the court said, the undisputed evidence showed that the company was financially unable to purchase the meters and that it could not procure the necessary money. (119 At. 284.)*

**Appeals from Oklahoma Commission.**—Proceedings by the Quinton Relief Oil & Gas Company to review an order of the Corporation Commission of Oklahoma revoking without notice a former order have been dismissed by the Oklahoma Supreme Court on a question of procedure. The court points out that under the constitution and laws of the state appeals from commission proceedings must be taken in the same manner as appeals from district courts; i.e., by petition in error. (211 Pac. 493.)

**Overflow Damages, Temporary or Permanent.**—In Bennett vs. Louisville & Nashville Railroad Company, an action for damages because of the overflowing of crops through the alleged faulty construction of an embankment, the Court of Appeals of Kentucky found that whether temporary or permanent damages resulting from overflow are allowable is dependent on the nature of the structure causing it. If a permanent structure properly built, a single recovery in permanent damages is allowable; if intended as permanent and unlawfully or negligently built, or if a temporary structure, temporary damages are recoverable as injuries occur, the question of whether construction was negligent in any event being for the jury. Where the cost of repairs necessary to remedy negligent construction is in excess of any damage to the property involved, the court should instruct that such cost is unreasonable and permit damages for permanent injury. (246 S. W. 121.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## Medal for Lee de Forest

Dr. Lee de Forest, inventor of the audion or three-electrode vacuum tube for the amplifying of minute electrical currents and pressures, received the Elliott Cresson medal on Wednesday, Feb. 21, awarded to him by the Franklin Institute of the State of Pennsylvania. The presentation address was made by Dr. Walton Clark. A special committee, headed by Charles E. Bonine, appointed to investigate the audion reported that the invention of the three-electro vacuum is one of the most important ever made in the field of electrical transmission of intelligence and through its development has worked a profound revolution in the art of radio communication. Dr. Lee de Forest has been a pioneer in radio activity. He was born in Council Bluffs, Iowa., in 1873 and was graduated from the Sheffield Scientific School of Yale University in 1896.

**C. A. Bigelow** of Stone & Webster, Inc., has returned from Japan, where he has been associated with the Shogawa water-power development.

**S. Barfoed,** chief engineer for F. G. Baum, consulting hydro-electric engineer, San Francisco, is at present in Europe, visiting large hydro-electric developments.

**H. S. Walker,** former member of the sales force of the Denver office of the Westinghouse Electric & Manufacturing Company, has been transferred to the Salt Lake office of the company.

**Col. Charles H. Tenney,** of Charles H. Tenney & Company, Boston, was decorated with the distinguished service medal Feb. 21 at Springfield, Mass., by Assistant Secretary of War Wainwright, in recognition of his services in the Ordnance Department during the world war. The citation accompanying the decoration was read by Brig.-Gen. W. S. Pierce, assistant chief of ordnance, U. S. A.

**Eugene A. Yates,** who recently succeeded W. N. Walmsley as general manager of the Alabama Power Company, was elected vice-president and general manager of the company and was added to the board of directors at the annual meeting of the board held in Birmingham on Feb. 20. The following officers were re-elected: President, Thomas W. Martin; vice-presidents, R. A. Mitchell and W. N. Walmsley; treasurer, Robert M. MacLetchie, and secretary, Lamar Aldridge.

**William McClellan** and **Peter Junkersfeld,** consulting engineers of New York City, left on Saturday, Feb. 17, for Porto Rico to make final arrangements relative to the completion of the electric railroad which the firm has been building on the island. The railroad, which is virtually completed now, extends from San Juan to the outlying mountainous regions. In connection with this construction work Mr. McClellan made two previous trips to Porto Rico during the last few months. His present trip is partly one for rest.

**C. T. Jones,** formerly of the engineering department of the Northern Texas Traction Company at Fort Worth, is now in the engineering department of the El Paso Electric Company as distribution engineer.

**William Q. Gallaher,** formerly chief engineer for the West Virginia Public Service Commission, has taken charge of the "frigidaire" department of the H. & S. Electric Company in the Charleston district.

**P. I. Robinson,** formerly manager of the Fort Madison Electric Company, has been appointed manager of the Baton Rouge Electric Company, and Walter M. Bird, formerly of the Savannah Electric & Power Company, has been appointed manager of the Fort Madison Electric Company.

**G. J. Newton,** who has been associated recently with the Philadelphia Electric Company on underground distribution work, has joined the engineering department of the George Construction Company, Inc., of Philadelphia. Mr. Newton has been associated with underground distribution work for more than twenty years. He will have charge of the designing department.

**James Orr** has been appointed superintendent of power for the Hartford (Conn.) Electric Light Company, succeeding F. M. Wilbraham, who recently resigned the post to act as consulting engineer for the company. Mr. Orr has been in the company's service for more than a year, having previously been on the staff of Stone & Webster, Inc. Mr. Wilbraham is widely known in central-station power-plant circles and has been with the company many years.

**John W. Carpenter** of Dallas, vice-president and general manager of the Texas Power & Light Company, was recently appointed by Governor Neff to the board of regents of the new Texas Technological College. Mr. Carpenter is active in a widespread effort for the construction of cotton textile mills in Texas. He has made thorough studies of textile-mill conditions in New England and the Carolinas and has brought mill men to Texas to look over the situation, with the result that several such mills are now in process of organization, most of the proposed plants being designed to operate with central-station electric power.

**F. D. Knight** has been appointed superintendent of construction of the new power station of the Edison Electric Illuminating Company of Boston at Weymouth.

**Charles P. Dunn,** formerly connected with the city of Seattle's Skagit development in the capacity of hydraulic and structural designer, has become head of the drafting department of the Portland Railway, Light & Power Company.

**George W. Saathoff,** construction engineer for the Cities Service Company, which operates the Denver Gas & Electric Light Company, recently arrived in Boulder, Col., from New York, to inspect the site for the four-million-dollar steam plant which the Denver utility plans to erect near that city.

**K. W. Kissick,** chief engineer of the Sheridan County Electric Company for the past two and a half years, has been appointed manager of the Deming (N. M.) Ice & Electric Company, succeeding R. E. Thompson, who resigned to become manager of the Springfield (Mo.) Gas & Electric Company.

**A. Strauch,** formerly electric heating specialist for the Pacific Gas & Electric Company, has opened offices in the Rialto Building, San Francisco, as an electric heating engineer. Mr. Strauch was in charge of the development of electric heating and cooking for the Pacific Gas & Electric Company for eight years.

# Obituary

**Guilford S. Wood,** president of the Southern Sierras Power Company, died recently. Mr. Wood was one of the original incorporators of the Nevada California Electric Corporation, which is the parent company of the Southern Sierras Power Company.

**Arthur M. Leacock** was killed by gas on Thursday morning, Feb. 22, in a room occupied by him at the plant of A. M. Leacock & Company, manufacturers of electrical appliances. Mr. Leacock, who was president of the company, was accustomed to devote time in the evenings to the study of improvements on electrical appliances, using the room fitted up by him for that purpose. It is believed that when he entered the room he turned on the jets in a small gas heater but failed to ignite them.

**Dr. John Trowbridge,** professor of physics at Harvard University for many years and for twenty-two years director of the Jefferson Physical Laboratory in that institution, died at Cambridge, Mass., Feb. 18, at the age of seventy-nine. Professor Trowbridge became an assistant in mathematics at Harvard in 1866, was assistant professor of physics at the Massachusetts Institute of Technology 1869-70 and taught physics at Harvard from 187[illegible] to 1910, when he was made professor emeritus and honorary director of the Jefferson Laboratory.

# Prices or Profits on Electric Ranges?

**Lapse of Marsh Patents Will Not Change Market Conditions—The Opportunity Calls for "Quality" Goods and Prosperous Dealers, Not Cheap Ranges**

By L. D. Smith

Secretary and General Manager Standard Electric Stove Company, Toledo, Ohio

THE twelve or fifteen years' experience I have had in the electrical cooking business inclines me to believe that all range manufacturers have tried to make their respective appliances as good as possible. Considering the magnitude of the undertaking and the resistance in the market, I think that the general acceptance of the electric range idea has made wonderful progress.

So far I presume that most observers will agree. But we now see an unwise and uninformed element coming into the business with the idea that the public can absorb a cheap electric range. Even some of the oldest of the present manufacturers are advising their trade to "wait and see what we are going to make for $99—something that every workingman can buy," and more along similar lines.

It happens that 54 per cent of our families have average incomes of $920 per year. I do not believe that these families can afford to use electricity for cooking purposes at any rate for which the lighting company can distribute it today, and to my way of thinking it would be an "unwise service" to the customer and an "unwise investment" to the lighting company to install an electric range in these homes on any easy-payment plan. Homes of this class too often have "wasteful ways," and the after-sale service alone would in too many cases be a hardship which the dealer could not long endure.

In giving the best service to a customer the customer's capacity to use the article should be considered. I see no present market possibility for a cheaply made electric range. Being cheaply made, it would quickly be out of order, it would consume more energy, bills would be higher and the user be correspondingly dissatisfied.

L. D. Smith

A user's dissatisfaction entails additional expense on the lighting company for service, repairs, apologies and out-of-use conditions, all involving again an increase in rates. I think the lighting companies have in the main been wise in guarding their users against the shoddy in electrical appliances and that it is supremely to their interest to discourage any attempts to dazzle the blind with poor quality electric ranges.

### Market Is for Quality

If memory serves me rightly, about 20 per cent of American families have incomes of $3,000 to $10,000 per year, and it is to this class of families that the electric range makes its first appeal. These families include the thrifty, discriminating class, and when they buy they select carefully with an idea of permanency and beauty. They want the best and cleanest finish and the most durable construction. They never have absorbed and never will absorb the low-priced article. They are always buyers of the best and take the best care of it, prize it most highly and pay for its repairs.

The lighting company, the jobber and the dealer ought in self-protection to saturate this 20 per cent market with the best the most experienced manufacturers can make before they experiment with what might be done by some one "proceeding along new lines" with a low-price rainbow to catch the workingman demand. I take it that when this is done there will be time enough to sell ninety-nine-dollar ranges.

### Profit Means More than Price

One need not disparage the ambitious gas-range manufacturer who finds his gas-stove business declining and wishes to go into a better thing. But up to date such advance as the electric range business has made was not made by him but in spite of him. He has not as yet merited the confidence of the electrical trade in any instance that we know of. If he can give the electrical public a convincing demonstration of better value, we certainly want it no matter who makes it; but we certainly do not want to load the public up with unsatisfactory appliances from any source. One must also remember that satisfaction to the user means many things. It means first a fair return to the manufacturer, a fair return to the distributing sales force and a full measure of return for the dealer service rendered. Otherwise none of these remain to render it and it is not given or received.

We are all here because each supplies, and has supplied, a want not possible to fill otherwise. The "Three Graces" cited above are just as essential to trade as faith, hope and charity are to morals, and I for one do not like to see one trying to strangle the other in the interest of low prices, or all gasping for breath in the interest of low prices on some gas-stove manufacturer's departure.

A "low-priced" range is an invitation to do business below cost. It encourages bad practice in the factory and poor service from the

dealers, who should be in a position to give the best. A poorly conceived electric range will be thrown back on the lighting company no matter who makes it. We have sufficient evidence of this in localities where the lighting companies have in previous years established cooking rates as low as 2 cents per kilowatt-hour in order to move them. In these localities the interest in and use of the electric range is not so great today as in many other localities where rates are 100 per cent higher. The lighting company must have a sufficient return from its range customers to justify the service they receive and must give a certain service not to be secured otherwise.

We have never urged a low rate in order to sell electric ranges. The range load is a profitable load to the light company, provided the range they install is a "bang-up," well-conceived and well-made article and installed in that class of homes that we classify as housing 20 per cent of our population. Something like four million ranges can find useful employment in these homes, and when all are filled and satisfactory service is rendered we can begin all over again. I should like to see the electric range become "class conscious" and the electrical trade united to discourage the efforts of any manufacturer who tries to make something competitive in price with gas or gasoline stoves.

### Prices of Ranges Should Go Up

A great many of the trade are under the impression that since the Marsh patent contracts have expired electric ranges will be considerably reduced in price. It must be remembered, however, that the licensers derived their income from royalties paid by manufacturers and they really were interested in a substantial remittance. The royalties depended on the sales and hence it appeared to be expedient to offer the user as low a price as was at all consistent in order to get the maximum royalty. Therefore, in the past, the jobber's margin of profit has been fixed very low. The dealer likewise was given a short discount and the manufacturers' lists were less than they should have been on a nominal volume.

The manufacturers who are selling at licensers' lists at regulated discounts have had no funds for publicity, the jobber has had no margin of profit for special sales work, and the dealer has not felt that his margin was sufficiently large to permit him to give reasonable service.

We do not know what action others are taking, but our list prices are being increased, and we feel that it is distinctly for the good of the range business.

# The Gypsum Case as a Guide

## Why This Decree Means Nothing to the Trade Association Member—A Simple Rule of Conduct for the Observance of Business Men

By Franz Neilson
Counsel Association of Electragists International

Wide publicity has been given to the "consent" decree in the "gypsum case" under the mistaken belief that for the first time a concrete case has been decided in the courts furnishing a "yardstick" by which to judge just what can be done by trade associations and what cannot be done by them under the seemingly puzzling anti-trust laws. The district attorney in this case is credited with the remark that "this decree is a death knell to the trade association." On the other hand, Samuel Untermyer is reported to have said in effect that, so far from being the death knell of the trade associations, it marks the passing of the Sherman anti-trust law.

### Decree No Guide Whatever

When doctors so eminent disagree what shall be done about it? For one thing, it may be well to recall a few fundamentals and do some thinking for ourselves to see whether or not it is all a tempest in a teapot. In the first place, there is no "decision" by any judge in this case. Decisions are rendered by the court on litigated questions of law or fact. Decisions deliberately arrived at on matters in dispute are entitled to great respect, especially when accompanied by opinions stating the important facts found and the conclusions of law. Counsel and laymen in other cases with similar facts will find such decisions helpful as indicating what rulings of law they may confidently expect in their own cases.

But this is a "consent" decree. It means nothing of any importance to any one save the parties to the suit. It means that the defendants agreed to submit to such decree without putting up any fight. It does not even mean that the judge who signed the decree gave it any thought. It is no guide whatever to other business men and trade associations unless the facts in their case are precisely like those in the gypsum case. If the decree represented a judgment following determined litigation on matters in dispute, it would be regarded as very significant and would become the leading case in anti-trust-law questions. But it was not such a judgment. There was no litigation. The decree therefore constitutes no precedent whatever. In any new case to be adjudicated the court would proceed exactly as if there were no gypsum "consent" decree in existence.

The gypsum decree is thus, I repeat, of no help whatever as a guide. It represents an agreement between the gypsum people and the government as to what they will refrain from doing hereafter. It can have no application to any other trade unless that trade finds it is doing precisely what the gypsum people did and prefers to arrive at an agreement with the prosecuting authorities rather than to have any and all points in dispute adjudicated before the court.

The anti-trust laws are really not so puzzling to business men who have given thought to them. They merely prohibit "restraint of trade," which usually follows the fixing of prices, the maintaining of prices, the apportioning of territory among competitors, the allocating of customers to competitors, etc. The significance of such acts in connection with the interpretation of the laws had been pretty well grasped by lawyers and students of various decisions before the gypsum decree appeared. Ordinarily the business man who has given thought to this broad question is conscious of the true answer when a question of legality arises.

### A Rule of Conduct

My office long previously expressed a simple rule of conduct for members of trade associations desirous of

legitimately exchanging price information, to wit:

The members may meet, contribute, compile and publish facts, including past prices and other statistics; but there must not be any agreement or concert of action respecting prices to be charged, apportionment of territory, allocation of customers, punishment of competitors, limitation of output, etc. Each member by himself and uninfluenced by the others must arrive at his own conclusions from the facts he has received and decide for himself what he will do; and this without communicating his decision by word or sign to the others.

In other words, each member will use the information gained through the association in the same way that he uses information gained from all other sources, including trade reports in newspapers, gossip in the trade, salesmen's reports, confidential investigations, and so on.

# Business Conditions

**A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand**

## Farm-Lighting Plants Gaining Ground in Foreign Countries

The increasing amount of farm-lighting plant business being placed in foreign countries by manufacturers of the United States is shown in reports recently issued by the Bureau of Foreign and Domestic Commerce. On Feb. 26 the bureau issued a statement on the possibilities of these foreign markets and showed that certain South American countries, Australia, Mexico, Cuba, Java, the Straits Settlements, India and Ceylon are markets in which the farm-lighting plant is making considerable progress. As an indication of the volume of business done throughout the world, the total exports of farm-lighting sets from the United States during 1922 were valued at $441,569, of which $123,934 worth went to Australia, $1,727 to Brazil, $10,570 to Cuba, $27,658 to Mexico, $21,040 to Argentina, $14,851 to India, $7,811 to the Straits Settlements and $15,910 to Spain.

According to the survey made by the government officials, rural districts in many foreign countries offer increasing possibilities for the sale of the plants. Where the land is worked in large holdings, as in the case of sugar and rubber plantations, the demand is for isolated plants, which may range in capacity from ½ kw. to 50 kw. or even 100 kw. Where the rural districts are highly cultivated and thickly settled, there is a growing tendency to build distribution lines out from nearby central stations.

In connection with the successful marketing of farm-lighting plants abroad it is important that arrangements be made not only for aggressive representation but for a certain amount of service, especially where storage batteries are a part of the installation, according to government surveys.

## Spotty Conduit Stocks Prevail

Nothing like well-rounded stocks of rigid conduit are reported at this time, and the farther one gets from the steel mills the more uneven the supply of pipe appears to be. In some places the shortage of both black and galvanized conduit in the ¾-in. to 1¼-in. sizes is very acute and few orders of substantial size can be filled without a lot of "shopping around" among jobbers.

Prices are firm as a result. The heavy traffic burden upon the railroads, combined with the large business the steel mills are handling in many lines, makes the early accumulation of reasonably complete stocks little more than a dream for the jobber far distant from the steel-producing centers.

The increasing popularity of pipe is a marked feature of the building revival of the past few months. There seems to be no immediate prospect of acquiring satisfactory stocks, but as the rigors of winter disappear improved deliveries by rail will unquestionably relieve the situation, to some degree, at least as regards the more pressing construction jobs.

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.0303 | $0.0296 | $0.0247 |
| Cold finished shafting, per lb. | 0.0397 | 0.0378 | 0.0336 |
| Brass rods, per lb. | 0.1804 | 0.1742 | 0.155 |
| Solder (half and half), per lb. | 0.2617 | 0.2425 | 0.2075 |
| Cotton waste, per lb. | 0.1181 | 0.1175 | 0.106 |
| Washers, cast iron (¼-in.), per 100 lb. | 4.33 | 4.33 | 3.83 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.11 |
| Machine oil, per gal. | 0.349 | 0.36 | 0.40 |
| Belting, leather, medium, off list | 49% | 49% | 46% |
| Machine bolts, up to 1-in. x 30-in., off list | 51⅓% | 51⅓% | 64⅔% |

## Well-Sustained Demand for Motors

**Absorption of Motors Into Diversified Industries Continues to Feature Current Business**

Absorption of motors into diversified industries continues to feature current business, the demand being concentrated mainly into size ranges below 10 hp. At present motor stocks are substantial, although deliveries in the North are handicapped by railroad embargoes and highways obstructed by snow and ice. Competition is acute for the business available, and complaint is heard in some quarters that the margin between factory and list prices is unsatisfactory. There is also some discussion going the rounds relative to the granting of credits by manufacturers in territorial sales not directly negotiated by motor agencies, there still being some difficulty in assigning such credits under sharply competitive conditions.

The introduction of new motors into the market is also in evidence in some quarters, and the older lines are meeting this competition by increased attention to application engineering and to insistence upon high-grade construction. Some of these new motors have captured the business on the basis of one or two special features peculiar to their design, and at present the designing engineers of motor manufacturers generally are becoming more and more impressed with the demand of the user for maximum reliability of service. In the textile field sales have been gratifying, one manufacturer having recently received an order for 1,050 loom motors and one for 225 motors for the direct driving of carding machines.

### No Shortage of Steel

No reports have been received of late as to shortages of steel, copper or insulating material used in motor construction, but under present railroad conditions factory purchasing agents are obliged to look well ahead in ordering raw material. The larger companies usually maintain stocks of steel adequate for all ordinary demands for motors. The tendency of raw-material costs is upward, and labor shortage in the unskilled and skilled fields alike is making some impression upon the industry. Prices of motors have not changed much lately, barring occasional cuts to move stocks under very sharp competition. This competition acts as a deterrent to sporadic price advances for the time being, but the feeling is far from local that the present volume of business is being done at a relatively low margin of profit. Therefore the price outlook is uncertain, with strong pressure on the buyer's side to hold orders subject to quotations at or near current levels, and, on the other hand, a pressure within the trade to realize more satisfactory margins of profit on the business in sight.

In well-informed circles it is believed that the unsaturated condition of industry as regards proper motor appli-

cations will stabilize production for a long time to come. An immense number of industrial and mercantile establishments remain to be equipped with suitable motor drives and collateral control equipment. This includes numerous installations which should be periodically analyzed from the standpoint of changing interior loads, modifications in load factor and power factor. Progressive motor-sales engineers realize that in the readaptation of drives toward wider use of individual motors on tools and other machines lies a field of exploitation which will be permanently useful to the industry and to the owner alike. The movement toward the substitution of alternating-current motors for direct-current units continues, and new applications of motors in paper manufacture, in the textile field and elsewhere are now featuring this important branch of the electrical industry.

## The Metal Market

**Active Demand Continuing to Force Prices Higher—Talk of Quotation Above 17 Cents**

Active demand for copper is forcing prices higher, so that 16.37½ cents is quoted for electrolytic. Some producers are asking 16.50 cents. Domestic demand shows no signs of abating. Buying continues to be for prompt March and April shipment, and so far as can be learned is to meet requirements of business already booked or firmly in hand.

Owing to the sudden jumps in prices during the last few weeks, consumers have spent time trying to find 16.25-cent copper, but are now paying 16.37½ cents freely, with some producers refusing such bids and demanding 16.50 cents. The price trend apparently is still upward. In fact, with most of the unsold copper available for shipment earlier than May in the hands of two or three agencies, there is considerable talk that the price will go above 17 cents a pound, delivered. Iron and steel scrap soared during the past week. Whereas a normal price rise is 25 cents a ton, the list moved up on an average of $1 a ton.

NEW YORK METAL MARKET PRICES

| | Feb. 20, 1923 Cents per Pound | Feb. 27, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 15.12½ | 16.37½ |
| Lead, Am. S. & R. price | 8.00 | 8.00 |
| Antimony | 7.50 | 7.50 |
| Nickel, ingot | 30.00 | 30.00 |
| Zinc, spot | 7.05 | 7.20 |
| Tin Straits | 40.00 | 43.12½ |
| Aluminum, 98 to 99 per cent | 23.00 | 24.00 |

### Copper and Brass Products

Copper, brass and bronze mills quote the following prices on brass and copper products:

Copper wire, prices upon application, mill; brass wire, 20.87½ to 22.50 cents; copper sheets, 23.75 cents; copper rods, 21 cents; brass rods, 18.62½ to 22.75 cents; sheet brass, 20.37½ to 22 cents.

## Rocky Mountain Credits Better

Credit conditions in the Rocky Mountain region are improving, according to recent reports from Denver. Bankers in many of the small towns have taken a more liberal attitude in making loans. Electrical accounts in those places are with few exceptions considered good, although there is still a tendency by many contractors to pass their respon sibilities along. The situation in th retail trade is improving.

No failures have been reported sinc the first of the year. Time payment on heavier appliances are being readil financed. Excepting in the dry lan agricultural regions, electrical busines is gaining through the amount of ne building now under way.

# The Week in Trade

**Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

RISING prices in the copper market have caused considerable increases i the price of all wires, including some wiring devices. Shortages of ste in the East are said to be hindering manufacturers of heavier commoditie and deliveries are lengthened as a result. Appliances generally are sellin steadily, and a slight spurt in heaters is still in evidence because of the colde and damper days of the last few weeks. Lamp sales are picking up graduall and increased activity leading to larger volumes than for the correspondin period a year ago is expected by the jobbers. Collections throughout the countr are improving.

**Boston** Greater activity in trade appears to be stimulating all lines. Many New England factories are now working on close to a war-time basis of production, although night operation is not yet general. Slow delivery of materials produced outside this section is the chief handicap to current business. Stocks are very low in steel products extensively used in electrical construction. Appliance sales are holding up well and much interest is evident in illumination. The labor situation here is relatively quiet at the moment. Interconnection of power systems is making rapid headway and there will be considerable construction activity in the transmission field this spring. Additional central-station capacity is being developed in various quarters. The general price trend is firm, but, notwithstanding shortages of some radio apparatus, prices in the retail field are weak.

**New York** Increased activities in manufacturing circles are reported in anticipation of unusually heavy buying during the summer and fall months. Steel-product deliveries are slower than a few months ago, and some manufacturers report that they are hard pressed in filling special orders. The higher copper prices have caused several markings up during the past week on wire, armored cable and some wiring devices. Most jobbers report that lamps are moving in larger volume, and this tendency is expected to increase greatly during the next two months. Conduit stocks continue to remain in a very low condition. Collections throughout the state are somewhat improved.

**Baltimore** Lamps are showing a falling off in considerable volume. The stocks to a large extent are very low. Considerable increase is noted in heaters and heating appliances in the past week, due t the coldest spell of the winter, but this probably only momentary as the mode ation of the weather has already cause a practical halt on this demand. Co ditions in general are marking time, ar jobbers are preparing for the expecte rush of business with the opening of th spring season. Construction work ha been retarded considerably in the pa week owing to weather conditions. I terest is being taken in the comir "Better Homes Exhibition," at whi all the jobbers will be represented wi exhibits.

**Pittsburgh** Jobbers and manufa turers' representativ in this territory are reporting increas sales. This especially applies to ste commodities, such as armored cab conduit boxes and fittings, and ste conduit, which includes various sizes rubber-covered wires. Dealers repo steady demand on appliances with go business on small construction jobs a repair work. The increased prices conduit have not up to the prese affected business to any considera extent.

**Atlanta** The general tendency of t electrical trade is towa greater volume in almost every li with conduit especially in heavy c mand. The construction of office bui ings and large apartments is cutti heavily into the stocks of jobbers, w the result that great difficulty is e perienced in maintaining stocks. Th shortage is general throughout the te ritory, and the price continues climb. Jobbers and manufacturers electrical generating equipment such is required for small municipalities port business in this line the best several years, with the prospects ceedingly bright for the spring a summer trade. Motor sales are

# Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Instruments, Electric Ranges and Hollow Ware

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Radio | Conduit Boxes | Signal Apparatus | Rectifiers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boaton** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Slow | Slow | Act | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Act. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Low | Low | Low | Low | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Low |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **New York** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Sdy. | Slow | Slow | Sdy. | Act. | Act. | Sdy. | Sdy. | Act. | Act | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. |
| Supply | Nml. | Hi. | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Low |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **Baltlmore** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Act. | Act. | Slow | Act. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Act. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Low | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy | Act. | Slow | Slow | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Act. | Act. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **St.Paul-Minneap.** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Sdy. | Sdy. | Act. | Slow | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Act. | Act. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Slow | Sdy. | Act. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Act. | Act. | Sdy. | Slow | Act. | Slow | Sdy. | Act. | Sdy. | Act. | Slow | Act. | Act. | Slow | Sdy. |
| Supply | Nml. | Low | Low | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Act. | Sdy. | Slow |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Act. | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Sdy. | Sdy. |
| Supply | Hi. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Inc. | Firm | Inc. | Inc. | Firm | Dec. | Firm | Firm | Inc. | Firm | Firm |

proximately 15 per cent in excess of those of the same period of last year, with the outlook for improvement within the next ninety days. Stocks have been maintained with fair satisfaction, although shipments are lengthening, quotations now being on the average of ten weeks.

## St. Louis

Business reports indicate that sales are remaining unusually good for this time of year in almost all lines. Retail trade has slackened to some extent owing to the cold weather. One of the light and power companies has announced plans for an extensive house-wiring campaign which will undoubtedly result in large sales of all materials used in this line of work, including fixtures and wall switches. The demand for radio equipment continues, stocks being spotty. Many of the industrial plants and the railroads are planning extensive electrical installations in the near future. Jobbers report a slight increase in price for alternating-current generating equipment.

## Chicago

With building construction for the first two months of 1923 averaging an increase of 100 per cent over the same period in 1922, the local demand for wiring material and devices is continuing briskly. Jobbers report increased activity in almost all staple lines. Prices are also stiffening, but there is a tendency to give more effort to obtaining deliveries than to worrying over prices. Winter trade in lamps is active. Radio equipment is selling well and supplies are fairly normal. The motor market is steadily advancing, the biggest volume being on motors ranging from 1 hp. to 10 hp., to be built into machine tools.

## Cleveland

Deliveries are greatly improved and stocks with but a few exceptions are recovered. A rising copper market has tended to make wire quotations higher, but no actual shortage is evident. Conduit is active and the supply is barely sufficient to allow quotations for future deliveries. Industrial equipment sales are in good volume, the week having brought a better movement in transformers, poles and pole-line hardware

Motors are not so active, although prices are firm, but high-tension equipment and porcelain are in better demand. Radio manufacturers have increased production and dealers are ordering consistently. Central-station business continues to improve.

**St. Paul-Minneapolis** Builders predict a banner year. The week's orders are reported smaller. Conduit supply is critical, and retail sales in the city are poor. Wiring is falling off slightly. Prices are firm but uncertain. All steel products show an upward tendency.

**New Orleans** With the approach of summer the electrical trade is already beginning to feel the slump in radio. New Orleans is one of the worst radio markets in the country because of the climate. The fact that there are no first-class broadcasting stations here makes the situation worse. With the lengthening days the market for electric bulbs is falling off. The difference in the consumption between summer and winter is about 25 per cent. Business in washing machines and suction cleaners is just hanging on. New Orleans is a very poor market for apparatus of this kind, principally because New Orleans women as a rule do not do their own housework and find it does not pay to intrust expensive apparatus of this kind to ignorant labor. A number of firms that made a specialty of washing machines and suction cleaners have gone out of business or changed their lines, and apparatus of this kind is now carried as a by-line only.

**Denver** Outside construction throughout the state is being held up by the weather. Local jobbers feel that the lull will permit replenishment of low stocks in certain lines, notably armored cable, conduit, rectifiers and special radio outfits. New orders placed by central stations throughout this territory for generating equipment indicate active market shortly for transmission materials. Considerable interest is developing in ornamental street-lighting systems, especially in the southern part of the state.

**Portland-Seattle** There has been a marked increase in inquiries regarding high-tension equipment during the past week, and the indications are that a considerable amount of this equipment will be installed throughout the Northwest this coming season. Many orders are reported for pole-line material. Bare copper wire is in active demand and the price trend is upward. The base rate advanced from 17½ cents to 18 cents per pound during the past week. The jobbing business continues to remain steady and better than a year ago. Competition is still keen in the contracting field, but there is a plentiful supply of large-sized contracts, and standard contractors generally are busy. Sales are slow for electrical dealers, with the exception of radio material, which is very active.

**San Francisco** With the apparent end of the rainy season building has considerably increased, many sizable staple orders being reported. Retail trade in small appliances and supplies is noticeably better, while larger appliances, especially vacuum cleaners and sewing machines, are moving briskly. Time payment collections are in a slightly better condition than they were last year. Very few stock shortages have been reported during the winter. Rail service has been practically uninterrupted. Temporary shortages, such as in boxes and covers, caused by factory conditions are no longer serious. The demand for these is large and steady.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Western Electric Sales Expected to Break Previous Records

Sales by the Western Electric Company for the year of 1923, it is officially predicted, will again break all records. The increase in production, based on orders now on the books, will amount to between 15 and 20 per cent over 1922. Sales for 1922 amounted to $210,900,000, surpassing the year 1920, the previous banner year, by $4,800,000.

Business during the last quarter of 1922 swept away all previous records. Orders received during that period aggregated $63,000,000, or about $5,000,000 more than sales for the same period in 1921.

At the close of business Dec. 31, 1922, there were $62,000,000 worth of unfilled orders on hand. A reflection of this kind of business shows itself in the Hawthorne apparatus schedules for 1923, which are now being prepared. In some cases these schedules have almost doubled and in all cases they have been materially increased.

## Uehling Instrument Orders

Among very recent notable sales of Uehling $CO_2$ recording and indicating equipment are eight units for the Detroit Edison Company, making a total of sixty-five units purchased for the different plants of that company since 1911.

The River Rouge plant of the Ford Motor Company has also added two more units to its present Uehling equipment. This company has now a total of twenty-one units in operation. The application of this equipment to the River Rouge plant is of particular importance since the boilers are of unprecedentedly large size.

## Organize New Jobbing Concern in Binghamton, N. Y.

Edwin C. Wehle, William H. Hecox and Harry A. Yetter are the directors of a jobbing concern known as the Southern New York Electrical Supply Corporation, 78 State Street, Binghamton, N. Y., which has been incorporated for $50,000. The corporation will have floor space of 10,000 sq.ft. Mr. Wehle recently resigned as president of the Southern Tier Electrical Supply Company of the same city and disposed of his interests in that concern in order to devote his entire time to the new supply company.

## To Auction National Conduit Brass Plant March 9

Because the present scope of manufacturing operations of the National Conduit & Cable Company, Inc., under Receiver Clarence G. Galston, does not include the milling of sheet brass, the North plant of the Hastings-on-Hudson concern will be offered at receiver's auction sale, Friday, March 9, on the premises.

"This sale of the North (brass) plant of the National Conduit & Cable Company, Inc., will not affect the copper and cable plants of the company. Operations in these mills during receivership have been profitable and will be continued," declared Receiver Galston.

The North plant comprises ten acres, docks, buildings and equipment. The plant is served by a New York Central Railroad siding and has 1,400 ft. of deep-water bulkhead on the Hudson River. In all, there are fifteen brick and frame buildings, containing about 180,330 sq.ft. of floor space, fitted out with sprinkler system. In the material are five 3-ton traveling cranes.

## Stevens & Wood, Inc., Acquire Wood Hulse Yates Company

Stevens & Wood, Inc., 120 Broadway, New York City, announce that the engineering and construction business formerly conducted by the Wood Hulse Yates Company, Inc., has been acquired with increased personnel. A general engineering and construction business will be conducted. Engineers will give personal attention to all engineering and construction work, including investigations, reports, appraisals, designs, purchase of materials and equipment for steam and hydro-electric power developments, transmission projects, railroad electrification, terminals and shop facilities, port and harbor works and industrial plants, and will supervise the financing, operation and management of utility and industrial properties.

### Standard Electric Time Plans to Spend $65,000 on New Buildings

The Standard Electric Time Company, Springfield, Mass., plans additions to its plant in order to meet increased orders and also to provide facilities for introducing a new adaptation of its product. The buildings, for which about $65,000 will be expended, will include a wing for manufacturing, three stories in height, 88 ft. x 40 ft.; a one-story shipping room, 46 ft. x 46 ft., and a lumber storage shed, 21 ft. x 51 ft. Work will begin immediately. Orders are running one-third ahead of a year ago, officials of the company state.

### Inland Glass Starts Production

The Inland Glass Company, 6101 West Sixty-fifth Street, Chicago, is a new manufacturing concern recently organized to manufacture a complete line of illuminating glassware for domestic, store, office, factory and street-lighting purposes. The production capacity of this company, according to officials, is $2,500,000 worth of glassware annually. Ground was broken for the new factory plant on Oct. 1, 1922, and production was started Feb. 19 last. J. B. Weaver, formerly vice-president in charge of production for the Pullman Car Company, is president; Noble B. Judah vice-president, and H. P. Withers secretary and treasurer.

### New Agent for Wakefield Brass

The F. W. Wakefield Brass Company, Vermilion, Ohio, announces the appointment of the George A. Gray Company, San Francisco and Los Angeles, as its Pacific Coast representative for "Red Spot" hangers and other lighting specialties. Factory stocks will be carried in warehouses at 910 Howard Street, San Francisco, and 236 South San Pedro Street, Los Angeles.

### American Flat Lite Organized to Take Corcoran Properties

The American Flat Lite Company, Cincinnati, has been organized to take over the properties of the T. J. Corcoran Lamp Company and the Corcoran-Victor Company, following the absorption of the latter company by the T. J. Corcoran Lamp Company. The company manufactures automobile and other lamps and has three large plants in Cincinnati. Thomas J. Corcoran is president.

### Westinghouse Bookings Gain 25 per Cent

Bookings of the Westinghouse Electric & Manufacturing Company from Feb. 1 to 15 were 25 per cent ahead of the corresponding period of January. Orders taken were primarily industrial and supply goods with no unusual contracts. January showed the largest bookings of any month with one exception since the beginning of the fiscal year, April 1.

The Westinghouse company is meeting increased demands for power apparatus in mills. The outlook as forecast by the fourteen Westinghouse district sales managers in the United States for the six months from Feb. 1 is very encouraging. Eleven managers looked for increased business in their localities as compared with the previous six months. The forecast on Jan. 1 showed only six of the fourteen expecting larger business for the six months ahead.

### Crescent Insulated Wire & Cable Arranging for Extensions

The Crescent Insulated Wire & Cable Company, Olden and Taylor Streets, Trenton, N. J., is arranging for extensions, to include the production of armored conduit wire, magnet and other wire. The company recently acquired the Crescent Armored Wire Company and will merge the business. A fund of $500,000 has been arranged to carry out the expansion. C. Edward Murry is president of the company.

**The Connecticut Telephone & Electric Company**, Meriden, Conn., manufacturer of radio apparatus, telephones and molded insulation, is planning to erect a new factory building just as soon as weather conditions will permit. It will be built of iron and concrete and will add much space to the company's present extensive plant.

**The A. J. Bressan Company**, 120 Liberty Street, New York City, announces that C. L. Hight, who acted for many years as sales representative and later manager of the New York office for Henry D. Sears, distributor of wiring devices, has associated himself with A. J. Bressan, head of the Bressan company. This company has recently been appointed New York representative for the Adapti Company, Cleveland.

**The Berthold Electrical Manufacturing Company**, Chicago, manufacturer of washing machines, has recently advanced E. L. Bennett from the position of sales manager to vice-president.

**The Bates Expanded Steel Truss Company**, Chicago, Ill., has completed plans for a new galvanized-steel-post plant to cost $100,000. The building will be erected on a site adjoining the present factory and work will be started early in the spring.

**The American Electric Fusion Corporation**, 92 Montana Street, Chicago, has broken ground in the block on Diversey Boulevard between Rockwell and Tallman Streets for a two-story plant, 80 ft. x 130 ft. It is said that this building will be under roof within sixty days and that other units will be completed before the end of the year, which will give this company a total of 60,000 sq.ft. of floor space. It was organized in September, 1920, by E. J. Henke, president, and others.

**The Pure Carbon Company**, Wellsville, N. Y., announces the recent establishment of an Alabama representative, the Commercial Electric Sales Company, 1322 Empire Building, Birmingham, Ala.

**The Electroplax Company**, Toronto, manufacturer of electric supplies, equipment, etc., will soon call for bids for the erection of a plant at Mount Dennis, Ont., to replace the one recently destroyed by fire. H. E. Cory is general manager of the company.

**The Western Instrument Company**, 1001 West Washington Boulevard, Chicago, has acquired a factory on Jefferson Street, south of Munroe Street.

**The Morganthau Electric Company**, 204 Market Street, Harrisburgh, Pa., manufacturer of motors, fans, etc., is planning the erection of a two-story factory, 80 ft. x 110 ft., to cost $90,000, including equipment. R. B. Thompson and L. A. Gable are officials of the company.

**The Combustion Engineering Corporation**, New York City, announces that T. J. Cleary, who recently opened an office in Atlanta for the sale of power plant equipment, has been appointed its Southern agent. Mr. Cleary has been a sales engineer in the South for many years.

**The Moloney Electric Company of Canada, Ltd.**, Toronto, a subsidiary of the Moloney Electric Company, St. Louis, has been incorporated with a capital stock of $500,000 by George D. Y. Leacock, Richard W. Hart and others as provisional directors. It has purchased the tractor building of the Canadian Fairbanks-Morse Company, on Sterling Road, at a cost of $100,000, which will be equipped for the manufacture of transformers, electrical equipment, etc.

**The Dudlo Manufacturing Company**, Fort Wayne, Ind., manufacturer of electric coils, wire, etc., is arranging for the rebuilding of the portion of its enameling department, destroyed by fire Jan. 29. The loss was confined to one of the three buildings at the plant devoted to this service.

**The Delta-Star Electric Company**, 2437 Fulton Street, Chicago, has let a contract for a one-story plant, 103 ft. x 109 ft., to cost $40,000, for the manufacture of high-tension electrical products.

**The Hamilton-Beach Company**, Racine, Wis., manufacturer of electrical equipment, has plans for a three-story addition, 75 ft. x 385 ft., work on which will start about March 1. The investment in building and additional equipment will be approximately $240,000. F. J. Osius is general manager.

**The Tri-City Electric Company**, 16 Mechanic Street, Newark, N. J., jobber and manufacturer of electrical equipment, has leased a five-story building, totaling 30,000 sq.ft., and also a two-story rear structure at 52 Lafayette Street for a new plant. G. M. Ellis is president.

**The New York Testing Laboratories**, 80 Washington Street, New York City, have just installed a new automatic 100,000-lb. Tinius-Olsen testing machine, making their equipment one of the most up to date in New York City for handling tensile tests, compression tests and transverse tests.

## Foreign Trade Notes

CATALOGS OF ELECTRICAL GOODS DESIRED IN CHILE. — C. A. McQueen, American commercial attache, Santiago, Chile, *Commerce Reports* states, is interested in receiving catalogs of electrical goods. The catalogs should be in Spanish if possible and should be sent in duplicate. If local representation has been provided for in Chile, it is suggested that each manufacturer note the name of its local agent.

A COMPANY ORGANIZED IN CHINA TO DEAL IN ELECTRICAL APPARATUS AND TO ENGAGE IN ENGINEERING WORK.—A company has been organized by David L. Anderson, 104 Consular Road, Tientsin, China, to engage in engineering and construction work and also in the merchandising of electrical products. The company proposes to act as agent to manufacturers of power and mining machinery particularly. Mr. Anderson is general manager of the company. Liang Shih Yi, head of a Chinese banking group, is chairman of board of directors.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Switzerland (No. 5,511) for electric clippers and other barber supplies.

An agency is desired in Denmark (No. 5,513) for electric motors of all kinds and complete sawmill plants.

An agency and purchase is desired in Japan (No. 5,517) for wireless telephone apparatus and materials, etc.

Purchase is desired in China (No. 5,540) of two electrically driven centrifugal pumps, capable of delivering a minimum of 5,000 gal. of water to tank above main building, against a head of 150 ft., through a 3-in. pipe about 600 ft. long, and two electric motors to drive the above pumps.

Purchase is desired in Bolivia (No. 5,541) of radio-telephone instruments for communications up to 500 miles between cities at altitudes of 300 m. to 4,000 m.; telephones of the magnet system and switches for telephones.

Purchase is desired in Greece (No. 5,543) of power plant and supplies for city lighting, including turbine, regulator and generators.

Purchase is desired in Canada (No. 5,549) of gas producers of 200 hp. to 400 hp. for electric light plant.

An agency is desired in Greece (No. 5,574) for electrical accessories, batteries, generators and Diesel and semi-Diesel generating sets of from 1½ hp. to 40 hp.

The following inquiry has been received by the Philadelphia Commercial Museum, which will furnish names and addresses of the inquirers to any one desiring them and mentioning the number given: Parties in Kyoto, Japan (No. 40,540), would like to get in touch with manufacturers of small electric cars, motorcycles, etc., and would like to receive catalogs and descriptive matter pertaining to same.

## New Apparatus and Publications

ELECTRIC DISHWASHING MACHINE. —The Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn., has placed on the market a new dish, silver and glass washing machine for restaurants, known as model A "Autosan."

ECONOMIZER—Bulletin EC 100 issued by the Power Specialty Company, 111 Broadway, New York City, gives an outline of the use of the "Foster" economizer for recovering waste heat from boiler-flue gases.

LIFTING MAGNETS. — The Cutler-Hammer Manufacturing Company, Milwaukee, is distributing publication No. 3,015 covering the "C-H" lifting magnets. Special attention is called to the "Red" magnets, which are described and illustrated in this booklet.

PORTABLE AIR COMPRESSOR. — A portable air compressor, mounted on a standard Ford truck chassis, has been introduced by the Ingersoll-Rand Drill Company, 11 Broadway, New York City.

PORTABLE VENTILATOR. — The Ilg Electric Ventilating Company, 2850 North Crawford Avenue, Chicago, is distributing a folder describing its new portable "Ilgair" ventilator for household ventilation.

INDUSTRIAL LIGHTING UNIT. — The Ivanhoe-Regent Works of General Electric Company, Cleveland, has developed a new industrial lighting unit, known as "Glassteel." It consists of a white porcelain-enameled steel reflector and a glass-inclosed diffusing bowl.

ASH CONVEYOR. — The Combustion Engineering Corporation, 43 Broad Street, New York City, is distributing a pamphlet entitled "Combusco Ash Conveyor," which describes its "Combusco" water-seal ash conveyor.

SIGNAL EQUIPMENT. — The Signal Engineering & Manufacturing Company, 533 Canal Street, New York City, is distributing a folder describing its signal and control equipment.

SELF-PRIMING PUMPS. — The Fulflo Specialties Company, Blanchester, Ohio, has added a ball-bearing, motor-driven pump of 75 gal. capacity to its line of "Fulflo" self-priming pumps.

INSTRUMENTS FOR RECORDING CONDENSER LEAKAGE. — Bulletin No. 1,222 issued by the Esterline-Angus Company, Indianapolis, Ind., describes its instruments for recording condenser leakage and indicating concentration of boiler water.

FLASHLIGHT.—A new flashlight with a 500-ft. range, known as the "Ever-Ready Focusing Searchlight," has been put on the market by the National Carbon Company, Inc., Thompson Avenue and Orton Street, Long Island City.

TOASTER.—The Terry Kitchen Device Company, 25 West Forty-third Street, New York City, has placed on the market an electric toaster for use in hotels, restaurants, etc.

ELECTRIC STOVES. — The Standard Electric Stove Company, Toledo, Ohio, has issued a catalog supplement and selling price list (twelfth edition) covering its products.

ELECTRIC HAMMER. — The National Electric Manufacturing Company, Inc., Pittsburgh, Pa., is distributing a folder describing its "Syntron" electric hammer.

TRAFFIC-CONTROL DEVICES.—"Trafficons" is the title of a booklet issued by the Line Material Company, South Milwaukee, Wis., describing a new system of traffic-control devices.

PORTABLE REFLECTOR.—A new reflector, known as the portable reflector with extension, has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

GEARED UTILITY TOOL.—A new flexible-shaft geared utility tool ("Dumore") has recently been developed by the Wisconsin Electric Company, Racine, Wis.

OUTLET. — A new convenience outlet, known as the "Duplex," is being marketed by the Square D Company, Detroit. This outlet is rated at 10 amp., 250 volts, but the heavy current-carrying parts permit a current of 20 amp. without heating.

ELECTRIC BOILER.—Bastian & Allen, electrical engineers, 58 Haymarket, London, S.W.1, England, is distributing a leaflet describing and illustrating the Bastian & Allen electro-steam boiler.

REFLECTOR.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a new mill-type reflector for use with the new mill-type B lamp in mills and factories.

THEATER LIGHTING.—"The Control of Lighting in Theaters" is the title of bulletin No. 28 issued by the Frank Adam Electric Company, St. Louis, in which an attempt has been made to give some standardized practice for lighting theaters.

## New Incorporations

THE CACAPON ELECTRIC COMPANY, Martinsburg, W. Va., has been incorporated with a capital stock of $11,000 by Clarence E. Martin, Martinsburg; E. L. Coblentz, Frederick, Md., and M. F. Riley, Hagerstown, Md.

THE KIRBYVILLE (TEX.) ICE & LIGHT COMPANY has been granted a charter with a capital stock of $20,000. The incorporators are R. J. Cooper, J. M. Mixon and B. A. Woods.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

GARDINER, ME.—Steps have been taken by the Gardiner Board of Trade for the installation of an ornamental lighting system on Water Street and Depot Square.

RUTLAND, VT.—The city of Rutland has petitioned the State Legislature for permission to amend its character so as to allow the city to operate electric and gas plants.

SPRINGFIELD, VT.—The Vermont Hydro-Electric Corporation will made extensions at its hydro-electric power plant at Carvers Falls.

EAST BRAINTREE, MASS.—The East Braintree Bleacheries, Inc., will build a one-story power house in connection with an extension to its mill.

GLOUCESTER, MASS.—The Gloucester Electric Company will erect an addition to its power plant.

MIDDLEBORO, MASS.—At a recent town meeting the proposal to issue $31,000 in bonds for the construction of a hydro-electric plant at Muttock dam was carried.

WILBRAHAM, MASS.—At a town meeting held recently it was voted to extend the street-lighting system on several additional highways.

EAST GREENWICH, R. I.—Improvement to the street-lighting system on Main Street is under consideration by the Chamber of Commerce.

BETHLEHEM, CONN.—The Litchfield Electric Light & Power Company has begun work on the erection of an electric transmission line to Bethlehem to furnish electrical service here.

BRIDGEPORT, CONN. — The Jenkins Brothers Company will build a switch house for electric service at its valve-manufacturing plant. Motors and other electric power equipment will be installed in the proposed factory addition, to cost about $250,000.

HARTFORD, CONN.—The Connecticut Power Company, controlled by the Hartford Electric Light Company, is planning to erect a high-tension transmission line connecting its electric stations with those of Springfield and Turners Falls. It will also have connection with the hydro-electric plants on the Deerfield and Connecticut Rivers.

## Middle Atlantic States

BATAVIA, N. Y.—In a report submitted to the City Council by Alvord, Burdick & Howson, engineers, changes and improvements to the municipal electric distribution system are recommended, involving an expenditure of about $10,000.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D.C., until March 13, for 80,000 ft. of incandescent lamp cord. (Schedule 551.)

BUFFALO, N. Y.—The City Council has adopted a resolution authorizing the gas lamps along Fillmore Avenue for several miles to be replaced with luminous electric arc lamps.

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Power Company has petitioned the Public Service Commission for permission to issue 19,685 shares of stock of no par value, to be sold at not less than $40 per share, the proceeds of at least $407,400 to be used for the purpose of acquiring 916.865 acres of land in the towns of Lewiston and Niagara and in the city of Niagara Falls, owned by the Lower Niagara Power & Water Supply Company.

HADLEY, N. Y.—The electric plant of the Hadley Light & Power Company has been purchased by M. B. Riddle of the Riddle Light & Power Company, Luzerne.

KINGSTON, N. Y.—The installation of a new street-lighting system is under consideration. The Kingston Gas & Electric Company furnishes the street-lighting service.

YONKERS, N. Y.—The installation of a iew street-lighting system in the business listrict is under consideration.

BAYONNE, N. J.—The Ingram-Richardson Manufacturing Company, Beaver Falls, Pa., will build a power house in connection with its proposed local plant, to cost about $85,000.

CAMDEN, N. J.—The Public Service Electric Company has been awarded a con- ract to supply electricity for the new pump- ng stations for the Camden City Water Department. Each pump will have a capac- ty of 1,000 gal. per minute.

CAMDEN, N. J.—Steps have been taken y the Kaighn Avenue Merchants' Asso- iation for the installation of an improved ighting system on that thoroughfare.

EAST ORANGE, N. J.—The City Coun- il is considering the replacement of the as lamps on Main Street, Central, Spring- ale and Fourth Avenues and Harrison and Washington Places with electric lamps. Electric lamps will also be installed in the icinity of the Lackawanna bridges. The ost of the work is estimated at about 100,000.

PATERSON, N. J.—The North Main Street Business Men's Association has peti- ioned the City Council for the installation f about twenty-five additional ornamental amps on North Main Street.

HAZLETON, PA.—The Jeddo-Highland Coal Company plans to rebuild its power ouse at its No. 2 Highland Colliery, recently amaged by fire, with a loss of about 17,000.

PHILADELPHIA, PA.—Bids will be re- eived by the Bureau of Supplies and ccounts, Navy Department, Washington, . C., until March 13 for 25,000 ft. single- onductor high-tension ignition cable. Schedule 553.)

PITTSBURGH, PA.—The Fort Duquesne aundry Company will build a power house t its plant at 129 Fortieth Street.

POTTSVILLE, PA.—An electrically oper- ted pumping plant will be installed in con- ection with a sewage-disposal plant, to ost about $1,000,000.

POTTSVILLE, PA.—The Eastern Penn Electric Company has been organized by the Eastern Pennsylvania Light, Heat & Power Company, Pottsville, as a subsidiary, to onstruct and operate electric generating lants and systems in Schuylkill County.

ABERDEEN, MD.—The Maryland Fin- hing Company will build a power house i connection with its proposed local plant, cost about $30,000.

ANNAPOLIS, MD.—Bids will be taken t once by the Supply Officer, United States avy Department, for 20,000 ft. of cable. Requisition 65.)

HAVRE DE GRACE, MD.—The Havre e Grace Electric Company has issued 90,000 in bonds, part of the proceeds to be sed for extensions and improvements.

BLUEFIELD, W. VA.—The Pond Creek ocahontas Company, recently organized operate coal properties in McDowell ounty, plans to install a power house in onnection with an electrically operated al-mining plant. T. B. Davis is president.

HUBBELL, W. VA.—The Huntington as & Development Company is planning rebuild its power house and lubricating orks, recently damaged by fire. The loss estimated at about $100,000.

LOGAN, W. VA.—The Guyan Machine hops are making inquiries for an electric oist with alternating-current motor; also r a motor-generator set, 100 kw. to 150 v., or a rotary alternator of same capacity.

DANVILLE, VA.—The Danville Traction Power Company has entered into a ten- ar contract with the city of Danville for e purchase of energy from the municipal ectric light plant, the service to begin ly 1. The traction company will install rotary converter in the municipal plant.

NORFOLK, VA.—Plans for the proposed cal sugar refinery to be erected by Adolph gal, Philadelphia, and associates, to cost out $4,000,000, include a power plant. harles B. Hughes, president Hughes-Ellis- owell Corporation, 403 Boush Street, Nor- lk, is interested in the project.

STRASBURG, VA.—The Town Council is awarded the Northern Virginia Power ompany, Winchester, a franchise to fur- sh electricity here.

SUFFOLK, VA.—The Instant Collapsible im Company, Bank of Commerce Building, orfolk, contemplates the construction of substation at its proposed local plant.

WASHINGTON, D. C.—The Potomac ectric Company contemplates the erection an office building and garage at 13½ and Streets, N. W., to cost about $200,000. ne Milburn-Heister Company, 710 Four- enth Street, N. W., is architect.

## North Central States

ALMA, MICH.—The property of the Central Michigan Light & Power Company has been sold to the Consumers' Power Company, Jackson. The Central company supplies electrical service in cities and towns in Clare, Isabella and Gratiot Counties.

DETROIT, MICH.—The Père Marquette Railroad Company plans to install electrical equipment and an addition to its power house in connection with improvements at its shops on Twelfth Street, Detroit, and at Grand Rapids, to cost about $1,200,000 and $1,500,000, respectively. An electric block system from Alexis to Carleton is also under consideration, to cost about $100,000.

JACKSON, MICH.—Plans are being considered by the Commonwealth Power, Railway & Light Company for extensions in Michigan, to cost about $9,000,000. The proposed work includes a 30,000-hp. steam-driven plant on the Saginaw River, between Saginaw and Bay City; a 12,000-hp. hydro-electric development on the Au Sable River at Alcona, and a 20,000-hp. plant on the Manisteo River.

CINCINNATI, OHIO.—Surveys are being made of the electric power requirements of the southern Ohio district by the Union Gas & Electric Company. Tentative plans, it is said, are to erect an electric generating plant in the West Virginia coal fields, to cost about $25,000,000.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 10 for furnishing X-ray equipment for the new city hospital.

CLEVELAND, OHIO.—Plans are being prepared by the Cleveland Electric Illuminating Company for an electric boosting station at North Woodland Road and East 130th Street, to cost about $50,000.

CLEVELAND, OHIO.—The Cleveland (Ohio) Electric Illuminating Company, it is reported, contemplates taking over the power house of the Lake Shore Electric Railroad Company in Avon Beach Park, east of Lorain.

GIRARD, OHIO.—The proposed new street-lighting contract with the Pennsylvania-Ohio Power & Light Company calls for forty-three lamps of 100 cp., 127 lamps of 250 cp. and twelve lamps of 400 cp. At present there are only eighty-seven street lamps in operation.

HURON, OHIO.—The trustees of the municipal electric light plant are negotiating with the Sandusky Gas & Electric Company to furnish electricity in Huron, as the municipal plant is not self-sustaining.

PORT CLINTON, OHIO.—The American Gypsum Company will install electric power equipment in connection with its proposed plant addition, to cost about $100,000.

SOUTH BEND, IND.—Plans are being considered for replacing the sixty-four gas lamps now in use in River Park with electric lamps at the expiration of the present contract, which expires April 30.

SOUTH BEND, IND.—Work will soon begin on the erection of a power plant, in connection with a new five-story hospital to be erected at 123 West Navarra Street, by the Methodist Hospital Association. Schmidt, Garden & Martin, 104 South Michigan Avenue, Chicago, are architects.

CHICAGO, ILL.—Upon the rejection of the third bid for the installation of 14,000 municipal electric street lamps, George E. Carlson, Commissioner of Gas and Electricity, has announced that the city will install the lamps.

KEWANEE, ILL.—The Consolidated Light & Power Company has submitted a proposal to the City Council offering to sell its plant to the city. Bonds to the amount of $125,000 have been voted for the installation of a municipal electric plant.

MILWAUKEE, WIS.—The Milwaukee-Western Electric Railway Company, 253 Third Street, contemplates the construction of a new electric railway to Fox Point, via Juneau, Beaver Dam, and other towns, 65 miles long, to cost about $1,500,000.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has petitioned the Wisconsin Railroad Commission for permission to issue $3,000,000 in capital stock, the proceeds to be used for extensions to its electric light and power and street-railway service in Milwaukee and surrounding territory, including Whitefish Bay, Shorewood, North Milwaukee, Wauwatosa, West Allis, Cudahy and other towns.

OSHKOSH, WIS.—Plans have been prepared by the Water Department for additions to the waterworks pumping station, including the installation of three electrically operated pumps, to cost about $80,000.

SLAYTON, MINN.—Arrangements have been made by the Northwest Light & Power Company, Hutchison, to extend its transmission line from Pipestone to Slayton.

CEDAR RAPIDS, IOWA.—The Disbrow Sash & Door Company, Seventh Avenue, contemplates the erection of a power house, in connection with an addition to its plant to cost $80,000.

DUBUQUE, IOWA.—The Albert Emanuel Company, Inc., 61 Broadway, New York, has acquired the property of the Dubuque Electric Company and the Eastern Iowa Electric Company. Tentative plans are under consideration for extensions and improvements.

EAGLE GROVE, IOWA.—Electric power equipment will be installed in the proposed local ice-manufacturing plant, to be erected by the Iowa Cold Storage Company, Gilmere, to cost about $50,000.

OSKALOOSA, IOWA.—All work in connection with the proposed hydro-electric plant to be erected at Harvey by the city of Oskaloosa, we are informed, is in charge of Brown & Cook, Ottumwa, engineers. This is to correct an item published Jan. 27 stating that Burns & McDonnel, Interstate Building, Kansas City, Mo., were engineers.

SIOUX CITY, IOWA.—The Sioux City Brick & Tile Company, Third Street, will install electric power equipment in connection with the rebuilding of the portion of its plant recently damaged by fire. The loss is estimated at about $50,000.

KIRKSVILLE, MO.—The City Council has authorized a bond issue for $40,000 for extensions and improvements to the municipal electric plant. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

SEDALIA, MO.—The West Missouri Power Company has issued $1,350,000 in bonds, part of the proceeds to be used for extensions and improvements.

SENECA, MO.—At an election to be held April 23 the proposal to issue $25,000 in light and power bonds will be submitted to the voters.

HOT SPRINGS, S. D.—Preparations are now being made for the installation of a new power plant at Sylvan Lake to replace the plant which was destroyed by fire last summer. The size of the plant depends upon the amount appropriated by the Legislature for state park requirements.

LINCOLN, NEB.—The Continental Gas & Electric Corporation has disposed of a bond issue of $2,000,000, part of the proceeds to be used for extensions and improvements to the system of the Lincoln Gas & Electric Company, recently acquired.

ONG, NEB.—The Electric Development Company, Omaha Loan & Building Association Building, Omaha, is planning to erect a transmission line to Ong, Shickley and vicinity, to cost about $28,000. Distributing systems will also be installed.

## Southern States

BELMONT, N. C.—The Stowe Spinning Company contemplates extensions to its works, including the construction of a power house, to cost about $750,000.

BURGAW, N. C.—Bonds to the amount of $12,000 have been issued for the installation of an electric lighting and power system.

NORTH WILKESBORO, N. C.—The Wilkes Hosiery Mills Company plans to build a power house in connection with its proposed local mill, to cost about $75,000.

PINE BLUFF, N. C.—Electrically driven pumping machinery will be installed in connection with extensions and improvements to the waterworks system. Bids, it is understood, will soon be asked for equipment.

RALEIGH, N. C.—The Carolina Power & Light Company contemplates enlarging its substations at Goldsboro, Selma and at several other places.

ROCKINGHAM, N. C.—Plans for the proposed new textile mill to be erected by the Leak Manufacturing Company, at a cost of about $500,000, provide for an electric power plant.

TAYLOR, S. C.—A steam-driven electric generating plant of 1,000 kw. capacity, will be erected at the proposed new mill of the Southern Bleachery Company. J. E. Sirrine & Company, Greenville, S. C., are architects and engineers.

ATLANTA, GA.—The George Railway & Power Company contemplates the erection of a susbtation on Walton Street.

MACON, GA.—Electric power equipment will be installed in the proposed ice-manufacturing and cold-storage plant to be erected by the Central Railway of Georgia, Savannah, to cost about $300,000.

ST. PETERSBURG, FLA.—The St. Petersburg Lighting Company contemplates extension and improvements to its system.

TALLAHASSEE, FLA.—The installation of an ornamental lighting system on Park Avenue, between Duval and Calhoun Streets is under consideration.

CHATTANOOGA, TENN.—The Southern Sheet Steel Company will build a power house in connection with its proposed new plant, near Glendale, to cost about $1,000,000.

LIVINGSTON, TENN.—The Cumberland Power Company contemplates extensions and improvements in the local electric system, recently acquired.

PIKEVILLE, TENN.—The Pocahontas & Sewanee Coal & Iron Company will install electric power equipment at its properties. The Williamson Construction Company, Pikeville, will make purchases.

LEEDS, ALA.—Preparations are being made by the Alabama Power Company, Birmingham, to erect a substation in Leeds, to cost about $1,000,000.

CLINTON, MISS.—Negotiations are under way between the Town Council and the Jackson (Miss.) Public Service Company whereby the latter may furnish electricity to operate the local system. If the project is carried through a twenty-four-hour service will be established.

MOSS POINT, MISS. — The Southern Paper Company will soon break ground for the construction of a power plant in connection with mill extensions, to cost $1,500,000.

NEW ALBANY, MISS.—Bonds to the amount of $25,000 have been issued for extensions and improvements to the municipal electric plant.

HOT SPRINGS, ARK.—Permission has been granted to the Caddo River Power & Irrigation Company to construct a hydro-electric project on the Caddo River, to cost about $5,000,000. The initial installation will develop about 15,000 hp. and will cost about $2,000,000.

DE QUINCY, LA.—Bids will be received by W. W. Tuck, president of the municipal waterworks, light and power board, until March 6 for construction of a municipal electric light plant and waterworks system. The equipment will include one 50-kw. and one 100-kw., three-phase, 50-cycle, 2,300-volt generator directly connected to oil engines, switchboard, motor-driven well pump, electric light and power distributing system, meters, transformers, etc. J. W. Billingsley, Interstate Bank Building, New Orleans, is consulting engineer.

ARDMORE, OKLA. — The Consumers' Light & Power Company will build a power plant to cost about $100,000. A cold-storage plant will also be erected.

CLINTON, OKLA.—At an election held recently the proposal to issue $45,000 in bonds for extensions to the municipal electric light plant and waterworks system was defeated. A new election will be held later.

CUSHING, OKLA.—The local plant of the Minnesota Electric Light & Power Company, Bemidji, Minn., was recently destroyed by fire, causing a loss of about $50,000. The plant, it is stated, will be rebuilt at once.

WYNNEWOOD, OKLA. — Bonds to the amount of $85,000 have been voted for extensions to the municipal electric light plant and waterworks system.

ABILENE, TEX.—The West Texas Utilities Company contemplates extending its transmission lines from Rotan to Roby.

BEAUMONT, TEX.—Arrangements are being made by the Eastern Texas Electric Company for extensions and improvements to its system, to cost about $150,000.

CUERO, TEX.—The Texas Central Power Company is planning to extend its high-tension transmission line to Kingsville and to furnish electrical service there.

HEMPHILL, TEX.—Plans are under way for rebuilding the electric light and power plant of the Temple Lumber Company, recently destroyed by fire. The loss is estimated at about $150,000.

HENRIETTA, TEX.—The City Council has entered into a contract with the Wichita (Tex.) Electric Company for the installation of seventy street lamps. In the business district 400-cp. lamps will be used and in the residential section 50 cp. will be installed.

VERNON, TEX.—The Texas Electric & Ice Company is preparing plans for the construction of an electrically operated ice-manufacturing plant in Vernon. Plants will be built at Bay City and Mount Pleasant.

VERNON, TEX.—The Vernon Electric & Ice Company has submitted a proposal to the City Commission offering to take over and operate the municipal waterworks and street-lighting systems. The city has authorized a bond issue of $100,000 for the installation of a municipal lighting system, but the project is tied up in litigation.

## Pacific and Mountain States

OLYMPIA, WASH. — The proposal to extend the ornamental lighting system to take in Franklin Street and the cross streets from Fourth to Sixth Street has been approved by the City Council.

TACOMA, WASH.—The Wheeler-Osgood Company will install electric power equipment at its proposed new sash and door plant, to cost about $250,000.

YAKIMA, WASH.—The installation of an ornamental lighting system on Yakima Avenue from the railroad tracks to Twelfth Avenue is under consideration. The cost is estimated at about $8,000.

EUREKA, CAL.—Plans are under consideration for the installation of an ornamental lighting system in Seventh Street. H. H. Hannah is city engineer.

MARYSVILLE, CAL.—Plans are being considered for the installation of an ornamental lighting system in Fourth and Fifth Streets. W. M. Meek is city engineer.

SAN FRANCISCO, CAL.—Extensions are contemplated by the Market Street Railway Company, including a double-track line from Pacific City to San Mateo, to cost $150,000; double-track line from San Mateo to Beresford, $355,000, and the erection of substation, $30,000.

SAN PEDRO, CAL. — Plans are being prepared by the Pacific Coast Borax Company for an addition to its borax-refining plant, including machine shop, boiler house and generating plant, to cost about $75,000. A. C. Martin, Higgins Building, Los Angeles, is architect.

TURLOCK, CAL.—The Board of Trustees has granted the Turlock Irrigation District permission to install a distribution system to supply electricity for lamps and motors in the city.

WILLITS, CAL.—The Central Mendocino County Power Company will soon ask for bids for the erection of a transmission line to Potter Valley, 15 miles, to connect with the plant of the Mountain Water & Power Company. H. S. Tittle, 766 Folsom Street, San Francisco, is electrical engineer.

CALHAN, COL.—Plans have been prepared for a municipal electric plant and waterworks system, to cost about $50,000. The Brew & Sidow Engineering Company, Kitridge Building, Denver, is engineer.

DENVER, COL.—The City Council has adopted an ordinance permitting the Denver Gas & Electric Light Company to substitute Mazda lamps for street lighting for the arc lamps now in use.

FORT MORGAN, COL.—Work will soon begin on the construction of a new municipal electric plant.

TUCSON, ARIZ.—The Tucson Gas, Electric Light & Power Company contemplates extensions and improvements to its power plant and system, to cost about $300,000

## Canada

POWELL RIVER, B. C.—Tenders are being asked on the first unit of a power plant to be erected at Power River for the Powell River Company, Ltd., Vancouver. Tenders will be received by N. R. Lang, manager, for a power house and smoke stack.

WINNIPEG, MAN.—Tenders will be received by the city clerk until March 15 for water-tube boilers and accessories.

MONKTON, ONT.—The Council is considering the installation of a hydro-electric plant and system.

NORWICH, ONT.—Bonds to the amount of $25,000 have been voted for the installation of an electric lighting and power system.

BAGOTVILLE, QUE.—Tenders, it is reported, will soon be asked by the Town Council for the construction of a municipal power plant to cost about $150,000.

DRUMMONDVILLE, QUE.—The Southern Canada Power Company, Montreal, is considering a 30,000-hp. hydro-electric development at Hemming's Falls on the St. Francis River, near Drummondville, this year.

MONTREAL, QUE.—Work has started on a hydro-electric development, to cost about $7,000,000, at St. Etienne des Gras, Quebec, for the Shawinigan Water & Power Company.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued Feb. 6, 1923)

1,445,206. THERMIONIC RECTIFIER AND C[IR]CUITS THEREFOR; J. K. Elderkin, Newa[rk], N. J. App. filed July 8, 1921. Stora[ge] battery charging apparatus.

1,445,217. WINDING DEVICE FOR DR[OP] LIGHTS; C. V. Johnson, San Francis[co], Cal. App. filed Sept. 25, 1918. Automa[tic] coil winder for extension or trou[ble] lights.

1,445,226. SEMI-AUTOMATIC TELEGRAP[H] SENDING MACHINE; H. G. Martin, Broo[k]lyn, N. Y. App. filed Dec. 10, 19[..]. Simplified construction of the operat[ing] lever.

1,445,231. WELDING JIG; O. Muller, [..] Ridgewood, N. Y. App. filed Sept. [..] 1919. For welding vacuum-tube el[ec]trodes.

1,445,233. TELEGRAPH SYSTEM; H. [..] O'Neill, Brooklyn, N. Y. App. filed N[ov.] 19, 1919. Improves wave-form impul[ses] transmitted over conductors having h[igh] electrostatic capacity.

1,445,235. IMPULSE TRANSMITTING DEVI[CE]; L. D. Plotner, Brooklyn, N. Y. App. fi[led] April 14, 1920. For use at an operato[r's] position in semi-automatic telephone s[ys]tem.

1,445,242. VARIABLE INDUCTANCE ELEME[NT]; W. J. Shackelton, Scotch Plains, N. [J.] App. filed Dec. 24, 1920. Coils wound [in] form such that inductance varies p[ro]portional to angle turned through.

1,445,258. TESTING SYSTEM; S. B. Willia[ms], Jr., Brooklyn, N. Y., and H. L. Bosta[..], West New York, N. J. App. filed Feb. [..] 1919. Testing device for telephone ap[pa]ratus.

1,445,260. METHOD OF AND APPARATUS [FOR] TESTING ELECTRICAL COILS; A. H. Ada[..], Sparkill, N. Y. App. filed Oct. 23, 19[..]. Detects short-circuited coil during wi[nd]ing operation.

1,445,278. THERMIONIC VACUUM TUBE; [..] A. Heising, East Orange, N. J. App. fi[led] Nov. 1, 1917. Series arrangement [of] filaments of several tubes.

1,445,321. RHEOSTAT; A. A. Kent, Ardm[ore], Pa. App. filed July 21, 1922. For va[ry]ing filament current in vacuum tubes.

1,445,360. ELECTRIC TROLLEY APPARAT[US]; E. Schild, Seattle, Wash. App. filed [..] 31, 1921. Trackless trolley pole.

1,445,391. SLIDING-TROLLEY SHOE; H. [..] Coats, Veedersburg, Ind. App. filed [..] 24, 1922. Reversible flat surface.

1,445,398. INCANDESCENT ELECTRIC LA[MP]; K. Kambayashi, Kuze-Gun, Kyoto, Ja[pan]. App. filed April 29, 1921. Protects [fila]ment and lead wires from injurious ef[fect] of Edison effect current.

1,445,411. PROCESS OF MAKING VAL[VES]; C. Pfanstiehl, Highland Park, Ill. [App.] filed Dec. 26, 1916. Welding two pi[eces] of metal of different melting points.

1,445,421. TELAUTOGRAPHIC SYSTEM; G. [..] Tiffany, Summit, N. J. App. filed [..] 25, 1916. Telautographic and teleph[oni]c messages simultaneously transmitted [over] the same line.

1,445,422. VARIABLE INDUCTANCE; E. [..] Turney, Holmes, N. Y. App. filed M[arc]h 22, 1921. Hinged coils.

1,445,432. TELEPHONE-EXCHANGE SYST[EM]; B. G. Dunham, Hawthorne, N. J. [App.] filed Aug. 7, 1919. Decreases time inte[rval] between actual seizure of trunk and ap[pli]cation of busy connection.

1,445,501. HOT-WATER BAG; H. F. Dwi[..], Highland Mills, N. Y. App. filed July [..] 1921. Electrically heated.

1,445,503. GALVANIC BATTERY; G. F[..] L. Fuller and G. J. A. Fuller, Lon[don], England. App. filed Feb. 16, 1921. [..] action prevented until it is required [for] use.

1,445,529. ELECTRIC LOCK AND ALARM [FOR] AUTOMOBILES; S. L. Mathews, St. L[oui]s, Mo. App. filed Oct. 11, 1919. Mec[han]ically controlled automatic clutch [and] electrical locking and circuit-making-[and-]breaking mechanism.

1,445,567. BATTERY-CHARGING CONNEC[TOR]; M. D. Sweet, Alliance, Ohio. App. [filed] May 26, 1921.

1,445,580. AUTOMATIC SYSTEM OF [CON]TROLLING THE CHARGING OF STORAGE [BAT]TERIES; O. P. Fritchle, Denver, Col. [App.] filed March 1, 1920. Gives a direct [indi]cation of the amount of charge that [in] battery.

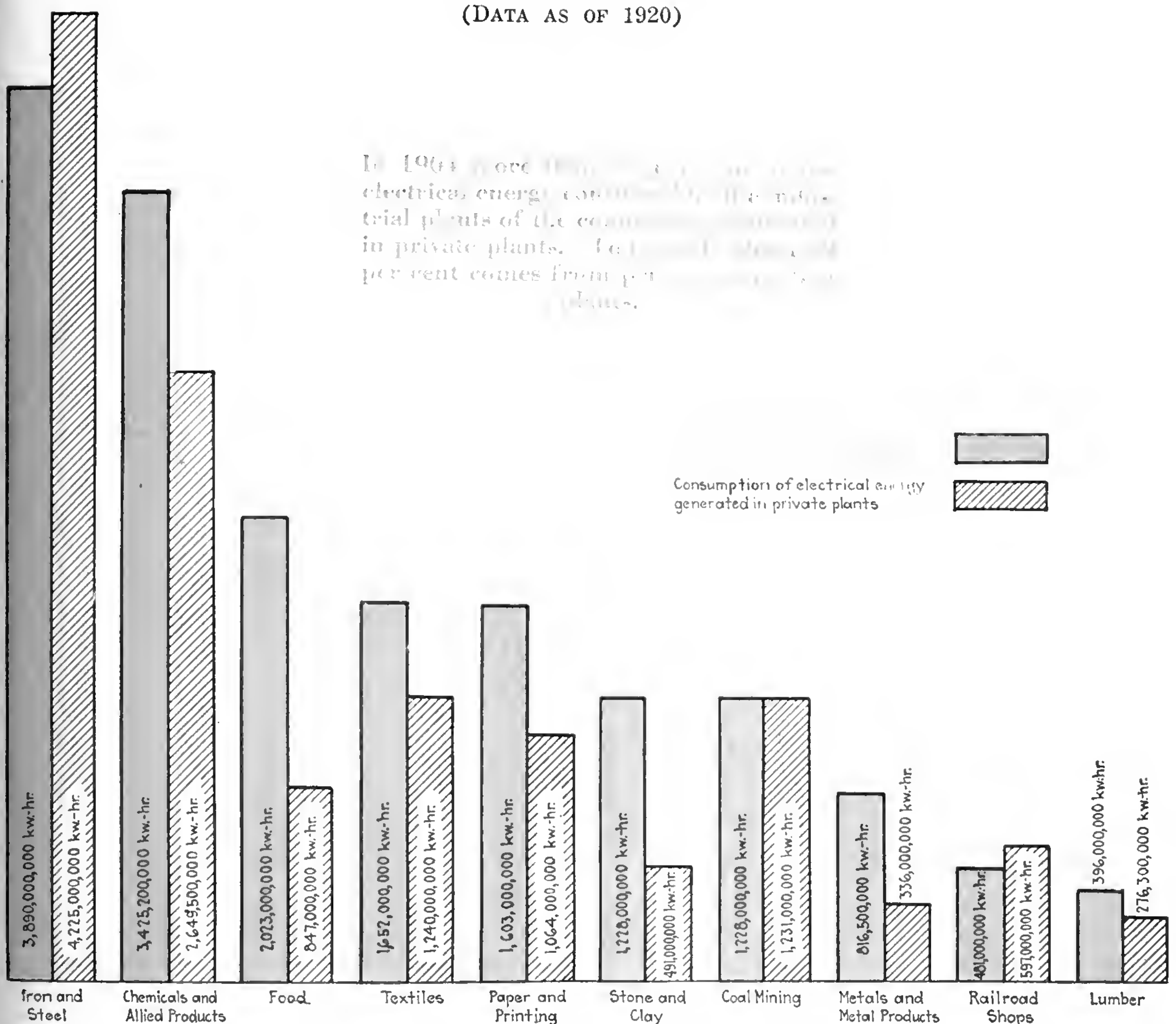
1,445,585. STREET INDICATOR; W. G[..], Wichita, Kan. App. filed Jan. 8, [..]. Indicates next stop of vehicle.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## The Extent to Which the Central Station Has Supplanted the Private Generating Plant

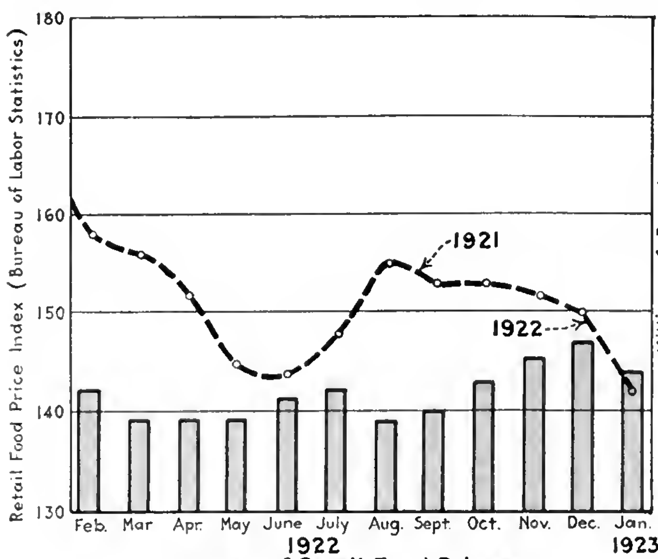
(DATA AS OF 1920)



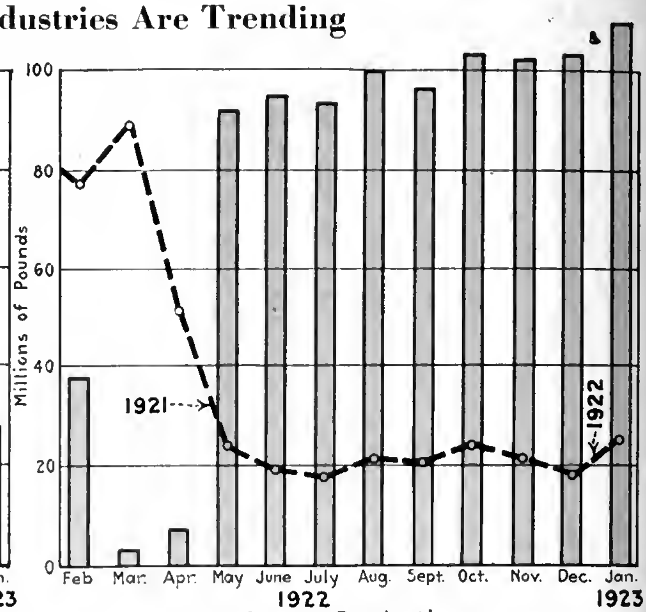

## A Measure of Progress

"ACHIEVEMENT is the measure of progress, the prophecy of greater things." The electric light and power industry during its forty years of history has achieved results unparalleled by any other primary industry and stands today on the threshold of still greater things. The gradual replacement of privately generated power by central-station service brought about by the greater efficiency, lower costs and greater dependability is of itself an achievement worthy of record. In 1904 more than 72 per cent of the electrical energy consumed by the industrial plants of the country was generated in private plants. In 1920 all but three primary industries used more central-station energy than electrical energy from private generating plants, and it is probable that today the central station has overtaken private-plant generation even in these three industries. The progress of the industry is continual.

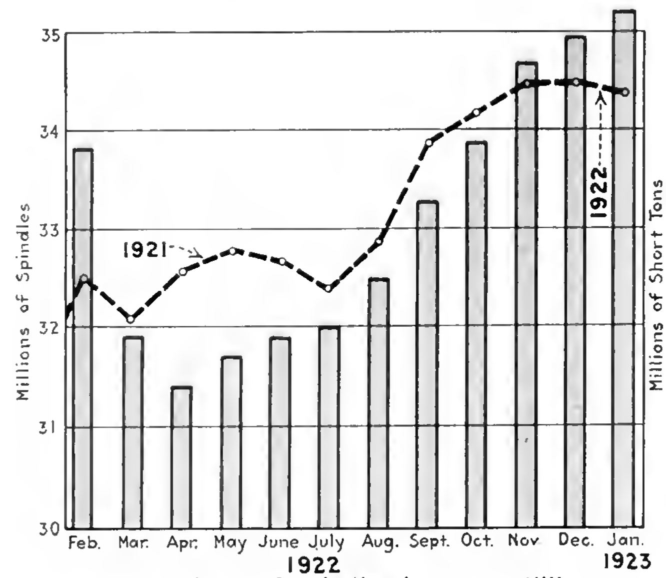
## How the Primary Industries Are Trending



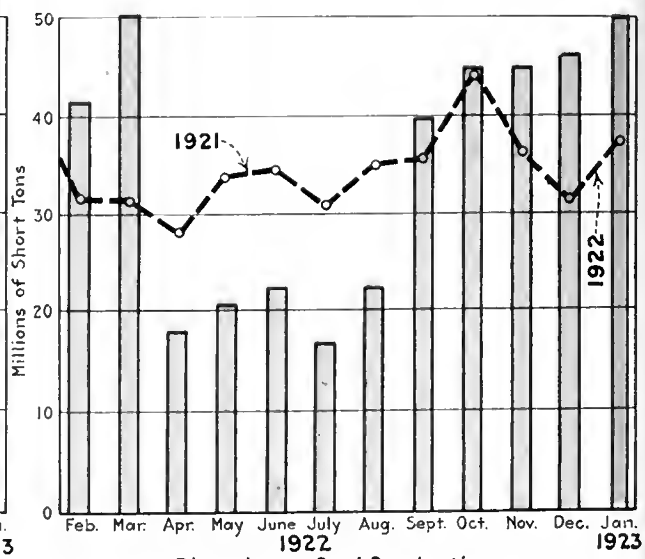

Index of Retail Food Prices



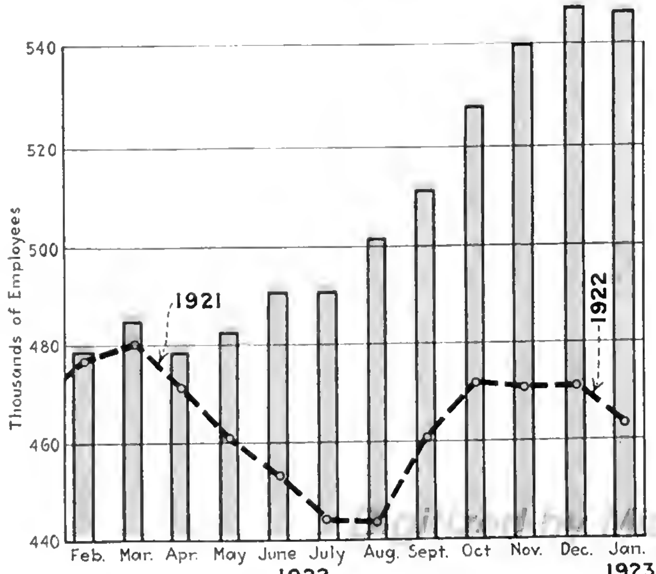

Copper Production




Activity of Spindles in Cotton Mills




Bituminous Coal Production




Employees in Factories of New York State

## Factory Employment Retarded

ALTHOUGH a large increase in general productive activity is indicated by figures received from the Department of Commerce for January, data on employment in factories for the typical industrial state of New York indicate that the high point of employment has been reached, at least temporarily. The number employed during January, however, was still approximately ninety thousand below the high figures reported in March, 1920, so that the slight drop reported for January is probably only a seasonal reaction, which will be overcome as the year advances. The almost uniformly large monthly increases in number of factory employees which have been experienced since last July were bound to taper off as industry caught up with demand, and it is probable that from now on employment will show the ups and downs which are normally characteristic of the various seasons of the year.

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# Electricity and Immigration

THE connection between electricity and immigration may seem somewhat nebulous, but it is not at all beyond the bounds of possibility that the electrical industry may prove most effective at least in mitigating, if not in solving, the immigration problem of the country. Electricity has conquered most of the multitudinous tasks which have confronted it; it has gone even further and has been constantly on the alert with untiring and brilliant initiative to devise and create new ways to make life easier and to help material and social progress. Even with this record, the problem of immigration will put the electrical industry on its mettle. Yet if there is any answer to the insistent and growing demand for more cheap hands to perform menial tasks it lies in the further substitution of mechanical appliances and automatic control for human brawn and brain. And electricity is the one agency for motive power and for effective control to make this possible.

IMMIGRATION is a subject which has forced its attention on everyone in this country — whether he is an employer of labor or merely a reader of the daily newspaper. Industry calls for immigrants in large numbers, and the high cost of many things is blamed on the scarcity of low priced men to do the physical work. On the other hand, those who are most concerned over the character of the future American citizens urge more and more restriction on intending immigrants. The recent Congress tried in vain to make some constructive advance on the subject but its efforts came to naught except to incite some intelligent discussion.

Briefly, as previously pointed out in these columns, here is the story: Immigrants came to this country in desirable numbers and character during the latter half of the last century. Their quality decreased and quantity increased the two decades preceding the war. While common labor came in and helped do the common work, finally, as one noted American has put it, some lumps got into the "melting pot" that we have been unable to melt. The present 3 per cent law based on the 1910 ratio of races is admittedly not the solution. To open the gates creates an Americanization problem the answer to which is not known, the result of which might prove disastrous. To adopt a 2 per cent law based on the 1890 ratio of races, it is held, will give the quality but not the quantity. Some answer is needed which will at once retain American institutions and standards and yet not halt American industry and progress.

AS A NATION we have developed machinery to perform many chores. Electricity as a motive power and as a control agency has been the most important factor in the extension of these benefits. But the half has not been realized. For the electrical industry there still exists the greatest opportunity further to develop applications of electricity to do the work of man, or, more effectively perhaps, to multiply the work of the individual. Industry after industry have not even dreamed of what electricity can do to solve their production and labor problems. There is practically no task that electricity can not ultimately perform. But what of the human factor? Once again — it is only the more simple of control operations that electrical equipment now supplies — the beginning has not been much more than made in what can be done to replace the present necessary human brain by selective electrical control apparatus.

Genius rises to meet the demands of the times. The electrical industry will not be slow to recognize and grasp the opportunity of service to the nation in this problem. It must tell the rest of the country of its ability and its plans. More and more will it relieve industry of its labor problems, freeing machine-bound Americans to take the place of foreign importations and to become better paid — because more efficient — men and citizens. In this way will electricity in the hands of American inventive ability continue to prove its inestimable value to humanity and to the nation.

# Farley Osgood

*A prominent engineer and forceful executive who has a particular faculty as an organizer and director of men.*

FEW men can find the time or have the ability or inclination to contribute personally and constructively to many different activities in the electrical industry, and pre-eminence is usually obtained by those who have specialized and concentrated on one particular phase. Farley Osgood is a leader who has established himself as an active worker in many electrical activities and has carried out the letter and spirit of his belief in the benefits to be derived from co-operative work and personal participation in things which advance the interests of the industry. As vice-president and general manager of the Public Service Electric Company of New Jersey, Mr. Osgood directs the engineering and business activities of one of the largest light and power utilities, yet, through his ability in organizing a supporting staff, he finds time to take an active part in the work of the national scientific and public utility organizations.

Mr. Osgood was born in Boston in 1874 and after completing his studies at the Massachusetts Institute of Technology in 1897 he entered the service of the American Telephone & Telegraph Company. He rapidly advanced in this organization to the position of territorial manager in New Jersey. After five years he became chief engineer and general manager of the New Milford Power Company in Connecticut and was very active in working out pioneer engineering problems associated with 33,000-volt transmission. Four years later Mr. Osgood became general superintendent of distribution for the Public Service Electric Company. His ability as an organizer and educator of men brought about rapid advancement until he was directing the production and engineering departments, and in April, 1917, he became vice-president and general manager of the company.

In association work Mr. Osgood has been very active. He was vice-president of the A. I. E. E. in 1914-16 and manager in 1911-14, and he has served as chairman of the New York Section. In the N. E. L. A. he contributed largely to national specifications as chairman of the overhead-line construction committee, and he had much to do with the formulation of the National Electrical Code as a representative of the A. I. E. E. His long-extended and valuable service in association work has seldom been equaled, and the electrical industry is indebted to him in unusual degree for his work and counsel. His personal and social popularity is attested by his membership in many social and sporting clubs in New York and New Jersey.

# Editorial Comment

Electrical World, March 10, 1923
Volume 81 Number 10

## Phenomenal Growth in the East

ORDINARILY in matters electrical it is the West that sets the pace. We are wont to associate the West with things progressive and with engineering of the spectacular or daring sort. Are there records of huge units or exceedingly high potentials to be established, it is almost taken for granted that the West will supply them. But while we admire the enterprise and initiative so often and so freely displayed by our Western friends, we ought not to overlook records being made in the conservative East. For instance, last year the Brooklyn Edison Company added more than 55,000 new customers to its lines and made power contracts aggregating over 60,000 hp.—a huge central-station system in itself. The gross operating revenue during the year increased 18 per cent, while the gain in the net corporate income was approximately 52 per cent.

But that is only part of the story. To keep pace with such a growth requires equipment and new capital, and particularly an organization capable of responding to such large demands. These things, through the foresight of M. S. Sloan and the co-operation of the Bradys, have all been provided. The authorized capital of the company has been increased since 1921 from $19,000,000 to $50,000,000. Work has started on a new and most interesting generating station and a new office building. Lines have been extended right and left, and so great is the demand for service that it is only with difficulty that the company manages to keep from being literally swamped. This desire for electricity has swept over the whole industrial section of the East like a tidal wave. Boston, New York, Philadelphia, Newark, Baltimore, Buffalo, Pittsburgh, Cleveland, Detroit and Chicago have all felt it, so that for some little time to come things will be humming in the eastern part of the country.

## Cincinnati Curtails a Needed Service

FINDING itself short of funds, Cincinnati has decided to curtail some of its public lighting—not that the streets of Cincinnati are the best lighted in the world or that the city is exceptionally free from crime but because its Director of Public Service is lacking in discernment and does not appreciate just what benefits proper street lighting bestows on a community. When electricity was first used for street lighting its fitness for the purpose was instantly recognized. Among those most outspoken in their praises were directors of public safety and police commissioners, who saw in the new light a deterrent to crime. So great was appreciation that it became quite common to say, "An arc lamp is equal to a policeman."

Considering the wide difference between the cost of the lamp and the cost of the policeman, the constant service of the one compared with the other, and the fact that street lighting is the only public service which benefits every man, woman and child in the community, the wonder is that appropriations for street lighting are not twice as large as they are. Certainly no city is overlighted; none, in fact, is even adequately lighted, and for a city of the size and importance of Cincinnati deliberately to weaken its safety and protective measures is shortsighted and blameworthy. It indicates a lack of enterprise which one would not expect in the stanch old city, whose name recalls both Revolutionary and Roman history and which was a flourishing town when Cleveland was a hamlet and Chicago still unborn.

## The Manager of the Small Utility Must Fit His Community

THE executive of a public utility property in the large community has an organization of specialists at hand through which the details of engineering, accounting, legal and operating matters are handled. Such an executive is selected largely for his ability as an organizer, as a man to be respected by the business community of which he becomes a part. The small community executive, however, has an entirely different atmosphere and problem. Not only must he be his own organizer, but he must also bear the brunt and responsibility in almost every line of activity his company is called on to pursue. In addition he must fit into the community's social and commercial life and way of thinking in a manner that makes the people he must deal with feel at home with him and he with them. It is a very difficult problem indeed.

The rôle is rather a large one for one man to fill, especially when the salaries that can be paid are such that they appeal principally to young men just beginning their careers. Yet the problem must be faced in most communities that have utility service, for, after all, there are few great cities and an overwhelming number of lesser communities.

One Middle West syndicate with small-town properties has found that the point in which the managers in such places most often fail is inability to get the viewpoint of the community, talk its language and be a part of it commercially and socially. This particular syndicate is now making it a practice to employ a local man with some practical experience in operation who has, either by being brought up in the community or by long residence in it, established himself as an honorable and upright individual in whom the public has confidence and who has a record of business experience sufficient to justify the general estimate of him.

With a man of this kind at the head of a local organization, the executives of this particular company feel that any technical and operating shortcomings he may have can be supplied under the existing system of syndicate management and operation, and that he can be depended on to ask for help in the problems on which he may lack experience. Public confidence, it is held.

can rest only on the personality of the man himself, and the selection of men for executive positions in the smaller communities must rest largely on the way in which they measure up in this regard.

### Give Adequate Support to the Meter and Test Department

SOME operating companies provide excellent meter and test facilities. Others overlook them or neglect them entirely. Why this should be so is hard to understand when one considers the fact that meters are the cash registers of electric service systems and are more liable to under-register than over-register. Furthermore, why isn't it more generally recognized that trouble forestalled in other apparatus means a saving in investment, operating expense, revenue and good will? Adequate testing facilities plus scheduled inspection and maintenance are the means of forestalling trouble.

It seems axiomatic to state that the meter and test department to be effective should be provided with the necessary testing apparatus and that it should have convenient space in a building which is centrally located for the work handled. The head of the meter department may have some ideas regarding the apparatus he needs and the building space and location preferred. Usually it will be found that most of his desires can be satisfied at an expense that will bring a neat return on the investment if the intangible as well as the tangible results of inadequate test facilities are considered.

### Wire Covering for Overhead Lines Gives False Sense of Security

IF THE proposed requirement that approved weatherproof or rubber insulation be provided on all overhead conductors operating at potentials up to 5,000 volts is included in the new edition of the National Electrical Code (up for final public hearing Monday, March 12), it is bound to give many persons a false sense of security. In reality such insulating covering has very doubtful protecting value at voltages above 2,300 and questionable value even at this voltage after being in service a short time. Central-station operating practice has rather generally been built on the basis that the insulating value of weatherproof covering is so uncertain that, for their own safety, workmen must be instructed to proceed on the assumption that all conductors being worked upon are bare. This practice is based on a sound foundation of experience, and there is no development in view that promises a reasonably priced insulating covering which will withstand the effect of climatic conditions indefinitely and retain its insulating value. Despite this condition, the sole basis on which advocates of this proposed addition support it is the assumption that weatherproof covering has some protective value part of the time and for that reason should be used. It is this uncertain value that makes its use most hazardous. Even if it is used to prevent accidental swinging contact, there is every likelihood that the covering will become abraded by rubbing contact and not provide the protection intended.

There is another reason why weatherproof covering should not be used on all conductors up to 5,000 volts, and that is that it increases the diameter exposed to wind and sleet nearly 100 per cent and increases the hazard of wires breaking. Another factor is that the requirement of a weatherproof covering of doubtful effectiveness would increase unjustifiably the expense of rural service.

If insulating covering be advisable for all wires up to 5,000 volts, it is surprising that this requirement is so briefly covered in the National Electrical Safety Code. As a matter of fact, a provision of this character was withdrawn from the National Electrical Code in the 1920 edition. The most dependable way of removing any life or fire hazard that may exist from close proximity of wires of the class considered to other objects is to provide ample clearances and safe construction, as is done by progressive companies and prescribed by the National Electrical Safety Code.

There is no reason to believe that central stations and others will discontinue the use of weatherproof wire where they now employ it. But it is best to defer the inclusion of the proposed blanket requirement for all wires up to 5,000 volts until it can have more complete consideration.

### Outdoor Construction Should Not Become a Fad

THE growth of sentiment in favor of putting apparatus out of doors instead of under a roof has been an interesting phenomenon. Ten years ago the radical who suggested putting switches or transformers out of doors to save space and expense within the four walls of a station was looked on as a fit subject for the psychopathic ward. Rather gradually, as becomes the spirit of the conservative, a change in opinion came about. The first open-air switches were installed often from sheer inability to meet architects' bills. They were followed by out-of-door transformers and by substations in their entirety. More recently there have been, as will be remembered from published descriptions, some very useful experiments in outdoor generating stations. Now the key to the whole situation is a golden one. Broadly, there is no particular reason for designing weatherproof apparatus, save that its extra cost will be less than that of constructing inclosed space in which to stow it. In very high-tension work part of this extra cost is implied in the provisions for getting circuits into and out of station structures.

The early step to mere utilization of air switches whenever practicable was a simple one, very logically followed by putting the transformers out of doors so that only low-tension circuits would have to enter or leave the station building proper. There was the collateral advantage that the exit of the transformers took with it a further amount of switchgear.

The whole matter of "going the limit" and putting the generators out of doors is really one of climatic conditions. There are cases in tropical and subtropical climates where, save for a roof to shed the sometimes heavy rains, a building in the ordinary sense seems superfluous. In our Northern climate protection for the station staff, if not for the apparatus, is essential. In hydro-electric plants the wheels, like the penstocks, have not infrequently been placed in the open and driving shafts brought within the station for the comfort of the attendants. From an operative standpoint almost any class of equipment can be made sufficiently weatherproof to permit its successful operation out of doors, but does it pay? Generally speaking, it is doubtful, as regards the mass of the generating apparatus and auxiliaries. That it pays for transformers and their accessories is due chiefly to the fact that the ac-

cessories have gradually taken up more and more room and involved more and more cost to a point where one almost can say that the tail is wagging the dog, the switchboard swamping the rest of the equipment so far as the balance sheet is concerned.

If the engineer rigorously holds down costs in the matter of mere structure, he is very likely to gain enough in convenience and cost of the general station equipment to be worth the while. If he feels it necessary to employ switching apparatus that must be installed in a bombproof structure, it does not make much difference whether that structure is under a roof or not. If the transformer leads can be properly protected by roofing in or otherwise, there is certainly gain in keeping high-tension equipment where plenty of air, one of the best and cheapest insulators, is available. The main ends to be sought are simplicity and reliability, and it is well to remember that these may be sacrificed out of doors to just as ill effect as under a roof.

## Theory Now Needed in Practice

THE so-called practical engineer has done a splendid job in this country. He was the rough-and-ready type who could adapt the new discoveries in the electrical art to utilitarian purposes in order to meet the demands of a young, vast and rapidly developing nation. His scale of achievement cannot be matched elsewhere. It has placed America in the front rank as regards the number and extent of electrical installations.

During this era of strenuous pioneering the practical engineer was prone to ridicule the theoretical engineer —also so-called. The theoretical engineer of that period was typified by the foreign technician whose problems were associated with minor and small-scale developments in old and well-developed localities. The practical engineer had no scholarly leisure to delve into the unknown, no incentive to achieve perfection and no necessity for checking up carefully the economical and technical performance of his equipment. It was natural for him to label theoretical treaties "pipe dreams" and to adopt the motto "Practice makes perfect."

Today conditions have changed. No longer is there the imperative demand for engineering exploitation of virgin territory or readily available natural resources. Today's problems are connected with the economical operation, consolidation and remodeling of existing systems and with the demand for technical accuracy in the selection and operation of engineering equipment and installations. Now the theoretical engineer is called into commercial practice, and the operating and practical engineer of the old school often finds himself handicapped. In electrical engineering as in no other branch theory has reached a plane far above operating practice, and there is an imperative call for the closer coordination of theory and practice through the education of the operating personnel, which, of course, includes many high-grade practical engineers.

Few operating engineers remember much more than the rudimentary mathematics and electrical theory they learned at college, yet the efficient performance of their work necessitates the use of hyperbolic functions in transmission, Kirchoff's laws in distribution, the dielectric circuit in cable practice and fundamental theory in dealing with transients and protective equipment. Exponential functions and calculus are necessary tools for the solving of practical problems. Indeed, calculus is considered elementary mathematics today by the theoretical specialists, if their literary productions be accepted as criteria.

In order for the operating engineer to select, operate and install economical and properly rated lines and cables, breakers and switches, motors, arresters, relays and meters, he must either increase his theoretical proficiency or be at the mercy of a small group of theoretical engineers in the ranks of electrical manufacturers and consulting engineering firms. "Cut and try" and guesswork are alike out of date in the economical operations of today, and the practice of copying other installations is no longer to be commended in highly refined, extensive and complicated engineering activities.

To wed electrical theory and electrical practice is a real job, and much work must be done before it is accomplished. Professional engineering societies serve, among other things, as clearing houses for the production of certain specialized theoretical papers which can be understood by a very limited number of specialists and by still fewer operating engineers. These papers must be interpreted, and the specialists must be drafted into the educational scheme to educate all engineers in the theory of their art. The schools can do good work by furnishing extension courses, textbook material, lecture courses and other helpful facilities. The technical press is an active agency in interpreting and in carrying out the educational program. The whole industry should change its attitude toward the value of theoretical training and take active steps to bring theory and practice nearer together.

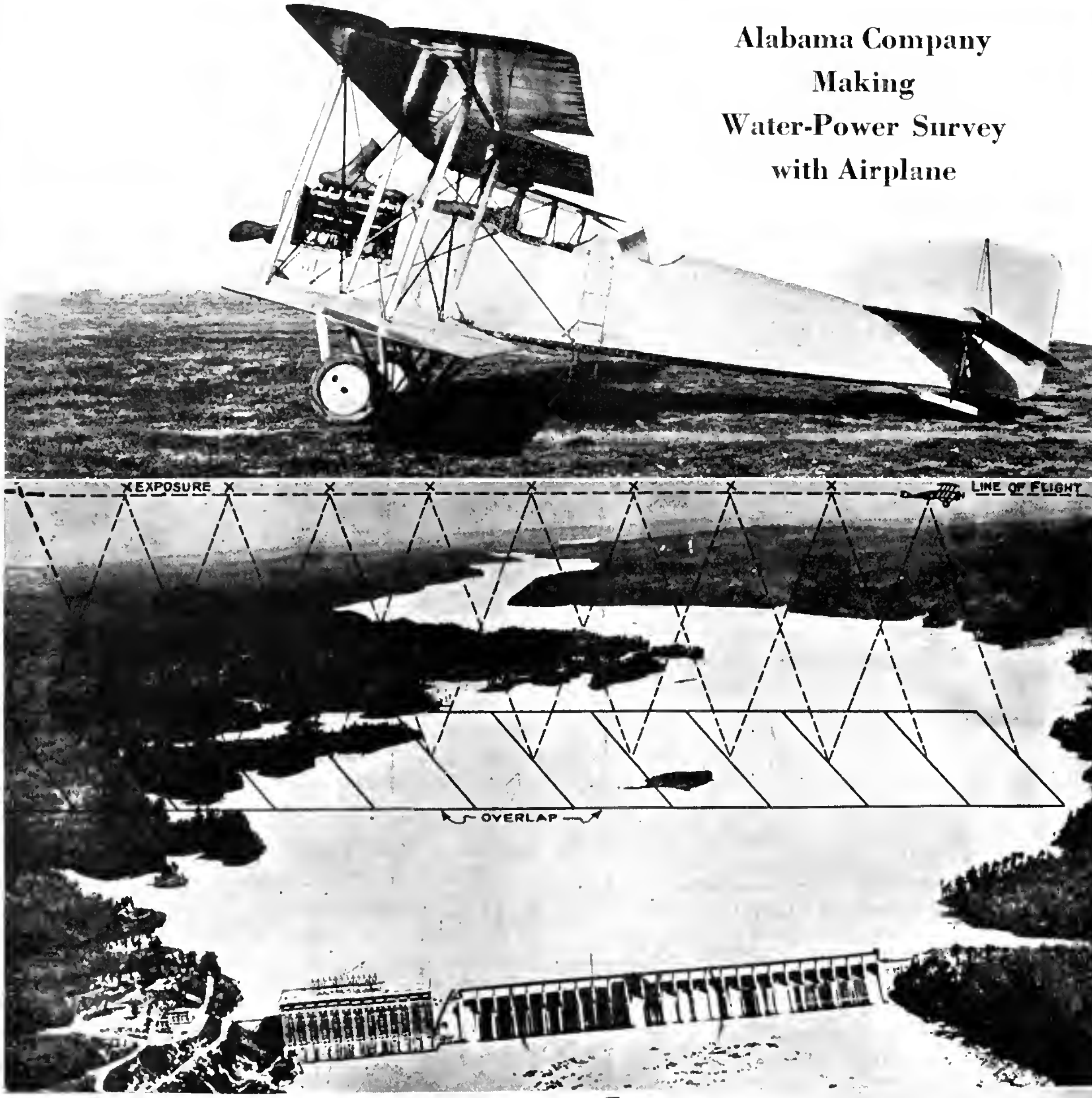
## Too Great Haste Makes Waste

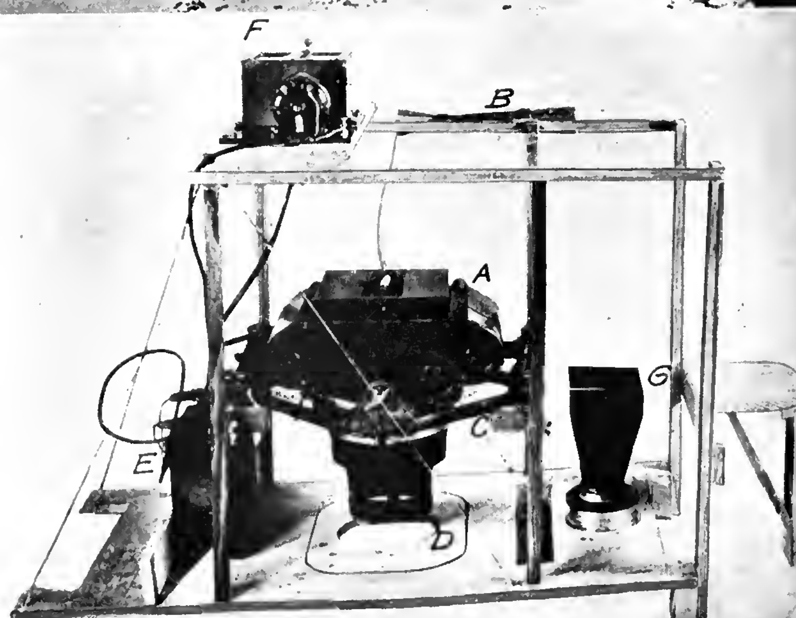
MAKING estimates on a "wanted day before yesterday basis" because some executive feels that he cannot take the time to make a thorough investigation, or does not know that it takes time, is the nightmare that many an engineer experiences daily. Generally the individual who is responsible for unreasonable demands is a man with a financial viewpoint only, or of the type known as a "go-getter."

It is refreshing to hear a banker take this sort of thing to task as did H. D. Thrall, vice-president of the Minnesota Loan & Trust Company, recently in an address before the Engineers' Club in Minneapolis. Mr. Thrall seriously questions whether we are not sacrificing more to speed than is really necessary. He points to the habit engendered during the war of doing things regardless of cost and without proper attention to preliminary detail, because human life and the fate of military movements depended on getting such things done, as one to be broken and a return to sane planning and building encouraged.

Incompetent engineers have produced many a bad plant such as Mr. Thrall mentions in his talk, but many more mistakes have been made because some one in authority forgot that raising the money to carry out a project still leaves the physical project as far from completion as ever. Accuracy and vision can be expected in engineering work only when the engineer, in addition to being competent, has time accorded him to make a thorough investigation. "Wanted day before yesterday" and "I want what I want when I want it" are executive attitudes that cause far more serious errors than engineering incompetency.

# Alabama Company Making Water-Power Survey with Airplane




By CONDUCTING an airplane photographic survey instead of the ordinary land survey, the Alabama Power Company expects to make a thorough study of the relative merits of water-power development on the Tallapoosa River in about sixty to seventy-five actual hours of flying, and besides save about 50 per cent of ordinary cost of surveying. The company estimates that it would take a land survey force at least eighteen months to do the same work if that force were no larger than the one which is to be employed for the air survey.

The plane which will be used is of the Breguet bombing type capable of carrying five passengers, a pilot and 600 lb. of equipment at a maximum speed of 135 miles per hour. An Eastman "K1" camera with a single-focus lens of 10 in. will be mounted over an aperture in the cockpit of the airplane and will contain a roll of film 75 ft. long, sufficient for 100 exposures.

# Some Economic Phases of Engineering—II

### Methods of Procedure When Cost, Efficiency, Load or Other Curves Must Be Analyzed for Economic Study of Engineering Design—Specific Handling of Turbine Water-Rate Curves Used for Illustration

By GEORGE F. MARSTELLER

*Electrical Engineering Department, Utica Gas & Electric Company*

SOME economic phases of the engineering study necessary prior to the replacement of a turbo-generator were discussed in a previous issue, a general method being described. Since special analysis is sometimes required, it seems advisable to look further into this particular type of problem. In the previous illustration a practically constant load was tacitly assumed; that is to say, for $8{,}760T_L$ hours per year, there was a constant load of 7,500 kw., differing from this value, more or less, for a total time which is such a small percentage of $T_L$ that these deviations from 7,500 kw. can be neglected. Though such a condition is true of much power-consuming apparatus or equipment, it rarely represents the state of affairs of a power-producing device, as a turbo-generator, for example.

For studying the relative economic advantages of increased efficiencies in the particular case of a turbo-generator, reliable or guaranteed water-rate curves must be insisted upon. At the present stage of development the writer is not aware of any manufacturer that either can or will guarantee the steam consumption of a turbine per kilowatt-hour to a degree of accuracy including the second decimal point, under all conditions of vacuum, pressure and superheat. Owing to unavoidable factors such as deposits or wear on bladings, changes in clearances, etc., a water-rate curve is not absolutely constant in shape or position. However, by obtaining reliable curves for the most favorable and most unfavorable working conditions as to pressure, vacuum, superheat, etc., a trustworthy comparison could still be carried out.

Since we are dealing here with relative rather than absolute thermodynamic efficiencies, the factors which cause instability from external and internal sources are inherent in all types, and unless the design represents a radical departure in principle or construction, these inherent factors most probably affect to the same relative degree the machines being compared and therefore annul each other for the purpose of economic comparison. Where this is known not to be the case, allowance for additional contingencies must be made. Fig. 1 represents the guaranteed water-rate curve obtained by test of a modern compound turbo-generator of 60 000 kw. capacity, taken at 28½ in. vacuum referred to a 30-in. barometer.*

Speculating upon these conditions as being fixed, it is evident from the curve that a gain of only 1 per cent in efficiency at a full load of 50,000 kw., with an annual running time of say 5,000 hours and an evaporation of 8 lb. of water per pound of coal, the latter costing $3 per ton, would result in a yearly saving of:

$$Sa = 50{,}000 \times (10.93/8) \times 3 \times R_M = \$5{,}117,$$

where 10.93 is taken from water-rate curve. (Here $R_M = 0.02497$ corresponds to $T_2 = 5{,}000/8{,}760 = 57$ per cent, $E = 1$ per cent. (See Fig. 1, ELECTRICAL WORLD, January 27, page 217). That is, under the conditions assumed, a reduction in pounds of steam per kilowatt-hour from 10.930 to 10.8207 would net a yearly saving in coal of $5,117, which is an appreciable sum.

However, with a constantly fluctuating load the water-rate curves to be compared may have such a shape that a gain in efficiency at one load might result in no advantage, a very insignificant gain, or even a loss in efficiency, at other loads. Since in the most general case the loads and thus the relative efficiencies will vary at all times, it becomes necessary to examine the sum-total effect throughout the entire range of all points of the load range.

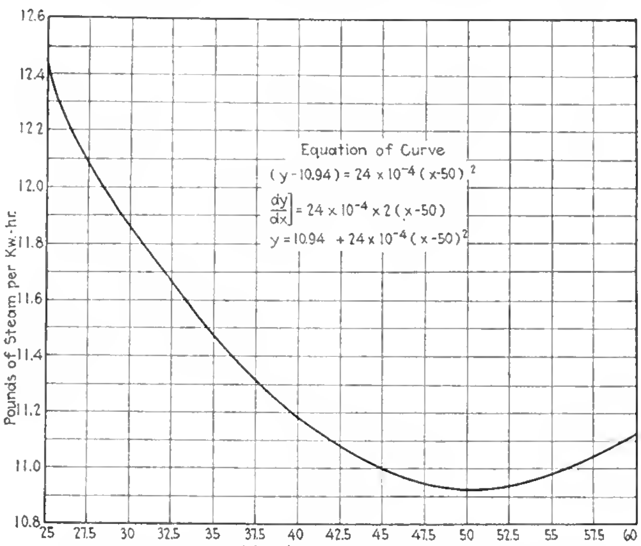



FIG. 1—WATER-RATE CURVE OF MODERN 60,000-KW. CROSS-COMPOUND TURBO-GENERATOR TAKEN AT 28½-IN. VACUUM REFERRED TO A 30-IN. BAROMETER

The curve in Fig. 1 is remarkable for its general characteristics, not only from the point of view of operating performance, but, as examination will show, because it follows very closely a parabolic law of the form $(y - a) = k(x - b)^2$, such that in this case $y = 10.930 + 24 \times 10^{-4}(x - 50)^2$, and therefore the rate of change of pounds of steam per kilowatt-hour, or the stability of steam consumption for the various loads, would be expressed by the differential of the parabolic equations above, which gives a straight line such that the rate of change along the parabola—i.e., the slope of this straight line for any value of $x$—is equal to:

$$dy/dx = 48 \times 10^{-4}(x - 50).$$

Unfortunately, most water-rate curves cannot accurately be expressed by the simple parabolic equation

*Courtesy *Electric Journal*, May, 1921.

above, though in many cases an approximate equation can be had by assuming it to have a general parabolic form with displaced vertex.

Also, for some curves the potential series $P = P_0 + AL + BL^2 + CL^3 + DL^4 + \ldots$ gives satisfactory results, where $A$, $B$, $C$, $D$, etc., are coefficients found by solving the simultaneous equations formed from letting the approximate curve to be determined run through several corresponding points $P$ and $L$ on the actual curve already given by test. Usually an equation of the fourth degree is sufficient for all practical purposes.

In most instances, however, the mathematical advantage of dealing with such curves as exact equations is outweighed by the very laborious processes of obtaining them. This is especially true when simpler, even if somewhat less approximate, methods can be suggested, and the merits of each case to be dealt with become then a matter of judgment and experience.

### Method of Comparison

In the attempt to look into these salient features more explicitly, let Fig. 2 represent some typical daily load curve as applying to $N$ days per year, the remaining days being idle; that is, the time-load factor $T_L = N/365$.

If the typical daily load curve for one part of the year differs radically from another part of the year, an analysis would have to be made for each case individually and their effects studied collectively in order to determine the proper contribution of each toward the total economic effect.

Striking blind averages between extremes often reduces the most laborious study to a piece of scientific guesswork, thus making it useless as a dependable guide. For simplicity, Fig. 2 is assumed to be the typical daily load curve of the only turbo-unit present. However, if the main bus is supplied by several alternators running in parallel, and possibly all of different rating, it would even then in most cases be necessary to obtain individual load curves by metering the kilowatt-hour output of the particular unit under consideration. In some isolated cases, where the load variation is known never to exceed definite limits, the governors of all but one machine are held fixed, thus compelling the fluctuations in load to be taken up by this single unit. Where this is not the case, we are justified in considering the division of the total power-component load as proportional to the several units only, provided that the necessary operating conditions as to governor adjustment, etc., are maintained.

Examination of the load curve of Fig. 2 gives a total area below the curve which corresponds to a daily output of 53,570 kw.-hr., and the mean daily load is therefore 53,570 ÷ 24 = 2,232.7, thus resulting in a "daily load factor" of 2,232.7 ÷ 3,360 = 66.3 per cent. Suppose that there was a temporary peak load of 740 kw. superimposed upon the present 3,360 kw. and lasting twelve minutes. It would not affect the average load much, since it would contribute at the most probably only an additional 150 kw.-hr., increasing the mean load from 2,232.17 to 2,238.5 and giving a new "load factor" of 2,238.5 ÷ 4,100 = 54.5 per cent. To evade this conventional but vague, and for many purposes utterly useless, definition of load factor, and in order to gain a more comprehensive insight into the distribution of all loads with respect to the total time we may resort to a replot of Fig. 2 and proceed as follows:

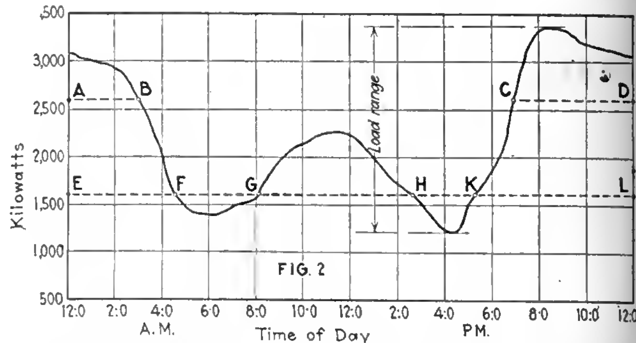



FIG. 2—ASSUMED TYPICAL DAILY LOAD CURVE FOR ANALYSIS

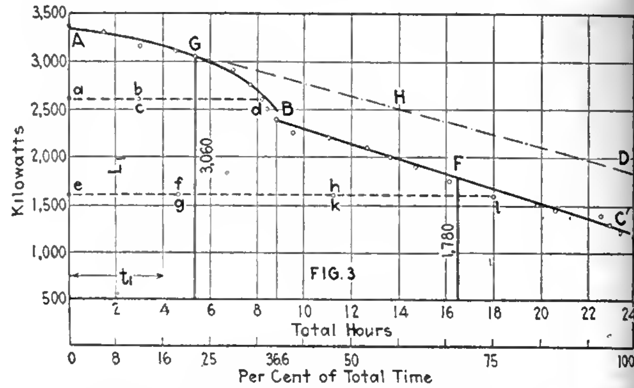



FIG. 3—LOAD CURVE OF FIG. 2 REDUCED TO FORM THAT SHOWS THE SHARE EACH LOAD CONTRIBUTES TO THE TOTAL KILOWATT-HOURS GENERATED FOR THE DAY

Consider the lines *a-d* at 2,600 kw. and *e-l* at 1,600 kw. The former intersects the load from *a-b* and *c-d*; the latter from *e-f*, *g-h*, *k-l*. If we now add the length *a-b* to *c-d*, we obtain a new line *a-b-c-d* in Fig. 3, laid off at the identical load of 2,600 kw. and terminating in *d*, which is one point on the new curve. In like manner *e-f*, *g-h* and *k-l* are laid off at their respective load of 1,600 kw., and a new line *e-l*—being the sum of the three lengths just mentioned, terminating in *l*, is obtained. Connecting the required number of all such points as *d* and *l*, taken for the entire load range of the curve to be replotted, we obtain a new and irregular curve. The area of this latter curve, if an infinite number of points were taken, would represent exactly the same number of kilowatt-hours as the original.

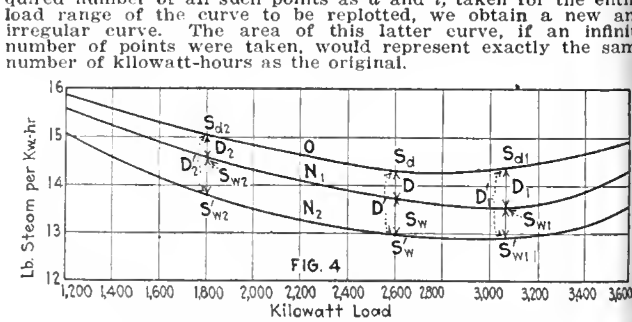



FIG. 4—ARBITRARILY ASSUMED WATER-RATE CURVES TO ILLUSTRATE METHOD OF COMPARISON

Starting with the greatest peak, we draw a series of lines parallel to the abscissa. The spacing of these lines depends upon whether or not critical points or abrupt changes are encountered or whether they pass through sections of the curve where the variations are slow and the slopes more gradual. Out of some twenty lines used in this manner only two are shown in Fig. 2. However, an exceedingly close approximation is obtained by selecting a number of well-chosen points and connecting these by one or two smooth lines, as shown in Fig. 3.

This new curve does not reflect the variation of load with respect to the clock or time of day, as usual. It rather represents the share which each load is contributing toward the total number of kilowatt-hours generated. Taking the time-intervals for the period of a length on the abscissa, which corresponds to a total of one hour (collectively) during the day, then the average kilowatts during that interval will be the num-

ber of kilowatt-hours contributed by that load. For example (see Fig. 3), a load of 3,348 kw. contributes 3,348 kw.-hr.—a load of 2,095 kw. contributes 2,095 kw.-hr., etc.—each one for a period of time whose total is one hour, taken collectively, during the period of one day, or twenty-four hours. The smaller the interval we choose, the more nearly does the average kilowatts for that interval approach the *actual* load and hence the actual kilowatt-hours contributed by that load.

Incidentally, a replot such as that shown in Fig. 3 is often a convenient means of expressing very irregular curves or graphs by a single equation, permitting their treatment algebraically. However, when even this replot cannot be very closely averaged by means of a single smooth line or curve, two separate equations will serve just as well, provided that the applicable limits of each are kept in mind. For example, Fig. 3 happens to be such a case. The curve from $A$ to $B$ proves to follow very closely a parabolic law with displaced vertex, thus: $(a - x) = k(y - b)^2$, where $a = 36$ (per cent), $b = 2{,}300$. From this $k = 11/36 \times 10^4$, and hence:

$$y = \frac{600}{\sqrt{11}} \sqrt{(36 - x)} + 2{,}300.$$

Similarly the straight line $B - C'$ is expressible by $y = a - R \times \tan^{-1}\theta x = 3.075 - 18.84x$, where $a =$ intercept with the $y$ axis, $R =$ scale ratio between $y$ and $x$ axes, and $\tan^{-1}\theta =$ slope of line $B - C'$.

To get the average ordinate for the curve $A - B$, its equation may be integrated by the use of the calculus, or since in this case it happens to be a parabola, more directly from the simple fact that the area within a parabolic arc is two-thirds times the area of the circumscribed rectangle. Therefore, we have at once (see Fig. 3): Average ordinate $= 2/3 \times 8.8(3{,}340 - 2{,}500) \div 8.8 = 560$, thus making the total average ordinate $(2{,}500 + 560) = 3{,}060$, as shown. The midway, or average, ordinate for the straight line being evidently 1,780, we have thereby divided our entire daily load curve into two characteristic parts which are representative of actual conditions. One part contributing: 3,060 kw. $\times$ 8.8 hours = 27,104 kw.-hr.; the other part furnishing: 1,780 kw. $\times$ 15.2 hours = 27,056 kw.-hr., giving a total of 54,160 kw.-hr., which compares very favorably with the actual kilowatt-hour output of 53,570. It contains an error of only about 1 per cent.

To avoid the possibility of misunderstanding to the casual reader it may be said that the fact that these two mean loads, taken over unequal intervals of time, contribute almost identical kilowatt-hours, is a mere coincidence.

### FORMULAS FOR GENERAL PURPOSES

Before proceeding to apply the two mean loads of 3,060 kw. and 1,780 kw. above to the water-rate curves of Fig. 4 we may summarize the algebraic relations more generally in order to make them applicable to all cases—not only water-rate curves. Fig. 4 shows a number of purely arbitrary water-rate curves, merely used to illustrate the methods under discussion. Let curve $O$ be the water-rate curve of the old machine and $N_1$, $N_2$ be those of the new machines to be compared. The more unevenly and irregularly these curves are and run with each other within the load range, evidently the more time intervals must be taken on the replot (Fig. 3) in order to apply more closely the particular differences between the curves of Fig. 4 to that corresponding load. We must keep in mind that the abscissa of Fig. 4 corresponds to the ordinate of Fig. 3, and that obviously the particular differences between the water-rate curves, a few of which are indicated by $D_1$, $D_2$, $D'_1$, $D'_2$, etc., are a measure of the gain in comparative efficiencies.

Let:

$N$ = number of days of twenty-four (or $m$) hours each during which the machine is running.

$P$ = number of pounds of steam per pound of coal.

$L_1, L_2, L_3 \ldots . L_n$ = mean loads during the time intervals $t_1, t_2, t_3 \ldots . t_n$

$t_1 + t_2 + t_3 + \ldots . + t_n = 24$ (or $m$) hours (from Fig. 3).

$S_{d_1}, S_{d_2}, S_{d_3} \ldots S_{dn}$ = old steam consumption in pounds per kilowatt-hour at such mean loads as $L_1, L_2, L_3 \ldots . L_n$.

$S_{w_1}, S_{w_2}, S_{w_3} \ldots . S_{wn}$ = new steam consumption in pounds per kilowatt-hour for one prospective machine at such mean loads as $L_1, L_2, L_3, \ldots L_n$.

$D_1 = (S_{d_1} - S_{w_1}),\ D_2 = (S_{d_2} - S_{w_2})$, etc.

$\frac{C}{2{,}000} = C'$ = cost per pound of coal.

$O_d, O_w$ = yearly operating cost in coal of old and new machine to be compared.

$I_n$ = total yearly interest charges.

$M_d, M_w$ = investment on old and new machine respectively.

$V$ = greatest permissible investment in new machine over old one.

Therefore, for the old machine we have:

$$O_d = \frac{NC'}{P} \times (t_1L_1S_{d_1} + t_2L_2S_{d_2} + \ldots . + t_nL_nS_{dn}) \quad (1)$$

Similarly:

$$O_w = \frac{NC'}{P} (t_1L_1S_{w_1} + t_2L_2S_{w_2} + \ldots . + t_nL_nS_{wn}) \quad (2)$$

Thence:

$$O_d - O_w = \frac{NC'}{P} [t_1L_1(S_{d_1} - S_{w_1}) + t_2L_2(S_{d_2} - S_{w_2}) + \ldots . + t_nL_n(S_{dn} - S_{wn})] \quad (3)$$

$$= \frac{NC'}{P} [t_1L_1D_1 + t_2L_2D_2 + \ldots . + t_nL_nD_n]. \quad (4)$$

In some special cases it is more advantageous to express $t_1$, $t_2$, $t_3$, etc., in per cent, if the gain in efficiency is also expressed in per cent, so that $E = 1 - (S_d/S_w) = (1 - k')$, and $R'_M = T_2E$, which can be read off a suitable diagram such as Fig. 1, ELECTRICAL WORLD, January 27, page 217. Then equation (4) becomes:

$$O_d - O_w = \frac{mNC'}{P} [L_1S_{d_1}R'_{M_1} + L_2S_{d_2}R'_{M_2} + \ldots + L_nS_{dn}R'_{Mn}] \quad (5)$$

By making $t_1 = t_2 = t_3 = \ldots . = t_n$, where $t_1 + t_2 + t_3 + \ldots t_n = m$ hours, and $n$ is the total number of equal time intervals on the replot of the load curve (as Fig. 3), then $t_1 = t_2 = t_3 = \ldots = t_n = m/n$, (6)

and equation (4) can be written:

$$O_d - O_w = \frac{NC'm}{Pn} \times (L_1D_1 + L_2D_2 + L_3D_3 + \ldots L_nD_n), \quad (7)$$

and if, for example the value of $P$ (the pounds steam per pound of coal) is also a known variable for certain conditions, as obtained from a boiler load curve, then equation (7) becomes:

$$O_d - O_w = \frac{mNC'}{n} \times \left( \frac{L_1 D_1}{P_1} + \frac{L_2 D_2}{P_2} + \frac{L_3 D_3}{P_3} + \ldots + \frac{L_n D_n}{P_n} \right) \qquad (8)$$

If in any unusual case the comparative curves (in Fig. 4) should overlap, then the respective term or terms, including this interval of overlap in any of the equations above, would be preceded by a sign opposite from that which precedes them here.

## Numerical Evaluations

In order to make this method more readily usable a few numerical solutions will be evaluated from the expressions developed above. Assume $P = 8$, $C' = 3.2/2{,}000$ and $N = 300$; then, using equation (3), the two mean-load values over the two unequal time intervals as previously derived from Fig. 3, and by aid of Fig. 4, we have:

$$O_d - O_w = \frac{300 \times 3.2}{8 \times 2{,}000} \left[ 8.8 \times 3{,}060\,(14.40 - 13.55) + 15.2 \times 1{,}780\,(15.05 - 14.60) \right]$$

$$= \frac{9.6}{160}\,(22{,}888.8 + 12{,}175.2) = \$2{,}103.84.$$

If we now take six equal time intervals, we are justified in assuming by inspection that each interval in both Figs. 3 and 4 is small enough to insure that each part of the curves covered by each interval will in no way seriously depart from a straight line. Therefore, the midway ordinate of each interval very closely approaches the actual average for that interval, and by using this method in connection with the replot we can obviate the necessity to determine either the areas or the equations of any curve. From equation (6), $m/n = 24/6 = 4$ (number of hours covered by each interval). The values for $L$ and $D$ are read from Figs. 3 and 4, and the various results as required from equation (7) may be conveniently arranged as shown in the accompanying table.

METHOD OF TABULATING CALCULATIONS AND DIFFERENCE IN RESULTS DUE TO SELECTION OF EQUAL TIME INTERVALS

| $m/n$-Hour Intervals | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|
| Corresponding: $L$ | 3,265 | 2,985 | 2,300 | 1,980 | 1,680 | 1,375 |
| Corresponding: $S_d$ | 14.50 | 14.33 | 14.52 | 14.84 | 15.20 | 15.60 |
| Corresponding: $S_n$ | 13.67 | 13.53 | 13.98 | 14.32 | 14.74 | 15.27 |
| $S_d$-$S_w - D$ | 0.83 | 0.80 | 0.54 | 0.52 | 0.46 | 0.33 |
| $LD$ | 2,710.0 | 2,388 | 1,242 | 1,029.6 | 772.8 | 453.75 |

Then $\sum L = 13{,}585,$

also $\sum LD = 8{,}596.1;$

hence, $m/n \times \sum L = 54{,}340$ kw.-hr., which compares well with 53,570 kw.-hr. from original load-curve, and

$$\frac{mNC'}{nP} \times \sum LD = \frac{24 \times 300 \times 3.2}{6 \times 8 \times 2{,}000} \times 8{,}596.1 = \$2{,}063.06.$$

showing a difference as compared with the previous solution of:

$$(2{,}103.84 - 2{,}063.06) = \$40.78.$$

Therefore:

$$V = M_d - M_w = 2{,}063.06/I_n, \text{ etc.}$$

(See Electrical World, Jan. 27, 1923, page 217.)

If we had used twelve equal time intervals with their corresponding twelve-mean $L$ and $D$, our result would have been 2,072.52 instead of 2,063.06—an error of less than one-half of 1 per cent, thus showing no corresponding gain in taking too many time intervals.

If the load on a machine, equipment or system, as reflected by its typical daily (or yearly) load curve, is known to increase gradually during a predicted or predetermined period of years (i.e., if, for example, the load curve assumes a shape and location as represented by *A-G-H-D* in Fig. 3), another condition arises which must be taken into account. Evidently it would be unfair to base our calculations on the initial or on the final state of affairs. The basis must be somewhere between and such that the exact location is determined by the weight average of characteristic portions of the present and probable load curve.

Assume, then, for illustration that one typical portion of the loads (higher values, lower or both) have

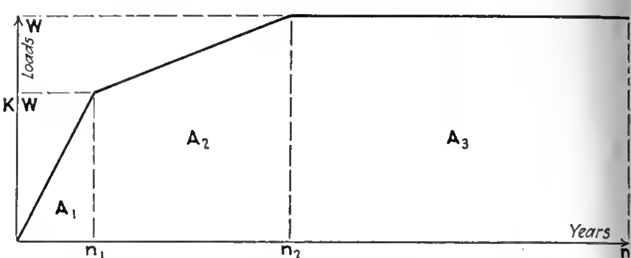



FIG. 5—METHOD OF CONSIDERING RATE OF LOAD GROWTH. THIS METHOD AVOIDS TREATING ONLY THE INITIAL AND FINAL LOAD CONDITIONS

a probable rate of growth determined by the diagram of Fig. 5.

Here, $W$ = maximum rating of the machine; $KW$ = fractional part of $W$; $n_1$, $n_2$, $n_3$ = corresponding of years; $A_1$, $A_2$, $A_3$ = corresponding areas of $n_1$, $n_2$, $n_3$ where $n_3$ is the end of useful life, owing to obsolescence, inadequacy, etc.

$$A_1 = KWn_1/2;\; A_2 = KW(n_2 - n_1) + W/2(1 - K)(n_2 - n_1)$$

$$A_3 = W(n_3 - n_2)$$

therefore the total area $A_T = A_1 + A_2 + A_3$ divided by the total number of years or $n_3$ gives the average load $W_g$ upon which to base our calculations, and this reduces to:

$$W_g = A_T/n_3 = W + W/2n_3[(K-1)n_2 - n_1]$$

From what has been indicated previously, a similar comparison could be carried out between the curves $C$ and $N_2$ or $N_2$ and $N_1$ of Fig. 4. In general, any number of curves of any shape can be examined simultaneously—curves, for instance, representing cost of coal with the number of years, fluctuations in wages, water rates, boiler efficiencies, load-variations; etc.

## Two Types of Magnetic Testing

The routine magnetic testing of the Bureau of Standards has been placed on a new basis which provides for two classes of tests. Class A will be restricted to specimens which are sufficiently uniform in dimension and magnetic properties along their length to justify the employment of test methods of the highest accuracy intended for use as standards for the calibration of testing apparatus and for other uses where high precision is necessary. Class B tests will be made in general in cases where the material is not sufficiently uniform to justify the use of precision methods or where the highest accuracy is not necessary. Circular 85 describes the tests in more detail and contains a schedule of prices.

# Effect of Coal Supply on Public Utilities*

## Essential Character of the Business Necessitates Constant and Adequate Supply of Suitable Coal, as Well as Ample Storage, to Insure Against Interruptions of Service—How Public Utilities Conserve the Nation's Coal Resources

By JOHN W. LIEB

*Vice-president New York Edison Company and Chairman of Joint Fuel Committee of Three National Utilities Associations*

THE development of the public utilities to their present size and importance where they serve practically the entire population of the United States has occurred largely in the last forty or fifty years. At present nearly one-third of our industries are supplied with power by central electric power stations. The total number of consumers for lighting and power exceeded ten million in 1922. Gas was supplied in 1921 to more than nine million consumers. The street railways in 1922 carried more than fifteen billion passengers. Here are a few significant public utility statistics: The total capital invested in 1922 (including gas companies) exceeded $15,000,000,000; the total kilowatt capacity of dynamos in central electric stations and electric railway stations exceeded 15,000,000 kw.; the outputs of these stations was 46,000,000,000 kw.-hr., and the number of employees was estimated at 525,000.

The magnitude of the public utilities may be realized by comparing their $15,000,000,000 of capitalization with the valuation of all of the class 1 railroads of the United States, estimated at approximately $20,000,000,000.

The essential importance of the utilities to the public welfare is also indicated by the importance and variety of useful service they render. Electric and gas lights are essential to the policing of our great cities. Fire protection, water supply, telegraph and telephone service and vertical transportation are all largely dependent for their operation on central-station service.

Domestic lighting, heating, cooking and many other household functions are dependent in our cities upon the utilities, as in like manner are urban and interurban transportation, shops, factories of all kinds, the manufacture of artificial ice, and so forth. The industrial uses to which electricity is now put are legion.

The utilities through their economical operation and low cost of energy are making possible the supply of greater and greater amounts of power for industrial workers, and, paralleling this increase, workmen are able to produce a greater value per worker through increased output.

A comparison, through a reasonably stable period, of the average horsepower available per workman and his increased productiveness shows that in 1899 the horsepower per worker was 2.12 as against 3.10 in 1914, while in the former year the annual value added to products per wage worker was $1,025, as against $1,404 in the latter. Though the output per workman is undoubtedly influenced by many factors, this increase in the application of mechanical power as a substitute for manual labor is undoubtedly a cause of the rapidly increasing wealth of the country and the emancipation of workers from drudgery and heavy labor. Largely through supply of adequate power deftly applied by American genius will this country in the coming years be able to hold her leading place in the markets of the world and still maintain for its workers the high plane of American living conditions.

The United States has outstripped the world in the total consumption of electrical energy, using about half of all the power produced and far exceeding her principal competitors. The kilowatts consumed per capita in the United States amount to 472, as compared with 163 in the United Kingdom and Ireland, 147 in France, 141 in Germany and 85 in Italy. Three small countries, Switzerland, Canada and Norway, which have large available water powers exceed the United States in the per capita consumption of electrical energy and have in that regard a material economic advantage.

### Utilities Must Have Constant Fuel Supply

The services of the utilities have become so essential to our industrial and civic life that should the electric and gas plants of a great city fail to function an inconceivable catastrophe would result. The public requires that the utilities maintain the continuity of service as a necessity to its health, safety and comfort, and it demands that the utilities keep in constant readiness the equipment and facilities to carry whatever load may be forced upon them, no matter how high or unexpected the demand or how adverse the circumstances. In order to do this it is evident that there must be available at all times adequate quantities of suitable fuel. During the past few years adequate supplies of coal of this character have not at all times been available. The public utility must function, and coal is the raw material upon which its service usually depends. For the public good it should, therefore, be placed beyond any danger of failure to obtain adequate quantities of proper fuel.

### The Coal Industry

During the past few years the gas and electric utilities have had great difficulty in obtaining coal of the proper quality and in the amounts needed. The supply was unreliable, the principal causes being strikes, car shortages and failures of transportation, due to congestion of equipment, resulting embargoes, etc. Yet the production of bituminous coal has not varied greatly during the last ten or twelve years. In 1910 the mines produced 416,000,000 net tons; in 1918 580,000,000 net

*Abstract of an address delivered before New York Electrical League, Feb. 28, 1923.

tons and in 1920 569,000,000 net tons. The increase from 1910 to 1920 was therefore 37 per cent.

The estimated percentage of distribution of bituminous coal mined is as follows: Industrial uses, 31.6; railroads, 27.7; electric power utilities, 5.7; domestic, export, coke and gas making, bunkering, etc., 35. The electric utilities used in 1922 34,000,000 tons of anthracite and bituminous coal.

Isolated power plants consume about two-thirds of the 31.6 per cent consumed for all industrial uses, or about 20 per cent of the total coal mined. A comparison of this consumption with that of the utilities, amounting to only 5.7 per cent of the total, indicates the high fuel economy of the utilities when the relative outputs of electrical energy are compared. These data were collected in an exhaustive study covering a number of states and the results demonstrated that the electrical utilities generated annually more energy than the aggregate produced by isolated industrial plants.

Up to the time of the war the coal business was reasonably constant, and it was not involved in serious straits until the end of 1917. In 1918 our activities in the war caused an excessive demand for coal and made a high peak which could not be fully cared for by our railroads. In 1919 conditions were fair until the advent of the miners' strike on Nov. 1, when production decreased to a low figure for about six weeks. Early in 1920 a heavy demand followed the coal strike, while on April 1, before conditions had become stable, the railroad switchmen's strike occurred. In 1921 the demand was not heavy and supply was reasonably uniform.

In 1922 coal was plentiful in quantity and reasonable in price, considering freight rates, until the great strike occurred on April 1, to be followed by the widespread strike of railway men somewhat later. Though the situation in 1922 was more serious and dangerous than that of 1919-20, it was better handled and the utilities suffered less, though the conditions last year and during the previous coal stringencies were still such as to call for the most earnest consideration.

As is well known, these great disturbances in the coal industry have caused prices to fluctuate enormously. We have not yet recovered from the results of the last disturbance and are still paying abnormally high prices, as has been the case since early in the summer of 1922.

### THE CAR SUPPLY

The opening up of an excessive number of new mines had its reflection on the railroad situation, making it necessary for the railroads to divide their available cars among 2,900 more mines in 1918 and 6,800 more mines in 1920 than would have been necessary had the average production per mine in these years been maintained on the 1910 basis.

Gathering the increased tonnage from a largely increased number of mines calls for vastly increased motive power, coal-car supply and man power from the railroad to serve them all. The number of cars called for, based on the rated ability of the mines to produce coal, kept pace with the increased number of mines until for the year 1920 cars were ordered in sufficient number to load more than 830,000,000 tons—56 per cent more than the total consumption of the country. In the latter part of 1922 cars were called for at the rate of twice the annual consumption of the country.

Under the conditions described, which have existed since 1917, the utilities, as has been said, have experienced great difficulties in obtaining the required amounts of coal of the right character at prices which they could afford to pay under the prevailing rate schedules, framed when coal and labor costs were much lower.

### UTILITY FUEL DIFFICULTIES

The utilities are in a sense agents of the public and must not only provide continuous service, but they hold a distinct responsibility to maintain that service at most economical rates. They are, however, peculiarly vulnerable to the injuries which result from coal crises—first, because they are strictly controlled by the regulatory authorities as to the rates they may receive for their products, and, second, because coal constitutes the absolutely essential and most costly raw material necessary in their processes of manufacture.

Quite uniformly over the United States, public utilities are regulated by public service commissions set up by the several states. They are, therefore, except in a few instances, unable readily to adjust their charges to the cost of coal and thus are at a disadvantage when competing for coal with industrial consumers.

From 20 to 30 per cent of the revenue received for products or service of the utilities is spent for fuel. By the practice of strict economy in every direction the public utilities, both gas and electric, were able to weather the period of excessively high costs during the war. Immediately following the war, however, a number of utilities found it necessary to appeal to the public, through the public service commissions, for increases in rates. In some cases these increases were allowed as applicable to the schedules themselves; in many others the exigency was met by the introduction of a so-called coal adjustment clause or coal charge.

Under the so-called coal clause plan the companies were permitted to add to their base rates, which had been established under low costs of coal, a supplementary charge based on the actual demonstrated increase of cost of coal alone, the companies themselves absorbing the similar large increases in labor, supplies and other items of expense.

These coal clauses became effective generally through the companies filing with the state public service commissions each month a statement as to their actual increases in coal costs, and on the basis of these increases approval was given for the application of the surcharge during the succeeding month. In this way a sliding scale was introduced under which the movement of the coal prices upward and downward became immediately applicable as an element in the rates.

The situation became so serious during or after the strike periods following the war, owing to shortage of production, railroad congestion, etc., that the three national public utility associations were compelled to designate special committees to aid in obtaining coal and to assist in untangling transportation difficulties. During the early summer and fall the joint fuel committee representing these associations found it necessary to intervene to aid more than two hundred utilities in order to save them from curtailment of service. This service has consisted in advising with and appealing to the government where conditions or policies required change, aiding specific utilities in

danger of shutdown through inability to purchase coal, helping to restrain prices and to guard contracts, preventing confiscation, tracing utterly lost coal shipments, and so forth. To do this it was found necessary to have an office in Washington and to maintain continuous contact with the principal administrative arms of the government, with coal dealers and their associations, with the railroads and their associations and with various other agencies which could be of service.

The experience of the utilities has proved beyond question that coal contracts are, as a rule, of little value in obtaining coal during times of extreme emergency unless protected by priority orders issued and policed under government authority.

One of the serious difficulties has been due to the fact that when there is a shortage of coal or of coal cars the supply the utilities receive on their annual contracts is often prorated proportionately with other consumers, some of whom may be "spot" purchasers.

During the periods of stress coal is usually difficult to obtain. Heat value, ash content, volatile constituent and delivery clauses in contracts are not accepted by operators—they can ordinarily sell their coal at these times without any such clauses—and changes in the attitude of mine workers and railroad conditions have often made it impossible for them to accept reasonable specifications. The result of all this has been that "spot" coal purchased to cover contract shortages resulting from these conditions has been exorbitantly high in price and most unsatisfactory in quality.

Little coal was received on regular contract from the beginning of the strike until August.

### UTILITIES REQUIRE COAL OF RIGHT QUALITY

To the electric utilities the question of quality of coal is a particularly serious one. In large electric power plants the kind of fuel which is usable is dependent in large measure upon the design of boilers, stokers, ash-handling equipment, etc. Utility plants are designed and installed with a view to quality and quantity of fuel, and when the coal is not of the character for which the plant was specifically designed serious difficulties result in the form of deteriorated equipment, reduced outputs or even complete shutdown.

The actual value of the coal for steam-making purpose declines rapidly with large ash content, and thus it is with great difficulty, if at all, that the outputs can be maintained when coal of inferior preparation and quality must be used. The following figures give the results of a test of Illinois coal of varying ash content under a standard boiler:

| Percentage Ash in Dry Coal | Horsepower | Percentage Efficiency |
|---|---|---|
| 9 | 690 | 61 |
| 24 | 615 | 51 |
| 35 | 227 | 30 |

It is important to obtain coal complying with a specific analysis from another point of view—the availability of coal for storage. Some coals, while they may be satisfactory in other respects, are unavailable for storage in considerable piles, as becomes necessary where large quantities are involved, owing to the danger of spontaneous combustion. When we have been compelled to accept unsuitable coals, we have frequently had two or three fires going in our coal piles, necessitating rehandling and restacking of the coal with a serious loss due to coking. Owing to the high temperature attained it is also difficult to transfer such coal into barges, the bottoms often burning through, which results in a complete loss of the coal as well as the barge. Coal which is liable to spontaneous combustion also causes extreme difficulty when deposited in the relay bunkers situated immediately above the boilers in the very center of the power houses where a fire is difficult to get at.

Utilities must be provided with fuel of a reasonably definite quality that they can use efficiently, and they have not been adequately cared for when they have been merely provided with some coal. The experience of the utilities covering several years has demonstrated that much unsatisfactory and grossly inferior, badly prepared coal is shipped during periods of fuel and transportation stringency. This not only reduces plant capacity but absorbs railway equipment unnecessarily.

### SOME PROPOSED REMEDIES

Various remedies have been proposed for stabilizing the coal business, though as yet the United States Coal Commission, after several months of intensive study, has not been convinced that a proper solution has been found.

One important group of those interested advocate in essence that the situation be allowed to work itself out without external government or other interferences under the ordinary laws of competition and of supply and demand.

A second suggestion is that the government itself purchase and operate the mines. This plan, though vigorously and continuously promoted by a group of the more radically inclined, has been almost universally condemned by the public on the ground that government ownership and operation has not proved either efficient or economical, and experience with the railroads under government management has not been such as to encourage further experimentation in that direction.

Finally, plans have been proposed whereby through the extension of the storage of coal by all users, by the seasonal variation of prices of coal and possibly seasonal variation of freight rates, by conservation or economy in the use of coal, and by simplifying its distribution, conditions can be materially improved.

Of the methods for ameliorating fluctuating conditions in the coal industry, the proper use of storage seems to offer exceptional advantage. The public utilities for self-protection early inaugurated the policy of maintaining generous storage of coal at their plants. Indeed, they have been leaders in this regard, and through wise buying and handling of storage have proved to be a helpful stabilizer to the coal industry. The large amounts of coal they put in storage prior to the beginning of the great coal strike on April 1, 1922, were a material element in saving the country from a catastrophe of large dimensions.

The following table of days' supply the utilities and all users had on hand in the country at various dates is significant:

| | 1922 March 1 | 1922 Oct. 1 | 1923, Jan. 1 |
|---|---|---|---|
| Coal-gas plants | 82 | 38 | 60 |
| Electric utilities | 54 | 3 | 33 |
| All users | 43 | 21 | 26 |

Larger storage capacities for all coal users, to be filled at times during the year when transportation facilities are best available, would do much to remedy

the present unsatisfactory fuel conditions. The railroads themselves should, in as great measure as possible, haul and store the coal for their own needs during periods when their facilities are not pressed by peak loads.

Further, the mines can in a certain measure promote storage which would prevent the irregular daily production outputs caused by variations in daily car supply. In many locations a coal pocket holding from one to two days' output may be installed at a moderate expense and so arranged as to discharge directly into the railroad cars with little additional equipment and no additional handling. Such a storage should enable the mine to run continually at least five days per week, and the slight additional cost would be largely overbalanced by improved showing in the overhead per ton of coal produced.

Application of electrical equipment in coal mines, while showing steady progress, has not yet reached the rapid development that was to be expected. Electric haulage was reported as in use in 46 per cent of the coal mines reporting, with 11,265 motors, and 51 per cent of the mines used electric cutting machines, although animal haulage and hand methods of mining still prevail to a surprising extent. Of the 3,054,000 hp. used in the anthracite and bituminous industries, about 1,383,000 hp. represented power produced by prime movers at the mines and 888,000 hp. motors operated by purchased power.

### Power Stations at Mines

It has frequently been suggested that much expense and transportation difficulty could be saved to the electric utilities and steadiness of mine output could be promoted by the location of generating stations at the mine mouth and the transmission of the power so generated to the point of use. This has been done in a number of cases in England, on the Continent of Europe and to some extent in America, and it has been found that wherever adequate water supplies exist for condensing purposes the installation has been successful. This condition, however, does not obtain in the majority of cases. Speaking broadly, it must be remembered that for every ton of coal burned in the power station from 600 to 1,000 tons of water must be provided for condensing purposes.

It is unfortunate that very few rivers of adequate size to provide this flow are available in the coal regions, and it is apparent that the object to be attained by placing the station in the coal region has in most cases been impossible of achievement.

The project of pumping coal through a pipe line has been considered by many engineers, and its feasibility has been shown, at least theoretically. The cost and design of the apparatus are well known, and no engineering difficulties are entailed in its operation. A proportion of 50 per cent by volume between material and water can be maintained. At 10 ft. per second, which is not excessive, a 14-in. pipe will carry more than 7,000,000 tons of coal per year, and this delivery is independent of the length of the pipe.

At the present time it is estimated that the cost of delivering a ton of coal, including fixed charges, from Scranton to the New Jersey side of the Hudson would probably not exceed 50 cents per ton, to which would have to be added the ordinary charges for lighterage and handling in the port of New York. It is also probable that bituminous coal could be pumped from either the Broad-Top or Clearfield region with equal facility, but at an increased cost of say $1.25 per ton, although this increase would be well within the cost of railroad freight. It has been estimated that approximately 18,000,000 tons or 20,000,000 tons of coal pass through New York City every year, which would absorb the capacity of three 14-in. pipes.

An advantage of all stabilization methods is that they will tend to furnish more continuous employment to miners and thus improve the economic and social conditions of the mine workers.

### Coal Conservation-Superpower Systems

America is notorious for her extravagance in the use of coal. Moves made to conserve this vitally important natural resource are wise for the protection of the future of the country and also tend to relieve the strain of heavy coal transportation. The public utilities can be of exceptional service in aiding to accomplish this result.

The government Superpower Survey of the Atlantic Coast from Maine to Washington, the report on which was made in 1921, affords a view of what is possible in this regard. It is estimated that power in this region can be supplied with the use of about 2 lb. of coal per kilowatt-hour, as against nearly three times that amount at present. The savings to be obtained would come largely through the possibility of the erection and efficient use of large, highly economical, suitably located power stations, taking advantage of the diversity factor in the varied industries of the several districts covered, lessening the reservation of spare equipment, making possible the electrification of railroads, and so on.

The building of great power systems, interconnected, as contemplated, by the Superpower Zone would make possible utilization of many water powers which otherwise would stand idle.

The electric and gas utilities offer an exceptionally effective medium for simplifying the transportation and distribution of coal. Though this phase of the coal distribution problem is seldom discussed, it nevertheless is one of great and growing importance.

In the power zone heretofore referred to are to be found more than seventy-six thousand industrial plants which use power. Five or six thousand of these use water power as their prime mover, but the great bulk are operated by power generated from steam. If these seventy thousand minor establishments obtained coal for generating their own power, large fuel shipments would have to be sent to seventy thousand points, requiring the time of locomotive and car equipment, and this would involve a material increase in shifting and switching.

However, as about one-third of the power required by these seventy thousand plants is supplied by central power stations, the amount of this detailed coal distribution and local delivery is materially reduced, as this power is generated from coal delivered at a few conveniently located central stations which have available the best modern coal-handling apparatus and commodious storage facilities. Thus today a very material measure of relief has been afforded the railroads through this centralization of coal delivery. If the transfer of the industrial plants of the country is continued, eventually the great bulk of the industrial power coal will be delivered to a few super-plants of great interconnected superpower systems.

It is evident that the public utilities hold wonderful opportunities for advancing the welfare of the nation through the conservation of coal and oil, simplifying the distribution of fuel, contributing to its conservation by the utilization of water power, and providing a supply of abundant, reliable and cheap power to our industries.

In order that their full value may become available to the nation, great systems covering large areas and supplying great loads will be necessary. To accomplish this purpose the utilities must continually expand, ever developing larger and more extended systems. This development is one of state-wide importance, and such public regulation as is needed should be of a state-wide character. Systems of this kind already include scores and hundreds of municipalities within their transmission areas, but they necessarily must be operated as a unit. It is impossible for them to develop or give good service to the public if they are subject to the harassing interference of all of the municipal or minor political establishments through which they may extend and in which they operate. Nor will such a consummation as the public desires and the companies wish to provide be possible unless state-wide regulation of a broad and equitable character is maintained and the laws and rulings governing the utilities are of a helpful and stable character and such as to attract the large quotas of capital which it is necessary to obtain each year to provide for the rapid extension of the public utilities in order that they may serve the public adequately, efficiently and economically.

# Automatic Start Reduces Surges

## Rotor with Two Windings of Different Resistances on 10-Hp. Induction Motor Brings Static Current Down from 550 to 260 per Cent of Full Load Current—Field of Application

TO KEEP down the excessive static current in induction motors without requiring extra compensating equipment has been one reason for the development of the automatic-start polyphase induction motor. A paper on this subject presented before the American Institute of Electrical Engineers by James L. Hamilton, chief engineer Century Electric Company, St. Louis, discusses this development from both mechanical and electrical standpoints.

The stator of this motor is similar to those of other induction motors, but the motor has two windings—one being a progressively wound, low-resistance winding connected to a short-circuiting device, while the other is a high-resistance squirrel-cage design. The high-resistance winding is usually placed near the surface of the armature, thus giving minimum reactance. It can be proportioned to give high static torque with low static current. The low-resistance winding is usually placed deeper in the armature or beneath the high-resistance winding and as a result would have high reactance at standstill due to primary frequency in the armature. However, near synchronism, the frequency in the armature being low, the low-resistance winding also has low reactance; hence good running conditions result.

The motor starts as an induction motor with only the high-resistance armature winding in circuit, thus permitting low static current and high static torque. After the motor has attained a predetermined speed, the low-resistance winding is short-circuited, thus permitting the motor to run with all the rotor copper in circuit, giving small slip, high efficiency and high power factor. The starting winding can be designed for a maximum static torque for a given current, thus limiting the starting current. The running winding can be designed for the best running conditions when the motor attains speed. This type of motor, therefore, has the desirable characteristics of a very high-resistance squirrel-cage motor at starting and the desirable characteristics of a low-resistance squirrel-cage motor when running.

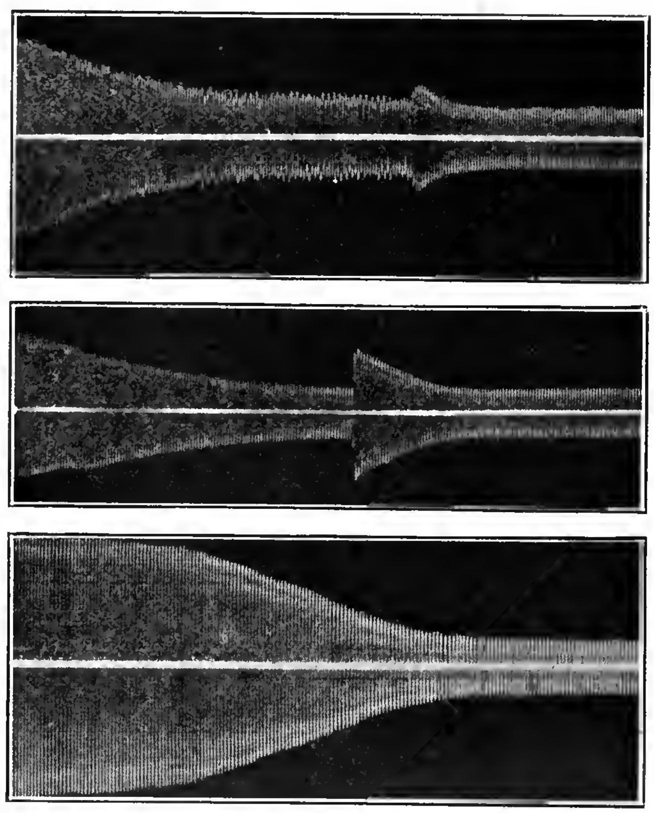


FIG. 1—STARTING CURRENTS FOR SINGLE-PHASE REPULSION-START, THREE-PHASE AUTOMATIC START AND THREE-PHASE SQUIRREL-CAGE MOTORS

| Oscil-logram | Motor Data | Amperes: Static | Amperes: When Governor Operates | Amperes: Per Line | Amperes: Full Load Equivalent Single Phase |
|---|---|---|---|---|---|
| Above— | 10-hp., 440-volt, 60-cycle, four-pole, single-phase repulsion start induction motor....... | 72 | 42 | 24 | 24 |
| Center— | 10-hp., 440-volt, 60-cycle, four-pole, three-phase, automatic-start induction motor. ..... | 60 | 54 | 12.5 | 21.5 |
| Bottom— | 10-hp., 440-volr, 60-cycle four-pole, three-phase squirrel-cage induction motor....... (without compensator) | 105 | | 12.5 | 21.5 |

A study of the static torque and current for various classes of direct-current and alternating-current motors is presented in Fig. 3. From these data it is seen that approximately the same low static current for a given static torque may be obtained from direct-current motors with starting resistance, from single-phase motors of the repulsion-start type, from polyphase induction motors with manually operated resistance in the rotor, and from the automatic-start polyphase induction motor. With a three-phase motor the starting current was reduced from 550 to 260 per cent full-load current with this automatic start, compared with the results obtained using a standard motor without starter.

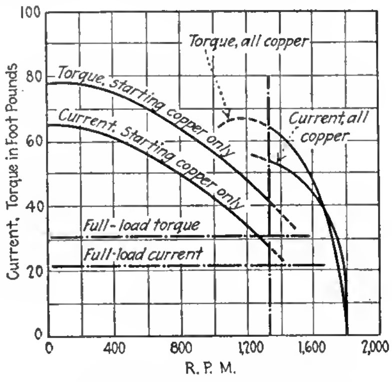
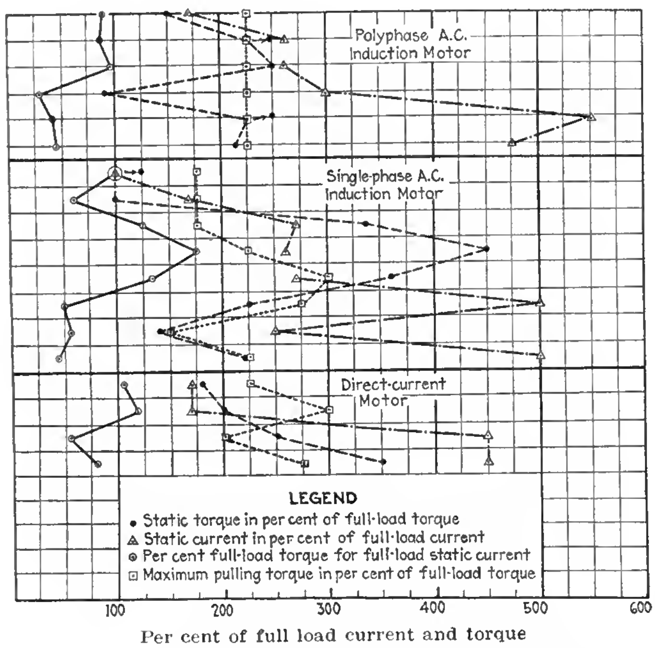



FIG. 2—STARTING CHARACTERISTICS OF 10-HP. INDUCTION MOTOR




Per cent of full load current and torque

FIG. 3—STUDY OF THE STATIC TORQUE AND CURRENT FOR VARIOUS CLASSES OF MOTORS

TOP SECTION—POLYPHASE ALTERNATING CURRENT INDUCTION MOTORS

Four symbols on uppermost line of diagram: Two-phase or three-phase, wound rotor, 5 hp. with starting resistance.
Second line: Two-phase or three-phase, automatic start, wound rotor, 15 to 50 hp.
Third line: Two-phase or three-phase, automatic start, wound rotor, ½ to 10 hp.
Fourth line: Two-phase or three-phase, squirrel cage with compensator, 7½ hp.
Fifth line: Three-phase, squirrel cage, no compensator, ½ to 10 hp.
Sixth line: Three-phase, squirrel cage, no compensator, ¼ hp.

CENTER SECTION—SINGLE-PHASE ALTERNATING-CURRENT INDUCTION MOTORS

Symbols in first row of squares across diagram in this section: 7½-hp., repulsion start, with compensator starter.
Second row: 7½-hp., repulsion start, with resistance starter.
Third row: ⅓ hp., repulsion start.
Fourth row: $\frac{1}{10}$ to ¼ hp., repulsion start.
Fifth row: 1 hp., repulsion, weakly compensated.
Sixth row: 15 hp., repulsion, strongly compensated.
Seventh row: 15 hp., with $R$ and $X_L$ start.
Eighth row: ⅓-hp. split-phase start.

BOTTOM SECTION—DIRECT CURRENT MOTORS

Symbols in first row of squares across diagram in this section: ½-hp. shunt, with starter.
Second row: ½-hp. compound, with starter.
Third row: ¼-hp. compound, without starter.
Fourth row: ¼-hp. shunt, without starter.

From experience it has been found that a static torque of 175 to 250 per cent of full-load torque is desirable to break the static friction of machinery or apparatus. Since the automatic-start polyphase motor takes a minimum of current from the line during the starting period for a satisfactory static and starting torque, it has been considered favorably by some central stations because it reduces the starting load period. The starting currents are predetermined and cannot be changed by an inexperienced operator.

A representative curve on starting characteristics is given in Fig. 2 for a 10-hp., 440-volt, four-pole, 60-cycle induction motor. These curves have been plotted from observed readings on the motor. The static torque in this case is 75½ lb.ft., or 250 per cent of full-load torque, with a static current of 65 amp., which is 300 per cent of full-load current. The National Electric Light Association states that 75 per cent of the locked rotor current is considered as the starting current, so that the so-called starting current of this motor would be 75 per cent of 65 amp., or 49 amp.—250 per cent of full-load current. As noted in Fig. 1, the starting winding has a maximum torque at or near standstill, which gives the maximum torque efficiency at this point. If the starting winding of higher resistance is used to obtain lower static current, the amount of load the motor can bring up to speed will be reduced. It is always desirable to have no greater current flow when the governor short-circuits the running winding than flowed at the moment of connecting the motor to the line. While the starting copper resistance is nine times the stator resistance, the running rotor resistance is practically only twice the stator resistance. Therefore, the starting copper winding has a resistance of four and one-half times the running rotor resistance.

The weight and size of this type of induction motor for a given speed and rating are practically the same as for a direct-current or a polyphase wound-rotor slip-ring type induction motor.

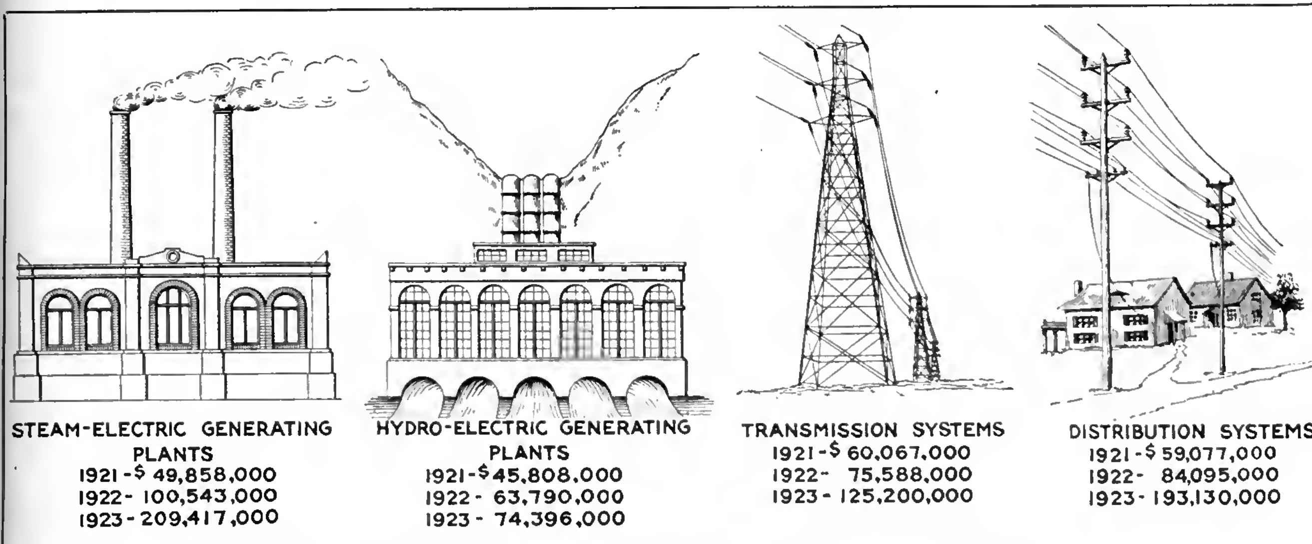
The automatic-start polyphase induction motor is well adapted for operating various kinds of machinery having considerable inertia, or loads that are difficult to start from rest. It is also suited for the operation of machinery where the motor would not be under constant supervision of an operator. It can be started on a fuse or other protective device which will protect the motor under operating conditions. A fuse of 120 per cent of rated current of the motor is usually quite large enough, while a fuse as large as 150 per cent of rated current of motor is never needed.

The oscillograms and the table in Fig. 1 show the starting point for three different types of motors, a single-phase repulsion start, a three-phase automatic start and a three-phase squirrel-cage induction motor without compensator. In this last-named motor it can be seen that the static current swings up to 105 amp. while the automatic-start induction motor had an amperage of only 60.

The starting efficiency of the automatic-start polyphase induction motor is substantially the same as for shunt or a compound-wound direct current, a polyphase slip-ring motor with resistance in rotor starting and a single-phase repulsion-start induction motor. In all sizes this type of motor may be started by closing the switch without the use of a starter as it takes not over 300 per cent of full-load current and has a static torque of about 250 per cent of full-load torque.

# Additions and Extensions During 1923 Estimated at $602,143,000

### "Electrical World" Survey Indicates that 2,890,400 Kw. Will Be Added to Generating Plants by Central-Station Companies—Value of Extensions to Distribution and Transmission Systems Estimated at $318,330,000




VALUE OF PROPOSED ADDITIONS AND EXTENSIONS DURING 1923 EXCEEDS ONE-HALF THE TOTAL GROSS REVENUE FOR 1922

A HIGH degree of expansion in an industry is an excellent indication of prosperity in that industry. When expansion follows a period of general industrial depression and takes on the attributes of high records, then general conditions in that industry may well be considered as of the highest order. Such are the conditions to be found in the electric light and power industry at the beginning of 1923.

Ever since its birth in 1882 the industry has spent annually an always increasing amount for additions and extensions to take care of the constantly growing demand for electrical energy. During the recent period of high prices and high cost of money it was financially impossible for the central generating and distributing companies to make any but the most necessary extensions and additions to equipment. With the recession of exceedingly high costs and the possibility of once again borrowing money at a reasonable rate of interest, the industry has laid plans for record additions and extensions to equipment during 1923. The extent of the large expenditures to be made in the present year is indicated by a survey which has just been completed by the ELECTRICAL WORLD. Returns were received from more than two hundred companies, representing about 70 per cent of the installed generator rating of the country.

The total value of the additions that will be made to the central generating, transmission and distribution systems during the present year is estimated at $602,143,000, which is $278,127,000, or about 86 per cent greater than the estimated expenditures made during 1922, and $387,325,000, or about 180 per cent more than the 1921 expenditures.

The estimated new generating installations during 1923 total 2,890,400 kw., of which 1,987,400 kw., or about 68.8 per cent, will be for steam-electric plants and 903,000 kw., or about 31.2 per cent, for hydro-electric plants. In 1922 it was estimated that 1,772,000 kw. was added to the generating equipment of the central stations, of which about 58 per cent was for steam-

TABLE I—VALUE OF PROPOSED ADDITIONS TO ALL CENTRAL-STATION GENERATING AND DISTRIBUTING SYSTEMS DURING 1923 AS ESTIMATED BY "ELECTRICAL WORLD"

| Section | Steam-Electric Generating Plants | Hydro-Electric Generating Plants | Total Value of Additions to Generating Plants | Transmission Systems | Distribution Systems | Total Value of Extensions to Transmission and Distribution Systems | Total Value of All Estimated Additions During 1923 |
|---|---|---|---|---|---|---|---|
| New England States | $6,270,000 | $4,626,000 | $10,896,000 | $6,680,000 | $7,420,000 | $14,100,000 | $24,996,000 |
| Middle Atlantic States | 66,800,000 | 11,300,000 | 78,100,000 | 31,200,000 | 76,900,000 | 108,100,000 | 186,200,000 |
| South Atlantic States | 22,700,000 | 10,000,000 | 32,700,000 | 11,920,000 | 12,340,000 | 24,260,000 | 56,960,000 |
| North Central States | 107,900,000 | 5,180,000 | 113,080,000 | 44,800,000 | 48,300,000 | 93,100,000 | 206,180,000 |
| South Central States | 1,455,000 | 4,490,000 | 5,945,000 | 9,970,000 | 9,230,000 | 19,200,000 | 25,145,000 |
| Mountain States | 802,000 | 4 000,000 | 4,802,000 | 610,000 | 2,240,000 | 2,850,000 | 7,652,000 |
| Pacific States | 3,490,000 | 34,800,000 | 38,290,000 | 20,020,000 | 36,700,000 | 56,720,000 | 95,010,000 |
| Totals for United States | $209,417,000 | $74,396,000 | $283,813,000 | $125,200,000 | $193,130,000 | $318,330,000 | $602,143,000 |

TABLE II—ESTIMATED EXTENT AND VALUE OF ADDITIONS AND EXTENSIONS TO CENTRAL-STATION GENERATING PLANTS DURING 1921, 1922 AND 1923

| Section | Steam-Electric Generating Plants | | | | | | Hydro-Electric Generating Plants | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Estimated Additions During Year | | | Estimated Value of Proposed Additions | | | Estimated Additions During Year | | | Estimated Value of Proposed Additions | | |
| | 1921 (Kw.) | 1922 (Kw.) | 1923 (Kw.) | 1921 | 1922 | 1923 | 1921 (Kw.) | 1922 (Kw.) | 1923 (Kw.) | 1921 | 1922 | 1923 |
| New England States | 236,000 | 76,000 | 151,200 | $8,085,000 | $5,870,000 | $6,270,000 | 18,700 | 39,000 | 24,000 | $1,480,000 | $3,690,000 | $4,626,000 |
| Middle Atlantic States | 102,000 | 332,000 | 678,000 | 10,430,000 | 41,250,000 | 66,800,000 | 23,300 | 256,000 | 180,000 | 2,458,000 | 7,240,000 | 11,300,000 |
| South Atlantic States | 106,000 | 76,000 | 200,000 | 5,004,000 | 6,890,000 | 22,700,000 | ...... | 222,000 | 240,000 | ........ | 10,900,000 | 10,000,000 |
| North Central States | 404,000 | 388,000 | 867,500 | 22,020,000 | 34,700,000 | 107,900,000 | 60,000 | 78,000 | 64,000 | 2,680,000 | 9,800,000 | 5,180,000 |
| South Central States | 15,000 | 78,000 | 29,100 | 1,920,000 | 6,460,000 | 1,455,000 | 30,000 | 32,000 | 90,000 | 1,110,000 | 6,000,000 | 4,490,000 |
| Mountain States | 1,000 | 20,000 | 16,800 | 72,000 | 828,000 | 802,000 | 2,200 | ..... | 25,000 | 58,000 | 310,000 | 4,000,000 |
| Pacific States | 37,500 | 58,000 | 44,800 | 2,327,000 | 4,545,000 | 3,490,000 | 216,000 | 117,000 | 280,000 | 38,030,000 | 25,850,000 | 34,800,000 |
| Totals for United States | 901,500 | 1,028,000 | 1,987,400 | $49,858,000 | $100,543,000 | $209,417,000 | 350,200 | 744,000 | 903,000 | $45,808,000 | $63,790,000 | $74,396,000 |

electric plants and 42 per cent for hydro-electric plants, while in 1921 it was estimated that only 1,251,000 kw. in generator equipment was installed during the year, of which 72 per cent was for steam-electric plants and 28 per cent for hydro-electric plants. The new generator installation in 1923 will, therefore, probably exceed that of 1922 by about 63 per cent and that installed during 1921 by about 131 per cent.

It must be borne in mind in studying these data that the estimates are for additions to generating and distributing systems which were operating prior to Jan. 1, 1923, and do not include the systems of new operating companies organized during 1923, the expenditures of which are, of course, impossible of computation at the present time.

### Value of Steam-Electric Plant Additions More than Double that in 1922

The returns received from the survey indicate that the value of the proposed additions to steam generating plants during 1923 will total $209,417,000, or a little more than twice the expenditures estimated in connection with this type of plant during 1922 and more than four times the steam-plant expenditures in 1921. The rating of the new generators to be installed in steam-electric plants during the present year is estimated at 1,987,400 kw., which is about 93 per cent over that estimated for 1922 and about 120 per cent over the 1921 new generator installation in steam-electric plants. No relation, however, can be said to exist between the value of the additions to steam-electric generating plants and the kilowatt rating of the new generators to be installed. Many companies reported extensive expenditures for new buildings, boilers, stokers, switches and protective equipment without any increase in the generator equipment.

While the net investment involved in hydro-electric projects in course of construction under licenses from the Federal Power Commission totals about $202,300,000, it must be remembered that that figure includes the cost of transmission systems involved in these developments and also that only a portion of this new development will be completed during the present year. Returns received in the ELECTRICAL WORLD survey indicate that during 1923 about $74,396,000 will be spent for new hydro-electric plants or additions to old plants, exclusive of the cost of transmission systems leading from such plants. In 1922 it was estimated that $63,790,000 would be spent in hydro-electric development, and in 1921 $45,808,000. Though the value of additions to hydro-electric plants appears to have increased yearly, yet the rate of increase is materially below that reported for additions to steam-electric plants.

The total value of extensions to the transmission and distribution systems of the country during 1923 reaches the high figure of $318,330,000. Extensions to transmission systems will total about $125,200,000, which is about fifty million dollars over the estimated value of the 1922 extensions. The estimated value of expenditures for extensions to the distribution systems of the country reach $193,130,000, or about two and one-third times the estimated value of extensions to distribution systems during 1922. These record-forming proposed extensions to the distribution systems of the country are probably the most indicative to be found in the accompanying tabulation. The crux of central-station operations is the ultimate consumption of the generated energy by the consumer. The record extensions to distribution systems reported from every section of the country are clear indicators of the extent to which the electric light and power industry is weaving itself into the domestic and economic fabric of the nation.

The North Central States lead in total value of proposed additions and extensions during 1923 with $206,180,000, of which 45.2 per cent will be spent for extensions to transmission and distribution systems and 54.8 per cent represents the value of additions to generating plants. The Middle Atlantic States and the Pacific States follow with $186,200,000 and $95,010,000 respectively. In the case of the Pacific States almost 60 per cent of the total expenditures is for extensions to transmission and distribution systems, this item totaling $56,720,000.

TABLE III—ESTIMATED VALUE OF ADDITIONS AND EXTENSIONS TO CENTRAL-STATION TRANSMISSION AND DISTRIBUTION SYSTEMS DURING 1921, 1922 AND 1923

| Section | Value of Extensions to Transmission Systems | | | Value of Extensions to Distribution Systems | | | Value of Extensions to Transmission and Distribution Systems | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1921 | 1922 | 1923 | 1921 | 1922 | 1923 | 1921 | 1922 | 1923 |
| New England States | $1,440,000 | $2,570,000 | $6,680,000 | $2,629,000 | $3,095,000 | $7,420,000 | $4,069,000 | $5,665,000 | $14,100,000 |
| Middle Atlantic States | 8,240,000 | 20,130,000 | 31,200,000 | 8,374,000 | 17,680,000 | 76,900,000 | 16,614,000 | 37,810,000 | 108,100,000 |
| South Atlantic States | 6,197,000 | 5,140,000 | 11,920,000 | 3,570,000 | 5,045,000 | 12,340,000 | 9,767,000 | 10,185,000 | 24,260,000 |
| North Central States | 20,510,000 | 22,000,000 | 44,800,000 | 22,690,000 | 30,200,000 | 48,300,000 | 43,200,000 | 52,200,000 | 93,100,000 |
| South Central States | 2,230,000 | 4,150,000 | 9,970,000 | 2,220,000 | 5,220,000 | 9,230,000 | 4,450,000 | 9,370,000 | 19,200,000 |
| Mountain States | ...... | 148,000 | 610,000 | 117,000 | 955,000 | 2,240,000 | 117,000 | 1,103,000 | 2,850 000 |
| Pacific States | 21,450,000 | 21,450,000 | 20,020,000 | 19,477,000 | 21,900,000 | 36,700,000 | 40,927,000 | 43,350,000 | 56,720,000 |
| Totals for United States | $60,067,000 | $75,588,000 | $125,200,000 | $59,077,000 | $84,095,000 | $193,130,000 | $119,144,000 | $159,683,000 | $318,330,000 |

# The Hope of Reward

By L. R. NASH
*Stone & Webster, Inc., Boston, Mass.*

SOME years ago the writer had on the walls of his office an old saying to the effect that "People who do what they get paid for generally get paid for what they do." This is an apt characterization of one of two classes into which those who toil either with hands or brain may be broadly divided.

The first class includes those who hold that the world owes them a living and that they are justified in giving the minimum in hours or effectiveness of work that will insure the holding of their jobs. The second class, with broader vision, holds that in the long run diligence and efficiency will be rewarded and that each day's work should embody the maximum of accomplishment or plans for future achievements.

Few of us realize the extent of individual responsibility for the world's welfare. We may admit that this welfare is measured by the total productivity of all industry, but we are apt to measure this total in terms of inventive genius and the ever-expanding application of machinery to even the simplest of daily tasks.

No one will deny that during the past generation the world has made its greatest progress in labor-saving devices, and yet the appalling fact remains that during that period there has been no appreciable increase in the per capita production of commodities useful in maintaining human life and comfort. This almost unbelievable situation has, by very careful statistical analysis, been shown to exist in the United States, and no other country in the world has shown greater application of machinery to industrial processes.

What is the reason for this stagnation in productivity after centuries of rapid progress? A searching study of the situation, however important and even imperative it may be, is not appropriate herein. Certain of the reasons, however, are obvious and are within the scope of this discussion. The period in question has witnessed a steady reduction in hours of daily labor. At its beginning ten hours or more was common practice. Now eight hours is fairly well standardized, and the workers in a few industries regard six hours as their goal. Certain trades have adopted the habit of school children by working only five days a week.

### *Reduced Working Hours Decrease Productivity*

A reduction from sixty to forty hours of work per week is in itself sufficient to counteract a vast increase in productivity through use of machinery. But curtailment has not stopped there. The units of work per day or per hour have also been subject to drastic and artificial restrictions in many industries, as have also the kinds of work a particular individual is permitted to do. Coincident with these tendencies have come higher rates of wage and standardization of wages without definite recognition of wide ranges in skill within a particular industry.

The inevitable effect upon industry as a whole has been to increase costs of production. A part but not all of this increase has been offset by the use of machinery. For more than twenty-five years there has been a steady upward movement in prices, independent of the war increases. Those whose productivity has been curtailed, as well as others, have had to meet this increase, and they have, therefore, shared in the consequences of their own acts. Few thinking people now deny that reductions in hours of labor, manual or mental, have been beneficial to industry generally, as well as to the individuals directly involved, to the extent that efficiency and productivity have been increased; nor will it be denied that labor in many cases deserved an increased proportion of the value of the joint products of labor and capital. It is the arbitrary reductions and restrictions, benefiting neither industry nor individuals, that deserve unrestrained criticism.

The effect of restrictive methods upon the individual is more far-reaching than its drain upon his pocketbook. It does not take more than ordinary intelligence to recognize the dishonesty in accepting a day's pay for work that might be done in a half day, nor to see that a standardized wage is an averaging process under which the skilled workers help to support the incompetents. A competent worker thus restricted knows that his abilities are wasted, for not only does their full exercise, if permitted, bring him no more pay but it even draws out the reproaches of his less skilled fellow workers against such a proof of their own shortcomings.

In short, the tendencies of the day toward standardization and co-ordinated efforts are destructive of the highest moral standards and efficiency and of that individual incentive which is necessary for both. Any person working without stimulus or hope of reward beyond a fixed standard stipend is a drifter upon life's troubled waters and may become a dangerous derelict.

The proponents of collective methods and standardization claim that the gains which have been brought about justify the individual sacrifices which have been made. A careful study of wage history fails to disclose these alleged gains, but shows, on the contrary, that individual bargaining has brought greater gains in income than collective bargaining. Individual incentive with its hope of reward, contrary to popular impression, has proved more powerful than collective action without such incentive and hope. And this is as it should be; for, if our cherished American standards and traditions, so often praised and defended, mean anything, they mean a maximum of individual freedom and full opportunity for advancement financially, politically and socially.

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THE foregoing comments, applicable broadly to all kinds of human activities, are merely the preamble or text for the real point of this paper. A rule that works well for individuals is apt to work equally well for groups of individuals. If a hope of reward serves as a desirable stimulus to one man, it will have a similar effect upon a business in which the energies of a number of men are combined. Business is very sensitive to opportunities for profitable expansion, as it is also apprehensive of possible burdensome restrictions. If the profits from business undertakings are in large part taken from the owners through taxation, or are kept within closely prescribed limits, the incentive for ventures into new fields and for aggressive developments and refinements in existing activities is destroyed. It matters not that such new activities might be of great or even revolutionary advantage to the world through new processes or commodities or lower costs of existing ones; the attendant risks will not be taken without the possibilities of unfettered commensurate reward.

In the pioneer days of steam railroads lines were pushed out into or through vast uninhabited areas in the hope that, after the inevitable years of losses, a liberal measure of compensating profit would follow. Why has railroad building in the United States virtually ceased during the last generation? Not because all actually or potentially productive sections have been reached, but, rather, because the undiscerning hand of regulation has withdrawn the possibilities of reward which alone appeals to hardy, adventurous spirits. A return of not more than 5 per cent upon investments in uncertain ventures has no appeal to a prospector who scorns the placid security of a savings bank.

Illustrations might be multiplied, almost without limit, of the steady encroachment of restrictive regulation in the field of commerce and industry, accompanied in most cases by withdrawal of incentive for aggressive activity, and followed by a spiritless conservatism which no longer seeks or expects anything more than conventional compensation for a standardized product. Progressive business, as well as red-blooded American citizens, will not be satisfied with such stifling of their ambitions and hopes of reward. They will either de-

stroy the unwise restrictions or, failing this, will withdraw to other fields not yet touched by the leveling process. It is to be hoped that the first course will prevail.

This is not a condemnation of public regulation, but only a criticism of certain phases of it in which the phenomena above discussed have been in evidence. Those of us who are engaged in the public utility field have not yet realized the results of the standardization of regulatory methods which is gradually becoming effective. The public service field is still comparatively new, and the pioneer spirit and enthusiasm for progress have not yet yielded to conventionalizing influences. However, if the influences continue, the yielding is inevitable.

A more specific statement with respect to regulatory methods as applied to public utilities is now necessary in order that the corrective measures which this paper proposes may be more intelligently considered. The most common exercise of regulatory powers is in the fixing of rates. The almost universal rule is that rates should be sufficient to cover the cost of the service rendered, including operating expenses, taxes, depreciation and a reasonable return upon the fair value of the property employed in the service. It is customary to accept actual operating expenses and taxes and perhaps retirement annuities, if or when they have been shown to be reasonable.

### Operating Efficiency Deserves Recognition

When, however, the value of the property and the proper rate of return thereon are considered, the commissions are apt to abandon specific inquiries and adopt a standard procedure. For example, a uniform return of 8 per cent may be declared reasonable, at least for utilities of a particular kind, without due regard for the risks of the particular enterprises and the efficiency with which its operations are conducted. Operating ratios of public utilities may differ by as much as 25 per cent under apparently similar conditions; the return demanded by investors may vary an even greater amount. In either case the difference may be due, in large part at least, to business skill or the lack of it in the management of the properties. It does not seem reasonable to permit widely different rates for different utilities when the entire difference may be due to varying skill in the construction or handling of the properties. Under competitive conditions no such variation in charges would be possible, for the business under higher rates would soon disappear.

Under regulation, which is merely a means of securing competitive results in monopolistic business, such differences could be adjusted by establishing a reasonable standard of business skill, presumably materially higher than that of the least efficient company and assuredly lower than the most efficient. A premium for efficiency and a penalty for inefficiency would thereby be created, serving a very useful purpose. Both penalties and premiums would lead to better results, with the weight of advantage in favor of the premiums. Without them there is lacking a natural, sustained incentive for improvement. Public utility executives will not in the long run make strenuous efforts to improve and expand their service if all the benefits derived therefrom are taken away from them and given to others. Why should they worry about lower cost and greater volume of business which do not add to their profits? Eighteen holes of golf on pleasant afternoons will prove much more interesting to them than saving a tenth of a pound of coal per kilowatt-hour for the benefit of their patrons.

That this principle is of broader application may be seen in an assumed case of a reasonably efficient street railway of the conventional type. An investigation shows that by the purchase of one-man cars the service of this railway can be improved and operating expenses reduced enough to pay a return on the added investment and provide a margin to amortize the investment in superseded two-man cars. If the proposed change in cars were made, a rate case might be brought and a finding made limiting operating costs to the new basis and the rate of return to the conventional amount on the "used and useful" property, excluding the unamortized superseded equipment. Surely with such possibilities there is no incentive to give better service, but, rather, a risk of serious loss.

If the above illustration is considered as extreme or unusual, a simpler and more conventional one may be substituted. Our assumed street railway, after strenuous past efforts to raise its power-station efficiency to the maximum possible limit, with no heat unit escaping without the closest scrutiny, may awaken to the fact that the kilowatt-hours so zealously produced are being handled rather carelessly after they leave the switchboard. It may find that, through a moderate investment in power-measuring devices on its cars, it can save 10 to 20 per cent of its entire station output. But the installation of these devices calls for some new money and also for a clerical and supervisory force which, if results are to be accomplished and maintained, may disturb the peaceful routine of some of the veterans on the front end of the cars and cause other annoyances. Why bother with the thing at all if the savings are all passed along to the other fellow? These and other more routine refinements in operating costs offer no advantages to the utility if they are to be wholly passed along to patrons through rate reductions as soon as they are discovered.

One more illustration, in this case from actual experience, may be cited to make clear the broad application of this principle to public utilities. Not long ago a large company became convinced, after careful investigation, that welfare activities and a program of death and disability payments would be a good investment through the increased efficiency and improved morale of its employees that would follow. After the company had spent considerable money in studying the plans adopted by other companies and in working out its own plans in the light of the most successful experience elsewhere, but before putting them into effect, its rates were the subject of an investigation by the public service commission. In its findings in the case the commission excluded from the cost of service all charges relating to the proposed welfare and pension program on the ground that such expenditures should not be reimbursed by customers unless or until the program had been put into effect and had proved profitable. It is not hard to forecast the policy of other utilities under the same jurisdiction with respect to such matters, however helpful they might think the final results would be to company, employees and public. With their own initial investment in jeopardy and no ultimate financial gain possible, the unanimous verdict would be "nothing doing."

The situations here illustrated are perfectly analogous to that of the individual who is assured of a standard wage so long as he renders reasonable service. In either case service would be better or greater if the reward were in proportion to the effort and ability to serve. The remedy in the case of the individual is simple in principle, although it involves practical difficulties of application. A suitably adjusted reward for business administration of a high order is not so simple in principle, although it has possibly fewer difficulties of actual application.

A number of regulatory commissions have reduced the authorized return upon public utility property as a penalty for mismanagement or inefficiency. A few others have commended unusual administrative ability as being worthy of reward but have not put the reward in tangible form. The suggested method of award has usually been a higher rate of return, and this appears in imperfect form in several service-at-cost franchises and in the so-called "sliding scale." A greater refinement in this factor might include the value of the property on which the return is based, with particular reference to the basis of valuation and certain intangible elements which are often subjects of controversy. Another real incentive would be found in the establishment of a standard of operating cost, the savings under which would belong wholly or in part to the utility.

The difficulty attending the practical application of such an incentive program lies in the exceptional ability, good judgment and intimate knowledge on the part of the regulatory bodies required for its equitable adjustment in each of the many and diverse cases which would arise. One of the state commissions* has recently developed an interesting system of grading public utilities. This system, which furnished the original motive for this paper, sets up an extended list of factors and elements which are concerned in the furnishing of satisfactory service to the public. The items are given varying weights, depending upon their importance, in determining the final standings of the various utilities. The system has the imperfections to be expected in a pioneer effort of its kind, and the purposes of the grading have not been disclosed. It is doubtful if any system of rating can be devised which would even approximately measure the over-all excellence of a complex business. The more complications are encountered, the less opportunity there is for helpful application of rules and formulas and the greater the need of broad, unrestricted judgment.

### MERIT SYSTEM NEEDS CONSIDERATION

In spite of these fundamental limitations to a rating or merit system, the increasing need of it in the public utility field justifies a most careful study of its possibilities by all regulatory commissions and its tentative application at an early date. Regulation is still in its development stage and the commissions have much to learn from the results of their past practices before a stable, consistent policy can be established. With due deference to the earnest efforts of the commissions to deal justly with both public and utilities, it is submitted that too many restrictions have been placed upon values and returns thereon in rate cases. This element in the cost of service amounts ordinarily to from one-fourth to one-third of the total cost. A variation of 10 per cent in this element has a negligible effect upon the bulk of the utility's patrons. For customary individual or home service it would amount to less than 10 cents per month. On the other hand, this difference may in the aggregate mean to the utility good credit instead of inability to meet all capital needs, liberality in making service extensions instead of delays and restrictions, satisfactory and reliable service instead of breakdowns and irregularities, and, finally, an incentive to improvements and progress instead of discouragement and stagnation. Surely these differences are worth much more to customers than their trivial cost, and a recognition of this fact by the commissions would be of advantage to all concerned.

An increase in the rate of return by 1 per cent, or even less, in a few merited cases as a reward for earnest and successful efforts to render excellent service, and the recognition of such proceedings as a tentative standard by commissions generally, would go far toward reviving the old pioneer courage and aggressive spirit of the operators and to inspire new interest on the part of investors. Good public utility service is vital to any live community, and it should not be withheld for lack of a reasonable hope of reward.

*The Illinois Commerce Commission.

# Accuracy and Vision Required*

### Quite Often Insufficient Time Is Allowed Engineers in Which to Prepare Estimates Properly—Costly Errors from Too Great Haste

BY A. D. THRALL
Vice-President Minnesota Loan & Trust Company, Minneapolis

WERE I to be asked what I considered the most desirable qualifications in an engineer's report, I should reply, "Accuracy and vision." Have we not sacrificed more to speed in this country than really is necessary? The man who wishes to develop water power wants to do it all at once. The engineer must within a few days have his statistics prepared and in hand. He is supposed to be able to make soundings by guesswork that are absolutely perfect. His contours are expected to be drawn by the naked eye in a few moments. His costs must be estimated and be turned in before he actually has determined where his sand and gravel may be obtained. The proprietor wants to let the contract before the cubical contents of the structure or the general plan are finally determined. Isn't this a mistake? We cannot maintain this lavish expenditure of funds simply for the purpose of cheating time. We acquired the habit during the war. A minute then might have meant a hundred thousand lives, and we weighed lives against money, with the balance tipping always in favor of the former.

But the war was a lavish devourer of raw materials. It was a spender of men's labor, and there was a depletion of wealth such as never before had been known.

We became accustomed to get results in the shortest space of time, regardless of costs and very often without proper attention to preliminary details.

I have in mind a project where several million dollars was expended on a large power project before it was definitely known just what the flow of the stream had been. (I don't believe that today, years after construction, there are any definite data.) The consequence was that before the project was successful it was necessary

*Part of a recent address before the Engineers' Club of Minneapolis.

to build a large steam auxiliary to produce sufficient power to carry on the enterprise. Only during three or four months a year was the water power up to the capacity of the plant. Here was a waste of many hundreds of thousands of dollars caused by lack of an engineer's report and by accepting insufficient and unauthenticated figures.

We are all acquainted with projects built during the last two or three years that have been estimated on the basis of a dollar and have cost on the basis of two dollars. The usual calm excuse has been that it was the rise in price of commodities and of labor that caused the discrepancy, but the wildest stretch of the imagination could not cause the mere price of commodities to double the cost of a project within the limit of time that elapsed. There was more behind it than that. It was probably the speed at which the project had been planned, the fever under which everybody worked to complete the proposition, which caused many things to be left out of the calculations that, had time been given him, the engineer would have included. So that before we can have the accuracy that we need on the part of the engineer, or the financier, we must have patience on the part of the promoter.

One of the great reasons why it is so difficult just at the moment to get an entirely new project going is because of the uncertainty of the actual figures of cost. The individual investor is very loath to hazard his funds in any enterprise the cost of which is not assured. Before we can effect a complete cure of this condition the engineer must know that he has full time to finish his work thoroughly, so that, barring the slight variance in actual prices, he can figure very closely the cost of a project. The banker, on his part, must feel that the engineer has had sufficient time to insure that the figures submitted are the actual figures and that before the undertaking is completed there will not be added an additional 100 per cent of cost, the avenues for raising which have been closed. When confidence shall have been re-established, then again will the investors' money be available for new developments.

Not only is accuracy an essential, but there is that great intangible gift of vision. We all strive to get as broad a view as possible. To a few men it is given to see in front and behind, but the success of our personal achievement and of the country's commercial development depends upon the breadth of this view. We all know it, we all appreciate it, when we meet it, and we endeavor in every way to develop a broad view individually. It doesn't reside in figures, it is in the human element behind the figures, and when based upon sound judgment developed from reasonable deduction and not as the result of idealistic hopes it forms the basis of the most permanent kind of confidence.

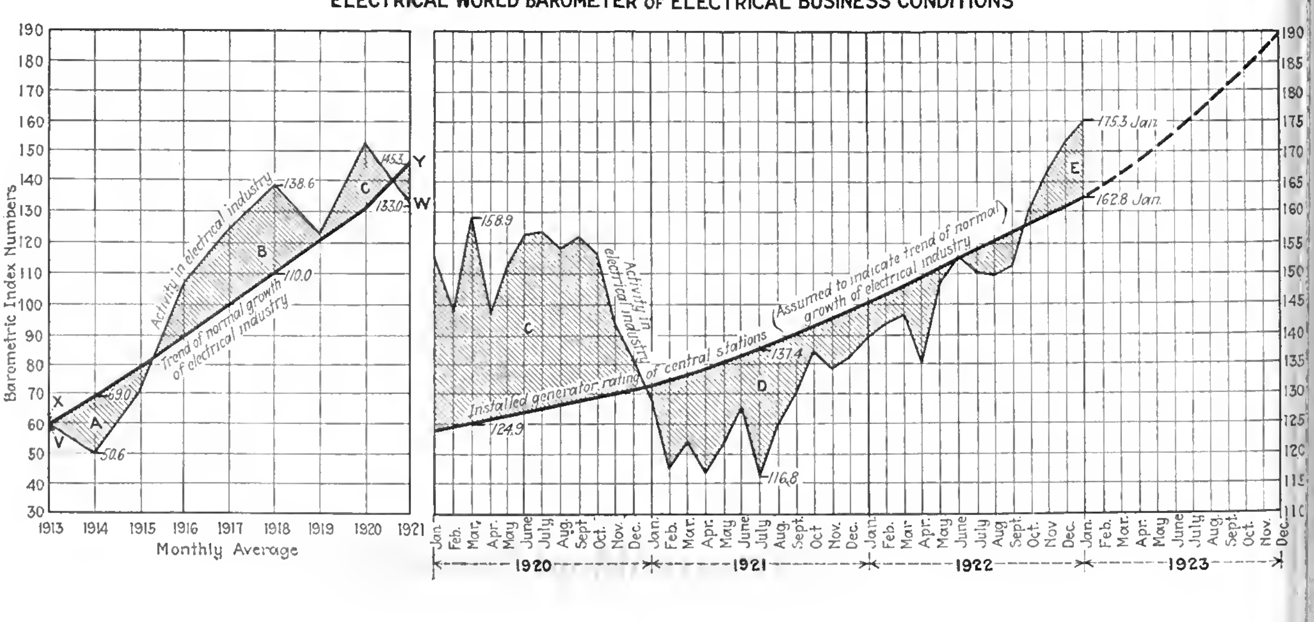
With this friendly interest fully developed, we shall at least make a beginning toward a condition of broader and wiser endeavor along those lines in which we are mutually interested.

## Upward Trend Retarded During January

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that January activity within the industry was in excess of that of December, but that the upward trend was retarded during January as compared with the trend generally experienced by the industry since last September. The basic data indicate an increase of 3.2 points on the barometer scale as compared with December activities. The electrical industry as a whole was in January operating at 12.5 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In December it was operating at 11.2 points or per cent above the point of normal demand.

In its review of general business conditions the Harvard University committee on economic research has the following to say: "Developments in speculation and money during the first month of the year were favorable to the continuance of business advance, although the movements of the curves of our index charts are small. Speculation remains at the same level as in December. Actual commercial paper rates declined under seasonal influences by about the expected seasonal amount. These developments strengthened the probability that the expansion in business activity and the increase in wholesale commodity prices now in progress will be extended through the second half of 1923. With fundamental conditions in the money market unchanged during the next month or two, continuance of improvement in business throughout the year will be clearly forecast."

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



# Natural Gas as a Fuel for Central Stations

## Unusually High Efficiency in the Burning of Natural Gas Has Been Developed with New Type of Burner—Long Life of Burner and Boiler Settings Are Assured with This Equipment

By E. A. QUINN
*General Superintendent San Joaquin Light & Power Corporation, Fresno, Cal.*

NATURAL gas as a fuel for central-station steam plants has failed to meet with the great degree of favor it should have enjoyed in sections where this fuel is available because of the very poor efficiency and short life of the ordinary types of burner that have been employed. The cost of fuel is the greatest single item of expense in the production of power and ranges from 40 to 70 per cent of the total cost. For this reason and because of the fact that all fuels are slowly but surely increasing in price larger investments in fuel-saving equipment are justified. In localities where a specific fuel is plentiful the problem resolves itself merely into a study of the best methods of burning this fuel. To the engineer efficient combustion means the chemical union of a substance with oxygen at such a rate as to cause rapid increase in temperature without waste. In the new Midway plant of the San Joaquin Light & Power Corporation a burner developed by the engineers of the company is in use which is giving efficiencies of 20,000 to 22,000 B.t.u. of natural gas as fired per kilowatt of electrical energy at the switchboard. This plant recently completed and placed in operation has a capacity of 25,000 kva. It is located near the oil fields of Kern County, California, and is the third plant on the system of this company in which natural gas is burned under the boilers.

### Gas Quality and Pressure Vary

Gas varying from 900 B.t.u. to 1,080 B.t.u. per cubic foot, depending on the location of the wells where it is obtained, is purchased from a local gas company. It is delivered to the plant through a 10-in. welded steel-tube line, guaranteed to withstand a pressure of 500 lb. per square inch. The pressure of the gas delivered ranges from 150 lb. to as low as 7 lb. per square inch in extreme cases. There is no gas held in storage by either the gas company or the power company, and with the exception of what may be taken from the mains by pulling down the pressure there is no reserve to draw on. In this way a small amount of gas can be obtained in case of an interruption to the supply while the oil burners are hurried into action to prevent losing the load on the station. In view of the fact that the gas companies have no storage they desire a constant load and a uniform flow from the wells. Variation in the demand for gas entails a hardship on them and in some cases may injure wells. Flow meters of the orifice type are used to measure the gas delivered. The static and differential pressures are recorded on one chart, from which records the consumption is readily calculated by means of planimeter readings and standard tables. As the gas enters the company's property it is stepped down to 20 lb. or 25 lb. pressure by Chaplin-Fulton pressure regulators and is metered at this pressure.

At the Bakersfield plant there are two sources of supply, and after passing through the regulators the lines continue to the metering stations, where a tie connection parallels them so that the total gas may pass through either or both of the metering lines. In each of these lines there is provided a disk with a 4-in. orifice installed in a flange joint with Wescott differen-

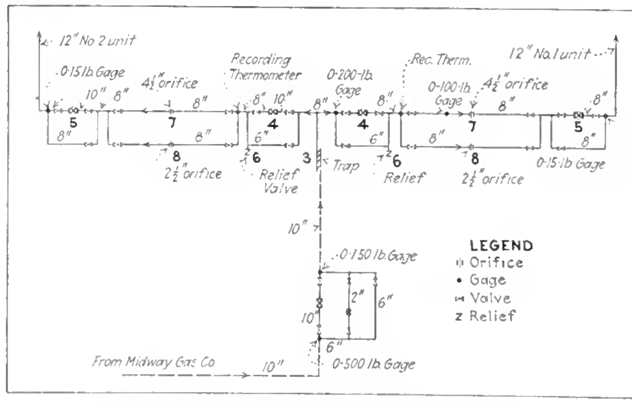



FIG 1—ARRANGEMENT OF METERING EQUIPMENT AT THE MIDWAY STEAM PLANT

tial connections. Meters are operated at their highest rating, cutting them in or out as the demand varies.

After passing the meters the gas is reduced to a maximum of 2 in. of mercury and a minimum of 1½ in., at which pressure it enters the boiler-room header and is passed on to the boilers, being controlled at each boiler by a hand-operated gate valve. Just outside the power house traps are installed to collect oil, water or other residue which may have been carried over from the wells by the gas. These traps are so designed that it would seem impossible that they should not function properly. There are times, however, when the gas carries an oil vapor that will not be caught in any form of trap, and this vapor is carried past the traps and into the boiler-room gas piping and is apparently only given up when the pressure reaches the exceedingly low point at which it is sent directly to the burners. The first two boilers taking gas from the header get the greatest amount of this free oil. Each individual header is provided with drains to remove the oil before it reaches the burner tips.

Samples of gas are brought in twice daily from the Midway steam plant and tested for heating value, or B.t.u. content, and specific gravity. The gas is shipped in bottles made of 4-in. pipe, 30 in. long and tapering to a point at each end, with ⅜-in. nipple and valve attached. The gas is blown in one end and out the other until there is no doubt as to the contents being a true sample of the gas being delivered to the plant. The outlet valve of the cylinder is closed and the pressure allowed to build up to 200 lb. The inlet valve is then

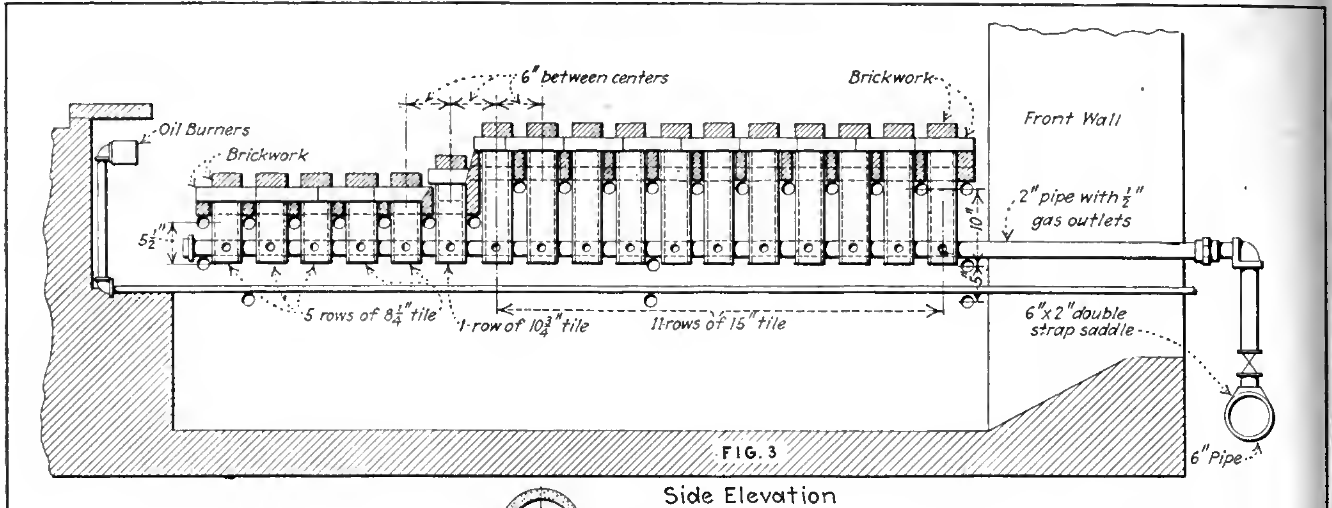
closed and the cylinder immersed in water for the purpose of detecting leaks.

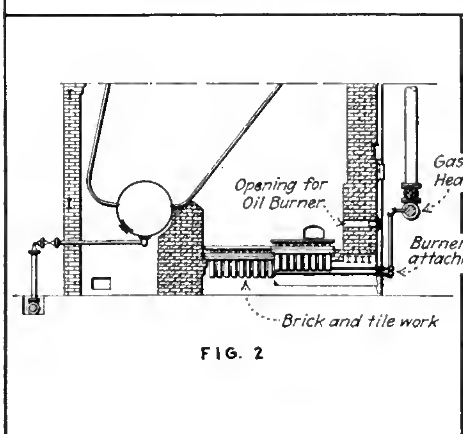
A Humian-Junkers constant-flow calorimeter is used to determine the B.t.u. value of the gas. In this type there is a constant flow of water through the calorimeter and the gas is burned at a constant rate. The temperature of the water at the inlet and outlet of the calorimeter is very accurately read from thermometers calibrated to 0.1 deg. F., mounted with telescopic sights. The gas burned is measured with a very accurate meter of the wet type, and corrections are made for barometer and gas pressure. With these

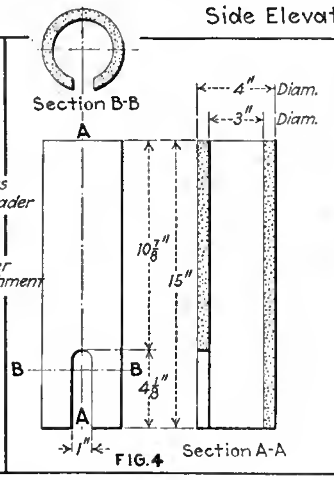
Beaumé fuel oil may be calculated. From this the kilowatt-hours per barrel of oil is figured and used by the operators who are more familiar with the firing of oil to get some conception of the relative performance of oil and natural gas.

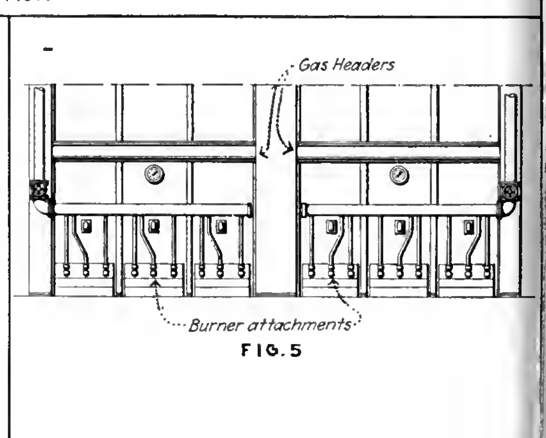
For accurately calculating the gas consumption as recorded by orifice meters, the specific gravity of the gas must be considered as this has a material bearing upon their accuracy. For this purpose an Edwards density balance is used.†

The specific gravity of the gas is the ratio of the total pressure required to balance the beam in air to




DETAILS OF BURNER SETTINGS FOR TYPICAL BOILER INSTALLATIONS

Fig. 2—Setting used with 800-hp. Connelly boiler. Two shutters control the air to the two sections of the combustion chamber. An emergency inlet is provided for oil burners. This is the present and most efficient application of gas burners under boilers.

Fig. 3—Burner setting in class M Stirling boilers. Used before present development was adopted. Oil burners were originally installed in an offset in the bridge wall.

Fig. 4—Cross-section of tile used.

Fig. 5—Front of 825-hp. Connelly boiler with main gas header and pipe feeds to each furnace. In burning gas it is essential that both the air and gas be easily and quickly controlled. In this plant the gas is controlled by the shifting of one lever so that the quantity of gas delivered to each boiler can be reduced immediately should the plant suddenly lose its load.

corrected measurements the B.t.u. per cubic foot is the following calculation:

Temperature rise of water × weight of water ÷ cubic feet of gas used. *

The B.t.u. values of the gas are used as a basis for comparative efficiency data. The total B.t.u. of the gas consumed during a twenty-four-hour period is used to determine the B.t.u. per kilowatt-hour, or the over-all efficiency of the plant. Knowing the total B.t.u. value of the gas consumed, the equivalent barrels of 14-deg.

*There are other corrections which must be made also. One is for the relative humidity of the air. In general this correction is positive up to about 8 per cent humidity and negative for humidity above this amount, varying with the temperature of the air in the room. The other is for the difference in temperature, if any exists, between the room and the water at the inlet, due to the heat that may be absorbed or given off by the body of the calorimeter.

that required to balance it in the gas. The specific gravity of the gas must be accurately determined, as a slight inaccuracy extending over a month's time will mean a large difference in the monthly fuel bill. The beam is brought to balance three times on gas and air and the average of the three readings is taken as a

†This instrument consists of a balance beam carrying a sealed cylinder on one end and a counterweight on the other. The balance beam with its support is mounted in a gas-tight chamber to which is attached a mercury manometer and a small rotary vacuum pump operated by a small motor. The balance case and manometer connections are filled through an inlet needle valve with dry air, and the pressure is adjusted by removing the excess air through another needle valve by use of the small vacuum pump until the beam balances, which balance is ascertained by the observation of the cross line on the end of the beam. After this pressure is determined the balance is evacuated by use of the vacuum pump and filled with gas. The pressure is again adjusted until the beam is in equilibrium, and note is made of the pressure.

basis from which to make calculations. The variations of these readings are very slight, and the use of any one set has been found to be sufficiently accurate for calculation.

### IMPORTANCE OF GAS ANALYSIS

It must be borne in mind that the analysis of the gas is continually changing owing to the variable demand made upon the gas companies for their product and the consequent necessity of cutting in and out of service different wells, each of which produces a gas of different analysis. With gas from different wells it is possible to obtain a theoretical $CO_2$ percentage in the flue gas of from 8 to 13 per cent. All of the gas used at the company's plants contains $CO_2$ ranging from a fraction of 1 per cent to 6.6 per cent, the balance being methane and ethane with minute parts of illuminants. Thus it may be seen that caution is necessary when prescribing a percentage of $CO_2$ as a basis from which to work toward furnace efficiency. Any changes in the gas can be readily detected by the firing of the boilers. The static and differential pressures are recorded by the differential meters, and the temperature of the flowing gas is recorded. Averages for the twenty-four hours are taken of the above pressures and temperatures and with the specific gravity found from test, and, knowing the orifice constant, the cubic feet of gas is calculated. If the gas tests were not made daily, it might work an injustice to the gas company as well as the power company.‡

### NEW BURNER DEVELOPED

The San Joaquin Light & Power Corporation first used natural gas under its boilers at the Bakersfield steam plant in 1911. The first burners installed were of various types. Experiments were made with different burners in an effort to find one which would burn gas economically and at the same time would stand up in service. It was found that patented metal burners were rapidly destroyed, and in an effort to overcome this difficulty the tile burner was developed. At first this was a crude affair as there was no control of the air passing through the tiles, the only control over the fire being by increasing or decreasing the quantity of gas and opening or closing the dampers in the stacks. This original burner gave a very high combustion and high efficiency, and attempts to increase its efficiency by adopting a method of controlling the air through the combustion chamber resulted in an even higher development.

From the accompanying illustrations it will be seen that all air entering the combustion chamber must pass through the burner tiles, and by having a long tile with two baffle bricks over each one a high degree of oxidation is insured. A gas burner to be efficient and economical must have the heat applied properly in the combustion chamber. Gas burners of the horizontal type are likely to damage the boiler foundation and side and bridge walls of the boiler settings owing to an excessive heat being concentrated in certain spots in the combustion chamber. Some burners will not carry boilers at a high rating without causing excessive vibrations or pulsations which can assume dangerous proportions. These pulsations are due primarily to improper mixing of the gas and air which gives incomplete combustion in the form of a series of explosions.

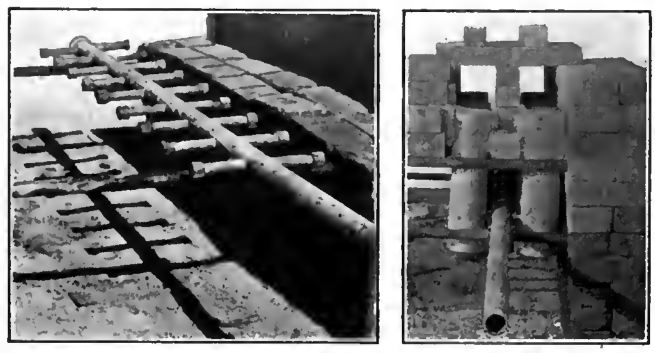
The San Joaquin burner does not have these objectionable features. The load on the boiler can be varied from 25 to 200 per cent boiler rating without back flares. This feature is due to the small gas orifice and the extreme length of the burner tile. Furthermore, the gas is distributed over the entire furnace floor and is not concentrated in the front or at the back of the furnace. The burner tiles are supported by ½-in. pipe nipples and are held in vertical position by shredded asbestos and high-heat-resisting fireclay, allowing perfect freedom for expansion of the tiles. The arrangement and number of burners required for any given installation depends on the width and depth of the combustion chamber and the horsepower of the boiler. Quality of the gas, except in extreme case of an excessive amount of water, has not made any change in the satisfactory operation of the burners which are now being used.

The assistance of C. P. Rhine, designing engineer, and R. A. Wallingford, boiler-room efficiency man, in the preparation of this article is acknowledged.

RESULTS OBTAINED WHEN BURNING GAS

(Based on weighted water tests run on an 825-hp. class M-30 Stirling boiler)

| Boiler Rating (per Cent) | $CO_2$ in Flue Gas (per Cent) | Temperature of Flue Gas (Deg. F.) | Efficiency (per Cent) |
|---|---|---|---|
| 84 | 9.88 | 443 | 84 |
| 110.6 | 10.5 | 518 | 84.7 |
| 139 | 9.8 | 578 | 82.7 |
| 163.64 | 10.64 | 514 | 82.2 |
| 171.2 | 9.3 | 625 | 78.3 |



GAS-BURNER HEADER SUPPORTED BY PIPE AND RED BRICK PIERS AND DETAILS OF FURNACE CONSTRUCTION FOR GAS BURNING

Left—The header is very accurately drilled and tapped so all nipples will be in a horizontal plane. Orifices $\frac{3}{16}$ in. in diameter are drilled in the nipples to permit issuance of the gas. Right—The fire brick wall starts at the burner supports with two courses below the top of tile. Pipe or rod supports hold the tile or burner floor in place. The powdered asbestos cement and fireclay mixed half and half is also supported by the pipes. Asbestos and fireclay are packed around the tiles to allow expansion and reduce breakage. All air entering the combustion chamber passes through the tiles.

‡The following examples illustrate this point: The orifice constant for a 4½-in. orifice in an 8-in. line is 7004.5. Take the differential pressure as 32, static pressure as 21, gas temperature as 68 deg. F. and specific gravity as 0.65. The temperature gravity correction is 0.953; the pressure extension is 33.657; the cubic feet of gas per hour equals 7004.5 × 33.657 × 0.953 = 224,669. The cubic feet of gas for twenty-four hours equals 5,392,056. If the specific gravity had changed to 0.60 with the temperature, static and differential pressures the same as in the above example, the cubic feet of gas per twenty-four hours would be 5,612,736. If the gravity had been taken as in the first case, the plant would have used 220,680 cu.ft. of gas that did not show on the meter. As another case take the specific gravity at 0.70. Other things being equal, the cubic feet of gas per twenty-four hours would be 5,194,932. In this case if the specific gravity had been assumed to be 0.65 and the true gravity was 0.70, the plant would not have used 198,024 cu.ft. of gas that showed on the meter. From these examples the necessity of taking gas samples each day is evident. Assuming that the plant is carrying a load of 10,000 kw. and that the calorific value of the gas is 972 B.t.u. per cubic foot, then in the first of the examples the B.t.u. per kilowatt-hour equals 21,837, in the second 22,731 and in the third 21,035. From this it will be seen that the engineer cannot get a correct report of the number of B.t.u.'s per kilowatt-hour unless he absolutely knows the calorific value of the gas in question.

# Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

## Importance of Cable Engineering

*To the Editors of the* ELECTRICAL WORLD:

I have been impressed many times recently with the lack of appreciation, on the part of young engineers as well as some old ones, of the magnitude and importance of cable engineering as a part of electrical engineering. In trying to find a reason for this, I am inclined to believe that there is at least some fault in the university training of these engineers. I think any one will agree, any analysis will show, that most of the emphasis of electrical engineering courses is on machinery, with some attention to high-voltage transmission, and that cable work is largely neglected.

I think it will surprise some to know that this company spends almost twice as much for lead-covered cable as it does for turbo-generators, and that the investment of this company in overhead and underground lines, including the poles and conduits and manholes, is nearly one-third of the total investment.

A superintendent of one of the large cable factories told me recently of his difficulty in finding a technical man who would devote his time to research work on wires and cables, principally lead-covered cable. In answer to an advertisement he said he had about twelve or fourteen applications, and when these men, who were all technical graduates, were told that the research was to be regarding lead-covered cable, they thought the field entirely too narrow and did not consider it worth their while to undertake such work. Where did the technical graduates get such ideas, and is it not fair to assume that their ideas regarding the narrowness of the field were due in large part to the fact that while they were in the university they received very little information along such lines and performed in the laboratory no experiments or tests on cables? Is it not true that the technical graduate forms his opinion of the relative importance of the various lines of engineering work largely from the amount of time devoted to the various subjects by the professors in their classwork and their lectures, and by the routine experiments or tests which are required of him in the electrical engineering laboratory? And if the technical colleges in their classwork and in their laboratory work devoted an amount of time to the subject of wires and cables in keeping with the importance of these subjects, do you not think that the condition above described would have been reversed, and would not the cable manufacturer probably have had more applications than he could use, instead of being turned down by fourteen men who answered his advertisement?

That particular manufacturer has no occasion for feeling lonesome. There are other manufacturers and utilities that are in exactly the same condition. As you are aware, there have been some tremendous advances in the art of cable manufacture in the past five years, and there is every reason to believe that the present rate of improvement will continue for some years.

The manufacturers that are making the most progress are the ones who have a staff of technical men continuously engaged on research work, and the ones that are making the slowest progress have no men whatever engaged continuously on research work, or perhaps do a little research spasmodically when they are forced into it by difficulties in meeting their guarantees. The last two sentences are not mere theories or ideas, but are statements based upon the records of our tests on cable purchases made in the last four years. We buy cable from all of the leading manufacturers in this country, and we are able to tell from the tests on the cables that we purchase just when a manufacturer makes an improvement in his product and the amount of the improvement. We can also tell from these records, beyond any doubt whatever, which manufacturer is in the lead, and, with a very close degree of accuracy, the relative standing of the leading makers in the art of cable manufacture. Their order shifts a little from time to time, owing to the varying amount of research work that is being undertaken by the several manufacturers.

In view of the facts set forth above, does it not seem self-evident that the regular series of tests offered to the higher students in electrical engineering laboratories should include a few tests on lead-covered cables? Such tests, for example, might be thermal resistivity of the insulation and dielectric loss. If the dielectric-loss curves are taken at a number of temperatures and voltages on a single piece of cable, then these curves will show the ionization loss in the cable. All of these tests could be made on a single piece of single-conductor cable, permanently set up in the laboratory, although it might be more convenient to have the two tests made on two separate pieces of cable. I think that these tests would very likely require the use of instruments and methods of tests which would be entirely different from any of the tests which students are now performing, and if this is the case would not such tests be a distinct addition to the laboratory? And would not the laboratory, with the addition of these tests, give students a better idea of the relative importance of the various branches of electrical engineering than they can possibly get without such equipment?

D. W. ROPER,
Chairman Joint Cable Research Committee of A. I. E. E. and N. E. L. A.
Commonwealth Edison Company,
Chicago, Ill.

## Lighting of Hampden County Memorial Bridge at Springfield, Mass.

*To the Editors of the* ELECTRICAL WORLD:

Referring to page 378 of the Feb. 17 issue of the ELECTRICAL WORLD, showing a night photo of the Hampden County Memorial Bridge at Springfield, Mass., which was taken by the writer, I would call your attention to an error which occurred in the description of the lighting.

Your account makes it appear that one 500-watt "Mazda C" lamp was used in each of the four 80-ft. towers in a globe of 2½ ft. diameter. These towers each use four 500-watt "Mazda C" lamps, which are inclosed in a sectional diffusing globe 6 ft. in diameter. Owing to the height of the towers and the characteristic of the globe it was necessary to use approximately five times the wattage in this unit that was used in the ornamental luminous-arc lamps to obtain the correct balance in the lighting effect.

L. O. INGALLS,
Electrical Engineer.
United Electric Light Company,
Springfield, Mass.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Cable Rack for Industrial Power House

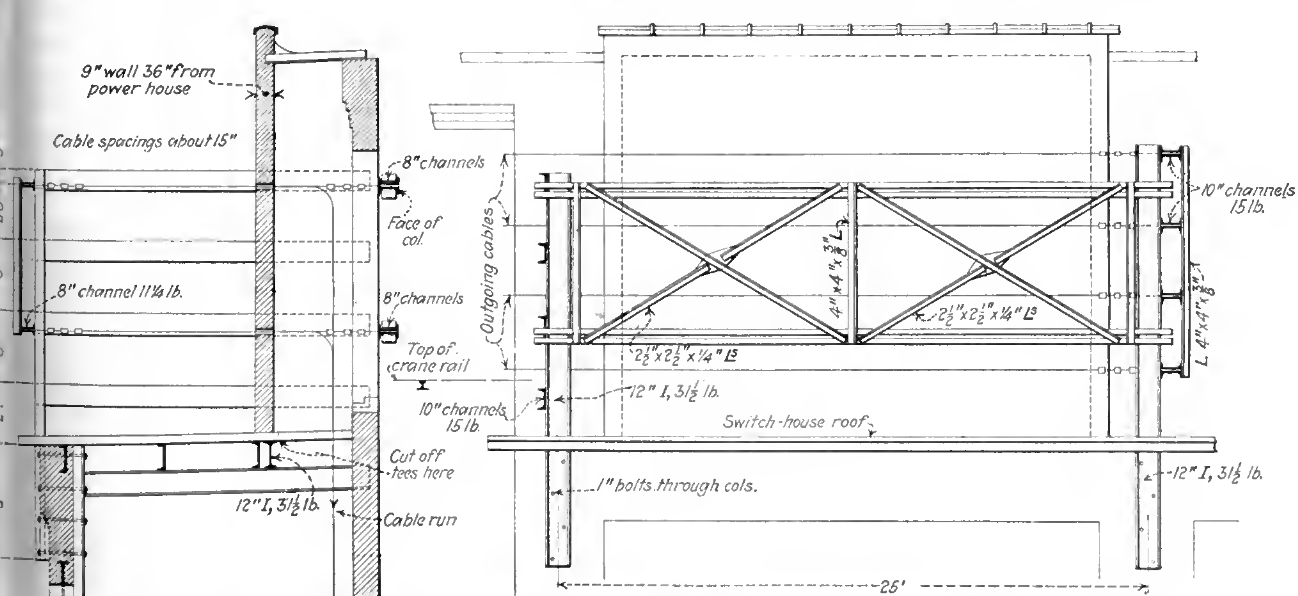
CABLE RACK CONVENIENTLY BUILT ON SWITCH-HOUSE ROOF

XIGENCIES often arise in industrial-plant layouts which involve tensive and difficult changes in ectric power distribution facilities, id too often, it sometimes seems, a pe line or some structural arrange-ents force the power distribution ystem out of its logical and impor-nt position in the industrial-plant ans. No doubt this condition has isen because of the inherent flexi-lity of electric distribution systems compared with the carriers of her forms of energy.

Some time ago a problem presented self during the construction of a rge industrial plant concerning the rangement of outgoing power feed-s from the power house. The origi-l design contemplated the feeders aving the switch house at right igles to the outer wall, but subse-ient location of additional buildings ljacent to the power house left only ie avenue for the power feeders—arallel with and above the switch ouse, which was essentially a lean-to ructure half the height of the power ouse.

Naturally a cable rack above the of then became essential, but running the leads from the interior of the switch house to the rack above presented considerable difficulty. It was not possible to obtain room for an exit on the outer wall of the switch house owing to adjacent structures, and roof bushings are not often desirable for the usual industrial-plant conditions. A solution was found by building a 9-in. "false" wall from the roof of the switch house about 36 in. out from the power-house wall. The roof purlins of the switch house under this wall were reinforced by a 12-in., 31½-lb. I beam. A large steel-frame window in the power-house wall was removed, permitting the placing of channel members as shown in the line drawing to carry the ends of the short transverse cables. The cables from the switching equipment were run vertically along the wall and were spliced to the transverse cables. A short vertical jumper connected the transverse cables with the line cables above and below the transverse cables and running parallel to the walls of the power house.

All dead-end connections were made without the necessity of drilling by arranging 8-in., 11¼-lb. chan-




STRUCTURAL LAYOUT OF CABLE RACK ON ROOF NECESSITATED BY CLOSENESS OF OTHER BUILDINGS

nels back to back with spacers so that a space of 1¼ in. was left between them in order that any size of eyebolt required might be inserted in the slot. At one end of the rack 10-in. channels were provided for attaching steel pins and line insulators.

The transverse cables are horizontal, but water does not run in through the wall bushings as the very slight sag in the cables causes a drip to be formed on the cables outside the false wall 36 in. from power house.

J. E. HOUSLEY,
Electrical Engineer.
Aluminum Ore Company,
East St. Louis, Ill.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Dangers from High or Low Water in Boilers

VERY serious damage may be caused in boilers or to engines or turbines connected to them if the water becomes too high, so that it goes over into the steam main, or if it is too low, causing the boiler to overheat. There are three things that may cause the water level to rise quickly, and that should be very closely watched by the water tender: (1) Increasing the forced draft, particularly when the setting and the water in the boiler are still hot from previous high steaming rates; (2) increase in feed-water pressure, caused by placing an additional feed pump in service or by decrease of feed-water temperature; (3) faulty action of the feed-water regulator.

In case of high water the following preventive steps abstracted from the operating code of the Philadelphia Electric Company should be taken as a typical method for reducing the water level properly:

INSTRUCTIONS TO REDUCE HIGH WATER IN BOILERS

1. Close the feed-water valve.
2. Try the gage cocks to make sure that the water is high.
3. Open the superheater drains and surface blow-off valves, if easily accessible.
4. Cut off the forced draft.
5. Open the blow-off valves.
6. Stop the stoker.
7. Partly close the back damper, leaving sufficient draft to clear the gases.
8. Maintain practically a banked condition and blow down until the water level has been lowered to between two and three gages.
9. If a feed-water regulator is in service, close the feed valve to the regulator and operate the feed valve by hand until the trouble has been located.
10. When normal water level is reached put the boiler in service.

Low water in a boiler may be dealt with under two divisions—one treating conditions where the water in the gage glass is low and can be seen and the other where the water is below the gage glass.

Case 1. When the water level in the gage glass is low it should be brought to normal level by increase in rate of feeding the water.

Case 2. When the water is out of sight and the water tender has no positive knowledge of its level a very dangerous condition exists which may result directly in a disastrous accident, or later in extended and expensive boiler repairs, unless proper steps are taken to remedy this condition at once.

Should water be admitted to overheated drums or tubes, the sudden formation of steam would greatly increase the pressure, which would violently rupture the boiler metal in case it was hot enough to have lost its strength. The least that can be expected would be loosening of the tubes in the drums or headers, caused by the uneven contraction of the boiler metal when the cold water touched the hot surfaces. In this case the fire should be dumped and the boiler subjected to a hydrostatic test. The specific instructions for this operation follow:

WHEN WATER IS BELOW GAGE GLASS TAKE BOILER OUT OF SERVICE

1. Close the feed-water valve to the boiler.
2. Cut off the forced draft.
3. Partly close back damper, leaving sufficient draft to clear the gases.
4. Stop the stokers.
5. Where possible, drop the dump plates.
6. Drown the fire and allow the boiler to cool.
7. As the steam pressure drops, shut the main stop valve.
8. Close the trap-line valve above the automatic non-return valve.
9. Lock the automatic non-return valve.
10. After the boiler is cool, open all vents between automatic non-return valve and the boiler.
11. Inspect the boiler and subject it to a hydrostatic test.

## Induction Motor-Generator with Compensator Start

INDUCTION motors of motor-generator sets without slip rings and external secondary resistance must be protected against excessive starting current by impressing a low voltage on the primary in starting. This voltage is obtained by placing the compensator handle in the starting position. When the machine has reached approximately full speed full voltage is impressed by throwing the compensator handle to the running position. The following abstracted from the operating code of the Philadelphia Electric Company are instructions for operating these sets.

STARTING

1. Close the alternating-current bu[s] switch.
2. Place the compensator in th[e] starting position.
3. When the machine comes up t[o] speed place the compensator in the running position.
4. Close the generator field switch.
5. If the generator is compoun[d] wound, close the equalizer switch.
6. Adjust the direct-current voltag[e] to that of the bus and close the circu[it] breakers and negative and positive machine switches.

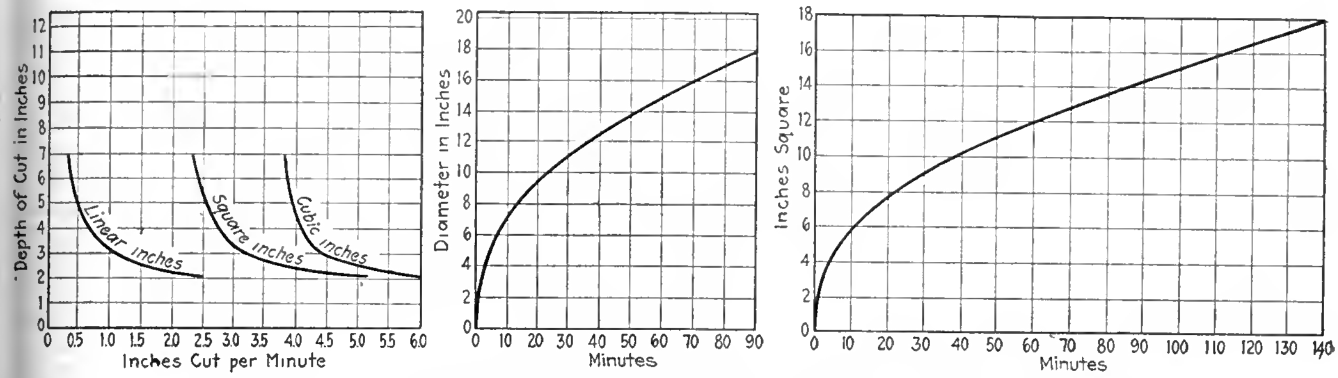
SHUTTING DOWN

1. Reduce the load of the machin[e] to be taken off to as low a value a[s] possible.
2. Trip the direct-current circu[it] breakers and open the machine an[d] equalizer switches.
3. Open the alternating-current bu[s] switch.
4. Return the operating handle [of] the compensator to the "off" position [if] it does not return automatically.

## Repairing Flume Without Interrupting Service

FIVE miles of wood flume su[p]ported directly on the groun[d] along level stretches and on woo[d] trestles at gulleys is being rehab[il]itated by the Tennessee Electr[ic] Power Company without taking [it] out of service. The flume, whi[ch] serves the 15,000-kva. hydro-electr[ic] station No. 2 on the Ocoee Riv[er], measures 11 ft. x 14 ft. in cross-se[c]tion and carries 13,000 cu.ft. [of] water per second. The wood ber[ts] supporting the bottoms and sides a[re] being replaced by galvanized-ste[el] bents and the wooden trestle by co[n]crete. The substitute parts are bei[ng] placed between those to be replac[ed] so that the latter can be removed [as] the work progresses. Seven hundr[ed] out of 6,400 bents have been install[ed].

FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.




RATE OF CUTTING CAST-IRON PLATES (LEFT), CIRCULAR SECTIONS OF CAST IRON (CENTER) AND SQUARE BLOCKS OF CAST IRON (RIGHT)

## Cutting Metals with the Electric Arc

THE process of arc cutting is purely a melting process, the heat energy of the arc terminal being directed along the line where the cut is desired. Graphite or carbon electrodes are usually employed for this work. In special cases metallic electrodes heavily wrapped with asbestos yarn employing current values higher than normal have been used for cutting, the electrodes being first dipped in water, which forms steam and blows the molten metal away. This method, however, is quite expensive and has been used only to a limited extent by the British Admiralty for cutting deep, small diameter holes in armor plate.

For general cutting work graphite or carbon electrodes are used and current values of 300 amp. to 1,000 amp., depending upon the nature of the work and the cutting speed desired.

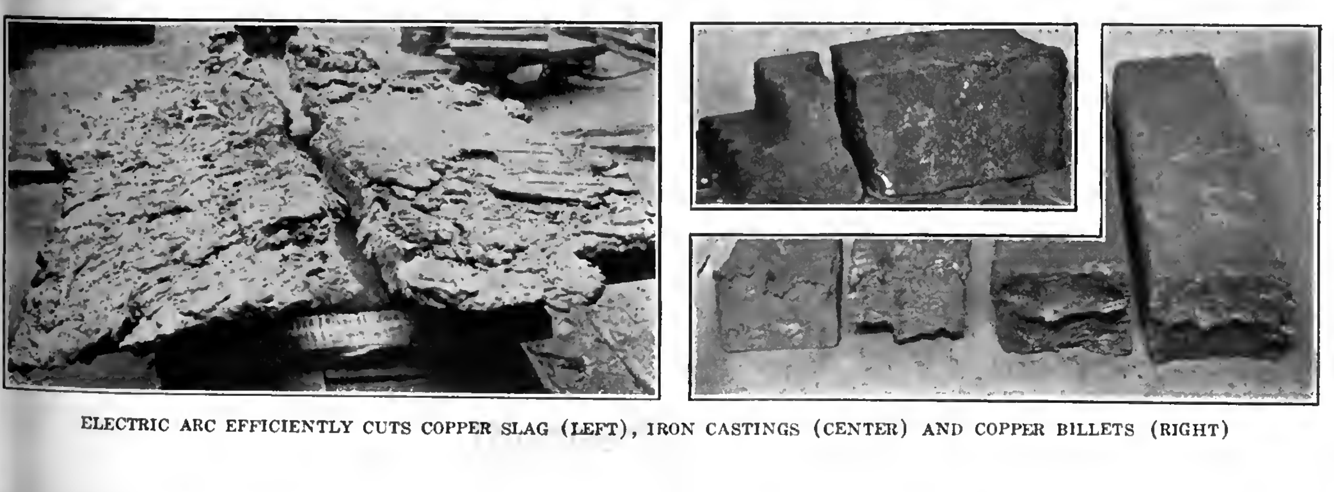
Foundries make use of arc-welding equipment for repairing defective castings and use the same apparatus for cutting off risers and burns from their castings. A riser from a large gray-iron casting was cut through the neck in five minutes' time, using 800 amp., the neck measuring 3 in. x 9 in. The riser was then cut through the main portion, 8 in. x 8 in., in seventeen minutes, using the same current. With labor at 60 cents an hour and electric power at 2 cents a kilowatt-hour for the motor-generator, there would be a cost of 15 cents for cutting the neck and 52 cents for cutting the body of the riser. The speed of cutting castings of several forms is shown in the accompanying curves, using a current of about 600 amp.

Where it is desirable to cut the material to accurate dimensions, it is necessary to lay out a guide line with white lumber crayon which the operator can follow with his arc. It is then possible to make a neat cut in plate steel $\frac{1}{4}$, $\frac{3}{8}$ or $\frac{1}{2}$ in. thick. As an example, a piece of $\frac{1}{4}$-in. plate steel was cut at the rate of 75 ft. per hour, using 450 amp.

Companies will find the arc process by far the cheapest method for cutting rivets and for cutting up steel-plate material into pieces sufficiently small either to be charged directly into the cupola or to be cut up to such size that the pieces may be handled for recutting in a shear. The plate material in these cases is generally heavily covered with paint or rust so that current values of 400 amp. to 600 amp. are frequently used, and in some instances as much as 800 amp. Using this latter current value coal cars have been cut up at an average rate of 75 ft. per hour, an entire coal car being cut up in four hours' time into pieces sufficiently small to be handled by four men who were shearing the material for cutting into charging size. The cost, including labor and power for the motor-generator, was \$6.80.

For cutting the rivets, currents of 400 amp. or 600 amp. are usually used. When using 400 amp., average operators will cut from 1,800 to 2,000 rivets, $\frac{5}{8}$ in. in diameter, per ten-hour day, and some operators will run as high as 2,600 to 3,100 such rivets when the work is on a piece-rate basis. Cutting with the arc is not limited to iron and steel, but can be applied equally well to non-ferrous metals such as brass, bronze and copper. In fact for cutting copper which cannot be cut mechanically the arc process is by far the cheapest to use.

Because of the high thermal capacity and high heat conductivity of copper it is necessary to concentrate the applied heat at a sufficiently high rate to melt the copper before the heat is dissipated in it. To do this cutting effectively it has been found most satisfactory to use a current value of 800 amp. to 1,000 amp.



ELECTRIC ARC EFFICIENTLY CUTS COPPER SLAG (LEFT), IRON CASTINGS (CENTER) AND COPPER BILLETS (RIGHT)

A large piece of copper slag which was originally 6½ ft. wide and 7 ft. long along the central cut had several cuts made. The metal was approximately 1½ in. thick through the sections where the side cuts were made. This was done at a rate of 3½ ft. per hour. The thickness of the metal through the central cut varied from about 1½ in. at the extreme edge to 7 in. at the center of the piece, the average thickness therefore being about 4¼ in. This cut was completed in five hours. A current value of 1,000 amp. was used for all this work The cost on the basis of labor at 60 cents an hour and electric power for the motor-generator at 3 cents a kilowatt-hour is $16.78.

A. M. CANDY,
General Engineering Department.
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

## Safety Entrance Switches with Meter Adapters

INCLOSING service entrances and meter loops has received much consideration during the past year, and many companies which formerly had no specified entrance requirements have adopted some type of combination safety entrance box. The benefits derived from this type of entrance are evident. They include a decrease in fire hazard over open meter loops, the prevention of tampering with the meter as all wires are inclosed and sealed between service brackets and meters, and the improved and more uniform appearance of the meter installations. Companies which have adopted certain types of switches have had minor problems to solve arising from the peculiarities of the type of switch, while others are attempting to solve the same problems before announcing their requirements.

The following questions no doubt have confronted many companies and have led to varied solutions:

1. Will the extensive use of entrance switches and keen competition between manufacturers develop a more practicable switch than is now on the market?
2. Is it good policy to specify one particular type of switch?
3. If a particular make of switch is not specified, will meter installations become a hopeless assortment of different types of boxes, causing much trouble and expense in changing meters and testing and also resulting in the electrical contractors using the cheapest box procurable?
4. Which should furnish the meter adapter, the central station or the consumer?
5. Are testing devices essential, and, if so, who should bear the expense?
6. Should the box be so constructed as to permit the renewal of blown service fuses by the customer without breaking the seal on the box?
7. Has the company a legal right to seal a switch box owned by the consumer?
8. If the service fuses are sealed: (a) Shall the consumer be required to place an additional set of fuses on the load side of the meter, when there is only one circuit in the house? (b) Should the customer or any electrician have permission to break the company's seal to renew service fuses? (c) Who should bear the expense of renewing the service fuses?
9. If the service fuses are accessible to the customer: (a) Will a fire hazard often be created by improper fusing or cutting out of fuses when none are available at the time of blowing? (b) Will the assurance against theft of energy be decreased?
10. What type of fuses shall be specified for the service, plug or N. E. C. standard?
11. Will older types of meters have to be junked for lack of suitable adapters for them?
12. Should the combination entrance box be required on previously wired installations when these are reconnected?
13. Does the expense to both consumer and central station justify the requirement of this type of entrance?

In adopting a standard entrance box it is essential that the box be rugged in construction, simple in operation, plainly designating the "off" and "on" positions of the switch, equipped with some device which will facilitate testing without removing wires from the load side of meter, and at the same time afford means of supplying electricity to the premises by conveniently shunting the meter. If more than one box is approved, the meter adapters should be interchangeable, or else difficulty will be encountered in changing the type of meter at an installation where the type of box is not the same. It will also cause an undue investment on account of having to carry in stock an assortment of adapters for each box.

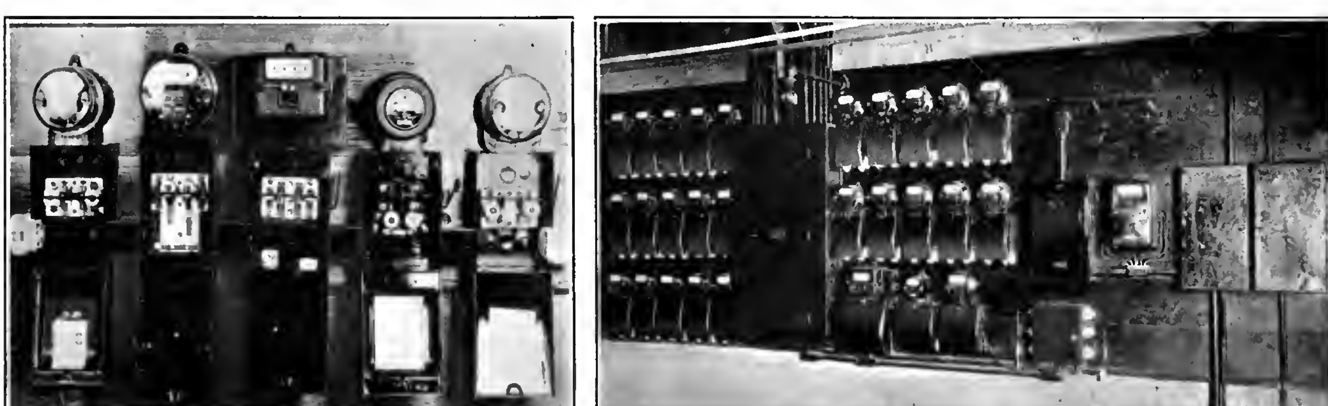
It seems plausible that sooner or later some standard specifications in the manufacture of these boxes must be adhered to, and it is up to the central stations to specify this standard and avoid the use of the irregular designs before their lines are crowded with boxes which will eventually be objectionable. A good combination box is an asset to both the consumer and the central station, but a poorly made and designed meter entrance box is far worse than none at all.

W. C. DEVIN,
Meter Department.
Chester Valley Electric Company, Coatesville, Pa.

## Repainting Towers with Conductors Alive

OWING to the fact that the Tennessee Electric Power Company has no loops or duplicate circuits in most parts of its system, it is repainting its black-steel towers while the circuits are "alive." Around the conductors and in the other hazardous portions of the tower this is being accomplished by using paint brushes attached to insulating wood poles like those used in live-line insulator changing.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.



METER ENTRANCE BOXES MUST BE RUGGED AND PROVIDE SUITABLE MEANS FOR SHUNTING AND TESTING

# The Stoker Problem Discussed from an Operating Viewpoint*

THE mechanical stoker regarded as a unit is one of the most reliable pieces of apparatus in station equipment provided that it is worked continuously and is operated and maintained intelligently. This statement is qualified because it is felt that there is room for improvement in design to provide against undue depreciation of the stoker while in a banked condition and to insure that it is not put out of commission during the banked period or while bringing it from "banked" to "steaming."

With regard to the subject of maintenance, there is still a chance for further improvement. Particular reference is made to those parts on the stoker where the wear is greatest, emphasizing that the construction be made so that these parts can be renewed separately.

In discussing the efficiency of the stoker the auxiliaries which the stoker imposes are also included. If inefficient auxiliaries are required, then the use of them must be charged up against the stoker.

### Factors Controlling Efficiency of Stokers

In using the stoker efficiently the operator is bound by limitations of design over which he has no control. He has a definite load to maintain, and if this is maintained efficiently, a definite amount of coal is required. The size and distribution of the air holes in the grates and the grate area are fixed quantities for the operator. These two items should be so accounted for in the design that, for continuous operation at uniform rates, a fuel bed can be maintained of such shape and thickness that the proper amount of air will pass for the efficient burning of the coal and that the coal will approach 100 per cent combustion before reaching the grinder pit.

It is realized that the designer cannot design the furnace to meet uniform conditions of service and at the same time produce a furnace for wide and rapid change in the rate of forcing without some sacrifice of efficiency. However, the design should be such that the change can be made without undue throwing of the coal by the air, so that the contour of the fuel bed may be brought back to give efficient operation.

*Extract from an address before the Stoker Manufacturers' Association.

It is generally conceded now that it is not feasible to operate the clinker-removal system continuously in synchronism with the stoker drive but that it is better to adopt a policy of intermittent operation in order to allow for variations of ash content in the coal and for the different rates of forcing the stoker. There is one objection to this method of operation: As the grinder always removes the refuse faster than it is made, the responsibility for keeping the clinker grinder from burning out is left to the operator. Hence it has been found desirable to speed the grinder up to a point where it is only necessary to operate it a few minutes out of each hour.

### Design of Clinker Crushers Claimed to Be Wrong

A fallacy in design that has done more to discredit the clinker grinder than any one other thing is the usual shape of the grinder pit. When the coal reaches the clinker pit it is nearly all ash, and there is then very little decrease in volume. However, almost invariably the clinker pits are designed with decreasing volume as the ash proceeds on its way. This particular mistake in design is causing a large part of the trouble met with today with clinker grinders.

While discussing the coal feed, it should be pointed out that the same mistake is made as in the grinder pit. Why decrease the size of the hopper as the coal feeds down closer to the ram? Agitation would be needed in few cases if the hopper were properly designed.

If the variable forced-draft fan does not prove possible, other things considered, then a compromise ought to be made by running several fans to a common duct serving several boilers and by arranging to take fans out of operation in order to maintain the desired conditions. By following this method the efficiency will be impaired only when the pressure is not carried at an economical point for the given speed. The delivery of air per fan can be maintained approximately constant and therefore efficiently.

The cost of operation of stokers is affected both by the design and by the method of operation. The admission of air through the brickwork of the side walls and side air boxes has done much to cut down cost of operation as well as maintenance owing to absence of clinkers. The increasing amount of air added above the fire, however, will have to be taken into consideration in the design of the stoker when its use is extended to other parts of the furnace, as is the tendency in new layouts.

The designer of the stoker should do everything that is possible to reduce siftings. The accumulation of siftings not only increases operating cost because of the labor of removing but also by the moral effect on men working in untidy surroundings.

With the improved method of operation and the improvements in the design of the stoker that have been made, the labor of operation has been reduced to a minimum, and today 60,000 kw. is being produced with three men, two of these being rated as water tenders and stoker operators and the other as greaser and oiler and general utility man. The stoker has been brought today to a degree of perfection where there is no advantage from the labor standpoint in burning oil.

### Heating Feed Water by Bleeding Main Turbine Units

Perhaps it would not be out of place to speculate on changes in stoker design which will have to be made in the future in order to keep pace with changes of methods in other parts of the plant. The particular thought in mind is the change of sentiment with regard to the source of heat for feed water. The latest ideas on the subject among engineers who have made a study of this problem is to bleed heat from one or more of the stages of the main turbine in addition to what may be obtained from steam auxiliaries and house-turbine sets.

This method is making the installation of economizers harder to justify in large power plants. The heat from the flue gases, however, cannot be wasted; therefore preheaters will be forced into use, and apparatus for this purpose, which is now effectively in use abroad, will undoubtedly be introduced into this country. When this becomes an accomplished fact and air is being delivered to the boiler at 200 deg. or 300 deg. F., there will be need for redesigning grate air-flow passages to meet the new requirements in order to maintain the present good results in maintenance.

R. E. DILLON,
Assistant Superintendent Generating Department.
Edison Electric Illuminating Company,
Boston, Mass.

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## Hazards of Amateur Radio Antenna

THE sub-committee on radio of the accident prevention committee of the National Electric Light Association, has recently reported on twelve fatal accidents caused by radio enthusiasts coming into contact with light and power circuits when installing aërials or working with radio conductors. The committee calls attention to installations being made by youngsters and laymen which were heretofore made only by experienced linemen.

A serious aspect of the situation is the fact that the accidents are due entirely to ignorance and are of a character which regulation cannot reach because the damage is done before the authorities who must administer regulatory measures are aware of what is going on. Court penalties are therefore ineffective. The committee has called attention to some of the educational work done by central stations in sending out bill stickers and by the use of newspaper advertising, talks to school children and in some cases warnings and information broadcast over the radiophone itself. The following points have been compiled by the committee from data used by a number of companies in such educational work:

Never pick up a wire lying on the ground or dangling from a pole. The wire might be alive, that is, charged with electricity to a dangerous degree. Report fallen wires immediately to the police department or power company.

Never climb a pole to which wires are attached. They might be in contact with high-voltage wires and consequently dangerous.

Never string wireless aërials over or under any other wires. Should these two sets of wires come in contact with each other, the aërials might become dangerously charged.

Never attach radio aërials or anything else to poles carrying wires of any sort. Accidental contact with live wires may cause injury or death or bring about fires.

Always attach aërials to substantial supports so located that if either the support or aërial wire breaks it cannot come in contact with other wires.

Remember that it is quite practical to operate a radio set with an indoor aërial.

Do not use kite aërials.

Do not attach antennas to chimneys. Chimneys were not designed for such purposes, and you might be down below when the bricks start falling.

In the interest of public safety the company is forced to forbid the attaching of any radio aërials to its poles and to insist that no radio antennas be strung above its power distribution wires.

The committee also made the general recommendations that amateurs should not be allowed to attach aërials to poles or towers carrying electric light or power wires and that surveys should be made and aërials in hazardous locations, insecurely fastened or supported, should be condemned or removed. The central-station companies should co-operate with those installing aërials and when practicable supervise their erection. Indoor aërials are recommended where practicable, and care should be taken to see that storage-battery and rectifier sets are properly installed as to both electrical and fire hazards. It was also recommended that reliable information as to radio hazards and prevention methods should be given adequate publicity. This information should be widely distributed through newspaper men, superintendents of schools, and to the general public by talks, newspaper advertising, stickers on customers' bills and other available means.

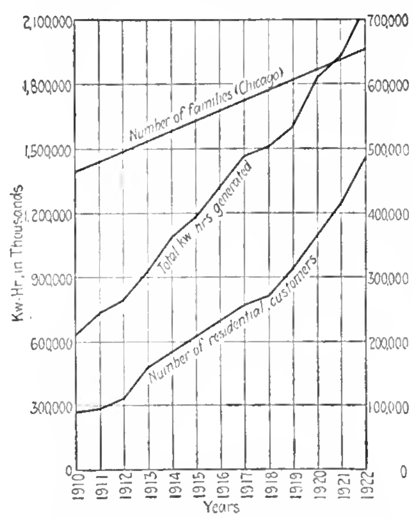
## Boston Edison Forming Boys' Club

TO INTEREST boys of ten to sixteen years who are related to its employees, the Edison Electric Illuminating Company of Boston is forming an "Edison Light Boys' Booster Club," under the direction of L. D. Gibbs, superintendent of the advertising department. A letter has been sent to all of the company's employees with the object of ascertaining the probable field of activity to bring the rising generation into closer contact with the business of producing and supplying electricity. It is expected to develop a self-governing organization and to include visits to plants and other "doings" of interest to boys in the company "family."

## Twelve Years' Growth of Electric Service

THE accompanying diagram shows graphically how the number of residential customers on the lines of the Commonwealth Edison Company in Chicago has increased during the last twelve years. This increase has been much more rapid than the increase in the number of new families in the city.

Since 1910 the number of families




INCREASES IN CUSTOMERS, NUMBER OF FAMILIES AND KILOWATT-HOUR SALES

has increased less than one-half, while the number of residential customers of the Edison company has increased over four times. The chart shows that the territory is far from the saturation point as there are still about 157,000 families in Chicago who are not now being supplied with electricity. This fact provides a large field for expansion of the company's business.

In addition, commercial and large industrial users of electricity are constantly being added as customers. One of the greatest factors in increased business of the company, as reflected in the curve showing kilowatt-hour sales, is the increased use of electricity by the existing customers. The home is rapidly becoming electrified, greatly relieving the housewife of physical labors, and electricity is being put to more widely diversified uses as respects both power and light.

## Installment Bonds Used to Finance Rural Lines

AN INTERESTING method of financing rural extensions is used by the Wisconsin Hydro-Electric Company at Amery, Wis. A separately formed construction company builds the lines, for which it receives payment from the central station in installment bonds having a face value of $500 each payable in twenty-five annual installments of $20 each. The annual payments cover both principal and interest.

The construction company has the privilege of selling the bonds to prospective customers on a rural-service line at $300 each. The plan is to sell a sufficient number of bonds to cover the entire expense of the extension for any given group of consumers. The $200 in addition to the purchase price covers the item of interest over the period of twenty-five years. The actual working out of the payment plan is shown in the accompanying table. Column 1 shows the bondholder's investment year by year as the installments are paid. Column 2 is the interest on the actual investment each year at 5.13 per cent. Columns 3 and 4 show the payments made yearly on principal and interest and make up the $20 yearly installment payment shown in the last column.

The contract with a prospective consumer is made contingent upon the ability of the Wisconsin Hydro-Electric Company to make similar contracts with a sufficient number of consumers to justify the extension from a revenue standpoint. The customer agrees to take service for a period of five years at rates that may now or hereafter be established as reasonable by the Wisconsin Commission. Following is the form of contract used:

CUSTOMER'S INVESTMENT IN INSTALLMENT BONDS WITH COMPUTED INTEREST RATE AND YEARLY PAYMENTS ON PRINCIPAL AND INTEREST

| Year | Customer's Investment | Return at 5.13 per Cent | Annual Installment Payment on Investment | Interest | Total Annual Payment |
|---|---|---|---|---|---|
| 1st... | $300.00 | $15.39 | $12.00 | $8.00 | $20.00 |
| 2nd.... | 238.00 | 14.77 | 12.00 | 8.00 | 20.00 |
| 3rd.... | 276.00 | 14.15 | 12.00 | 8.00 | 20.00 |
| 4th.... | 264.00 | 13.54 | 12.00 | 8.00 | 20.00 |
| 5th.... | 252.00 | 12.92 | 12.00 | 8.00 | 20.00 |
| 6th.... | 240.00 | 12.31 | 12.00 | 8.00 | 20.00 |
| 7th.... | 228.00 | 11.69 | 12.00 | 8.00 | 20.00 |
| 8th.... | 216.00 | 11.08 | 12.00 | 8.00 | 20.00 |
| 9th.... | 204.00 | 10.46 | 12.00 | 8.00 | 20.00 |
| 10th... | 192.00 | 9.85 | 12.00 | 8.00 | 20.00 |
| 11th... | 180.00 | 9.23 | 12.00 | 8.00 | 20.00 |
| 12th... | 168.00 | 8.61 | 12.00 | 8.00 | 20.00 |
| 13th... | 156.00 | 8.00 | 12.00 | 8.00 | 20.00 |
| 14th... | 144.00 | 7.38 | 12.00 | 8.00 | 20.00 |
| 15th... | 132.00 | 6.77 | 12.00 | 8.00 | 20.00 |
| 16th... | 120.00 | 6.15 | 12.00 | 8.00 | 20.00 |
| 17th... | 108.00 | 5.54 | 12.00 | 8.00 | 20.00 |
| 18th... | 96.00 | 4.92 | 12.00 | 8.00 | 20.00 |
| 19th... | 84.00 | 4.31 | 12.00 | 8.00 | 20.00 |
| 20th... | 72.00 | 3.69 | 12.00 | 8.00 | 20.00 |
| 21st... | 60.00 | 3.08 | 12.00 | 8.00 | 20.00 |
| 22nd.... | 48.00 | 2.46 | 12.00 | 8.00 | 20.00 |
| 23rd.. | 36.00 | 1.05 | 12.00 | 8.00 | 20.00 |
| 24th... | 24.00 | 1.23 | 12.00 | 8.00 | 20.00 |
| 25th... | 12.00 | .62 | 12.00 | 8.00 | 20.00 |
| | | $200.00 | $300.00 | $200.00 | $500.00 |

APPLICATION AND AGREEMENT FOR RURAL ELECTRIC SERVICE

Whereas the undersigned,.............. hereinafter called "the customer," desires to obtain electric service for use on........ farm, located on the..........side of the highway and on the..........of Section........, Township.........North, Range.......West, in...........County, Wisconsin, and

Whereas the Wisconsin Hydro-Electric Company of Amery, Wisconsin, hereinafter called "the company," is engaged in the business of generating, transmitting, and supplying electric energy to the public for general use, and is contemplating the extension of service in Barron and adjoining counties, and

Whereas the Amery Construction and Supply Company of Amery, Wisconsin, hereinafter called "the construction company," is in the business of constructing and contracting, and desires to obtain a contract from the company to construct the said proposed extensions, and the company has proposed to the construction company, to employ it to construct said extension and to pay it in installment bonds of the said company for the total sum of principal and interest of five hundred dollars each, payable in twenty-five annual installments of twenty dollars each, beginning on the first day of January, 1923, and thereafter annually, until paid, said annual installments to be in lieu of both principal and interest with the privilege of said construction company selling said bonds to prospective customers along said extension, for the sum of three hundred dollars each, and soliciting contracts similar to these presents, and

Whereas the customer subscribing hereto firmly believes that there are many others along the highway leading from the company's high-tension electric system at.... .....of Section.........., Township..... ....North, Range..........West, past the customer's farm and to................. in the County of.............., Wisconsin, who are also desirous of obtaining electric service, and who will sign a contract similar to these presents, in the aggregate to warrant the construction of such extension and to insure a reasonable return to the company on its investment, the customer therefore hereby authorizes the company to proceed with the construction of an electric extension that will supply............with single-phase, alternating-current electric service, at 115 and 230 volts, 60 cycles, delivered to and connected with the customer's nearest building on the premises above described, nearest to the company's transmission line; as soon as, in its judgment, sufficient applications and agreements similar to these presents have been obtained to warrant the construction thereof, and to insure the company a reasonable return upon its investment, it being understood that unless such sufficient agreements are obtained within one year from date hereof, then this contract shall be void; it being further understood that all cost of furnishing and constructing the transmission line along the highway and the branch line from the highway to the customer's nearest building and including transformer, lightning arresters, meters and all other equipment up to the meter, are to be paid for and thereafter to be maintained by the company so long as the customer desires service; all wiring beyond the company's physical connection to the customer's nearest building is to be provided by the customer at..................expense.

In consideration of the construction company and the company soliciting and being able to obtain a sufficient number of applications and agreements, in the company's judgment, to warrant it in constructing the electric extension applied for, and in consideration of the construction company entering into a contract with the company to construct the said extension, and to accept in payment thereof the bonds of the company above mentioned, the customer hereby agrees to take over and purchase from the construction company.... ..........of said installment bonds in the sum of principal and interest of five hundred dollars each, and to pay the construction company for the same the sum of three hundred dollars for each of said five hundred dollar bonds, one of said bonds to be accepted and paid for when the poles for said extension have been distributed out as far as the customer's premises; and an additional............of said bonds to be accepted and paid for upon the completion of said line and when it is energized for use of the customer.

In consideration of the premises, and of the company constructing the lines applied for, the customer hereby further agrees to give the company free use of right-of-way across any of his lands along the route taken for said electric line and extensions, together with permission to trim any trees, so that they will clear the wires and equipment of the company at least fifteen feet, on any property owned by............

The customer,.........successors, heirs, or assigns, further agree to take and pay the company for electric service for a period of at least five years beginning not later than sixty days from the time said lines are energized by the company at such reasonable rates and charges for rural service and energy as are now, or may hereafter be, established by the Railroad Commission of Wisconsin.

It is understood and agreed by the customer, and also by the company and the construction company, that this application and agreement, when duly signed by them, is a binding agreement, and in the event that sufficient similar agreements are obtained within one year to warrant the company, in its judgment, to make said extension, this agreement shall not be subject to cancellation or revocation.

## An Unbiased Criticism of Municipal Ownership

SELDOM is it possible to find an expression concerning municipal ownership which is not tinctured by the prejudices of one side or the other. For that reason an editorial, "The Power-Plant Issue," appearing in the Aberdeen (Wash.) *Daily World* of Feb. 15 is particularly refreshing. It deals with the taxation on the income of the municipal plants in Seattle and Tacoma for service which they propose to render by extending their lines beyond the corporate limits of those cities. In an impartial manner the editorial questions the efficiency of municipal operation and points out the unfairness of competition between the tax-exempt plant and the privately owned company. It further emphasizes the fact that after all the public pays the freight, for it must make up, through increased taxation, the loss sustained by the removal of city-owned property from the tax rolls. The editorial reads:

Seattle and Tacoma, in both of which the power plants are municipally owned, desire to sell power outside their city limits. The Legislature, so far as present proceedings go, thinks that if they are permitted to do so, they should be taxed for the privilege. The proposal is that they shall pay the state a tax on earnings. Objection is made to this on the ground that municipal enterprises ought to be tax-free, that in return for tax exemption they provide the people with cheaper power.

But there is another side. If these power plants were not municipally owned, they would be privately owned

and the private owners would pay taxes on the property. The transfer of these plants to municipal ownership simply means that that much property has been taken from the tax rolls. If the state goes on doing that sort of thing, private enterprise will be driven out, along with the taxes private enterprise pays. That is the aim in certain quarters. But even if it is achieved the state will still need revenue. It will get it in one way or another. The people will pay it. There is no other outcome. There can be no system of taxation that will make one certain class pay all the expenses of government with the majority exempt.

The question involved in this power issue is whether the municipally owned plant is entitled to a tax advantage over the private enterprise. If the private enterprise were not subject to state regulation, which it is; if its earnings were not limited by the state, as they are, and if its service were not controlled under the law, the municipal plant would be entitled, perhaps, to state aid, which is what a tax exemption amounts to. But since the state assumes power over the private enterprise and practically takes charge of it, why should the municipal plant be tax exempt? If it is to survive, it must do all the things that private enterprise is supposed to do and do them just as well. It should have no advantage.

In going outside their own domains Seattle and Tacoma ought to stand on the same basis as any other purveyor of power. Why not? Communities outside Seattle and Tacoma are not concerned with the success of the Seattle or Tacoma power plants, which were designed in the first place to serve the people of those two cities. That is their sole function. With that the people of the state have no concern. But the state is not entitled to give these cities a subsidy in the shape of tax exemption so that they can sell their surplus power outside their city limits. That is especially true when other power concerns stand ready to furnish the service the Seattle and Tacoma city plants want to furnish.

These city-owned plants enter the outside field under the advantage of no taxes at home. They ought to be able to sell power cheaper than other companies, which contribute to the support of the state, without asking a further subsidy from the public. They ought to be able to undersell the private company even with a 5 per cent earnings tax. If they cannot, and it appears they think they cannot then it must be that public control and management of business enterprise is neither so efficient nor so economical as private operation. And that is the truth. The public enterprise, with every advantage on its side, cannot compete with the private enterprise. It never has in this country, and chances are it never will. In order to maintain it at all, the people must pay. But their concern ought to be to get power as cheaply as possible and service as good as possible. Why should they subsidize municipal plants when they can get power as cheap without the subsidy? Why should they care where the power comes from so long as their needs are met at a reasonable price? And why should they dig down in their pockets to pay the taxes the municipally owned plants of Seattle and Tacoma should pay?

Tax exemption as enjoyed by municipally owned utilities is the "ace in the hole" whereby their advocates have been able to show an apparent saving over the privately owned company. How much importance municipal authorities attach to this form of special privilege is indicated by objections raised by Seattle and Tacoma to payment to the state of a tax on earnings which would accrue to them if they extend their lines beyond the city limits.

## Portable Exhibit Displays Better Window Lighting

TO EDUCATE the merchants of the state to the advantages of better window lighting and higher intensities of illumination, the California Electrical Co-operative Campaign is using the portable window-lighting exhibit shown in the accompanying illustration. The window is a model in every respect, with equipment of the latest design. It has been made large enough to accommodate a good-sized display and is provided with three types of fixtures used to give low, medium or high intensity of illumination. Daylight lamps with which it is possible to obtain an intensity of approximately 100 foot-candles are used.

PORTABLE WINDOW-LIGHTING EXHIBIT BEING SHOWN THROUGHOUT CALIFORNIA

The display is being shown by the electric clubs of the state at special merchants' day programs which the clubs have arranged. The trimming of the window is done by an experienced window trimmer supplied by some one of the merchants of the city, and the display is in charge of a special demonstrator. The chart shown at the right in the picture gives the results of the survey made in Cleveland last year to determine the relative drawing power of show windows with various kinds of displays and different intensities.

## A Bonus Plan to Increase Appliance Sales

TO CREATE and maintain interest in the sale of merchandise, the Pacific Power & Light Company, Portland, Ore., has adopted a plan of merchandising bonuses for employees which became effective the first of the year. In the past the company has achieved good results during periods of campaigns, but it was not practicable to increase the yearly volume of sales to a satisfactory amount by one or two successful campaigns a year. The company operates in eighteen districts in three states — Oregon, Washington and Idaho—and it is expected that the plan will bring about continuous selling effort throughout the year. A brief outline of the bonus plan and average sales during the past six years is interesting.

The amount of the bonus accruing to any district will be a fixed percentage of the merchandise sold in that district. To each district a yearly and quarterly sales quota is given, based on the number and classification of customers served. The bonus money will be distributed quarterly, and in order to qualify the district sales must equal or exceed the quota assigned for the period. The quarterly bonus will amount to 2 per cent of the gross sales, in addition to which 1 per cent will be paid at the end of the year on the amount by which the yearly quota has been exceeded. Provided each quarterly quota is reached, this would mean 2 per cent on the yearly quota and 3 per cent on all over that figure.

The quotas for the districts have been placed much lower than the anticipated sales in 1923, and every district is expected to be able to exceed its quota by a comfortable margin.

It is interesting to note how the quotas given the districts compare with the average yearly sales for the past six years, during which time the Northwest has experienced a variety of business conditions. The tabulation shows the relation between average yearly sales for six years and the quota assigned for 1923.

AVERAGE YEARLY APPLIANCE SALES DURING LAST SIX YEARS

| District | Per Cent of 1923 Quota | District | Per Cent of 1923 Quota |
|---|---|---|---|
| Astoria | 113 | Prosser | 224 |
| Dayton-Waitsburg | 105 | Seaside | 97 |
| Goldendale | 183 | Sunnyside | 86 |
| Hood River | 91 | The Dalles | 88 |
| Kennewick | 182 | Toppenish | 105 |
| Pasco | 100 | Walla Walla | 80 |
| Lewiston | 130 | White Salmon | 157 |
| Pendleton | 90 | Yakima | 107 |
| Pomeroy | 165 | Vancouver | 120 |

It will be seen that in twelve of the eighteen districts the average yearly sales equaled or greatly exceeded the quota established for 1923. No district failed to sell less than 80 per cent of the 1923 bogey. Taking each year's sales separately, it is found that in 1917 thirteen districts exceeded their quota, in 1918 eleven districts exceeded their quota and in 1919 every district went over the mark set. In 1920 all but two districts sold more than the quota allotted to them, and in 1921, the poorest year experienced in the sale of merchandise, six districts exceeded their quota, while in 1922 the number was increased to ten.

## Observance of Safety Rules Rewarded by Extra Vacation

EMPLOYEES of the Dallas (Tex.) Power & Light Company engaged in hazardous work who go the entire year without personal injury will be allowed extended time on their vacations as a reward. The announcement of this policy was made by C. E. Gill, vice-president and assistant general manager, at the annual safety meeting of the employees. C. E. Calder, president of the company, addressed the men and paid high tribute to the work of the engineering, construction, organization, distribution and operating departments, which, by adoption of safety methods, have materially reduced the number of accidents and time lost on this account. As an additional incentive to observe safety rules, the sixteen crews in the distribution department will compete in a contest for the best record in the application of safety rules and practices, and suitable rewards will be given members of the winning team.

## "Quality" Merchandising by the Central Station

RELIANCE of the public upon the word of the central-station company has long been a potent factor in the growth of appliance sales. That the great majority of central stations are rendering a good account of their stewardship is reason for congratulation within the industry. The accompanying rather unusual advertisement throws a light upon the pursuit of quality merchandise by one of the Tenney companies in Massachusetts and shows the value of testing appliances before putting them upon the sales floor.

**Here's a strange advertisement**

*It tells about an article we'll never sell you*

A manufacturer of household appliances was very anxious to have us sell his electric iron.
We submitted his iron to tests in our laboratory. It was satisfactory in many respects. But—we quote the laboratory report—
"The nickel plating is insufficient to prevent the surface from rusting."
So that's why we'll never offer that iron for sale. You can't buy it from us.
Our business depends on your satisfaction. We take care to offer only such articles as give true value and efficient service.

**Suburban Gas & Electric Company**

C. F. Chisholm, Mgr.

**Telephone Revere 145 or Ocean 254**

## What Other Companies Are Doing

**Hartford, Conn.** — The appliance department of the Hartford Electric Light Company in 1922 had a very successful year, passing its bogey of 10,000 sales by 247. Following are the numbers of the principal appliances sold: 4,034 flat irons, 1,124 cleaners, 1,061 portable lamps, 834 radiators, 589 toasters, 271 percolators, 244 washers, 299 heating pads, 44 electric ranges.

**Springfield, Ill.**—The Central Illinois Public Service Company sold 18,763 shares of its preferred stock in its own territory during the year 1922. This is 300 per cent greater than the sales for any previous year. The company's stockholders increased in number from 2,355 to 4,541. In addition, there were at the end of the year, on account of these and other sales, 5,643 subscribers for stock on the partial payment plan. A total of 993 employees sold one or more shares each during 1922. The company had at the close of the year stockholders and subscribers for stock in the ratio of one for less than nine electric customers served.

**Malden, Mass.** — In a recent house-wiring campaign under the auspices of the Malden Electric Company the owner of fifty-four dwellings authorized the minimum installation of three floor outlets per home, which formed the basis of the development of business under central-station and contractor-dealer auspices. Tenants were left free to expand the initial installation and in many parts of the company's territory the three-outlet initial installation was regarded as only a starting point by the local public.

**Texas.** — The Texas Power & Light Company recently completed the reconstruction of its offices at Denison, Taylor and Sweetwater to provide the best possible accommodations for customers both for routine transactions and for the merchandising of appliances. In the case of the Denison office the company arranged to move from a side street to a site in the center of the business section. The office chosen was completely renovated and arranged for the attractive display of electrical merchandise. G. B. Richardson, the company's merchandise sales manager, argues that every customer who comes in to pay a bill is a possible purchaser of energy consuming appliances and that facilities should be provided for their careful inspection.

**Astoria, Ore.**—At the recent meetings of the Commercial Section of the N. E. L. A. at Denver John V. Strange of the Pacific Power & Light Company of Portland, Ore., brought out an interesting condition with regard to electric bake ovens as a result of the fire which recently destroyed the business section of Astoria. The company supplies both gas and electric service in the city, and, desiring to retain as much gas business as possible in the reconstruction after the fire, gas rates for industrial uses were reduced to below pre-war rates. In spite of this fact every commercial bake oven which will be installed will be an electric oven.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Design of Structural Supports for Turbo-Generators.*—The relative merits of the three common types of foundations or pedestals for steam-turbine units—that is, reinforced concrete, structural steel and composite construction, are discussed in this paper, which was presented by E. H. Cameron before the American Society of Civil Engineers on Dec. 20. The restraint of vibration, provision for repair of auxiliaries and restrictions of deflections should be the controlling factors of the design. The author suggests that the basis of comparison in deciding on a type of pedestal for a turbo-generator installation should be solely utility or fitness, rather than relative cost.—*Power*, Jan. 23, 1923.

*Water Developments on the St. Lawrence River.* — NEWTON FUESSLE. — A general discussion of the hydro-electric development that is being considered on the St. Lawrence River. Virtually 5,400,000 hp. is available and if totally developed it would save 54,000,000 tons of coal each year. The article was written following an interview with Hugh L. Cooper on the subject.—*Outlook*, Jan. 31, 1923.

*Modern Jet Condensers in Small Lighting Plants.*—R. E. HELLMER.—Condensing equipment is essential to the economical operation of a steam-power plant. There are two classes of condensers, namely, surface and jet types. The question as to which is the better type to employ in a particular power plant should be determined wholly by the operating conditions that exist at the plant. The author describes a variety of installations using the jet type of condenser, particularly small power plants.—*General Electric Review*, January, 1923.

## Generation, Control and Switching

*Voltage Maintenance on Direct-Current Systems.*—P. J. ROBINSON.—The problem of maintaining a constant voltage over a network and keeping down costs has resulted in the installation at Liverpool of an automatic substation. The equipment of the station includes one 500-kw. rotary converter, coupled through a transformer to a 6,000-volt, three-phase, 50-cycle supply on one side and to a three-wire, 460-volt direct-current circuit on the other. An electrically operated oil switch with an alternating-current closing coil is used to control the rotary converter. Other apparatus includes a three-phase transformer for the various instruments, isolating switches, a low-tension direct-current panel for the rotary converter, low-tension feeder panels for control of the four three-wire feeders, etc.—*Paper presented before the Institution of (British) Electrical Engineers*, Feb. 1, 1923.

*Remote Supervisory Control.*—J. L. McCOY. — The author describes a method by which there are transmitted a series of low-frequency impulses which are interpreted by electromechanical apparatus at the receiving end of a system, thus enabling a load dispatcher at all times to control the system. When initiated these impulses cause the actual operation at remote points. The receiving apparatus in such cases translate the series of impulses directly into an operating impulse, performing the desired switching operation.—*Electric Journal*, February, 1923.

## Transmission, Substations and Distribution

*Transformer Designed to Conserve the Oil and Eliminate Explosions.*—W. M. DANN.—On account of the number of explosions of serious nature in power transformers a new type of transformer has been designed for the prevention of disasters. The author first considers the conditions producing explosions and then describes the transformer, in which inert gas such as nitrogen is employed over the oil or in an expansion tank. A compartment containing a deoxidizing material is mounted on the wall of the tank and is connected to the nitrogen space by means of pipes. Within this compartment is a valve which by means of a mercury seal isolates the nitrogen body from the atmosphere within certain predetermined limits. A dehydrator is placed in the connections between the deoxidizing compartment and the gas space to remove all traces of moisture from the ingoing gas.—*Electric Journal*, February, 1923.

*Predetermination of the Heating of Self-Cooled Transformers.* — R. KÜCHLER.—The author develops formulas for the calculation of the heating of tanks, cores and windings of core-type, oil-immersed, self-cooled transformers. Tested on fourteen standard transformers of well-known make, the different formulas come in 60 per cent of the cases within about one degree of the observed value. In the remaining cases considerable discrepancies occur, but the author ascribes these to measuring inaccuracies. — *Elektrotechnische Zeitschrift*, Jan. 18, 1923.

*The Lead-Cable Borer in California.*—H. E. BURKE, R. D. HARTMAN and T. E. SNYDER.—Experiments indicate that the cable-borer beetle is able to penetrate any lead alloy used as a cable sheathing or any poison or repellent placed on the sheathing. The greatest damage done by these beetles is to the lead sheathing of telephone cables in California. The extensive report gives a review of the injury done throughout the world to metals by boring insects, damage by the California lead-cable borer to trees and forest products, a history of the beetle and an account of the investigations.—*Bulletin No.* 1107 *of the United States Department of Agriculture.*

## Units, Measurements and Instruments

*Spectro-Photo-Electrical Sensitivity of Some Halide Salts of Thallium, Lead and Silver.*—W. W. COBLENTZ and J. F. ECKFORD.—This paper narrates the results of a study of the effect of crystal structure, chemical constitution and atomic weight upon spectro-photo-electrical sensitivity. It was found that the photo-electrical reaction on the above salts is confined to a very narrow region of the violet end of the spectra, being the narrowest and most sharply defined electrical spectrum of all substances yet investigated.—*Scientific Paper No.* 456 *of the Bureau of Standards.*

*Apparatus for Calibrating Alternating-Current Meters.*—W. SKIRL.—In calibrating alternating-current meters it is customary to provide a separate current and voltage circuit. Aside from a decided saving in current, this method permits an easy and independent regulation of current, voltage and phase displacement. Special transformers are described to regulate current and voltage in a great number of fine steps from zero up to the full meter rating. Motor-generator sets with one rigid and one adjustable stator are described which serve to obtain any desired phase displacement. The author describes some actually built single and three-phase testing switchboards and gives their complete wiring diagrams.—*Siemens Zeitschrift*, December, 1922.

## Motors and Control

*Direct Current.*—O. POLLOK.—The author shows that while for high-tension transmission three-phase alternating currents are beyond dispute the best system, transformation into direct current for motor drives has many and valuable advantages over the use of three-phase motors. The necessary small air gap of induction motors, the lack of speed regulation, the very poor power factor at low or no load, their straight motor character without the possibility of generative braking, the 50 per cent larger number of starter contacts and connections, are all decided disadvantages as compared with the direct-current motor. The latter has been much improved with the introduction of commutating poles, and the usual troubles with the commutator do not exist with well-made, modern direct-current motors. For the drive of tool machines, if three-phase motors are

used, a large number of gears, gear cases, friction clutches, fly wheels, etc., are usually required, in order to obtain the necessary number of speeds. As an example, a milling-machine drive is shown with twenty-four gears, six shafts, two clutches and four operating levers, which give sixteen different speeds from 5.5 r.p.m. to 200 r.p.m. of the spindle. A similar drive, equipped with a variable-speed direct-current motor, contains only nine gears, two shafts and two levers and gives 120 speeds between 5.5 r.p.m. and 200 r.p.m. of the spindle. The drive of a 3-ton crane is mentioned where a 22½-hp. direct-current motor gave the same hourly lifting output as a 45-hp. three-phase motor, the latter consuming 40 per cent more watt-hours. A saving in current of from 35 per cent to 40 per cent can be realized by driving feeding rolls on blooming mills with direct-current motors instead of induction motors, aside from the much simpler controlling apparatus for direct-current motors. It is emphasized that the safety of a drive depends not only upon the reliability of the motor itself, but also upon that of the necessary control apparatus, which is much greater for a two-wire direct-current system.—*Elektrotechnische Zeitschrift*, Jan. 11, 1923.

## Illumination

*Adequate Street Lighting a Municipal Necessity.*—F. M. REAST.—Effective lighting for streets and highways is of the utmost importance to every town and city. Based on a recent report of 3,223 fatalities which occurred during the hours of darkness in a large number of cities in the United States, it was found that 15.6 per cent were directly attributed to lack of sufficient illumination. This indicates very pointedly the conditions that must exist in localities where effective lighting facilities are not available.—*Central Station*, February, 1923.

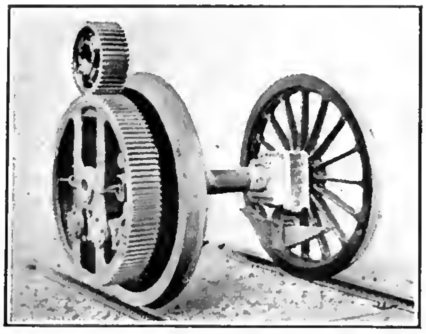
## Electrophysics, Electrochemistry and Batteries

*Preparation and Properties of Pure Iron Alloys.*—W. L. CHENEY.—The author discusses the results of a study of the effect of heat treatment and chemical composition on the magnetic properties of a series of unusually pure iron-carbon alloys ranging from pure iron to 1.6 per cent carbon. Magnetization curves and hysteresis data were taken after each heat treatment and microscopical analysis were made after certain selected heat treatments. The hardened alloys when drawn back to successively higher temperatures showed marked changes in the normal induction, residual induction and coercive force which correspond to transformations of the material. They also showed variations in the maximum intensity of magnetization as computed from the reluctivity relationship. Microscopic analyses confirmed in the majority of cases the fact that the number of values of intensity indicates the number of constitutents present in the material. Variations in the maximum permeability for some alloys show greater differences than other magnetic quantities. Comparing the magnetic properties with the carbon content, there were found certain changes in these properties as the carbon content was increased.—*Scientific Paper No. 463 of the Bureau of Standards.*

*One-Axle Electric Mule.*—D. TRAUTWETTER.—A newly developed electric mule is described which has only one axle, to each end of which is fastened a solid rubber-tired double wheel of about 18-in. diameter. A 3½-hp., 60-volt motor is mounted above the axle and actuates by means of a chain a differential worm drive. On each side of the axle is suspended one half of the 36-kw.-hr. storage battery, which, under normal service conditions, is charged every two days. The mule has a pull of 250 kg. on the wheel circumference, weighs 1,500 kg. and develops a speed of 1 m. per second. The operator walks in front of the vehicle.—*Elektrische Betrieb* (formerly "*Elektrische Kraftbetriebe und Bahnen*"), Jan. 10, 1923.

## Traction

*Individual Axle Drive for Locomotives.*—In the new drive described the motor is between the wheels of the driven shaft and connected to it over a single reduction gear, the large wheel of which is outside of the axle journals. The pinion on the motor is not keyed solidly to the shaft, but contains four intermediate springs. The large gear wheel is connected to the driven axle by a somewhat complicated lever mech-



SET OF LOCOMOBILE DRIVING WHEELS WITH OUTSIDE GEARING

anism, which permits a considerable misalignment between the centers of the gear and the wheel in every direction. Sixteen distinct advantages of this drive are enumerated, and locomotives of the same power output, one with the conventional rod drive, the other with the new drive, are compared. The first locomotive built with this individual axle drive has recently been inspected after running 66,000 miles, and no traces of wear have been noticed, nor was it necessary to make any readjustments.—*Brown-Boveri Mitteilungen*, January, 1923.

*An Analysis of Regenerative Braking on Electric Locomotives.*—C. E. FAIRBURN and F. A. HARPER.—As a result of extended investigations, characteristic curves of locomotives regenerating energy used for braking have been made for the authors. Motor characteristic curves which show the horsepower, tractive effort, speed and efficency plotted against the current input are well known, and the problem of regenerative braking is handled in a similar manner. The mathematical solution of the curves developed is given.—*English Electric Journal*, Vol. II, No. 2.

*New York, London, Paris and Berlin Transit Compared.*—D. L. TURNER.—In the matter of transportation methods a somewhat different condition prevails in this country from that in Europe. Attention is directed to some of these points of difference in a report presented before the New York Transit Commission by the author, who spent some time in Europe studying city transit conditions. One striking point brought out is the far more strict adherence to rules on the part of European crowds. Another point of difference is the better methods used by European railways to give travelers the information they want. This is done in a variety of ways—by signs on the cars, maps in poster form, direction signposts and other methods which make traveling by street car abroad easy for the stranger.—*Electric Railway Journal*, Jan. 13 and Jan. 27, 1923.

## Telegraphy, Telephony, Radio and Signals

*Standardization of Wavemeters.*—A. TSUBOUCHI.—The establishment of an accurate standard wavemeter is based on calculating the inductance and measuring the capacity of a standard wavemeter and computing the wave lengths from these quantities combined. For checking or correcting the wave lengths harmonics drawn from a triode generator are made use of. Thus the range of wave lengths from about 200 m. to about 22,000 m. are covered by the standard wavemeter. In order to cover a wide range of wave lengths a series of eight standard coils of simple forms with larger inductance than that of the square coil has been made. Combining these series of coils and the standard condensers, the required range of the standard wavemeter has been covered.—*Research No. 115 of the Electrotechnical Laboratory*, Tokyo, Japan.

*Permissible Telephones for Coal Mines.*—The Bureau of Mines is prepared at its Pittsburgh experiment station to conduct inspections and tests of telephones designed for use in coal mines. A telephone submitted for permissibility tests is to be so designed and constructed that under no circumstances can its normal operation cause ignition of either dust or gas, or a combination of dust and gas, in the surrounding mine atmospheres. A thorough inspection of the telephone will be made to determine its adequacy and permissibility. Tests will be made to check the electrical characteristics and constants of the various parts, and to determine the adequacy of the insulation and of other parts or features of the apparatus.—*Schedule 9-A of the Bureau of Mines.*

# New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

## Electrical Engineering Laboratory Experiments

By C. W. Ricker and Carlton E. Tucker. New York: McGraw-Hill Book Company. 310 pages, illustrated.

This book is a commendable compilation of the usual laboratory experiments for engineering students. With each experiment is sufficient explanation to guide the student who has not thoroughly studied the theory connected therewith. At the end of each experiment a list of the results required is given, subdivided into several parts. This permits an instructor utilizing the book as a laboratory manual to assign certain parts for a given laboratory period or for a given group of students. Other parts may be entirely omitted or assigned at some other time. Thus the book is adapted to the use of many different types of classes and also indicates to the student the portion of the standard tests which he is not required to perform, leaving no doubt in his mind that he has not mastered the complete field. The list of additional references is very desirable for the student who wishes more information on the subject at hand.

Naturally the laboratory manual must be based on the apparatus available to the student for the performance of the experiment. Although the experiments are of a quite general nature, it is obvious that the writer has in mind perfectly definite apparatus. This is as it should be, and any institution utilizing a book of this nature should keep this fact in mind, making such modifications as may be necessary.

Many institutions prefer the loose-leaf manual of instructions containing little or no theory. Such sheets can be filed with and as a part of the complete report. The advantage of the bound manual is its availability for reference.

R. G. Warner

## The Twelve-Hour Shift in Industry

By the Committee on Work Periods in Continuous Industry of the Federated American Engineering Societies. New York: E. P. Dutton & Company. 302 pages.

The title of this book is a misnomer. It treats chiefly of eight-hour shifts and gives no economic or engineering reasons for changing from the longer to the shorter work period. Such reasons as are vouchsafed are sentimental and humanitarian, and these appear unwieldy instruments in the hands of engineers. Where good management and co-operation of labor prevail a shorter day has proved advantageous; but how much credit is due to management, good relationships, labor-saving devices, etc., and how much to the shorter period of labor, is hard to determine. From 5 to 10 per cent of industrial work is on processes requiring continuous operation, and of the men engaged in such work only one-half to one-third operate on twelve-hour shifts, so that the argument is directed to only a small part of industry. That part comprises the iron and steel works, and there the plea is hardly necessary, because those in authority are already convinced of the necessity of a change to a shorter work period. Judge Gary of the United States Steel Corporation has addressed the presidents of the subsidiary companies on this point as follows: "I am not going to argue in favor of the twelve-hour day. I am opposed to it if and when it can be eliminated, not because I think it is necessarily harmful but largely for the reason that there is more or less public sentiment against it." Public opinion will be more potent in effecting a change than any engineering study, and the present volume can add little in the way of argument and proof to minds already made up upon the desirability of an eight-hour day.

## Rate Making for Public Utilities

By Lamar Lyndon. New York: McGraw-Hill Book Company. 209 pages.

This book is fundamentally a thesis on the question of valuation and rate making for public utilities in which the author expounds and explains—in fact, argues—his analysis of the proper approach to these problems. It cannot be gainsaid that the whole thesis is fair. Of all the various bases of valuation, that which will clearly support the integrity of the honest investment is held to be the most sound on economic, social and ethical grounds. In the treatment of his subject the author indulges in few generalities, but confines his statements and arguments to the various phases and elements of valuation and rate making. There is never any doubt as to what is being talked about or said. In his foreword the author says the book "is not partisan in any respect," but that "at first glance it might appear that this book is antagonistic to the public service corporations." It is not hard, though, to agree with him that "such, however, is not the case," if the public service corporation's real interests are considered.

The author does not hesitate to criticise, and try to educate, both public utility engineers and engineers for the public. He takes a justified fling at engineering experts who "claim that they can tell by inspection how far a plant has depreciated. They can look it over and say, at once and without hesitancy, just what condition it is in, just how much of its life has expired and what its remaining value is, and these statements they can make so surely and definitely that they testify under oath, in court, that these statements are facts and truly so."

There are closing chapters on rate making for gas supply, for electrical supply, for electric railways and for telephone service, in which the individual characteristics of each utility service are carefully analyzed. This is a book which any one who has anything to do with public utility economics, operation, control or criticism should not fail to read. It should do much to prevent divergence between engineers for the public and engineers for the public utility.

H. V. Bozell.

## Freileitungsbau Ortsnetzbau

By F. Kapper. Third edition. 368 pages, 364 illustrations, 2 plates and 53 tabulations. Munich and Berlin: R. Oldenbourg.

The fact that this book has had three editions within seven years well bespeaks its popularity. The author covers the vast subject of dimensioning and installing of main and distribution lines in a comprehensive and simple manner, interspersing constantly actual examples of existing lines and network. A great many valuable working drawings are included in the text, such, for example, as steel-tower constructions for long-distance spans. The use of survey instruments and methods for the quickest lay-out of the right-of-way of lines are among the subjects treated in the twenty-seven chapters. A useful book for the construction engineer in the field.

A. Palme.

## New Electric Power Handbook

Cleveland: The Electric Power Club. Fourteenth edition. 364 pages.

This volume, which is given without charge to consulting engineers, architects, electric light and power companies, educators and rated electrical contractors and dealers, covers substantially all the standardization the club has effected in electric motors, motor pulleys, generators, transformers, electric tools, mining and industrial locomotives, control equipment, power switchboards and switching equipment manufactured in this country. The handbook also contains definitions, symbols, general engineering recommendations and other information needed by users and purchasers of electric power apparatus and control equipment.

# Books Received

La Force Motrice Electrique dans l'Industrie. By Eugene Marec. Paris: Gauthier-Villars et Cie. 613 pages, illustrated.

The Advance in Electricity Since the Time of Franklin. By John Trowbridge. Cambridge and New York: Harvard University Press. 183 pages.

"Mechanical World" Electrical Pocket Book, 1923. London: Emmott & Company, Ltd. 326 pages, illustrated.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Merger of Illinois Utilities

**Illinois Power & Light Corporation Organized to Take Over McKinley and Studebaker Properties**

SENATOR McKINLEY and others associated with him are proposing a consolidation of the southern Illinois properties controlled by Clement Studebaker and his associates with the properties of the Illinois Traction Company.

The plan provides for the retirement or exchange of approximately $50,000,000 of securities and the creation of a new company, all of whose common stock will be owned by the Illinois Traction Company.

All of the operating properties of the Illinois Traction Company in Illinois will be consolidated into one company, to be known as the Illinois Power & Light Corporation, which will acquire through consolidation the properties operated by the Southern Illinois Light & Power Company. To accomplish this consolidation and to establish a proper foundation for a new first and refunding mortgage for the consolidated operating company, including the creation of an attractive preferred stock, it is planned to acquire approximately $22,000,000, par value, of bonds and to call for redemption a further $9,000,000 of bonds now in the hands of the public. It is also proposed to acquire approximately $9,300,000 of guaranteed preferred stock issued by subsidiary companies and $1,641,000 of preferred stock of the Illinois Traction Company. All these holdings will either be canceled or pledged under the new mortgage. In addition it will be necessary to provide for the retirement of $5,649,000 of Illinois Traction preferred stock, $2,169,000 of Western Railways & Light preferred, $1,665,000 of Southern Illinois Light & Power preferred and $631,000 of Bloomington & Normal Railway & Light preferred, all of which are now in the hands of the public. The intention is to offer the holders of these securities in exchange therefor a like amount of 7 per cent cumulative preferred stock of the new Illinois Power & Light Corporation.

CAPITALIZATION OF ILLINOIS POWER & LIGHT CORPORATION

| | |
|---|---|
| Divisional bonds (including Southern Illinois Light & Power bonds) | $36,414,800 |
| First and refunding mortgage 6 per cent bonds | 30,000,000 |
| Thirty-year 7 per cent sinking-fund debentures | 10,000,000 |
| First preferred 7 per cent cumulative stock, par $100 | 17,678,500 |
| Participating preferred stock, 6 per cent cumulative, par $50 | 1,865,500 |
| Common stock, no par value | 400,000 shares |

For legal reasons it will probably be necessary for the Illinois Power & Light Corporation to control through stock ownership the Illinois interurban railways and the utilities operating in states other than Illinois.

The capitalization of the new company, subject to the approval of the Illinois Commerce Commission, is given in the accompanying table.

## Alabama Power Company to Reduce Retail Power Rates

Reduction of the cost of electric power furnished under retail power contracts by the Alabama Power Company and the Sheffield Power Company is provided for in a formal order issued by the Alabama Public Service Commission last week following an agreement with the companies. The rate follows: Demand charge, $1.50 per month per kilowatt, plus energy charge, 3 cents per kilowatt-hour for the first 1,000 kw.-hr. consumed per month, plus 2 cents for the next 4,000 kw.-hr., plus 1 cent for the next 15,000 kw.-hr., plus 0.9 cent for the next 30,000 kw.-hr. It is specified that the demand shall be determined by either inspection or demand meter, but in no case shall it be less than 1 kw.

## Committee on Insulation Is at Work

During the midwinter convention of the American Institute of Electrical Engineers held at New York last month there was a meeting of members of the committee on insulation of the National Research Council. This committee numbers about forty men, but it is to a small active group among this large membership that the Engineering Division of the National Research Council looks for the pushing of the work. Those present at the meeting were J. B. Whitehead, chairman of the committee; G. B. Shanklin, F. M. Farmer, W. A. Del Mar, R. W. Atkinson and A. D. Flinn, chairman of the Engineering Division. Their preliminary report, as prepared by the chairman, will be a general statement of the important problems in the field of insulation attacked from the simplest fundamental aspects with specific suggestions of problems for experimental approach. The more complex questions continually propounded by the industries will be left for a later date.

## Ford Gets High Dam

**Preliminary Permit Granted as Concession to Sentiment in Twin Cities —Rigorous Conditions**

WHAT is very apparently a concession to public opinion in the locality affected was made by the Federal Power Commission in awarding a preliminary permit to Henry Ford covering the High Dam project in the Mississippi between Minneapolis and St. Paul. To guard against non-use such as has followed the construction of the Ford dam at Troy, N. Y., and to safeguard the public interest in other ways, the commission imposed very strict conditions.

In the first place, provision is made to insure the maximum possible utilization of the power. Mr. Ford is required to install four units with the maximum capacity of 4,800 hp. This is all the power that can be developed without extensive and expensive changes in the dam. A further condition imposed by the commission is an annual charge of $95,500 for the use of the government's dam. Mr. Ford is also required to put in a tailrace 2,000 ft. long, so as to prevent the silting up of the navigation channel and the lock. The commission feels that these rather rigorous conditions are necessary in order to insure the use of the power in the public interest.

NORTHERN STATES MAY BUY POWER

Mr. Ford is required by the permit to apply for license before July 1. On that date he must present executed contracts for the sale, delivery and use of the maximum power that can be delivered at the dam. This probably means that a large block of the power must be sold to the Northern States Power Company. That company is understood to be ready to purchase such power as Mr. Ford has to sell, but since it is now securing dump power for 2½ mills per kilowatt-hour, delivered, it was brought out clearly at the hearing that the company would not be willing to pay a higher rate to Mr. Ford. It could be discerned that the Northern States Power Company has some apprehension as to what might develop if one or both of the municipalities adjacent to the High Dam should receive power for general use.

Doubtless with some of the extravagances of another Ford development in mind, the commission required as a condition of the preliminary permit that the development be made along the most efficient and economical lines.

Chief Engineer Mayo of the Ford

staff, who appeared in his behalf, told the commission that it is the expectation to use the power principally in electric furnaces. No attempt was made to explain why Mr. Ford is desirous of resorting to hydro-electric power for his St. Paul plant when engineers' estimates are that it will cost three times more than the power he could develop from coal at such a plant.

The president of the University of Minnesota and Representative Newton of that state made vigorous pleas for the reservation of power for the university's use and of a turbo-generator site to permit the university to carry on extensive experiments of a hydro-electric character. This plea was not granted. Under the law the commission has no right to place charges on a licensee in addition to those prescribed in the act.

# Governor Smith's Views on Water Power

### Favors State Ownership, Development and Limitation—To Continue Fight Against Federal Control—Wants Private Lines Made Common Carriers

GOVERNOR SMITH'S long-awaited message on water power was sent to the New York State Legislature last Tuesday. A remarkable feature of the message is that the issue of cost receives scant consideration. The Governor asks for an "adequate appropriation" to begin the work, but the vital question of when and how $150,000,000 is to be raised is not answered. Another outstanding feature of the message is the Governor's proposal that existing private transmission lines be made common carriers and regulated as such by the state. He opposes exportation of any power beyond the boundaries of the state.

#### THE GOVERNOR'S RECOMMENDATIONS

Declaring that the state should at once develop the power resources on the Niagara and St. Lawrence Rivers for transmission to every municipality in the state over lines owned and controlled by it, the Governor makes, in brief, the recommendations which follow:

First—That appropriate legislation be enacted to carry out this policy. "To do this will require an adequate appropriation of public funds made immediately available."

Second—That the State Engineer be charged with the duty of beginning development work and negotiating with the federal government for consent to develop hydro-electric power on these streams consistent with its control over these waters for navigation.

Third—That, pending the development of all these powers, existing transmission lines should be declared common carriers by law and compelled to transmit electrical energy at a reasonable rate.

Fourth—That no further permits or licenses for the development of power should be granted to any private corporation, existing statutes providing for such grants to be repealed.

Fifth—That $75,000 be made immediately available to the Attorney-General to enable him to defray the expenses of the action now pending and begun by the state against the federal government to determine the jurisdiction of the state over the navigable waters within its borders for power development.

On the last recommendation the Governor says:

"This action should be prosecuted with the utmost care, vigor and dispatch in order that this vital question be finally determined. We have already delayed too long. While we have been debating and bickering over the enactment of laws for the progressive development of our great water power under state ownership and control, the federal government has enacted a water-power law which challenges our right, authority and jurisdiction over the navigable waters of our state in all matters relating to power development.

"The federal government contends that it has the right, authority and jurisdiction to control and dictate by license how, when and where developments are to be made on the Niagara and St. Lawrence Rivers, as well as all other navigable streams of the state. Such right and authority, if sustained, would enable the federal government to deprive the State of New York and its people of this priceless heritage bestowed upon us by the Creator himself. In the final analysis it would permit the federal government to divert the energy created by the fall of water in our streams to other states against our will. The bed of our streams over which power-creating water flows belongs to the state, or, better still, to its citizens. Our use and control of the same is threatened. I am credibly advised that a strong and determined propaganda is now being spread in support of a plan to divert the electrical energy from our border streams to territory outside the state. This we must resist with all the power that we can bring to our command.

"No pending public question is of more moment to the people of this state than the development of this great resource. It has been exploited in the past in the interest of private corporations that have operated it for private gain. What remains of it must be developed in accordance with the enlightened thought of today, and that, I take it, is by the state itself, under state ownership and state control, to the end that all of the people may be able to realize the individual benefit which should flow to them from their own resources and their own property."

After an investigation now in progress with respect to the development of power from the surplus canal waters at Crescent and Vischer Ferry, the Governor will prepare a message on that subject.

Immediate action by the state for the development of hydro-electric power and its sale to municipalities for distribution to private consumers was urged by the New York State Mayors' Conference at its mid-winter session in Albany on Wednesday.

#### UTILITY BILL FOR NEW YORK CITY

Public utilities in New York City other than transit lines will be regulated by a single-headed department of public utilities if a bill introduced on Tuesday by the Democratic leaders shall become law.

The New York City Public Utilities Commission would be an appointee of the Mayor, but, like the New York City transportation bill, this measure provides that the Board of Estimate shall have the power to increase the number of public utilities commissioners exercising supervision for the city.

The bill gives to the city the power to own and operate gas and electric light plants and other utilities. The Board of Estimate could initiate steps for their construction or acquisition when it deemed such action advisable. As in the transportation act, the board appears to be the sole judge of the timeliness and need of such steps.

All the powers now exercised by the Public Service Commission in regard to public utilities within New York City are transferred to the prospective New York City Department of Public Utilities, which would control rates as well as the operations of such corporations.

# Surveys in Two States

### Pennsylvania and Massachusetts Contemplate Further Development of Hydro Resources

GOVERNOR PINCHOT of Pennsylvania has requested that the Legislature provide a special appropriation of $35,000 to carry on an outline survey of water and fuel resources available for Pennsylvania and of the most practicable means for their utilization for power development.

The Governor explained that the purpose is to conduct a careful study of power development possibilities both within and outside the state, expressing it as his opinion that the development of Niagara Falls, the Delaware, Susquehanna and Potomac Rivers and other sources of power is of as great interest and value to the state as if these sources were entirely within Pennsylvania.

"Such a survey should point out the way to secure for all industries, farms, homes and railroads in all parts of the commonwealth an abundant supply of cheap electrical energy while duly safeguarding existing investments in the electric industry," the Governor said.

A conference was held at Boston on

Monday at the instance of the Associated Industries of Massachusetts on the question of whether steps should be taken to ascertain the possibilities of securing additional power from Massachusetts water sources. The question at issue was whether the manufacturers would care to make a united survey of the situation, which would involve an expense probably of $50,000. President Charles R. Gow of the Associated Industries and President Charles L. Edgar of the Boston Edison company were the principal speakers.

There is a great deal of water power wasting in the state, they declared, which might be transformed into electrical energy, especially since it is impossible to bring electricity from Maine or Canada.

# Water Power National, Not Local

## Guy E. Tripp, in an Argument for a Superpower System in North Atlantic States, Protests Against Narrow View of New York's Resources

INSTANCING the interconnected system of the Southeastern States, which stretches for more than six hundred miles and embraces Alabama, Georgia, Tennessee and the Carolinas, and the still longer Pacific Coast interconnections as examples of hydro-electric practice that should be emulated in the Northeast, Guy E. Tripp, chairman of the board of the Westinghouse Electric & Manufacturing Company, has just given to the press a protest against narrow state views on the development of the water powers of New York and against basing plans on the engineering practice of 1907 rather than that of 1923.

"Large water powers," Mr. Tripp says, "are no longer merely a local asset. No matter where they are situated, they are, beyond the shadow of a doubt, a resource of the entire nation. It is now economically wrong to restrict the energy derived from them within any arbitrarily chosen limits. This energy must be so distributed that it will benefit the greatest possible number of people.

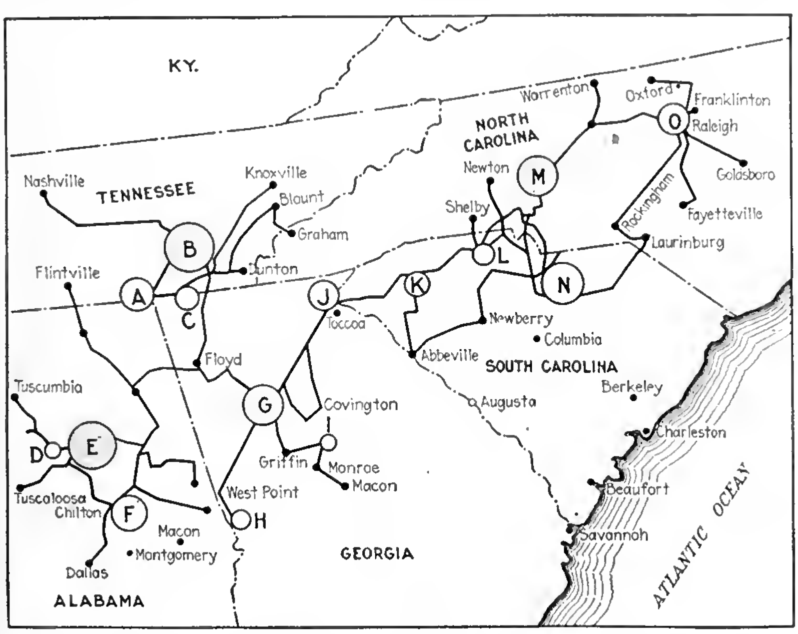
"Water power," he continues, "must be developed on a national, and not on a local, basis. From now on every hydraulic generating station should be designed with reference to a great interstate system of distribution. Engineering science has prepared the way for such a system. It has studied every source of power and every center of power distribution in America, and since it knows or can accurately estimate practically every factor involved, it has devised means for supplying all of the power needed for fifty years to come.

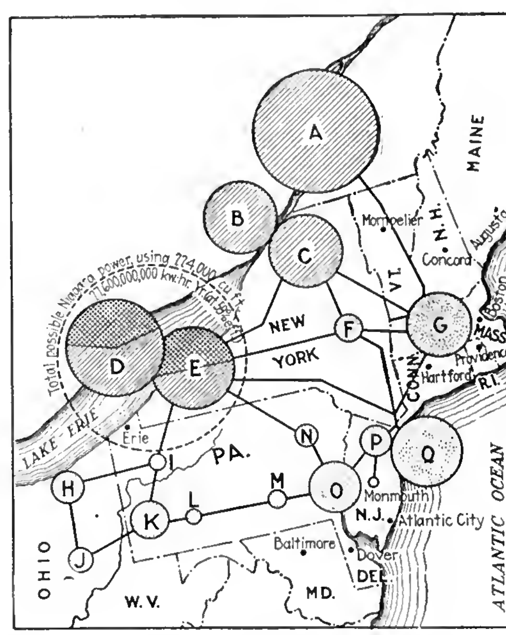
### NEW YORK MUST CHANGE POLICY

What is the situation in New York State? Though it has the finest steam and water-power stations in the world, there is no comprehensive co-operation between them. The great Niagara companies distribute power to only a narrow strip lying along the northern border of the state, and the splendid steam plants of New York City serve only the metropolitan section. As things now stand, millions of horsepower are being allowed to run to waste, vast and unnecessary sums are being spent for coal, large areas of the state are unsupplied with electricity, there is danger of power shortages because of lack of coal and other causes in even our largest city, and all through the district, relatively small generating equipments are being installed, only to be replaced by somewhat larger ones, which in turn are soon replaced, causing a continuously pyramiding of capital charges which are borne by the public. Yet, under the encouragement of the state government, together with the co-operation of the various power companies, which will undoubtedly be given, an interconnected power system, unsurpassable anywhere in the world, could be readily formed in this section."

According to Mr. Tripp, the total amount of power generated by the electric systems of New England, New York, New Jersey and Pennsylvania in 1921 was 14,000,000,000 kw.-hr.; the total power of the Niagara Falls and River is 27,000,000,000 kw.-hr. per year, and the total power of the St. Lawrence River is 21,000,000,000 kw.-hr. per year.

Mr. Tripp explains his conception of how New York's water powers should be developed by the use of two maps, here reproduced, one showing the Southern system and the other the suggested North Atlantic system, as explained in the captions. "The plans are complete," he says, "but a leader is needed to put them into execution."




SOUTHERN SUPERPOWER SYSTEM, AND PROPOSED SUPERPOWER SYSTEM FOR THE NORTHEASTERN STATES

In the map on the left hand of the page the white circles (A, C, D, F, H, I, J, L, N) represent the amount of power generated at points indicated; the gray circles (B, E, G, K, M, O) represent amount of power distributed to consumers from the points indicated, which are the principal distributing centers of the system. All circles are drawn to scale. The total amount of power supplied by this system exceeds 2,000,000,000 kw.-hr. a year, most of which is generated by water power.

In the map on the right hand of the page circle A represents the total undeveloped power of the St. Lawrence River lying wholly in Canada. B and C represent the undeveloped power of the border portions of the river belonging respectively to Canada and the United States. The light portions of D and E represent the amount of Niagara Falls power now being used by Canada and the United States; the dark portions represent the amount of Falls power proposed for early development. The inclosing dotted circle represents the total power of the Falls. Circles F to Q inclusive represent the amount of power now being generated and consumed at the points indicated. All circles are drawn to the same scale.

## President's Coal Commission Is Continued

While the continuance of the President's Coal Commission was imperiled by the delay in voting its appropriation, Congress in an eleventh-hour effort gave the commission all legislation which it had asked. This included the appropriation of $400,000, the authorization to require sworn answers to questionnaires, the extension of the life of the commission until Dec. 31, and the authorization for Judge Alschuler to serve as a member of the commission. Chairman Hammond said that he can foresee no contingency that will interfere with the submitting of the final report on Sept. 22. There is reason to think, however, that the commission is glad to have additional time made available to provide for delay.

## Charts Show Growth of Illinois Northern Utilities

To explain the meaning of its annual report for the year ended Dec. 31, 1922, the Illinois Northern Utilities Company used charts indicating annual growth from 1918. Gross earnings for 1922, including merchandise sales, were $2,129,276, which is an increase of $141,956 over 1921. For the same year the gross revenue from the sale of gas and electricity increased $198,088, or 12 per cent. Net earnings amounted to $707,685 as against $655,426 for 1921, an increase of $52,250. This increase would have been even greater had not the coal strike compelled the company to pay abnormal prices for coal during the latter part of the year. After paying $189,362.92 on preferred stock, a surplus remained of $111,473.69.

During the year 2,101 electric customers were added, making a total of 29,348. Stock sales to customers were continued, adding 491 stockholders and giving a total of 1,477 at the close of the year. In addition, 423 individuals were subscribing to the company stock on the monthly installment basis.

## Pacific Gas & Electric Has Big Year

The report of annual earnings issued this week by the Pacific Gas & Electric Company showed an increase of $1,694,898 in gross revenues and a gain of $2,557,107 net as compared with the previous year. The company's gross business during the year ended last Dec. 31 was $39,204,605 and balance available for common dividends was $4,013,003, or 11½ per cent.

The company's sales during the year reached 1,098,000,000 kw.-hr., an increase of 76,300,000 kw.-hr., or 7½ per cent, as compared with the previous year. The net addition of 46,295 customers during 1922 exceeded all former records. Total customers served as of Jan. 31 were 649,293.

The company's investment in plants and properties on Dec. 31 last stood at $200,250,877. On Dec. 31 last the funded debt was 56.53 per cent of the total capitalization. In 1922 15.3 per cent of gross and 38 per cent of net was required for annual interest on all outstanding bonds as against 25.9 per cent and 61 per cent respectively in 1921. The company has approximately $15,000,000 cash on hand, which it is anticipated will be sufficient to cover its capital requirements for construction work during the year.

## Hoover Calls Radio Conference for March 30

Inaction by the Senate having caused the radio control bill passed by the House of Representatives, as reported in the ELECTRICAL WORLD for Feb. 3, page 292, to fail, the House a few hours before the session closed adopted a resolution directing the Federal Trade Commission to investigate and report to the next Congress regarding control of radio patents. The bill that died in the Senate would have vested authority in the Secretary of Commerce to regulate transmission stations through a licensing system. Because of its failure Secretary Hoover on March 6 sent out invitations for a reassembly of the radio conference held a year ago, together with some additional members, to investigate what administrative measures may properly be taken temporarily to lessen the amount of interference in broadcasting. The conference will be held March 20 at 11 a.m. at the Department of Commerce, Washington.

## A. T. & T. May Increase Its Stock to $1,000,000,000

The directors of the American Telephone & Telegraph Company recommend in their annual report to stockholders for 1922, just issued, that the authorized share capital of the company, now $750,000,000, of which more than $699,000,000 was outstanding at the end of the year, be increased to $1,000,000,000 to take care of present commitments and future requirements. No new stock offering is, however, contemplated for 1923. With a billion-dollar capitalization, the company would rank all others in the country in share capital, the present leader, the United States Steel Corporation, having a total of $950,000,000.

Taking the American Telephone & Telegraph Company alone, without its associated companies, the report shows that in 1922, after meeting operating charges and making provisions for depreciation, obsolescence and taxes, it had available for interest and dividends $81,668,440. Interest charges were $15,498,012, a reduction of $4,023,097 from 1921, thus reflecting the reduction of $74,095,100 in the company's debt during the year. Dividends paid to stockholders at the rate of $9 per share per year amounted to $52,971,252, an increase of $10,296,849 over 1921, this increase being principally the result of an increase in the outstanding capital stock of $151,162,100.

## N. E. L. A. on Code Revision

**Objections to Addition to Rule 12-b to Be Made at Public Hearing of N. F. P. A. Committee**

AT THE public hearing of the electrical committee of the National Fire Protection Association next Monday, W. H. Blood will present objections of the National Electric Light Association to certain proposed revisions of the National Electrical Code. The requirement which is most objected to is the proposed addition to Rule 12-b, second paragraph, which reads as follows: "Line wires of voltage less than 5,000 volts between wires shall have an improved weatherproof or rubber-insulated covering." The National Electric Light Association requests that this proposed addition shall not be added to the code.

### WHY RULE IS OPPOSED

The reasons given for the objection are as follows:

1. The covering consisting of braidings and compound known as "weatherproof" covering is not an insulating material and should not be so described. The fact that this material was at one time considered to be an insulating material is not of present significance, considering the great advance in the knowledge of the properties of insulating materials made during the last few years.

2. It is current good practice among the electricity supply companies to warn all employees that covered wires are to be handled as though they were bare, and this practice is sound on account of the unreliable insulating properties of these coverings. It is only with the utmost difficulty that this wise provision is impressed upon the line workmen and others concerned, and therefore any official expression tending to support the idea that such materials are insulation will have the effect of weakening the earnest efforts made for the safety of line workmen and others.

3. Any slight temporary protection as actual insulation that may be afforded by new weatherproof coverings for line wires is usually more than offset by the increased wind and ice loadings which result from the greater diameter of the covered wire, whereby the lines are more liable to stretch or break and the supporting structures are more heavily loaded.

Attention is invited to the following quotation from the Bureau of Standards Handbook No. 4, "Discussion of the National Electrical Safety Code": "No requirements for provision of insulating coverings for conductors in overhead lnes of any voltage have been made. While such coverings are sometimes an aid in preventing burn-outs, the reduction of hazard derived from their use is problematical. Their use may even cause an added hazard for the higher voltages, as after being in service some years they deteriorate. Their use in this condition gives rise to a false feeling of security. Much

more reliable and effective safeguards against the danger from fallen and crossed wires are the provision of proper wire clearances and separations and the maintenance of these clearances and separations by suitable minimum conductor sizes, sags and strength of supports."

4. During the three years past, when the 1920 edition of the code contained no requirement for the use of weatherproof coverings on line wires, there has been no general tendency to discontinue its use for the purpose to which it was formerly applied, and this is good evidence that there is no desire on the part of the electricity supply companies to abandon this weatherproof covering in the situations where it is useful and appropriate.

5. The proposed voltage limitation of 5,000 is arbitrary and unrelated to any standard distribution voltage and to current good practice. It may have been intended at some former time to provide a figure for demarcation between "distribution" and "transmission" voltages, but if this was the case, it no longer has any significance in that connection or any relation to current good practice. It provides no reasonable line of demarcation between voltages for which covering has a large and only a negligible value.

6. Municipal and insurance inspectors are widely averse to such a rule, as shown clearly in the discussion at the recent meeting of the Western Association of Electrical Inspectors, where stress was laid on the rapid deterioration of line wire coverings and the false sense of security engendered by such coverings. Inspectors of state utility commissions, who deal much more generally with overhead lines both near to and remote from buildings, generally adhere to the provisions of the National Electrical Safety Code and do not require insulating coverings.

7. It is submitted that the applicable parts of the National Electrical Safety Code should govern in this case, no less than as provided in the proposed change in Rule 13 which every one supports and which reads: "It is advised . . . that the rules of the National Electrical Safety Code, Part 2, be followed."

8. Finally, it is believed that the proposed revision is entirely too sweeping in its effect and not justified by experience. Such a rule, if included in the National Electrical Code at all, should be drawn only after thorough study and full hearing of all interested parties; that has not been done in the present case.

## Another Bill Aimed at Indiana Commission Fails

A bill to enable cities on referendum vote to operate municipal utilities without jurisdiction of the Public Service Commission or to build a utility plant without obtaining its consent has failed in the House of Representatives of the Indiana General Assembly by a vote of 48 to 39. Three more votes would have given the bill the requisite two-thirds majority. A motion to postpone the bill indefinitely was lost, and it may be called up for third reading again at any time by any representative.

The same bill in the Senate is expected to come from committee with a divided report, the majority against it. It is thought to have small chance in the Senate. Governor Warren T. McCray will be vigorously against it.

## Federal Board Files Reply

### Amended Bill of Complaint of New York Contested in United States Supreme Court

SETTING up the claim that the federal government has authority over the Barge Canal system of New York under the interstate commerce clause of the Constitution, the canal system being a part of an interstate and foreign commerce waterway, Solicitor-General Beck has filed in the United States Supreme Court for the Federal Power Commission an answer to the amended bill of complaint entered by the State of New York to test the authority of the commission. In its amended bill the state had claimed that it had spent great sums on the development of waterways within the state and had projected hydro-electric developments concerning which it claimed the Federal Power Commission had no authority.

The commission's amended answer declares that the bill does not join essential parties in that no determination can be made of the authority of the United States to enter into contracts with citizens of New York for the acquisition of real or other property useful in the preservation or improvement of navigation in the absence of the citizens whose property is affected. The answer further claims that the state does not present any concrete plan regarding its proposal for hydro-electric development or show how such plans would affect navigation. It is pointed out that the United States government spends large sums for the development of navigation in the harbor of New York and on the Hudson River. The state has filed no plans for power development with the commission, the answer says, but private persons have, and these applications are being considered by the commission.

Regarding the state's announced contemplation of hydro-electric development on the St. Lawrence River, the commission's answer sets forth that this waterway has been the subject of an international conference by act of Congress looking toward its improvement for oceangoing transportation and that if the state were to make any effort to construct plants there the commission would seek action by the Attorney-General to determine the effect.

The Federal Power Commission itself does not construct plants, the answer continues, and such construction by those licensed to do so by the commission would not deprive the state of the right of taxing such properties.

## Arkansas Light & Power Gets Mississippi Properties

Announcement has been made by H. C. Couch, president, and J. L. Longino, vice-president of the Arkansas Light & Power Company, of their acquisition of the Jackson (Miss.) Public Service Company and the Vicksburg (Miss.) Light & Traction Company. The Jackson company operates the street railway, electric and gas systems in that city and formerly was controlled by the American Public Utilities Company of Grand Rapids, Mich. W. E. Brown of Jackson is the general manager. The Vicksburg company operates the street railway and the electrical systems in Vicksburg and was controlled by the Union Utilities Company of Chicago. E. S. Myers is general manager. It is understood that relinquishment of control of the Jackson properties by the Brewer interests and of the Vicksburg properties by the Elston interests is due to the fact that these were the only properties of these syndicates in the South.

In the reorganization of the Jackson and Vicksburg companies H. C. Couch will be president, J. L. Longino vice-president and general manager, W. E. Baker treasurer, and L. Garrett secretary. These, with C. P. Couch, manager of the Arkansas Light & Power Company properties at Arkadelphia and Malvern, Ark., will comprise the board of directors.

Improvements already started at Jackson will be carried out. A transmission line will be extended west from Jackson to Clinton, and it is probable that another line will be extended east from Vicksburg, interconnecting these two power stations. The Arkansas Light & Power Company will supply electrical energy to the American Bauxite Company for mining and drying bauxite and lighting the town of Bauxite, Ark.

## Oklahoma Is Seeking to Tax Utilities on Rate Valuation

Efforts are being made in Oklahoma to force public utilities to return for tax purposes the same property values that are fixed by the Corporation Commission for rate-making purposes. Several bills introduced with this object have been held unconstitutional by the Attorney-General. The judiciary committee of the House has introduced a bill designed to correct the defects in the previous bills. This provides that in all hearings before the commission to fix utility rates the state shall be considered a party adverse in interest to the public utility, and that before an order fixing rates is entered the commission shall enter a judgment fixing the value of the property. Where a report was filed by a utility showing the value of its property, the report would be considered as a confession of judgment and a commission order entered accordingly, except as the commission might desire to dispute the value reported.

## Convention Arrangements

**Advance Circular from the N. E. L. A. Headquarters Tells of Hotels and Transportation**

AN ADVANCE circular on the forty-sixth convention of the National Electric Light Association, to be held in New York City on June 4-8, has been issued by headquarters, and intending visitors are already being urged to secure their hotel accommodations by filling out a form inclosed and returning it to the hotel committee, N. E. L. A., 29 West Thirty-ninth Street, New York. A list of thirty hotels within a radius of a mile of the convention meetings is listed, with their rates. Joseph F. Becker is chairman of the hotel committee.

Convention headquarters will be at the Commodore Hotel, Forty-second Street and Lexington Avenue, immediately adjacent to the Grand Central Terminal, where the business sessions will be conducted, with additional facilities, if necessary, also provided in the Biltmore Hotel, adjoining. The first business sessions of the four national sections will convene early Monday afternoon, June 4, with other section sessions on the afternoons of Tuesday, Wednesday and Thursday. The first general and executive session will be held on Tuesday morning, June 5, with other such sessions following on Wednesday, Thursday and Friday mornings. The important session of the public policy committee will be held on Thursday evening, June 7, at Carnegie Hall, Seventh Avenue and Fifty-seventh Street.

#### Transportation

Godfrey H. Atkin, Electric Storage Battery Company, 713 Marquette Building, Chicago, has accepted the appointment of master of transportation. Mr. Atkin has already made application for a special round-trip rate of one and one-half fares from all points to New York City. A special round-trip fare from all Pacific Coast points to New York City of $147.40 has been agreed upon by the railroads.

It is the intention of the transportation committee to operate special trains from Chicago and Boston for the convenience of the Western and the New England delegates. The master of transportation will be glad to hear from any members who would like to have special trains or special cars operated from their particular sections of the country.

For special information not covered by the circular, A. Jackson Marshall, committee secretary, should be addressed at headquarters.

## Insufficient Grant May Hamper California Commission

Some concern is felt in California over the rigorous policy of economy of the new Governor as it affects the State Railroad Commission. The commission's allowance for the next two years is $793,000, which is $234,800 less than the appropriation made for the two years just past and $100,000 less than the minimum requirements estimated by the president of the commission. Ninety per cent of the burden of this cut in the budget falls on the engineering department, whose engineering staff will be reduced from fifty-two to twenty-four.

During 1922 there were 4,950 informal complaints made to the commission, virtually all of which were handled by the engineering department. To curtail the work of this department will, in the view of many, seriously reduce the commission's service to the public and will mean that it will either take a discouragingly long time to obtain the facts in a case or that only part of the facts will be obtained. A decision which is not based on full engineering investigation may, these men point out, be inequitable either to the public or the utility. Personal views of the commissioners might under such circumstances influence their decision, and it is not inconceivable that the commission might in time lose something of its present standing or even degenerate into a political body.

# Utility Commission Engineers Confer

**Discuss the Grading of Public Utilities in Conformity to Service Rules and Other Utility Problems and Lay Plans for Permanent Organization**

PLANS for an annual conference of engineers attached to the state utilities commissions, to be conducted under the auspices of the Bureau of Standards, were laid at a meeting at the Department of Commerce, Washington, on March 2 and 3. It was the consensus of opinion of the engineers of more than one-third of the state commissions that there should be an annual conference at which the technical and engineering questions involved in utility operation could be discussed in the interest of the common good.

#### Objects of Conference

This conference was called by Dr. F. C. Brown, the acting director of the Bureau of Standards. The conferences are to be along the lines of those which have been held for many years, in which the specialists of the bureau have met with the weights and measures officials of the various states with the idea of exchanging views and experiences. In addition to the benefits which will come from the exchange of views among the utilities engineers, it will give them an opportunity to obtain first-hand knowledge of the experiments and research which the bureau is conducting on the public utility problems.

Addresses were made at the meeting by representatives of the Bureau of Standards and by commission engineers. The topic chosen was "Grading Utilities in Conformity to Service Rules." An executive committee was selected to work out plans for future conferences. C. B. Hayden of the Wisconsin commission was chosen as the chairman of this committee, and E. C. Crittenden, chief of the electrical division of the Bureau of Standards, as secretary. Other members are William M. Black of the Maine commission, C. R. Vanneman of the New York commission and A. I. Thompson of the Oklahoma commission.

Other topics on which there was a general discussion were inductive interference and the grounding of electrical circuits. Secretary Hoover opened the conference.

In explaining the relationship of the Bureau of Standards to the conference Mr. Crittenden said:

"The bureau has aimed to do three things, first, to carry out experimental investigations of problems affecting the efficiency of operation, cost and quality of service rendered; second, to determine the facts with regard to actual practice, and, third, to combine the results of laboratory investigations and of field observations with the judgment of trained and experienced engineers so as to formulate recommendations or codes of practice which would safeguard the interests both of utility operators and of utility customers.

"It should be emphasized that the bureau does not seek or desire any authority to impose its findings on others. Its position as an impartial fact-finding and advisory body is believed to be the most useful one for a federal government agency in this field. Such success as the work has attained in the past would have been impossible without the cordial co-operation of utility companies and their associations as well as city and state authorities. The earlier work was done largely with city officials, but as the principle of state regulation has gained wider and wider acceptance, our contacts have naturally shifted to the state commissions."

#### Engineers in Attendance

Commission engineers who attended the conference were, by states: Alabama, I. F. McDonnell; Georgia, J. Houstoun Johnston; Illinois, J. Howard Mathews; Indiana, Earl L. Carter; Iowa, A. B. Campbell; Maine, William M. Black; Maryland, H. C. Wolf, W. F. Strouse, S. A. Covell, Mr. Cullen, L. Ellis, R. Y. Gildea and J. L. Wicks; Michigan, Manfred K. Toeppen; New Hampshire, D. Waldo White; New Jersey, Col. P. Betts; New York, C. R. Vanneman and R. H. Nexsen; Ohio, L. G. White and Ward Snook; Oklahoma, A. I. Thompson; Tennessee, F. G. Proutt; Virginia, J. W. West, Jr.; West Virginia, James Imboden and W. B. Hall; Wisconsin, C. B. Hayden; District of Columbia, E. G. Runyan, and Connecticut, A. E. Knowlton.

## City Ownership Is Agitated in Denver

Recent developments in Denver indicate that municipal ownership of public utilities will be one of the chief planks in the platform of several mayoralty candidates in the spring campaign. Governor Sweet is out with a statement that he will not favor any candidate who does not stand for this policy. During the term of the next Mayor the franchises of both the Denver Tramway Company and the Denver Gas & Electric Light Company will expire, and it is likely that the traction system, although in the hands of a receiver, will receive the first attack, with the central-station company second.

Both Governor Sweet and Frank N. Briggs, a prominent Denver banker who has announced his independent candidacy for Mayor, have declared their belief that regulation and control are positively unsuccessful. Many years have elapsed since a fight was waged against the public service corporations in Denver, and the results of the coming campaign will determine the character and intensity of the effort to be made by public utility companies in the near future for the acquisition of new franchises.

Mr. Briggs recently addressed the Denver Section of the A. I. E. E. in support of his views, taking as his subject "Possibilities of Denver as an Electrical City."

## Illinois Utilities to Hold Convention Next Week

A joint convention of the Illinois Gas, Illinois State Electric and Illinois Electric Railways Associations will be held at the Hotel Sherman in Chicago Wednesday and Thursday, March 14 and 15. At the joint morning sessions Charles M. Thompson, dean of the College of Commerce and Business Administration, University of Illinois; Ralph E. Heilman, dean of the Northwestern University School of Commerce; Martin J. Insull, vice-president Middle West Utilities Company; Britton I. Budd, president Chicago Elevated Railroads; E. W. Lloyd, chairman Joint Committee for Business Development; George R. Jones, chairman public speaking bureau of Illinois Committee on Public Utility Information; E. Hill Leith of Halsey, Stuart & Company, and B. J. Mullaney, director Illinois Committee on Public Utility Information, will speak.

The program of the electric section of the convention follows: "Survey of Appliances and Their Use in Residences in Chicago," H. B. Gear, Commonwealth Edison Company; "Development of the Mazda Lamp, Introducing the New 30,000-Watt Lamp," F. T. Benson, General Electric Company; "Unattended Distribution Substations of the Commonwealth Edison Company with Remote-Controlled Automatically Regulated 4,000-Volt, 60-Cycle Circuits," H. E. Wulfing, Commonwealth Edison Company; "Alternating-Current and Direct-Current-Controlled Automatic-Feeder Substations," F. E. Goodnow, Public Service Company of Northern Illinois; reports of committees on uniform classification of accounts and customers' records and billing; "Correct Meter Installation and the Use of Protective Devices Against Thieving," R. D. Hart, Central Illinois Light Company; symposium: "Merchandising Domestic Appliances," R. S. Bell, United Appliance Company; "Commercial Appliances," "Convenience Outlets," Electrical Home," representatives of Commonwealth Edison Company.

## Best Definitions of Courtesy to Win Prizes

An unusual feature of the convention of the Oklahoma Utilities Association to be held at Oklahoma City on Monday to Wednesday of next week will be the awarding of first and second prizes for the best definitions of "courtesy to the public" from the public utility operator's standpoint. Answers are limited to twenty-five words, and five replies, selected by a committee of three, will be voted on at Wednesday morning's general meeting. E. B. Smith is in charge of the contest.

The electric light division of the association, meeting on Tuesday afternoon, will hear addresses by R. G. Tyler, dean of the Agricultural and Mechanical College, Stillwater, Okla., on "The Relation of the School of Engineering to Utilities;" by B. P. Stockwell of the Oklahoma Corporation Commission on "Commission Regulations Governing Rate Changes," and by W. D. Riggs, Oklahoma Gas & Electric Company, on "Meters and Theft of Energy." Martin J. Insull will address a general session on Monday afternoon on "The Public's Interest in the Public Utilities." On Wednesday to Friday the Southwestern Geographic Division, N.E.L.A., will meet, its Wednesday sessions being held jointly with the Oklahoma Utilities Association. Expected speakers were named in the "Associations and Societies" column last week, page 538.

## Additional Hydro Development in Arkansas

The beginning of actual construction work by this month on a hydroelectric development that will have an ultimate capacity of 120,000 hp. is announced by the Caddo River Power & Irrigation Company of Little Rock, Ark. The company has received permission from the Federal Power Commission to construct a dam on the Ouachita River at what is known as the Remmel site, south of Hot Springs. It has already a license covering two other sites, but work is beginning on the dam just authorized. This dam will develop 15,000 hp. at an estimated cost of $2,000,000, and the plant is expected to be in operation in eighteen months.

By a contract with the Arkansas Light & Power Company, the energy from the new development will be distributed largely through the system of that company. The Arkansas Power & Light Company already has a 66,000-volt transmission line from Picron, near Little Rock, to Malvern, connecting with the Malvern-Arkadelphia system. The new plant will be connected with this tie line. The William Crooks Engineering Company has formulated the plans for the development. Ford, Bacon & Davis are consulting engineers. The financing arrangements have been underwritten by a syndicate of western New England and Chicago bankers, according to announcements from the Pine Bluffs headquarters of the Arkansas Power & Light Company.

## Brief News Notes

**Urbana, Ohio, Has Successful Show.**—Urbana, Ohio, with a population of 7,600, closed its first electrical show with such success that the promoters plan to make it an annual affair hereafter. Paid admissions during the two days, Feb. 22 and 23, totaled 2,343.

**A Maryland Merger.**—The Maryland Public Service Commission has authorized the American Water Works & Electric Company of New York to assume control of the Cumberland Edison Electric Company, which was a recent merger of the old Cumberland Edison Electric Illuminating Company and the Cumberland Electric Company.

**University of Colorado to Give Meter Course.**—The electrical department of the University of Colorado will, through the electrical standardizing laboratory, furnish a course for metermen in the week of March 19-24. Intensive laboratory work, lectures and round-table discussions will be given. This will be the first time a meter course has been provided at the University of Colorado, but success will lead to its being made a yearly event.

**Electrical Alumni Gather at Milwaukee.**—Electrical engineers from all over the United States met in Milwaukee on March 1, 2 and 3 to participate in the "homecoming" of the alumni of the College of Electrical Engineering of the School of Engineering of Milwaukee. Bryce Tolbert of Greenwood, S. C., was chairman of the homecoming, and Arthur Richards of Brockport, Pa., was secretary and treasurer.

**Scholarships in Electrical Engineering.**—Two universities have recently announced the establishment of new scholarships in electrical engineering. Columbia has placed at the disposal of the A. I. E. E. a scholarship in its School of Mines, Engineering and Chemistry which pays $350 for annual tuition fees. Stanford University announces the Elwell scholarship, founded by Cyril F. Elwell, which carries a sti-

pend of $500 in its electrical engineering department.

**Flashboard at Neenah Dam, Wis., Ordered Removed.**—Efforts are being made by the Wisconsin state government, the Association for Relief of High Water and the water-power interests to agree upon a permanent co-operative plan by which flood conditions may be relieved in the Fox River Valley. The water-power companies are vitally concerned because the Secretary of War has ordered the removal of the flashboard from the Neenah dam and this flashboard is said to effect a saving in fuel to them of $180,000 a year.

**Work on St. Croix Development Begun.**—The first work by the Northern States Power Company to develop the water power of the upper St. Croix River has just begun. Camps have been built, and a crew of men is making an area survey of the river bottoms, which it is expected will take the greater part of this year. The power dam will be erected at the mouth of Snake River. A large reservoir dam will also be built at the head of the Kettle River rapids.

**Federal Court Protects Emergency Rates of Wisconsin-Minnesota Company.**—A preliminary injunction restraining the Wisconsin Railroad Commission from interfering with the existing emergency rates of the Wisconsin-Minnesota Light & Power Company has been issued by the United States District Court at Madison. These rates were necessitated by the decision of the Wisconsin Supreme Court annulling the order of the commission which fixed uniform rates on the company's "loop" system and ordering that they be determined for every city on the unit plan. The emergency rates were adopted by the company until the commission can fix permanent rates in accordance with the order of the state court.

**Dispute Over Rights on Coosa River.**—A storm is brewing in Alabama over the water-power project at Lock No. 2 on the Coosa River. One bank at that point is owned by Roswell Cobb. The other bank belongs to the government. The Alabama Legislature, in which there is some hostility to the Alabama Power Company, is expected to adopt legislation which will extend Cobb's rights. If this legislation is approved, plans are being considered, it is said, whereby the cities of Birmingham and Anniston will attempt to secure rights as municipalities through an arrangement with Cobb. The Alabama Power Company two years ago filed on the site, and it is anticipated that it will not give up its contemplated development without a struggle.

**Way Cleared for Large Water-Power Developments in North Carolina.**—The bill in the North Carolina Legislature dealing with "eminent domain" and sponsored by the water-power interests has been passed, and the way is now clear for the greater water-power projects to proceed to condemn and fix by court proceedings the price at which lesser water-power developments should be bought. The legislation was thought to be necessary because nuge dams being erected across the rivers were putting smaller dams for long distances up the rivers out of business, and where the parties at interest could not agree on purchase price or damages, development was sometimes blocked. The new law gives power to condemn the affected property and pay assessed price or damages.

**United States Supreme Court May Refuse Jurisdiction of Potomac Company Case.**—Arguments were presented before the United States Supreme Court Feb. 26 and 27 on the question of the jurisdiction of that court to review the decision of the District of Columbia Court of Appeals reversing and remanding for further proceedings a ruling of the District of Columbia Supreme Court which dismissed an injunction sought by the Potomac Electric Power Company against the District Public Utilities Commission to set aside valuation of the company's property for rate-making purposes. Arguments on the appeal were begun before the Supreme Court on Jan. 24, but were interrupted by Chief Justice Taft, who asked the attorneys to submit briefs on the court's jurisdiction. Attorneys for both the company and the commission argued that the court had jurisdiction, both sides being anxious to have the case passed on by that tribunal.

## Associations and Societies

**New Section of Institute Organized.**—The Southern Virginia Section, A. I. E. E., has been organized at Richmond, Va., with W. C. Bell as chairman and H. C. Leonard as secretary of the executive committee.

**Special Libraries Association.**—The Special Libraries Association, which is a national organization of all business and special librarians in the country, will hold its fourteenth annual convention in Atlantic City on May 22 to May 25, at the Hotel Chelsea. Librarians, business men, research workers and statisticians are urged to attend.

**Sioux City Electrical Club Formed.**—About seventy electrical men of Sioux City, Iowa, have formed the Sioux City Electrical Club. The purpose of the club is primarily educational. Membership is open to any one interested in electrical development. C. E. Murphy, superintendent of the Sioux City Service Company, was elected president. Other officers are: E. A. Artz of the Sioux City Electrical Construction Company, vice-president, and Elmer A. Croll, secretary and treasurer.

**Engineering Society of Wisconsin.**—Meeting at the University of Wisconsin, Madison, on Feb. 22 to Feb. 24, the Engineering Society of Wisconsin went on record as favoring a bill which would create a board of examiners of architects, engineers and land surveyors to consist of the state architect, the state chief engineer, the dean of the engineering college of the university and three engineers in good standing, all to be appointed by the industrial commission. The bill will be presented to the Legislature. Officers elected were: President, John C. White, Madison; vice-president, D. G. Kirchhoffer, Madison; secretary-treasurer, L. S. Smith, Madison.

**Coming Section Meetings of A. I. E. E.**—March section meetings of the A. I. E. E., in addition to those listed in this column on Feb. 24, are announced as follows: Baltimore, March 18, "Wired Wireless," R. D. Duncan, Jr.; Boston, March 30, "History of Artificial Illumination," M. Luckiesh; Chicago, March 19, "Industrial Research," C. E. Skinner; Cleveland, March 22, "Motors, Bearings, Brakes, Clutches, Control," A. M. MacCutcheon; Minneapolis, March 16, "National and International Standardization," C. E. Skinner; Pittsfield, March 15, "Vacuum Tubes and Their Application," Irving Langmuir; Rochester, March 23, "Relay Protection," Mr. Hunting; Seattle, March 23, "Power-Factor Correction," F. F. Ambuhl; Washington, March 13, "Electrical Equipment on Automotive Vehicles," J. H. Hunt.

### Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.

Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Illinois State Electric Association—Chicago, March 14-15. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

Middle West Division, N. E. L. A.—St. Louis, April 11-12 H. M. Davis, Bankers' Life Bldg., Lincoln.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Ohio Electric Light Association—Cedar Point, June 10-13.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Canadian Electrical Association—Montreal, June 20. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

# Recent Court Decisions

**Prior Franchise Gives Exclusive Right to Space Occupied by Lines.**—In modifying or interpreting its finding in the inductive interference case of Phillippay vs. Pacific Power & Light Company (ELECTRICAL WORLD, Aug. 12, 1922, page 345, and Jan. 6, 1923, page 56) the Supreme Court of the State of Washington declared that, though the holder of a prior franchise has no exclusive right to the occupation of a street, it does acquire a right, which is in the nature of an exclusive one, to the continued occupation of the space occupied by its poles and wires, subject to proper control by public authorities, and this right must be recognized by the subsequent company in the construction of its line. (211 Pac. 872.)*

**Responsibility for Fatality Shared by City and Railroad.**—In Carroll vs. Atlantic Coast Line Railroad Company and City of Ozark damages for the death of a pedestrian who came in contact with an electrically charged guy wire were sustained by the Supreme Court of Alabama, which held the defendants equally culpable. The railroad company, which purchased energy from the city plant, had strung a wire on a post to brace which a guy wire and post were maintained by the city, and evidence showed that the lighting wire had become worn and uninsulated for several weeks before the accident and in danger of contact with the guy wire and that the guy post was loose. It was for the jury to decide whether the victim was guilty of contributory negligence in touching or grasping the guy post or guy wire. (94 So. 820.)

**Erection of Dam Authorized by Legislature Cannot Be Held a Nuisance.**—Charging that the backwater from a dam erected by the Wateree Power Company had formed stagnant pools and provided a breeding place for mosquitoes to the injury of the land and the spread of malaria, the plaintiff in Belton vs. Wateree Power Company obtained damages of $2,000 in the trial court. This verdict has been reversed by the Supreme Court of South Carolina, which holds that an individual not suffering peculiar damages from a nuisance prevalent in the whole community cannot recover, the injury, if any, being a public one. However, the court continued, assuming that the breeding of malaria-bearing mosquitoes is incidental to the construction of a dam authorized by the Legislature, this authorization prevents the dam from being considered as a public nuisance subjecting the company to indictment. In the absence of negligence in the construction of the dam, the only recourse lies in action for compensation. One conveying a part of his land to defendant to be flooded by a dam had impliedly consented to defendant's entry on the land, and even though entitled to recover consequential damages to other lands, if there had been no entry, is limited to an action for compensation under the statute authorizing the construction of the dam. (115 S. E. 587.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

**Possibility of Raising Dam No Excuse for Backing Up Water Below Dam.**—Harp vs. Iowa Falls Electric Company was an action in equity to enjoin defendant company from maintaining its dam at such a height as to back the water up at plaintiff's dam and mill, and thus destroy or infringe upon plaintiff's right to the fall of the water. The Supreme Court of Iowa, affirming a decree for the plaintiff, held that the possibility that a riparian owner may increase the height of his dam, and therefore obtain the same head of water, does not justify the act of the lower owner in backing up the water on the wheels of the upper owner, especially where the upper owner's statement that his attempt to raise the dam had been objected to by those above him was not denied. Neither did the fact that the owner of a dam could secure enough power to operate his mill with a lesser head by installing more efficient wheels justify the lower owner in the course complained of, since the upper owner is entitled to the intrinsic value of his entire right of fall. The cost to the company of reconstructing its dam was found not so disproportionate to the damage caused to the upper owner as to defeat the right of the latter to an injunction. (191 N. W. 520.)

**Indiana Commission Sustained in Indiana Electric Corporation Case.**—Sustaining the demurrer of the Indiana Electric Corporation in the suit brought by the cities of Indianapolis and Kokomo against the Public Service Commission, the Indiana Electric Corporation and others to prevent the merger of seven Indiana utility companies, the Supreme Court of Indiana said, among other things, that where the Public Service Commission has jurisdiction and keeps within it, and its action is not vitiated by fraud, its decision of all questions of fact as to value of the properties of public utilities, sufficiency of the income to pay interest and dividends on bonds and stocks authorized, qualifications of a proposed purchaser, and all other questions which it is required to decide as preliminary to taking action in a proposed purchase by a corporation of public utilities, is conclusive upon the courts in a collateral action; that the mere averment that the property is only of the value of $10,300,000, but that the commission, after hearing conflicting evidence as to such value, found it to be worth $17,500,000, does not charge fraud, and that a complaint which does not show by the facts alleged that the Public Service Commission was without jurisdiction nor the order complained of fraudulent is not sufficient to constitute a cause of action. (137 N. E. 705.)

# Commission Rulings

**Taxing Customers for Extensions.**—Holding that a contribution from prospective customers to the cost of extending the lines of the nearest central-station company to Bloomfield was a prerequisite to service, the Utah Public Utilities Commission said: "If the revenue derived from a particular consumer in relation to the special investment made to serve him is not a reasonable amount, then such consumer becomes a burden upon the general consuming public and the service to him constitutes unlawful discrimination. Hence it is that consumers at too great a distance from existing lines or having peculiar conditions of taking service are required to share in the special investment made to serve them."

**Location of Service Extensions.**—A complaint brought by the C. L. Dooley Company against the Brooklyn Edison Company arose through a dispute over the location of the service entrance on the premises of the complainant, the complainant contending that the defendant should supply the electric service underground, while the Brooklyn Edison Company made the contention that service should be accepted at an existing inlet already on the wall of an inclosed alley or driveway at the complainant's premises. The commission dismissed the complaint, holding that service given to the owner of the premises at one service point through an electric meter properly located is sufficient and that any new electrical construction on the premises should be run to that point.

**Original or Reproduction Cost.**—In adopting original cost rather than reproduction cost as the measure of value in fixing rates for the Exeter Waterworks, the New Hampshire Public Service Commission said: "Reproduction new values and depreciation values are entirely matters of estimate, and the results obtained depend wholly upon assumptions. An expert will advance convincing arguments why his assumption is correct, and another expert will give equally convincing reasons why *his* assumption is correct, yet the results derived from these assumptions may be and usually are very different. This is not said in derogation of experts, but the fact is that their opinions are of very little help to the commission for the reason that opposing interests can always obtain experts to sustain their side of the case, regardless of how irreconcilable their conclusions may be with the conclusions of the opposing experts. For that reason, if for no other, in fixing values the historical cost of a plant is always more satisfactory than the reproduction cost. One is based upon facts, while the other is based upon estimates which at most are only intelligent guesses."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## D. H. Foote Third Vice-President of P. G. & E.

D. H. Foote, secretary of the Pacific Gas & Electric Company since 1907, has received the title of third vice-president of the company in addition to that of secretary. Mr. Foote is a native of Philadelphia, and much of his business experience, which was along banking lines, was gained in the position of secretary and treasurer of the Union Trust Company of that city. He went to California in 1901, and upon the organization of the California Gas & Electric Corporation, in 1903, he became its first cashier and assistant secretary. In 1905 the Pacific Gas & Electric Company was organized, and in July, 1907, Mr. Foote was elected to the responsible position of secretary. In 1909 he was elected a member of the board of directors and later was also appointed assistant treasurer.

## F. F. Rossman Leaves Westinghouse Company

Frank F. Rossman has resigned as division manager of the Westinghouse Electric & Manufacturing Company at Kansas City to become vice-president and general manager of the Mobile (Ala.) Light & Railroad Company. Mr. Rossman has represented his company in the Kansas City territory for the last eight years and has gained wide esteem and popularity. He had completed his twenty-third year of service with the Westinghouse company and in that time became thoroughly acquainted with railway matters. Friends of Mr. Rossman gave a dinner in his honor at the Hotel Baltimore, Kansas City, on Feb. 22. He assumed the duties of his new office on March 1.

F. A. Bryan, president of the Indiana & Michigan Electric Company of South Bend, Ind., has offered his resignation to the board of directors, to be acted upon at a meeting of the board to be held in New York in April. Mr. Bryan took this action shortly before departing for San Francisco en route to Hawaii, the Philippines, China, Japan and Korea. He will be gone several months. Mr. Bryan has completed twenty-two years of service with the company.

H. E. North, for many years connected with various Byllesby companies, has been transferred from the Oklahoma Gas & Electric Company at Oklahoma City to the Western States Gas & Electric Company at Stockton, Cal. Mr. North was in the stock sales department at Oklahoma City for several years and now takes charge of the Western States Gas & Electric Company's investment department. H. K. Griffin, who has been connected with the electrical industry in California for the last few years, has been appointed commercial agent in charge of new business for the Western States Gas & Electric Company.

## Ready Succeeds Sachse on California Commission

Lester S. Ready has been appointed chief engineer of the California Railroad Commission to succeed Richard Sachse, who has resigned to practice as a consulting engineer. The appointment became effective March 1. The new chief engineer has been associated with the Railroad Commission more than nine years, having been assistant chief engineer in charge of the gas and electric department four years. He is a native of Ventura County and a graduate of the University of California College of Electrical Engineering, class of 1912. Since graduation Mr. Ready has been actively engaged in engineering, specializing on public utility regulation. He entered the service of the Railroad Commission of California on Dec. 1, 1913, in the gas and electric division. On Jan. 1, 1918, he became gas and electrical engineer in charge of electric and gas service, rates and valuation. In October, 1919, he was advanced to the position of assistant chief engineer in addition to being in charge of the gas and electric division of the commission, which position he has held since.

L. S. READY

Richard Sachse had been with the commission since 1912 and since 1914 had held the position of chief engineer. He was graduated in civil and structural engineering in 1900 and then was engaged in railway, hydraulic, electric and harbor engineering work in West Africa, Belgium, Germany and Norway and later in the United States. Since 1903 he has been connected in an engineering capacity with the Western Electric Company, United States Steel Corporation, United States Reclamation Service and the Southern Pacific Company. He was recently appointed chairman of the engineering advisory committee to the National Association of Railway and Utilities Commissioners in connection with valuations now being made by the Interstate Commerce Commission. His work as chairman of the inductive interference committee is well known to the electrical industry. After leaving the commission his first work will be a comprehensive investigation of the street-railway situation in Los Angeles with a view to bringing about a unification of the two local systems.

The commission has appointed A. V. Guillou as assistant chief engineer in charge of the gas and electrical division of the commission. Mr. Guillou, who, like Mr. Ready, is a graduate of the University of California College of Electrical Engineering, class of 1912, has acted as assistant engineer in the gas and electric division for the last three years.

# Obituary

James Howard Zigler, manager of the lamp sales department of the Westinghouse Electric International Company, died at the Lexington Hospital, New York City, on Friday, Feb. 23, after a short illness, diagnosed by the doctors as sleeping sickness. Mr. Zigler was born in Columbus, Ohio, in 1890, and became associated with the Westinghouse Electric & Manufacturing Company at East Pittsburgh in 1917. Four years later he was transferred to the price department of the Westinghouse Electric International Company with headquarters at New York, and just before his death was made manager of the lamp sales department.

David Augustus Decrow, manager of the waterworks department of the Worthington Pump & Machinery Corporation, died in East Orange, N. J., on Thursday, Feb. 15. Mr. Decrow's association with the company dates back to the early eighties, when he joined the Holly Manufacturing Company as a mechanical draftsman. His promotions were rapid, and in 1903 he was made secretary of the company. Later the Holly Manufacturing Company was combined with the Snow Steam Pump Works at Buffalo as part of the International Steam Pump Company, and Mr. Decrow went to Buffalo to take charge of the pumping machinery. The International Steam Pump Company was succeeded by the Worthington Pump & Machinery Corporation in 1916. Not long after the change Mr. Decrow was called to the head office in New York as manager of the waterworks department, which position he held at the time of his death.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Systematic Selection of Employees

**Fundamental Considerations that Should Be Observed in Hiring Help—Studying the Job—Analyzing the Applicant**

By Joseph Willits
University of Pennsylvania, Philadelphia

NO BUSINESS organization can be stronger or better or more successful than the individual men and women who are employed in it. The character of the company is the character of the people who represent it. The development and progress of the company cannot advance beyond the capacity of the personnel to grow with it. There is no point, therefore, at which the effectiveness of the whole organization may be so readily influenced as at the point where the selection of employees is made.

There have been many books written about "hiring and firing," and many quack methods have been presented whereby character may be determined and competent service assured by testing the color of the eyes, the thickness of the lips or the bumps on the brow. I have no faith in this. But as the result of a number of years of study, combined with our experience in hiring about six thousand persons for Uncle Sam during the war, I have the greatest faith in the systematic selection of employees by the practical exercise of ordinary care and common sense and scientific methods. And there are certain fundamentals of such intelligent selection that may be readily classified and easily applied.

### System Needed in Hiring

In the first place, for any industry and any organization, employment should be centralized so that those who do the hiring for the company may become expert in it. By this I mean not only expert in the judgment of character but skilled in the judgment of the job as well and in the maintenance of the standards and policies of the house. For when the hiring is left to each department head to choose his own assistants it is done in odds and ends of time by any method that suits him, and the result is a hit-or-miss policy with no governing purpose nor central control. To hire intelligently requires a very systematic process of adaptation and proficiency and can only be attained through experience and aptitude.

Before all else, it must be known what kind of an employee is needed for the job in prospect, and in order to be sure a careful detailed statement of the qualities desired should be drawn up. This statement should be prepared by the person who is to do the hiring, for it forces him out into the factory or the department to learn the labor problem and it helps him to give the applicant a clear idea of the job. It avoids either overselling or underselling the job, which would become a source of unrest. For too often the desire in the part of eagerness to fill the position leads to the painting of a too rosy picture.

The statement mentioned above should embrace:

1. A careful description of the work; the job that leads to it and the job that it leads to; responsibility, permanence, pay, hours, overtime; whether it requires an alert or a placid person; operations, machines, tools, postures, speed, disagreeable features, causes of common objection, sources of supply.

2. Description of the employee wanted; sex, race and nationality, language, education, physical and personal qualities, age limits.

To draw up such a specification requires a close study and contact with the work of the organization and intelligent knowledge of the personnel. The man who hires must know not only the kind of an employee who is needed and what kind of a job must be filled, but where the man or woman for the job can be found. He must be in a position also to guide in the training of men for promotion, for it is far better to find material within the organization, if possible, on account of the influence it exerts on ambition and slackness. But he must also know the outside sources of labor. He must have his work organized so that he may maintain a "prospect" file. He should receive his acquisitions sufficiently in advance to have time to draw from his classified "prospects" and not merely "hire at the gate." This also gives the person hired time to consider the job and give proper notice to the employer for whom he is working.

### Four Practical Tests

The person who does the hiring must be approachable, sympathetic and a judge of human nature. He must have maturity, education and experience in the industry. He must have a place provided so that the interview may be held in private. He must proceed with the examination of each prospective employee with systematic thought and thoroughness, testing the applicant in accordance with the nature of the job to be filled. There are four tests that can be applied in the classifying of prospective employees and adapting them to jobs that must be filled. They are:

1. Health test. Its purpose is not to eliminate but to guide and aid employment by setting applicants into four classes: (a) Health all right for any job; (b) health right for some definite class of work; (c) health adequate for certain work, but needs attention as to throat, heart, etc.; (d) a small group with health dangerous to other members of organization.

2. Trade test — of limited use, where trade information is a factor in the job. It serves to sort out novices, apprentices, journeymen, experts.

3. Mental test—for alertness, intelligence, character.

4. Physical test — to determine special ability and fitness, speed, alertness, strength, endurance, sight, hearing, nerve poise.

Such tests, however, should be used only to assist the judgment of the hirer, for systematic, painstaking common sense and thoroughness must be the foundation of it all. Intelligent discrimination comes out of experience, and in any organization it pays to take the job of hiring seriously enough to approach it in this way and make it a chief function of the one best fitted in the organization to do that work. The degree to which the physical and mental tests may be carried depends somewhat on the size of the organization and the amount which can be expended on expert assistance for the employment official.

The principle of intelligent selection, however, may be applied in any case in any business and deserves more attention than it usually receives.

That this applies as well in the electrical industry as elsewhere is evidenced by a recent statement by J. W. Bancker, assistant vice-president of the Western Electric Company, Chicago. He said:

> During the past few years the application of scientific analysis to the problem of industrial management has occupied the attention of many companies. This analysis has been largely directed to the solution of the problem as it was affected by the factors of materials, processes and equipment, and while it has been recognized that the study of the human element is at least as important as the other elements involved, comparatively little analysis of this factor has been attempted in comparison with the thought and study directed to the others.*

*Annals, American Academy of Political and Social Science, May, 1916.

# The Matter with Bill Jones, Contractor

### A Little Close-up of the Man on Whom the Electrical Industry Is Waiting to Develop the Market for Electrical Appliances—What the Manufacturer and the Jobber Must Do

By J. Eugene Chrisman
Dallas, Tex.

THERE is a good deal the matter with Bill as a retailer of electrical appliances, but only part of it is his fault. Most of it is the fault of the industry he is connected with. If Bill Jones is asleep on the job, what of the jobbers and the manufacturers that serve his territory?

If Bill Jones has eleven "Sloshwell" washers collecting dust in his warehouse, whose fault is it? What sold them to Bill? Not the fact that he needed washing machines. Not much. The thing that sold those washers to Bill was the fact that the "Sloshwell's" so-called "dealer helps" looked as though they would produce results and move the goods. Bill may not be a merchandiser, but he knows that the profit on washing machines, so far as he is concerned, begins only when they are out in homes washing clothes.

#### "Campaign" Experience

Bill did have the agency for a good vacuum cleaner too. One day he received a letter stating that if Bill felt that a good live vacuum-cleaner campaign would help in his town, the manufacturers would be glad to send a crew of trained salesmen to conduct such a campaign through his store. Bill bit! In due course of time the "crew" arrived. The company sent a letter to most of Bill's customers stating that "they had been selected by the Jones Electric Shop" for a free demonstration and trial of the cleaner Most of the folks in Centerdale, knowing Bill to be on the square and feeling that he was behind the campaign, accepted the free trial. The crew stayed two weeks and "sold" sixty-one cleaners. The first week one of the salesmen jumped his board bill and departed between days, bringing down the wrath of the widow Elkins upon Bill's innocent head. A week after the departure of the crew numerous customers who had "bought" cleaners began calling Bill on the phone. It developed that most of the "sold" machines had been merely left with the customer on the pretence of a thirty days' trial and no money paid down. They had signed monthly-payment agreements on this pretext, which had been turned in to the company as a bona fide sales, the "crew" having been engaged in a prize contest and each out to win. Bill suffered in silence, vowing never again!

What Bill Jones needs is real factory and jobber co-operation. Instead of gaudy window displays that are never displayed and broadsides that are never broadcasted, he needs selling campaigns that sell goods, Bill Jones must be sold the idea that if he wants business he must go after it and then be shown how to do it. Bill Jones needs resale assistance that will involve the personal aid and guidance of trained factory resale men, on the ground and not in an envelope.

Will it pay to put a man on the ground to show Bill Jones how to sell? Decidedly yes! Within a distance of 10 miles from Bill's store, waiting for good selling methods to gobble it up, lies approximately $20,000 worth of vacuum cleaner business alone. There is possibly $30,000 worth of small appliance business to be written on irons, heaters, percolators, toasters and fans alone! It is surely worth the time of any washing-machine manufacturer or jobber to begin working on the fifty-thousand-dollar washing machine market in his territory. In addition to this there should be not less than $20,000 on ironers and $10,000 on dishwashers, considering only the better class of homes as prospects for these appliances.

#### Key Log in the Jam

Jobbers and manufacturers are asking daily, "What's the matter with Bill Jones?" Bill Jones is all right. He's waiting—waiting for some one to come along and show him how to do it. He's waiting for some one to show him that he's sitting on a gold mine. He is all set to go. He is established in his town. Everybody knows Bill; he's been square with them; their children go to school with his; he belongs to the same lodge as most of them. Of course, if Bill had the enterprise he should have, he would undoubtedly have figured out a way to take advantage of this gold mine of his by himself. It's really too bad that he hasn't done it, for it would have saved the electrical industry a lot of trouble, but since Bill is just Bill there's no use lamenting the fact. The thing to do is wake him up.

The big problem not only of the electrical business but of every other business is turnover. In the electrical industry the problem starts with Bill Jones and goes right on up through the jobber's establishment and into the factory. Bill Jones is the key log in the jam. Show Bill how to move goods and you break the jam that holds back profits and production. Its regrettable that Bill has to be educated into an electrical merchandiser; he should do it for himself. But he doesn't.

Let's educate him to the fact that if he wants business he must go after it. Let's educate him to the fact that the home and not the display room is the place to sell appliances. Let's educate him to the fact that no new home should go up in his city without him being on the ground to figure on modern wiring and fixtures and a complete equipment of household appliances. Let's show him why a home builder, putting up a home at a cost of, say, $8,000, can be sold $500 worth of appliances before the house is erected, making it $8,500, easier than he can after he's moved in.

Let's show him how to keep card files that keep him posted on the electrical needs of his territory. Let's show him how to use any one appliance as an entering wedge and how to follow up on it until he's sold full equipment. Let's show him how to put on and train a couple of outside house-to-house men and let's help him train them. Let's instill into Bill Jones the "Sell 'em something more" idea. Let's realize that a dozen washers, cleaners or percolators gathering dust in Bill's store mean no more washers, cleaners or percolators on the jobber's salesman's order blank until those dozen are out in homes on duty and Bill is reaping the profit from them.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Manufacture of Fixtures Gained 29 per Cent in Seven Years

The Department of Commerce on March 2 announced that, according to reports made to the Bureau of Census, the value of products of establishments engaged primarily in the manufacture of gas and electric fixtures amounted to $42,890,000 in 1921, as compared with $42,268,000 in 1919 and $28,740,000 in 1914. This shows an increase of 1 per cent from the year 1921 and an increase of 29 per cent for the seven-year period from 1914 to 1921.

This industry includes establishments manufacturing, as their products of chief value, gas fixtures, chandeliers, domes, burners, mantles, etc., and electric fixtures, holders, electroliers, brackets, portables, etc. Of the 308 establishments reporting products valued at $5,000 and over in 1921, 97 were located in New York, 41 in Pennsylvania, 31 in Illinois, 25 in Ohio, 24 in California, 13 in Wisconsin, 11 in New Jersey, 8 each in Michigan and Minnesota, 7 each in Connecticut and Washington, 6 in Missouri, 5 each in Maryland, Massachusetts and Tennessee, 3 each in Indiana, Iowa and Oregon, 1 each in Colorado, Kansas, Kentucky, Nebraska, Oklahoma and Rhode Island.

In December, the month of maximum employment, 10,680 wage earners were reported, and in August, the month of minimum employment, 8,787—the minimum representing 82 per cent of the maximum. The average number employed during the year was 9,419 as compared with 9,795 in 1919 and 10,913 in 1914.

The statistics for 1921, 1919, and 1914 are summarized in the table.

DATA ON MANUFACTURE OF FIXTURES—ELECTRIC AND GAS

| | 1921* | 1919* | 1914* |
|---|---|---|---|
| Number of establishments | 308 | 319 | 389 |
| Persons engaged | 11,735 | 12,379 | 13,649 |
| Proprietors and firm members | 203 | 221 | 320 |
| Salaried employees | 2,113 | 2,363 | 2,416 |
| Wage earners (average number) | 9,419 | 9,795 | 10,913 |
| Salaries and wages | $15,479,000 | $14,292,000 | $9,852,000 |
| Salaries | 4,419,000 | 4,490,000 | 3,348,000 |
| Wages | 11,060,000 | 9,802,000 | 6,504,000 |
| Paid for contract work | 41,000 | 65,000 | 67,000 |
| Cost of materials | 18,788,000 | 20,259,000 | 14,090,000 |
| Value of products | 42,890,000 | 42,268,000 | 28,740,000 |
| Value added by manufacture† | 24,102,000 | 22,009,000 | 14,650,000 |

*Statistics for establishments with products valued at less than $5,000 are not included in the figures for 1921. There were twenty-nine establishments of this class, reporting twenty-three wage earners and products valued at $77,000. For 1919, however, data for twenty-two establishments of this class, reporting sixteen wage earners and products valued at $59,000, and for 1914 data for seventy-one such establishments, with eighty-two wage earners and products to the value of $200,000, are included in all items with the exception of "number of establishments."

† Value of products less cost of materials.

## Denver Radio Equipment Sales Improving

Radio activities in Denver have been materially stimulated after the announcement that a new broadcasting station, backed by the leading radio jobbers and dealers in that city, will soon be put in operation. Although radio equipment has been moving well in the Denver territory for some time, a recent report indicates that improved broadcasting facilities are badly needed. Higher-priced sets are moving in good number in the Rocky Mountain territory. Crystal sets and cheap parts for home assembly are not so much in demand as they were last fall. Stocks, both jobbers' and dealers', are complete, and since the holidays there has been a marked standardization. Business in the radio departments of dry-goods and stores other than specialty or electrical shops has decreased.

## Active Demand for Wire in Many Types

Continued expansion of the electrical industry is throwing an immense amount of business upon wire manufacturers and jobbers, well ahead of the increased seasonal demand anticipated, as open weather permits the acceleration of construction work. All winter the sale of rubber-covered wire has been active, and the increased amount of building construction reported from many parts of the country has been a major factor in keeping the wire plants on full time. During the past few weeks a large amount of weatherproof wire has also been purchased, and in some sections the growth of interconnection and the insatiable demand of consumers for central-station service have resulted in heavy shipments from jobbers' stocks and from the manufacturing plants into the field. More life has appeared in the bare-wire market as a result of these interconnection programs, New England in particular having committed itself to a vigorous development in this field.

### CONSUMPTION INCREASING RAPIDLY

For months the reports of the business statisticians have marked substantial gains over contractual totals of a year ago, and both old and new building wiring jobs are demanding great quantities of wire. Campaigns for increased outlets are of some importance in this trade as well as the never-ending call of betterment jobs in industrial and mercantile establishments. Enormous increases in wire sales for telephone work are being noted, including the extension of toll cable facilities, some of which with auxiliary apparatus represent an investment of $35,000 per mile.

Advances in copper and cotton prices have lately been reflected in wire, and a good proportion of the business of the past month has been stimulated for early delivery by the anticipated stiffening of quotations as the prices of these basic commodities have risen. Notwithstanding the large volume of business being done, competition continues acute in the wire market. The delivery situation is aided somewhat by the production of wire in various localities, with the maintenance of supply by motor trucking in cases where railroad congestion is blockading freight movement. Considerable reliance is placed on boat

shipments in the Atlantic Coast market, and the outlook is much better along transportation lines than it was a few weeks ago. There seems little doubt that the year's business will be in most satisfactory volume, for the demand for wire for use in machinery, appliances, radio equipment and in miscellaneous applications is increasing, as are also the requirements of interior and outdoor service.

## The Metal Market

**Copper Advanced to 16.75 Cents—Sales Smaller—Discourage Reckless Buying—Export Demand Better**

The daily advance in copper prices continued until now 16.75 cents, delivered, has been reached, this figure being generally quoted by producers at the week end. Two or three producers have not yet come to that level. Sales have not been quite so great as last week, but this has been more because producers have been inclined to discourage reckless buying rather than due to any lack of inquiry. A particularly encouraging feature of the week has been a good export demand, which has made some producers care little about booking further domestic orders. Some of the export business has been for the Orient.

NEW YORK METAL MARKET PRICES

| | Feb. 27, 1923 Cents per Pound | Mar. 7, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 16.37½ | 16.75 |
| Lead, Am. S. & R. price | 8.00 | 8.10 |
| Antimony | 7.50 | 7.62½ |
| Nickel, ingot | 30.00 | 30.00 |
| Zinc, spot | 7.20 | 7.30 |
| Tin Straits | 43.12½ | 42.00 |
| Aluminum, 98 to 99 per cent | 24.00 | 24.00 |

## Meter Sales Are Gaining with Well-Maintained Deliveries

Improved demand for meters is a marked feature of the present manufacturing situation, and thus far, with the exception of some special equipment, deliveries are being well maintained. The expansion of the building industry and widespread development of house-wiring and outlet campaigns is being reflected in the production of representative manufacturers. Shipments are prompt on the more common lines and types. As a result of anticipating this business, conditions are reasonably good with respect to the supply of raw materials, and thus far the advancing prices noted in copper and cotton have not been reflected in quotations for meters.

In well-informed circles the opportunities for a larger development of industrial meter business are receiving some consideration, especially in connection with the rapid development of central-station service in industry and the possibilities of attaining higher manufacturing efficiency through more accurate studies of departmental operations and the derivation of more data as to energy consumption per unit of product in different portions of industrial establishments. Considerable "missionary work" will have to be done here before the business makes any great impression upon the trade.

### Chicago Trade Brisk

Increasing demands for electrical services in Chicago, coupled with new building construction, are improving the market for watt-hour meters. This situation also appears to be universal in the Middle Western territory radiating from Chicago. With the increase of 73,321 new customers on the Commonwealth Edison Company lines during the year, each requiring a new meter, some indication can be given as to the number of meters needed in this territory. Jobbers' supplies are in good condition and prices remain firm. The Public Service Company of northern Illinois had a customer increase during 1922 of 20,938.

# The Week in Trade

**Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

STEADY progress is reported for the electrical market during the week just ended. Conduit stocks in the New York and Massachusetts territories are improving despite poor transportation caused by snow and rain in the interior states. An active call for meters, poles and wire by the utilities is noted. Lamps are said to be selling in greater volume. Appliance sales are slower than two weeks ago.

**Boston** General business is gaining momentum and the electrical industry is intensely active. Buying for stock is still being done conservatively, although the hardening of prices in basic commodities has stimulated orders sharply for the time being. The arrival of delayed shipments of conduit has relieved the scarcity in this line to a considerable extent. Shortages still exist in radio tubes, and poles are still scarce on account of bad road conditions in the interior. Business is greatly hampered by delays in mail service, notably between New York and Boston. Labor is very widely employed. The textile and leather industries are extremely busy and retail trade is developing steadily. Building contracts in New England totaled $2,933,700 for the week ended Feb. 27, against $1,565,800 for a year ago.

**New York** Business in the electrical market continues at a steady gait with some falling off in the demand for appliances and radio. Commodities which have taken on added interest during the last few days are meters, motors and lamps. Conduit stocks are reported to be slightly improved with rather higher prices noticed in the wire lines. Construction projects are progressing fairly well, and the demand for all electrical materials entering into new buildings is expected to pick up to the highest strength of last year at from two to three months earlier. Collections are reported to be only fair.

**Baltimore** The transportation situation has hindered deliveries along certain lines, causing a falling off in stock for some of the jobbers, although not to any detriment to business, owing to the fact that most jobbers are well stocked in all lines. There has been a more steady demand for motors, especially in the larger sizes. There is an expected activity in wire due to the increase in the price of copper. The exceedingly warm spell which is breaking all heat records for this period in the year for this section has completely demoralized the market for all heating apparatus. Commercial fixtures and lamps have been holding their own, and there is a fair demand for cable.

**Atlanta** Electrical jobbers report very satisfactory sales in the 5-amp. and 10-amp. two-wire and three-wire meters, small residential and commercial construction having acted as quite a stimulus to sales. Jobbers' stocks are in good shape, with the exception of the large and high-tension types. Wire continues to move briskly, despite continued price advances, and local stocks of the more popular sizes are somewhat depleted. Shipments from factory on the larger sizes are becoming longer. Electric range sales are satisfactory, and one jobber expressed the opinion that his sales this year will be at least 100 per cent in excess of those last year. Stocks are satisfactory and prices generally firm.

**Pittsburgh** The general tendency is for increased business in all lines. There was a specially good business report during the week on electrical appliances. One jobber reported as having received an order for ranges for a large apartment dwelling now being constructed. Increased business was reported by the jobbers from the industrials, this being of greater volume than ever before. It is quite noticeable that these orders are for new material rather than for piece parts as in the past. During the week new agreements were signed by practically all building crafts in this territory, which means that labor troubles will be averted during 1923 and a portion of 1924. Central stations are showing a marked activity in the way of taking over new territory.

# Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Conduit Boxes, Signal Apparatus
and Rectifiers

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Radio | Instruments | Electric Ranges | Hollow Ware |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boston** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Slow | Sdy. | Act | Act. | Sdy. | Sdy. | Act. | Sdy. | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Low | Low | Low | Low | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Low | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **New York** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Sdy. | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Hi. | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **Baltimore** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Act. | Slow |
| Supply | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Act. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Low | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy | Act. | Slow | Slow | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Act. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **St.Paul-Minneap.** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Sdy. | Sdy. | Act. | Slow | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Act. | Sdy. | Slow | Slow |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Slow | Slow |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Slow | Slow |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Act. | Act. | Sdy. | Slow | Act. | Slow | Sdy. | Act. | Sdy. | Act. | Slow | Act. | Sdy. | Slow | Sdy. |
| Supply | Nml. | Low | Low | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Slow | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Slow | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Slow | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Dec. | Dec. | Firm | Inc. | Firm | Inc. | Inc. | Firm | Dec. | Firm | Firm | Inc. | Firm | Firm |

## Cleveland

Dealers as well as manufacturers and jobbers enjoyed a very satisfactory week. Improvement in industrial equipment is evident. Wire, conduit and copper stocks are extremely low and demand constantly increasing. Prices of these commodities are advancing rapidly in consequence, while deliveries are hampered by poor transportation. Poles, porcelain and hardware are recovering gradually but with firm prices. Appliance sales are in greater volume, with active interest in heaters and ranges, due to the gas controversy and cooler weather. Radio equipment is in fair demand, and the tube shortage has been relieved somewhat. Meters are in better demand and central-station business is most promising. Building operations are handicapped slightly by labor difficulties, but plans are under way to assure an active spring. Fixtures are moving well and collections are in good shape.

## Chicago

Electrical business, according to jobbers and manufacturers, is steadily forging ahead. Building construction requires an increasing amount of wire and wiring materials, although prices on these commodities are gradually strengthening. Demand on commercial fixtures is also active. The call for motors is up to the previous sales rate, but shipments from manufacturers are slowing up. The porcelain market is a little irregular, since manufacturers are somewhat pressed for raw material.

## St. Paul-Minneapolis

All steel products are on the rise. Stocks are getting low on all kinds of wire. Demand from the country is still active for all lines. Retail business is dragging. Appliances are slow, but wiring is fairly active. Jobbers expect a lull for about three weeks for all lines.

## St. Louis

An increase of approximately 40 per cent is reported in the sale of electrical supplies during the past month over the same period a year ago. This is attibuted to the general improvement in business, almost uninterrupted building operations during the winter and heavy buying by the public utility companies.

Orders for automobile equipment have also aided in swelling the sales for this month. There is an excellent demand for small motors for household appliances, and more than the usual seasonal volume of contract work for wiring is reported. Electrical equipment for mining work and for the oil fields is moving well. The consumption of electrical energy for industrial purposes shows an increase of almost 70 per cent over the same month last year.

**Denver** Cold weather is holding back outside construction. Improved broadcasting programs have stimulated both interest and trade in radio. Electric commercial vehicles are again developing interest in this territory after a decade of inactivity. Steel mills are working at capacity and coal shipments are moving easily. Business is good and the electrical industry is profiting, but not in the degree it should if conditions through the territory were more stabilized.

**New Orleans** The feature of the market is the continued and steady rise in the price in wire, the largest item in electrical installation. Wire is now about 25 per cent higher than it was last year, and the copper, rubber and cotton markets indicate further increases. The market for ranges is increasing.

**Salt Lake City** The real-estate market is showing improvement, particularly in the larger towns and cities. Homes are in fair demand, and the 1923 cottage construction program promises to be on a par with that of 1922. The month of March opened with bonds showing strength and mining stocks in a much improved condition. A more pretentious live-stock show will be staged in April than has been held in several years past, a fact indicating marked improvement in that important Intermountain industry.

**San Francisco** Building is brisk, averaging about a 15 per cent increase over last year. Retail business is good, department stores especially reporting excellent business as compared with 1920. The recent San Francisco automobile show gave good indication of increasing buying power in its attendance and immediate sales. Labor conditions continue excellent, and non-employment is virtually confined to unskilled laborers. Conduit demand is active after a 5 per cent increase. Stocks are far below normal. Construction demand is steady. Power company crews report progress in apartment-house sales. The popularity of white-enameled ranges has necessitated local stocks of several makes. Percolator sets, in urn patterns, and waffle irons are especially popular. Silver-finish sets are increasing slightly in demand, but the real call is for nickel sets listing from $30 to $40. Collections are improving.

**Portland-Seattle** Business conditions continue to hold up in good shape. The value of building permits for the first two months of this year is materially in excess of that of a year ago, and the same condition applies to electrical permits. Conduit stocks are still in a precarious condition with a sustained active demand, slow deliveries and short stocks. Manufacturers are no longer quoting prices in advance and jobbers' orders are placed subject to price at time of shipment. Another advance in the base price of copper is reported for the past week. Weatherproof wire followed the rise, but rubber-covered has not yet been affected.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Gain in Allis-Chalmers Orders

Orders on the books of the Allis-Chalmers Company, Milwaukee, on Feb. 1 amounted to $9,000,000, compared with $8,400,000 on Jan. 1. Officials of the company estimated that the total on March 1 would be at least $9,500,000. The lead in incoming orders has been taken by the electrical cement machinery and turbine departments.

## Westinghouse Electric Rents Half of Proposed Skyscraper

The Westinghouse Electric & Manufacturing Company last week leased for a period of ten years twelve floors in the new twenty-three story bank and office building to be erected at 150 Broadway, New York City, by the 150 Broadway Corporation. The building will be known as the Westinghouse Building. The space leased by the Westinghouse company comprises between 90,000 sq.ft. and 95,000 sq.ft., and the amount of money involved in the lease is in excess of $3,000,000.

The Westinghouse lease is for all the floor space from the twelfth floor to the twenty-third floor, inclusive. Co-tenants with the Westinghouse Electric & Manufacturing Company will be the Westinghouse International Company, the Westinghouse Lamp Company and the Westinghouse Air Brake Company. It is expected that considerably more available office space in the building will be leased to companies allied with the Westinghouse company's business. The offices of the Westinghouse Electric & Manufacturing Company are now at 165 Broadway.

## Electric Power Equipment Firm Arranges Agency in Seattle

The Electric Power Equipment Corporation, Fifteenth and Wood Streets, Philadelphia, announces that it has arranged an agency in Seattle, Wash., with Eicher & Bragg, 2107 L. C. Smith Building. This agency will cover the states of Washington and Oregon. This agency is handling, in addition to the line made by the Electric Power Equipment Corporation, equipment of the Kelman Electric & Manufacturing Company, Pittsburgh Transformer Company, Pittsburgh Electric Furnace Corporation, Jewell Electric Instrument Company and the Stromberg lines.

## To Manufacture and Repair Transformers in Newark

D. J. Norton, formerly of the General Electric Company's Pittsfield works and for the past seventeen years superintendent of the American Transformer Company, Newark, N. J., has opened a manufacturing plant at 71 Hamilton Street, Newark, specializing in manufacturing and repairing of transformers. Special attention will be given to engineers having their own designs, and estimates will be furnished on request.

## Rome Wire Plans Addition

The Rome Wire Company, Rome, N. Y., manufacturer of electrical wires and cables, will build a one-story addition to its branch plant on Clyde Avenue, Buffalo, to be 33 ft. x 300 ft. and estimated to cost about $42,000. It will be used for general increase in production. The contract for the work has been awarded to the John W. Cowper Company, Fidelity Building, Buffalo.

## Apex Representatives Meet

Fifty Southern representatives of the Apex Electrical Distributing Company, including state and branch managers and salesmen of the company, attended the annual Southern district sales convention in Atlanta on March 3. The principal speakers were R. J. Strittmatter, sales manager of the company, Cleveland, and R. H. Short, Southern district sales manager, Atlanta.

## Buffalo Fuse Corporation Plans Sales Expansion

Rapid sales expansion is planned by the Buffalo Fuse Corporation, 72 Main Street, Buffalo, which a year ago took over the manufacturing of the renewable electric fuse formerly made by the Pierce Fuse Corporation. The company has just amended its incorporation to provide for $50,000 preferred stock in addition to its 2,000 shares of common. The new board follows: Robert F.

Bickford, president; W. S. Harrison, vice-president; John G. Clemens, secretary, and Lambert G. Smith and Harvey B. Harrison, additional directors.

## Northwest Electric Changes Name

The Independent Electric Company is the new name of the Northwest Electric Apparatus Company, Security Building, Minneapolis. The reason for this change was that the company was sometimes confused with other companies and also that it was representing independent manufacturers in the capacity of manufacturers' agent.

## P. A. Geier Announces Spring Housecleaning Sales Contest

A spring housecleaning sales contest, which will run from April 2 to June 2, has just been announced by the P. A. Geier Company, Cleveland, manufacturer of the "Royal" cleaner. This contest is open to retail salesmen, cash or merchandise prizes being awarded not only to the leaders, but to all who qualify with a reasonable number of sales.

Previous contests conducted by this manufacturer have proved very successful in stimulating selling activity during seasons which are normally considered dull. The present competition, held during the period of heaviest demand, is expected to give exceptional results.

## To Handle Anaconda Sales

A new organization, to be known as the Metals Sales Corporation, will be formed to handle the sales of copper of the Anaconda Copper Mining Company. This business heretofore has been handled by the United States Metals Selling Company, which in the future will handle the sales of lead, zinc and other metals other than copper.

The new organization will take over all liabilities of the United States Metals Selling Company involving the sales of copper. It is expected to be the second largest organization of its kind in existence, and if later it should handle the sales of copper produced by the Chile Copper Company, now controlled by Anaconda, it is expected to hold first rank in the metal-selling business.

## Uehling Instrument Appoints Agents in Japan and China

Mitsui & Company have just been appointed exclusive representatives in Japan and China for Uehling $CO_2$ recording equipment and other Uehling power-plant instruments and gages. The head office of Mitsui & Company is in Tokio, and the New York branch office of the company is located at 65 Broadway.

The main office and factory of the Uehling Instrument Company is in Paterson, N. J. Many Uehling installations have been made in Japan and China without the aid of local representatives, but it is believed that with the co-operation of the engineering department of Mitsui & Company the Japanese and Chinese Uehling customers will be served to advantage.

## Benjamin Electric Appointments

The Benjamin Electric Manufacturing Company, Baltimore, has announced that Merritt L. Tice, district sales representative, will soon take on added territory in North and South Carolina, Georgia, Florida and parts of Tennessee and Alabama. Additional men will be put into the district and the territory more intensively served.

Thomas F. McDonough is now in charge of the Northwest territory of the Benjamin Electric Manufacturing Company, consisting of Montana, Idaho, Washington and Oregon, with headquarters in the L. C. Smith Building, Seattle. The company also announces that Carl O. Martin, formerly in charge of the Northwest sales territory, has been transferred to a larger field, with headquarters in San Francisco. He will serve in that city as assistant to Miles S. Steel, Pacific Coast manager.

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**The Century Electric Company**, manufacturer of single and polyphase motors, St. Louis, has opened an office at 603 Queen and Crescent Building, New Orleans, where a complete stock of motors will be carried.

**The Union Electric Manufacturing Company**, South Bend, Ind., of which Fred. A. Bryan is president, has recently been absorbed by the Indiana & Michigan Electric Company by the purchase of stock by the latter company. No change in management will occur, it is said. Hugh McVicker will continue as manager and Joseph Black as superintendent.

**The Sunlight Lamp Company**, which has been operating in Warren, Ohio, under the name of the Sunlight Electric Company, has moved to Newton Falls, Ohio, having acquired the building formerly occupied by the Newton Manufacturing Company.

**The Weldon Manufacturing Company**, Detroit, electrical specialties, will establish a plant at Grand Rapids, having purchased a site at Russell Avenue and the Père Marquette Railroad. It is announced that contracts have been let for a factory, 50 ft. x 125 ft.

**The Gibb Instrument Company**, Bay City, Mich., manufacturer of welding equipment, has increased its authorized capital stock from $75,000 to $175,000. Of the increase, $40,000 has been sold at par value to provide increased manufacturing facilities and to take care of increasing business.

**The Cornell-Mathews Company**, sales engineers, Christ Building, Orlando, Fla., announces the closing of a contract with the Orlando Utilities Commission for all-steel switching and distribution towers equipped with air brakes, switching apparatus and choke coils. The structures are 50 ft. long and 40 ft. high and contain 48,000 lb. of structural steel. The entire output of the new generating station for Orlando will be carried underground in cable and distributed from the switching towers described above. The Cornell-Mathews firm is district agent for the Delta Star Electric Company, Chicago.

**The American Electrical Supply Company**, 953 Washington Boulevard, Chicago, on March 1 moved into a new building at 117 South Morgan Street. C. E. Browne is president of the company.

**The Art Craft Fixture Company**, 85 Academy Street, Newark, N. J., manufacturer of lighting fixtures, has acquired a factory at Adams, Malvern and Delancey Streets for a new plant. The present works will be removed to this location and additional machinery installed, according to officials of the company.

**The E. H. Freeman Electric Company**, Meade and Prince Streets, Trenton, N. J., is arranging for the installation of equipment and operation of its three-story addition, 35 ft. x 164 ft., now being completed for the manufacture of electrical equipment.

**The Holland Maid Company**, Holland, Mich., has been organized with a capital of $400,000 to take over the plant of the Holland Manufacturing Company, manufacturer of electric washing machines and clocks.

**The Am-Plus Storage Battery Company**, formerly at 741 Van Buren Street, Chicago, has leased the third floor, 100 ft. x 100 ft., of the building at 449 West Superior Street.

**Carman & Fryer**, Indianapolis, operating an electrical contracting business, have acquired the electrical repair department of the Vonnegut Machine Company, with local works and will operate it in the near future. The works will be extended and additional equipment installed, according to officials of the firm.

**James Seffel & Company**, Springfield, Ohio, manufacturers of turbines, water-wheels, etc., have announced the removal of their Boston office from 161 Devonshire Street to the Little Building, 80 Boylston Street, Boston.

**Hall Brothers Cedar Company**, formerly of Jacksonville, Tex., has recently moved to Cœur d'Alene, Idaho, and will engage in the manufacture and wholesaling of western red cedar posts, poles and piling.

**The Wise-McClung Manufacturing Company**, New Philadelphia, Ohio, has appointed G. B. Gaiennie as general manager of the Sunshine Sales Company, with offices in Cleveland, Ohio.

**Commercial Truck Company.**—F. F. Espenschied, who represents the Commercial Truck Company, makers of the C-T Electric Truck, in the Pittsburgh territory, has added the local account of the Electric Machinery Manufacturing Company, makers of synchronous motors, alternators and motor-generator sets.

## Foreign Trade Notes

FUNDS SECURED TO COMPLETE THE HYDRO-ELECTRIC PLANT ON TEIGIBSCH RIVER, AUSTRIA. — Arrangements have been made by the Steirische Weag Aktien Gesellschaft to secure a loan of 5,000,000 francs from a Swiss banking group, which will enable it to complete the hydro-electric station now in course of construction on the Teigibsch River and to begin work on other hydro-electric projects in its program.

A MODEL ELECTRICAL FARM IN SWEDEN. — To encourage the use of electricity in agriculture, a model electrical farm, according to *Commerce Reports*, is being established near Stockholm, Sweden, and demonstrations of electrically operated plows, harrows, harvesters, threshing machines, churns, separators, etc., will be given.

MANUFACTURE OF INCANDESCENT LAMPS IN NORWAY.—The rights of the Osram patent (German) for Norway, *Commerce Reports* states, have been acquired by a new company. Existing plants have been modernized so that they are now capable of producing 5,000 lamps daily, which is sufficient to supply the Norwegian trade. The factory is under the supervision of workers brought from Germany and the lamps are said to be exact replicas of the German product.

INVESTIGATIONS OF WATER-POWER PROJECTS IN BELGIAN CONGO.—Investigations are now being made by hydro-electric engineers, according to *Commerce Reports*, of the possibilities of two large water-power projects in the Katanga district of the Belgian Congo. One is a 60,000-70,000-hp. project on the Lualaba River, and the other a 50,000-hp. development on the Lufira River. The latter includes a mass-concrete intake dam and an earthen reservoir dam 17 m. high. The schemes are as yet only in the project stage.

ELECTRIC SIGNS IN LILLE, FRANCE. —Electric advertising signs, unknown in 1921 and even late in 1922, have appeared in various parts of the business centers of Lille, France, according to a report of Vice-Consul J. G. Finley to the Department of Commerce. The development of electric sign advertising is becoming noticeable in France and should lead to a market for American waterproof sockets and sign appliances in all important commercial and industrial centers of that country.

## Foreign Trade Opportunities

TELEPHONE INSTALLATION IN COLOMBIA.—A new telephone system has been installed in Barranquilla, Colombia. A long-distance line to Cartagena and a new system in Cali is proposed. The system in Barranquilla was installed by an American company.

ELECTRIC PLANT TO BE INSTALLED AT ITARSI, INDIA.—The Itarsi (India) Industrial Corporation, according to *Commerce Reports*, will require an electric plant to supply electricity to the town of Itarsi and to furnish power for driving saws.

CONCESSION ASKED TO INSTALL A TELEPHONE SYSTEM IN BRAZIL. — Application has been made to the Secretary of Public Works of the State of Rio Grande do Sul by Argentine interests, *Commerce Reports* states, for a concession to install a telephone system in the city of Uruguayana and join it with the systems in the municipalities of Quarahy, Alegrete and Livramento.

NEW TELEPHONE SYSTEM PROPOSED FOR REVAL, ESTHONIA.—The telephone system in Reval, Esthonia, is to be enlarged to provide for 2,500 subscribers. The present system is of the old Russian type, and the Post Administration proposes to install two automatic stations, each to have a capacity of 500 telephones. The plans provide for 10,000 telephones eventually. An item of 35,800,000 marks (approximately $105,000 at the present rate of exchange) is included in the national budget for 1923, now before the State Assembly, for such construction.

ELECTRIC PROJECTS IN SPAIN. — Plans are being prepared by the Co-operative de Flúido Electrico of Barcelona for supplying electricity in the Barcelona district. The company proposes to utilize the falls on the River Cadi and coal from its own mines. Several Asturian coal companies, it is announced on the Bourse, have formed a group with a capital of 4,550,000 pesetas, of which 3,100,000 is contributed by the Duro-Fêlguera concern, to generate electricity by utilizing coal of an inferior quality. The initial capacity of the project will be 5,100 kw., to be supplied by the Duro-Felguera Company.

ELECTRICALLY DRIVEN PUMPING EQUIPMENT FOR BUENOS AIRES. — Tenders will be received by the Department of Sanitary Works, Buenos Aires, Argentina, until April 26 for nineteen groups of vertical centrifugal pumps with electric motors and spare parts.

## New Apparatus and Publications

ARMATURE AND FIELD TESTERS.—The Century Electrical Company, 100 Randall Avenue, Syracuse, N. Y., is distributing a folder describing the "Century" armature tester and also a booklet covering the "Century" field tester for testing fields and armatures.

MOVING SIGN. — The American Sign Company, Kalamazoo, Mich., has brought out a new moving sign, known as the "Roto-Sign."

ELECTRIC CLOTHES DRIER.—The Airo Electric Appliance Company, Columbia Building, Pittsburgh, is manufacturing the "Airo" electric clothes drier.

REEL FOR PORTABLE ELECTRIC TOOLS.—Forbes & Myers, 172 Union Street, Worcester, Mass., have placed on the market a reel for use with portable electric tools.

ANGLE AND STRAIGHT CONNECTORS.—The Sprague Electric Works of General Electric Company, 527 West Thirty-fourth Street, New York City, have designed a new duplex Y-shaped connector made in both the straight and 90-degree-angle types.

STEAM-POWER PLANTS. — "Steam Power" is the title of a booklet distributed by the J. G. White Engineering Corporation, 43 Exchange Place, New York City, which describes and illustrates some of the more important steam-power plants which have been built by the corporation.

INDUCTION FURNACE.—Bulletin No. 2 issued by the Ajax Electhrothermic Corporation, 636 East State Street, Trenton, N. J., describes the "Ajax-Northrup" high-frequency induction furnace.

SURGE ARRESTERS.—Bulletin No. 4-A distributed by the Electric Service Company, Marietta, Ga., covers the "Bennett" surge arresters and disk gaps.

BATTERY CHARGER. — A new small battery-charging set has been developed by the Ohio Electric & Controller Company, 5900 Maurice Avenue, Cleveland.

PORTABLE WELDING GENERATORS. —The Alexander Milburn Company, 1416-1428 West Baltimore Street, Baltimore, has recently placed on the market a portable acetylene welding generator, designed to obviate the use of high-pressure cylinders.

BELL-RINGING TRANSFORMER. — A new bell-ringing transformer has been developed by the Killark Electric Manufacturing Company, St. Louis.

SINGLE-PHASE MOTORS.—Bulletin No. 131 issued by the Wagner Electric Corporation, St. Louis, gives instructions for ordering and adjusting repair parts for the "Wagner" single-phase repulsion induction motors.

COKE PLANT MACHINERY. — Leaflet 1,867 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes electrical equipment for coke-plant machinery.

## New Incorporations

THE BURKE POWER COMPANY, Morgantown, N. C., has been incorporated with a capital stock of $1,000,000 by A. M. Kistler and others to develop water power in that section.

THE ILLINOIS POWER & LIGHT CORPORATION, 122 South Michigan Avenue, Chicago, has been incorporated with a capital stock of $1,000 by A. C. Winters, H. W. Snell and M. G. Grover.

THE MANUFACTURERS' POWER CORPORATION, Rome, N. Y., has been incorporated by H. T. Dyett, H. D. Wolfe and E. L. Spriggs. The company is capitalized at $50,000 and proposes to generate electricity. M. J. Larkin, Rome, is attorney.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

BOSTON, MASS. — The Edison Electric Illuminating Company will commence work at once on the construction of a power plant on Summer Street, to cost about $500,000.

BOSTON, MASS. — The Gillette Safety Razor Company, 41 West First Street, will install electric power equipment in its proposed factory addition on Dorchester Avenue, to cost about $200,000. Charles T. Main, 49 Federal Street, is architect and engineer.

NORTH ABINGTON, MASS.—The Electric Light & Power Company of Abington and Rockland is arranging for a stock issue of $136,000, part of the proceeds to be used for extensions, etc.

FAIR HAVEN, CONN.—The Ward Baking Company will build a power house in connection with a proposed local baking plant, to cost about $250,000. C. B. Comstock, 110 West Fortieth Street, New York City, is architect and engineer.

LYME, CONN.—The Eastern Connecticut Power Company, Norwich, is negotiating for the purchase of the property of the Lyme Electric Company and a controlling interest in the Danielson & Plainfield Gas & Electric Company.

NEW HAVEN, CONN.—The Connecticut Power Company will soon begin work on an addition to its power house on Grand Avenue, to cost about $25,000, exclusive of machinery.

## Middle Atlantic States

LOCKPORT, N. Y.—The City Council has awarded the Lockport Light, Heat & Power Company a contract for street lighting for a period of three years, to furnish a minimum of 705 lamps. In addition the company was given a contract to install seventy-two new lamps on Main Street in the business section.

MALONE, N. Y. — Seventy additional 400-cp. single-lamp standards will be erected on five residential streets this year. The Malone Light & Power Company furnishes the street-lighting service. S. G. Hunter is operating manager.

MASSENA, N. Y. — The plant of the Beakes Dairy Company, including its power house, was damaged by fire recently, causing a loss of about $100,000.

NEW YORK, N. Y.—The New York Edison Company will build a three-story substation at 127 East 120th Street, to cost $85,000.

PENN YAN, N. Y.—The Yates Electric Light & Power Company has applied to the Public Service Commission for permission to erect a new generating station at Cascade Mill, to cost about $500,000.

WATERTOWN, N. Y.—Bonds to the amount of $415,000 have been voted to develop the water power at Delano Falls.

NEWARK, N. J. — The Department of Public Affairs, City Hall, contemplates the erection of an addition to the power station at the city alms house.

NEWARK, N. J. — The Public Service Electric Company will reconstruct a portion of its transmission system in different parts of the state, changing from two-phase to three-phase system.

PHILLIPSBURG, N. J.—The New Jersey Power Corporation has been organized by W. S. Barstow & Company, 50 Pine Street, New York, with a capital of 25,000 shares of stock, no par value, to construct and operate a power plant and system in this section. It will be operated in conjunction with the New Jersey Power & Light Company, Dover.

ASHLEY, PA.—The installation of an ornamental lighting system on Main Street is under consideration by the Borough Council.

FREEBURG, PA.—The Freeburg Power & Light Company, recently organized, contemplates the installation of a local distributing system. A transmission line will be erected. C. M. Walter, Allentown, is treasurer.

HAZLETON, PA.—The Jeddo Highland Coal Company is planning to build a power house at its No. 2 Highland Colliery, to replace the one recently destroyed by fire.

HOLTWOOD, PA. — The Pennsylvania Water & Power Company has issued $450,000 in bonds, the proceeds to be used for extensions to its hydro-electric power plant, comprising two units, each 19,000 hp., on the Susquehanna River.

PHILADELPHIA, PA. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 20 for 5,000 ft. electric wire for use at the local navy yard. (Schedule 584.)

PITTSBURGH, PA.—The Press Publishing Company, 228 Oliver Avenue, will install electric motors and other power equipment in its proposed newspaper-publishing plant at Seventh Avenue and Bigelow Boulevard, to cost about $800,000.

YORK HAVEN, PA.—The York Haven Power Company has acquired property on the Susquehanna River for extensions to its power dam and generating station.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company is arranging funds to the amount of $6,500,000 for extensions and improvements during the present year.

CHARLESTON, W. VA.—The Virginian Power Company is considering the construction of a hydro-electric plant on the New River, near Hinton, to cost about $300,000.

BRISTOL, VA.—The Big Jack Overall Company, Inc., Lee and Water Streets, contemplates extensions to its power house.

NORFOLK, VA. — The Pender Grocery Company will install motors and other electric power equipment at its proposed baking plant at Twenty-fifth Street and Fawn Avenue, to cost about $125,000.

SUFFOLK, VA. — The America Brick Corporation will build a substation in connection with its proposed new brick-manufacturing plant.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until March 16 for 12,000 dry batteries. (Circular PR 14,085-1 CP.)

## North Central States

ALBION, MICH. — P. E. Ganson, local manager of the Consumers' Power Company, has submitted a proposal to the City Council offering to install a new street-lighting system, to cost about $26,000.

BAY CITY, MICH.—Bids will be received at the office of the W. H. Reid, city manager, City Hall, until March 12 for furnishing and installing electric lighting systems and power wiring in pumping station and filtration plant. Bids will also be received at the same time for one 5,000,000-gal.-per-minute motor-driven centrifugal pump, complete with connecting piping, and for two 10,000,000-gal.-per-minute steam turbo-centrifugal pumps with condenser and auxiliaries. The Frazier-Ellms-Sheal Company, B. F. Keith Building, Cleveland, is engineer.

DETROIT, MICH.—Roehm & Davison, Mack Avenue, will install electric power equipment in the proposed addition at their iron and steel works, Mack and Beaufaite Avenues, to cost about $100,000.

AKRON, OHIO.—Electric lamps will be placed on the High Level Bridge, the expense to be paid by the city.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 16 for one 600-hp. steam turbine for the Fairmount pumping station.

CLEVELAND, OHIO. — The Teachout Company, Prospect Avenue, manufacturer of sash, doors, etc., will install motors and other electric equipment in the proposed addition to its plant, to cost about $250,000.

WASHINGTON C. H., OHIO.—Plans are being prepared by the Washington Gas & Electric Company for extensions to its plant, including the installation of new equipment.

DECATUR, IND.—Extensions and improvements will be made in the municipal light and power plant and waterworks, including the installation of additional machinery, to cost about $40,000.

FORT WAYNE, IND. — The Indiana Service Corporation has issued $1,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

INDIANAPOLIS, IND. — The Burnet-Birford Lumber Company, 1401 West Thirtieth Street, contemplates extensions to its power plant, including the installation of boilers, etc.

CHICAGO, ILL.—The Marquette Cement Company, 140 South Dearborn Street, will install electric power equipment in a new building, to be erected at Elston and Redfield Streets, to cost about $260,000.

CHICAGO, ILL.—The Pullman Company, 79 East Adams Street, will install electric power equipment in its car shops, to be erected at Cottage Grove Avenue and 103d Street, to cost about $150,000.

SPRINGFIELD, ILL.—The installation of an ornamental lighting system on Noble Avenue from South Grand Avenue to Laurel Street is under consideration by the City Council.

AMERY, WIS.—The Wisconsin Hydro-Electric Company has acquired the electric light and power plants in Poskin, Hillsdale and Dallas. The company will extend its lines to these communities and establish a twenty-four-hour service.

FOND DU LAC, WIS.—The City Council has authorized the installation of a new fire-alarm system, to cost $7,000.

MANITOWOC, WIS.—The City Council has authorized the Board of Public Works to secure estimates for extensions and remodeling the municipal electric light and power plant, to include the installation of the following equipment: One 2,000-kw. turbine, to replace a 300-kw. unit; two 4,000-hp. boilers; one 2,000-hp. feed-water heater, duplex pump, mechanical stokers, complete switchboard equipment and auxiliaries.

MARKESAN, WIS. — Plans are being prepared by the River View Canning Company for the construction of a canning factory and power house, to cost about $50,000.

NEENAH, WIS.—Preliminary plans are being prepared by Cahill & Douglas, engineers, 217 West Water Street, Milwaukee, for a power house, 60 ft. x 160 ft., for the Valley Paper Mills.

OWEN, WIS.—The Wisconsin-Minnesota Light & Power Company is planning to erect a high-tension transmission line from Owen to Curtiss.

PESHTIGO, WIS. — The Northeastern Power Company, a subsidiary of the Wisconsin Public Service Corporation, Green Bay, is planning to erect a new transmission line between Peshtigo and the Air Line Road.

WAUKESHA, WIS.—The installation of an ornamental lighting system in the business district is under consideration by the City Council.

BRAINERD, MINN.—Bids, it is reported, will soon be asked for a 200-hp. engine and generator for the waterworks pumping station. L. P. Wolff, Guardian Life Building, St. Paul, is engineer.

ST. PAUL, MINN. — The Ford Motor Company, Detroit, Mich., has been granted permission by the Federal Power Commission to construct a hydro-electric power plant at the High Dam, Mississippi River, to be used in connection with a proposed local automobile and tractor plant, to cost about $2,000,000.

DAVENPORT, IOWA.—The substitution of a single-unit street lamp for the present five-lamp electroliers is under consideration by the light committee of the City Council.

ROCHESTER, IOWA.—Plans have been prepared by the Iowa Railway & Light Company, Cedar Rapids, for the construction of a hydro-electric plant and dam on Cedar Rapids at Rochester. Three plans are under consideration: (1) a five-unit plant, 22-ft. head, to cost $1,317,000; (2) an eight-unit plant, 22-ft. head, to cost $1,551,000; (3) an eight-unit plant, 27-ft. head, to cost $1,963,000.

MARTHASVILLE, MO. — The Marthasville Electric Light & Power Company, recently organized, is preparing plans for a electric light and power system.

KANORADO, KAN. — The Council has awarded a contract to the Goodland (Kan.) Light & Power Company to furnish electricity in Kanorado. Bonds to the amount of $25,000 were recently voted to erect a transmission line and distributing system.

## Southern States

CHARLOTTE, N. C. — An electrically operated pumping plant will be installed in the proposed municipal filtration plant and waterworks, to cost about $300,000.

COCOA, FLA.—The plant of the Cocoa Ice & Light Company has been acquired by the Southern Utilities Company, Palatka. Improvements, it is said, will be made to the system.

MARIANNA, FLA.—The Marianna Light & Power Company has started work on the construction of a power plant on the Chipola River in Marianna. G. M. Thomas is interested in the company.

LIVINGSTON, TENN.—The Cumberland Power Company, which recently acquired the local plant, plans to erect a transmission line to Rock Island, a distance of 25 miles, to connect with its water-power plant.

ALBERTVILLE, ALA. — The municipal electric plant and waterworks system has been acquired by the Alabama Water Company, which will make improvements to same.

CITRONELLE, ALA. — The Citronelle Light & Power Company contemplates building an ice-manufacturing and cold-storage plant.

RIVER FALLS, ALA.—The Public Service Commission has granted the River Falls Power Company permission to build a hydro-electric plant on the Conecuh River, near River Falls.

CORINTH, MISS.—The City Council contemplates an expenditure of about $200,000 for municipal improvements, including electric light plant, waterworks and street work.

POPLARVILLE, MISS.—The Love Lumber Company plans to rebuild its power house and lumber mill, recently destroyed by fire, causing a loss of about $100,000.

RAYNE, LA.—Bids will be received by the Mayor and the Council of Rayne at the office of the city clerk until March 20 for improvements to the municipal electric light plant and waterworks system, including the construction of power house, two 200-hp. or one 300-hp. oil-engine generator unit, one three-panel or one two-panel switchboard, one deep well, one 750-gal.-per-minute deep-well centrifugal pump and motor, one air lift system for pump, cast-iron pipe, etc. The J. B. McCrary Company is engineer.

MUSKOGEE, OKLA. — The Oklahoma General Power Company is planning to erect an addition to its local steam-driven plant, increasing the output by 20,000 hp., to cost about $1,000,000.

SAND SPRINGS, OKLA.—Electric power equipment will be installed in the new plant of the Sand Springs Cotton Mill Corporation, to cost about $115,000.

WYNNEWOOD, OKLA.—The Texas Pacific Refining Company will install electric power equipment at its proposed local oil refinery.

FORT WORTH, TEX.—The installation of a street-lighting system in the Rosen Heights district is under consideration.

HOWE, TEX.—Plans for the proposed new waterworks system call for the installation of electrically operated pumping machinery.

PANHANDLE, TEX.—Plans have been completed for the construction of a transmission line for local light and power service.

STAMFORD, TEX. — The West Texas Utilities Company has completed plans for the construction of a local power plant for auxiliary service, to cost about $400,000.

## Pacific and Mountain States

ANACORTES, WASH.—Plans are being prepared by the E. K. Wood Lumber Company for the erection of a new mill, with power plant and machine shop, at Burrows Bay, to cost about $400,000.

OLYMPIA, WASH.—The County Commissioners have granted the Olympia Light & Power Company permission to extend its lines into the Pleasant Glade district to furnish electrical service.

QUINCY, WASH. — The Washington Water Power Company plans to erect a 13,000-volt transmission line from Moses Lake to Quincy (20 miles) to supply electricity for irrigation purposes to the orchards around Quincy.

SEATTLE, WASH.—Work will soon be started on the erection of the 105-mile transmission line from the Skagit River (municipal) hydro-electric project to Seattle. C. F. Uhden is chief engineer of the work.

TACOMA, WASH.—Plans are under consideration by the Municipal Electric Light Department for the erection of a substation on the Wapato Hill reservoir site to distribute electricity in the South Tacoma district.

VANCOUVER, WASH. — The Columbia River Paper Mills, Inc., is preparing plans for its proposed new plant, including power house, to cost about $500,000.

ALBANY, ORE.—Extensive improvements are contemplated by the Mountain States Power Company, including the erection of a transmission line from Prospect to Springfield. The cost of the work is estimated at about $200,000.

INDEPENDENCE, ORE.—The Mountain States Power Company plans the erection of a transmission line from Albany to Independence, to cost about $60,000.

KLAMATH FALLS, ORE.—The California-Oregon Power Company contemplates erecting a 66,000-volt transmission line from Algoma to Chiloquin, a distance of 22 miles, to serve the latter town and the sawmills in that district.

METOLIUS, ORE.—The Federal Power Commission has granted the Columbia Valley Power Company a preliminary permit for the development of the Metolius power site.

CONCORD, CAL.—The Pacific Gas & Electric Company contemplates extending its transmission lines into the Concord Burgess district, east of the town.

DAVIS, CAL.—The Pacific Gas & Electric Company, San Francisco, has acquired a site in Davis on which it will erect a power house, machine and repair shop and other buildings, to cost about $100,000.

LE GRAND, CAL.—The San Joaquin Light & Power Corporation, Fresno, plans to erect a 70,000-volt transmission line in this section. A new substation will be built for service in the eastern sections of Merced and Madera Counties.

LIVERMORE, CAL.—Bids will be received by the director of the United States Veterans Bureau, Arlington Building, Washington, D. C., until March 29 for the construction of a tuberculosis Hospital at Livermore, including all buildings, heating, ventilating, electric work, etc.

LOS ANGELES, CAL.—An ordinance is being arranged for the installation of an ornamental street-lighting system on Arden Boulevard, Third Street and El Centro Avenue.

LOS ANGELES, CAL.—The California Cyanide Company has been organized by the officials of the Air Reduction Corporation, 342 Madison Avenue, New York City, and F. W. Braun of the Braun Corporation, New High Street, Los Angeles, to erect a plant here for the production of sodium of cyanide and kindred products, to cost about $500,000. The proposed work will include a power house and machine shop.

NEWMAN, CAL.—The National Ice & Cold Storage Company will install electric power equipment at its proposed ice-manufacturing plant, to cost about $100,000.

PORTERVILLE, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on Main Street.

SACRAMENTO, CAL.—Plans are under consideration for the installation of fire and police signal-alarm systems.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company is preparing plans for the construction of five substations in different parts of the city, to cost about $800,000.

TRACY, CAL.—The Chamber of Commerce is securing estimates of cost for the installation of an ornamental lighting system on Central Avenue and Sixth Street.

BOISE, IDAHO.—Plans have been completed by the Idaho Power Company for extensions to its power plant on the Snake River at American Falls, to cost about $1,000,000. The work will include an addition to power house and the installation of two new generating units having a total capacity of 17,000 hp.

CHANDLER, ARIZ.—An election will soon be held to vote on the proposal to issue bonds for the installation of a municipal electric distribution system and an ornamental street-lighting system. It is proposed to purchase energy to operate the system.

GRAND JUNCTION, COL.—Arrangements are being made by the Grand Junction Electric, Gas & Manufacturing Company for resetting a 268-hp. Heine boiler in reinforced-steel concrete boiler frame and for erecting a new fireproof power house. A. E. Anderson is general superintendent.

## Canada

ST. JOHN, N. B.—New tenders, it is stated, will be asked by the City Council for switching equipment and for heating and lighting the civic substation.

LONDON, ONT.—The erection of 18 to 20 miles of rural transmission lines in London Township is under consideration by the Public Utilities Commission.

WALKERVILLE, ONT.—The local Hydro-Electric Commission has petitioned the Town Council for an appropriation of $25,000 for extensions to the system. Plans have been approved by the Town Council for the installation of electric lamps on Wyandotte Street, to be maintained by underground wires, to cost about $12,000.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued Feb. 13, 1923)

1,445,589. Lock; K. Horiguchi, Tokyo, Japan. App. filed July 9, 1921. Magnetic lock.

1,445,600. Electric Heater; J. Lavoie, Montreal, Can. App. filed Nov. 25, 1921. Combined cooking unit and room heater.

1,445,610. Adjustable High Resistance; C. P. Brockway, Toledo, Ohio. App. filed June 14, 1920. High-resistance shunt across the condenser located in series with grid electrode of audion.

1,445,613. Detector; H. P. Donle, Meriden, Conn. App. filed April 6, 1922. Contact-type detector for radio signaling.

(Issued Feb. 20, 1923)

1,445,636. Method of and Means for Indicating the Frequency Alterations of an Alternating Current; A. Meissner, Berlin, Germany. App. filed May 3, 1922. Apparatus for measuring radio frequencies.

1,445,640. Pole-Carrying Ring for Electric Apparatus; T. E. Murray, Jr., and J. B. Murray, Brooklyn, N. Y. App. filed April 6, 1921. Stamped sheet metal with segments welded together.

1,445,644. Material for the Production of Carbide; J. H. Reid, Pittsburgh, Pa. App. filed Oct. 23, 1919. Calcium-oxy-compound and cokable carbonaceous material reduced in electric furnace.

1,445,645. Process of and Material for the Production of Metal Hydrates and for the Production of Gas; J. H. Reid, Readsboro, Vt. App. filed Jan. 27, 1921. Coke from gas retort reduced in electric furnace.

1,445,665. Electric Lighting Fixture; E. L. Dales, Philadelphia, Pa. App. filed March 9, 1922. Reflector over end of lamp and one around lamp.

1,445,678. Rheostat; A. C. Gilbert, New Haven, Conn. App. filed Jan. 28, 1918. Designed for base of electric fan.

1,445,706. Electric Heater; A. Papini, Philadelphia, Pa. App. filed Oct. 15, 1919. Vacuum chamber on rear of reflector prevents escape of heat.

1,445,707. Circuit Controller for Electric Heaters; A. Papini, Philadelphia, Pa. App. filed Oct. 15, 1919. Device opens circuit when pedestal occupies any position other than normal

1,445,731. Transmission System; H. J. Van Der Bijl, New York, N. Y. App. filed Sept. 30, 1918. Three-electrode tube combined with two-electrode tube for amplifying radio signals.

1,445,759. Means for and Method of Testing Multiplex Carrier Circuits; J. Davidson, Jr., Montclair, N. J. App. filed Sept. 25, 1919. Testing the transmission efficiency of apparatus.

1,445,811. Apparatus for Exhausting Incandescent Electric Lamps and Similar Articles; M. P. Wetmore, Newark, N. J. App. filed Nov. 5, 1918. Rotary air pumps on rotating table successively place evacuated lamps before operator.

1,445,829. Telephone Rest; C. Fischer, New York, N. Y. App. filed July 21, 1921. Attachable arm for holding receiver to ear.

1,445,855. Trolley-Wire Frog; G. D. Slaymaker, Detroit, Mich. App. filed Jan. 12, 1922. Provided with adjustable renewable runners.

1,445,860. Apparatus for Treating Metals; J. S. Turek, Cicero, Ill. App. filed May 13, 1921. Electric furnace of tilting type used for refining, melting or heat-treating metals.

1,445,885. Commutator; A. J. Hix, Hellier, Ky. App. filed July 13, 1922. Method of soldering leads to segments.

1,445,896. Variable Inductance; M. C. M. Lane, Roselle Park, N. J. App. filed June 2, 1922. Combines all functions of variometer, variocoupler and variable inductance.

1,445,897. Electric Heater; E. N. Lightfoot, New York, N. Y. App. filed March 8, 1920. Resistor enclosed by and insulated from sheet metal armor.

1,445,919. Electrical Coil Unit; D. Stone, New Rochelle, N. Y. App. filed March 25, 1922. Movable end attachment to secure accurate resistance value.

1,445,924. Electrical Connector; R. E. Williams and H. H. Moreton, Los Angeles, Cal. App. filed April 9, 1920. For lamps, spotlights, and similar devices.

1,445,929. Electrical Apparatus; W. R. G. Baker, Schenectady, N. Y. App. filed Oct. 7, 1920. Wireless transmission system employing two electron tubes.

1,445,933. Dynamo-Electric Machine; J. L. Burnham, Schenectady, N. Y. App. filed July 19, 1920. Poles in which magnetic material not only carries magnetic flux but also exciting current.

1,445,961. Electrolysis Apparatus; P. M. Kree, New York, N. Y. App. filed Oct. 15, 1918. Depilatory apparatus.

1,445,967. Cigar Lighter; J. C. Lehmann, Jamaica, and G. H. Timmerman, Brooklyn, N. Y. App. filed Jan. 13, 1922. Induction coil spark used to ignite wick.

1,445,978. Stationary Induction Apparatus; H. O. Stephens, Pittsfield, Mass. App. filed April 30, 1921. Electric furnace transformer with multiple connected windings.

1,445,988. Method and Apparatus for Rectifying High-Tension Alternating Current; G. A. Witte, Philadelphia, Pa. App. filed April 8, 1919. Mechanical device operated in synchronism with alternating current makes and breaks connection between supply circuit and load, giving unidirectional impulses.

1,445,992. Cutting Machine; J. S. Cameron, Montreal, Canada. App. filed Sept. 24, 1921. Prongs electrically heated to temperature that will cut through material without tearing.

1,446,005. Rotary Converter; H. F. T. Erben, Schenectady, N. Y. App. filed Oct. 17, 1913. Method by which commutating field strength may be automatically adjusted.

1,446,029. Liquid-Treating Instrument; F. E. Beidler, New York, N. Y. App. filed Sept. 9, 1921. Electric heater for small receptacles

1,446,106. Contact Shoe for the Third Rail of Electric Cars; W. A. U. Seltzer, Philadelphia, Pa. App. filed Nov. 25, 1922. Shoe provided with side roller member engaging beneath or upon third-rail.

1,446,133. Railway Signal Lantern; P. J. Sloan, Denver, Colo. App. filed Dec. 27, 1921. Electric lantern with differently colored bulbs.

1,446,135. Insulator; L. Steinberger, Brooklyn, N. Y. App. filed March 15, 1917. Pin-type insulator with four petticoats.

1,446,153. Method of Making High-Speed Steel; W. B. Brookfield, Syracuse, N. Y. App. filed Dec. 29, 1920. Subjecting material to continuous heat of electric furnace.

1,446,166. Variometer; C. R. Dumble, Arlington, Mass. App. filed July 24, 1922. Spherical type.

1,446,170. Electric Arc Welding Machine; J. W. Fay, Milwaukee, Wis. App. filed March 25, 1920. Two arcs operated in welding joint or seam, one being used for welding one portion of the seam and the other for welding remaining portion.

1,446,182. Clock; W. A. Hicks, Cincinnati, Ohio. App. filed May 10, 1921. Electrically operated clock.

1,446,234. Thermotelephonic Receiver; A. Williams and L. D. Williams, London, England. App. filed April 24, 1920. Arrangement of metal foil improved.

1,446,246. Means for Recording and Reproducing Sound; L. de Forest, New York, N. Y. App. filed Sept. 18, 1919. Sound waves recorded on photographic film similar to motion-picture film.

1,446,317. Electrical Liquid Heater; W. Penzold, Hanover, Germany. App. filed May 22, 1922. Electric steam generators.

1,446,318. System for Electrically Heating Liquids; W. Penzold, Hanover, Germany. App. filed Aug. 5, 1922. Liquid heated by electric current flowing through it.

1,446,385. Aircraft Landing Station; E. C. Hanson, Washington, D. C. App. filed March 5, 1919. Radio compass signal system to guide airplanes in flight and in landing.

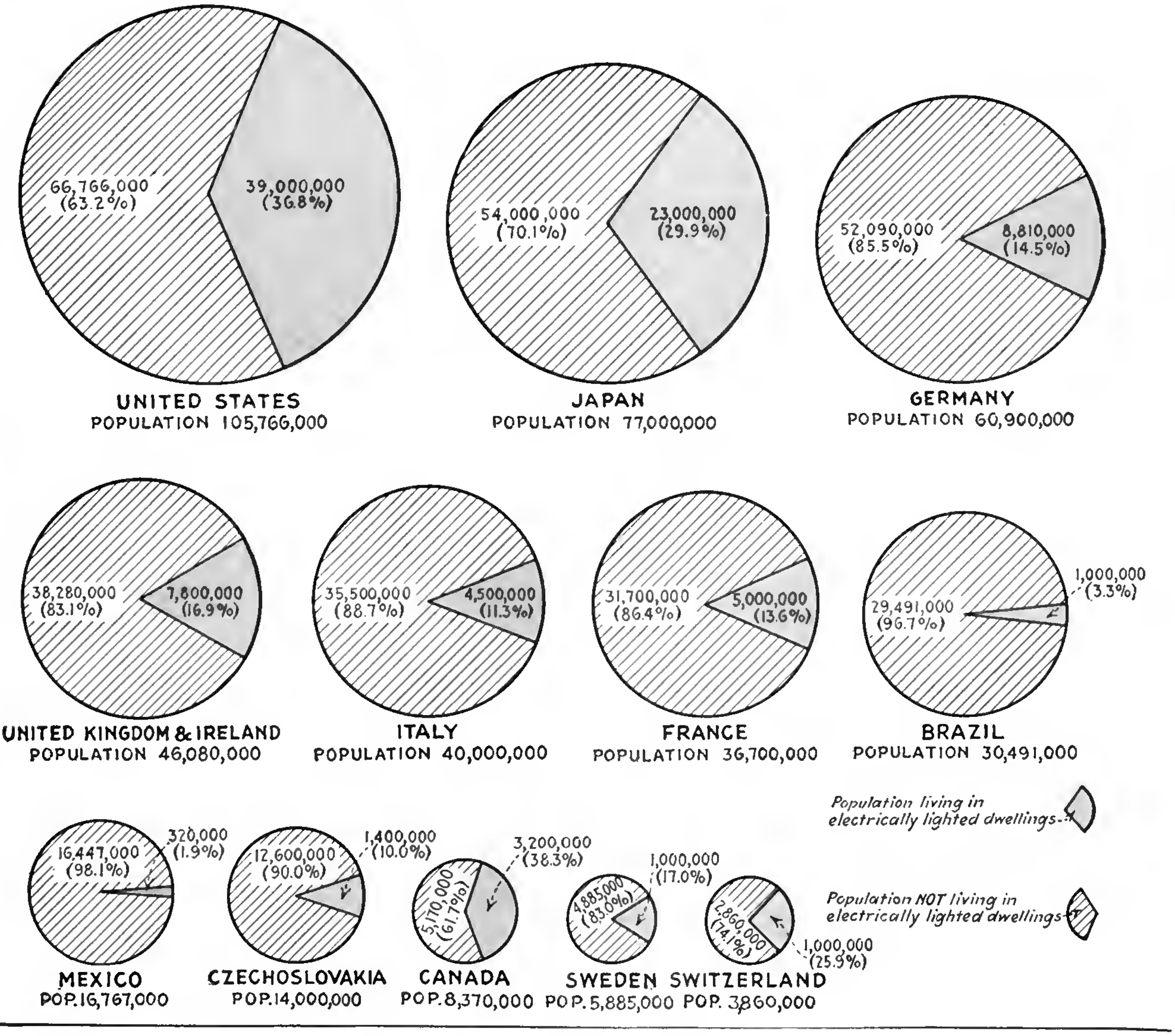
1,446,433. Circuit Arrangement for Indicating the Deviation of a Sender from a Desired Frequency; W. Schaffer, Berlin, Germany. App. filed Aug. 3, 1922. For wireless transmitting work.

1,446,436. Machine Synchronizing System; F. Stevens, Philadelphia, Pa. App. filed Sept. 30, 1920. Means for controlling speed relations between any driven machine and one or more other independently driven machines intended to be operated in conjunction.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

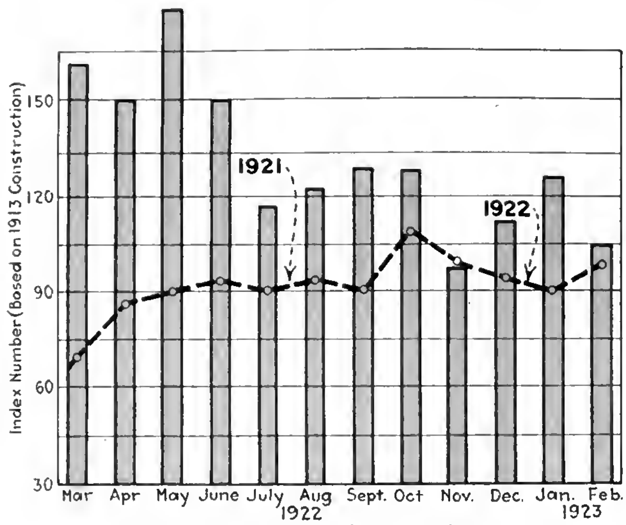
## Only 111,822,000, or 6.5 per Cent, of the World's Population Live in Electrically Lighted Dwellings



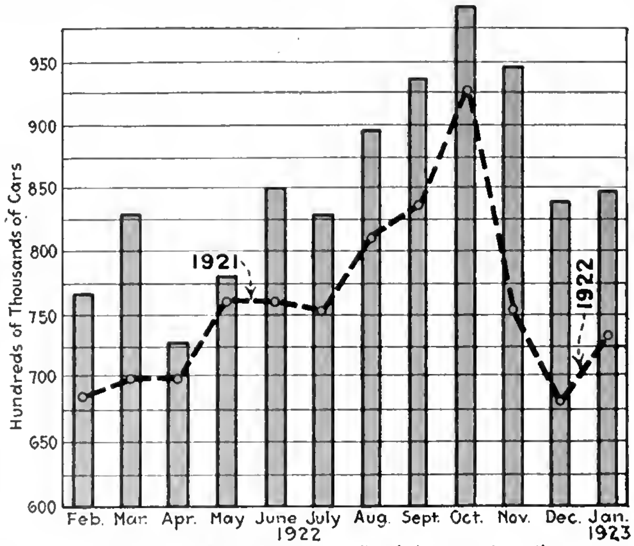

## A Test of Civilization

DEGREE of civilization is judged by certain standards. One of these is the extent to which home life has been developed. The general adoption of home comforts and domestic labor-saving devices places a nation upon a high plane of civilization. This is particularly true of the use of electrical energy in the home. Nations which are recognized as the leaders in modern civilization will be found to be rated high in the percentage of their inhabitants living in electrically lighted dwellings. Such peoples have at their beck and call a source of comfort in the way of light, heat and power which has a strong tendency to elevate the mental and moral standards of the community. It may be stated with confidence that the central station bids fair to be one of the greatest civilizers in the world's history.

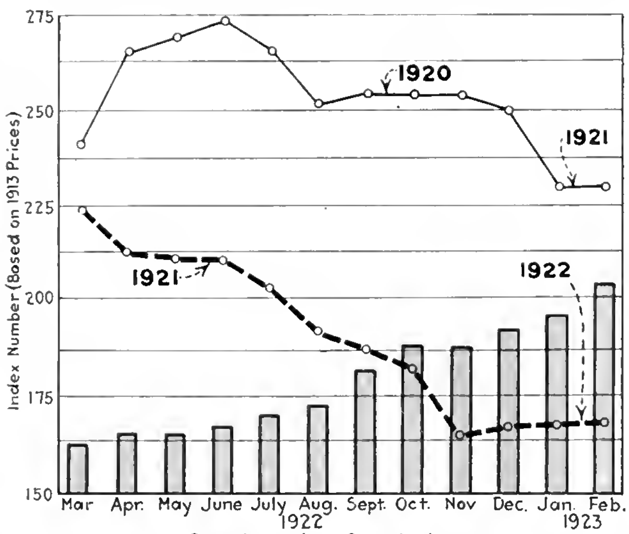
## How the Primary Industries Are Trending



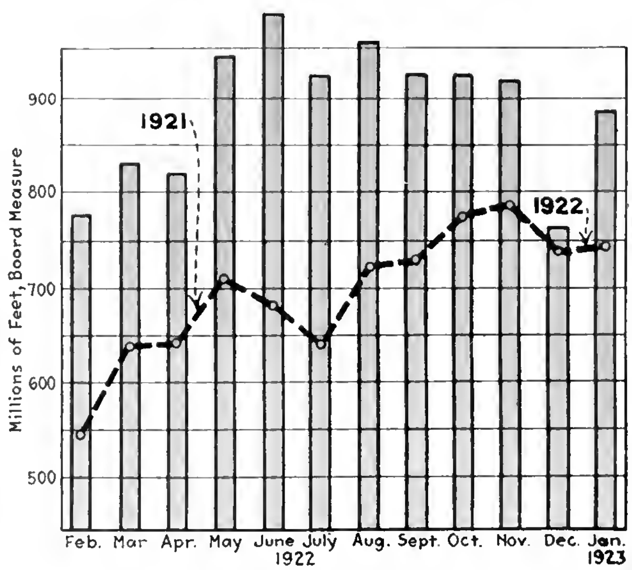

Construction Volume Index
(Engineering-News Record)



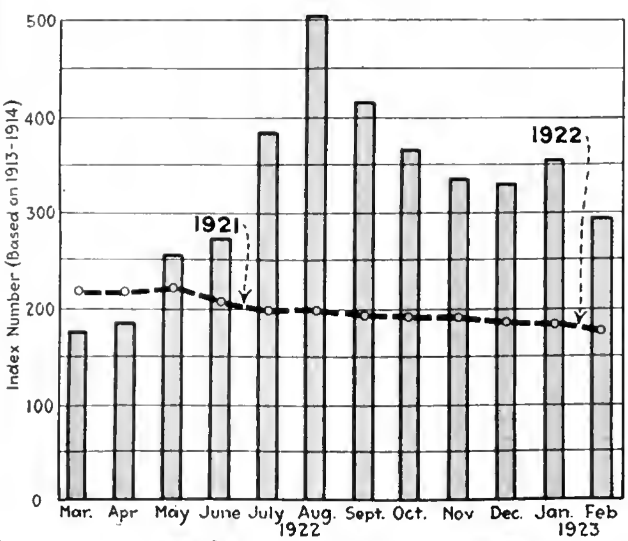

Total Average Weekly Freight-car Loadings




Construction Cost Index
(Engineering-News Record)




Lumber Production
(Yellow Pine and Douglas Fir)




Price of Bituminous Coal at Mines
(Coal Age)

## The Rise in Construction Costs

THE gradual rise in the cost of construction materials which has taken place during the past eleven months is playing a large part in holding back the rapid return to normal industrial conditions. Many construction projects which last fall appeared certain of realization in 1923 are being held up on account of the excessively high cost of material and labor. In February the cost of general construction was 26.4 per cent above that of March last year and was only 25.2 per cent under the high record figure of June, 1920. A very large part of this is due to the increased wages demanded by labor, but the cost of construction material has also shown a decided upward trend. What effect this adverse condition will have on the sales of electrical apparatus and supplies as well as on new consumers of electrical energy is problematical, but it is a condition which will bear careful watching by the industry.

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W. H. ONKEN, JR. Editor HAROLD V. BOZELL Editor

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# Allies of Industry

FINANCED by private capital and not by the public treasury, managed by business men selected by people who have put their savings into the service of the public, and regulated in the public interest by public authority, our utilities are today essential allies of industry. What kind of allies does industry want? It doesn't want weak, anemic, crippled, halting, shriveling, broken-down, "busted" allies—it wants them strong, alive, dependable, on the job 8,760 hours per year, if, as and when needed, progressive and growing!

As Vice-president Hall of the American Telephone & Telegraph Company recently told the Boston Chamber of Commerce in speaking upon this theme, public utilities must be prosperous if they are to be strong. Now, a prosperous public utility is not the same thing as a prosperous industrial or mercantile corporation. An electric service company or a transportation company cannot fill the valleys of the lean years from the large profits of the good years. All it can ask and all it does ask is money enough to pay good, fair, reasonable wages to the men and women engaged in giving its service; a good, fair, reasonable return for the capital necessary to provide the service; enough money to pay all its bills, and only one thing more—a narrow margin just wide enough to give a cushion of safety to maintain its credit.

If utilities prosper, they never prosper at the expense of the public. If they fail to prosper, they fail to prosper always at the expense of the public. As allies—yes, agencies—of industry they render a fundamental service on which modern civilization is built.

New money does not come in to make *more* money for present investors. These are limited to a reasonable return. The new money is needed just to "carry on," to provide the service demanded by the public, to do the job as the community wants it. The ability to get this money depends on one thing, assuming reasonably good management—credit. Credit means just a good, fair, decent, able-bodied margin or surplus to come and go on after expenses are met. The only real mistake utilities can make is by having rates even a little bit too low. The damage that is done by too low rates is stupendous compared with any little temporary saving through rate reductions. What the public pays for service is not a horse trade. This relation is a permanent, livable one whereby public and company can work together for each other's benefit from now on, and not on the outworn theories of twenty-five years ago. And the greatest reward for service rendered is not money, but appreciation by the customers of the utility. This appreciation warms the heart of the utility worker and strengthens his power to serve.

# Matthew Orpheus Troy

*A sales executive whose masterly application of the principles of engineering to commercial problems is helping the industry to attain higher planes of efficiency.*

IN THE extreme specialization of the present age it is out of the ordinary to find in a single individual the talent for high leadership in both technical and commercial fields. Matthew O. Troy, manager of transformer sales for the General Electric Company, combines to an unusual degree these qualities. He is a sales executive of wide reputation, an inventor and designing engineer, and relatively few men illustrate so well the possibility of completely harmonizing technical and sales problems. Mr. Troy's work in a national way along the line of transformer standardization and the reduction of excess sizes and ratings has accomplished the conservation of material and labor to a degree difficult to estimate. A trained engineer with a strong penchant for sales work, he has for more than twenty years been intimately concerned with the advance of transformer design and application along sound lines. To him is credited the original idea of organizing a sales force of transformer specialists who assist the general salesmen in the field, a development in sales management which has found wide acceptance in other branches of the electrical industry.

Mr. Troy was born in Burlington, N. C., in 1872 and was graduated from the University of Virginia in 1896 with the degree of B. S. in electrical engineering. He entered the testing department of the General Electric Company in Schenectady a year later and shortly thereafter was transferred to Lynn, Mass., where he was soon made foreman of transformer tests. In 1898 he was associated with Prof. Elihu Thomson and Richard Fleming in pioneer work on constant-current transformers.

In 1901 Mr. Troy was made assistant engineer of the Lynn alternating-current engineering department, but shortly thereafter was transferred to the transformer sales department at the Schenectady works. In 1910 he became head of the department. Throughout his sales work Mr. Troy has always been a close analytical student of engineering design.

Mr. Troy has been a leader in the Pittsfield and Schenectady Sections of the A. I. E. E. He is chairman of the service voltage sub-committee of the electrical apparatus committee of the National Electric Light Association and chairman of the joint conference committee of the Electrical Manufacturers' Conference and the N. E. L. A. on service voltages. For a number of years he has been chairman of the transformer section of the Electric Power Club. He has, besides, found time to be a frequent contributor to the technical press of the country.

# Editorial Comment

Electrical World, March 17, 1923

Volume 81 Number 11

### Water Power of Navigable Streams Is the Nation's

ALFRED E. SMITH, Governor of New York, is a stalwart and likable man whom multitudes of his admirers hope some day to see in the White House. Much to his credit, he deprecates this idea and asserts that his only present desire is to do his duty as Chief Executive of the Empire State. His sincerity can be doubted by no one without reflecting likewise on his intelligence, for surely no intelligent man whose heart was set on being head of the nation would proclaim a belief that power from Niagara Falls or the St. Lawrence must never be allowed to cross the boundaries of New York. As well might Pennsylvania announce that it will consume all its anthracite coal, Montana all its copper or Kansas all its grain. The news columns of last week's ELECTRICAL WORLD presented the contrasting views of Governor Smith and Guy E. Tripp in this matter, Mr. Tripp indicating that the Governor's conception of hydro-electric service is sixteen years behind the time and that only by interconnected systems transcending state lines can its full benefit to the nation be realized.

Mr. Smith was born in New York City's East Side, and one reason for his popularity is that, unlike most men who rise from poverty to prominence, he still keeps his home among the scenes of his early struggles. Every one likes him for that, and every one admires his democratic spirit. But, just as he has in state affairs acquired an outlook far broader, even if less picturesque, than can be afforded by the Bowery or the sidewalks of New York, so, if he is to develop into a national leader, he must learn to look beyond the boundaries of his state. In this great nation, indissolubly welded by centripetal forces, state's rights are no longer a shibboleth by which to conquer. We prosper and thrive through free and unlimited co-operation, and each state is proud to share its resources with all the others. In this regard the attitude of Governor Pinchot of Pennsylvania on water-power development stands out in refreshing contrast to that of Governor Smith of New York.

### Radio Interference or Radio Co-ordination?

SECRETARY HOOVER'S second radio conference, scheduled for March 20, should result in some constructive agreements which will make possible a wider utilization of radio with full co-ordination of the various radio facilities of the country. This should surely be so if the conferees approach their task on the basis of "co-ordination" rather than on that of "interference." Though the terminology may not, technically, have a great deal of significance, the psychology of the appeal to co-ordinate or co-operate should mean a stronger effort to reach a common agreement than can spring from a state of mind where elimination of "interference" is the uppermost thought and where every person is strongly on guard in his own particular domain of ether waves.

It is, of course, recognized that there are commercial considerations, pride, priority and many other intangible though forceful elements in the problem, yet in the end the technical solution of the instrumentation of stations must decide what can and cannot be done. With the rapid advance in the science and the art of radio—the greater ability to confine radiant energy to limited wave bands and to control direction, the increased sensitivity and selectivity of receiving sets, and the more intimate knowledge of the peculiar radio characteristics of certain parts of the country—there is no doubt that the technical problem of allowing full opportunity to every legitimate radio use will be adequately solved. As the term "inductive interference" has given way with advantage to "inductive co-ordination," so let the radio problem be approached not as one of "radio interference" but as one of "radio co-ordination."

### Midnight Oil Must Still Be Burned to Keep Up with Progress

EVERY time a practicing electrical engineer decides that he knows enough theory for sound judgment in his particular branch of the profession he is rudely awakened by an unexpected advance in scientific and technical knowledge, a new set of phenomena that bear directly upon his problems, an unexpected application of some obscure physical relationship, a new terminology, an important new mathematical method, or what not. Hardly a year passes without a progressive engineer having to face the dilemma of again burning midnight oil or being relegated into the class of "has beens."

It seems like a big step from the ancient bellhanger to a modern superpower expert, and yet the progress has come in imperceptible installments most of which are within our memory. Beginning with Ohm's law for direct current, the transmission engineer had to absorb trigonometry, inductance and capacity, to swallow transients, ionization theory, polyphase relationships and catenary curves, and to learn to look blasé when hyperbolic functions and complex quantities were mentioned. Now something new is about to be sprung on him in the form of decremental vectors due to a complex angular velocity of rotation.

A decremental vector, it is asserted, is one which rotates uniformly, like the old ones used to do, but at the same time decreases in size. If it increases in size, it is to be called incremental. To get a simple idea of a decremental vector one must think of a rotating flywheel with a bug creeping leisurely along one of its spokes toward the hub. The distance between the center of the wheel and the bug is then a decremental vector because it revolves uniformly and at the same time decreases in size. Furthermore, the particular

kind of decremental vectors of importance in the study of electrical transients is one whose length decreases in a geometric progression. It means that when the bug is, say, three feet from the wheel center it should creep at one-half the speed at which it creeps when six feet from the center. The bug thus describes a logarithmic spiral in space, whether it wishes to or not.

At the recent midwinter convention of the American Institute of Electrical Engineers decremental vectors were treated in at least four papers, at three different sessions, and were discussed by two manufacturing engineers, an operating engineer and two professors. Unless a sordid conspiracy existed, the admission is forced that such vectors must be useful in the understanding of and in the calculations relating to transient conditions in transmission lines, in transformers and in rotating machinery. Next it will be necessary to get posted on the new notation and on the properties of such vectors, lest there soon shall be another category of papers which the uninformed simply cannot read beyond the title and the acknowledgments at the end.

### Needed Changes in Wiring Code Rules

THIS ought to be a happy week for the electrical industry, particularly for the electric light and power companies and the electrical wiring contractors. At the biennial meeting to revise the National Electrical Code held in New York this week the Underwriters abolished the 660-watt limitation on circuits, permitted the installation of a solid neutral and also sanctioned the use of a 15-amp. fuse on 125-volt branch circuits. For years these changes have been proposed, but no action has been taken until now. Naturally the Underwriters are slow to move in matters affecting fire hazards, but there is such a thing as being too cautious, and the Underwriters are inclined to stand so straight at times that they lean backward. That they have sensed the handicaps of some of their rules on household electrical devices augurs well, and that they have acted accordingly is even better.

### The Specifications of 1914 Are Retired

THE adoption of the National Electrical Safety Code as an American engineering standard has placed a more or less effective ban on most of the specifications for overhead-line work that have hitherto been used, particularly in the cases where crossings and conflicts are involved and utility-regulating bodies may be called upon to take a hand. By its formal withdrawal of the "1914 specifications" the overhead-systems committee of the National Electric Light Association removes more of the specifications that have been superseded but, because of the lack of authoritative action, have remained to confuse those called upon to make use of specifications for line construction.

It would be well if the other technical bodies having specifications of this kind which have become more or less obsolete because of the presence of the safety code in the field would take action similar to that of the N. E. L. A. and clear the slate of specifications that will only be a source of controversy so long as they have some sort of official standing. A method of revising the safety code has been provided in the routine of the American Engineering Standards Committee, and the place to stage any discussion of matters that may affect line construction and modify the code is through that routine and not by the maintenance of separate specifications which some one must try to thrust down the throat of the electrical industry. The thrusting process results in bad feeling and controversy that do not help in the final solution of line-construction problems where conflicts between the lines of two or more utilities exist.

### The War-Learned Lesson of Excess Varieties

WHILE the nation was struggling to win the war many simple truths were uncovered that had long lain buried, but many of them apparently are being covered up again. The principle of simplification, for instance, was found and recognized and shown to all the people and was adopted by industry, and the manufacturers of America made great strides in the elimination of excess varieties and the reduction of waste. One large firm that builds a certain piece of machinery used in power stations was when the war began manufacturing sixty-odd modifications of that machine, but when the pinch came and economies were demanded a conference of executives was held and the sales manager recommended simplification. The president, filled with pride for his line, argued against it; but the meeting voted for this obvious economy and the line was gradually cut to three modifications of the machine only. And the same policy was applied to other products until the plant was 80 per cent occupied with staples.

As times grew bad after the war the eagerness for business, the demands of customers and the importunities of salesmen gradually broke down this economic principle, and the plant began to turn out more varieties, until today the company is taking orders for almost anything that customers call for. A manufacturing plant has been turned into a job shop with resultant high prices to the consumer. It is a typical case, and yet this manufacturer knows and admits, as other manufacturers must know, that the best way in the world to cut down costs is to save waste on bad habits and that carrying excess varieties is economically as bad a habit as a man can have.

Turning the back on simplification and ignoring the undoubtable demonstration which the war gave of the effectiveness of this fundamental principle of industry do not alter the position of the manufacturer today nor the needs and rights of those he sells to. How can any manufacturer justify the presence of excess varieties in his catalog? It is his responsibility and his job to weed them out.

### Kelvin's Law Should Not Be Misinterpreted

LORD KELVIN was a pioneer in engineering economics, and few realize to what an extent he studied the subject. His findings and the use that has been made of them constitute a lesson in what should and what should not be done in engineering.

What is commonly known as Kelvin's law declares that "the most economical size of conductor is that for which the annual charge on the investment is equal to the annual cost of energy losses." This statement, though probably made by Lord Kelvin, was not made without due reservations by him. It is well recognized that it is true only in some very specific cases and is in no way general. However, many have used it for solving

general problems because it seemed convenient and because they did not recognize the necessity for doing a thorough piece of work. Lord Kelvin, however, as his own writings attest, believed that a thorough study of all factors entering into the problem of design of a line must be made and that from such a study alone an economical solution could be attained.

The paper by P. O. Reyneau and H. P. Seelye in this issue emphasizes that fact and points the way to a thorough and complete study of the problem of designing a distribution line. The wire is but one part of a distribution system, and it should be evident that no economical design can be obtained if none of the other elements that enter into line construction are taken into consideration. The lesson to be drawn from the application of Kelvin's law is that an indiscriminate use of laws and rules whose exact application is not thoroughly understood will not produce sound results and is not engineering.

### How to Co-operate with the Farmer

IN COMMENTING on efforts now being made to bring together the organized farm interests and the electrical industry in a study of the use of electrical energy on the farm Philip S. Rose said, in a recent issue of the *Country Gentleman*: "This is a kind of co-operation that brings results. It gives the farmers first-hand inside information of what is going on in the minds of those whom they depend upon for service. It enables the farmers to present their views in court where they will have a respectful, sympathetic hearing. Such a policy should result in a happier understanding of the problems both parties are obliged to meet."

Mr. Rose's article is a fair and commendable statement of the entire problem written from an agricultural viewpoint. In it he points out some of the pitfalls that must be looked for in the establishment of the service, winding up by saying: "The rural market is a big one and needs developing. There may be no big immediate profits in it as there have been in city and industrial development, but it is necessary for the healthy growth of the entire country. It will not pay for one-half the country to let the other half exist under half lights. The big power companies cannot afford to network the country with power lines and neglect the farmer. He will feel discriminated against and become bitter. There is thus involved in this problem not only engineering but a problem of politics and of social relationships that is even more important."

The last statement is one of which the electrical industry cannot afford to lose sight. The effort referred to by Mr. Rose is one that is only in its initial stages, but in which the National Electric Light Association is vitally interested. The organized agricultural interests involved view the farmer as a business man who must take his place among business men and cease to be classed with the radical and unstable elements in any way. With this viewpoint, co-operative work with the farmer in the effort to solve the problem of the use of electrical energy on the farm ought to progress rapidly. However, every central station ought to be in close relations with its own local agricultural organizations, looking the problem square in the face from all angles and seeking so far as possible to hasten the solution. A good way to do this is to get on intimate terms with the state agricultural schools, the county agent and the farm organizations back of him as representing the agricultural viewpoint. While they are interpreting this viewpoint to the central-station man, he in turn can be interpreting his own viewpoint to them. Mutual understanding thus built up will not only clear away many of the difficulties to be met but will be a valuable asset on both sides.

### Thermal Resistivity and Surface Emissivity of Cables

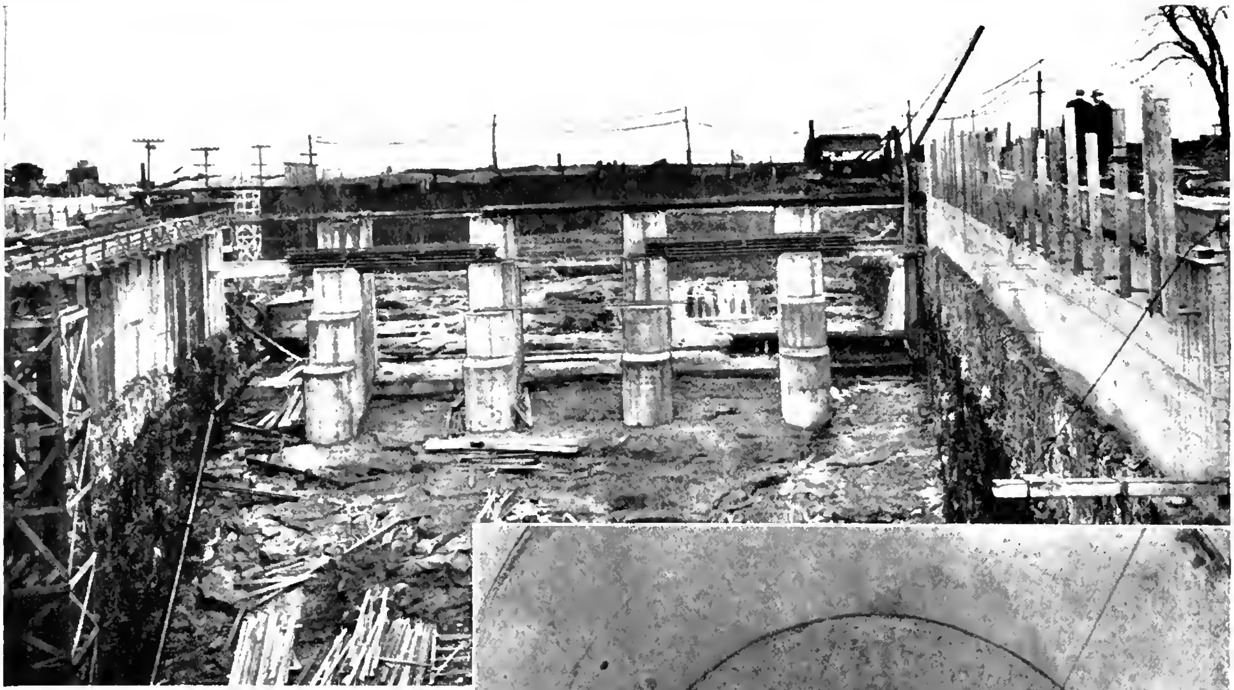
THE Biblical saying about straining at gnats and swallowing camels has been exemplified by some recent tests on lead-covered, paper-insulated power cables. A difference of 10 per cent in the carrying capacity of two apparently identical cables was caused by the differences in the thermal resistance of the insulation and in the amount of heat emitted by the lead surface. It is insisted in many cable specifications that the prescribed amount of copper should be correct within a fraction of 1 per cent, and yet nothing is usually said about the above-mentioned factors, which, as just stated, may affect the carrying capacity by ten times this amount. Seeing that the thermal resistivity clause is included in some British contracts, the time should not be far distant when makers and users of cables in this country will come to some reasonable standard agreement on this point.

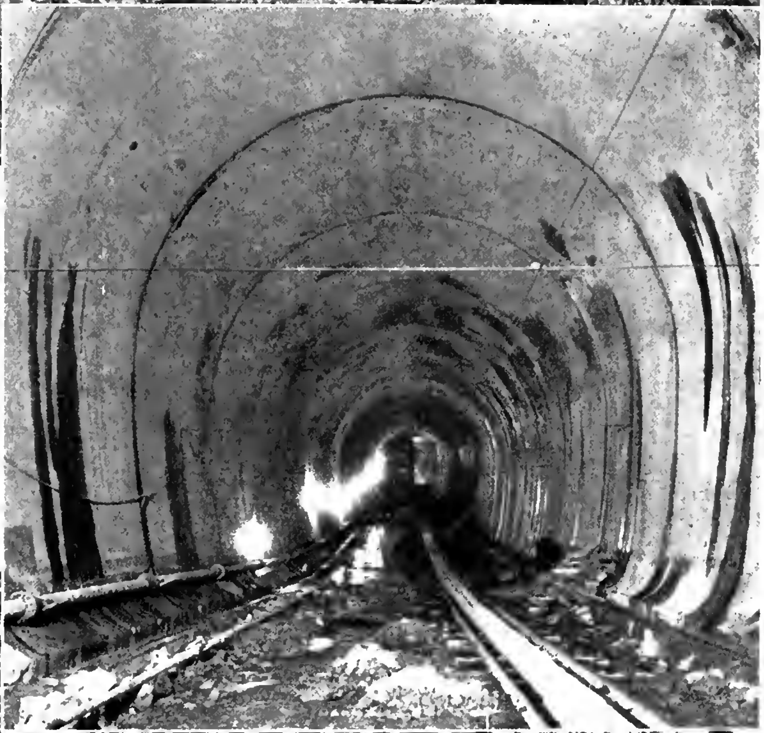
### Engineers Must Have Time for Forethought and Retrospection

IF THE distribution engineer is to do what should be done to eliminate the present wastes in distribution systems and bring them on a par with the economy of power stations, he must be provided with sufficient statistical help to work out ahead of time the possibilities and economy of the contemplated work. This does not mean that a statistical department especially for the distribution engineer must be supported, but it does mean that sufficient help must be provided to permit him or some of his staff to spare time from routine duties to devote to forethought, planning or retrospection.

Economies achieved are more self-evident in power stations than in distribution systems. In the power station the coal pile and other material, the payroll and the maintenance and interest charges tell the story of the cost per kilowatt-hour generated. In the distribution system results are not so immediately perceptible, and an analysis is necessary to make them clear, because the many factors involved vary continually in their cost and conditions vary greatly in different sections.

It was recently stated in these columns, in a letter by D. W. Roper, that the cable investment alone of the Commonwealth Edison Company is double that in turbo-generators. That economy in installing and operating such a system can be realized should be self-evident. But the possibilities of economies in the whole distribution system and the magnitude of the task of obtaining these economies are known only to those in close contact with the work. Means must be given them to prove their point either while they are doing their work or before they do it. A great deal is heard about the necessity of improved distribution-system conditions, and most managements are talking about it, but there is little evidence of a real appreciation of the engineer's requirements or of support for him in these problems.

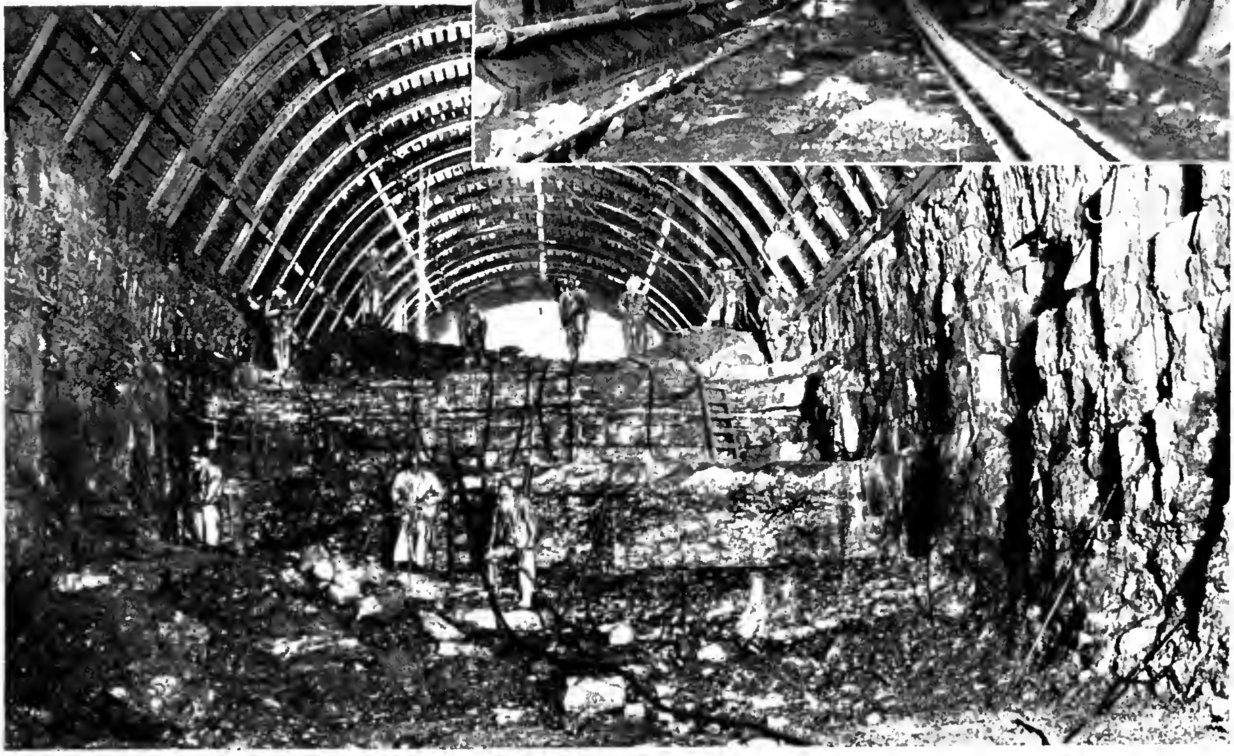




## New Pressure Power Tunnel of the Niagara Falls Power Company

THE improvement in efficiency, of which the construction of this new pressure tunnel is a part, will practically double the power which the water it carries will produce. It is excavated in solid rock for its entire length of 4,500 ft. Its cross-section is horseshoe shaped, having a maximum height of 32 ft., and a maximum width of 32 ft. measured inside the concrete lining, which is about 2 ft. thick. From its inlet at Port Day it dips to a depth of 120 ft., passes underneath to the city of Niagara Falls, and emerges near the brink of the Gorge about a half mile below the falls.

Engineers interested may inspect the tunnel between March 20 and April 1, if advance notification is sent to the Niagara Falls Power Company. It is expected that the tunnel will be filled with water by April 1.



# New Radial Relay Protection*

## Utilizes Excess-Current Relays with Current, Time and Voltage Elements to Insure Selective Operation on a Radial Transmission System

By P. ACKERMAN
*Electrical Engineer Shawinigan Water & Power Company
Montreal, Canada*

THE principle now employed for a radial distribution system makes use of the excess current in the line to indicate the abnormal condition of a short circuit, whereas selectiveness of tripping is obtained by time-delay difference on relays of switches located in series with each other between the point of fault and the generating station. This principle of protection is found to be entirely inadequate for transmission systems where the whole generating capacity is fed out over a few long lines.

A new principle has been developed which makes use of the fact that a short circuit manifests itself not only by excess current but also by low voltage. This fact is made use of so as to obtain a selectiveness of switches located in series, not only by time selective setting, but by a relay which will respond only if the relay is located close enough to the point of short circuit to insure that the voltage at that point will be so low as to offset the relation between voltage and current sufficiently to actuate the relay.

### THE 30-CYCLE SHAWINIGAN SYSTEM

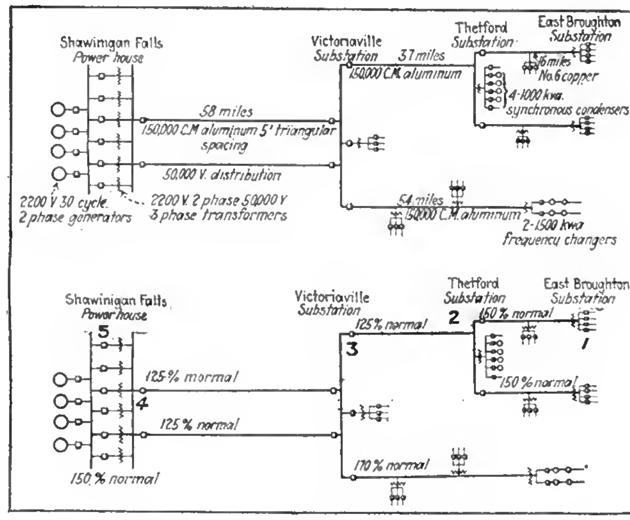
Fig. 1 shows a schematic single-wire diagram of the 30-cycle transmission system. The system is one of the oldest existing transmitting power at 50,000 volts. The power is generated at Shawinigan Falls as 2,200-volt, two-phase current. It is stepped up at the power house to 50,000-volt, three-phase current, and as such is transmitted over 150,000-circ.mil aluminum lines.

The system is particularly characterized by the comparatively large load of 25,000 kw. being transmitted over a distance of 110 miles with the small-size conductor and the comparatively low transmission voltage, the voltage drop under normal load being nearly 30 per cent. These features are particularly responsible for the rather limited short-circuit current in case of distant short circuits.

The generator capacity is liable to vary between 12,000 kva. and 35,000 kva., depending on load conditions, so that during light-load conditions line short circuits may be limited as to current magnitude on account of limited generator capacity. Two parallel transmission lines are feeding Victoriaville. If one of these lines is taken out of service, the total reactance between Shawinigan Falls and Victoriaville will double and as a result cause a further limiting of the short-circuit current in case of short circuits beyond Victoriaville.

Toward the end of 1918 a careful investigation was started on the system in question in an endeavor to improve the relay protective system. Up to that time ordinary bellows-type overload relays were employed with varied success. The result of the investigation led to the decision to equip the main system with a time selective excess-current protection, consisting of modern inverse definite-time relays of great accuracy and reliability.

The serious short-circuit current limitation in case of distant line shorts and under certain operating conditions was then already realized, but no effective means were then known to assure the same protection for all operating conditions. As a result a protection was developed which would offer fair effectiveness during heavy load conditions. In an endeavor to improve the ordinary time selective protection a com-




FIGS. 1 AND 2—SYSTEM DIAGRAM AND CURRENT SETTINGS OF RELAYS

Above is the schematic layout of the 30-cycle system. Below are the current settings adopted on various lines in per cent of normal maximum load current.

bination of time-limit and instantaneous relays was provided on each line. One set of relays consisted of the customary inverse definite time relays, set so as to be time selective with switches in series. The other set consisted of instantaneous excess-current relays of such high current setting that they would respond only to short circuits very close to their respective station.

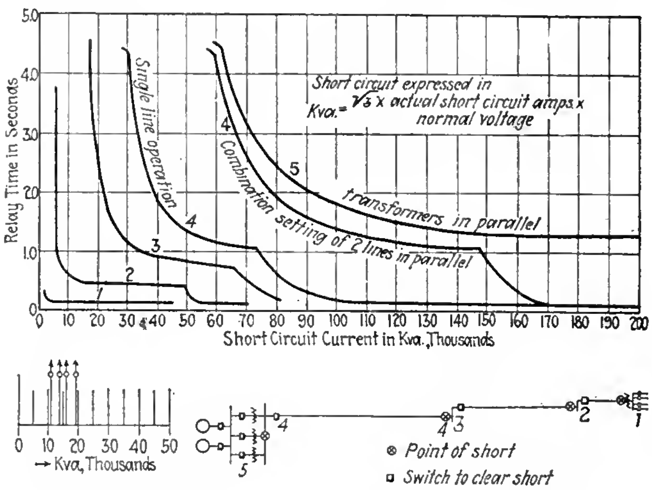
This combination protection assured quick clearance in case of most serious shorts. Such rapid clearance was essential in order to limit the damage at the point of fault and also to limit the seriousness of the disturbance, particularly in view of the sensitive synchronous load of the system. The combination protection also permitted shorter time settings, which was particularly essential in order to obtain at least some effectiveness from the excess-current protection. The settings were governed by the following considerations:

(a) The current setting of each time-limit excess-current relay must be in excess of the maximum load current of the respective line. This is necessary so as

*Paper read before the Montreal Branch, Engineering Institute of Canada, Nov. 16, 1922.

to prevent normal load current actuating the relays. Fig. 2 shows the current settings of the relays of the various line switches in relation to the normal load current of the respective line. Ordinary practice considers a current setting of at least one and a half to two times normal as minimum permissible current setting to avoid wrong tripping on account of momentary overload.

Fig. 2 indicates that most lines were provided with a current setting of less than one and a half times normal load current. These low current settings were somewhat dangerous, but it was realized that they were essential if at least some good were to result from the protection, owing to the limited short-circuit current to be expected.




FIGS. 3 AND 4—TIME CURVES OF EXCESS-CURRENT PROTECTION AND SUSTAINED SHORT-CIRCUIT CURRENTS UNDER MOST LIMITED CONDITIONS

The distant 2,200-volt local distribution feeders (see Fig. 2) were equipped with instantaneous excess-current relays (1). The line switch (2) had to be set time selective with switches (1) up to any maximum short-circuit current value which might be created by a short circuit beyond switches (1). It was calculated that such shorts would never exceed 45,000 kva., owing to the limiting effect from the transformer reactance. Short circuits on the 50,000-volt side of this line, however, could exceed the value considerably. Switch 2 was, therefore, equipped with an inverse definite-time relay having sufficient time lag up to shorts of 50,000 kva. to allow feeder switches (1) to clear ahead of the main-line switch (2). In addition to this time-limit protection, switch 2 was equipped with instantaneous relays of 50,000 kva., to effect a quick clearance of 50,000-volt line shorts. Thus time curve 2 was obtained for switch 2. Switch 3 in turn had to be time selective with switch 2. In this case the most critical point of the two time curves is the point where the instantaneous relay of switch 2 starts. Time curve for switch 3 had to be chosen so that at that point sufficient time difference would exist to allow switch 2 to clear a trouble on its own line before the relays of switch 3 would close contacts. Switch 3 was also equipped with an instantaneous protection for heavy short circuits close to its station, similar to switch 2. The time curve for switch 4 was determined in a manner similar to that given for switch 3.

Finally, transformer switches (5) had to be made time selective with line switches (4). In this case, however, the time curve had to be made time selective with respect to the combination setting of the two lines (4) operated in parallel. Time curve for the generator switch (6) was found to become so high that this protection was considered useless and was never installed.

The sustained short-circuit current values are shown for minimum condition of two generators and one line feeding to the extreme end of the system. The current values are the sustained values which would be created with short circuits at the extreme end of the respective lines. Comparing these values with the current settings of the respective line switches, it will be noticed that these values are all below the current setting of the respective line switches, with the exception of short circuit 2 cleared by switch 2.

(b) The time curves of the various relays were adjusted in such a way that under maximum short-circuit conditions, when two switches had to function selectively as to time, the switch closer toward the power house was given about 0.4 second additional time lag. Such time difference is necessary to allow a switch to rupture the current before the next switch toward the power house may be released by the relay protection. With the combination protection of inverse time setting for limited shorts and instantaneous settings for heavy shorts, the critical condition for time selective action exists always under a short-circuit condition, which reaches a current value of the magnitude of the current setting of the instantaneous excess-current relay.

This may be more clearly understood from an example. Fig. 3 shows the time curves adopted for the various switches.

The system of protection and settings, as shown in Fig. 3, was installed early in the spring of 1919. In addition to this time-selective excess-current protection, a double line protection and ground protection in conjunction with a ground selector were installed.

## Operating Results of Time-Selective Excess-Current Protection

The performance of the protection was carefully watched during the summer months of 1919. A considerable improvement could be noticed compared with previous conditions. It was, however, soon noticed that the protection was unable to function properly in case of distant line shorts. In several instances it happened that a trouble at the Thetford end which should have been cleared by switch 3 cleared very slowly or not at all, and as a result the short had to be cleared by the power-house operator pulling line switches (4), thus causing a total interruption.

Upon closer investigation it was noticed that this condition was particularly pronounced whenever one line only was in service between Shawinigan Falls and Victoriaville. Suspicion arose then that, apparently under the above operating condition, the sustained short-circuit current dropped below the current settings of the relay, and that it was for this reason that the relay was unable to clear the short-circuited line.

To verify this a short-circuit test was arranged, as per operating diagram (Fig. 5). Three generators with four step-up transformers were feeding over one line to Victoriaville into the Thetford line. A short circuit was thrown onto the system at Thetford and the relays of switch 3 were watched. The inverse definite time relay of the induction type started to move on the initial short-circuit current kick, which indicated that the initial current rush was in excess of the current setting of one and a quarter times normal load current. Before the relay disk reached the trip position its movement became slower and slower and finally stopped completely. This was an indication that the short-circuit current had dropped to the relay setting equal to one and a quarter times normal load current. Finally, the relay disk started to move backward, returning to its original dead position, which indicated that the final sustained short-circuit current had dropped even below the tripping value of the relay; in fact, from some other observations it could be noticed that the ultimate sustained short circuit had dropped even slightly below normal load current. All this happened within an interval of about two seconds.

The explanation of this apparently strange behavior is to be sought partly in the high reactance of the lines and partly in the short-circuit characteristics of generators in general. A dead short circuit at the terminals of a generator will cause a momentary current flow in the generator of up to ten times normal load current or more. This short-circuit current will, however, within one and one-half to two seconds, gradu-

ally drop to one and a half to two and a half times normal load current or less, depending on the characteristics of the generator. Fig. 6 shows a typical curve of the gradual decrease of the short-circuit current of a generator. This gradual decrease of the generator short-circuit current from a high initial value to an ultimate low, or so-called sustained, value explains the behavior of the relay in our short-circuit test.

The test demonstrated clearly that the sustained short-circuit current on the line under the given conditions dropped below normal load current. It was, therefore, clear that for such condition the principle of excess-current protection was utterly inadequate, since no such excess-current relay could naturally be given a setting low enough to be effective in case of shorts and still not operate under normal load conditions.

From the operating experience of the summer season 1919, it had also been realized that it was very unsatisfactory to have a protection which would only offer a fair effectiveness under maximum generator and load condition, whereas under light load of abnormal operating conditions the protection would be inoperative.

Fig. 4 shows how particularly inadequate the excess-current protection is with respect to light load conditions and with distant line short circuits.

From the foregoing it became evident that a new principle of protection had to be adopted before effective protection could be obtained for this system.

In the search for a new principle it was instantly realized that a new scheme had to take advantage of the fact that under short-circuit conditions low voltage existed. Normal voltage had to keep the current relay blocked, even if its setting were below normal load current, so that it would not operate under any circumstances on normal load current unless a short circuit existed at the same time, pulling down the voltage.

An attempt was made first to develop a combination protection, consisting of current relays and low-voltage relays. The complications and the difficulty of effective settings, however, were found to be so great that the idea was abandoned. After a few other fruitless attempts with alternate schemes, the principle of the so-called current potential overbalance protection was conceived. A thorough preliminary study disclosed the soundness of the new principle, and as a result it was decided to have the necessary relays developed and installed as a first trial installation on switches 3 and 4 of Fig. 2.

## THEORY OF THE NEW TYPE OF PROTECTION

A transmission line of a certain physical characteristic represents a certain impedance $Z$. If such line was short-circuited at the far end and voltage was built up at the station bus from which the line emanates, the relation between current in the line and the bus voltage would be expressed by $E = IZ$. In other words, the current in the line is proportional to the bus voltage. Referring to Fig. 7, as an example, it is assumed that the impedance drop of the line is 10 per cent of normal voltage with normal line current flowing in the line; that means that the line, short-circuited at its extreme end, would require 10 per cent of normal voltage at the station busbar to cause normal current to flow in the line. Any greater short-circuit current under the same condition would leave a proportionally higher voltage at the station busbar.

In case of a line short circuit closer to the station, the impedance of the circuit to the short-circuit point would become lower, and as a result less voltage would be left at the busbar, with the same current flowing in the line, compared with a far end short. On the other hand, a short circuit beyond the next substation would offer a higher impedance and in consequence would leave higher voltage for the same current.

A relay (see Fig. 7) consisting of a beam pivoted in the center and equipped at either end with a solenoid, one side being equipped with a current coil fed from the line and the other side having a potential coil fed from the station bus, could be adjusted with respect to current and potential coils in such a fashion that the magnetic pull of current and potential coil

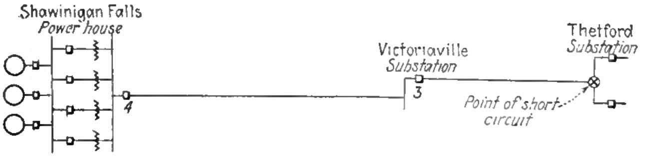



FIG. 5 (ABOVE)—OPERATING CONDITION DURING SHORT-CIRCUIT TEST WHICH PROVED INADEQUACY OF EXCESS-CURRENT PRINCIPLE

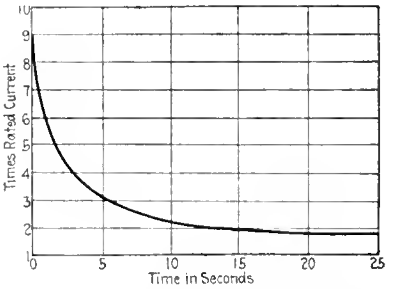



FIG. 6 (AT RIGHT)—TYPICAL CURVE OF TRANSIENT SHORT CIRCUIT ON THREE-PHASE GENERATOR

would just be equal under the condition of a short circuit at the extreme end of the line. A trip circuit arranged as shown would trip the line switch whenever the current coil would overpower the potential coil.

In our specific case of Fig. 7, the two coils could be adjusted for a balance of 10 per cent voltage against normal current. Such balanced condition would exist irrespective of the actual short-circuit current as long as the short circuit would be at the same point, since any change in the current coil would also produce a proportional change in the potential coil. A short circuit closer to the station, however, would leave a lower voltage on the potential coil of the relay, because of the lower impedance, and as a result would cause the current coil to overpower the potential coil and would thus trip the line switch. A short circuit beyond the end of the line would leave more than 10 per cent voltage per normal current, because of the higher impedance and, in consequence, the potential coil would overpower the current coil and would thus keep the trip circuit blocked. Under normal load condition, the potential coil, with full voltage across, will keep the current coil overpowered and will thus keep the trip circuit blocked.

From the foregoing it will be seen that the new type of protection has the following valuable features, none of which can be attained by the excess-current principle of protection:

1. Its actuation depends entirely on the relation between current and voltage irrespective of their actual magnitude.

2. The protection will be just as effective, therefore, for currents below normal load current; and in consequence the functioning can be made the same for all operating conditions and irrespective of the generator capacity.

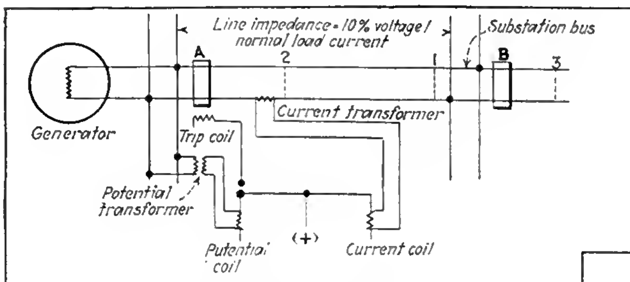
3. The actuation of the relay depends on the location

of the short circuit, so that its radius of action can be fixed. In consequence, selective action of switches in series can be obtained by limiting the active radius of the relay, instead of by time selective setting. Thus it is possible greatly to reduce the time settings of relay protection toward the power house.

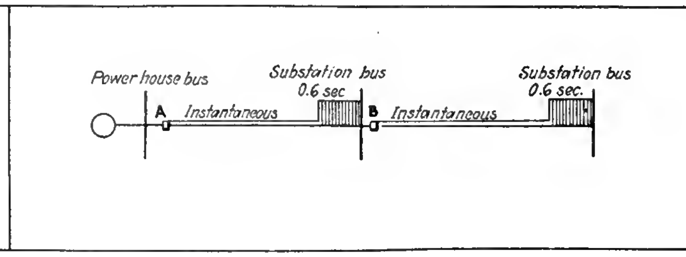
4. The protection is unaffected by load conditions and thus does not cause wrong tripping of line due to unexpected load increases.

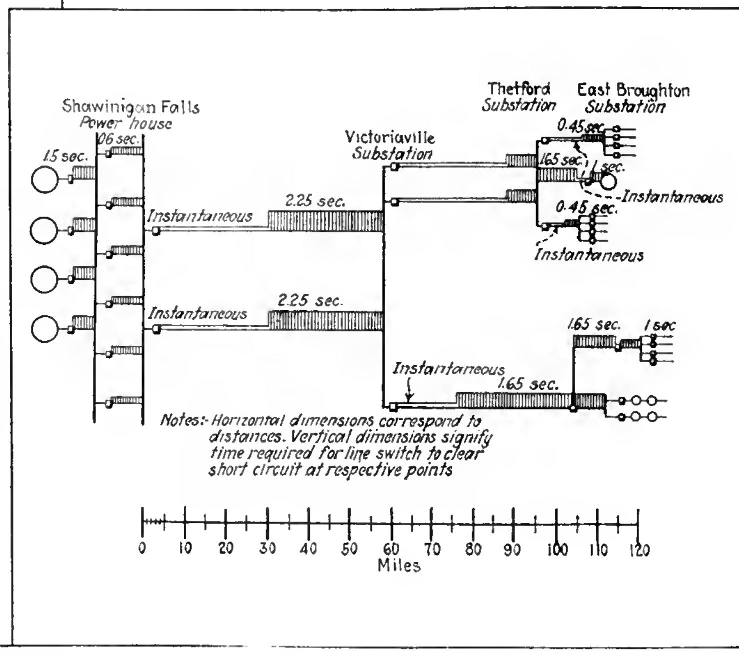
In the example of Fig. 7 it was assumed that the relay would be adjusted for such balance that it would just cover the short-circuit condition of the line end short. In actual practice no such accurate adjustment will thus assure effective tripping. As a result of this higher balance adjustment in the relay of switch *A*, its radius of action will extend into the line controlled by switch *B*. A short circuit at point (3) in that line would, therefore, be liable to trip switch *A* as well as switch *B*, if both were instantaneous. In order to prevent a wrong tripping of switch *A* under these conditions, switch *A* protection would have to be provided with a time lag sufficient to allow switch *B* to clear ahead of switch *A*.

In actual practice the selectiveness between the switches in series was solved by providing each switch with two sets of protection. One set is adjusted for a




| Condition | Relative Magnetic Pull on Solenoids | | Action of Relay |
|---|---|---|---|
| | Potential Coils | Current Coil | |
| Light load | | | Potential coil overpowers current coil and keeps trip circuit blocked |
| Full load | | | " " |
| Short at end of line at point 1 | | | Potential and current coils just keeping balance relay adjusted for this balance |
| Short near Power house at point 2 | | | Current coil overpowers potential coil and trips switch |
| Short beyond line at point 3 | | | Potential coil overpowers current coil and keeps trip circuit blocked |




FIGS. 7, 8 AND 9—CURRENT-POTENTIAL OVERBALANCE PROTECTION FOR ALTERNATING-CURRENT SYSTEMS

Fig. 7 (left)—Schematic diagram of current-potential overbalance principle for a single-phase circuit, with table showing functioning under different conditions. The principle of protection is based on an overpowering effect of current against voltage, irrespective of phase-angle relation. Any relay principle could be employed, therefore, in which current and potential produce mechanical forces which are proportional to the actual value of current and voltage respectively. The two mechanical forces thus created must cause opposing movements on a mechanical structure, so that movement occurs in direction of greater force. The induction principle, similar to the induction-type excess-current relay, could be used, having current and potential creating opposing torques on the shaft. Similarly the dynamometer principle could be used to produce opposing torques on a shaft.

In this case it was felt that a simpler and more rugged relay was obtained by using a beam pivoted in the center and with current and potential solenoid mounted on opposite ends of the beam. Thus the beam is pulled to the side of excess force. All relays were developed along this line. Current and potential coils were provided with taps so that different adjustments could be obtained. In this way any desired balance can be established by choosing such taps on the two coils that for a given current and potential value for which balance is to be created the ampere-turns, and thus the magnetic force of the two coils, become the same.

Fig. 8 (above, right)—Typical time graph of current-potential overbalance protection as applied to a system of several stations in series.

Fig. 9 (below, right)—Time graph of current-potential overbalance protection of 30-cycle system.

would be possible. In order to be sure that the protection of switch *A*, Fig. 7, will be effective for shorts at the end of the line and for troubles in the substation, it will be necessary to set the relay balance of potential and current somewhat higher than the impedance would require, say 12 per cent voltage per normal load current, instead of 10 per cent voltage per normal load current, as was assumed in Fig. 7. Thus, in case a substation bus short creates on the relay 10 per cent voltage per normal load current only, the current coil will have a decided overpowering effect and balance to be effective for line end shorts and substation shorts. This set is provided with a time delay sufficient to allow switch *B* to clear on instantaneous protection. The other set of protection is adjusted for a balance which will confine its active range to its own line. This set can be made instantaneous since its balance adjustment prevents it from operating in case of a short circuit beyond switch *B*, so that no time-selective adjustment will be required for this set.

The functioning and radius of action of a protection as above described for a system of two lines in series

is illustrated in Fig. 8. Distant line shorts on line $A$, as well as line $B$, are cleared by their respective switches by time-limit relays. Short circuits at the beginning of the respective lines are cleared by instantaneous relays. From this example it will be noticed that the great advantage of the new scheme is that no progressive time setting toward the power house is required, such as is necessary with the excess-current principle of protection; but that instantaneous protection can be introduced by applying relays of such a potential current balance setting that their range of action does not overlap the switch ahead.

In the spring of 1920 the first lines were equipped with this new type of protection. The protection was tested out with actual extreme conditions, and the result proved fully satisfactory. It was, therefore, decided to equip the whole system with this new type of protection. The 50,000-volt line system has been completed and in service since the fall of 1921, and the power house protection is in the course of completion. Fig. 9 shows a diagram of the system, indicating in what time short circuits at various points of the system are cleared. From this diagram it will be noticed that the action of the relay depends entirely on the location of the short circuit, the protection being equally effective for both minimum and maximum generator capacity. The diagram shows how distant line shorts only are cleared by time protection, whereas shorts nearer the substations are all cleared instantaneously.

In the fall of 1921, after completion of the line protection a series of tests were made to find out any possible weak feature of the new protection, and the tests proved that the protection was fully effective for all conceivable conditions.

The protection has effectively operated ever since its installation. The outstanding features with respect to the operating results are:

1. Since the installation of the new protection there has been no case where the operator had to clear a short-circuited line by hand, a condition which was quite a common occurrence with the previous excess-current protection.

2. There is nothing to indicate that the new principle might cause incorrect actions.

3. The one inconvenient feature of the protection wherever the protection has to be effective even for currents below normal load current is the danger that the relay is liable to trip a line on normal load current should ever the potential circuit be ruptured accidentally. During the two years of service there have been two such cases recorded. Both these cases were caused by an open circuit developing in the tap block of relays. Some alteration in the design, however, has prevented any recurrence. Other causes of open circuiting the potential circuits are very remote as long as the wiring layout is carefully worked out and as long as the operating staff is properly instructed.

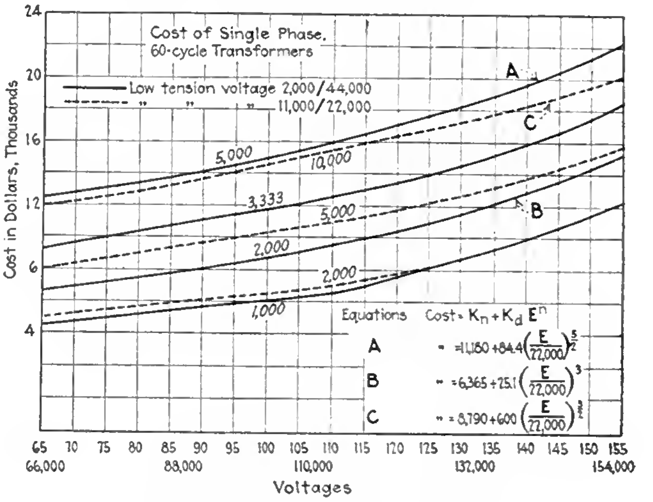
Similar conditions exist on all systems where the total power-house capacity is fed over a few large-capacity trunk lines. In any such case the sustained short-circuit current for distant shorts will always drop near or below the maximum normal load current, so that any excess current relay, set at 150 per cent of normal load current, will become useless. This condition is still more pronounced on modern systems, where the tendency is to install high-reactance generators which have a sustained short-circuit current of normal load current or less.

# The Economical Design of Transmission Systems

## The Determination of the Most Economical Design for Backbone Lines Requires the Exercise of Judgment and Many Data

BY P. O. REYNEAU AND H. P. SEELYE

ANY problem of transmission design is one which will bear an almost infinite amount of study. Naturally the detail to which such a study should be carried will depend somewhat on the size and nature of the project. As a rule, however, time spent on an economical determination is well repaid. In many cases some of the variables are limited—voltage may be determined by other than economical considerations, route and location for towers may be fixed, and so on. This simplifies the problem, but in any case some study is essential to an accurate determination. Variations in the details will, of course, be found to accommodate special conditions. In any case it is to be emphasized that the problem is a complicated one and usually does not admit of solution by any easy, approximate method.




A CONVENIENT FORM ON WHICH TO KEEP COSTS OF SINGLE-PHASE TRANSFORMERS

In order to systematize the computations and to facilitate the determination of the effect of changes or additions to any design on the total cost the following factors should be considered:

1. *Fixed Quantities.*—As many as possible of the elements affecting the problem should be fixed. These will be:

(a) The maximum load. The expected increase should also be determined, and in case of more than one feeding point each load must be considered separately.
(b) The load factor and equivalent hours of the load.
(c) The power factor of load.
(d) The cost of energy per kilowatt-hour.
(e) The length and cost of right-of-way (at least approximately) for the various possible routes.
(f) The type of tower to be used for each route.
(g) The percentage of annual charges applicable to the various kinds of property entering into a transmission line.

2. *Limits of Problem.*—It is essential to discover approximately the limits of the problem so that time will not be wasted in considering voltages and wire sizes which are far from the final result. In case the designer's experience is not sufficient to tell him this, approximate formulas will be found useful.

3. *Cost Data.*—The necessary cost data, quotations, etc., must be collected. These will be:

(a) Cost of transformers, of the size determined by the load for various voltages within the range of the problem (more than one size may be necessary, especially if there

are several feeding points with different sized loads). Core loss and copper loss should also be ascertained.

(b) Cost of switches of proper size for various voltages.

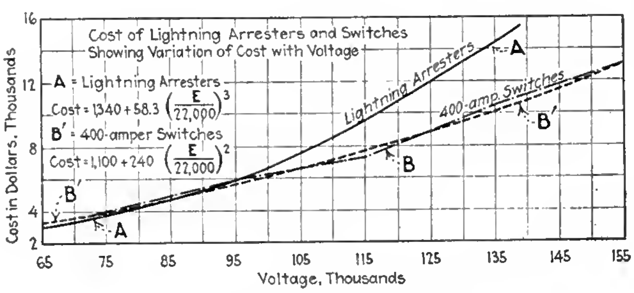
(c) Cost of lightning arresters for various voltages.

(d) Cost of insulators for various voltages. The limit in mechanical load for any string of insulators should also be determined. In cases where pin insulators are considered in comparison with suspension type, the cost of both must be obtained. The cost of placing insulators should be included.

(e) The cost per pound of conductors of different materials—copper, copper-clad steel and aluminum steel. In case the price per pound varies considerably with the size, the cost for a variety of sizes within the range of the problem should be obtained. The cost of stringing the conductor should be estimated or determined from previous experience.

(f) The cost of various sizes of tower for each type. If possible, sufficient costs on towers should be obtained to enable the variation of cost with span, wire size and voltage to be determined. This could be accomplished if three voltages, three wire sizes and three different spans covering the probable range of the problem were considered. By plotting curves the intermediate values could be determined with sufficient accuracy. The cost of foundation should be included with each tower. Anchor towers and semi-anchor towers should also be considered and similar costs obtained.

(g) The cost of terminal substations of the required size. The variation in this cost with voltage should be




CURVES LIKE THIS FACILITATE COMPARISONS

determined if possible. In case other special terminal apparatus, such as condensers or regulators, are considered, the additional substation cost for these must be estimated.

(h) Quotations on special apparatus considered, regulators, condensers, etc., should be obtained with variations in this cost with size and voltage.

(i) Annual cost of maintenance, testing, patroling, etc., must be estimated.

4. *Arrangement of Cost Data.*—After the data are collected they should be arranged for convenient use. This probably can best be done by means of curves. Such curves are illustrated in the accompanying figures. They should give:

(a) Annual cost of transformers (in place) in terms of voltage.

(b) Annual cost of switches (in place) in terms of voltage.

(c) Annual cost of lightning arresters (in place) in terms of voltage.

(d) Annual cost of insulators per string in terms of voltage.

(e) Annual cost per mile of conductors of different materials in place in terms of cross-sectional area.

(f) Annual cost of towers in place. These can be arranged, for example, as a series of curves for each standard voltages, showing for each standard wire size and material the variation of cost with span.

(g) Annual cost on terminal substation in terms of voltage.

(h) Annual cost of transformer energy losses in terms of voltage.

(i) Annual cost of line energy losses per mile for each material of conductor considered in terms of cross-sectional area.

5. *Most Economical Design.*— It now remains to apply these costs to determining the most economical design. The route is usually the most limited of all the variables, there ordinarily being no more than two or three possible routes at most. Likewise, on any route the layout is somewhat limited. Locations of anchor towers and semi-anchor towers are usually more or less fixed. On straight runs the span can often be varied. If two or three possible layouts are made for each route, varying the span where possible, a sufficient comparison will be obtained.

If, now, for each of these layouts a sheet of curves is prepared showing, for each standard conductor considered, a curve giving the variation in total annual cost with the voltage, a complete and accurate study of the economy may be made. Not only will the most economical voltage, wire size, route and layout be obtained but the comparative effect of variation in these quantities may be studied. Curves may be added to show comparison of two or more circuits with a single circuit. If a design chosen tentatively proves on further investigation to be impracticable on account of corona limit, too great regulation, etc., the cost of correcting the fault by a change in design, addition of regulator or in some similar way, as compared with one of the other designs not having that fault, may be easily determined.

## Fewer Pounds of Coal per Kilowatt-Hour

SOME interesting studies have been made by A. H. Horton, chief of the Power Resources Branch, United States Geological Survey, of the reports of production of electricity and consumption of fuel by public utility plants which are received by that government bureau. The gradual decrease within the last few years in the rate of consumption of coal per kilowatt-hour of electricity generated by public utility power plants is a remarkable achievement, the importance of which is very readily recognized when it is considered that 10,575,000 tons more of coal and its equivalent in other fuels would have been consumed in generating the electricity produced in 1922 by the use of fuel if the rate of consumption of fuel per kilowatt-hour had been as high as that of 1919. This gain in efficiency represents a saving of approximately $50,000,000.

A comparison of the percentage change in output by the use of fuel from one year to another with the percentage change in the consumption of coal for the same years indicates a marked advance in economy and utilization of fuel. For instance, the output by the use of fuel was 17 per cent greater in 1922 than in 1921, but the increase in coal consumption was only 8.2 per cent, or less than half the increase in output. The remarkable gain in efficiency and utilization of fuel and in plant operation is clearly shown by considering the average fuel consumption per kilowatt-hour for each of the four years, that is from 1919 to 1922. This average is most satisfactorily determined by converting the oil and gas consumed to their equivalent in coal. Records of actual operation indicate that a ton of coal is equivalent to about four barrels of oil and about 35,000 cu.ft. of gas. These figures will, of course, vary with the relative efficiency in utilizing the three fuels, especially coal, the methods of using which are the most susceptible to improvement. The accompanying table indicates most thoroughly the increased efficiency which has been obtained in public utility electric generating plants during the last four years.

AVERAGE CONSUMPTION OF COAL PER KILOWATT-HOUR BY PUBLIC UTILITY POWER PLANTS IN THE UNITED STATES, 1919 TO 1922

| Year | Output with the Use of Fuel* (Kw.-hr.) | Net Tons | Consumption of Coal and Its Equivalent in Other Fuels† Pounds per Kw.-hr. | Percentage of 1919 Rate |
|---|---|---|---|---|
| 1919 | 24,176,000,000 | 38,784,000 | 3.22 | 100.0 |
| 1920 | 27,248,000,000 | 41,424,000 | 3.04 | 94.4 |
| 1921 | 25,863,000,000 | 35,236,000 | 2.73 | 84.8 |
| 1922 | 30,215,000,000 | 37,996,000 | 2.52 | 78.3 |

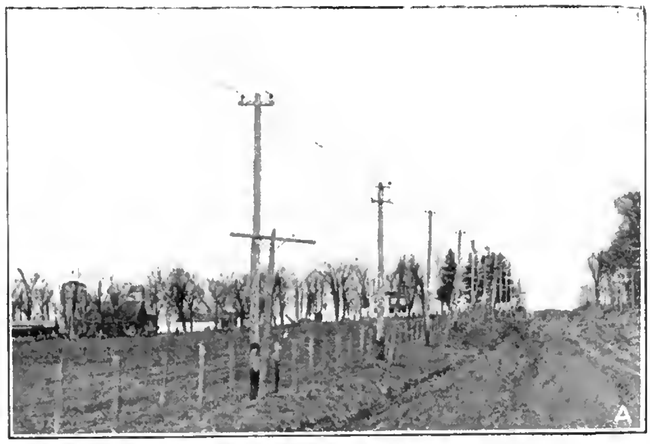
* Coal, oil, and gas. † 1 ton coal = 4 bbl. oil = 35,000 cu.ft. of gas.

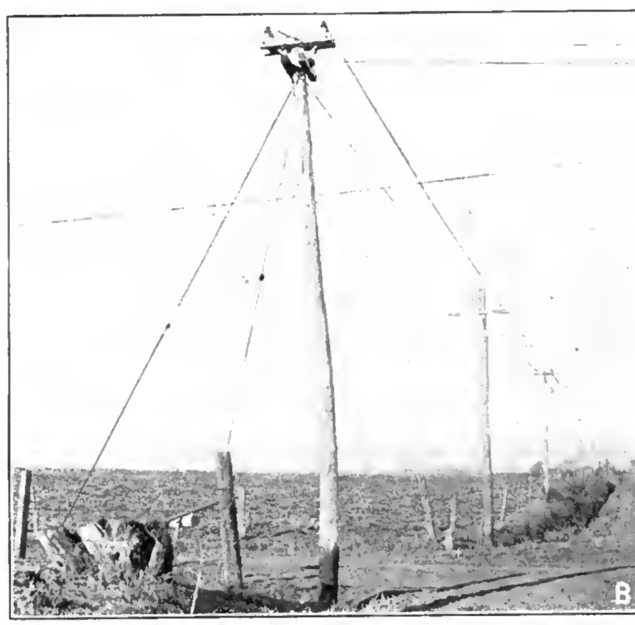
# Some Iowa Rural-Line Practices

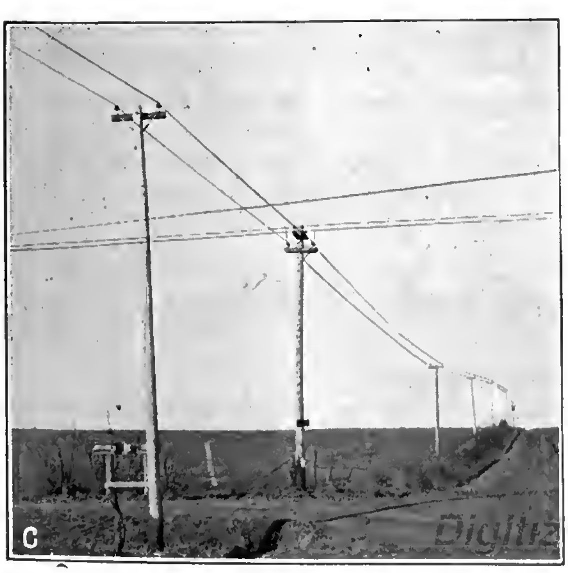
South Fairfax Line Constructed Under Iowa Commission Specifications — Construction Features and Load Characteristics —Utility to Maintain Line at Expense of Farm-Line Company

THE construction and operation of rural lines has seemed, in common opinion, to involve something special in the way of construction, maintenance methods and operating arrangements. In the sense that there is more territory to be covered, and therefore more expense involved, it may be necessary to adopt maintenance and operating methods slightly different from those in city or town territory. Such matters as meter reading may be done by means of cards on which the consumer marks the position of the meter dial hands at the billing period and then drops the cards into the mail so that the utility company may "read" the meters and render the bill. In such cases it is customary once or twice a year to make check readings, the work being done by a utility employee. This is to insure that no errors creep in and continue from year to year, leading to a reckoning at some future time that might be embarrassing to every one concerned. Operating matters such as trouble shooting, repairs due to accidents, action of the elements or emergency troubles of any kind are sometimes taken care of by arrangement with some local electrical contractor who works with the central station on such matters and who is on call for emergency purposes. Such arrangements are usually on a contract basis. In heavy maintenance work this arrangement is sometimes used, and in other cases the work is taken care of by the regular maintenance crews of the central-station company.

Just how such matters are best cared for depends on the individual central-station situation. In the case of







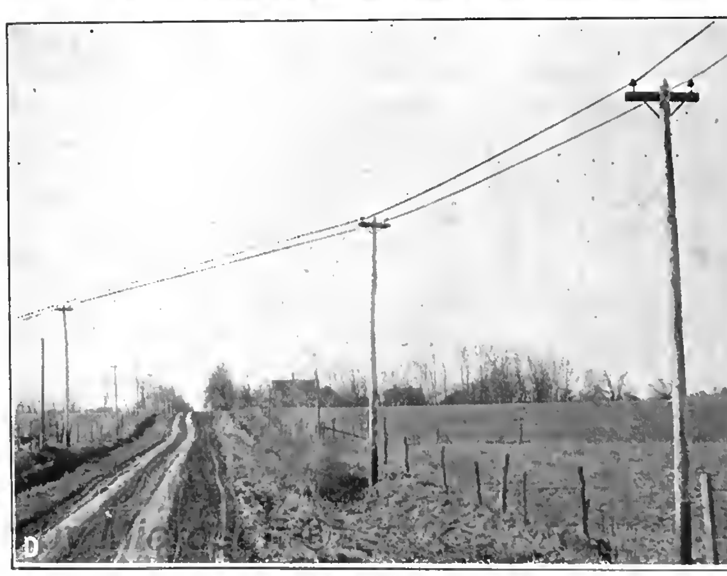


FIG. 1—CHARACTER OF LINE CONSTRUCTION EMPLOYED ON THE RURAL LINES BELONGING TO THE SOUTH FAIRFAX ELECTRIC COMPANY AND SUPPLIED FROM THE SYSTEM OF THE IOWA RAILWAY & LIGHT COMPANY

A—Straight-line construction on which two-pin cross-arms are used to carry the 6,600-volt, single-phase circuits. B—Typical corner construction. C—Typical crossroads construction with lines branching both ways. D—Cross-over construction necessitated by location of telephone circuits on the highway.

a company with a well-organized operating force, a fairly large number of centers from which the various crews work and distances to travel that are not too great, the work is usually best done by these forces, including even the meter reading. In other cases arrangements with local agencies that can be depended on seem to be best.

What shall be done in any particular case will depend on the local situation, the availability of organized utility crews at convenient points or the availability of other agencies that can be depended on to carry out the work properly. In short, the problem is economic in character, and its solution must depend on the distinctive factors present in each case.

Iowa probably contains as many rural lines as any state in the Union. This is due to the extent of its agricultural areas. A good example of the present rural-line practice of the Iowa Railway & Light Company is the 6,600-volt, single-phase, 60-cycle line south of Fairfax, which was built about three years ago. Thirty farmers raised slightly more than $5,000 to build the eleven miles of line, to which they added a considerable amount of labor contributed by the farmers themselves. The line was built by a utility employee loaned for the purpose. In the contract with the utility for wholesale power it is specified that the local company, the South Fairfax Electric Company, shall follow the specifications drawn for such lines by the Iowa Board of Railroad Commissioners. These specifications are practically identical with those in the report of the Overhead-Systems Committee of the National Electric Light Association presented at the 1922 convention. The National Electrical Safety Code is the basis of the requirements, and the aim is to insure substantial construction—construction that in maintenance and operation results will compare with construction in ordinary distribution practice.

The aim is to prevent the construction on the public highways (a) of lines which will fail within a few years and require rebuilding at a high expense because flimsy construction was used in the beginning, (b) of lines which will require very high expense for maintenance after a few years for the same reason, and (c) of lines which will become a menace, because of their physical condition, to the public and to other utilities occupying the same highway. There is no departure from well-established distribution practice, as will be seen from examination of the photographs of the completed lines. The lines are maintained under a contract by the Iowa Railway & Light Company, and the cost of maintenance is charged to the South Fairfax Electric Company. As the situation has actually worked out there has so far been no real maintenance work required as the lines are not old enough to require repairs except those due to accident or storms. For fuse replacements and minor troubles there is always available among the group of farmers some one who has learned to take care of such troubles.

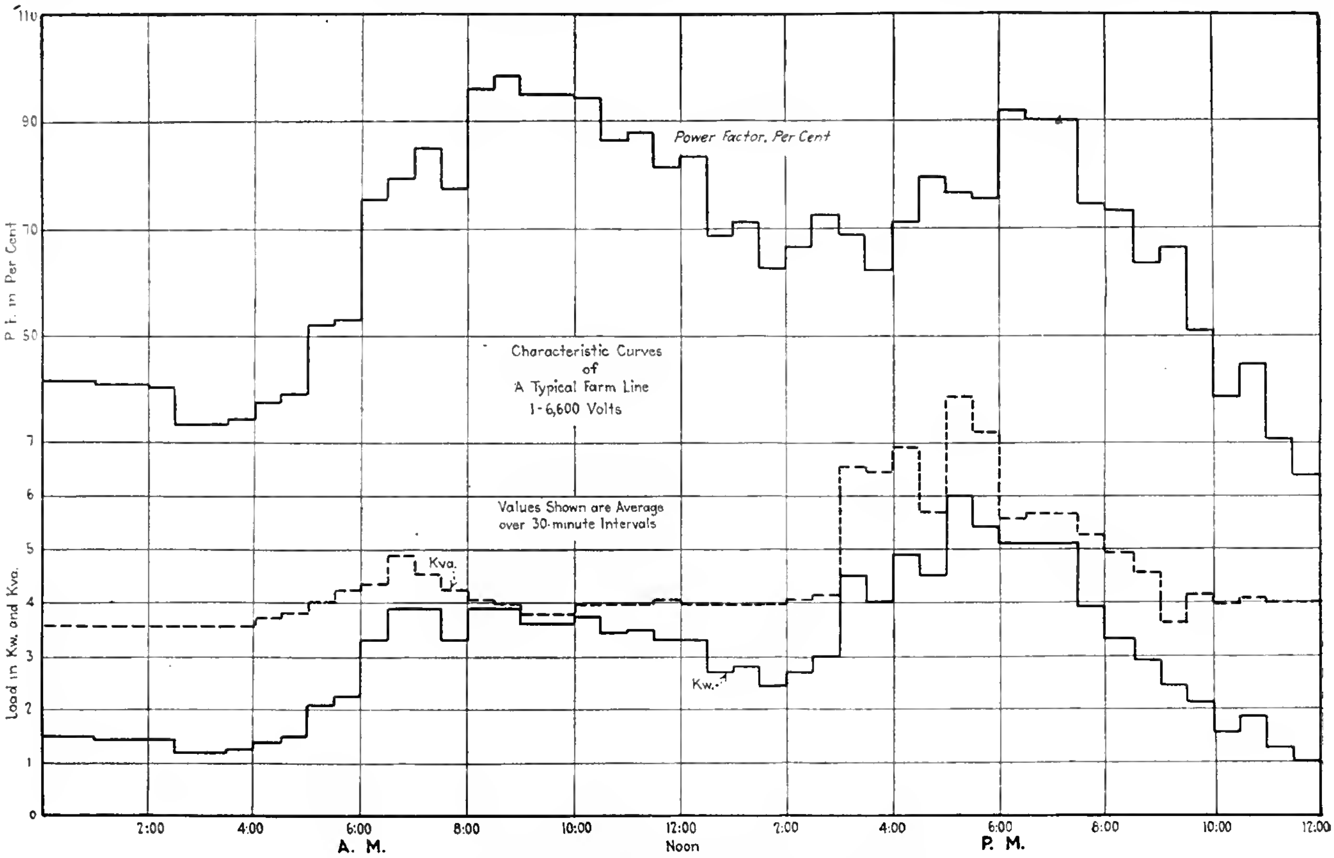
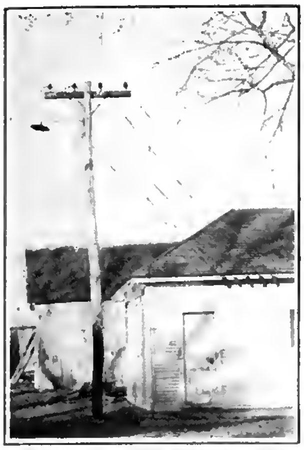


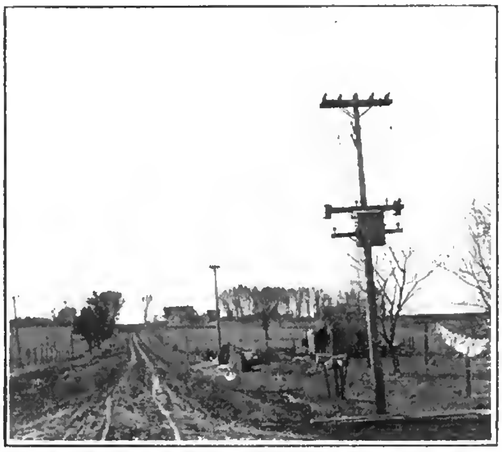

FIG. 2—POWER-FACTOR LOAD AT SOUTH FAIRFAX

Much has been said about the poor characteristics of rural-line loads. This typical curve shows that there are times in the day when the power factor is on a fairly satisfactory basis. The middle of the day and the late night and early morning hours give the worst power-factor conditions. There should also be no objection to the power load here shown.

### CONSTRUCTION FEATURES OF THE LINES

Fig. 1 shows several views of the 6,600-volt, single-phase, straight-line construction and the corners. A is a section along the highway in which a transposition is placed. The poles are 25 ft. high except at the highway crossings or other points where greater clearance is needed and where 30-ft. poles are used. Minimum top





FIGS. 3, 4 AND 5—YARD LIGHTING ON A FARM, SECTION SWITCH INSTALLATION AND MASTER METER EQUIPMENT AT FAIRFAX

Fig. 3—This illustrates the terminal pole for the service which is employed for the yard lighting also. The meters are in the small building at the right of the pole.

Fig. 4—Plain underhung disconnecting switches for 6,600-volt sectionizing pole.

Fig. 5—The farmers buy power wholesale and then retail it to the members of the South Fairfax Electric Company. The farmers read their own meters and transmit the readings to the secretary, who sends separate bills to all of the individual consumers each month.

diameters of 6 in. are adopted. All poles are butt-treated Western red cedar. The line cross-arms are two-pin, while four-pin arms are used at points where special construction requires more pin space. The standard N. E. L. A. specification is followed in the use of cross-arms, a 3¼-in. x 4¼-in. cross-section being employed. Cross-arm braces are 26 in., and the bolts used except on the braces are ⅝ in. No attempt is made to use special hardware. B shows the corner construction and the guying practice followed on the entire line. C shows a corner at a crossroads point where the line branches in both directions. D shows a point where it has been necessary to jog across the highway because of the presence of telephone-line construction.

Fig. 4 shows section switches which are used on the line and the method of mounting. These are plain underhung disconnecting switches for 6,600-volt service.

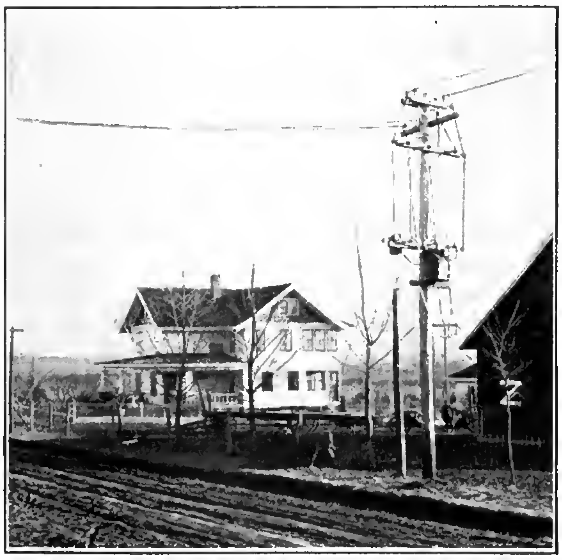
Fig. 6 shows a transformer mounting that is somewhat unusual in that it is of 10-kva. capacity and the meter is mounted on the pole. The farm is that of Cyrus Tow, a well-known cattle fancier, who makes a rather larger use of electricity than the average farmer. Feed grinding and water pumping as well as lighting all over the farm call for fairly large amounts of electrical energy.

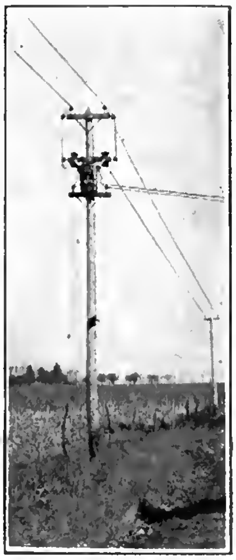
Figs. 7 and 8 show typical transformer mountings on the rest of the line. Fig. 7 is at the end of the present line and serves two consumers. Fig. 8 is erected on the highway and shows the service tap-off clearly. Consumers are so far apart that in most instances each consumer has his own equipment, because secondaries would be too long to reach more than one individual from a transformer.

Fig. 3 shows the way in which the farmers make use of light in their yards. In this case the end of the service line and also a yard lighting installation are represented. The meter installation is in the small building to which the service lines drop.

Typical meter installations are shown in Figs. 9 and 10. Fig. 9 is typical for places having a single meter. Fig. 10 is one case in which both power and lighting meters are employed. It is interesting to note that the farmers themselves hung at least a part of the meters.

Fig. 5 is the master-meter installation at the begin-





FIGS 6, 7 AND 8—TYPICAL TRANSFORMER INSTALLATION ON RURAL LINES

Fig. 6—A transformer installation with the meter on the pole. This 10-kw. installation is at a well-known cattle-raising farm, where a rather unusual amount of power is used. Most of the farms use transformers rated at 1½ kw.

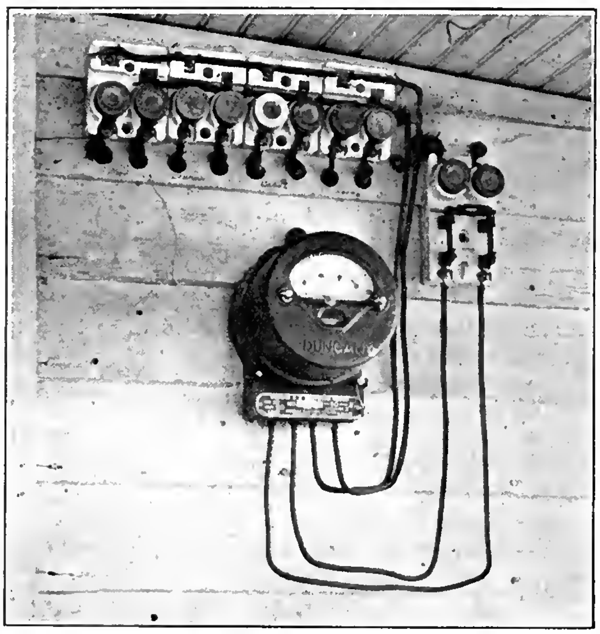
Fig. 7—Transformer installation located at the end of the line and serving two customers.

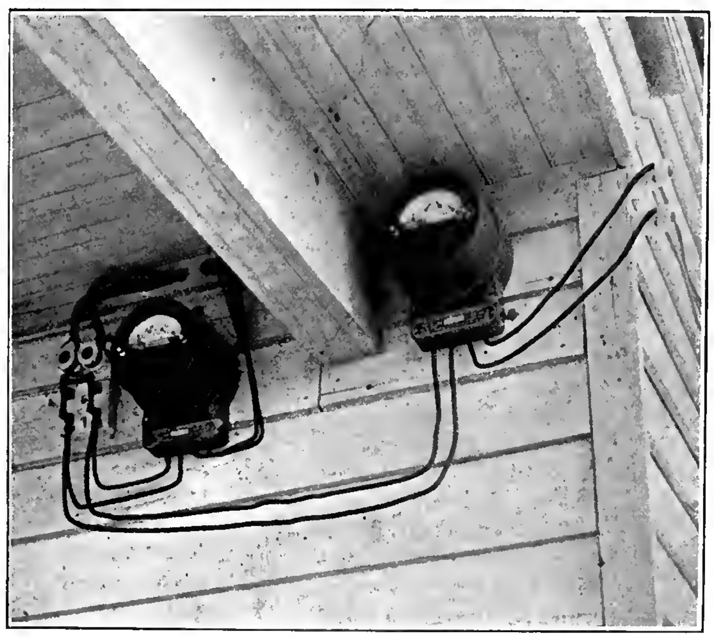
Fig. 8—The majority of services are of the nature shown here, where a single customer is served from each transformer.

ning of the line out of Fairfax. Since this photograph was made the meter has been placed in another box near the foot of the pole, only the transformers being left in the upper box. Energy is sold wholesale to the corporation and each farmer reads his own meter. These readings are sent to the secretary of the company, who handles the billing that divides the expense of energy, maintenance and other expenses between the farmers getting service. The rate to the South Fairfax Electric Company is made up of a monthly demand charge of $5 per kva. plus a service charge of $5 per month. An energy rate of 2½ cents is charged for the consumption shown by the master meter. On Jan. 1 and July 1 a 1-mill adjustment plus or minus is made on the energy rate for each 30-cent variation above or below $5.50 per ton taken as the average cost of coal for the previous six-month period. The monthly demand is taken as the highest average kilovolt-ampere load recorded in a fifteen-minute period, provided this figure be not less than 75 per cent of the highest maximum for the preceding twelve months, in which event it shall be 75 per cent of the preceding twelve months period.

Some studies have been made on this line to determine the characteristics of the load. Fig. 2 shows the results of the study in the form of a typical daily load curve giving the kilowatt load, the kilovolt-ampere load corresponding to the kilowatt load, and the power factor for the different hours of the day. The interesting curve is that showing power factor. Contrary to the usual assumption, there are hours of the day when the power factor on the line is on a good basis. Twice a day it rises to 90 per cent or better. During the middle of the day it drops to less than 70 per cent, and during the late night and early morning hours it falls far below 50 per cent.

This sort of study is being carried out regularly by the engineering school at the Iowa State College at Ames. These studies are expected to continue for several years, or at least until reliable data on the characteristics of rural-line loads are established.





FIGS. 9 AND 10—METER INSTALLATIONS AT CONSUMER'S PREMISES

Fig. 9—This represents a lighting and small power installation. The farmers have made some of these installations themselves.

Fig. 10—Where considerable power is used the consumer employs a power meter in addition to that for lighting.

## Putting a Tangible Value on Diversity Factor

THE value of diversity factor between classes of service in the economical production and distribution of electrical energy was very clearly explained in a recent address by Samuel Insull before the Western Society of Engineers. He pointed out that with the existing street-railway and light and power load in Chicago the combined maximum demand if all steam railroads entering Chicago were electrified at their terminals would be 1,110,500 kw.—that is, if the separate demands were added together. In 1922 about twice as much power was required to supply light and power for Chicago as it took to supply the street railways, and if the steam railroads had been electrified they also would have required about one-half the power now used for light and power. Still, if all of these loads had been served from one electric system, as is now being done so far as the street railways and light and power are concerned, the coincident demand would be only 959,500 kw. as compared with the combined maximum demand of 1,110,500 kw., making a diversity of 151,000 kw. between the various classes of load.

Mr. Insull went on to say: "If you will take that saving of 151,000 kw. and figure it out at $100 per kilowatt, which is a very low price for central stations at this time, and allow a 25 per cent reserve, that diversity would save an investment of $18,120,000. And if you go a little further and include the diversity that exists between the city and county districts, the diversity is increased to about 170,000 kw. The saving in serving all these various organizations, with energy produced from the same source, would be upward of $20,000,000, not figuring anything for the electrification of the steam railroads outside the switching area."

The foregoing saving is not based on the diversity between the demands of individual consumers, but, as pointed out by Mr. Insull, on the diversity between the major classes of service.

# The Preference of Preferred Stocks

## Remarkable Record of the Junior Securities of Electric Light and Power Companies in Earning Power and in Popularity—Customer Ownership a New Factor

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ONE of the outstanding features of the trend of financial affairs in 1922 was the rise in popularity of preferred stocks. This was the perfectly natural outcome of a sequence of investment conditions which had its beginning in the period of inflation subsequent to the chaotic markets of the war. At that time high money rates prevailed, and new bond issues commonly bore coupons at 7 and 8 per cent. The reconstruction of industry, furthermore, demanded large capital, and these bonds and similarly high-interest-bearing notes were issued in considerable volume. As money rates eased and as industry gradually began its return to a state nearer "normalcy" such companies as were the first to rehabilitate themselves began calling their high-interest-bearing bonds. By the beginning of 1922 conditions were sufficiently better to occasion a very general reduction of these high-coupon issues. During the year a great many of the 7 and 8 per cent bonds and notes were retired by the companies that issued them during the stress of the previous competition for capital. Refunding issues commonly bore considerably lower coupons, and the general average of bond prices was correspondingly higher.

For two or three years, however, the investor had been receiving not only a high ultimate yield on his investment, but had been securing an annual return of 7 per cent or better with a very fair security. It was a perfectly natural reaction for him to look about for a means of reinvesting his money to similar advantage. There followed a period characterized by an assiduous hunting out of laggards in the bond market. The stragglers behind the general up trend of bond prices were one by one brought up to the procession by individual investors who still sought a 7 per cent return.

Very naturally the time came when the great bulk of well-secured bonds were selling consistently at a rate to yield less than 7 per cent and bonds with 7 per cent or higher coupons were very rare indeed.

It was then that the investor, influenced by the rich yields of his investments during recent years, sought another class of investment in which he might with a certain sense of safety still obtain a generous return on his capital. This opportunity was immediately presented by the broad field of preferred stocks.

### Opportunity Offered by Preferred Stocks

Preferred stocks had for a period been rather overlooked in the market. There was small inducement to invest in this class of securities when bonds were yielding a high rate and the speculative possibilities of common stocks were enormous. Suddenly, however, they became strikingly attractive. The inattention that had been theirs during the early part of the reconstruction period had left them relatively far behind the procession of advancing values. The gradual betterment of the companies behind them at the same time made their investment position correspondingly better. Almost overnight came a sudden realization of the peculiar advantages of their situation. No issues of preferred stock were in a better position to attract investors than those of public utility companies, and more particularly those of electric light and power companies. Examination of the record of a few of these securities brought out their unusually strong investment foundation in an extremely vivid manner.

Many began to appreciate rapidly in price, and a report on public utility preferred stocks more exhaustive than any available seemed worth preparing. A thorough investigation of their record over a protracted period was made by George J. Wightman. The results are certainly worthy of a good deal of thought.

The most significant portion of this careful analysis was that covering the preferred stocks of the prominent electric power and light companies. The dividend record of every power and light company in the United States whose output exceeded 100,000,000 kw.-hr. per year, as well as that of all the larger holding companies in which traction operation had not been an important element and any of whose subsidiaries supplied power and light to cities with more than 100,000 population, was carefully checked. This list included practically all electric light and power companies with gross earnings of $3,000,000 and upward. The combined capitalization represented more than 85 per cent of the total capitalization of all the electric light and power companies in the United States.

### The Remarkable Record

This list included eighty-one companies, sixty-seven of which had preferred stocks. In the case of the fourteen with only common stock outstanding the records were investigated and included in the results. The conclusions obtained through this analysis are indeed striking. It shows that:

1. Current cash dividends are being paid on all the issues in question.
2. In only three cases are there accumulated back dividends unpaid.
3. In thirteen other cases dividends have been deferred but have subsequently been paid off in stock or in cash.
4. In all other cases the stocks have unbroken dividend records.

In more detail, and distinguishing between the companies having preferred stock issues and those with simply one capital stock outstanding, the results of the analysis follow:

Of the sixty-seven companies having preferred stocks:

Fifty-one companies have never omitted a preferred dividend since such stocks were issued. The majority of these have been outstanding for ten years or more.

Thirteen companies had accumulations—now paid off in stock, cash or both. (Many of the companies included in this analysis conduct some traction operation in addition to their electric power and light business. The contributing causes of these deferments seem to have been about equally divided between the high cost in recent years of such traction operation and the heavy expense incurred in initiating hydro-electric enterprises.)

# Dividend Record of Electric Light and Power Companies

PREFERRED STOCK

| Company | Incorporated | Dividend Record |
|---|---|---|
| Adirondack Power & Light Corp. | Mar., 1920 | 7 per cent preferred annually July, 1920, to date—8 per cent preferred annually July, 1921, to date. |
| Alabama Power Co. | Dec., 1906 | 7 per cent annually from issuance 1920 to date. |
| American Gas & Electric Co. | Dec., 1906 | 6 per cent annually 1907 to date. |
| American Light & Traction Co. | May, 1901 | 6 per cent annually 1901 to date. |
| American Power & Light Co. | Sept., 1909 | 6 per cent annually 1910 to date. |
| Appalachian Power Co. | May, 1911 | First preferred 7 per cent annually from issuance March, 1920, to date.* |
| California Oregon Power Co. | Oct., 1920 | 7 per cent annually from issuance October, 1921, to date. |
| Carolina Power & Light Co. | July, 1908 | 6 per cent July, 1909, to January, 1911—7 per cent annually January, 1911, to date. |
| Central Illinois Public Service Co. | May, 1902 | 6 per cent annually 1912 to date. |
| Cleveland Electric Illuminating Co. | In 1892 | 6 per cent preferred annually 1893 to date—8 per cent preferred annually from issuance September, 1920, to date. |
| Colorado Power Co. | Apr., 1913 | 7 per cent annually 1913 to date. |
| Columbus Railway, Power & Light Co. | Nov., 1913 | 5 per cent preferred from 1914 to date—6 per cent preferred from 1914 to date.† |
| Connecticut Light & Power Co. | Aug., 1917 | 8 per cent annually from issuance December, 1921, to date. |
| Consolidated Gas, Electric Light & Power of Baltimore | June, 1906 | 6 per cent 1906 to 1917 when retired—new 7 per cent and 8 per cent issued 1922—common paid not less than 5 per cent since 1911. |
| Consumers Power Co. of Michigan | Apr., 1910 | 6 per cent preferred annually 1910 to date—7 per cent preferred from issuance September, 1920, to date. |
| Dayton Power & Light Co. | Mar., 1911 | 6 per cent annually 1911 to date. |
| Duquesne Light Co. | Aug., 1903 | 7 per cent annually from issuance in 1915 to date. |
| Electric Bond & Share Co. | Feb., 1905 | Dividends of 5 per cent annually 1905 to 1911—6 per cent 1911 to date. |
| Empire District Electric Co. | Oct., 1909 | 6 per cent from 1909 to date—accumulated unpaid dividends paid up by 1918. |
| Fort Worth Power & Light Co. | July, 1911 | 7 per cent annually 1911 to date. |
| Georgia Railway & Power Co. | Oct., 1911 | Cumulative at 6 per cent from 1912—a new issue of 8 per cent preferred was brought out in 1922 to care for unpaid dividends amounting to 30½ per cent. |
| Idaho Power Co. | May, 1915 | 7 per cent annually 1916 to date. |
| Indiana & Michigan Electric Co. | May, 1907 | 7 per cent annually from issuance in 1920 to date. |
| Kansas City Power & Light Co. | June, 1919 | $7 annually February, 1921, to date. |
| Kansas Gas & Electric Co. | Dec., 1909 | 7 per cent annually 1910 to date. |
| Louisville Gas & Electric Co. | Feb., 1913 | 6 per cent annually 1913 to date. |
| Metropolitan Edison Co. | Aug., 1917 | $7 annually from issuance October, 1919, to date. |
| Milwaukee Electric Railway & Light Co. | Jan., 1896 | 6 per cent annually 1900 to date. |
| Mississippi River Power Co. | Aug., 1910 | 6 per cent—accumulation amounting to 37½ per cent from 1915 paid off in stock March, 1921—cash dividends began April 1, 1921. |
| Montana Power Co. | Dec., 1912 | 7 per cent annually 1913 to date. |
| Nebraska Power Co. | Apr., 1917 | 7 per cent annually 1917 to date. |
| Nevada-California Electric Corp. | Dec., 1914 | Not less than 4 per cent 1915 to October, 1918—none to January, 1923, when resumed at 7 per cent. |
| New England Power Co. | In 1911 | 6 per cent annually 1912 to date. |
| Niagara Falls Power Co. | In 1886 | 7 per cent annually 1919 to date. |
| Niagara, Lockport & Ontario Power Co. | May, 1894 | 6 per cent annually 1912 to December, 1920—stock since exchanged for common shares—new 7 per cent preferred issued November, 1922. |
| North American Co. | June, 1890 | 6 per cent annually from issuance July, 1921—common has paid not less than 3¾ per cent from 1903 to date, except 1908, when no dividend was paid. |
| Northern Ohio Traction & Light Co. | Nov., 1902 | 6 per cent preferred annually 1911 to date—7 per cent preferred from issuance May, 1921, to date. |
| Northern States Power Co. | Dec., 1909 | 7 per cent annually 1910 to date. |
| Northwestern Electric Co. | In 1911 | 6 per cent preferred annually 1914 to date—7 per cent preferred annually from issuance August, 1921, to date. |
| Northwestern Power Co. | Jan., 1905 | 6 per cent—cumulative from 1909—accumulated unpaid dividends taken up in 1914 by stock dividend and in 1922 by exchange into American Power & Light Co. preferred—on a cash basis since January, 1921. |
| Ohio Power Co. | Apr., 1907 | 6 per cent annually 1907 to date. |
| Pacific Gas & Electric Co. | Oct., 1905 | 6 per cent annually 1906 to date—three years' accumulation paid off in stock 1909. |
| Pennsylvania-Ohio Power & Light Co. | Oct., 1920 | 8 per cent annually from November, 1920, to date. |
| Pennsylvania Power & Light Co. | June, 1920 | $7 annually July, 1920, to date. |
| Philadelphia Electric Co. | Oct., 1902 | 8 per cent annually from issuance in September, 1920, to date. |
| Portland Railway, Light & Power Co. | June, 1906 | Old preferred 5 per cent annually 1906 to retirement in 1910—new 6 per cent preferred from 1915 to date—accumulated unpaid dividends paid off in cash and stock 1921—7 per cent preferred annually from issuance January, 1922, to date. |
| Public Service Corp. of New Jersey | May, 1903 | 8 per cent annually from issuance February, 1919, to date. |
| Puget Sound Power & Light Co. | Jan., 1912 | 6 per cent from 1912 to date—accumulated unpaid dividends of 22½ per cent paid off in stock and cash 1922—7 per cent preferred annually from issuance January, 1922, to date. |
| Rochester Gas & Electric Co. | June, 1904 | 5 per cent preferred annually 1904 to date—7 per cent preferred from issuance March, 1918.‡ |
| San Joaquin Light & Power Corp. | July, 1910 | 6 per cent preferred annually 1912 to 1914, and from 1917 to date—accumulated dividends unpaid amount to 16½ per cent —7 per cent preferred annually from issuance September, 1920, to date. |
| Scranton Electric Co. | Apr., 1907 | 6 per cent annually 107 to date. |
| Southern California Edison Co. | July, 1909 | 5 per cent annually 1909 to 1914—6 per cent 1914 to 1916—7 per cent 1916 to 1921—8 per cent 1921 to date. |
| Southern Power Co. | June, 1905 | 7 per cent annually accumulated unpaid dividends have been taken care of. |
| Southwestern Power & Light Co. | July, 1912 | 7 per cent annually 1912 to date. |
| Standard Gas & Electric Co. | Apr., 1910 | 7 per cent 1910 to 1912—8 per cent 1912 to date—13 per cent accumulation paid off in stock, 1919. |
| Syracuse Lighting Co. | May, 1901 | Not less than 5 per cent annually since 1901—8 per cent 1915 to date. |
| Tennessee Electric Power Co. | June, 1922 | 6 per cent and 7 per cent first preferred from issuance July, 1922, to date. |
| Texas Power & Light Co. | May, 1912 | 7 per cent annually 1912 to date. |
| Toledo Edison Co. | July, 1901 | 8 per cent annually from issuance October, 1921, to date. |
| United Electric Light & Power Co. | In 1887 | 6 per cent annually—stock practically all owned by New York Edison Co., which see. |
| United Gas Improvement Co. | Apr., 1888 | 7 per cent annually from issuance May, 1920—common paid not less than 4 per cent since 1889. |
| United Light & Railways Co. | July, 1910 | 6 per cent annually 1910 to date. |
| Utah Power & Light Co. | Sept., 1912 | 7 per cent annually 1913 to date. |
| Virginia Railway & Power Co. | June, 1909 | 5 per cent annually 1910 to 1914—6 per cent 1914 to date—dividends from July, 1919, to July, 1922, paid in stock—dividends now in cash. |
| Washington Railway & Electric Co. | Feb., 1902 | 5 per cent annually 1904 to date. |
| Western Power Corp. | June, 1915 | 4 per cent 1916 to 1919—6 per cent 1919 to date—accumulated unpaid dividends total 13 per cent. |
| West Penn Power Co. | Mar., 1916 | 7 per cent annually 1916 to date. |

## Dividend Record of Electric Light and Power Companies (Continued)

| COMMON STOCK | Incorporated | Dividend Record |
|---|---|---|
| Brooklyn Edison Co. | June, 1890 | Dividends of not less than 6 per cent since 1900—8 per cent from 1903 to date. |
| Buffalo General Electric Co. | Aug., 1892 | Dividends of not less than 5 per cent since 1900—8 per cent 1918 to date. |
| Columbia Gas & Electric Co. | Nov., 1906 | Dividends of not less than 4 per cent—1917 to date. |
| Commonwealth Edison Co. | Sept., 1907 | Dividends of not less than 5 per cent since 1907—8 per cent from 1913 to date. |
| Detroit Edison Co. | Jan., 1903 | Dividends of not less than 4 per cent since 1909—8 per cent from 1916 to date. |
| Edison Electric Illuminating Co. of Boston | In 1886 | Dividends of not less than 5 per cent since 1890—12 per cent from 1910 to date. |
| Hartford Electric Light Co. | In 1881 | Dividends of not less than 8 per cent since 1903—10 per cent from 1919 to date. |
| Indianapolis Light & Heat Co. | Dec., 1904 | No dividend record available. |
| Narragansett Electric Lighting Co. | May, 1884 | 8 per cent annually 1886 to date. |
| New Bedford Gas & Edison Light Co. | ** | Dividends of not less than 6 per cent since 1899—not less than 10 per cent 1905 to date. |
| New York Edison Co. | May, 1901 | 6 per cent annually 1907 to 1915—not less than 7 per cent 1915 to date. |
| Pennsylvania Water & Power Co. | Jan., 1910 | Dividends of not less than 4 per cent since 1914—7 per cent from 1920 to date. |
| Turners Falls Power & Electric Co. | In 1907 | Dividends of not less than 6 per cent 1907 to date. |
| Washington Water Power Co. | In 1889 | Dividends of not less than 4 per cent 1901 to date—7 per cent from 1920 to date. |

*Accumulated dividends on original preferred, amounting to 70 per cent, were paid off in stock Oct. 1, 1922; cash dividends accrue from Oct. 1, 1922.
†Accumulated unpaid dividends on both issues from 1918 paid off by stock in 1922—cash dividends have been resumed.
‡The 5 per cent preferred was cumulative at 4 per cent the first two years and only that amount was paid.
**Incorporated in 1850 but did not acquire light properties until 1884.

Three companies are now paying regular preferred dividends, but still have unpaid accumulations. These are:

(a) The San Joaquin Light & Power Corporation, which accumulated 16½ per cent between 1914 and 1916.

(b) The Western Power Company, the preferred stock of which has an uninterrupted dividend record but still owes 13 per cent back dividends, the explanation being that the dividend was not paid during the first year and was then paid at a reduced rate for four years.

(c) The Nevada-California Electric Corporation, which paid dividends until 1918 and deferred from 1918 to 1922. This was owing largely to slackness in the mining industry. The company has now resumed dividend payments.

Of the fourteen companies having only common stock outstanding:

One company does not make public its record.

Ten companies have an unbroken dividend record of more than fifteen years.

Three companies have an unbroken dividend record of more than five years.

Of the total of eighty-one companies cited—i.e., sixty-seven companies with preferred stock issues and fourteen with common stock—every one is paying current cash dividends.

This record speaks for itself and more than justifies the prevailing popularity of this class of security in the public utility field.

### Customer Ownership a New Factor

It is interesting, furthermore, to bear in mind that another factor has entered into this particular class of investment, a factor which is so comparatively recent as to have scarcely affected the history of those stocks in past years. This new element is "customer ownership." The distribution of preferred stocks among the customers and employees of public utility companies has had the effect of stabilizing the market and of distributing the issues into strong co-operative hands. Undoubtedly this single consideration will have an increasingly potent effect on the investment rating of these securities. It is a subject too broad for discussion here, but it is nevertheless a vital condition that should not be overlooked in the consideration of preferred stocks.

That the present favorable attitude of the investor toward electric light and power preferreds is well justified seems apparent, and that the future holds an attractive promise of appreciation in value for this class of security seems a very reasonable belief.

# Fuel Oil Helps Overcome Strike Menace

**With Slight Changes in the Structure of Its Coal Furnaces the Nebraska Power Company Found That It Was Able to Use This Substitute for Coal Successfully**

By K. R. MacKinnon

Chief Operating Engineer Nebraska Power Company

Among the lessons to be learned from the recent coal strike one should be taken to heart by all public utilities. It is that with present methods of producing coal we must always be prepared to face a prolonged stoppage of the larger part of the supply—a stoppage which cannot be entirely taken care of by increased storage. Unless the work of the President's committee now studying this subject results in some basic changes in the industry, we may expect that there will be periodic upheavals which are bound to cause serious shortages of power.

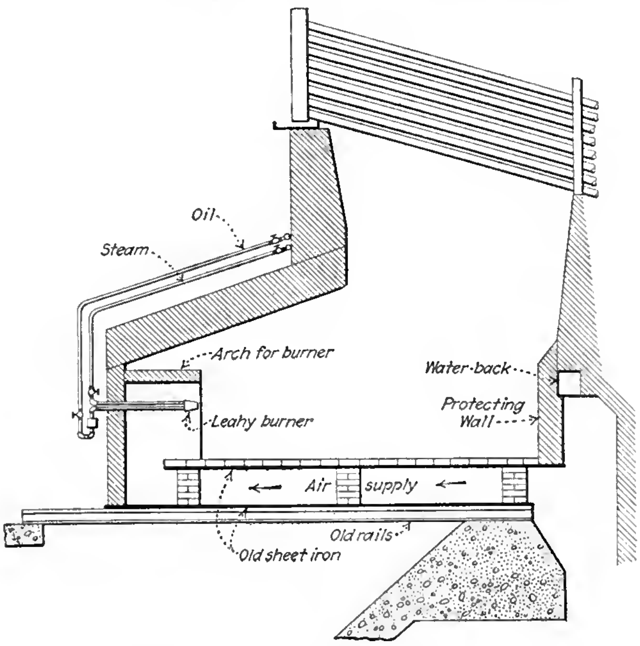
When the recent coal strike had been in effect about four months nearly all public utilities companies found their supply of coal in storage getting dangerously low. Some had exhausted it entirely. A large number turned to oil for relief, with various degrees of success. Numerous cases of secondary combustion and of burned-out grates, baffles or furnaces occurred. It may be that some plants that experimented unsuccessfully can benefit by an account of the methods used to overcome these difficulties in the plant of the Nebraska Power Company.

The boiler equipment in the plant consists of seven 550-hp. Stirlings, eight 508-hp. B. & W. and one 1,450-hp. B. & W. in service, with two more under construction. About Aug. 1, 1922, it was decided to burn oil under the eight 508-hp. B. & W. boilers. They are rather low-set boilers, six having front headers 10 ft. and two having headers 12 ft. above the floor. The Stirling boilers are equipped with an emergency oil system consisting of a 3,750-gal. underground tank, steam pumps, 250-gal. pressure reservoir, steam and oil lines to boilers and Leahy burners. This system is an emergency one only and is not suitable for continuous

use as it is not convenient to provide an adequate air supply for oil while burning coal.

To equip the B. & W. boilers for oil burning, the oil and steam lines were extended into the B. & W. boiler room. The boilers were changed over from chain-grate coal burners to oil burners at the rate of one per day. The work done on each boiler was as follows:

The chain grate was pulled out. A false sheet-iron floor was installed with another one 12 in. above it, so that the air was preheated in passing under the furnace floor from rear to front. The air came from the basement through the ash hoppers, then under the furnace floor to the front of boilers and up to the burners. The ledge plates and waterbacks were protected by side and rear walls built up on the sheet-iron floor to a height of 6 in. above them. A small air space was left under the ledge plates for air to circulate from rear to front into the furnace. Two small arches were built at the front end for the two burners. A firebrick covering was placed on the top floor. The front of the furnace was bricked up, leaving 4½ in. square openings for burners only. Two burners per boiler were used, taken from the Stirling system. The boilers were fired up in each case about eight hours after the work was started.




CHANGING OVER FROM COAL TO FUEL OIL

To equip its 508-hp. B. & W. boilers for burning oil, the Nebraska Power Company pulled the chain-grate stokers out and a false sheet-iron floor was built in. The 12-in. space between the false floor and the bottom of the furnace was utilized for preheating of the air supply, which was brought in from the rear through the basement and ash hoppers. The ledge plates and waterbacks were protected by side and rear walls built up on the false floor and the floor was protected by a layer of firebrick. Temporary arches were built at the front end for the two oil burners.

To control combustion test, ratings of 100, 135, 150, 170, 190 and 200 per cent were run on each boiler, and the draft over the fire was adjusted in each case until the $CO_2$ at the boiler uptake was between 12.5 and 13.0 per cent with no CO. As the oil being used was 36-38 Baumé, and therefore high in hydrogen, it was found that 13 per cent $CO_2$ was as high as it was safe to run. Each boiler-draft gage was then equipped with a card showing the draft over the fire to be used on that boiler at each of the above ratings. The firemen soon became accustomed to this control. and it was found that the $CO_2$ was held very steadily at all times between the limits set. This method was developed after $CO_2$ readings alone had been tried for control—a method which allowed CO to be formed on one occasion, causing secondary combustion and an overheated breeching. An average rating of 170 per cent was maintained on these boilers while burning oil.

The bottom two rows of tubes in all boilers were bored to make sure that no scale was present. This eliminated all chance of trouble from leaks. Previous experience has proved that tubes free from scale will never burn, while even a thin patch of scale will often cause blistering when burning oil. The only trouble that did develop was in the front baffles. The flame impinged on these baffles just above the bridge wall. The intense heat melted the slag which had coated the baffle tile, and in a short time there were numerous holes through the spaces between the tubes and the tile. This difficulty was overcome with an air gun, the baffles being completely smothered with a mixture of finely screened crushed firebrick and fireclay put on with an air blast. This gave excellent results and kept the baffles absolutely tight.

When coal became available the oil supply was cut off very quickly on account of the high cost. Changing back from oil to coal was done at the rate of two boilers per day. The average actual working time taken was one and one-half hours per boiler from the time dismantling was started until coal was being fed by the grate, ready to fire up. The chain of one grate had been taken off to reduce its weight while handling. This grate, measuring 10 ft. 6 in. long by 9 ft. wide, was rechained in seven hours. The furnaces were found to be in excellent condition in spite of their small size. The average furnace volume was 560 cu.ft., which at 170 per cent rating gave 1.5 hp. per cubic foot furnace volume, whereas a properly designed oil furnace generally allows 1 hp. per cubic foot.

### Furnace-Wall Erosion Slight

About 2,000 firebricks per boiler were used for the protection of the walls, ledge plates and waterbacks and for the floors. After two months' use 80 per cent of these bricks were in first class condition and were used in building linings in furnace walls. The erosion of the furnace walls was very slight. This was due to the fact that the spread of the burners was such that the flame did not impinge directly on the walls. If the flame is too wide for the furnace, it will cause very rapid erosion. The ledge plates and waterbacks were found to be unharmed. If occasion should arise again to use oil, the only change in furnace design will be in abolishing the air preheating device and lowering the burners one foot, thus increasing the distance from burner to tubes and increasing the furnace volume about 17 per cent. Burners using steam for atomization give a long, flat flame, and unless the setting is very high this flame at high ratings goes well up into the tubes. The saving that will be effected by complete combustion before the tubes are reached will more than offset any gain due to preheating the air, especially when the preheating is done by the furnace floor.

The monthly over-all boiler and furnace efficiency was 77 per cent, without deducting for steam used for atomization. Daily oil samples were taken and water was measured by Venturi meters. The regulation of steam pressure was done with these boilers, swinging either two or three at a time between 100 and 170 per cent rating. This efficiency compares very favor-

ably with that obtained in plants where the firemen are trained in oil burning. An adequate supply of air under proper control is probably the most important point to be taken care of when burning oil. If the stoker cannot be removed, as in the case of a forced-draft chain-grate or underfeed stoker, special care must be taken to admit air in sufficient quantities. Portions of the stoker and front wall must be removed in nearly every case. The method outlined above for controlling the air supply is extremely simple and is easily learned by the firemen. It is simply the principle of steam-flow-air-flow worked with separate instruments.

Mechanical burners are making great headway in replacing steam atomizers in permanent oil-burning installations; but for temporary work, such as changing over during a coal strike, the steam atomizer is in a class by itself for first cost and speed of installation. In efficiency they break about even. Experience with oil burners was first gained in this plant in the strike of 1919. This was followed in 1920 by several months when there was a shortage of boiler power and poor coal. The Stirling room was then fitted with emergency oil burners to be used in addition to coal for pulling over peaks. The only storage used is a 3,750-gal. underground tank, which is normally kept full of byproduct tar from the city gas works. With eight boilers using oil at the rate of 300 gal. each per hour, this storage was a little too small to be comfortable, but by close watching it was possible to switch the oil cars in such a way that the oil supply did not give out at any time. The experience of this plant is that the equipment required for such emergency service is small and cheap. Coal shortage can be met very quickly and at low installation costs. It is an excellent asset to any plant.

# Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

## How Shall Our Farms Be Served with Electricity?

*To the Editors of the* ELECTRICAL WORLD:

Your article on "Farm Power as an Issue" (ELECTRICAL WORLD, Feb. 3, 1923, page 257) is no doubt well meant but shoots wide of the mark. The article "Uses of Electrical Energy in Agriculture" (ELECTRICAL WORLD, Feb. 3, 1923, page 268) is also of little interest to American farmers and has little bearing on their conditions, because it is based on uses in England and Europe.

When you consider that rural lines serving the farmer in the Middle West, which is a wealthy, progressive farming territory, will have but three farms to the mile of line, and that each farm must be served with a separate transformer and necessary equipment to protect it from lightning and storms, and that the average farm will use but 240 kw.-hr. a year, you can commence to realize why the farms will not be served with electricity.

We are serving 450 farms in this section of Iowa, distributed over three counties, and we feel that we are able to judge of the conditions and possibilities. The farms we serve use electricity for lighting and to operate household appliances, such as washing machines, vacuum cleaners and flatirons, as well as electric fans, and possibly one-third of the farms have a small motor of 0.5-hp. or 1-hp. rating for pumping water. Most farmers have tractors, and when one considers that a Ford tractor costs but $432 delivered and will plow ten acres per day of ten hours with a kerosene consumption of 20 gal., at a cost of $2 plus oil costing 25 cents, giving a total cost of $2.25, or 22½ cents per acre, one can begin to wake up to the situation. This same Ford tractor can be used for operating a feed grinder and filling silos in the fall after the plowing season is over.

Electric service in England in a densely populated community of very small tracts is one thing, while electric service to farms averaging 160 acres to 200 acres in size is quite another thing. I can see no solution of the question of electric service on the farm until the farmer makes up his mind that he will pay a fair price for the service and that it is not to be compared to the old farm-line telephone systems, which were built in the cheapest possible manner and on which no money has been expended for maintenance, with the final outcome that they are in deplorable condition.

There is this feature in electric service, that it helps the farmer's wife with washing and ironing and makes the home brighter when well lighted; but even this advantage is somewhat discounted when the farmer's family pile into a Ford car and go to the village or town to take in the "movies" once or twice a week.

Further, in the matter of grinding feed for farm use, even this part of the work has been simplified by a mill which has recently been perfected and that will grind corn and oats almost like flour in one operation at the rate of 50 bushels an hour. This results in the farmer taking a load of corn and oats to the mill to have it ground while he is doing his shopping, and in a few hours he is ready to return home with the finest feed for hogs or cows.

Electric farm service is a business proposition and can only be settled the same as any other business, which means that it must have sufficient earnings if it is to survive.

GEORGE S. CARSON, President.
Iowa Gas & Electric Company, Iowa City, Iowa.

[Mr. Carson's idea of the English situation is natural and probably the same that most Americans hold. R. B. Matthews, the author of the paper on English and European practice in the rural use of electrical energy, says in the paper referred to: "For farms of under 150 acres careful thought must be given to insure that an adequate return is obtained for the capital expended, as the number of hours of use of each machine is limited. Similar care must, of course, be taken in designing installations for larger farms, but, as the hours of use are longer, it is not so easy to make a mistake in regard to the equipment." The research work Mr. Matthews has done is concerned with the larger farms that correspond well with Middle Western American farms in size. Just how far the research work done in England will apply in America is, of course, an open question. In human, animal and mechanical power the American farmer is a large power user. He is a great many years behind the other industries in his use of mechanical or electrical forms of energy. He has made up his mind that electrical energy should offer him the same advantages it has given all other industrial pursuits. The basic question is whether any considerable part of his operations can be handled electrically. Agricultural engineers of standing are already taking the position that ultimately a large part of them can be handled electrically at a profit to the farmer. The problem of the central station is either to help prove that these authorities are right and speed the development as rapidly as possible or help prove that the whole idea is fallacious. Accomplishments already noted in the little research work so far undertaken are such that the central station dare not sit still and say, "It cannot be done." Its influence must be actively exerted toward finding the real answer. The problem is fundamentally economic, as Mr. Carson

concludes, and as, too, agricultural men all agree, and if the use of electrical energy is to be established on the farm, it will be on the basis that the lower cost of farm production and better living conditions make it profitable to the farmer to utilize a sufficient volume of energy to enable the central station to furnish the service with profit. There can be no other answer. The issue is already well defined and is not of central-station making. The central station has no choice but to face it intelligently.—EDITORS.]

### Halifax's Hydro-Electric Plant

*To the Editors of the* ELECTRICAL WORLD:

In the Feb. 3 issue of the ELECTRICAL WORLD, page 298, the statement appears that Moncton, N. B., will be the first city in the Maritime Provinces of Canada to obtain power and light from a hydro-electric source, through the early completion of a connection with the Musquash hydro-electric station. Halifax, N. S., has been receiving hydro-electric power since June, 1922, from a development at St. Margaret's Bay. The Province of Nova Scotia built the development and entered into a thirty-year contract with the public utility in Halifax for virtually the entire output of the present development.

A. STUART PRATT,
District Manager.
Stone & Webster, Inc.,
Boston, Mass.

### Uniform Classification of Accounts

*To the Editors of the* ELECTRICAL WORLD:

My attention has been called to your editorial on uniform classification of accounts in the issue of Jan. 13. I hope that your editorials on other subjects, with which I am not familiar, are based on more complete information or are less partisan, so that those not conversant with the facts may reach accurate conclusions.

I attended the accounting conference last September before the Federal Power Commission. Representatives of the National Electric Light Association, the then president of the National Association of Railway and Utilities Commissioners, now counsel for the National Electric Light Association, and members of the committee on statistics and accounts of the two associations attended the conference and for several days argued in favor of their classification as then drawn. Since then their classification has been again revised, and it is apparently this revised form which you think is the final word on accounting matters. Your editorial is very much in line with some of the statements made at the Washington conference by representatives of the organization mentioned. The editorial impresses me as a bit of propaganda in favor of the classification recommended by the National Association of Railway and Utilities Commissioners and indorsed by the National Electric Light Association.

I assure you that I am not alarmed about your editorial but, rather, amused by it. You adroitly call attention to "certain mandatory practices of the Interstate Commerce Commission," but refrain from stating how such practices came to be written into the federal water-power act and the Federal Power Commission's accounting system. Nor do you point to a single defect in the classification you advocate. Of course, it would have been poor policy for you to do so. However, I feel confident that any impartial critic of accounting systems who will compare the system you favor with that adopted by the Railroad Commission of the State of California will decide in favor of that adopted by the California commission. Not only do I believe that this system is more complete and better adapted to California conditions than the one you advocate, but it also affords the means of keeping accounting work and expense of public utilities at a minimum. In the end the consumer must pay such expense. I have had the consumer's interest as well as the utilities' in mind when reviewing the two systems of accounts.

W. C. FANKHAUSER,
In charge department of finance and accounts.
Railroad Commission of the State of California,
San Francisco, Cal.

[The editorial to which our contributor takes exception dealt with the uniform classification of accounts adopted after much discussion and study by the National Association of Railway and Utilities Commissioners at its annual meeting in Detroit Nov. 14-16, 1922. That classification is at once flexible and universally applicable and does not embody regulatory functions in an accounting system. The Railroad Commission of the State of California, which is a member of the National Association of Railway and Utilities Commissioners, is the only commission which to our knowledge has discarded the work of its own association for that of the Federal Power Commission. Other water-power states in the Far West, like Washington, Idaho, Utah, Wyoming and Colorado, have adopted the "commissioners'" classification. In Oregon a decision favorable to the Federal Power Commission's classification has just been reconsidered and final action is expected in a few weeks. The commissioners' classification needs no justification from us. It speaks for itself, and the fact that it has been so widely adopted proves its worth. Our contributor presumes too much when he implies that no other commission has the interest of consumers and utilities in mind. We prefer to look upon them all as broad-minded and solicitous of the public welfare.—EDITORS.]

### Advantages and Difficulties in Copying Manufacturers' Methods

*To the Editors of the* ELECTRICAL WORLD:

On reading over the excellent article in the Nov. 11 issue of the ELECTRICAL WORLD on a manufacturing company's method of testing meters I was struck with the following differences in manufacturers' and operators' test requirements:

The meters handled by the manufacturer's meter testers are all new, and, except for trouble with defects in material and workmanship, only a few bad meters are encountered, so it becomes largely a problem of getting through as many as possible in a day. Electric service company's meter testers, on the other hand, have to look for trouble due to wear, dirt and other service conditions, and it is of the greatest importance that they be required to look for and remedy these troubles and not be allowed to race for speed only.

The manufacturer puts through so many meters a day that most of the racks can be arranged for one size and type of meter only, but this practice cannot always be followed by operating companies except by the largest.

Nevertheless, a number of the arrangements and methods used by the manufacturer can be utilized to increase speed, convenience and thoroughness. It would be of great value to readers of the ELECTRICAL WORLD if they could hear of meter-testing methods and practice from other manufacturers' men and from utility companies' meter engineers or superintendents. Such an exchange of ideas would acquaint meter engineers with different ideas and arrangements which might be combined to suit local conditions. These very often present a difficult problem for the metermen to tackle. As a general rule the rooms available for tests are not designed and built for the purpose, and a considerable amount of ingenuity has to be exercised in adapting them to laboratories and test rooms.

BEDFORD J. BROWN,
Superintendent Meter Department.
Southern Power Company, Charlotte, N. C.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Safety Switch Withstands Severe Service

By installing a new safety switch on the control of its motor-driven ice conveyor the Consumers' Company, Chicago, has been able to keep this conveyor in service for more than a year under very severe operating conditions. Withstanding successfully several hundred abrupt starting movements daily is the record of this control switch. The durability of this switch is insured by the four-surface engagements of contracts, the double break, the self-alignment and the absence of springs. The ice conveyor is 80 ft. long and runs the entire length of the ice-storage room. An average of 350 tons has been handled daily with it. Cakes of ice are placed on the conveyor and then the conveyor is started by closing the switch on the loading platform, located in front of the ice house where the ice cake emerges through a narrow chute, whence it is directed to the ice delivery truck. This switch has become so popular that, although several hand-fed exits are available, the ice men prefer to wait their turn to get ice from the motor-driven conveyor.

The safety switch has several important features differing from other safety switches. The main contacts are also the fuse mountings so that when the switch is opened these contacts are swung outward on a center rod.

By closing the switch the contacts are swung inward, thereby closing the circuit. When in this position the switch is foolproof, since there are no live parts exposed. Besides the protection offered by the impossibility of closing the switch when the door remains open, a glass shows the position of the switch itself. When once closed the door can be opened to allow fuse testing, but no live parts are exposed to the operator. No padlock is required since when the switch is opened it is impossible to touch any of the live parts.

The cabinet is made of two parts, one a box body containing the back and sides and the other the switch proper and the door.

All of the apparatus has operated satisfactorily. L. Winkler,

Consumers' Company, Chicago, Ill. Engineer.

## Production Expenses at Connors Creek

### Total Cost of Energy Now 0.577 Cent as Compared with 0.846 Cent for 1921 Peak—Thermal Efficiency of System Is the Best on Record

Although the unit fuel expense was higher and the load factor was lower, the total production expense per kilowatt-hour at the Connors Creek Station of the Detroit Edison Company for the twelve-month period ended Dec 31, 1922, was lower than for the same period ended June 30, 1922, according to figures just made available through the courtesy of Alex Dow, president of the company, and tabulated herewith. Another notable change since the Electrical World last printed these figures (see issue for Sept. 2, 1922, page 487) is the further increase in plant economy, the B.t.u. per kilowatt-hour being 19,660, the lowest since the plant was placed in operation.

The Connors Creek plant is still without economizers, and the average steam pressure at the turbine throttles is 219 lb. gage. The average steam temperature is 585 deg. The kilowatt-hour output given in the

COMPARISON OF PRODUCTION EXPENSES PER KILOWATT-HOUR OF OUTPUT FOR CONNORS CREEK POWER HOUSE OF DETROIT EDISON COMPANY

| | Twelve-Month Periods Ending | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1917 | 1918 | | 1919 | | 1920 | | 1921 | | 1922 | |
| | June 30 Cents | June 30 Cents | Dec. 31 Cents | June 30 Cents | Dec. 31 Cents | June 30 Cents | Dec. 31 Cents | June 30 Cents | Dec. 31 Cents | June 30 Cents | Dec. 31 Cents |
| OPERATION: | | | | | | | | | | | |
| Superintendence | 0.010 | 0.009 | 0.009 | 0.010 | 0.010 | 0.010 | 0.012 | 0.015 | 0.014 | 0.013 | 0.012 |
| Wages | 0.047 | 0.055 | 0.061 | 0.062 | 0.060 | 0.062 | 0.076 | 0.079 | 0.069 | 0.065 | 0.058 |
| Fuel | 0.240 | 0.368 | 0.382 | 0.394 | 0.407 | 0.471 | 0.652 | 0.682 | 0.532 | 0.438 | 0.448 |
| Water | .... | .... | .... | | | .... | .... | .... | .... | .... | .... |
| Lubricants | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 |
| Station supplies and expense | 0.005 | 0.006 | 0.009 | 0.010 | 0.007 | 0.011 | 0.012 | 0.010 | 0.010 | 0.010 | 0.007 |
| Total | 0.303 | 0.439 | 0.462 | 0.478 | 0.486 | 0.555 | 0.754 | 0.788 | 0.627 | 0.527 | 0.526 |
| MAINTENANCE: | | | | | | | | | | | |
| Station buildings | 0.011 | 0.008 | 0.007 | 0.008 | 0.011 | 0.010 | 0.011 | 0.012 | 0.011 | 0.012 | 0.001 |
| Steam equipment | 0.019 | 0.025 | 0.023 | 0.024 | 0.029 | 0.036 | 0.038 | 0.043 | 0.045 | 0.041 | 0.037 |
| Electrical equipment | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.003 | 0.003 | 0.002 | 0.002 | 0.004 |
| Total | 0.031 | 0.035 | 0.031 | 0.033 | 0.041 | 0.047 | 0.052 | 0.058 | 0.058 | 0.055 | 0.051 |
| Total production expense | 0.334 | 0.474 | 0.493 | 0.511 | 0.527 | 0.602 | 0.806 | 0.846 | 0.685 | 0.582 | 0.577 |
| Output in kw.-hr. | 210,039,700 | 280,814,700 | 327,020,500 | 383,252,000 | 445,535,500 | 488,060,600 | 479,425,900 | 485,189,500 | 527,121,200 | 555,896,300 | 613,263,100 |
| Maximum demand in kw. (30-minute period) | 50,000 | 59,000 | 80,000 | 82,000 | 104,000 | 104,000 | 100,000 | 107,500 | 118,000 | 120,000 | 144,500 |
| Average load (kw.) | 23,900 | 32,100 | 37,300 | 43,700 | 60,800 | 55,600 | 54,600 | 55,300 | 60,200 | 63,500 | 70,000 |
| Load factor | 0.478 | 0.544 | 0.466 | 0.533 | 0.488 | 0.534 | 0.546 | 0.515 | 0.510 | 0.529 | 0.485 |
| Coal per kw.-hr. (lb.) | 1.52 | 1.63 | 1.63 | 1.67 | 1.73 | 1.83 | 1.92 | 1.78 | 1.62 | 1.55 | 1.57 |
| B.t.u. per kw.-hr. | 20,040 | 20,930 | 20,900 | 21,200 | 21,800 | 22,800 | 23,300 | 21,800 | 20,250 | 19,700 | 19,660 |

table is net, delivered to the transmission lines as approximately 24,000 volts All energy used in the plant and yards and the losses in the step-up transformers are treated as plant uses so that the output figure is the current sent out and available for sale.

It should also be noted that the Connors Creek plant is not a base-load plant. It takes its share of the fluctuations of the load, which condition is indicated by the variation in the load factor of the station from year to year.

The tendencies in production expense, economy and load factor since 1917 are shown in Fig. 1, while the relation between fuel, wage and superintendence expenses is illustrated in Fig. 2.

The output for the twelve-month period ended Dec. 31, 1922, has increased to 613,263,100 kw., or 10.3 per cent more than for the period ended June 30, 1922. The maximum demand (thirty-minute period) has increased 20.4 per cent and the average load 10.2 per cent, while the load factor has decreased from 52.9 per cent to 48.5 per cent, or by 4.4 per cent.

The total production expense for this period was 0.577 cent per kilowatt-hour, as compared with 0.582 cent for June 30. The lowest figure in the table is 0.334 cent for the period ended June 30, 1917, while the peak was 0.846 cent for the period ended June 30, 1921. Last year's figure is 31.8 per cent less than the peak, but is still 72.7 per cent higher than the figure for the twelve months ended June 30, 1917.

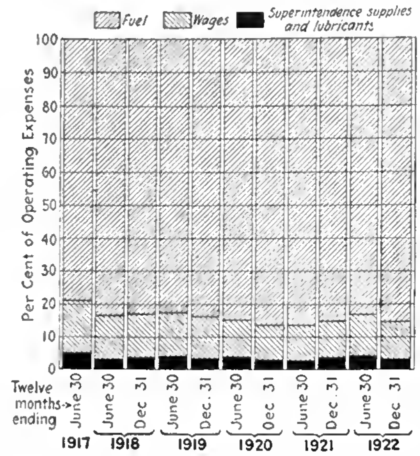


FIG. 2—RELATION BETWEEN FUEL, WAGE AND SUPERINTENDENCE EXPENSES

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

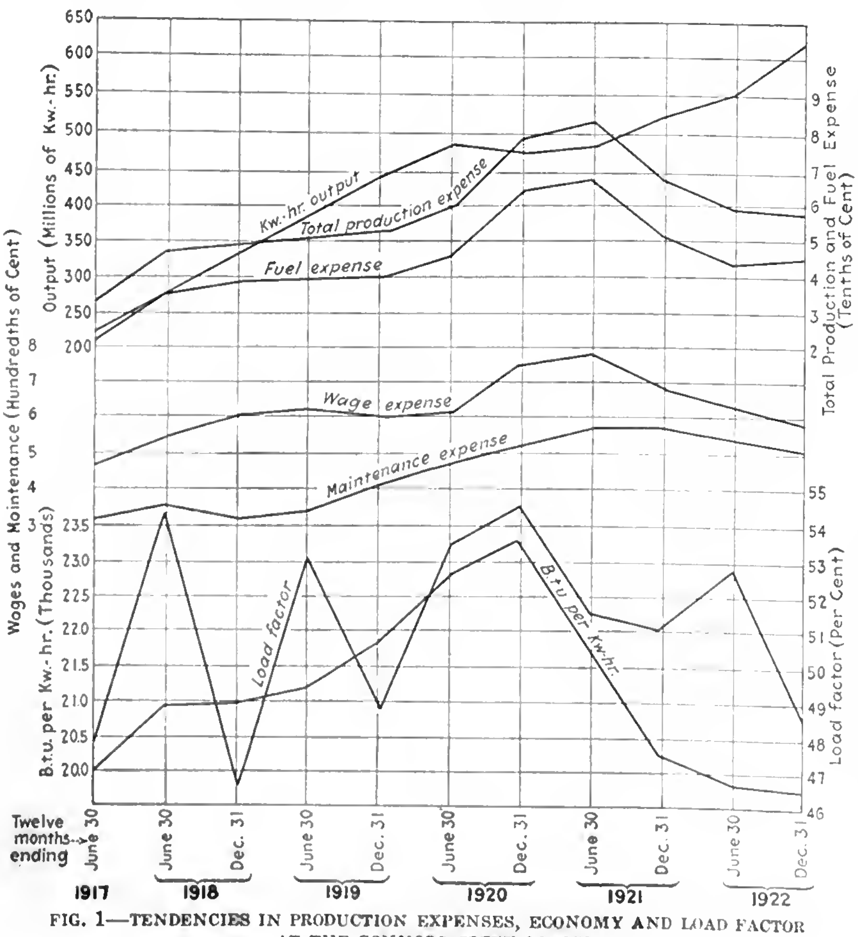


FIG. 1—TENDENCIES IN PRODUCTION EXPENSES, ECONOMY AND LOAD FACTOR AT THE CONNORS CREEK PLANT

## Building an Organization from Within

OPERATION of hydro-electric plants is usually an isolated occupation. No city-bred man can long remain in such a position without becoming restless. Hence the Alabama Power Company draws its isolated-plant operators from among the country folk who live in the vicinity of these plants and who are accustomed to the quiet of the "sticks." With careful training these recruits become good operators, and if paid fair wages and given a good home, as is done in the Alabama system, they may remain company employees for a lifetime. Some of these men turn out to be excellent handlers of men and acquire sufficient technical knowledge to act as superintendents of the station in which they are reared. In any event the company helps its men to find their niche by transferring them from one job to another or from one station to the next, leaving them long enough in one position to find what worth there is in them. Furthermore, it believes in placing responsibility on its men in proportion to the way in which they show they can shoulder it. Sometimes they are even forced to shoulder responsibilities merely to awaken latent ability. This practice eliminates the monotony of the occupation and has usually stimulated increased interest in the job.

### SELECTING THE BEST GRADUATES FROM TECHNICAL SCHOOLS

For another type of man who can grow within the company the Alabama company selects the best graduates it can from technical schools —not alone for scholarship, although a good technical foundation is required, but for alertness, aggressiveness, personality, thoroughness, etc. These men are put through a sort of apprenticeship—perhaps first as a governor-floor attendant or water boy in a power plant, then on the turbine floor, next as switchboard operator and later as an assistant load dispatcher. Then the recruit may be given several months of home office training in the production, distribution, operation and maintenance departments and finally exchanged with an electrical manufacturer who desires to give one of its representatives operating experience. When the man returns from his apprenticeship with the manufacturer it is usually possible to determine what position he will fit into best.

As a result of this type of training he Alabama company is building up real organization which has an opportunity to develop the best in itself for the individual and for the development of an interprising company.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## How to Prevent Priming and Foaming in Boilers

PRIMING, or the mechanical carry- ing of water out of the boiler by eam, is caused by foaming, which in turn caused by the collection of spended matter, such as salts, eases or sewage on the surface of e water. This renders the libera- on of steam bubbles difficult, so that e steam escapes in belches and car- es water with it. The best method r overcoming priming and foam- g, as pointed out in the operat- g code of the Philadelphia Electric mpany, is to reduce the water level d to rid the surface of the foreign aterial. This is most readily done use of both the main and surface ow-offs.

Following are the specific instruc- tions for this operation:

1. Close the feed valve.
2. Bank the boiler.
3. Open the surface blow-off valve d blow down until the water level lowered about one gage.
4. Start from a banked condition.
5. If foaming is not stopped by this thod, shut down the boiler and wash it out.

## Operating Synchronous Motor-Generators

IN THE case of a synchronous motor with a separate direct-cur- rent generator used as an exciter, t exciter voltage must be adjusted to approximately normal value as in- dicated by voltmeter or pilot lamps, according to the operating code of the Philadelphia Electric Company. With the proper rheostat setting this will insure a definite amount of field current to be taken by the motor when the field switch is closed and will cause a minimum amount of cur- rent to be drawn from the alternat- ing-current system.

It is a characteristic of synchro- nous motors that for every load there is a field-current value that gives unity power factor and minimum armature current. Increasing and decreasing the field current from this value give, respectively, a leading and a lagging current of greater value. The generator voltage must be made equal to that of its bus before connecting to it, otherwise a sudden rush of current would flow either from the bus into the machine or from the machine to the bus. This current may be of such value as to trip out both ends of the unit, which would necessitate starting all over again. The instructions for starting a synchronous motor-generator from the alternating current side and for shutting down as abstracted from the above code follow:

### STARTING

1. Close the alternating-current bus switch.
2. Close the starting switch and observe that the rotor turns over.
3. Adjust the exciter voltage to the proper value.
4. When the wattmeter or ammeter shows that the motor is taking minimum power, change to the running side of the compensator. If separate starting and running switches are employed, open the starting and immediately close the running switch.
5. Close the motor-field switch and adjust the field to give minimum armature current.
6. If the generator is compound-wound, close the equalizer switch.
7. Adjust the direct-current voltage to that of the bus and close the circuit breakers and the negative and positive machine switches.

### SHUTTING DOWN

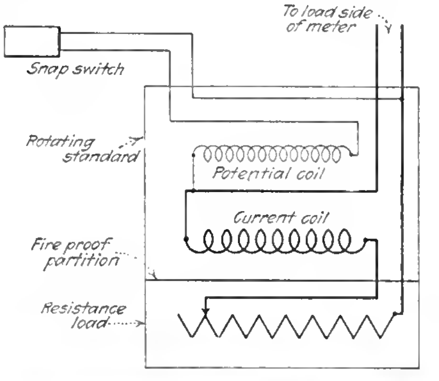
1. Reduce the load on the machine to be taken off to as low a value as possible.
2. Trip the circuit breakers and open the machine and equalizer switches.
3. Open the running and alternating-current bus switches.
4. Cut in all the field resistance and open the field switch.

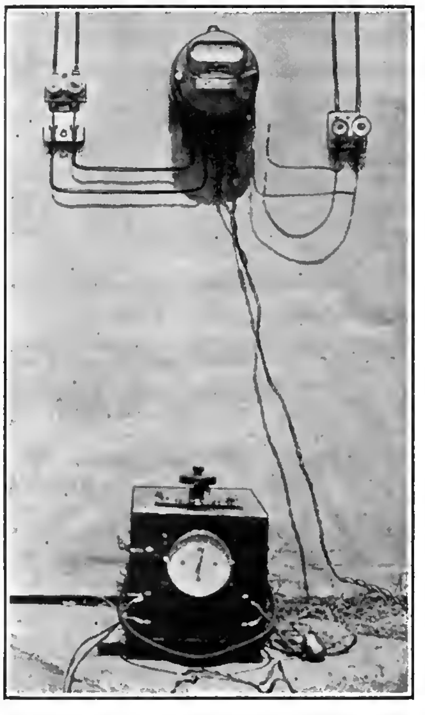
## Compact Meter-Test Set

IN THE testing of house meters much time is lost and inconvenience created by the usual method of connecting separate units containing the rotating standard and the phantom load. In order to eliminate these objectionable features and also to simplify routine testing the writer designed and built the test set illustrated.

The cost of the set, excluding the standard and resistance wire, was $50. One single carrying case, 8 in. x 8 in. x 14 in., contains the rotating standard, the resistance load and all the necessary leads. Instead of requiring 16 connections to be made on the site of the test, a meterman has but to disconnect the load side and connect them to the terminals on the test set.

A variable resistance load, built of five iron elements bolted in asbestos, is contained in the bottom of the case, which is protected by a fireproof composition board. Perforations in the case allow the heat to escape with any temperature rise. This resistance has steps of 1 amp. to 5 amp. at 100 volts, and the steps are all numbered to indicate the load, being made similar to a rheostat. There is a dial on the top of the case, graduated in 100 minor divisions in order to make it easy to read the accuracy of the meter under test in percentage. The accuracy of this test set, like all other rotating standards, depends upon comparison with a fixed standard.



COMBINED ROTATING STANDARD AND LOAD RESISTANCE

The simplicity of the set itself and

the reduction of the number of connections allow an ordinary layman or an unskilled meterman to make rapid tests on the meter site. For, once installed, it is only necessary to turn the rheostat handle to the desired load and note the number of revolutions of the disk on the service meter, then snap the switch on the test set to start or stop. This snap switch also has binding posts so that one can make the leads any desired length.

H. S. EDWARDS,
Meter Engineer.
Kentucky Utilities Company,
Pineville, Ky.

## Testing Transformer Oil in Field

A CONTINUOUS round of transformer inspection is made by one Southern power company to test the oil in the tanks. One man is engaged in doing nothing but this work and hence becomes expert at it. Since moisture in the oil is most likely to collect at the bottom of the tank, the test sample is drawn from this point and tested with a portable transformer and a $\frac{1}{10}$-in. disk gap. If the oil will not withstand 15,000 volts, another sample is drawn off 8 in. to 18 in. from the bottom of the tank and tested. If this fails to withstand 15,000 volts, another sample is withdrawn at the oil gage. If this still tests bad, all of the oil is replaced at the earliest opportunity. If it tests all right at the oil gage and not below, that much oil is drawn off and replaced by good oil.

Records of the oil tests are made on forms like the accompanying one and compared with tests which are made at a central point with a standard testing transformer. This is done to keep a check on the accuracy of the portable transformer. The latter has a 110-volt primary which can be energized from any lighting socket which is usually available around a substation.

The minimum test limit of 15,000 volts with a $\frac{1}{10}$-in. disk gap is maintained for all transformers having voltages up to and including 110,000.

With circuit breakers the practice of testing oil is not standardized to so great a degree, first, because facilities are not provided on most of the tanks for withdrawing oil and, second, because there is question regarding the extent to which moisture is seriously harmful in circuit-breaker oil. For lack of other means this company now has to wait until a circuit-breaker is de-energized and disconnected from the buses before any oil samples can be withdrawn. Then access is gained to the interior through the top of the tank by inserting a tube into the oil. The oil tester holds his thumb over the top of the tube until the lower end is at the elevation desired, when the top is opened and oil from the level of the lower end of the tube allowed to flow in. Then the top of the tube is closed again and the tube withdrawn so the oil can be transferred to the sample bottle.

Until tests can be conducted or experience obtained which will show how much moisture in oil is detrimental to circuit-breakers and how much water can collect in the bottom of the tank before opening of the breaker will force it to permeate the entire mass of oil, this company is determining the necessity for replacing all oil by testing samples withdrawn from the zone between the upper and lower contacts of the breaker. Of course, a collection of moisture at the bottom of the tank is drawn off whenever detected, regardless of what the oil tests show. The feeling is expressed that more information is needed regarding the extent to which moisture and carbon in the oil imperil curcuit-breaker performance and that better facilities should be provided for withdrawing samples from breaker tanks.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

OIL TEST REPORT

OATE__________192___ ____________POWER CO. ____________STATION

TEST TRANSFORMER USED____________ GAP USED____________

TRANSFORMERS

| Bank | Voltage | K-V-A | Serial | Break Down Test | Is Oil in Gauge | Is Thermo O. K. | REMARKS |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |

OIL CIRCUIT BREAKERS

| Location | Voltage | Amp. | Number | BREAK DOWN TEST Tank 1 | Tank 2 | Tank 3 | Is Oil in Gauge | REMARKS |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |

O. K.____________ SIGNED____________

All oil tested from transformers is to come from bottom of tank.
All oil tested from circuit breaker is to come from level of contacts.
All B. D. tests given are to be average of 4 tests made on each sample.
Results of oil tests made at stations where attendants are located must be recorded on Station Log Sheet.
Gap in Oil Test Box must be checked before making test.

BY HAVING SUITABLE FORMS FOR TEST PURPOSES VALUABLE RECORDS WILL NOT BE LOST

## Estimated Cost of 75-Mile 110,000-Volt Line

IN CONNECTION with the construction of a new hydro-electric plant at Davis Bridge, Vt., the New England Power Company plans to build a 110,000-volt steel-tower line connecting this station with the Millbury (Mass.) central substation. The estimated cost of the Massachusetts section of the line, 75 miles in length, is given in the accompanying table. The line traverses rural territory.

COST OF 110,000-VOLT TRANSMISSION LINE

| | |
|---|---|
| Rights-of-way | $201,000 |
| Clearing rights-of-way | 64,250 |
| Towers, double-circuit galvanized, spaced 7.7 per mile, 46 ft. to 70 ft. high; power wires spaced 12 ft. and 13 ft. apart in horizontal plane; minimum clearances: ground, 20 ft.; highways, 25 ft.; telephone wires, 8 ft.; towers in place | 655,000 |
| Power wires in place, one three-phase circuit, No. 4/0 B. & S. seven-strand conductors, hand-drawn copper, sagged to reach a tension of 4,000 lb. under ½ in. ice plus 8 lb. wind at 0 deg. F. | 181,200 |
| Insulators, suspension type, standard 10-in. porcelain disks, 8 disks in suspension and 9-in. strain | 54,500 |
| Ground wires in place, two $\frac{7}{16}$-in. double galvanized high-strength steel cables, one carried over each pair of tower legs, to be strung slightly tighter than conductors; strength of 15,000 lb. | 24,100 |
| Special work | 23,700 |
| Telephone line complete, two-wire private line carried on wooden poles about 60 ft. from and parallel to power line | 71,000 |
| Camp operation and tools | 26,900 |
| Superintendence, surveys, payroll, insurance, etc. | 65,200 |
| Total | $1,366,850 |
| Cost per mile | $18,225 |

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## A Practical Plan for Wiring Old Houses

**How a Central-Station Company Signs Up the Business for Contractors Who Share in Advertising Expense—Installment Payments Financed by a Local Bank**

By R. F. McGuinness
Lighting Division, Commercial Department, Utica (N. Y.) Gas & Electric Company

AT THE close of the year 1920 our company's records showed that only a small percentage of our cut-ins were made for old houses, most of them being for newly built homes. This indicated that there were a considerable number of unwired dwellings along our existing lines, and as no special effort had been made by the contractors to wire these homes the Utica Gas & Electric Company decided to launch a drive to get the old houses wired and using service.

To determine the number of prospective customers, a careful examination of our ledgers was made and a list prepared of all customers using gas who did not have an electric meter. Upon completion of this survey it was found that 6,100 houses were not wired. The majority of these were along existing lines, and the problem then to be considered was a practicable method of obtaining this business. Our company did not do wiring and did not care to enter this branch of work. It was realized that an important feature of such a campaign was extending terms of payment to the customer; also that many of our contractors could not afford to do wiring on the installment plan. The different features were investigated, one of our local banks was approached relative to handling the accounts, and tentative plans were prepared.

### Getting the Contractors Together

A meeting of all the contractors was called and the subject discussed in detail. It was explained to them that we would furnish the required number of solicitors and turn over the business to them all signed up ready to be installed. The only expense to the contractor would be the advertising, and our company offered to pay $1 toward the fund for every dollar the contractor paid. The arrangement made with the bank for handling the payments and the charge for this service were also explained. The payments were to be made 10 per cent down and the balance in twelve months, payable on the Christmas club plan. The bank's interest and carrying charges were added to the contractors' price for the job.

TABLE I—PRICE LIST OF OUTLETS AND HARDWARE

All openings for switches, receptacles, drop cords and fixtures are considered as outlets and based on a unit price for houses of different classes of construction.

The cost of conduit entrance, switches and receptacles should be added to the price of outlets, and this sum will he the contract price for all labor and material necessary to complete the work as outlined in the schedule.

All extra outlets, switches and receptacles will be charged for according to the class of wiring for which the contract is written.

The minimum number of outlets for any class of wiring shall not be less than four.

| | |
|---|---|
| **Class A—Outlets** | |
| All ceiling or switch outlets located under single flooring, each | $2.90 |
| **Class B—Mixed Flooring** | |
| Prices as per Class A except as below: | |
| Located under double or hardwood flooring: | |
| Ceiling outlet, extra | $1.85 |
| Switch outlet (controlling any center outlet), extra | 1.85 |
| **Class C—Mixed Walls** | |
| Prices as per Class A except outlets appearing on brick walls, extra | $3.15 |
| **Hardware** | |
| Push-button, single-pole switches, each | $1.50 |
| Push-button, three-way switches, pair | 3.60 |
| Snap single-pole switches, each | .85 |
| Flush-plate receptacles (one only) | 5.30 |
| Additional flush-plate receptacles, each | 1.30 |
| **Pilot Light** | |
| Installed in kitchen unless otherwise specified, including receptacle (no lamp) | $3.50 |
| Bullseye in plate including outlet and switch | 8.00 |
| **Conduit Entrance** | |
| Two-wire grounded entrance | $27.50 |
| Three-wire grounded entrance | 30.00 |
| **Garage** | |
| Feeders, using tubes on house | $5.00 |
| Feeders, using conduit on house | 10.00 |
| Maximum distance from house, 50 ft. 5 cents per foot over 50 ft. | |
| **Meter Boxes** | |
| For each additional meter box above two meters | $5.00 |

Ten per cent to be added to the above figures if applicant desires to make payments on the deferred payment plan.

We told them that, in consideration of our company furnishing the solicitors and turning the contract over to them without any effort on their part, and as they would get their money on completion of work, we would insist upon a very liberal price for the wiring. After some discussion, it was decided that a flat price for the entrance, outlets, switches, etc., would be the best way of figuring a job. By such a method many complications which would be sure to arise later were avoided, in addition to saving considerable time figuring the job. This flat price also enabled salesmen not thoroughly familiar with house wiring to arrive at the cost much more easily than if the old method had been adopted. The price for the work was determined by submitting a blank to all the contractors, requesting them to fill in their prices. An average was then taken and this figure used as our price. We investigated prices in other cities before accepting this figure, and found that it compared very favorably with wiring prices in other places. The accompanying price list of outlets and hardware shows the schedule of cost for wiring and terms of payment now in effect.

Fourteen dealers agreed to participate. An advertising budget was prepared and with our own payment we had $1,400 to start the campaign. Later on an additional $800 was added to the fund. Two salesmen were employed, whose business it was to sell house wiring and nothing else. They worked on a commission basis of $5 per contract, with a drawing account of $25 per week. Before making any calls in their territory, we sent out a letter to the owners telling them of our plan for wiring their homes, together with a booklet explaining the easy manner in which already-built houses were wired. This booklet also contained other information relative to the use of appliances in the home and the cost of operating them. The letter was mailed

about two days before the salesman was due to call. Besides paving the way for his visit, it got the customer thinking and talking about electricity in the home, and in many cases it was simply a question of giving a price and getting the contract.

It was decided that our company would not enter into the fixture end of the job but leave that to the customer to call on any of the dealers and select his own fixtures. Such a procedure did not require our salesmen to call back on the customer after the wiring contract was secured in order to change some style of fixture which the customer decided was not satisfactory. However, arrangements were made with the bank whereby the customer could pay for the fixtures on the same plan as the wiring, provided that the fixtures were purchased from one of the fourteen dealers.

### How the Plan Operates

When the contract is brought into the office a letter is mailed the customer acknowledging receipt of his contract, mentioning some of the advantages of electricity in the home and stating the name of the contractor to whom the job was assigned. The agreement is then forwarded to the ledger department, where it is checked for credit. Upon its return it is approved by the commercial manager and sent to the bank. The bank investigates his credit, approves or rejects the contract and returns it to our office. If the contract has been accepted by the bank, it is allotted to one of the dealers in alphabetical order regardless of the amount of the job. In case a dealer telephones us the name of a "prospect" we will have our salesman call, and if he is successful in closing the job it will be given the dealer without penalizing him when his regular turn comes.

Upon completion of the work the customer makes his first payment to the contractor and then gives him a twelve-month note for the balance. The note is indorsed by the contractor and turned over to the bank together with the wiring agreement, the contractor receiving immediately 90 per cent of the amount due him. The balance, or 10 per cent, is retained by the bank until the customer makes all his payments. In this way the contractor is interested in the job until it is fully paid. The bank notifies the customer that it has his agreement, the amount of the monthly payment agreed upon, and incloses a Christmas club booklet.

TABLE II—RESULTS OF UTICA HOUSEWIRING CAMPAIGN FOR YEAR 1922

| | | |
|---|---|---|
| Number of calls made on canvass | | 5,671 |
| Number of estimates given | | 1,067 |
| Number of prospects | | 587 |
| Number of contracts closed | | 438 |
| Number of new customers | | 769 |
| Total amount of contracts | | $32,910 |
| Average amount of contracts | | 75.13 |
| Number of contracts handled through bank | | 213 |
| Cost of obtaining new business: | | |
| Commissions to salesmen | $3,163 | |
| Advertising | 193 | |
| | | $3,356 |
| Number of new contracts solicited but closed independently | | 40 |
| Number of new customers on independent contracts | | 71 |
| Total number of new customers obtained through campaign activities | | 840 |
| Total estimated revenue from all customers secured through campaign activities | | $18,720 |
| Average cost for all customers secured | | $3.99 |
| Total number of houses wired through campaign activities | | 478 |
| Total number of already-built houses connected (city of Utica) | | 1,176 |
| Total number of new houses connected | | 373 |

During the first twelve months of the campaign 565 new customers were added to our lines in addition to the regular trend of business. The wiring for these jobs amounted to $31,438.51, or an average of $76.67 per contract. The amount subscribed by all the contractors for advertising was approximately $1,000. This represented 3.5 per cent of the business secured.

During 1922 we added 840 new customers to our lines through campaign activities. The average cost for obtaining each customer was $3.99. A total of 438 wiring contracts was taken, amounting to $32,909.59, or an average of $75.13 per contract. Table II shows the status of the house-wiring campaign at the end of the year, giving the cost per contract of obtaining the business and its value in gross revenue. This, of course, does not include the natural gain in business which came in unsolicited. During the first year of the campaign the number of meters connected increased from 15,198 to 16,993, a gain of 1,795 for the year 1921, while in 1922 there were 3,203 new meters added, bringing the total on Jan. 1, 1923, to 20,196.

Of the total number of contracts closed from Jan. 1, 1922, 45 per cent were cash jobs. Taking the total gain in residence lighting meters since Jan. 1, we find that we have added 50 per cent more business to our lines, which is directly traceable to our efforts in wiring old houses.

We recently increased the commission paid to salesmen by giving them $4 for each application turned in with a contract. Some contracts call for three meters, in which case the commission paid to a salesman would be $12, provided he turned in the three applications. We are getting more business in this way and the salesman is making more money. The average earning of the salesmen since this change is $38 per week.

We have on file a list of all the unwired homes in the city, together with the majority of the owners' names and addresses. Circular letters are mailed to the owners at different periods of the year urging them to wire their houses. The majority of the cards are also marked with the reason why the owners do not go ahead with the work.

One great advantage of the campaign, besides the additional business, has been to eliminate to a large degree price competition. In the past the contractor would estimate on a job on the hit-or-miss fashion, and in case he knew that other men had estimated he would cut out a plug or switch in order to get the job. Now, since all the reliable contractors are using these figures as a standard, it reduces work on the contractors' part and at the same time gives them a larger volume of business.

## Getting the Message Over to the Public

MOST electric service companies have found it difficult or impossible to get their message to the public through their local newspapers. Usually it has been because they have not investigated what the newspaper requirements are for material acceptable for publication in the reading pages. A few lessons may be learned from the experience of Preston S. Arkwright, president of the Georgia Railway & Power Company, who says: "Before any public relations work can be done there must be good service, and this service must be kept up to the best standard of the country." Next he maintains that the public is always glad to listen to anything about something that vitally affects it, if

told in an interesting manner and in terms it can comprehend. What business has more intimate contact with the public than that of the electric service company? In its various ramifications it has countless phases which would interest the public if related in the right manner. To be effective, however, the stories must be presented in an oral address, illustrated if possible. If properly prepared and presented, they can be made to establish a better understanding of public utility problems, the large investment, the nominal profit allowed by regulation, etc.

In addressing the public, utility men must learn to talk about those phases of their business which vitally affect it or about those which contain an element of "human interest," such as restoring service or constructing plants. Furthermore, they must talk about these things in the terms of the audience's business. For example, cotton-mill men must be addressed in terms of the cotton business and shoe men in terms of the shoe business. Dry statistics should be avoided.

Through his ability as a speaker Mr. Arkwright has made himself so welcome before public audiences that he receives periodic requests to speak before commercial organizations, clubs and civic bodies despite the fact that he refuses to talk in public on anything but the public utility business.

If such messages, prepared to interest the public, are made available to newspapers in typewritten form sufficiently in advance of presentation to allow them to be set in type and published while news, the newspapers are much more likely to use the information and to print it at greater length. Recognizing this, the public relations department of the Georgia company places copies of all addresses made by Mr. Arkwright in the hands of local editors—and of the associated press where the subject is of more than local interest—several hours before the delivery of the address. As a result the company has no difficulty in getting accurate information to the public.

The secret, in brief, is to deliver messages to the public through addresses at public gatherings—to talk about how the utility's activities affect any class of persons in the terms of their own business, and to make copies of the addresses available to the newspapers well in advance of presentation.

## El Paso Exhibits an Electrical Home

THE electrical home idea was introduced to the public of El Paso, Tex., in the recent exhibition of an "electrical home beautiful." During the three weeks the home was open to the public 10,982 people were shown through it, which is a very creditable showing in view of the fact that the population of the city is but 80,000 and of these 60 per cent are Mexicans. Merchandise and appliance sales by the electrical dealers during and after the opening of the home were greater than ever before. Sales of the larger appliances such as washing machines, electric refrigerators and ranges were particularly good.

The home chosen for the exhibition was a seven-room bungalow of Spanish architecture, which had been built for C. A. Winder, manager of the Southwest General Electric Company. To promote the home and raise the necessary funds for advertising and exhibiting, the electrical manufacturers, jobbers, contractors and dealers and the central station joined in forming the El Paso Electric Co-operative Association. Through this organization a total of $2,500 was raised, which was apportioned as follows: Central station, $900; manufacturers, $775; jobbers, $450, and contractors and dealers, $375.

ELECTRIC HOME DISPLAYED IN EL PASO AT AN APPROXIMATE COST OF 2¼ CENTS PER VISITOR

Free publicity concerning the home in the news columns of the local papers amounted to 1,140 in., and 2,895 in. of newspaper advertising was purchased. Based on the attendance and the total amount of money spent in displaying the home, the cost per visitor was approximately 2¼ cents. An attractive booklet entitled "My Own Electric Home in El Paso" was given to each visitor. The suggestion in the title was carried in headings throughout the booklet, as "My Living Room," "My Kitchen," etc., which made a personal appeal to the individual visitor and aroused a desire sooner or later to own a modern electrical home.

## Insull Properties Lead in Americanization Work

WITH 99.79 per cent of their 24,214 employees either American citizens or having signified their intention of becoming such by taking out their first naturalization papers, the group of six utility properties controlled by the Insull interests has an unuaual record. The employees are scattered over the fifteen states in which the companies operate, and the result has been obtained by eighteen months of Americanization work.

A report just made by the company committee in charge shows that on Jan. 1, 1923, 91.97 per cent of the employees were full-fledged American citizens. Those in possession of their first papers and who will gain full citizenship within the next few months total 7.82 per cent, and only fifty-one, or 0.21 per cent, were not citizens or had not taken out first papers. Of these nine are not eligible, being Japanese, East Indian or Filipino students in Chicago schools. In the Commonwealth Edison Company, only eleven out of 6,631 employees were non-citizens, nine of the eleven being the students referred to. The Middle West Utilities showed four non-citizens out of 4,702 employees, the Chicago Elevated Railroads thirty-two non-citizens out of 5,107, and the People's Gas Light & Coke Company's 3,398 employees were all either citizens or had taken out first papers.

Americanization work began with the People's Gas Light & Coke Company, in the summer of 1921, and by the following April every employee was a citizen or on the way to citizenship. The most difficult situation was that of the Chicago, North Shore & Milwaukee Railroad, where men of 15 nationalities, hired

through labor agencies, were scattered in camps along the right-of-way. The first step under the supervision of President Britton I. Budd was discontinuance of the practice of keeping such labor in contractors' boarding camps. Company camps, with better commissaries, baths, close attention to cleanliness and the things that go to make a camp that attracts the better class of men and keeps them contented, were established. Finally, a Y. M. C. A. secretary was employed to look after recreation.

This was a step in the right direction, and it was decided further that a systematic course of education to help these men become citizens should be established. Ninety per cent were not citizens. More than 30 per cent could not speak English—75 per cent could not read, and 25 per cent could not read or write their native language. Ages ranged from eighteen years to sixty years, with an average of thirty-six years.

An experienced instructor was engaged and was assisted by men in the organization. Schools were fitted up in company buildings along the line. Evening classes were established at convenient locations for the men, and the instruction was arranged so that the lessons and work the men were engaged in were associated. Motion pictures were used to prevent the study from getting tiresome. After several months a "first-paper day" was arranged, and applicants for their first citizenship papers were received at the court houses in Waukegan, Ill., and Kenosha and Milwaukee, Wis. This was a gala day, and the percentage of track employees not citizens or embryo citizens dropped from 90 per cent to 27 per cent. The success of the educational work is such that it is being continued, and a school has been started for the instruction of foremen who desire to prepare for such work. Safety classes are also held and accident prevention is taught.

Educational work of a similar character has been carried on by the People's Gas Light & Coke Company and the Commonwealth Edison Company, the co-operation of the Chicago Association of Commerce and the Chicago Board of Education having been obtained. The Edison company has been conducting classes in citizenship in its Fisk Street station in Chicago and in a public school building on the West Side. In the other Insull companies the work has taken on more of an individual character, as the properties are rather widely scattered and they employ relatively a much smaller number of non-citizens.

## Utility Maintains Information Bureau

VISITORS to the Turk's Head Building, Providence, R. I., which houses the headquarters offices of the Narragansett Electric Lighting Company, have found an information bureau maintained by the company in the main corridor on the street floor a great convenience. The bureau, illustrated herewith, occupies a corner between the main entrance and the company's electric shop and is equipped with a display cabinet for appliances, an illuminated bulletin calling attention to the value of labor-saving devices in the home, directories and facilities for small-scale demonstrations. During business hours a clerk familiar with the company's personnel, location of offices, departments, etc., and conversant with the company's practice regarding service applications, is on duty. On occasion electrically prepared toast and coffee have been demonstrated at the counter, and the service rendered saves no small amount of time for visitors to the company's offices unfamiliar with the location of officials and departmental headquarters.


PROVIDENCE COMPANY'S INFORMATION COUNTER

## What Other Companies Are Doing

**Providence, R. I.**—In the last four years the Narragansett Electric Lighting Company has added 12,143 residence lighting meters to its connected load, representing $1,260,291 in house-wiring contracts. In 1922 the company set 4,294 meters on house-wiring contracts, or a gain of 2,160 over the previous year's record, representing an expenditure by customers of $370,351 for house wiring. The company carries on continuous house-wiring contract development instead of seasonal or sporadic campaigns. F. A. Gallagher, Jr., is head of the lighting department.

**Falmouth, Mass.**—With a population density of about 70 per square mile, the number of customers of the Cape & Vineyard Electric Company has increased from 4,474 to more than 6,000 during the past three years. Last year's gross revenue was $334,893 against $290,512 in 1921. Eugene Carpenter, manager of the combined property, states that when the present interests acquired control in 1907 the gross earnings were but $12,000 per year. A consistent policy of co-operating with contractor-dealers throughout the Cape & Vineyard territory, coupled with intensive cultivation of lighting and power service and the application of a diversified rate system to meet contrasted summer and winter conditions, has been an influential factor in the above development.

**Illinois.**—A plan of educating the women employees in the different phases of public utility service has been put in operation by the Public Service Company of Northern Illinois. Mrs. M. A. Schrayer of the Evanston salesroom has been placed in active charge. Meetings have been held in several of the districts, on which occasions, in addition to a lecture by Mrs. Schrayer, addresses have been made by district officials.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Stratification of Gases Within a Boiler Furnace.*—W. C. STRUNK.—Method of taking combustion-chamber gas samples, analysis of air distribution in furnaces, operating relations of $CO_2$ and $O_2$ and methods for improving combustion efficiency are the main subjects discussed.—*Power*, Jan. 30, 1923.

*Developments of Steam Turbo-Generators, Water Turbines and Transformers During the Last Ten Years.*—A. ROSSOW, H. BAUDISCH and K. THIEN.—The authors give a brief review of the achievements made in the design and the manufacture of turbo-generators, hydraulic turbines and transformers during the last ten years in Austria and Germany. The unit output of steam turbines went up rapidly from 16,000 kva. to 25,000 kva. and finally to 60,000 kva. No data are as yet available as to what influence increased boiler pressure would have upon the formation of boiler scale and the chemical behavior of the boiler water. Careful design of the boiler firing system permits of the generation of 50 kg. of steam per square meter of heating surface. Pulverized coal is not being used yet to any extent in these countries on account of the high cost of the necessary auxiliary apparatus. Few changes have been noticed in the design of the Pelton waterwheels except as regards their size, which reaches now 25,000 hp. The Francis-type turbine has been much improved, the specific speed increasing from 450 to 600 and 700. The new propeller-type turbine with short and oblique vanes found extensive use on account of its high specific speed, which has reached 1,000. Great strides have been made during the last ten years in the design of transformers. Improved cooling methods permit today the building of practically limitless output units, curbed only by transportation possibilities. Several three-phase, 50-cycle units of 60,000 kva. rating have been successfully operated since 1918. Testing transformer sets of 1,000,000 volts, using the Dessauer series system, are being produced. One concern has designed and operated a 300,000-volt air-insulated testing transformer set. Air-insulated power transformers, formerly used very frequently, are becoming obsolete. A great deal of attention is being given to a better internal winding insulation to withstand more safely overvoltage stresses. On 100,000-volt transformers the first turns are made to withstand full line voltage. Circular coils are gaining ground constantly over rectangular and oval coils. Oil conservators are now used generally for all sizes and voltages. Output and voltage standardization is well under way.—*Elektrotechnik und Maschinenbau*, Jan. 1, 1923.

*Hydro-Electric Power Supply.*—A. TUSTIN.—The author describes briefly the chief constituent parts of a hydro-electric development and their functions, discusses some of the economic factors controlling the development and operation of water-power plants and considers the question of tidal power where it exemplifies the working of these economic factors.—*Journal of the Institution of (British) Electrical Engineers*, January, 1923.

## Generation, Control and Switching

*Switching Apparatus for High Voltage.*—A. ROTH.—According to the author's claims, Switzerland seems to be definitely gravitating toward the use of outdoor substations. Taking a voltage range of 25,000 to 150,000, it is claimed that savings of from 25 per cent to 30 per cent may be realized over an indoor installation. Radiator transformers almost identical with the type used in America have been standardized for large self-cooled units for outdoor use. Very carefully designed oil switches, as a rule with one or more resistance steps and built pressure-proof, are now in general use. Insulators made of a special paper are being employed for indoor stations, while dry or oil-filled porcelain insulators must be used outdoors. Three-phase disconnecting switches for more than 40,000 volts should be coupled to open simultaneously for all phases so as to avoid overvoltages. Bar-type current transformers are preferred on account of their higher safety under short circuit stresses. Modern European practice recommends a quenching coil or a Y-point grounding as the most effective overvoltage protection. For overhead lines up to 80,000 volts the quenching coil is used, for higher voltages the Y-point is grounded directly, while underground cables up to 30,000 volts are Y-grounded over a resistor. To guard against resonance of discharge waves the resistance shunting of all inductances, like relays, current transformers, trip coils, etc., is recommended. The article contains a great many instructive photographs.—*Elektrotechnik und Maschinenbau*, Jan. 28, 1923.

*Measurement of Loads on Pole-Type Transformers.*—C. E. SCHWENGER.—Information as to the temperature of transformers may be obtained in several ways, but the two most common means are the measuring of the temperature directly and the measuring of the loading current and deducing from it the temperature. For the latter condition the characteristics of the transformers and also the duration of the load must be known. For the first method the instruments used are the thermometers, temperature semaphores and maximum thermometers, while for the latter indicating ammeters, curve-drawing ammeters and maximum-demand ammeters are used. The author considers the merits of each type applied to transformers in service.—*Electrical News*, Feb. 1, 1923.

## Transmission, Substations and Distribution

*Electric Transmission Practice in Europe.*—L. KALLIR.—In a review of the last ten years of Austrian and German transmission line and substation practice the most important improvements are described. Owing to the moderate distances, 110,000 volts will probably be the highest needed tension. The first line operating at this voltage has been in operation since 1912, and since then several others have been added. The very strict rules previously governing the erection of high-voltage trunk lines have been simplified, especially in regard to crossings of highways, railroads and telephone lines. The satisfactory experiences gained with steel-aluminum cables are now a welcome relief in these countries since copper is lacking. Considerable space is given to the description of the different types of reinforced concrete poles used. Centrifugally cast round poles seem to give best service. Cap and Hewlett type insulator chains are in general use, and several companies plan to add metal rings to the last insulator element to give a better voltage distribution and to keep the arc away from the insulator chain. A general aversion is noticeable in these countries for the Y-grounded systems. In many stations the Y-point is connected to a Petersen or other quenching coil. In all extended networks a selective protection system is in use, such as the Lypro protection or the Pfannkuch system. The recent porcelain shortage prevents the general adoption of outdoor substations, as almost all insulators are made of paper.—*Elektrotechnik und Maschinenbau*, Jan. 1 and 14, 1923.

## Motors and Control

*Electric Drive in Mines.*—J. GUTMANN.—A paper of a generally descriptive nature, reviewing the up-to-date construction of electrically driven machinery as used in mines. The article deals with coal drills and cutters, conveyors, power shovels, mine fans, air compressors, pumps, small locomotives, winches and a large variety of mine hoists for direct and alternating current.—*Elektrotechnik und Maschinenbau*, Jan. 1, 1923.

*Electric Elevator Inspection.*—J. M. WALSH.—Serious mishaps to passenger or freight elevators may result in loss of life or heavy damage to property, and even a minor failure may cause

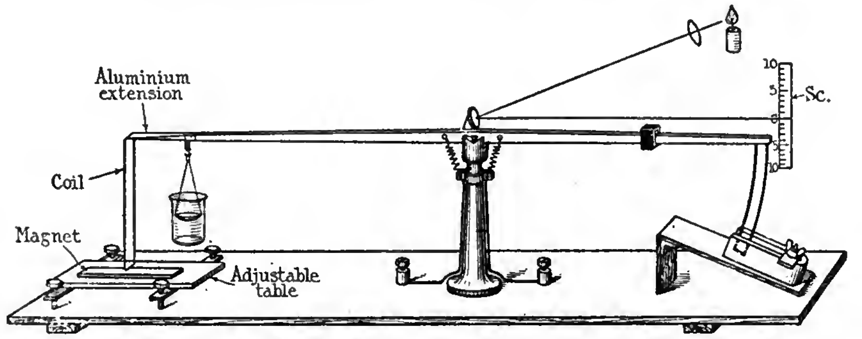
expensive interruptions of service. Proper inspection will detect trouble before it becomes serious. In this article the author outlines the inspection schedule for electrically driven elevators of the type used in industrial plants and tells how to make the adjustments that are necessary.—*Industrial Engineer*, February, 1923.

*Textile Mill Drive.*—The textile drive was among the earliest applications of the electric motor. In this industry there are numerous processes involved, and higher efficiencies are secured by combinations of individual and group drive. Specific installations in silk and cotton mills are described. The broad field of textile printing is covered in a general way.—*Electrical News*, Jan. 1 and 15, 1923.

*Crane Motors.*—J. F. LOCHHEAD.—A description of the construction and characteristics of direct-current and three-phase completely inclosed motors, such as are used on cranes or drives, where water-tightness is essential. Outstanding features of these are two and one-half times starting torque and only 60 per cent to 65 per cent of the usual momentum.—*Brown-Boveri Mitteilungen*, January, 1923.

## Units, Measurements and Instruments

*The Measurement of Flux Density in the Air Path of a Magnetic Circuit.*—W. P. CONLY.—A magnetic balance has been devised for the accurate measurement of the intensity of field at any point in the air path of a magnetic circuit, the instrument being sufficiently




INSTRUMENT FOR MEASURING THE INTENSITY OF A MAGNETIC FIELD

delicate to detect differences in intensity of field amounting to one line per square centimeter, whereas existing methods measure only the average intensity over the whole field or are only sensitive to differences of 150 lines to 200 lines per centimeter per centimeter. The instrument shown in the accompanying illustration has been constructed, based on the principal of balancing by a weight the force deflecting a short conductor placed in a magnetic field. The distribution of the lines of force issuing from the sides of a bar magnet have been plotted by the author, who has found that the surface of the magnet is not an equipotential surface. He also proves, experimentally, Boit-Savart's law.—*Journal of the Institution of (British) Electrical Engineers*, January, 1923.

## Heat Applications and Material Handling

*Gray-Iron Castings from Electric Furnace.*—L. J. BARTON.—The author considers the possibility of the commercial production of plate iron castings from electric furnaces, compares acid and basic practice and discusses the rôle of heat treatment. Exhaustive tests carried out on the production of these castings have been made by him. As a result of these he recommends the procedure to follow to procure a first-class product.—*Iron Age*, Jan. 25, 1923.

*Welding Practice on the Southern Pacific.*—How electric arc and gas welding is extensively used in the Sacramento general shops of this railroad is discussed in this paper, which was presented before the San Francisco Section of the American Welding Society. Certain factors which determine the physical characteristics of a welding joint are enumerated, among which are examination of the weld by visual means, clipping the edges of the deposited metal with a cold chisel to determine the relative adhesion of the deposit, pulling apart a welded section cut from the finished product and the bending and breaking test.—*Railway Electrical Engineer*, January, 1923.

## Electrophysics, Electrochemistry and Batteries

*X-Ray Examinations of Steel Castings.*—H. H. LESTER.—It is now possible to locate $\frac{1}{16}$-in. flaws in steel 3 in. thick with a thirty-minute exposure using commercial X-ray tubes. Correspondingly smaller defects can be likewise revealed in thinner sections. A complete description of the apparatus and method of applying the X-ray machine for this purpose is given.—*Chemical and Metallurgical Engineering.*—Feb. 7, 1923.

## Traction

*Electric Clock System for the Berlin Rapid Transit Lines.*—O. WILIGUT.—Distributed over the great number of stations of the elevated and subway lines of the Berlin rapid transit system are more than 500 electric clocks, which are controlled from one master clock. They are operated every thirty seconds with a short current impulse of changing direction. All clocks in each of these lines are connected in series, operating on 60 volts. The current impulse is only 350 milliamperes and is supplied from two storage batteries, one of which is a stand-by.—*Siemens Zeitschrift*, January, 1923.

*Advantages of Diesel Electric Locomotives.*—L. G. COLEMAN.—There has been great development of Diesel engines in the last twenty-five years, but the author points out that only the surface of the subject has been opened up. He says that a modern Santa Fé type locomotive with fully loaded tender weighs approximately 283 tons. A Diesel electric locomotive of similar tractive effort can be build to weigh about 130 tons and will require available at its maximum point of consumption 1,800 kw. Locomotives of this type provide great flexibility in design.—*Railway Age*, Jan. 20, 1923.

## Telegraphy, Telephony, Radio and Signals

*The Design of Radio Towers and Masts.*—C. F. ELWELL.—Several examples of the variety of specifications employed to calculate the wind pressure on radio towers are brought out by the author. In building design the assumption that the wind pressure at the top is the same as at the ground level is not very erroneous, but in the case of radio masts this load is the chief factor to be considered. The author points out that on a large number of high radio masts and towers which have been built in recent years there are many opportunities for placing pressure indicators at various heights. The data that could be secured from this source would help to a great extent designers who have the problem of designing radio masts and towers.—*Electrician*, Jan. 26, 1923.

*Effect of Local Conditions on Radio Direction-Finding Installations.*—R. L. SMITH-ROSE and R. H. BARFIELD.—An account is given of some of the experiments carried out during the past year by the sub-committee of the Radio Research Board (England) on wireless direction finding. The authors summarize the work of previous investigators along the same lines and indicate why further research was necessary. Various experiments are described and quantitative data are provided regarding the effect of metal work, coils, aërials, overhead wires and trees on a direction-finding set in their vicinity, with definite figures showing the extent in which certain kinds of errors are produced by mountains and buildings. —*Journal of the Institution of (British) Electrical Engineers*, January, 1923.

*Operation of Receiving Tubes from Direct Power Supply.*—A. RINGEL.—The author relates his experiences in operating oscillators and amplifiers from a 240-volt direct-current line. He points out that direct-current lines have additional advantages in that no external B batteries are necessary. He then goes on to describe practical circuits, explaining the essential methods involved with various systems.—*Wireless Age*, February, 1923.

# Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

*Conducted by* PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[ PRINTED IN THE THIRD ISSUE OF EACH MONTH ]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

## Research Completed

### Carrier-Current Broadcasting

Broadcasting over 2,300-volt, three-phase, and 115-volt lines has been accomplished in Lakewood, Ohio. A 50-watt transmitter was employed, which operated through protective-tuning condensers into the 2,300-volt, three-phase lines. The receiving apparatus consisted of an inductively coupled circuit tuner, a vacuum-tube detector and a two-stage audio-frequency amplifier. The circuit was maintained in the non-regenerative condition. The 3,800-m. wave-length tests were the most satisfactory. Careful comparison was made between reception over the 115-volt lines and from an antenna. With 3,800 m. good reception was obtained over the former and only the faintest on the latter. Throughout the experiments no changes were made or required in the transmission system.—*R. D. Duncan, Jr., North American Company, New York.*

### Concrete, Effect of Calcium Chloride in

The studies on the different methods of proportioning concrete mixtures carried out in co-operation with the American Society for Testing Materials have been completed, and the use of certain admixtures for accelerating the early hardening of concrete has been studied. It has been found possible by the addition of small percentages of calcium chloride to increase the early strengths of concrete to such an extent that forms can be removed at least twenty-four hours sooner than would otherwise have been possible. This has been applied on the Queenston-Chippawa development and enabled maximum production to be obtained from the canal-lining plants during the fall and winter months.—*Hydro-Electric Power Commission of Ontario, Toronto.*

### Lamps, Best Efficiency at Given Price and Cost of Power

A study of the economics of lamp operation under present conditions has been made. Calculations of the cost of lighting for different rates of power and prices of lamps indicated that, although the solution of the problem of the most economical efficiency is too complicated for general application throughout the province, a satisfactory compromise can be made. The adoption of efficiencies to produce an average life of 1,500 hours was decided upon as the most suitable for general use on Hydro systems.—*Hydro-Electric Power Commission of Ontario, Toronto.*

### Pressures, Mechanical, Piezo-Electric Measurement of

A number of circular quartz plates are cut from a quartz crystal so that an electric axis is perpendicular to the plane surface of the plates. These plates are stacked up condenser-fashion with sheet-metal electrodes. Electrodes collecting charges of like sign are connected to a common terminal. The two terminals are electrically connected to a ballistic galvanometer. The stack of plates is subjected to the pressure to be measured by means of a piston which exerts a force perpendicular to the plane faces of the plates. When pressure is applied, a charge is liberated by the plates which flows through the galvanometer, causing a deflection. The galvanometer deflection is photographed on a rapidly moving film. The pressure-time curve is the differential of the recorded deflection-time curve multiplied by the proper constant. It has been found that the amount of charge liberated by the quartz plates is proportional to the pressure applied, for pressures up to 50,000 lb. per square inch.—*J. C. Karcher, Bureau of Standards, Washington, D. C.*

[This principle has been utilized in several gages for pressure measurements in guns, and the results found to be in entire accord with the same pressures determined by other means.—EDITOR.]

### Radio Communication in Mines

Tests conducted at the experimental coal mine of the Bureau of Mines at Bruceton, Pa., hold out the hope that wireless waves may be used in the future as a means of effective communication between rescuers on the surface and miners entombed in mines. Signals were heard distinctly through 50 ft. of coal strata, although the audibility fell off rapidly as this distance was increased. The absorption or loss of intensity with distance is very great for the short wave lengths used in these tests. Longer waves are known to suffer less absorption and may possibly be found practically effective under certain conditions.—*United States Bureau of Mines, Washington, D. C.*

### Reactors, Current-Limiting

Tests to destruction have been made on large reactors with a 27,000-kva. special alternator, to ascertain the mechanical stresses which such reactors should be able to withstand. Tests have also been made on the effect of shunting the reactors with carborundum resistors. It seems that the resistors damp out oscillations and clear the system of disturbances which might otherwise build up very high voltages.—*A. I. E. E. Sub-Committee on Current-Limiting Reactors.*

### Sphere Gap for 1,000,000 Volts

Hollow spheres, 100 cm. in diameter and about 9 mm. thick, have been cast of special bronze and carefully turned to size. One sphere is attached to the top of the condenser bushing terminal of the million-volt transformer; the other is suspended vertically over it on an insulating shaft terminating in a metal rack. An electric motor, operated from the switchroom, is geared to this rack. Zero setting is accomplished electrically, and the motor is stopped instantly when the upper sphere touches the lower one.—*J. F. Peters and D. F. Miner, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

## In Progress or Proposed

### Cable Operation

Committee program: Automatic selective protection for underground distribution, both alternating current and direct current: Enlarge upon principles set forth in the American electrolysis committee's report so that they can be applied and digested by the cable using companies; continue record of burnouts and failures; investigate methods of measuring sheath current to ground. Temperature survey methods: Permissible short-time excessive overloads without causing damage to cables. Heat radiation from conduits: Cases of excessive heating and how cured; spacing between adjacent conduits; best arrangement and maximum number of ducts in a bank; advisability of reducing heating in large banks by increasing copper. Use of kenotron in testing cable: (1) High-voltage tests, i.e., breaking-down faults; (2) routine insulation tests. Expansion of cables.—*Underground Systems Committee of the N. E. L. A.*

### Circuit-Breakers, Oil, Duty Cycle of

In view of the lack of agreement among the various organizations interested in the matter of duty cycle, it is proposed to begin work on the guidance of member companies contemplating oil-circuit-breaker tests, specifying the data which are necessary to certify or amplify the correctness of the present definition of interrupting capacity. It is believed that such a course will eliminate to a large extent duplication in tests and will also serve to remove elements of doubt as to the efficacy of the tests.—*A. I. E. E. Sub-Committee on Circuit Breakers and Switches.*

### Condensers, Dielectric Losses in

A comparative study is being made of the methods used in measuring dielectric loss in condensers, especially those having a large value of capacitance. An air condenser is available with a capacitance 0.1 mf. which will withstand 3,000 volts without corona. By means of bridge methods the losses in other condensers may be compared with this condenser, which has a negligible loss. Other methods of measuring dielectric loss will also be investigated, particularly the electro-dynamometer method and the electrostatic wattmeter method.—*Bureau of Standards, Washington, D. C.*

[This investigation will be of considerable importance for the measurement of dielectric loss in power cables, in which this loss often limits the current rating.—EDITOR.]

### Grounding of Transmission Systems

A questionnaire was sent out, and the replies from thirty-one companies indicate a very wide divergence in practice. Some systems, including many miles of line at very high voltages, are apparently operating successfully ungrounded, although the trend is strongly toward a dead-grounded neutral for systems operating at 66,000 volts or above. For systems operated at lower voltages resistances of widely varying ohmic magnitude are used. Practice with reference to switching, type of ground used and other protective devices is also very divergent, and some unique schemes have come to the committee's notice.—*A. I. E. E. Sub-Committee on Grounding.*

## Suggestions for Research

### Cables, High-Tension, Dielectric Strength Test

The standards of the Institute cover only the maximum length of the sample and the limiting temperatures. The rules also specify the test voltage to be applied to full reels of varnished-cambric and impregnated-paper cables at the factory, but not the ratio between the dielectric strength and the high voltage applied to full reels. If the standards of the Institute should help to determine whether or not the cable is satisfactory for the proposed working voltage, then the rules should include a dielectric strength test so as to insure that the cable has a proper factor of assurance.—*A. I. E. E. Cable Research Committee.*

### Corona Loss Below the Visual Voltage

Peek's well-known quadrature law for the corona loss, $(e_v - e)^2$, holds true above the visual critical voltage $e_v$. Between $e_v$ and the lower disruptive critical voltage, $e_0$ the corona loss is erratic and depends upon the surface condition of the wire. It happens, however, that in many cases on actual transmission lines it is of importance to know the loss to be expected in this erratic region, for which we have no formulas. The most economical amount of copper or aluminum to be put in the line is sometimes determined by the loss at voltages below $e_v$. An extensive investigation in the range between $e_v$ and $e_0$ is desired, under the actual atmospheric and wire surface conditions met with on long transmission lines.—(See *A. I. E. E. Transactions*, 1918, Vol. 37, page 118.)

### Furnace, Electric, Non-Oxidizing

It is exceedingly difficult to have anything but a somewhat oxidizing atmosphere in the electric furnace chamber. This makes some process applications difficult, as, for example, the bright annealing of steel. For such applications the development of a furnace with non-oxidizing atmosphere is highly desirable.—*J. L. McK. Yardley, Pittsburgh, Pa.*

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Court Defines Wholesalers

**Co-operative or Mutual Associations, Although Buying in Wholesale Quantities, Are Retailers**

THE United States Circuit Court of Appeals, Second District, in a decision written by Judge H. W. Rogers and handed down this week in the case of the Mennen Company against the Federal Trade Commission, upset the ruling of the latter and elucidated many points under the Federal Trade Commission act as well as under the Clayton act. The right of a manufacturer to classify buyers was upheld, the court decreeing: "If real competition is to continue, the right of the individual to exercise reasonable discretion in respect of his own business methods must be preserved."

The court states that "the Mennen Company, acting independently, has undertaken to sell its own products in the ordinary course, without deception, misrepresentation or oppression, and at fair prices, to purchasers willing to take them upon terms openly announced. . . . The company is engaged in an entirely private business, and it has a right freely to exercise its own independent discretion as to whether it will sell to wholesalers only or whether it will sell to both wholesalers and retailers, and if it decides to sell to both, it has a right to determine whether or not it will sell to the retailers on the same terms it sells to the wholesalers. . . .

"It did not discriminate as between retailers, but sold to all retailers on one and the same scale of prices; and it did not discriminate as between wholesalers, but sold to all wholesalers on one and the same scale of prices.

### Mutual Corporations Retailers

"In conclusion," says the decision, "it ought perhaps to be said that we have not been unmindful of the fact that the Mennen Company, in classifying purchasers into two groups, those of wholesalers and retailers, placed in the group of retailers a class of mutual or co-operative corporations which purchased in large quantities the Mennen products. These mutual or co-operative corporations, it is admitted, consist solely of the retailers in the same line of trade, the stock being held exclusively by retailers.

"The fact that these individuals, admitted by the counsel for the Federal Trade Commission to be retailers, see fit for their own convenience to organize themselves into a corporation which they constitute their agent for purchasing purposes does not change their character or the character of their purchases and convert them into wholesalers."

The Circuit Court of Appeals, in the course of its opinion, discusses the Clayton act and also the Federal Trade Commission act and lays down a broad interpretation of these acts contrary to that heretofore adopted by the Federal Trade Commission. It concludes with the statement that "The Mennen Company is not shown to have practiced unfair methods of competition in commerce." The important bearing of this decision on the legal aspect of trade associations is obvious.

## Langmuir Talks on Increasing Electron Emission

Recent discoveries in electron emission and current control were related by Dr. Irving Langmuir before the Schenectady Section of the A. I. E. E. on March 16. He referred particularly to the increased electron emission obtained with new cathode materials, that of thoriated tungsten at 1,500 deg. absolute being 130,000 times that for ordinary tungsten. Other materials have even greater emissions. If very high voltages are applied to the anode, Dr. Langmuir declared, it is possible to pull electrons out of even cold cathodes, but they come from minute areas. Attention was also called to the effect of alkali vapors in vacuum tubes, it being pointed out that cæsium vapor will give an electron emission equivalent to 0.3 amp. per square centimeter of filament surface at temperatures below a visible red heat.

## Hoover for Interstate Power Treaty for Northeast

The next step toward the realization of the superpower plan in the Northeast, George Otis Smith announced at Washington on March 10, will be a conference between members of the superpower advisory board and representatives of the eleven state commissions having jurisdiction over public utility matters in that region. Commerce Secretary Hoover believes the most workable scheme to insure the co-ordination of these regulating bodies would be the drafting of an interstate treaty along the lines of the Colorado River compact.

An early effort will be made to have a legal study undertaken of the existing state statutes or regulations which would interfere with the superpower project.

## Pinchot Pleads with Smith

**Pennsylvania Governor Asks New York Executive to Discontinue Fight on Federal Power Board**

A LETTER sent by Governor Pinchot of Pennsylvania to Governor Smith of New York just after the message of the latter to the New York Legislature advocating state ownership, development and limitation of water powers asks Governor Smith to withdraw the suit now before the United States Supreme Court which seeks to annul the federal water-power law and to give each state the right to control the water power generated within its own boundaries.

Pennsylvania and New York should co-operate, Governor Pinchot writes in telling Governor Smith that he will regard with deep concern any movement to separate their mutual interests. Governor Pinchot holds that in exchange for power generated at Niagara Falls and along the St. Lawrence River, part of which could be diverted into northern and western Pennsylvania, that state could give to New York a percentage of the fuel power derived from its mines.

### Nation-Wide System Must Come

"After eighteen years of study and work upon this problem," Governor Pinchot says, "I have come confidently to expect the growth of a nation-wide interlocking power system. No small part of this future power development, especially water-power development, will, I believe, be made by state or municipal enterprise—some, perhaps, by national or even international undertakings.

"By proceeding under the federal water-power act and by accepting the preference it gives to state enterprise over private enterprise, New York can initiate the new policy under the most favorable circumstances and without the delay inseparable from litigation and can do so without jeopardizing the interests of other states. For it is true that by this statute, and by it alone, the rights of the people of all the states in water power are now safeguarded. If the State of New York should attempt, and unhappily succeed, in overthrowing it while safeguarding the rights of her own people, she would thereby strike down the people's rights in forty-seven other states which are not ready to undertake a state ownership policy at this time."

Governor Smith's answer had not been given out when the ELECTRICAL WORLD went to press.

## Topics at Oklahoma City

### Company Policies and Rates, Commission Control and Public Relations Discussed by Utility Men

ASSERTING that the three essentials of a successful public utility are an efficient and sufficient plant, intelligent supervision and organization and a form of rate that will distribute the costs of service equitably among all classes of customers, F. C. Hamilton, consulting engineer of the Cities Service Company, speaking before the fifth annual convention of the Oklahoma Utilities Association, held at Oklahoma City on Monday to Wednesday of this week, dwelt on the necessity for a proper rate form if these essentials are to be realized.

Mr. Hamilton advocated a three-part rate in which a fixed or readiness-to-serve charge, a demand charge and an energy rate are contained and asserted that one reason why the gas utilities, in spite of their advantage in number of consumers, have lagged behind the electric utilities is the fact that flat meter charges in place of rate forms that take into consideration the load factor and characteristics of the customer's demand have been employed ever since the inception of the gas business, while the electric utilities have utilized forms of rates that have taken these things into consideration and thus have encouraged rather than discouraged utilization of their service. He said that the flat meter rate penalizes the best users of service and, regardless of the specific value of the rate, will not build up a profitable business.

#### POWERS OF COMMISSIONS

In discussing the subject "Is Anything Ultra Vires in Utility Regulation?" E. F. McKay of the Oklahoma Corporation Commission called attention to the fact that utility powers are exclusive and not inclusive, since these powers are fixed by law and any case with which the commission is allowed to deal must possess a definite interest for the public. Commissions, he pointed out, have no arbitrary powers.

Martin J. Insull, in discussing "The Public's Interest in the Public Utilities," said that without disparagement of the technical and operating forces in the utility field the two big problems in that field are public relations and financing. Confidence in utilities on the part of the public is necessary, he continued, before financing can be carried on and the technical and operating talent have full play in establishing the service the public wants and is entitled to.

Charles B. Scott enumerated the benefits of accident prevention work in utility organizations as the establishment of public confidence, the building up of a proper relation between the company and its employees and the promotion of the most efficient operation. He asserted that the utilities in any community should not only participate but take the initiative in community safety efforts. The first essential in making safety work a success is interest on the part of the company management, the second interest by the supervisory forces and the third a definite plan and organization.

Labert St. Clair, the director of the advertising section of the American Electric Railway Association, told of the sympathy and human understanding that lie at the bottom of successful public relations work.

On Tuesday afternoon the Electric Light Division of the association listened to a discussion of how to prevent theft of electricity. The strengthening of the present Oklahoma law on this matter and the use of conduit entrances were favored. W. D. Riggs of Oklahoma City, who led the discussion, made a plea for the careful treatment and installation of meters, styling the electric meter the utility's cash register.

O. B. Seyster of Bartlesville, speaking on "Building Good Will," expressed dislike for the term "public good will" and suggested the term "customer good will." Educational work he held to be threefold—the education of employees, of the adult consumer and of the future consumer, now in the schools.

Gen. George H. Harries in an address on Wednesday expressed the belief that the period of ill-considered utility regulation is past and that regulatory commissions are now on the same plane as courts of justice and realize their obligation to see that both the public and the utilities receive just treatment.

The retiring officers were re-elected for the coming year as follows: President, Fred W. Insull; first vice-president, Sherman Mooter; second vice-president, J. C. Chestnut; treasurer, William Mee. O. D. Hall, who has been acting secretary, was chosen manager. C. L. Proctor of Joplin, Mo., was made chairman of the Electric Light Division of the association.

## Joint O. U. A. Session With Southwestern N. E. L. A.

That constitutions and laws are mere scraps of paper unless they exist in the hearts and minds of the people was the assertion of John W. Gleed, general attorney of the Southwestern Bell Telephone Company, in his discussion of public relations before the opening session of the Southwestern Geographic Division of the National Electric Light Association, which was a joint session with the Oklahoma Utilities Association, at Oklahoma City on Wednesday. Mr. Gleed told the delegates that utility owners and stockholders are vastly outnumbered and that in theory all sorts of dire things can come of regulation, since all utility matters, including the fate of regulatory commissions, are in the hands of the public. In the end the public will get about what is demanded as the result of its moral and intellectual level.

Henry S. Ives of the Casualty Information Clearing House of Chicago, in an address on "State Ownership and Operation of Insurance," made a plea for a stronger stand against state socialism and the building up of conditions under which individual initiative will be encouraged, declaring that he did not understand the term "saturation" as applied to the use of electrical energy and could see no likelihood of the result ordinarily understood by the term.

M. H. Aylesworth, executive manager of the National Electric Light Association, called attention to the growth of customer ownership and the growth of the utility business. Though it is not possible now, Mr. Aylesworth expressed the belief that eventually the farmer must be served by the central station.

The N. E. L. A. geographic division convention continued until Friday.

## Illinois Operators Discuss Educational Courses

The establishment of public utility courses in universities, to be patterned after the present courses in economics and business, received great attention at the third joint convention of the Illinois Utilities Association, held at the Hotel Sherman, Chicago, on Wednesday and Thursday of this week. Prof. Charles M. Thompson of the University of Illinois declared that the main outlines of such a course would be ready for next year's classes. He called this course descriptive engineering, a term which, while including the fundamentals of utility regulation, would give students a better appreciation of utility problems. Prof. Ralph E. Heilman, Northwestern University, added that such courses would afford utility companies the means of combating public prejudice through a loyal and aggressive personnel.

Britton I. Budd, president Public Service Company of Northern Illinois, insisted that the whole matter was "up to" the utilities, which should so handle the graduates they now employ that coming graduates would want to join their organizations. The movement was viewed with favor by Martin J. Insull, John F. Gilchrist, W. H. Sawyer and B. J. Denham.

On Wednesday afternoon H. E. Wulfing, Commonwealth Edison Company, spoke on the remote-controlled automatic substations installed in Chicago at an average cost of $2,160 for pilot-wire control. By means of two-line relays operating in synchronism through rotating wiping arms connected to twenty-five contacts all station operations can be controlled by the station dispatcher.

F. E. Goodnow, Public Service Company of Northern Illinois, presented a paper on the automatic feeder substations at Lemont and Barrington, the first of which has been in operation since Dec. 8, 1920, without any serious interruption of service.

The Thursday sessions were devoted to commercial problems with a symposium including talks on selling domestic appliances by R. S. Bell, on electric cooking by A. M. Lloyd and on convenience outlets and electrical homes by J. J. Kirk.

## To Finish Holtwood Plant

**Two 20,000-Hp. Turbines to Be Added by Pennsylvania Water & Power on Susquehanna**

COMPLETION of the Holtwood power station of the Pennsylvania Water & Power Company, on the Susquehanna River, is finally to be brought about, after almost ten years' delay caused by the war. A contract has been given the I. P. Morris Department of the William Cramp & Sons' Ship & Engine Building Company for the remaining hydraulic machinery needed, principally consisting of two 20,000-hp. Francis turbines of the I. P. Morris design.

The addition of this equipment will bring the station rating up from 110,000 hp. to 150,000 hp., for which it was originally planned. The present hydraulic equipment consists of eight turbines, all of I. P. Morris design and construction. The two new wheels will not only be much larger and more powerful than any of the older ones, but the delay has enabled the Cramp company to embody in them a number of improvements evolved since the original installation was made, in the design of draft tubes and so forth. All accessories are of I. P. Morris design and construction throughout.

The Holtwood station operates on an average effective head of 54 ft., the concrete dam being 55 ft. in height and half a mile long. The present battery of generators is of the three-phase, 25-cycle type, with 11,000 voltage at the generator terminals. This is stepped up by transformers to 70,000 volts for the long-distance transmission lines.

During the war the Pennsylvania Water & Power Company installed electric furnaces at the Holtwood station and produced a large amount of ferro-silicon and other alloys for military purposes. This plant, however, was discontinued soon after the armistice, and the company has no present intention of going outside its original field—the supply of electric light and power to the cities of its territory.

## Penn Central's New Plant at Saxton

Rapid increase of land has led the Penn Central Power Company of Altoona, Pa., which serves an area of 350 square miles with energy for coal mines and other industries, street railways and domestic lighting, to begin the erection of a plant at Saxton, Pa., close to coal mines, which will have an ultimate rating of 80,000 kva. The initial installation in the new plant will consist of two 12,500-kva. Westinghouse turbine-generators, three-phase, 80 per cent power factor, operating at 60 cycles and 13,200 volts. These turbines will operate under a steam pressure of 250 lb. and 200 deg. superheat. Excitation will be supplied from directly connected exciters rated at 75 kw., 250 volts, and there will be a 150-kw., 1,200-r.p.m. turbine-driven exciter for a spare. The turbine generators will have 17,500 sq.ft. of condensers. The boiler equipment will consist of four 1,100-hp. Babcock & Wilcox Stirling type units, equipped with eleven retort stokers made by the Taylor Stoker Company.

Four high-tension circuits will leave the plant at the present time. There will be two circuits carried on a steel tower from Saxton to Summit, a distance of 25 miles. These circuits will have No. 4/0 copper conductors. There will also be two circuits carried on a steel tower from Saxton to Lewiston, a distance of 53 miles, the conductors being of 250,000-circ.mil copper. Although these lines will operate for the present at 45,000 volts, they will be designed for 110,000-volt operation. There will also be two 13,200-volt feeders for supplying power in the vicinity of the plant.

## Plan Intercompany Plant

**Steam Station at Fall River Projected to Meet Needs of Three New England Companies**

PLANS are maturing for the construction of a large steam generating plant at Fall River, Mass., to meet the requirements of increasing loads on the systems of the Fall River Electric Light Company, the Edison Electric Illuminating Company of Brockton, Mass., and the Blackstone Valley Gas & Electric Company, Pawtucket, R. I. It is proposed to erect the station in the vicinity of the present generating plant of the Fall River company on Mount Hope Bay, with ample facilities for condensing water and fuel supply, both oil and pulverized coal being under consideration. The estimated cost of the initial development, which would involve the installation of one 30,000-kw. unit at Fall River and the construction of high-tension steel-tower lines totaling 25 miles in length between Fall River and Pawtucket and Fall River and Brockton, is about $5,000,000. The preliminary investigation, which has been under way for the past two years, has been handled by Stone & Webster, Inc., Boston, managers of the Blackstone Valley and Brockton companies. Over a term of years the plant at Fall River would probably be enlarged to 150,000 kw. or over. The interconnection of the three systems would result in marked economies in fuel and labor costs and enable full advantage to be taken of diversity factors and reserve capacities.

It is proposed to organize the Montaup Electric Light Company, to be owned by the three utilities named, in order to build and operate the plant and lines concerned. The Massachusetts Gas & Electric Association recently filed a bill in the State Senate at Boston authorizing the ownership of electric company securities by other companies under the supervision of the Massachusetts Department of Public Utilities. The commission is in favor of the bill, and there was no opposition to the plan at a hearing last week before the committee on power and light.

## Power on the Farm

**Committee on Electricity in Agriculture Organized to Get Data and Conduct Research**

A COMMITTEE on electricity in its relation to agriculture was formed at a meeting in Chicago on Thursday of last week at which representatives of the rural lines committee of the National Electric Light Association, the American Farm Bureau Federation, the American Society of Agricultural Engineers and the United States Department of Agriculture were present. The result of the meeting was an outline study of the farm power problem from which it is hoped a rational plan for the utilization of electrical energy on the farm will come. As a basis of future work the farm power committee of the United States Department of Agriculture will be asked to undertake a complete farm-power survey covering all types of farm power, both animal and mechanical. In the same investigation the amount of power required for the various farm operations will, it is hoped, be analyzed and the whole worked into such form as will make it most useful in the study of the relation of electricity to agricultural work.

The N. E. L. A. will be requested to undertake this from the central-station angle, while similar data will be obtained from the individual plant field. Among other things in this analysis, the extent of rural lines, number of consumers on such lines, energy used, farm operations which make use of electrical energy and the present cost of the service to the farmer will be ascertained.

An outline of the investigations to be carried on under the supervision of the committee, which was organized with J. C. Coverdale, executive secretary of the American Farm Bureau Federation, as chairman and G. C. Neff, chairman of the rural lines committee of the N. E. L. A., as secretary, is as follows: (a) Farm-power survey; (b) survey of central-station and isolated-plant service to the farmer; (c) survey of agricultural uses of electricity in foreign countries, and (d) experimental and research work on the uses of electricity in agriculture.

## N. E. L. A. Retires Its Overhead Lines Specifications

Formal action has been taken by the overhead systems committee of the National Electric Light Association to withdraw the standards and specifications for materials and methods of construction for overhead lines that have been generally know as the "1914 specifications," these specifications having been superseded in fact by later specifications or rules, notably the National Electrical Safety Code, which is now an American engineering standard. The overhead systems committee has passed resolutions of withdrawal which have been approved by the executive committee of the National Technical Section of the N. E. L. A.

## Further Growth in Georgia

**New Development Program Will Cost Eleven and a Half Millions More—Unfailing Power Sure**

ASSURANCE that north Georgia is to have dependable hydro-electric power in such abundance that any community on the lines of the company can guarantee to prospective industries an ample supply is contained in an announcement just made by the Georgia Railway & Power Company, of which P. S. Arkwright is president, of a development program totaling $11,568,000 in addition to the program of $6,500,000 already announced for 1923. (See ELECTRICAL WORLD, Jan. 27, page 234.) The new program, on which work is announced to begin within a few weeks, will make the deliverable output of the company two and a third times the present capacity. Provision is made, among other items, for four new water-power plants. The developments to be made during the years 1923 to 1926, inclusive, bring the total cost of the company's announced program for enlargements and improvements of service to more than $18,000,000. The deliverable output of the company will be increased from 272,000,000 kw.-hr. to 635,000,000 kw.-hr. per year.

### Work to Be Started This Summer

Construction will be started on the first two of the four new power plants this summer and carried along at the same time with the work in progress on the Tugaloo and the Mathis-Tallulah water-power plants. These two new plants will be at points yet to be determined on either the Tallulah or Tugaloo River. Of the two other power plants to be erected, one will be at the Burton dam, the largest storage reservoir of the company, and the other (the Seed development) on the Tallulah River between the Burton and the Lakemont or Mathis dams. The Seed development is to be finished in 1925 and the Burton development in 1926. Coincident with the construction of the new power plants necessary transmission lines, substations, etc., will be built in order that the energy may be ready for delivery at the earliest possible moment. Transformer stations are to be erected at Lafayette, Chickamauga, Marietta and Summerville, and extensive improvements are to be made on the Butler and Davis Street steam stations in Atlanta in addition to those already announced, in order that the company may always have ample steam reserves.

### Water to Be Used Six Times

Water of the Tallulah and Tugaloo Rivers will be used six or more times to generate power under the proposed developments—first at the Burton power plant, then in the lake to be created by the Seed development, on through the Seed power plant, the Mathis Lake and power plant, the Tallulah lake and power plant, the Tugaloo lake and power plant, and also the two other power plants at locations not yet decided upon. Not later than by the end of 1926, according to the official announcement, power from seven water power plants will be actually in use, all of it controlled through the great control switching station to be erected at Tallulah this year, which will make it possible to switch power from any of the seven stations on to any of the transmission lines whenever desired.

# Hydro-Electric Growth on Pacific Coast

**Pit River Power House No. 3 to Be Started in Thirty Days with Capacity of 81,000 Kva.—New 22,000-Kw. Unit for Caribou—Seattle to Build 100-Mile, 165-Kv. Line**

CONSTRUCTION of Pit River plant No. 3, the second of a chain of power houses which will ultimately develop more than 600,000 hp. from the waters of the Pit River in northern California, will start within the next thirty days, according to an announcement made by John A. Britton vice-president and general manager of the Pacific Gas & Electric Company. The plant will have a capacity of three 27,000-kva. units and will be completed by the fall of 1925. The development will involve the expenditure of approximately $17,000,000. Pit River No. 3 will be about 12 miles below Pit River No. 1. The installation will involve the construction of a diversion dam 125 ft. high at a point 2½ miles below Peck's Bridge on the highway between Burney and Bartle. From this point a tunnel approximately 22,000 ft. in length, having a capacity of 3,000 cu.ft. per second, will carry the water to a point above the site of the power house. The plant will operate under a static head of 313 ft.

The initial step in the development will be the construction of an extension of the Pit River Railroad. The line will branch off at Cayton Valley and will follow the river in a southwesterly direction, a distance of 5 miles to the dam site. The road will then extend 5 miles further to the site of the power house. A gravity road will lower the material to the construction camp at the dam site before work on the permanent dam is started. A temporary diversion dam and tunnel will be constructed in order to facilitate construction work. The driving of the 4-mile tunnel will start immediately. The installation will also require the construction of 8 miles or more of double-circuit 220-kv. transmission line from Pit River No. 3 to the main transmission system.

In connection with the announcement relative to this latest step in hydro-electric development Vice-president Britton said: "The company on its electric service side is growing at a rate of 20,000 kw. to 25,000 kw. of peak load a year. Our engineers calculate that demands for electrical energy increase at the rate of 7½ per cent per annum, or an increase in kilowatt-hour requirements of 120,000,000 kw.-hr. a year. It was a pleasure to record the opening of Pit River No. 1 last fall; but this, despite the fact that it may be expected to contribute nearly 1,000,000 kw.-hr. a day to our electric distributing system, did little more than fill the gap between supply and demand that had been occasioned by a slackening in construction work during the war period itself. We expect to complete Pit River No. 3 by the fall of 1925, by which time, according to our calculations, the demands made upon us for electrical energy will have increased between 350,000,000 kw-hr. and 400,000,000 kw.-hr."

### Expansion at Caribou

Plans for the immediate installation of a third unit of 22,000 kw. capacity in the Caribou plant on the North Fork of the Feather River have been announced by J. B. Black, general manager of the Great Western Power Company of California. This addition to the generating capacity of the company will entail the expenditure of approximately $1,500,000. Surveying parties are already in the field and preliminary engineering work is under way. Bids for hydraulic and electrical equipment will be called for within the next fifteen to thirty days. The installation will include penstock, turbine, generator, exciter, transformers and other electrical equipment. Tunnels and transmission lines are already completed.

Increased load demands constitute the reason for the enlargement of the plant. At the present rate of growth the added power will be required within a year, and it is expected that the installation will be completed within that time. The present Caribou plant was placed in operation in the summer of 1901. The equipment includes two 30,000-hp. double overhung impulse wheels operating under a head of 1,080 ft. and two 11,000-volt, 22,223-kva. generators. The ultimate capacity of the plant is six such units.

### Skagit River Development

Bids for the construction of a hundred miles of 165,000-volt transmission line and telephone line from the Gorge Creek plant of the Skagit River development to the city of Seattle will be called for April 13, according to C. F. Uhden, chief engineer of the project. Specifications will be completed by March 30. The line will bring power from the Gorge Creek plant, the first unit of Seattle's municipal development program on the Skagit River, to a substation outside the city. The plant, which will have an initial capacity of 34,500 kw., will be completed late in 1923, and it is planned to have the transmission line ready for operation at the same time.

## Large Auto-Transformers for Southern California Edison

The Westinghouse Electric & Manufacturing Company has just completed for the Southern California Edison Company six of the largest single-phase auto-transformers ever built. The transformers are of the water-cooled type and are for outdoor service in the Eagle Rock substation of the company, to form a part of the largest 220,000-volt power system in existence. Each unit is rated at 36,700 kva., 50 cycles, giving a bank capacity of more than 100,000 kva., and is adapted for star-star connection with solidly grounded neutral, stepping down from 220,000 to 150,000 line voltages. A tertiary winding, connected in delta, is supplied for suppressing third harmonics in the voltage wave. The transformers are of the shell type and are designed to withstand without injury mechanical stresses due to short circuits. The tested efficiency was over 99 per cent.

The new transformers are to be used for changing the voltage of the two 150,000-volt lines now running between the Big Creek stations and the Eagle Rock substation to 220,000 volts. The Eagle Rock substation is designed for 150,000-volt incoming transmission lines, and, to avoid making changes in the substation, the new auto-transformers will be used to step down the 220,000 volts to 150,000 volts. The units are to be connected as an integral part of the 220,000-volt line, there being no circuit breakers in the high-voltage side. All the switching and metering will be done, as before, on the 150,000-volt side of the substation.

In addition to being the largest auto-transformers ever built, these units are

REAR VIEW OF AUTO-TRANSFORMER SHOWING ARRANGEMENT OF BUSHINGS

also the largest in existence for stepping down from a 220,000-volt line. An idea of their size will be given by the following figures: The tank, which has flat sides and half round ends, is 10 ft. 3 in. wide and 14 ft. 3 in. long. It is approximately 15 ft. high; the height from the ground to the tip of the condenser bushings is about 27 ft. Ten thousand pounds of copper and about 45,000 lb. of iron laminations were required for each transformer. Over a quarter mile of copper tubing was required for the coils, and at normal rating 75 gal. of water per minute must be circulated through them. The total weight of the complete transformer is over 90 tons, 9,050 gal. of oil being required for each tank.

## Prizes Offered for Letters on Customer Ownership

Financial and business publications generally, as well as a large number of national magazines of general circulation, are showing great interest in the growth of the movement for customer ownership of securities. Among these financial publications is *Forbes' Magazine*, which has offered $1,000 in prizes for the best letters replying to the question: "What are the benefits of customer ownership of public utilities?" This is an attempt to get the customer-owners' side of the new relationship between producer and consumer. The first prize will be $500, the second $200, the third $100, with forty prizes of $5 each. The contest will close May 19, winners to be announced in the June 9 issue of the magazine. Letters may be any length and competitors need not be subscribers.

At a recent dinner in New York officials of a number of electric light and power concerns, comparing figures and estimates, arrived at a total of $175,000,000 as the aggregate of stocks sold during 1922. Inasmuch as a leading investment bond house estimates total sales of $550,000,000 in bonds, this indicates a grand total of $725,000,000. Customers, a recent compilation shows, now own 1,320,000 shares of stock in eighty-four central-station companies which have reported out of two hundred engaged in the sale of securities to customers. One customer in every eighteen now owns stock, and the average purchase is seven shares.

# Modifications Made in Electrical Code

### Solid Neutrals Permitted as Are 15-Amp. Fuses on 125-Volt Branch Circuits—660-Watt Limitation Abolished—No Rule on Separation of Gas and Electric Meters

At least three very important modifications, so far as electric light and power companies are concerned, were made in the National Electrical Code at the meeting of the Electrical Committee of the National Fire Protection Association held in New York this week. These modifications were the permitting of solid neutrals, the sanctioning of 15-amp. fuses on 125-volt branch circuits, and the abolishment of the 660-watt limitation. The proposed addition to the code limiting the minimum separation of electric and gas meters was dropped. The outcome of other proposed revisions, such as the requirement of an insulating covering on overhead wires for voltages up to 5,000, the specification of outlet-box dimensions, the location of radio antennas with respect to power circuits, and the protection of motor circuits, will be reported in a later issue.

The new ruling on fusing branch circuits connected with mains which have one conductor grounded is worded to the effect that the fuse *may* be omitted in the branch circuit conductor of two-wire circuits connected with the grounded main conductor and *must* be omitted in three-wire circuits. In place of the old limit of 10 amp., there has been substituted a higher permissible fuse rating of 15 amp. for 125-volt branch circuits in general and 40 amp. for circuits designed for and serving "Mogul" sockets. With the ordinary sockets and receptacles twelve outlets are allowed per branch circuit instead of the old 660-watt limitation. By using conductors not smaller than No. 12 eight "Mogul" sockets may be connected per branch circuit.

Both of the proposed requirements on covering for overhead wires and dimensions of outlet boxes elicited considerable written and oral discussion at the public hearing preceding the final action of the Underwriters on the revision of the code.

According to the revised code radio antennas must be kept away from trolley circuits and conductors energized at more than 600 volts. Below this voltage ample clearance must be provided between the antennas and power circuits and durable construction must be employed.

## Proposed Changes in Tennessee Commission Law

A bill with the backing of the state administration is, it is announced, to be introduced into the Tennessee Legislature to amend the Public Utilities Commission act so as to vest in municipalities the right to make contracts and fix utility rates with local utility companies. Regulatory power over utilities doing an intercounty business will be left in the hands of the state commission. The measure will provide for appeal from a city's decision on local rates to the state commission, and from that body's ruling appeal may be taken by either party to the chancellor of the county and thence to the Supreme Court of the state. The bill also provides that final award by the highest reviewing body may not be retroactive. Electric light and power, telephone and other rates for state-wide systems will still be fixed by the commission.

## Utah Commission Weathers Legislative Attacks

The Utah State Legislature adjourned at midnight, March 8, leaving the Public Utilities Commission of the state in the same form as when the session began, several bills to abolish it and others proposing various changes having all failed of enactment.

## Jurisdiction Upheld

**United States Supreme Court Sustains Appeal from Oklahoma Commission to Federal Court**

THE clause in the Oklahoma constitution permitting appeal to the Supreme Court of that state from decisions of the Corporation Commission of Oklahoma does not preclude recourse to the federal courts also where constitutional rights are involved, according to a decision of the United States Supreme Court handed down on March 5. The decision, delivered by Justice Holmes, was in the case of the Oklahoma Natural Gas Company against the Corporation Commission and the case of the Oklahoma Gas & Electric Company and the Muskogee Gas & Electric Company against the Corporation Commission, the two cases being consolidated in the decision, as the questions involved were the same, although they were argued separately.

The companies had applied to the Corporation Commission for an increase in rates established by the commission for natural gas supplied consumers. The applications were denied. The companies then appealed to the State Supreme Court, which under the Oklahoma constitution has the power to hear such appeals and to substitute other orders and grant a *supersedeas* in such matters. The State Supreme Court refused to grant the *supersedeas* and the appeals are still pending before that body. Alleging that present rates are confiscatory, the companies filed suit in the federal district court, asking a temporary injunction against the Corporation Commission to permit higher rates. Three judges heard the application for injunction and refused it on the ground that relief was provided by the state laws. An appeal was then taken by the companies to the United States Supreme Court.

In the decision rendered by Justice Holmes it is declared that the district court followed a precedent which does not apply to these cases. It is pointed out that if the present rates are confiscatory, the companies daily are suffering loss, from which there can be no future redress even if in the future higher rates are granted. The cases were reversed and remanded for further proceedings in the district court, with instructions that the applications for temporary injunctions be heard by that court.

## City May Not Intervene When Utility Sues Commission

A decision with a wide-reaching bearing on the regulation of utilities by state commissions was handed down by the United States Supreme Court March 12, when it affirmed the action of the United States District Court for Southern New York in refusing the petition of the city of New York to be made a party defendant to the suit instituted by the New York Telephone Company against the members of the New York Public Service Commission, the commission's counsel and the Attorney-General of the state to enjoin orders reducing rates.

Two orders of the commission were involved, one affecting rates within the city of New York and the other affecting rates within the state and outside the city. The company, alleging that the proposed rates were confiscatory and in violation of the Fourteenth Amendment to the Constitution, applied for an injunction in the District Court. The city attempted to intervene as a party defendant, but was refused permission by the court. An interlocutory injunction was issued and the decision granting this injunction was appealed to the United States Supreme Court, where it has been argued but not decided.

The decision of March 12 applies only to the appeal of the city against the lower court's ruling as to making it a defendant. In the decision, read by Chief Justice Taft, the Supreme Court holds that the New York Public Utilities Commission has jurisdiction throughout the state, within the city of New York as well as outside, that the city's only interest in the case is that of a subscriber to telephone service, and that even as such its interest in the rate order is not direct as its own rates are settled by a special contract.

## Vote on Pending Milwaukee Contract May Be Had Soon

The proposal for the city to take over the properties of the Milwaukee Electric Railway & Light Company under the service-at-cost plan, with the object of ultimate purchase of these properties by the city, will not be put up to the voters of Milwaukee on April 3, as was intended, according to information just given out by Fred S. Hunt, chairman of the public utilities acquisition committee, inasmuch as negotiations covering several points of importance are still in progress between the committee and attorneys for the company. A special election may be called later in the spring, at which time the people will be asked to pass on any contract finally agreed upon between company and city officials. Mr. Hunt said the new report would differ from the first one made to the council two years ago in that, instead of dealing with the situation generally, terms of a specific contract would be laid down.

## Arizona Rejects Colorado River Treaty

Twenty-two "willful men" stood in the path of the immediate ratification of the Colorado River compact. This, the ELECTRICAL WORLD'S Washington correspondent says, is how one federal official described the action of the Arizona Legislature on March 10, when by a vote of 22 to 22 the bill for ratification failed. The thought in official circles in Washington seems to be that these twenty-two men have taken upon themselves a very grave responsibility, since they have set up their judgment against that of an overwhelming majority. At their door must be laid the blame not only for delaying the development of the whole river, but for continuing the peril of floods, which carries with it the possibility of enormous loss of life and property.

As previously reported in the ELECTRICAL WORLD, the treaty was ratified by five of the seven states concerned—California, New Mexico, Utah, Wyoming and Nevada — and Colorado would almost surely have acted in the affirmative had Arizona done so.

## Wisconsin Utility Men Will Discuss Code

Automatic substations, code requirements affecting transmission lines and supply stations and their effect on the fire insurance rates of electric utilities will be among the subjects to be discussed next week by the electric section of the Wisconsin Utilities Association at the first annual convention of this body, which was organized last year to combine electric light and power, electric railway and gas utilities in one organization. The convention is to take place on Thursday and Friday at the Hotel Pfister, Milwaukee. The morning sessions will be joint ones, and there will be parallel section meetings in the afternoon. The tentative program for the electric sales and accounting sections is as follows:

ELECTRIC SECTION, MARCH 22

*Afternoon.*—Chairman's address, C. R. Phenicie; report of committee on electric meter school, George E. Wagner; report of committee on rural lines, R. G. Walter; "Automatic Stations and Their Application," C. W. Place, General Electric Company; progress report on electrical fellowship, Prof. Edward Bennett, University of Wisconsin; round-table discussion on "Inductive co-ordination," L. N. Boisen, A. J. Goedjen and G. C. Neff.

SALES SECTION, MARCH 22

*Afternoon.*—Chairman's address, A. E. Gerg; "Selling the Commercial Department to the Employees," W. T. Bracken, Beloit; "Business Ethics," Oscar Stotzer; "Manufacturers' Relation to the Sales Department," W. E. Derwent; "Electrical Merchandising," Thomas Casey; address, John F. Gilchrist, Commonwealth Edison Company, Chicago.

ELECTRIC SECTION, MARCH 23

*Afternoon.*—Report, B. F. Lyons, Great Lakes Division, N. E. L. A.; round-table discussion on Wisconsin State Electrical Code: "Features of Particular Concern to the Industrial Commission," John A. Hoeveler, Industrial Commission of Wisconsin; "Important Provisions of the Code Affecting Supply Stations," George G. Post, Milwaukee Electric Railway & Light Company; "Climbing Space, Clearances and Grading Requirements," William H. Damon, Railroad Commission of Wisconsin; "Code Requirements Affecting Transmission Lines," Edward J. Kallevang, Wisconsin Power, Light & Heat Company; "The Code from the City Inspector's Viewpoint," William A. Haig, Milwaukee; "Effect of the Code on Factory Application," George E. Cooper, Allis-Chalmers Company; "Effect of the Code on Fire Insurance Rates of Electric Utilities," Frank R. Daniels, Wisconsin Inspection Bureau; "Employees' Safety Rules," George E. Wagner, Madison Gas & Electric Company; "Important Interpretations and Applications Since the Issuing of the Code," Charles B. Hayden, Railroad Commission of Wisconsin; questions and general discussion of the code, including grounding requirements and other features not already covered.

ACCOUNTING SECTION, MARCH 23

*Afternoon.*—Chairman's address, C. E. Kohlepp; "Consumers' Meter Reading, Billing and Bookkeeping," Indmann P. Marking, Wisconsin-Minnesota Light & Power Company.

## Many Licenses Granted

**Federal Commission Gives Mississippi Sites to Little Falls Company —Feather River Conflict**

CONTRARY to expectation, the Federal Power Commission ruled in favor of the Little Falls Water Power Company in the conflict between it and the Pike Rapids Power Company for sites on the Mississippi at points near Royalton, Minn. It was a case of property rights versus a going concern. The Pike Rapids Company had 80 per cent of the land and flowage rights. There is particular interest in the project since the market for power in that vicinity is growing rapidly. Since the project had not been advertised, the commission will have to pass on it again after the law in that respect has been complied with.

### Rocky Mountain Power to Get Flathead Lake Site

Acceptance of the application of the Rocky Mountain Power Company for a preliminary permit covering the site at the outlet of Flathead Lake will be recommended. The applications of the Montana Water Power & Electric Company and of the Flathead Valley Electric Company for licenses covering that site were rejected. The Rocky Mountain Power Company is affiliated with the Montana Power Company and the Anaconda Copper Mining Company. It is planning a full development. The State of Washington, however, is insisting on certain stipulations, and no action will be taken until after a hearing.

Licenses were authorized for the Washington Coast Utilities Company of Arlington, Wash., covering a transmission line near Waterville, Wash.; for the White & Johnson Construction Company of Denver, covering a transmission line near Glenwood Springs, Col.; for the Minnesota Utilities Company of Eveleth, Minn., covering a transmission line in St. Louis County, Minn.; for the Ante-Up Mining Company of Nevada City, Cal., covering a transmission line in the Tahoe National Forest; for the Southern California Edison Company, covering a short transmission line near Los Angeles; for the San Diego Consolidated Gas & Electric Company, covering a transmission line in the vicinity of Escondido, Cal., and for the Southern Alaska Canning Company of Seattle, covering a minor project at Big Port Walter Falls, Alaska.

The Caddo River Power & Irrigation Company was authorized to assign its license covering the Narrows site on the Ouachita River to the Arkansas Light & Power Company.

A preliminary permit was granted to Lars R. Jorgensen of San Francisco covering a project on Bean Creek, which carries with it four headwater reservoir sites. A conflicting application by L. O. Griffith of Oroville, Cal., was rejected, as were applications by R. T. Harding of San Francisco and the Great Western Power Company. Mr. Jorgensen applied for permits covering six sites at which a total of 350,000 hp. can be developed on the Middle and South Forks of Feather River and on Buck Creek on the North Fork of the Feather River. The commission offered him a preliminary permit for any one of the six projects except the one at Buck Creek, which is in conflict with interests of the Great Western Power Company. That company has a number of developments on the North Fork which the commission believes should be undertaken before the Buck Creek project is developed, because of cheaper unit costs.

The application of the Kootenai Power Construction Company of Wilmington, Del., for a preliminary permit for a project on the Kootenai and Yank Rivers was denied because the commission believed that the project could not be financed. The application of an association of citizens in Batesville, Ark., for a preliminary permit to develop power at United States Lock and Dam No. 2 in the White River was also denied.

The preliminary permit granted James B. Girand for his Diamond Creek project on the Colorado River was extended six months from March 19. Mr. Girand's application for license is being held up pending ratification of the Colorado River compact.

### A Boulder Canyon Project

Formal application has been filed with the commission by G. Henry Stetson for preliminary permits covering developments on the Colorado River which have been the subject of discussion for some time. His proposal for the development of the Boulder Canyon site specifies a rockfill dam 1,064 ft. above the present water surface of the river and the storage of 155,000,000 acre-feet. He estimates that the power capacity of the project will be 1,600,000 hp. In another application he asks for a preliminary permit to build a rockfill dam 70 ft. high at Bull's Head Rock, 40 miles above Needles. He estimates that 160,000 hp. would be developed at that point. The plan is to utilize that power in the construction of the Boulder Canyon dam. Engineers of the federal government who are familiar with the Colorado River situation are not impressed with the scheme proposed, and since it conflicts with most of the plans for the development of the river, the prospects are that these applications will not be granted.

### Appalachian Projects

The Federal Power Commission has applications covering hydro-electric projects in the Appalachian Range alone which aggregate 2,000,000 hp. This does not include the power possibilities of the Delaware, the Susquehanna and the Potomac, which represent more than a million horsepower in themselves. In the area bounded by the Clarion River on the north and the Tallapoosa River on the south there are also many sites which have not been covered as yet by applications to the commission.

In the opinion of the chief counsel of the commission the rights granted under a preliminary permit remain in force until the commission acts on the application. The opinion will come before the commission for approval. If approved, it will prevent the annoyance occasioned by renewals.

## Great Falls Project Again Attracts Notice

With the expiration of the two-year period during which the water-power act gives Congress an opportunity to consider any development which the federal government is likely to undertake, interest again is being manifested in the Great Falls project on the Potomac. Stinemann & Quick of Baltimore are the only actual applicants for a preliminary permit covering that development, but it is understood that other interests are considering the project.

## Kettle Falls Development to Start This Summer

The project of the Washington Water Power Company at Kettle Falls promises to be the first going hydro-electric project on the Columbia River proper. All plans have been completed to go forward with construction this summer. D. L. Huntington, the president of the company, conferred with officials of the Federal Power Commission last week in regard to the license to cover the project. It is understood that J. L. Harper, the chief engineer of the Niagara Falls Power Company, has been engaged as a consulting engineer to assist in the preparation of the plans.

The principal engineering problem involved is the construction of the spillway gates. On account of the restricted channel of the river and the depth of the water, the gates have to be as long as possible in order to avoid interference with spillway capacity on account of the thickness of piers. Mr. Huntington has in mind the installation of gates 75 ft. long and has been visiting projects where the gates are of unusual length. It is believed, however, that there are no existing spillway gates of the length of those proposed for the Kettle Falls project.

## Maine Companies Plan Interconnection

Interconnection of the lines of the Central Maine Power Company and of the Milo Electric Light & Power Company will shortly be accomplished by permanently arranged tie transformer facilities, a temporary connection having been placed in service on Feb. 4. The Milo company owns two hydro-electric plants of about 750 kw. combined rating on the outlet of Sebec Lake, and connects at Dover with the Central Maine company's 33,000-volt lines. Economical use of water on diversified sheds will be made possible by

the interconnection with efficient employment of spare capacity in stations. The hydro-electric plants on the Androscoggin and Kennebec Rivers in Maine have been interconnected for nearly two years, with excellent results in the saving of fuel and water on the Central Maine system, and another advantageous interconection has been in use for still longer between the plant of the Cumberland County Power & Light Company, Portland, and the plants of the S. D. Warren Company in the Westbrook region.

# Wisconsin's Growing Water Power

### Developments Now Proceeding on Chippewa, Flambeau and St. Croix Rivers in Northwestern Part of State—Three Great Holding Interests Concerned

MANY items about the expanding development of the water-power sites of Wisconsin have from time to time appeared in the news columns of the ELECTRICAL WORLD. The total developed water power of the state is now put at 400,000 hp., and the total yet to be developed at approximately 300,000 hp. The most active development is taking place probably in the northwestern part of the state in the Chippewa, Flambeau and St. Croix valleys.

On the Chippewa the Wisconsin-Minnesota Light & Power Company, which owns a 45,000-hp. plant at its Wissota dam, 4 miles above Chippewa Falls, is building a supplementary plant at Jim Falls, still further up the river. This plant will develop 15,000 hp. The Wisconsin Light & Power Company, the operating company for the Kelsey-Brewer interests, controls not only the Wissota and Jim Falls power plants, but two plants on the Red Cedar River, at Menomonie and Cedar Falls, in Dunn County.

The company has also a storage lake at Pa-Kwa-Wong, below the junction of the east and west forks of the Chippewa River at the headwaters, in Sawyer County; the Turtle River reservoir on the headwaters of the Flambeau just below the junction of the Turtle and Flambeau Rivers, in Iron County, and the old lumber drive dams, at present abandoned, at Chippewa Falls and Holcombe on the Chippewa.

BIG FALLS DEVELOPMENT

Another large water-power development in the northwestern part of the Badger State is that at the Big Falls site above Ladysmith in the Flambeau Valley, where a dam is being built by the Lake Superior District Power Company of Ashland, Wis., an Insull property. Although the dam is not yet quite complete, power began to flow from this plant early last December. A 40-ft. head is maintained now, but when the new dam is completed the plant will have a 52-ft. head and a maximum of 16,000 hp. Properties have been purchased and power sites installed by the Insull interests all the way northward to Ashland and the Lake Superior coastal region.

MAP OF HYDRO-ELECTRIC DEVELOPMENTS IN NORTHWEST WISCONSIN

At St. Croix Falls, on the St. Croix River, which forms part of the boundary line between Wisconsin and Minnesota, extensive developments are now under way by the Northern States Power Company, controlled by H. M. Byllesby & Company, to which the Federal Power Commission granted a license. From this site power is to go directly to St. Paul and Minneapolis, 30 miles distant, to the disappointment of Wisconsin communities in the neighborhood of the site, which had foreseen rapid industrial development from its exploitation by a company interested in local development rather than in an urban market in another state.

## Manitowoc Decides to "Go It Alone"

Manitowoc, Wis., which has been facing the problem of how to increase its supply of electrical energy, either a large addition to the municipal plant or a contract with the Wisconsin Public Service Corporation for power from its High Falls hydro-electric plant having become necessary, has finally, through the City Council and after much discussion, declined an offer from the Wisconsin Public Service Corporation to furnish power at the actual cost of manufacture at the switchboard.

The city, some of whose representatives saw in the company's proposal a move to get ultimate possession of the municipal plant, will, according to the Mayor, be in a position to produce power as cheaply as the private company as soon as the additional capacity now determined on is installed. It will then be able to dispose of surplus power to the company, local officials hold, if the company desires to purchase it, but no agreement with the company for helping each other out can be entertained by the city now, as it is operating at full peak load at all times. Under the regulations governing the Public Service Corporation's existing business in Manitowoc the company is barred from supplying consumers using less than 40 hp. daily, this business being diverted to the municipal plant.

Similar conditions as regards the need for more power than the municipal plant can supply exist in Marshfield, Wis., and in Rochester, Minn., in both of which cities the project of seeking relief from the High Falls plant has been discussed. Marshfield has rejected proposals from both the Wisconsin-Minnesota Light & Power Company and the Wisconsin Valley Electric Company to erect high-tension lines to bring in additional power and is advertising for bids for new equipment.

DAM AND POWER HOUSE AT BIG FALLS, ON THE FLAMBEAU RIVER, WHERE 16,000 HP. WILL BE DEVELOPED

## S. E. D.'s Classification of "Electrical Fires"

Fire underwriters and other insurance organizations have expressed interest in the proposed classification of fires attributable to electrical origin which originated with the Society for Electrical Development some months ago, and the Electrical Manufacturers' Council, among others, has indorsed the plan. This classification as recently revised and agreed upon is as follows:

1. Fires caused by defective or improper wiring, substandard apparatus and installations, etc.
2. Fires caused by overfusing and overloading electric circuits.
3. Fires caused by electric flatirons, curling irons and similar devices, worn portable cords, old electrical appliances, etc.
4. Fires caused by street-railway current, automobile electric systems, high-tension power lines, etc.
5. Fires caused by static electricity, lightning and electrical disturbances over which little control is as yet possible.

This scheme not only classifies electrical fires according to their origin, but puts the blame for each clearly and directly on the cause responsible.

## Engineering Museum to Be at Washington

It is regarded as probable that the proposed historical museum of engineering will be established at Washington, with local museums in different parts of the country. The Smithsonian Institution has agreed to act as custodian of existing collections and urges that they be made the nucleus of a great national museum of engineering and industry.

Edward D. Adams and Charles L. Clarke represent the American Institute of Electrical Engineers on the joint committee of the four founder engineering societies having the matter in charge.

## More Industrial Electric Heating Material

Engineers interested in industrial electric heating have been heard from in so many quarters that plans are afoot to publish in the near future the co-ordinated notes of many who took the courses in this subject last year under the auspices of the Power Sales Bureau of the N. E. L. A. and through the co-operation of leading manufacturers of such equipment. V. M. F. Tallman of Charles H. Tenney & Company, Boston, informed a representative of the Electrical World recently that it has been planned to make these notes generally available in the near future. Under the auspices of the N. E. L. A. a "Syllabus of the Industrial Heating Course" held at the Engineers' Club, Boston, in 1921 has now been printed, and Mr. Tallman will be glad to care for orders for copies at $2.50 each. Another useful early publication will be a directory of manufacturers and users of industrial electric heating equipment in the United States.

## Brief News Notes

**Uniform Accounts Ordered in Colorado.**—The Colorado Public Utilities Commission has issued an order that all electrical utility companies doing business in the state shall keep their accounts in accordance with the system worked out by the National Association of Railway and Utilities Commissioners and now in operation in many states.

**N. E. L. A. Tells of Its Activities.**—For the information of members and prospective members the National Electric Light Association has just issued a twenty-eight-page pamphlet explaining its activities, outlining the duties of its various sections and of some important committees and containing other useful information. It is entitled "Activities of the National Electric Light Association."

**Joint Committee to Publish Booklet for Truck Users.**—The newly created electrical transportation department of the Joint Committee for Business Development, of which Charles R. Skinner, Jr., of the New York Edison Company is chairman, has determined upon the publication of a booklet containing data of interest to prospective electric truck users. Members of the department are now at work gathering this information.

**Pacific Gas to Take Over Telephone Company.**—The Pacific Gas & Electric Company has, it is announced, completed arrangements for the acquisition of the California Telephone & Light Company on a basis of exchanging the preferred stocks of the two companies on a par for par basis and the junior stocks on the basis of one share of Pacific Gas & Electric for three shares of California Telephone Company.

**Plymouth, Wis., to Buy Energy.**—Electrical energy is to be purchased by the city of Plymouth, Wis., from the Eastern Wisconsin Electric Company for a period of one year, with the privilege of entering into a ten-year contract at rates quoted by the company. Plymouth had operated a municipal electric light and power plant for many years, but, in view of growing demand, found upon investigation that a great saving could be made by purchasing energy from private sources.

**Hydro-Electric Project on Grand River, Okla.**—Preliminary steps for constructing a dam and hydro-electric plant near Ketchum, on the Grand River, in Mayes County, Okla., are being completed. The project will, it is said, ultimately involve an expenditure of $28,000,000 and will develop 150,000 hp. The fall is 150 ft. The plan is not to build the large dam first, but to build a smaller one further down the river at a cost of $600,000 to provide power while the big dam is being constructed. The company will sell no power at retail but only at wholesale.

**Geological Survey's Figures the Basis.**—Attention is called by the United States Geological Survey to the fact that the figures printed in the Electrical World for Jan. 27, page 239, on the consumption of natural gas for fuel in electric power plants as of September last did not represent an independent investigation by the Texas Public Service Information Bureau, as the item implied, but were merely an analysis of the comprehensive table issued every month by the Geological Survey from figures obtained and compiled by it.

**Montana Utilities May Be Taxed 2 per Cent on Receipts.**—Power companies generating or transmitting electric power in the State of Montana will be taxed 2 per cent of their gross receipts if a bill introduced in the State Legislature becomes law. The bill for the additional tax upon power companies provides that each company, in addition to the reports otherwise required, must submit, at such times and in such manner as may be stipulated, reports and information that may aid in arriving at the true gross receipts.

**Commonwealth Power Corporation.**—Commenting upon the operations of the Commonwealth Power Corporation and its various subsidiaries in the year 1922, President George E. Hardy says that the total sales of electrical energy were 491,257,792 kw.-hr., an increase of 72,164,525 kw.-hr. over 1921. More than 23,000 electric meters were installed in the year. Gross earnings of all the properties were $26,386,030, as compared with $24,863,983 last year, and $4,022,597 was available for dividends, replacements and depreciation, or $16.76 per share of preferred stock.

**Syracuse University to Give Course for Metermen.** — Syracuse University has joined the many now giving spring courses for electric metermen. At the request of the Empire State Gas and Electric Association and the National Electric Light Association the extension division of the university, in conjunction with the Syracuse Lighting Company, is offering a course for the last week of March. It will consist of a combination of lectures, discussions and actual meter laboratory practice. The regular routine of the course will be supplemented by talks by engineers.

**Safety Conference Takes Up Question of Platforms in Front of Electrical Machinery.**—At a recent conference in New York attended by sixty-three representatives of trade associations, technical societies, safety organizations and government departments, which unanimously declared that "it is desirable to have a nationally uniform safety code on walkway surfaces," one of the recommendations was that the sectional committee consider the insulation and non-slip qualities desirable in platforms erected in front of electrical apparatus, with especial reference to switchboards and floors around machinery in motion.

**For a National Hydraulic Laboratory.**—One of the last acts of the Senate committee on commerce prior to the close of the session was to report favorably on the resolution providing for the establishment at Washington of a national hydraulic laboratory. The vote on the bill was unanimous. Although there was no hope of the Senate's taking action at the time the report was made, the indorsement of the committee will improve the prospects of the bill at the next session.

**A New All-Electric Paper Mill.**—In the illustrated description of the electrical equipment of the paper mill of the St. Maurice Lumber Company at Three Rivers, Quebec, which appeared in the March 3 issue, through an oversight no mention was made of the contracting firm which did the electrical work and a large part of the mechanical work in that notable installation. The Canadian Comstock Company, Ltd., New Birks Building, Montreal, was the electrical contractor. In addition to the wiring that company installed much of the electrical machinery and supplied the main switchboard, the transformers, high-tension switching equipment and a large number of motors as well.

**Modesto and Turlock Irrigation Districts in California Reach Agreement Over Power.**—The Modesto and Turlock irrigation districts in central California, which own jointly a power house at Don Pedro, have, after much controversy, at length reached an agreement over operation by which neither will sell power within the boundaries of the other unless one of them decides to wholesale its entire output, in which case the other may enter its territory. The Turlock district is reported to be almost ready to handle the power and distribute it in competition with power companies, it having obtained the permission of the city of Turlock to enter.

**Indian and Dog Team Restore Service to Blizzard-Swept Towns.**—Residents of three Minnesota cities, South St. Paul, West St. Paul and Northfield, thought when wires went down in a recent blizzard that they would have to pass several nights without electricity. Roads and streets were so badly blocked by snowdrifts that it was impossible for the regular repair wagons to get to the scene of the trouble, but by pressing into service a team of seven "huskies" driven by an Indian dog driver, who is also a line patrolman for the Northern States Power Company, the situation was met. A quantity of wire-mending equipment was placed on a sledge, manned by the driver and two repairmen, and in all three cities the break was repaired before night.

**Lightning Arresters Cause Slaughter of Birds.**—A report from the president of the Audubon Society of Florida that the equipment of the St. Petersburg Lighting Company had caused the destruction of at least twenty birds at one spot in that city within a short time led the company to make an investigation. It was found that the slaughter was due to the birds alighting on and bridging horn-gap lightning arresters, which at this point are installed partly in a large tree where the songsters congregate. To save bird life the company has now erected around the arresters simple structures consisting of two rods parallel to the plane of the horn gap but about three inches distant. One of these rods is raised about three inches higher than the horn and bent over it to serve as a perch—as inviting as the one it displaces and much safer.

**To Standardize Symbols and Abbreviations.**—The recent conference held in New York City under the auspices of the American Engineering Standards Committee to consider the unification of technical and scientific abbreviations and symbols revealed a sentiment among engineers, scientists, government officials, business paper editors and industrial executives to aid this movement. It was agreed that the standardization of abbreviations and symbols would result in large mental economies. It was thought desirable to include as a part of the project the graphical symbols which are used in engineering drawings and diagrams for representing instruments and apparatus and components of them. It was also agreed that the co-operation of foreign standardizing bodies should be sought in the development of the work, which will go forward under a committee organization developed in accordance with the rules and procedure of the American Engineering Standards Committee. Twenty-seven societies and other organizations were represented at the conference. Edward J. Cheney, George W. Metcalfe and C. H. Sharp represented the A. I. E. E.

# Associations and Societies

**Florida Engineering Society.**—The annual meeting of this society will be held at Jacksonville on March 19 and 20 in the Hotel Seminole. All interested in engineering are invited, whether members of the society or not.

**Federated American Engineering Societies.**—A meeting of the executive board of the American Engineering Council, executive body of the Federated American Engineering Societies, has been called for March 23-24 in Cincinnati. Government reorganization and reforestation will be among the chief questions to be discussed.

**American Association of Iron and Steel Electrical Engineers.**—This association will meet in Buffalo in September for the first time in its history. The meeting will be held in the Broadway Auditorium, which is now being overhauled and will provide the adequate facilities lacking in previous years.

**Engineering Council of Utah Elects Officers.**—At a meeting of the Engineering Council of Utah held at Salt Lake City on March 3 the following officers were elected to serve for the ensuing year: President, Dr. Joseph F. Merrill, director School of Mines and Engineering, University of Utah, and past-chairman of the Utah Section, A. I. E. E.; vice-president, W. E. Ware, architect; secretary-treasurer, Howard C. Means, State Road Engineer. The Engineering Council of Utah is the largest technical society in the state, representing about fifteen hundred men of the engineering professions.

**Joint Engineering Meeting on Hydro-Electric Power for New York.** — The metropolitan sections of the four major engineering societies are to hold a joint session next Wednesday, March 21, at 8 p.m., when a symposium on "Hydro-Electric Power for New York" will be presented. F. W. Scheidenhelm, consulting engineer, New York, will make a "Co-ordinating Statement of the Problem"; W. S. Murray, formerly chairman Superpower Survey, will give an "Approximation of Available Water Power and Cost of Delivery"; George A. Orrok, consulting engineer New York Edison Company, will speak on "Requirements of Service and Evaluation of Hydro Power"; F. A. Allner, general superintendent Pennsylvania Water & Power Company, on "Quality of Hydro Service," and Lorin E. Imlay, consulting engineer Niagara Falls Power Company, on "Reliability of Long-Distance Transmission." John P. Hogan and W. S. Finlay, Jr., will take part in the discussion, which will be open.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.

Middle West Division, N. E. L. A.—St. Louis, April 11-12. H. M. Davis, Bankers' Life Bldg., Lincoln.

American Society of Mechanical Engineers—Pacific Coast meeting, Los Angeles, April 16-18; general convention, Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Ohio Electric Light Association — Cedar Point, June 10-13.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association — San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Canadian Electrical Association — Montreal, June 20. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

# Recent Court Decisions

**Powers of Washington Department of Public Works.**—The Supreme Court of Washington in adjudicating a suit over jurisdiction brought by the Northern Pacific Railway Company against the Department of Public Works, which is the state body regulating utility companies, has held that though the statutes give the department broad powers to rescind or amend any order made, they do not give it jurisdiction to reopen after a lapse of four years a proceeding which has become final because no review was sought by the party injured thereby. (211 Pac. 876.)*

**Damages for Failure to Furnish Electric Service.**—In Huey vs. Wichita Falls Electric Company the plaintiff sought $30,000 damages for alleged breach of contract to light a tract owned by him in the outskirts of the city. A jury awarded him $14,000. The Court of Civil Appeals of Texas has reversed this award and remanded the case because double relief, by both damages and mandamus, was sought and the company's compliance with the writ made the award for continuing and indefinite failure to furnish lighting inequitable. The damages should be such, the court held, as proximately resulted from the delay in getting service. It refused to entertain the plea that the general manager of the company was not competent to make a binding contract in the absence of direct authority from the directors. (246 S. W. 692.)

**Negligence of Electric Company in Placing Guy Wire in Street a Question for Jury.**—The trial judge in Harris vs. Central Power Company, a suit to recover damages for injury caused by collision with a telephone-pole guy wire anchored 2½ ft. from the outer edge of the paving in a 20-ft. alley, held there was no showing of negligence on the part of the company and directed a verdict for the defendant. The Supreme Court of Nebraska, reversing this decision and directing a jury trial, sets forth that where an ordinance requires poles to be placed within or adjacent to the curb line of the street, the fact that the curb line and property line of an alley are the same, and that to place the poles adjacent to the curb line would cause cross-arms to extend over private property is no justification for the company to set its poles out in the paving, for it may either construct its cross-arms to extend from one side of the pole only or procure from private owners permission to let the cross-arms overhang their property. Testimony of experts that the poles and wires were erected according to the method generally approved by electrical engineers does not, the Supreme Court held, conclude the question of whether or not the placing of the guy wires in the alley, at the place and under the conditions in question, was a dangerous obstruction to public travel, negligently maintained, that being a matter within the range of common knowledge. (191 N. W. 711.)

**City Granting Permit for Manholes Has the Reserved Right to Rescind Grant.**—The Georgia Railway & Power Company and the Georgia Railway & Electric Company brought an equitable petition against the city of Atlanta to prevent the municipal authorities forbidding them to make certain manhole installations in the streets of the city which the companies contended were necessary in furnishing electricity. The Supreme Court of Georgia has, on a tie vote, given effect to the decision of the lower court sustaining the city, holding that in granting the original permit for the manholes it reserved the right to rescind the grant. The city did not refuse to allow the companies to open streets for the purpose of constructing conduits and ducts for wires or to construct manholes, but it denied their right to construct transformer stations therein, upon the ground that such stations would usurp one side of the street and interfere with its use for municipal purposes. (115 S. E. 263.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**Property Not Used for Utility Purposes Included in Valuation as Basis for Securities.**—The New Hampshire Public Service Commission has permitted the Exeter & Hampton Electric Company to include the whole value of an office building owned by it in a valuation made as a basis for issuing securities, although only part of the building is used for utility purposes. The commission decided that the entire property was a legitimate item in the capitalization of the company, although only that portion devoted to the service of the public could be considered in proceedings for fixing rates.

**Interests of Utility and of Public Identical.**—In its valuation of the Idaho Power Company the Public Utilities Commission of Idaho indicated three "angles of interest" which it must consider—those possessed by the consumers, the investors and the state. In the last analysis, said the commission, these do not conflict. "Whatever is conducive to the real interest of one is equally for the real interest of the others, while the cold, hard, uncomfortable measure of experience proves that any advantage one may gain over the others is temporary merely and invariably costs the one who gets it far more than it is worth. . . . The public can for a time force a level of rates below the point of fairness. By so doing it temporarily reduces the amount paid for service, but there promptly results a rapid reduction of quality and quantity of service. No one, whether it be an individual or a public, can for very long obtain more than is fairly paid for."

**Apportionment of Line Loss.**—Sixty per cent of the entire line loss of an electrical utility, the Midwest Power Company, was charged to the consumers in a village 7 miles distant from the generating plant, the North Dakota Board of Railroad Commissioners holding that the consumers near the generating plant should not be penalized by the excessive line loss to the more distant distribution center.

**Refunding—Amortization of Discount and Premium.**—The Arizona Corporation Commission has authorized as in the public interest the redemption by the Central Arizona Light & Power Company of 8 per cent fifteen-year bonds sold at 90 per cent of par and redeemable at 105 per cent and the issue in lieu thereof of 6 per cent twenty-year bonds at 88.45 per cent of par. The discount and premium on bonds which are refunded should, the commission asserts, be amortized over a period not longer than the life of the refunding bond, as this is part of the cost incident to the refunding process.

**Approving Securities of Interstate Utility.**—A state commission should, according to an opinion rendered by the Vermont Public Service Commission in approving securities to be issued by the Twin State Gas & Electric Company, approve the entire issue of securities for the construction of an interstate transmission line, instead of only that part for construction within the state, when the entire issue of securities for the proposed construction will be based on the properties of the utility in the state and there is no separation of the bonds and shares of stock and the proceeds of the same which will be used in construction in that state from stocks and bonds and the proceeds of same to be used in construction in the other state.

**Fixing Rates for a Utility Which Operates in Two States.**—In determining certain rates to be charged in Wisconsin by the Peninsular Power Company, a utility operating in both Wisconsin and Michigan, the Railroad Commission of the former state considered the total property value and the total earnings and expenses of the company, holding this to be a reasonable method where the characteristics of the business in the two states were alike. In effect the commission declared the rate arrived at proper for the entire property, though, of course, it could authorize it only in Wisconsin. There was only one consumer in Wisconsin affected, an iron-mining company, and the Peninsular Power Company agreed not to put the rate into force against this customer until the same rate shall have been established for its iron-mining customers in Michigan by the commission of that state.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## Albert Emanuel Heads Dubuque Company

Albert Emanuel of New York has been selected to succeed I. C. Elston, Jr., as president of the Dubuque Electric Company. At a recent meeting of the board of directors Mr. Elston, who for some time has been anxious to relieve himself of the responsibilities which for many years have rested upon him, withdrew from active connection with the operation of the utility. More than a year ago he withdrew from the presidency of the investment banking house of Elston, Allyn & Company and also disposed of his utility property at St. Charles, Iowa, and more recently he turned over the management of the electric light and street-railway company at Vicksburg, Miss., to owners of other utilities in the South. Mr. Emanuel, who is the chief executive of utility companies elsewhere in the Middle West, has purchased a controlling interest in the Dubuque company. O. H. Simonds, general manager of the company at Dubuque for the last five years, will continue in that post and in addition becomes vice-president of the company and a member of its board of directors.

**William T. Crawford** has succeeded George A. Peirce as secretary of the Columbus (Ga.) Electric & Power Company.

**Norman W. Mumford** has been elected vice-president of the Savannah Electric & Power Company to serve with Harry H. Hunt and Charles F. W. Wetterer.

**Thomas A. Edison** left his West Orange (N. J.) home on March 8 for his winter home at Fort Myers, Fla., where he will spend six weeks or more. He was accompanied by his wife.

**Judge Warren W. Foster** has been elected chairman of the executive committee of the American Light & Traction Company, New York City, succeeding the late Emerson McMillin.

**Edwin S. Bundy** is now in charge of the engineering department and chief engineer of the Niagara, Lockport & Ontario Power Company, with headquarters at Buffalo. Mr. Bundy joined the company in 1911 and served successively as draftsman, meter engineer, construction foreman and assistant superintendent. Before going to Buffalo he was superintendent of the Eastern division.

**A. T. Pamperin,** for many years president and manager of the Oconto (Wis.) Service Company, which was taken over by the Wisconsin Public Service Corporation recently, has become connected with the headquarters office of the Wisconsin Public Service Corporation in Milwaukee. C. M. Hasseler, who has been connected with the Wisconsin Public Service Corporation for some time, has been made manager of the Oconto company, now known as the Northeastern Power Company, and also of the plant at Peshtigo.

## L. F. Leurey Heads Electrical League

Louis F. Leurey, who has been elected president of the San Francisco Electrical Development League for the ensuing association year, as was announced in the Feb. 24 issue of the

L. F. LEUREY

ELECTRICAL WORLD, is a well-known figure in the electrical industry in the West. He is a graduate electrical engineer of Tulane University, New Orleans, La., with the class of 1902. The next two years were spent in the testing department of the General Electric Company. From 1904 to 1913 he held important engineering positions with the following companies: New Orleans Railway & Light Company, Spokane & Inland Railroad, Stanislaus Power Company of California, Sierra & San Francisco Power Company, British Columbia Railway Company and British Columbia Electric Company. Mr. Leurey is perhaps best known through his work with the Panama-Pacific International Exposition, held in San Francisco in 1915, where as assistant chief mechanical and electrical engineer he had direct charge of all field installation and operations. Since 1917 he has been engaged in consulting electrical engineering work, with offices in San Francisco. During this time he has been retained by many large electrical, industrial and mining companies of the West.

**S. Z. Mitchell,** president of the Electric Bond & Share Company, has been elected chairman of the board to fill the vacancy caused by the resignation of Marsden J. Perry. Mr. Mitchell will continue to serve also as president. F. B. Odlum and Frank Silliman, Jr., have been elected vice-presidents of the company.

**Joseph Bowes,** superintendent of the Port Arthur (Tex.) division of the Eastern Texas Electric Company, a Stone & Webster property, will be transferred to the office of the same company in Beaumont, Tex., to be general superintendent. Mr. Bowes entered the employ of the Port Arthur company in 1916.

**W. J. Hodgkins,** who has been general manager and superintendent of the Ashland Light, Power & Street Railway Company for a period of many years, recently was elected vice-president of the Lake Superior District Power Company with headquarters at Ashland. Mr. Hodgkins is widely known in utility circles in Wisconsin and the surrounding states.

**B. R. Farrand** has been appointed power engineer of the Connecticut Power Company, with headquarters at New London, Conn. Mr. Farrand, who has been on the power engineering staff of the Hartford (Conn.) Electric Light Company since June, 1919, was graduated in 1918 from the Sheffield Scientific School of Yale University in the electrical engineering course.

**M. Seki,** secretary to Viscount Mayedo, Minister of the Department of Communications of Japan, is en route from New York to San Francisco, where he will sail for home. He came to the United States from Europe after touring the principal cities, making a special study of hydro-electric plants. He is continuing his study of such plants in cities along his route across the United States.

**H. L. Myer,** who has been superintendent of construction on Mitchell Dam for the Alabama Power Company for the past two years, has resigned to join the Sanderson & Porter Company as superintendent on the Springfield steam plant of the West Penn Power Company. Mr. Myer will report to H. L. Polk, who was resident engineer with the Alabama Power Company on the construction of Lock 12. C. C. Davis, who has been night superintendent, has been appointed general superintendent.

**N. B. Ambler,** superintendent of the Toronto Power Company, Ltd., Niagara Falls, Ont., for the last ten years, has recently joined McClellan & Junkersfeld, Inc., engineers and constructors. J. T. Brusky, formerly with Stone & Webster, Inc., and the American International Shipbuilding Corporation, has also allied himself with the engineering firm. Other recent additions to the staff are Harrison E. Kleffel, who was associated with the Peabody Engineering Corporation, New York City, and Thomas Richardson, formerly with the M. W. Kellogg Company, New York City.

**J. E. Brokemyr**, who has been connected with the Utah Power & Light Company, is now in the drafting department of Stone & Webster, Boston.

**Clarence Auty**, formerly with Carver, Macomber & West, is now associated with Charles H. Tenney & Company as assistant electrical engineer.

**H. S. Russell**, until recently with the St. Joseph (Mo.) Railway, Light, Heat & Power Company, is now with the Virginian Power Company, Charleston, W. Va.

**Elliott G. Peabody**, recently connected with the Haverhill Gas Light Company, a Stone & Webster property, has been transferred to the statistics department of the organization.

**J. L. Kirkpatrick** has resigned his position with the American Telephone & Telegraph Company to become general manager of installation of the Western Electric Company, with headquarters in New York City.

**G. R. Thompson**, formerly salesman with the Electric Appliance Company of San Francisco, has recently left that company and is now acting as salesman for the Western Electric Company with headquarters in San Francisco.

**Tylor M. Barr** of Lisbon, N. Y., who has been with the General Electric Company for the last five years as illuminating engineer, has been appointed lighting specialist of the Hudson River Gas & Electric Light Company, with headquarters at Poughkeepsie.

**W. E. Barrett**, formerly of the Denver Gas & Electric Light Company, has been appointed to the publicity department of the Westinghouse Electric & Manufacturing Company in the Rocky Mountain region, with headquarters in Denver.

**K. E. Van Kuran**, district manager of the Westinghouse Electric & Manufacturing Company and vice-chairman of the California Electrical Co-operative Campaign, retired from the presidency of the Los Angeles Electric Club on March 5. Mr. Van Kuran was elected president a year ago to preside over the club's activities during the second year of its history.

**A. L. Spring**, formerly field representative of the California Electrical Co-operative Campaign in southern California, has joined the staff of the General Electric Company in Los Angeles as merchandising superintendent. Prior to his connection with the co-operative campaign Mr. Spring was sales manager in the Los Angeles office of the Western Electric Company.

**Benjamin Franklin Meissner**, who has been director of the phonographic research laboratory of the Brunswick-Balke-Collender Company since 1920, left that post on Feb. 15 to become chief engineer of the radio division for the Multiple Electric Products Company, Newark, N. J. Mr. Meissner's ability as an engineer and radio expert gained recognition several years ago as a result of his co-operation with John Hays Hammond, Jr., in the perfection of the wirelessly controlled torpedo.

**F. E. La Roque** has recently been appointed superintendent of the Ticonderoga (N. Y.) Electric Light & Power Company, succeeding Austin Moyes, who resigned.

**Philip P. Wells**, secretary of the National Committee for the Defense of the Water-Power Act, has been appointed a special attorney for the State of Pennsylvania to handle water-power matters.

**Jackson C. Phillips** of the steam-engineering department, Narragansett Electric Lighting Company, Providence, has been appointed betterment engineer of the Electric Bond & Share Company, with headquarters in New York.

**W. D. Smith**, formerly superintendent of the Middletown division of the Connecticut Power Company and until recently stationed at New London, has been appointed general superintendent of the Houghton County Electric Light Company, Houghton, Mich.

**L. G. Webb** has resigned his position as district manager of the Menomonie office of the Wisconsin-Minnesota Light & Power Company to engage in the real estate business. Mr. Webb has been associated with the company for four years and has been in charge of the Menomonie office for two years.

**Fred A. Larson**, who has been with the Titusville Light & Power Company for a number of years, has been made city electrician for Titusville, Pa., succeeding George B. Heron. Mr. Heron is now associated with the Westinghouse Electric & Manufacturing Company.

**Adolph Kanneberg**, Milwaukee attorney, has recently been appointed by Governor Blaine of Wisconsin to membership on the Wisconsin Railroad Commission, succeeding Carl D. Jackson, resigned. Mr. Kanneberg's term will be for two years.

**H. P. Sleeper**, formerly of the supply engineering department, Westinghouse Electric & Manufacturing Company, has entered the employ of the Duquesne Light Company, Pittsburgh, in its engineering department. Mr. Sleeper will handle the protective work of the light company. During the four years that he was with the Westinghouse company Mr. Sleeper devoted most of his time to work on protective relays. He is a graduate of the University of Maine of the class of 1915.

**Otis L. Johnson**, engineer and lecturer on illumination for the Benjamin Electric Manufacturing Company, has been appointed commercial engineer for the King Manufacturing Company, Chicago. Mr. Johnson attended the State University of Iowa, going from there to the engineering department of the National Lamp Works of the General Electric Company at Cleveland. In 1912 he resigned to accept the position of illuminating engineer with the Benjamin Electric Manufacturing Company, which position he held until recently. Mr. Johnson has been an active worker on committees of the National Electric Light Association and the Illuminating Engineering Society and is now a vice-president of the latter organization.

**Jack Fiester**, formerly with the Idaho Power Company at Pocatello, has joined the Salt Lake City office of the Edison Electric Appliance Company as range sales specialist.

**V. Y. Davoud** has been transferred to the engineering department of the Electric Bond & Share Company, New York City. He was formerly with the Utah Power & Light Company, Salt Lake City.

**J. B. N. Cardoza**, formerly with the Walker Vehicle Company, has become general sales manager of the Walter Motor Truck Company and in connection with that position has organized the Electric Truck Transportation Corporation, of which he is president. Mr. Cardoza has been actively identified with the promotion of the use of the electric truck for many years and has served on several committees of the N. E. L. A.

**Joseph Stansbury Jones**, general commercial manager and assistant to the president of Charles Cory & Son, Inc., was elected vice-president of the company at the February meeting of the board of directors, to succeed Franklin Washington Wood. Mr. Wood, while not now active, is a director. Mr. Jones resigned from the Navy Department as senior electrical expert aid in 1919 to become associated with the Cory corporation. His many years of varied experience with engineering problems pertaining to the navy and merchant marine have eminently fitted him for the new duties he assumed March 1. He has filled the rôle of electrical draftsman, electrical expert aid, assistant electrical superintendent and acting electrical superintendent. Mr. Jones has to his credit several important patents in electro-marine devices and is the author of technical and scientific treatises for the Navy Department covering various types of signaling and power equipment.

# Obituary

**Oscar E. Perry**, superintendent of the meter department of the Narragansett Electric Lighting Company, Providence, died recently after twenty-three years' service with the company. He was sixty-five years of age and was very active in company organizations.

**William Penn White**, identified for the last eleven years with the railway department of the General Electric Company at its New York office, died recently in the Garfield Hospital, Washington, following an operation. Mr. White was born in Washington in 1876. After being graduated from the Lehigh University with the degree of electrical engineer, he entered the employ of the General Electric Company at Schenectady. He served in the testing department, the calculating and drafting department and was then transferred to the railway engineering department. In June, 1912, Mr. White was transferred to the New York office.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Motor Sales by Contractor-Dealers

**Co-operation Secured for Central-Station Company by Letting Out Motor Business Is Worth Far More to the Utility Than the Profits Derived**

A VIGOROUS discussion of the policy of selling electric motors through the contractor-dealer recently brought to a focus a problem in trade relations which deserves consideration. It was pointed out that in some territories central-station companies maintain stocks of motors and sell them to industrial power customers in connection with investigations and subsequent contracts for service, while neighboring utilities turn the motor business over to the contractor-dealer and thereby accord such profit as may exist in the apparatus sale to the successful bidder on the wiring contract. A number of points were brought out in this discussion, which occurred in an informal conference, that are of interest in connection with the broad question of relations within the industry and the problem of economical distribution.

It was asserted that the co-operation gained for the central station by turning over motor business to the contractor-dealer is worth far more to the utility than the profit derived from the sale of the equipment. The manufacturer profits in either case, selling to the central station and to the dealer at a discount which need not be discussed here, but which offers roughly the same margin for each. The central station is responsible for the kind of business it adds to its lines and performs a useful service in power engineering analysis—or should do so—before any comprehensive motor installation is made.

### Giving Customer Service

It was recognized that unless the contractor-dealer performs a service in connection with a motor selection and installation, or in subsequent operation, there can be little gain through routing motor sales via his office. In many cases the contractor may be qualified to advise as to selection and in other instances not. On the wiring job he comes into his own, although the central station acts as a consulting engineer in relation to this work in industrial power applications, but in the last analysis the question of "servicing" the motor was declared to be the logical criterion of sales priority. The point was made that very few central stations maintain motor-service stations, even when they carry stocks of motors, whereas the well-equipped contractor-dealer handling such apparatus is either prepared to make good when a demand for parts arises or else to furnish a substitute motor until the one withdrawn from service can be replaced.

Two instances were cited where the central station had turned over its entire motor-sales business to contractor-dealers. One was in a city of more than 100,000 people, the other in a town of over 15,000. In both cases, it was stated, the contractor-dealers have prospered as a result of this change in policy. In the city enough spare parts or odd motors are carried to tide over emergencies with ease, and the contracting organization most successful in this work maintains a force prepared to render immediate restoration service to motor users in the local industries. There are almost always cases of regrouping of motors resulting from the growth and changes of industrial plant conditions within the place which make it possible to tide over local trouble until a motor suited to the job can be obtained. In the town it is not so feasible to carry motor stocks, but thus far the temporary substitution of motors not necessarily adapted to the job in size but available for one reason or another has met the situation nicely. Inefficiency in temporary applications of motors is not of long duration, and the contractor-dealer organizations are prosperous and work in close touch with the central station. This concord tends to result in mutual co-operation in the selection of motors for a given service and in complete information being given the central station regarding all motor changes or purchases of motors to go into existing plants. Increased interest in the solicitation of new power business is evident in the contractor-dealer branch of the industry. The central station knows the price situation, passes technical judgment upon the layouts proposed and is freed from the necessity of maintaining motor-part stocks.

### Took Over Burden of Routine

In one case where several hundred horsepower in motors was distributed among more than thirty small industrial concerns in a single sales proposition the routing of the sale through the contractor-dealer who was the successful bidder on the wiring job saved the central-station engineering department at least two weeks' work on minor details of the installations. Out of his profit on the motor sale the contractor-dealer took over the burden of routine installation in all its aspects. These purchasers will naturally turn to the contractor-dealer for future servicing of motor and control apparatus, and the central station will be kept in constant touch with the use and development of the installations involved. To not a few central stations the profit on motor sales weighs heavily in the scale when it comes to a decision to change the policy on behalf of the contractor-dealer, but the question is a live one and the purchaser of such equipment seemingly can be adequately served if the man who does his wiring also supplies him with motor and control equipment. A possible exception may arise on very extensive jobs in which the manufacturer's sales engineers figure as co-investigators with the central-station power sales department, resulting as they may in direct orders from the ultimate owner of the motor.

# Burden of Special Transformer Orders

**Engineers Specify Excessive Features That Bring Not Economy but Expense—Add 25 per Cent to Discourage Freak Designs**

BY A MANUFACTURER

THERE are probably forty-thousand different designs of transformers made today, owing in no small part to avoidable ordering of freak sizes. The engineer, not having on his mind the problems of production which confront the manufacturer, orders a transformer with specifications calling for extra taps that will provide for special voltages which he thinks might some day be desired. The salesman knows that the factory tries to avoid these "special" orders, but in his desire to please his customers he sacrifices the principle and takes the order. He fears that the purchaser will think he is trying to substitute something easier if he urges a standard unit. He forgets and does not explain to his customer that transformers have been standardized in type and size for the most definite of practical reasons.

### WIDE RANGE AVAILABLE

As it is, there are about ten voltages, three cycles and seventeen sizes up to the 200-kw. transformer. There are something between 150 and 200 sizes in all, which multiplied by voltages and cycles produce an almost endless variety from which selection can be made. But the bulk of the business, of course, comes in a comparatively small number of standard types which good use has proved the most convenient, economical and practical and which through standardization in production can be manufactured most efficiently. When the customer orders something special with extra taps to provide for extra voltages, therefore, it increases the cost of manufacture, in many cases out of all proportion to any practical value which this special feature may provide.

There are sometimes, of course, valid reasons for ordering to special design. California operates for the most part at 50 cycles, Niagara power is 25 cycles, New York State takes some 40-cycle equipment, and there are cases of high altitude or some other local condition that require special provision. But for all ordinary service these freak transformers are not required and accomplish little more than to make the manufacturers' job more difficult, which reacts inevitably upon the customer. For each of these special requirements means a special design which costs money. It requires special handling through the factory, which adds expense. It clogs up the manufacturer's engineering department and delays the completion of quotations and other items of service. It slows delivery, particularly in rush times.

There are times when a power company may be planning to change the voltages on a line, say from 33,000 to 66,000, and may rightly prepare by providing extra taps on all transformers. Yet orders are often given to provide taps for 10,000 volts and 40,000 volts which can hardly relate to any such plans in prospect. Rather, the engineer is probably thinking to provide an element of interchangeability, so that he need carry only a few sizes in stock.

But since this has to be all special stuff, it adds greatly to the cost, and it would pay far better to keep a larger stock of spares on hand in order to take care of possible breakdowns and to buy standard transformers.

It is general practice to add 25 per cent to the cost of special transformers in the effort to discourage this demand for freak stuff, and it is in fact a matter of discouragement. Some salesmen take very few orders for special designs, while others take many, showing a realization of the condition and the degree to which each salesman takes upon himself responsibility for protecting the customer and the factory from this extra cost.

### WAR BROUGHT EXTRA SIZES

The war brought in a demand for a number of special transformers to meet sudden and unusual needs, and the manufacturers cheerfully met the need and produced whatever was required. The profit which the manufacturer is making today is far below the profits earned then, but we are still carrying varieties and designs and providing extra taps and series and parallel connections that add greatly to the cost. It is a condition that should have the very serious attention of all those who make or wholesale or of those who purchase transformers.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Switch Sales Gained 10 to 15 per Cent in Six Months

According to leading authorities in the field, present sales of push and rotary flush switches are running from 10 per cent to 15 per cent ahead of the sales of six months ago. Deliveries are still longer than normal owing to very poor transportation conditions both in shipping and finished product and getting raw material. This condition is apt to improve considerably, however, during the next thirty or sixty days because of smaller coal shipments and the releasing of more rights-of-way and railroad equipment for other commodities.

Some slight price changes have been made during the last month or two, such changes having been upward. Raw-material prices, including porcelain, brass and copper, show an upward tendency, which may have to be reflected in advanced selling prices of finished products.

The outlook for the next six months is very good, owing to the fact that the building program of the last six months of 1922 was exceptionally high, and that will naturally be reflected in business for the first six months of 1923. Furthermore, the trade in general is pretty well acquainted with the upward tendency of basic material costs and, drawing from that the conclusion that finished products will be advanced, is buying with advancing prices.

### SAFETY TYPES VERY ACTIVE

Present sales of safety switches, according to several manufacturers in that line, are running between 35 per cent and 50 per cent ahead of six months ago. This increase in sales is attributed to the increased use of standardized switches, more industrial activity and a greater number of salesmen employed in merchandising. Deliveries are reported to be a little bit longer than normal. There have been some price reductions during the last few months, but the outlook in the switch market now is that there will be no

further changes in the near future. As the building season opens a corresponding increase in business is expected. Indications are that there will also be a lot of industrial building done during the coming summer months.

## New England Collections Well Maintained

With improved business in virtually all lines of industry, collections in New England electrical circles are being well maintained. Outstanding accounts are being cleaned up in about seventy days. Bad weather and poor transportation and highway conditions have slowed down payments in northern districts to some extent, but on the whole money is fairly easy. Railroads are meeting their obligations more readily as far as electrical purchases are concerned. Industrial plants and central stations are causing jobbers and manufacturers little anxiety, but in contractor-dealer circles some delays are evident. Competition among jobbers is keen and close watching of accounts is general. The outlook is excellent for an active spring and for a plentiful supply of funds for well-rounded business development.

## Netherlands Electrical Industry Reported Sluggish

Conditions in the electrotechnical industry of the Netherlands indicate a general tendency toward a decline in production, although renewed activity prevails in several of its branches. The industry on the whole is considerably better off than some others in that country.

Lamp and lighting-fixture manufacturers, as well as makers of telephone apparatus and parts, report that conditions are substantially the same. One lamp company, however, recently took on about four hundred additional workmen and another has re-employed a number of men discharged several months ago on account of the slackness in that line.

The Netherlands industries are unfortunate in being subject to keen competition from neighboring low-exchange countries. A general import duty of 5 per cent is levied, which, according to a statement of the Netherlands Association of Electrotechnical Producers, does not give sufficient protection. So far no action has been taken by the government to provide any increases in the duties.

## Insulating-Material Business Increased 35 to 45 per Cent

The insulating-material market is reported to be advancing nicely, with sales from 35 to 45 per cent in excess of those for the corresponding two months of last year. Deliveries are at normal periods, with little trouble experienced in transportation through the interior. Sales prices of special products in the insulating-material market have not changed recently, but, in the opinion of leading manufacturers, it may be necessary to increase prices in the near future owing to the considerable increase in the price of raw materials due to the higher import taxes assessed under the new tariff.

## Conduit Stocks in St. Paul-Minneapolis Extremely Low

The conduit market in the St. Paul-Minneapolis territory is seriously hampered by low stocks. The demand is not only active to supply present needs, but is actually feverish. It is estimated that there is less than half a carload of ½-in. conduit in the Twin Cities today and no more than five carloads of sizes up to an inch. Jobbers are furnishing ¾-in. pipe at ½-in. prices and galvanized pipe at black prices. Recent shipments of mine-run pipe have included no small pipe or very small percentages of anything under 1 in. Unless shipments improve very much by the springtime electrical work will be seriously handicapped. Jobbers declare that the increase in shipments of some small-sized conduit must be almost revolutionary if the spring demand is to be anywhere near satisfied.

## Cessation of German Competition in Japan

German competition in heavy electrical machinery sold in Japan has entirely disappeared, according to Acting Commercial Attaché H. A. Butts, Tokyo. Public statements made some time ago to the effect that Japanese buyers were inclined to place orders for this class of machinery with German manufacturers appear to have been only partly true, and Mr. Butts now states that no reliable Japanese company of which he knows is either quoting or endeavoring to secure the business for this sort of equipment of German manufacture.

Japanese consumers prefer the American product, with its dependability as to deliveries and quality. In this connection a representative in Japan of one of the leading American manufacturers states that he has no difficulty in securing orders for American products with a 10 per cent premium over the cost of the same article manufactured in Japan. At present about 80 per cent of the imports of heavy electrical machinery into Japan are from the United States.

## High-Tension Equipment Makers' Heavy Orders

High-tension equipment manufacturers in the Chicago territory continue to ship heavy orders. Last week a leading manufacturer sold two 11,000-volt, 3,000-kw. substation switching centers for the South and a large order for 135,000-volt air-break switches for the Middle West.

Another firm reports orders for 6,600-volt indoor switching equipment for the East and a 33,000-volt, 1,000-kw. outdoor substation for the Middle West. Call for farm-line equipment is improving and manufacturers feel that 1923 will yield active business on this line.

## The Metal Market

**Copper Less Active—Prices Are Sagging — Lead Continues Strong — Railroad Embargoes Troublesome**

The week has been a little more quiet in the metal market than were the two or three previous ones. Prices in the last day or two have shown a tendency to sag slightly in the case of copper and zinc, but lead continues active. Railroad embargoes are still troublesome, practically all transportation east of Buffalo being affected. There is not only a shortage of cars, but locomotives also are not available.

NEW YORK METAL MARKET PRICES

| | Mar. 7, 1923 Cents per Pound | Mar. 14, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 16.75 | 16.75 |
| Lead, Am. S. & R. price | 8.10 | 8.15 |
| Antimony | 7.62½ | 8.75 |
| Nickel, ingot | 30.00 | 30.00 |
| Zinc, spot | 7.30 | 7.50 |
| Tin Straits | 42.00 | 46.00 |
| Aluminum, 98 to 99 per cent | 24.00 | 25.50 |

Copper buying has not been so active this week, consumers evidently feeling that a reaction in price was about due after the rapid advances. Speculative holders of copper in London were quick to sense the slight dullness and put metal on the market, which caused the price to fall considerably.

## Copper and Brass Products

Copper, brass and bronze mills quote the following prices on brass and copper products:

Copper wire, 19.37½ cents, mill; brass wire, 21.62½ to 23.37½ cents; copper sheets, 23.75 cents; copper rods, 19.62½ cents; brass rods, 19.37½ to 23.62½ cents; sheet brass, 21.12½ to 22.87½ cents.

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb | $0.0312 | $0.0303 | $0.0247 |
| Cold finished shafting, per lb | 0.0402 | 0.0383 | 0.0330 |
| Brass rods, per lb | 0.1804 | 0.1766 | 0.15 |
| Solder (half and half), per lb | 0.2617 | 0.2508 | 0.20 |
| Cotton waste, per lb | 0.1181 | 0.1181 | 0.106 |
| Washers, cast iron (½-in.), per 100 lb | 4.33 | 4.33 | 3.83 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.11 |
| Machine oil, per gal | 0.349 | 0.349 | 0.40 |
| Belting, leather, medium, off list | 49% | 49% | 46⅓% |
| Machine bolts, up to 1-in. x 30-in., off list | 51⅓% | 51⅓% | 64⅓% |

# The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

BUSINESS in the Southern and Eastern sections is reported to be improving gradually, while orders received during the past week in the Northern and Western sections are below or only equal to the amount of those of one or two weeks ago. In the New York and Portland-Seattle territories greater interest is being shown in aluminum wire for transmission purposes following recent heavy markings-up in the copper market. The appliance market is reported fair with greater interest shown in the East, where many new apartment houses and single dwellings are being rapidly completed. Meters are moving in greater volume to central stations, which are taking on many new customers in all parts of the country. A large amount of "proposition" work is being developed following added interest in industrial power applications.

**Boston** Activity is more pronounced in electrical circles from week to week, paralleling the expansion of general business. Prices stiffened last week in armored cable, pole-line hardware and wiring devices. The shortage of rigid conduit continues to inconvenience builders. Deliveries on power transformers are lengthening, thirty-eight weeks being quoted on 1,500-kw. units last week. Price cutting in radio supplies continues, but the higher-grade material holds firm. Central stations are buying more meters, and electrical merchandise is moving well at retail. House-wiring jobs are increasing in many localities. Industrial power applications are developing a large amount of "proposition" work, and motor sales are reflecting better business conditions. Labor is getting scarcer, with accompanying demands for increased pay in the building trades.

**New York** Demand for all electrical materials entering into new residences is increasing from day to day. A noticeable spurt in interest by utilities for line materials is reported. With the rising prices of copper wire there is greater buying in the aluminum wire market. Slight markings-up in prices of pole-line hardware, armored cable and wiring devices were made during the week. Demand for meters is increasing with the completion of many new apartment houses in the metropolitan area. Prices for complete radio sets of the better makes are holding firm, while parts generally are considerably lower than one month ago. Outstanding accounts are running to sixty-five days.

**Atlanta** No changes of moment in the electrical jobbing line were witnessed during the past week. The demand for conduit is very brisk and stocks are spotty. One jobber reports the receipt of shipments sufficient to bring his stocks up to normal, while another says that his stocks continue low. Prices are unsteady, orders being taken subject to market quotations on date of shipment. Jobbers handling telephone equipment report a healthy volume of business with stocks ample to meet the demands. Because of the unusually warm winter, when for the greater portion of the time it was unnecessary to run furnaces for heating, air-heater sales have been good and stocks are almost depleted. Most of the large central stations in the Southeast are actively in the merchandising field, and a steady increase in the demand for lamps and appliances is to be noted. The price of cotton continues to climb, with no limit in sight, and this is being reflected in optimism in the rural communities. Taken as a whole, the entire line of the electrical trade reports business booming.

**Baltimore** Prospects are taking on a much brighter aspect. Contractors are estimating on considerable work for which contracts will be let in the near future. Motors, transformers and condensers have been holding their own during the past week, and a slight improvement is noted in radio equipment. The market on lamps has decreased considerably and all heating apparatus is practically off the market. There seems to be a picking-up in commercial fixtures. Conditions on the whole are very slightly changed.

**Chicago** The general demand for electrical equipment continues steadily. The price of flexible armored cable was increased the first of the week, and all wiring materials have an active call. Demand for radio equipment is active and stocks are in good shape, although there is a scarcity of the 1.5-volt vacuum tubes. Rectifiers have a steady sale so that stocks are not high. Gains in industrial employment for 240 manufacturers in the Seventh Federal Reserve District for January totaled 1.8 per cent in men and 8.7 per cent in payrolls over the December returns.

**St. Paul-Minneapolis** A general falling off in business is noticeable this week. Business, however, is better than a year ago, but below last month. This quiet period is declared natural considering market conditions in this territory. Most jobbers think heavier buying will start early in April. Home building is progressing nicely. Prices for wire show continual rise. Radio demand is falling off. Dealers are cutting prices to clean up stocks. It is impossible to get rectifiers and little relief is seen in the conduit stock situation. High-tension equipment and construction materials are quiet, but queries are numerous.

**St. Louis** The building permits for the month of February amount to $2,664,900, which is an increase of approximately 107 per cent over the month of February, 1922. The building permits for factories and workshops alone amounted to $1,370,690 compared with $41,400 for the same month last year. This impetus in industrial building is probably due, in a large measure, to the recent municipal bond issue for $87,000,000. Electrical contractors and jobbers are anticipating exceptionally good business to result from the electrical exposition held in the Coliseum from March 12 to 17 and are making preparations to take care of it. The shortage of wire continues while prices are climbing.

**New Orleans** An immense building program is forming here. Last year's fire losses in New Orleans were nearly $7,000,000, a record-breaking total. This building must be replaced and new structures are needed to meet the demands of the increasing business and increasing population. The effects of this building program have not yet made themselves strongly felt on the electrical trade, because construction for the greater part of the program has not yet reached the contractors. They will be felt, however, within the next few months.

**Salt Lake City** Reduction of freight rates to the Pacific Coast to meet competition via the Panama Canal will benefit intermediate jobbing points. The long-and-short-haul clause of the transportation act gives the Intermountain region advantages. The new schedule will be effective April 17, and it is believed it will have the effect of reducing prices on many lines manufactured in the East. Comparison of building statistics for the month of February, 1922, with 1923 shows that there has been an increase of construction work begun amounting to 400 per cent.

**Pittsburgh** Business from contractor-dealers and industrial firms continues brisk. Radio business seems, in a retail way, to have reached a healthy condition, and the demand is steady. The people now are buying a better class of sets and material than before. During the week there have been decided advances in armored cable, wiring devices and pole-line hardware. This contemplated increase has stimulated buying in these particular commodities among the jobbers and contractor-dealers. The greater amount of business among the contractors seems to be in small house wiring. Each jobber has reported a steady increase in business over the same period for 1922.

# Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Tape, Batteries and Irons

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Radio | Conduit Boxes | Signal Apparatus | Rectifiers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boston** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Slow | Sdy. | Act | Act. | Sdy. | Sdy. | Act. | Sdy. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Low | Low | Low | Low | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Low | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Inc. | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **New York** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Act. | Slow | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act | Sdy. | Act. | Act. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Low | Low |
| Price trend | Inc. | Inc. | Inc. | Low | Firm | Inc. | Firm | Firm | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **Baltimore** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Act | Slow | Act. |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Act. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Low | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy | Act. | Sdy. | Slow | Act. | Sdy. | Act. | Sdy. | Act. | Act. | Sdy. | Act. | Act. | Act. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Inc. | Firm | Firm |
| **St. Paul-Minneap.** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. | Act. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Slow | Slow | Act. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Hi. | Nml. | Low |
| Price trend | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Slow | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Act. | Act. | Sdy. | Slow | Act. | Slow | Sdy. | Act. | Sdy. | Act. | Slow | Act. | Act. | Slow | Sdy. |
| Supply | Nml. | Low | Low | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Act. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml | Nml. | Nml | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml | Nml. | Nml. | Nml. | Low | Low. | Nml. |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Dec. | Dec. | Firm | Inc. | Firm | Inc. | Inc. | Firm | Dec. | Firm | Firm | Firm | Firm | Firm |

**Cleveland** Most jobbers report the week just finished as the best thus far of 1923 and sales in excess of those in the same week last year. Particular strength in industrial equipment is noticed. Conduit boxes are in strong demand. Central-station companies have plans under way to increase power production to meet growing demand. Radio dealers as well as jobbers report an active week. Rectifiers are moving fairly well, but signal apparatus sales are rather spotty.

**Denver** General business continues to improve. In mercantile lines growing volume of business is reported. Increases in ore values are stimulating activity in metal mines, and coal mining is proceeding at a high percentage of full-time operations with the situation clarified by an extension to April of contracts between operators and mines. Loading of coal cars is increasing weekly. Crude-oil production is in greater volume than a year ago, while flour-milling and meat-packing operations are exceptionally heavy. All branches of the electrical industry as a result of these improvements are profiting accordingly.

**Portland-Seattle** Construction throughout the Northwest is very active. As a consequence lumber production is 10 per cent to 20 per cent above normal and the demand for electrical equipment is growing rapidly. Central stations are in the market for a large amount of equipment. The rising price of copper has had a tendency to create more interest in aluminum for transmission lines. Jobbers generally report very good business. A slight seasonal lull is being experienced at this time, but sales are appreciably better than a year ago. Radio is apparently very active in the better class of sets.

**San Francisco** Many price advances are recorded. Push switches, sockets, sign and weatherproof receptacles have climbed about 10 per cent. Solder has advanced because of lead-base increase with indications of further advances. Dealers report good sales of flatirons. Clotheswasher lists have changed, dealers' average profit having risen from about 30 per cent to nearly 40 per cent during the past year.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Westinghouse and Baldwin to Revise Agreement

The several-years-old agreement between the Baldwin Locomotive Company and the Westinghouse Electric & Manufacturing Company which called for co-operation in the manufacture of electric locomotives will be extended along revised lines, according to officials of these companies, because of the greatly increased demand for electric locomotives. The production has not kept pace with this demand.

It is predicted that orders for electric locomotives will be especially large in foreign countries where hydro-electric development is in progress. The movement is expected to expand for the purpose of economy of operation as well.

The American Locomotive Company recently entered into a similar agreement with the General Electric Company.

## Electric Storage Battery Declares Quarterly Dividend

The Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia, announces that its directors have declared a quarterly dividend of $1 per share from the accumulated surplus of the company on both the common stock and the preferred stock, payable April 2, 1923, to stockholders of record of both these classes of stock at the close of business on March 17.

## Robbins & Myers Change in Advertising Directorship

The Robbins & Myers Company, Springfield, Ohio, manufacturers of electric motors, generators and fans, have announced the appointment of H. H. Beck as its advertising manager.

Mr. Beck came to Robbins & Myers from Erwin, Wasey & Company, Chicago, advertising agents, with which concern he had been associated for the last few years. His connection with the Robbins & Myers Company became effective on March 1.

## Changes in Detroit Office of Cutler-Hammer Company

The Cutler-Hammer Manufacturing Company, Milwaukee, manufacturer of controlling devices, announces the following changes in its Detroit office:

J. C. Goodale, who has been in the Detroit office of the company for the past three years, has been appointed branch manager. C. W. Greenman of the Detroit office has been transferred to the sales department of the Chicago office, wiring-device department. B. J. Larsen has been transferred from the Chicago to the Detroit office to take up the sales work in connection with wiring devices, heating apparatus and molded products.

## Canadian Allis-Chalmers Awarded $1,500,000 Contract

Contract for the purchase by J. B. Duke, Charlotte, N. C., and Sir William Price, Quebec, Canada, who are developing around 400,000 hp. in hydro-electric plants in Canada, of $1,500,000 of hydraulic machinery has been awarded to the Canadian Allis-Chalmers Company, Quebec. The water-wheel machinery will be utilized in the building of the immense Canadian hydro-electric plants under construction by the Quebec Development Company, Ltd., in which Mr. Duke and Sir William Price are jointly associated.

Other bidders for this contract were the Vickers Company, London; the Armsbury-Whitworth Company, London; the Dominion Engineering Company, Montreal, and the Wellman-Seaver-Morgan Company, York, Pa.

## Parr Opens Newark Branch

The Parr Electric Company, Inc., 77 Warren Street, New York City, announces that in order to give better service to its customers in the State of New Jersey it has opened a branch warehouse and sales office at 28 Treat Place, Newark, where a complete stock is being carried.

## Lindsey Brothers Open Main Sales Office in Minneapolis

The Lindsey Brothers Company has established its Eastern sales office for handling its cedar-pole business at its concentrating yards in Minneapolis. F. D. Scott, who has been the sales manager of the Lindsey Brothers Canadian Company, Ltd., at Nelson, B. C., is in charge of the new office and yards at 3101 University Avenue, N. E., and L. E. Dunn, who has been the traffic manager at the Spokane office, is transferred to the Minneapolis office. The treating plant and Pentrex machine are at Minneapolis, and it is felt that the opening of the new office, which is midway between the Western producing districts and the Eastern consuming districts, will make for better service to customers. It is felt that the location of the main sales office directly at the treating and shipping plant in place of in a downtown office will help to better service to the consumer.

## Dust Explosion Body's Regulations of Interest to Lamp Makers

Manufacturers of electric lamps and other equipment, lamp guards, etc., used in grain elevators, flour and feed mills, sugar-pulverizing plants, pulverizing-fuel plants and cocoa-grinding plants will be interested in new regulations for the prevention of dust explosions which are being prepared by the National Fire Protection Association.

These regulations were finally revised and approved at a meeting of the dust explosion hazards committee held at Buffalo, March 5 and 6, and will be ready for distribution in printed form in a few days through the office of the National Fire Protection Association, 40 Central Street, Boston.

The regulations as printed are tentative only and will be subject to amendment until the next annual meeting of the association, to be held at Chicago, May 8, 9 and 10.

# Jeffery-Dewitt Awarded Large Orders

The Jeffery-Dewitt Insulator Company, Kenova, W. Va., reports an increase in demand for its products to be used in connection with large extensions of transmission lines now being made throughout the country. It states that it has just been awarded one order through its sales representatives, the R. W. Lillie Corporation, 50 Church Street, New York City, by the Southern Power Company, Charlotte, N. C., for 63,200 suspension-type insulators to be used in connection with a hundred-mile transmission-line extension, operating at 110,000 volts. It has also been awarded an order by the William A. Baehr organization of Chicago for 12,250 suspension insulators for shipment to the Oklahoma Light & Power Company.

The company also announces that it is now filling an order for the Niagara, Lockport & Ontario Power Company, Buffalo, for 100,000 suspension insulators to be used in connection with transmission-line extensions operating at 110,000 volts. Other orders for large amounts have been awarded by the United Gas Improvement Company, Philadelphia; the Southern Sierras Power Company, Riverside, Cal., and the Washington Water Power Company, Spokane, Wash.

The fact that this company uses continuous tunnel kilns which operate twenty-four hours per day and 365 days per year insures a large manufacturing production totaling well over half a million suspension insulators per year. Officials state that the demand for the flange-type insulator used in connection with switching apparatus and bus supports has run exceptionally heavy. New orders for flange-type insulators are now running at the rate of 8,000 to 10,000 units per month.

### Anaconda Formally in Control of Chile Copper

Control of the Chile Copper Company formally passed to the Anaconda Copper Mining Company March 7 with the resignation from its board of the following men: W. E. Bennett, A. C. Burrage, Russell Burrage, H. L. Chalifoux, Daniel Guggenheim, Murray Guggenheim, S. R. Guggenheim, E. A. Guggenheim, H. F. Guggenheim, R. C. Klugescheid, J. K. McGowan, E. Earle Moran, John A. Steele and C. A. Wilson.

The following new officers were elected: John D. Ryan, chairman of the board; C. F. Kelley, president; B. B. Thayer, vice-president, and A. H. Melin, scretary and treasurer.

The board of directors of the Chile Copper Company has been reduced to eleven members, the following new board having been elected: John D. Ryan, C. F. Kelley, B. B. Thayer, P. A. Rockefeller, Nicholas F. Brady, Andrew J. Miller, George H. Church and A. H. Melin.

### Dutchess Bleachery Appoints A. P. Eckert Sales Manager

The Dutchess Bleachery, Inc., 320 Broadway, New York City, announces the appointment of Avery P. Eckert as sales manager of its insulation division, with office in New York City. Mr. Avery's experience includes fourteen years with the india-rubber wire division of the United States Rubber Company and thirteen years with the Safety Insulated Wire & Cable Company, 114 Liberty Street, New York City.

### Northern Electric of Canada Opens Hamilton Warehouse

The Northern Electric Company, Ltd., 121 Shearer Street, Montreal, recently opened a warehouse in Hamilton, Ontario, at 43 King William Street, Empire Building, where it is carrying a complete line of electrical supplies, wires and cables, appliances, etc., performing a function similar to its warehouses at London and Windsor, Ont.

### Robertson-Cataract Buys Utica and Syracuse Supply Houses

The Robertson-Cataract Electric Company, Buffalo, announces that it has recently purchased and is operating the Mohawk Electrical Supply Company, Syracuse, N. Y., and the Utica Electrical Supply Company, Utica, N. Y. The company also has purchased property in Rochester, where a branch office and warehouse will be opened April 1.

For many years the Robertson-Cataract Electric Company has covered the entire State of New York (except the metropolitan and southeastern portion) as well as the northern tier of counties in Pennsylvania, and with the acquisition of the concerns enumerated it proposes to give the same service and intensive cultivation throughout the entire territory that has heretofore been given in western New York.

J. B. Wiseman, formerly purchasing agent, has been made supervisor of merchandise in connection with the expansion plans of this company. S. H. Brownlee, formerly investment manager, has been appointed manager of purchase and investment.

### To Represent Pacific Electric

Representation for the Pacific Electric Manufacturing Company has been provided in Denver by J. Ludwig Hansen, an electrical engineer of Salt Lake City, who recently opened offices in the Colorado capital.

### Changes in Varney Supply Staff

The Varney Electrical Supply Company, 121 South Meridian Street, Indianapolis, jobber, announces that H. A. Robertson has been appointed general manager of both its Indianapolis and Evansville (Ind.) houses. He was formerly manager of the Evansville branch. C. S. Walker continues as president of the company and W. H. Makepeace as sales manager of the Indianapolis house. O. L. Ferguson has been made local manager at Evansville and J. H. Richards sales manager at Evansville.

### Killark of St. Louis Appoints California Sales Agent

The Killark Electric Manufacturing Company, Easton and Warne Avenues, St. Louis, manufacturer of fuses, conduit fittings, bell-ringing transformers, soldering paste, etc., announces a new agency arrangement which it has completed recently in San Francisco. The selling agent in this territory is the Electric Sales Company, 111 New Montgomery Street, San Francisco, which will cover northern California.

### Denver Firms Promote Radio

The Hendrie & Bolthoff Company, the Reynolds Radio Corporation, the Winner Radio Corporation, the Rocky Mountain Radio Company and the Mine & Smelter Supply Company, acting through the radio jobbers' association of Denver, have, in the interests of better radio programs, arranged to provide regular afternoon and evening programs from the Reynolds and Winner stations under the direction of Jack O'Brien, a Denver promoter.

### Distributors' Corporation Formed

The Electrical Distributors' Corporation, 47 Center Street, New Britain, Conn., has been incorporated under Connecticut laws to engage in the advertising, distributing and marketing of electrical devices. The capital stock is $200,000, and the officers are: T. H. Lewis, Philadelphia, president; C. F. Smith, New Britain, vice-president; O. F. Rost, Newark, N. J., secretary; V. C. B. Wetmore, Boston, treasurer; P. C. Rickey, Berlin, Conn., assistant treasurer, and E. F. Hall, New Britain, assistant secretary.

### Western Electric Company Breaks Employment Records at Chicago

Records for employment have been broken at the works of the Western Electric Company in Chicago. Increasing at the rate of more than a thousand employees a month since last November, the plant has expanded its force until today it has a payroll of more than 31,000. This rapid growth is a result of the enlarged program of the Bell system.

The growth of the Western Electric works since it opened in 1905 to take over the manufacturing functions formerly carried on at the shops in New York and on Clinton Street, Chicago, has constantly reflected expansion of the country's telephone system. From a working force of 9,974 men and women in 1905 the plant personnel increased to 13,596 in 1910, 16,735 in 1918, 20,125 in 1920 and an average of 26,625 in 1922, until it reached its present high mark for more than 31,000.

The present working force at the Chicago works consists of 21,300 men and 8,700 women. Of this number 7,360 have been employed by the Western Electric Company more than five years each.

**The Main Electric Company**, Cleveland, manufacturer of power and light plants, announces that it has acquired the Radio Company, whose products will be continued as heretofore. The Main company has resumed shipping lighting plants to South America with the improvement in exchange rates and general business conditions.

**The Robert Findlay Manufacturing Company**, 100-104 Lexington Avenue, Brooklyn, N. Y., manufacturer of lighting fixtures, has plans nearing completion for the erection of a three-story plant addition, 60 ft. x 100 ft., estimated to cost $25,000. It is expected to call for bids and award a contract at an early date.

**The Interstate Electric Company**, St. Louis, Mo., recently organized with a capital of $20,000, has arranged for the operation of a local plant for the manufacture of battery-charging outfits for radio and other batteries and kindred electric equipment. The initial capacity will be about fifty charging outfits daily.

**The International Lamp Corporation**, Chicago, has been organized with a capital of $2,000,000 to take over and merge the International Lamp Manufacturing Company, 5338 Wabash Avenue, Chicago; the Superior Furniture Manufacturing Company, the Standard Lamp Manufacturing Company and the Garden City Manufacturing Company. Nathan Manilow, head of the first-named company, is president of the consolidated organization.

**The Pure Carbon Company**, Wellsville, N. Y., manufacturer of carbon brushes for motors and generators, also carbon specialties, announces the establishment at Clarksburg of a northern West Virginia representative, Norman Strugnell.

## Foreign Trade Notes

ELECTRIFICATION OF THE SWISS FEDERAL RAILWAYS TO BE RUSHED. —The Director-General of the Swiss Federal Railways, in a speech recently delivered before the members of the Swiss press regarding the accelerated electrification of the Federal Railways, stated that of the total amount appropriated for that purpose 25 per cent, or about 112,500,000 francs, will be expended abroad for the purchase of material. It is now proposed to rush the work on the electrification of 1,117 km. so that all the lines will be completed at the end of 1928. According to the new program, about 190 km. will be electrified each year, instead of 110 km. Energy to operate the above lines will be secured from the Barberine power station, now under construction, and the upper station at Chatelard. The cost of these stations is estimated at 42,000,000 francs and is included in the amount appropriated for the electrification work.

SPAIN DECREES RADIO A MONOPOLY. — The Spanish government has declared radio telephony, according to *Commerce Reports*, a state monopoly, and a decree to this effect was published March 1. Bids for an exclusive concession to exploit radio telephony in Spain will be asked within sixty days. Foreign companies interested will be given an opportunity for submitting proposals. It is stated, however, that Spaniards will have the preference in the matter.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency is desired in Bolivia (No. 5,627) of electrical goods, sanitary supplies, etc.

An agency is desired in Austria (No. 5,669) for automobile accessories, such as lighting systems, electric starters and furnishings for bodies.

An agency and purchase is desired in France (No. 5,684) for an electric dishwashing machine for household and hotel use.

Purchase or agency is desired in Italy (No. 5,685) for small electric furnaces for gold and silversmiths and like trades.

Purchase is desired in Spain (No. 5,691) for three electric cranes to lift up to 6,614 lb. with a radius of 14 m., with arms 16 m., on track of 5 m. width inside rails, and four electric motors, three-phase, 50 cycles, 11,750 volts, alternating current, to be transformed on the motors provided.

ADDITIONAL POWER FOR THE RAND MINES, SOUTH AFRICA. — The directors of the Victoria Falls & Transvaal Power Company, Ltd., which, with its subsidiary, the Rand Mines Supply Company, Ltd., supplies most of the Rand mines and municipalities with power, according to *Commerce Reports*, contemplate extensions to its plant, including the installation of two large generating units with boilers and accessories, which will be purchased in the near future. The municipality of Johannesburg is considering making arrangements with the company whereby the former will connect its light and power system with the municipal system of the town of Johannesburg.

TURBO-GENERATORS FOR WHITE BAY POWER HOUSE, SYDNEY, AUSTRALIA.—Tenders will be received by the Railway Commissioners until June 13 for two 20,000-kw. turbo-alternators with condensing plant and accessories for the White Bay power house, Sydney, of the New South Wales Government Railways and Tramways.

WATER-SCREENING PLANT FOR THE MORWELL POWER SCHEME, AUSTRALIA.—Tenders are being asked (no date) by the State Electricity Commission of Victoria, Melbourne, Australia, for a water-screening plant for the Morwell power scheme (Specification 23-28).

CAMA, NORTON & COMPANY, 11 Elphinstone Circle, Bombay, India, importers of electrical machinery, plants, devices and appliances, would like to receive catalogs and other literature relating to electrical machinery, equipment and appliances, and would also like to correspond with manufacturers and dealers of same.

POSSIBLE MARKET FOR ELECTRIC TRUCKS IN MARSEILLES, FRANCE.—Owing to the scattered location of many large factories and shipping firms around Marseilles, France, there is a considerable demand for trucks. Gasoline trucks have been used heretofore, but an enterprising firm, *Commerce Reports* states, desires to introduce electric trucks on account of their greater economy of operation. Further information may be secured on application to the Automotive Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

## New Apparatus and Publications

ELECTRIC INCUBATOR AND BREEDER. — The Oakes Manufacturing Company, Tipton, Ind., has placed on the market an all-metal electric incubator.

ELECTRIC SOLDERING IRON. — The Post Electric Company, 30 East Forty-second Street, New York City, has developed a new small electric soldering iron.

TRAFFIC LAMPS. — The Safety Traffic Light Manufacturing Company, 425 East Water Street, Milwaukee, has brought out a new line of disappearing-dome safety traffic lamps.

ELECTRIC RANGES.—Three new models of electric ranges, known as "Hotpoint Hughes" apartment-house ranges, have been developed by the Edison Electric Appliance Company, Inc., 5,600 West Taylor Street, Chicago.

ATTACHMENT FOR BATTERY CHARGE.—A device for charging "B" batteries, to be used as an attachment to the "Tungar" battery charger, has been developed by the General Electric Company, Schenectady, N. Y.

COIN-OPERATED ELECTRIC FAN.—The electric Fan Sales Company, Memphis, Tenn., has placed on the market an electric fan that will run one hour for each nickel deposited in the slot.

WAFFLE IRON.—The Fitzgerald Manufacturing Company, Torrington, Conn., has recently brought out a new "Star-Rite" waffle iron.

COMBINATION TESTER.—A combination tester, "Jefferson," for spark plugs and automobile lamps has been developed by the Jefferson Electric Manufacturing Company, 426 South Green Street, Chicago.

CEILING FAN.—An alternating-current ceiling fan with a "Brascolite" lamp attachment has been brought out by the Hunter Fan & Motor Company, 46 West Forty-eighth Street, New York City.

METER BOX. — A complete meter box installed so that it may be read outside the building is being offered by the Donley Brothers Company, 7,400 Ætna Road, Cleveland.

ELECTRIC WATER HEATER.—An electric water heater that can be attached to any water boiler has been developed by the Acme Electric Heating Company, 1,217 Washington Street, Boston.

SURGE ARRESTERS.—Bulletin No. 4-A distributed by the Electro Service Company, Marietta, Ga., describes the "Bennett" surge arresters and disk gaps.

## New Incorporations

THE MILFORD TOWNSHIP POWER COMPANY, Philadelphia, has been chartered to install and operate an electric system in Milford Township. R. Van Horn, 4,929 Catherine Street, Philadelphia, is treasurer.

THE CLARKE COUNTY POWER & WATER COMPANY, Vancouver, Wash., has been incorporated with a capital stock of $50,000 by C. W. Riddell, R. S. Durkee, A. L. Miller, George Nowak and H. H. Riddell. The company proposes to erect a transmission line to Battle Ground and vicinity.

THE CORAL GABLES UTILITIES COMPANY, Miami, Fla., has been chartered with a capital stock of $500,000. The officers are: George E. Merrick, president, and Edwin G. Bishop, secretary and treasurer.

THE LANIER COUNTY POWER COMPANY, Milltown, Ga., has been incorporated by F. E. Hatch, Albany; R. T. Berryhill, Milltown, and others. The company is capitalized at $300,000 and proposes to construct a hydro-electric plant on Lake Irma, for which contract has been awarded.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

LEWISTOWN, ME. — Electric power equipment will be installed in the proposed addition to the textile mill of the Hill Manufacturing Company, to cost $175,000.

MANCHESTER, N. H.—The directors of the Manchester Traction, Light & Power Company have authorized an increase in capital stock of $708,300, the proceeds to be used to pay for the addition to the Kelley's Falls plant and for laying wires in underground conduits which have already been built.

BEVERLY, MASS.—Plans for the proposed high school to be erected at Sohier Road and Conlon Street, to cost about $1,000,000, include a power plant. Adden & Parker, 177 State Street, Boston, are architects.

FALL RIVER, MASS.—Plans are under way for a new power development at Fall River to supply power in Fall River, Pawtucket and Brockton. A new company will be formed, known as the Montaup Electric Company, to operate the plant. The cost of the proposed plant is estimated at $11,000,000. Interests connected with the Fall River Electric Light Company, the Edison Electric Illuminating Company of Brockton and the Blackstone Valley Gas & Electric Company are said to be behind the project.

WORCESTER, MASS.—Improvements are contemplated by the Worcester Electric Light Company, including the installation of a 12,500-kw. turbo-generator. The cost is estimated at about $500,000.

WOONSOCKET, R. I.—Work has begun on the construction of a new power plant for the Guerin Mills, Inc., to cost about $80,000.

GEORGETOWN, CONN.—The Gilbert & Bennett Company will install electric power equipment in its proposed three-story mill addition, 50 ft. x 135 ft., for the manufacture of wire cloth.

MIDDLETOWN, CONN.—The construction of a new power house on Water Street is under consideration by the Connecticut Power Company, as are improvements to the power house in the Cromwell district. The company also plans to lay a 13,000-volt cable from Middletown to Portland.

SOUTH COVENTRY, CONN.—The Willimantic Paper Company will install a waterwheel and electric power equipment at its local mills.

## Middle Atlantic States

BUFFALO, N. Y.—Electric power equipment will be installed in the new printing plant to be erected by the J. W. Clement Company, Lord Street, at a cost of about $150,000.

BUFFALO, N. Y.—Plans for the proposed plant of the Hendon Chemical Company, recently organized, include a power house. The cost is estimated at about $1,000,000. Williams, Minard & Williams, Erie County Bank Building, are representatives.

BUFFALO, N. Y.—The New York Telephone Company has awarded a contract to the John W. Cowper Company, Fidelity Building, for the construction of a three-story mechanical plant at East Delavan and Jefferson Avenues, to cost $250,000. A machine shop with motor-driven equipment will be installed.

TRENTON, N. J.—The board of directors of the Mercer Hospital are considering the construction of a power house, to cost about $30,000.

DANVILLE, PA.—The installation of a street-lighting system on Mill Street is under consideration.

HAZLETON, PA.—The Wilkes-Barre & Hazleton Railway Company will install additional transformers and other equipment at its power plant. Connection will be made with the lines of the Pennsylvania Power & Light Company.

MARTIN'S CREEK, PA. — The Atlas Portland Cement Company, 25 Broadway, New York, is planning to install a 6,250-kw.

turbo-generator and auxiliary equipment in the power house of its local cement-mill. Extensions and improvements will also be made at other power plants of the company.

NORRISTOWN, PA.—The power plant of the Montgomery Ice & Coal Company was recently damaged by fire, causing a loss of about $55,000.

PHILADELPHIA, PA. — The Milford Township Power Company, recently organized, plans to erect a transmission line in Milford Township. R. Van Horn, 4920 Catherine Street, Philadelphia, is treasurer.

PHILADELPHIA, PA. — Electric power equipment will be installed in the printing plant to be erected by the Philadelphia *Inquirer* at Broad and Callowhill Streets, to cost about $500,000.

PHILADELPHIA, PA.—The Philadelphia Electric Company has acquired property, 100 ft. x 100 ft., adjoining its power plant on Sansom Street, for proposed future additions.

PITTSBURGH, PA. — The Philadelphia Company has issued $10,000,000 in bonds, the proceeds to be used for extensions and improvements, including an addition to its steam-generating plant on Duquesne Way to increase the output by 5,500 hp.

PITTSBURGH, PA.—The Duquesne Light Company is arranging a construction program for extensions and improvements at its Colfax power plant and transmission lines, including the erection of a number of substations, to cost about $10,000,000.

POTTSVILLE, PA.—The East Penn Electric Company has issued $2,500,000 in bonds, the proceeds to be used for the construction of a 33,000-hp. steam-driven electric power plant, on which preliminary work has been commenced.

WILKES-BARRE, PA. — A contract for street lighting has been awarded to the Wilkes-Barre company. All gas lamps will be replaced with electric lamps.

BALTIMORE, MD.—Tentative plans are under consideration by the United Railways & Electric Company for extensions and improvements during 1923, involving an expenditure of $2,120,000.

NEWELL, W. VA.—Electric power equipment will be installed in the proposed addition to the plant of the Homer Laughlin China Company, to cost about $700,000.

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until March 20 for 10,000 ft. of high-tension ignition cable, No. 26, B. & S. gage. (Circular 590.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until March 27 for a quantity of inclosed fuses for Eastern and Western yards. (Schedule 595.)

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until March 20 for insulators (Circular PR 13938-A-1CP); until March 19 for switchboard supplies (Circular PR 13932-1 CP); until March 22 for air condensers (Circular PR 13936-A-5CP): until March 26 for ten 200-ft. tubular-steel radio masts and one mast-erecting equipment complete (Circular PR 13938-A-22CP).

## North Central States

IONIA, MICH.—The Ypsilanti Reed Furniture Company will install electric power equipment for its proposed addition, to cost about $150,000.

ALLIANCE, OHIO.—The installation of a new ornamental lighting system is under consideration by the City Council.

TIFFIN, OHIO.—The County Commissioners have decided to install an electric lighting system in the buildings at the Seneca County Infirmary.

CARTER, KY.—The Ashland Limestone Company plans to build a power house at its local plant. M. E. S. Posey, Ashland, is manager and engineer.

LOUISVILLE, KY. — The City Council has applied to the Federal Power Commission for permission to construct two municipal hydro-electric plants, one on Green River near Mammoth Cave, and one the Cumberland River, near Burnside.

SEYMOUR, IND.—The Automatic Control Company, 707 Odd Fellows' Building, Indianapolis, contemplates building a plant in Seymour, including a power house, estimated to cost about $1,000,000. The Russell N. Edwards Company, 45 Union Trust Building, Indianapolis, is architect.

BELLEVILLE, ILL. — The Southern Illinois Light & Power Company, Hillsboro, contemplates the erection of a high-tension transmission line from Belleville to Edgemont, a distance of 10 miles.

CHICAGO, ILL. — The Illinois Central Railroad Company, 135 East Eleventh Place, is preparing plans for the electrification of its Wildwood yard, south of Kensington, and of the Markham yard, to cost about $1,000,000.

AMERY, WIS.—The Wisconsin Hydro-Electric Company contemplates extending its transmission lines to the village of Prairie Farm.

LADYSMITH, WIS.—The City Council has authorized the obtaining of estimates of cost for the installation of a municipal lighting plant to serve the city buildings and the ornamental street-lighting system.

MARSHFIELD, WIS.—The City Council has authorized the Light and Water Commission to advertise for bids for the installation of a new generating unit for the municipal electric light and power plant.

PHILLIPS, WIS.—The property of the Phillips Light, Heat, Water & Power Company has been acquired by the Flambeau Public Service Company, which will furnish electricity to operate the local service from its plant at Parks Falls. The Flambeau company, it is understood, will rebuild the entire local distribution system in the near future.

PLYMOUTH, WIS.—The committee appointed to investigate the question of purchasing electricity instead of generating it at the municipal electric plant has recommended to the City Council that the city accept the proposal of the Eastern Wisconsin Electric Company, Sheboygan, to supply electricity for the city. The company offers to erect a transmission line from its substation to the municipal plant.

PLYMOUTH, WIS. — Preliminary arrangements, it is reported, are being made by the Badger Public Service Company, Elkhart Lake, for the erection of a 132,000-volt transmission line from the electric generating plant of the Milwaukee Electric Railway & Light Company at Lakeside to Plymouth. The Badger company is now building a transmission line from Kewaskum to Cedar Grove.

ANNAPOLIS, MO.—Plans are being prepared for the construction of an 800-ft. power dam, 100 ft. high, to develop from 2,000 hp. to 5,000 hp., to cost about $1,000,000. The proposed dam will furnish power to the mines of the Annapolis Lead Company near here. C. T. Dana, International Life Building, St. Louis, is interested in the project. W. A. Fuller, Railway Exchange Building, St. Louis, is engineer.

HOLLISTER, MO. — Preliminary plans have been prepared by the Empire District Electric Company, Joplin, for a 1,500-ft. power dam, 175 ft. high, on White River, about 3½ miles from Hollister, to cost about $15,000,000. A large power plant, it is said, will be erected here at a later date. G. A. Montgomery, Joplin, is manager.

ST. LOUIS, MO.—Bids, it is understood, will soon be asked by the St. Louis & San Francisco Railroad Company, St. Louis, for repair shops, round shop, power house, mill shop, etc., at Fyler Avenue and railroad right-of-way, to cost about $500,000. R. C. Stephens is architect.

SEDALIA, MO.—The City Light & Traction Company plans to install soon equipment at its power plant, now under construction at Broadway and Ingram Avenue. It will have a capacity of 8,000 kw. and will cost about $350,000.

SENECA, MO.—H. G. Olmstead & Company, Oklahoma Building, Oklahoma City, engineers, have been engaged to prepare plans for a transmission line and local distributing system.

CLEARWATER, NEB.—Plans are being prepared for extensions and improvements in the municipal electric light plant.

RANDOLPH, NEB.—The installation of a Diesel engine and other equipment at the municipal power plant is under consideration.

KANORADO, KAN.—Bids will be received by the Council until March 27 for the erection of a transmission line, to cost about $25,000. W. B. Rollins, Railway Exchange Building, Kansas City, Mo., are engineers.

PARSONS, KAN.—The Kansas City Gas & Electric Company will build a steel-tower transmission line from Parsons to Wichita. Work will soon begin on its new local generating plant. The entire project will cost about $3,500,000.

WICHITA, KAN.—The American Power & Light Company has issued $5,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

WICHITA, KAN.—L. R. Hurd, president of the Red Star Milling Company, and associates are planning to build a power plant to furnish electricity to two units of the Red Star Milling Company's mills, at 1901 Worth Emporia Avenue. Contracts have been placed for part of the equipment.

## Southern States

CHINA GROVE, N. C.—The Swink Manufacturing Company contemplates erecting a large cotton mill and the development of a new town, to be named Swink. The town site will be on the Southern Railway, 6 miles south of Salisbury, and includes a development of 400 acres, power and sewer systems, to cost about $2,000,000. W. J. Swink, China Grove, is president.

FAISON, N. C.—Bonds for $15,000 have been sold, the proceeds to be used for a municipal lighting plant.

HENDERSON, N. C.—The Blue Ridge Power Company contemplates a new hydro-electric development on the Green River, to develop about 8,000 hp., at a cost of about $1,000,000.

WADESBORO, N. C.—The Wade Manufacturing Company is planning to build a hydro-electric generating plant for service at its cotton mills. The Yadin River Power Company is interested in the project. Robert & Company, Atlanta, Ga., are engineers.

BLACKSHEAR, GA. — Negotiations are under way between the Council and the officials of the Ware County Light & Power Company, Waycross, to furnish electricity to operate the local system. It is proposed to establish a twenty-four-hour service.

JACKSONVILLE, FLA.—Plans are being prepared for the construction of a substation on Enterprise Street, to cost about $55,000.

JACKSONVILLE, PA.—Bids will be received by the City Commission of the city of Jacksonville until March 19 for equipment for the municipal electric plant, including one 12,000-kw. turbo-generator, surface condensing equipment, switchboard additions and improvements, for generating and substations, constant-current transformers, power transformers, synchronous motors, two storage batteries, lead-covered cable and jointing material and copper wire. W. A. Evans is chairman. The Scofield Engineering Company, Philadelphia, is consulting engineer.

TALLAHASSEE, FLA.—The West Florida Power Company plans to erect a transmission line from Quincy to Havana, Fla. Work will soon begin on a hydro-electric power plant on the Ocklocknee River, 9 miles from Tallahassee, to cost about $500,000. Mees & Mees, Charlotte, N. C., are engineers.

TAMPA, FLA. — The Tampa Electric Company contemplates extensions and improvements, to cost about $300,000.

WAUCHULA, FLA. — Electrically operated pumping machinery and power equipment will be installed at the municipal waterworks.

CHATTANOOGA, TENN. — Extensions and improvements are contemplated by the Tennessee Electric Power Company during 1923, involving an expenditure of about $1,000,000, of which about $400,000 will be spent in the Chattanooga district, $100,000 being for the street-railway improvements. The balance will be used for substations, street-lighting purposes, transmission and distribution, lines, etc.

BIRMINGHAM, ALA.—Plans are being prepared by the St. Louis & San Francisco Railroad Company, St. Louis, for round-house, car repair shop, power house, machine shop, etc., to cost about $500,000, at East Thomas. Bids, it is understood, will soon be asked for the work.

HEFLIN, ALA.—The electric plant of the Heflin Telephone & Electric Company was recently destroyed by fire. At present the town is without electrical service.

NEWTON, ALA. — The Houston Power Company will soon take bids for equipment for the proposed 3,000-hp. addition to its local hydro-electric plant. The Southern Engineering Corporation, Albany, Ga., is engineer.

JACKSON, MISS.—The property of the Jackson Public Service Company, including the street-railway, electric and gas systems, has been purchased by H. C. Couch and J. L. Longino of Pine Bluff, Ark., and associates. Improvements to the systems, it is said, are contemplated.

BAUXITE, ARK.—The Arkansas Light & Power Company will build a transmission line for service in the city and for the plant of the American Bauxite Company.

SWIFTON, ARK. — Surveys have been made for the installation of an electric light plant in Swifton. A. T. White is reported to be interested in the project.

BATON ROUGE, LA.—The City Council is having plans prepared for complete new waterworks and sewerage systems, light and power plant, street improvements, etc., to cost about $1,000,000. J. W. Billingsley, Interstate Bank Building, New Orleans, is consulting engineer.

JEFFERSON, OKLA.—Plans are under way for the erection of a transmission line and extensions to the local distribution system, to cost about $10,000. J. D. Bomford, Masonic Temple, Enid, is engineer.

PICHER, OKLA. — The Mogul Mining Company plans to rebuild its plant and power house, recently destroyed by fire, causing a loss of about $90,000.

ELDORADO, TEX.—The Arkansas Light & Power Company is preparing plans for an ice-manufacturing and refrigerating plant, to cost about $100,000.

GRANBURY, TEX.—A special election will be held on March 20 to vote on the proposal to issue $75,000 in bonds for the installation of a municipal electric light and water plant.

## Pacific and Mountain States

BELLINGHAM, WASH. — The Puget Sound Power & Light Company and the Pacific Northwest Traction Company (affiliated) contemplate extensions in power systems in Whatcom and Skagit Counties to cost $400,000.

RAYMOND, WASH.—Arrangements have been made by the Willapa Lumber Company for the installation of a 1,500-kw. turbine, to cost from $75,000 to $100,000. The company proposes to electrify its entire plant.

SEATTLE, WASH.—The Banner Refining Company, Kohl Building, San Francisco, contemplates the construction of a power house at its proposed local refinery, to cost about $200,000.

YAKIMA, WASH.—The Artificial Ice & Cold Storage Company will install electric power equipment at its proposed ice-manufacturing and cold-storage plant, to cost about $100,000.

BERKELEY, CAL.—Plans are being prepared for an ornamental lighting system on Telegraph Avenue from the south city limits to Allston Way. About seventy-five standards will be required.

EL CENTRO, CAL.—The City Council has authorized Harry Ott, superintendent of the city department, to secure estimates of the cost of an electric plant of sufficient capacity to operate the pumping plant and to furnish electricity for street lighting.

FULLERTON, CAL.—The County Brick & Tile Company, recently organized, contemplates the installation of a substation in connection with its proposed local plant, to cost $50,000. F. C. Krause is interested in the company.

LOS ANGELES, CAL.—The Public Service Commission has rejected bids recently received for ammeters, and new bids will be called.

PORTOLA, CAL.—The electric plant of the Grizzly Electric Company was recently destroyed by fire, causing a loss of about $5,000. R. B. Young is owner.

SACRAMENTO, CAL.—Tentative plans are under consideration for the installation of an ornamental lighting system on Twelfth Street, from the Capitol grounds to the subway.

SAN MATEO, CAL. — Plans are being drawn for the installation of an ornamental lighting system in the business district, for which bids will soon be asked. G. Stanley Whitehead is engineer.

SAN MATEO, CAL.—The Pacific Gas & Electric Company will build a steel-tower double transmission line in San Mateo County, in the vicinity of Redwood City and Visitacion Valley (24 miles), to cost about $915,000.

SANTA MONICA, CAL.—Plans are being prepared for the installation of a street-lighting system on Pier Avenue.

SAN RAFAEL, CAL.—The Pacific Gas & Electric Company, San Francisco, contemplates the installation of a new generator and accessories and the erection of 8 miles of transmission line.

VENICE, CAL.—The proposal to issue $100,000 in bonds for the installation of an electric distributing system was defeated at a recent election.

EPHRAIM, UTAH.—Plans are being considered for extensions to the municipal electric light plant.

LOGAN, UTAH.—An election will be held April 2 to vote on the proposal to issue $200,000 in bonds for enlarging the municipal electric light plant.

ALAMOSA, COL.—Arrangements have been made by the local officials of the Colorado Power Company to provide electrical service in the towns of Antonito and Manassa, which heretofore have been served by local plants. The cost of rebuilding the systems in the two towns is estimated at about $12,000. The cost of extending the service to those communities is placed at $30,000. A private line from Alamosa to La Jara will be leased and a new line (22,000-volt) erected from that point into Antonito. A substation will be built at Romeo.

DENVER, COL.—In addition to several ornamental street-lighting projects planned for the spring, new lamps at street intersections in the residence section of the city have been authorized by the City Council. About 150 lamps will be installed, consisting of arc lamps, 400-cp. incandescents and 80-cp. bracket lamps.

RENO, NEV.—The Truckee River Power Company is preparing plans for extensions in its transmission lines (48 miles) for connection with the system of the Pacific Gas & Electric Company near Lake Spaulding, to be operated at 60,000 volts. The cost is estimated at about $300,000.

## Canada

BLENHEIM, ONT. — The Councils of Erieau, Cedar Springs and Erie Beach are having plans prepared for the installation of electric lighting systems in each town, electricity to be supplied from Blenheim. Frederick A. Gaby, chief engineer of the Hydro-Electric Power Commission of Ontario, will have charge of the work.

DURHAM, ONT. — The Hydro-Electric Power Commission of Ontario is planning to extend its transmission lines through Grey County, with Durham as the central point. F. A. Gaby, Toronto, is chief engineer.

HAMILTON, ONT.—The Hamilton Hydro-Electric Commission contemplates the erection of a new substation, to cost about $100,000.

LONDON, ONT. — The Public Utilities Commission is planning extensions to the ornamental lighting system, to cost about $30,000.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued Feb. 27, 1923)

1,446,523. Insulator; L. Steinberger, Brooklyn, N. Y. App. filed Feb. 14, 1919. Means for securing hollow strain members to strain or suspension insulators.

1,446,544. Electrical Sound-Detecting Apparatus; P. W. Bridgman, Cambridge, Mass. App. filed June 25, 1919. Microphone of double-cell type.

1,446,546. Method and Apparatus for the Fixation of Nitrogen; C. H. Buettner, Cincinnati, Ohio. App. filed Feb. 3, 1922. By annular electric arcs.

1,446,552. Weighing Scale; H. F. Dunn, Anderson, Ind. App. filed May 10, 1916. Electrically actuated indicating means for weighing scales.

1,446,582. Call-Distributing System; L. Polinkowsky, Antwerp, Belgium. App. filed June 20, 1922. Uniformly distributing calls received over a number of operators' positions.

1,446,593. Stress-Distributed Insulator; S. S. Sonneborn, Brooklyn, N. Y. App. filed April 24, 1918. High-tension guy-wire type that is subjected to considerable mechanical stress.

1,446,598. Terminal; T. W. Turner, Minneapolis, Minn. App. filed May 24, 1921. For aërial cable telephone wires.

1,446,622. Cut-Out Box; W. C. Hollins and F. P. Arrousez, Los Angeles, Cal. App. filed Aug. 27, 1919. Fireproof cut-out box.

1,446,642. Motor Controller; E. I. Deutsch, Milwaukee, Wis. App. filed April 2, 1920. Automatically interrupts braking connection of alternating-current motors upon stopping of motor.

1,446,650. Electrical Condenser; B. MacPherson, Roxbury, Mass. App. filed Oct. 22, 1919. For radio service.

1,446,653. Electric Curling Iron; M. Murphy, Indianapolis, Ind. App. filed March 30, 1922.

1,446,695. Electric Lamp Stand; H. Dunn, San Francisco, Cal. App. filed Jan. 12, 1921. Table light with switch button on top of shade.

1,446,703. Electric Heater; F. Hnilo, Cicero, Ill. App. filed April 9, 1921. Room heater of reflector type.

1,446,720. Process of Treating Electrical Resistances to Stabilize Their Resistance; F. R. Parker, Chicago, Ill. App. filed Jan. 8, 1920.

1,446,736. Manufacture of Hydrogen and Oxygen; F. G. Clark, Toronto, Ont., Can. App. filed Aug. 29, 1919. By electrolytic decomposition of water.

1,446,738. Fire-Alarm Signal Booth; J. Dziedzie, Detroit, Mich. App. filed May 1, 1920. Alarm system installed in booth that automatically locks when alarm is given.

1,446,748. Electroscopic Apparatus; F. A. Johnsem and K. Rahbek, Copenhagen, Denmark. App. filed July 16, 1919. For indicating charge of electricity in a body.

1,446,752. Generator and the Generation of Multiple Frequencies; B. W. Kendall, New York, N. Y. App. filed Dec. 29, 1916. Production of carrier waves for multiplex signaling.

1,446,757. Electrical Rectifier; O. K. Luscomb, Allston, Mass. App. filed May 19,1919. Vibrating type.

1,446,769. Aperiodic Pilot Condctor; M. I. Lupin, Norfolk, Conn. App. filed Jan. 10, 1920. For telephone systems.

1,446,770. Magnetic Interlocking Repeater; C. J. Rogers, Morris, Okla. App. filed Sept. 27, 1919. For telegraphic work.

1,446,780. Electric Flashing Device; V. W. Balzer and J. McK. Ballou, Los Angeles, Cal. App. filed Sept. 14, 1920. Sign advertising equipment.

1,446,787. Turbo-Generator Set; C. W. Dake, Chicago, Ill. App. filed Aug. 20, 1919. Small set such as is used for lighting locomotives.

1,446,798. Electric Flatiron; W. T. Hoofnagle, Glen Ridge, N. J. App. filed June 1, 1921. Fusable plug opens circuit within iron at predetermined temperature.

1,446,807. Electric Heater for Liquids; J. F. Mercer, Globe, Ariz. App. filed Nov. 29, 1921. Heating element placed between successive compartments.

1,446,821. Service Entrance Cap; C. H. Bissell, Syracuse, N. Y. App. filed Aug. 29, 1916. For electrical conduits.

1,446.861. Dynamo-Electric Machine; J. Slepian, Wilkinsburg, Pa. App. filed May 23, 1919. Means for annulling counter-rotational currents.

1,446,880. Thermostat and Control System; O. A. Colby, Irwin, Pa. App. filed Jan. 23, 1920. Helical bimetallic element heated in accordance with temperature of heat-storage device.

1,446,882. Method of Repairing Storage Batteries; C. W. Cox, Ames, Iowa. App. filed July 28, 1919. Method of steaming battery cells, drilling top connectors, withdrawing elements, washing and reassembling.

1,446,890. Radio Receiving Apparatus; L. Espenschied, Hollis, N. Y. App. filed June 7, 1918. Complicated connections of inductances and condensers to eliminate static.

1,446,898. Stator Structure for Dynamo-Electric Machines; M. E. Gysel, Wilkinsburg, Pa. App. filed Dec. 13, 1917. Laminated core and method of fastening in place.

1,446,909. Automobile Signal Light; H. F. Kuechler, Kenosha, Wis. App. filed March 14, 1922. Rear-end direction signal.

1,446,971. Electrical Controlling System; J. H. Hunt, Dayton, Ohio. App. filed May 21, 1921. Electrically controlling machine-gun firing through airplane propeller.

1,446,991. Heating Pad; W. Richmond, Chicago, Ill. App. filed Feb. 5, 1920. Electric therapeutic apparatus for treatment of mastoid and sinus trouble.

1,446,995. Temperature Compensating Appliance; H. S. Sines, Chicago, Ill. App. filed Nov. 7, 1921. Compensates for varying resistance of ammeter shunt caused by temperature.

1,447,026. Automatic Liquid Starter for Alternating and Three-Phase Current Motors; J. Lewin, Berlin-Halensee, Germany. App. filed June 5, 1922. Short-circuiting bars and liquid within motor rotor.

1,447,031. Electrically Heated Warming Pad; G. T. Newell, Jr., Beverly, N. J. App. filed Jan. 30, 1920. Three different degrees of heat with thermostatic control.

1,447,043. Electric Heater; J. H. Ross, Toronto, Ont., Can. App. filed Aug. 5, 1921. Heated for air-drying machines.

1,447,044. Heating Device; H. E. Roys, New York, N. Y. App. filed April 9, 1920. Grill plate.

1,447,046. Resiliently Mounted Armature; T. S. Scott, Pittsburgh, Pa. App. filed Feb. 15, 1919. Spring carriage for single-phase railway motors.

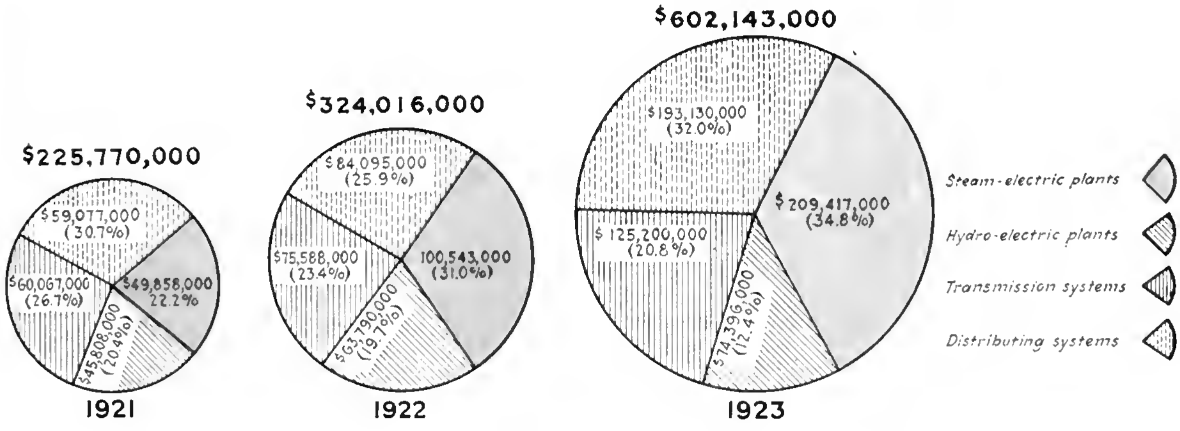
1,447,050. Anti-Rolling Handlamp; F. G. Stimson, Hamden, Conn. App. filed May 20, 1922. Octagonal head.

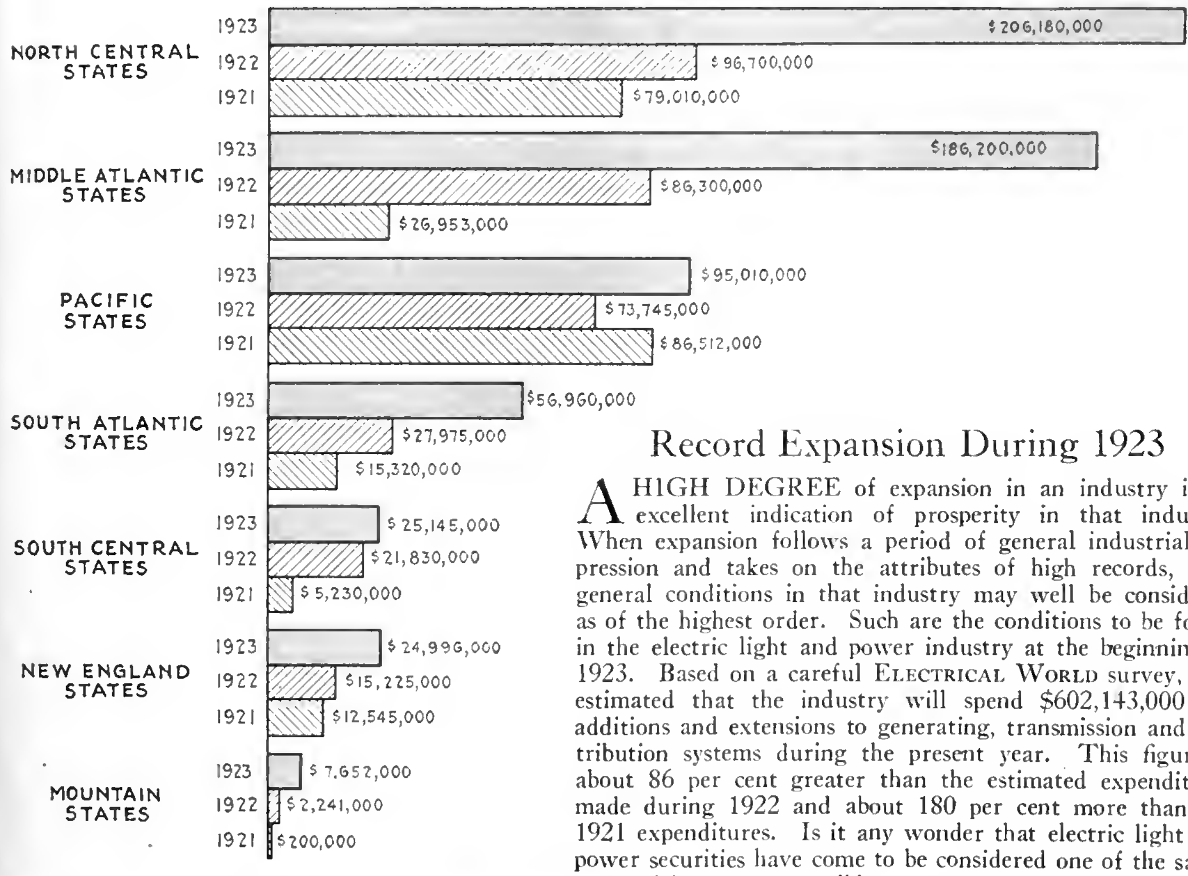
# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## Estimated Value of Central Station Additions and Extensions During 1923 Almost Double that of 1922

*The North Central States Lead in Proposed Expenditures During 1923*

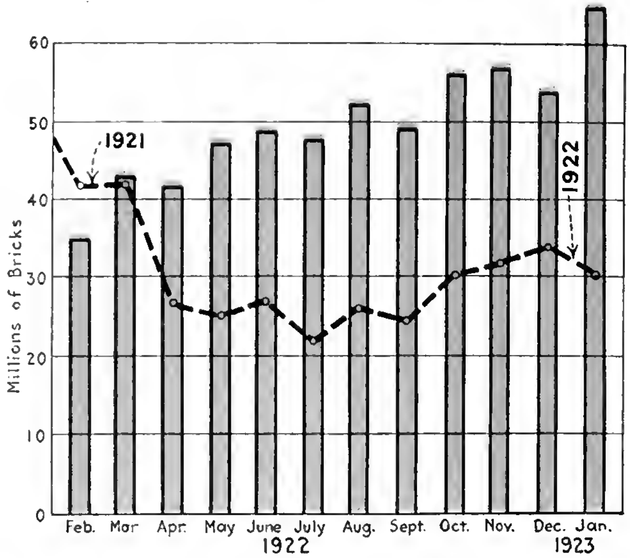


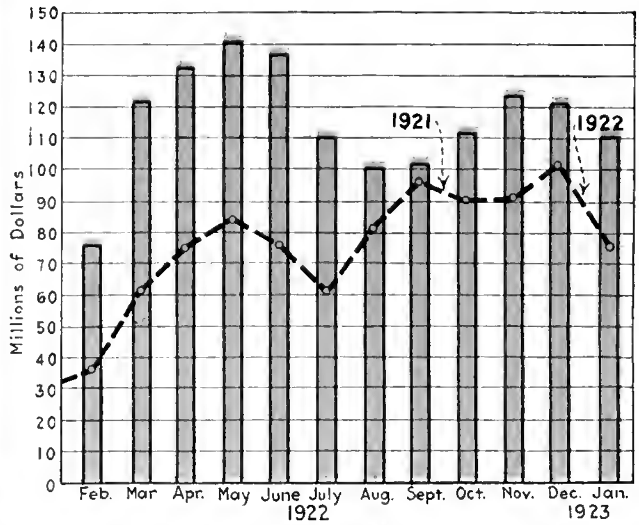

### Record Expansion During 1923

A HIGH DEGREE of expansion in an industry is an excellent indication of prosperity in that industry. When expansion follows a period of general industrial depression and takes on the attributes of high records, then general conditions in that industry may well be considered as of the highest order. Such are the conditions to be found in the electric light and power industry at the beginning of 1923. Based on a careful Electrical World survey, it is estimated that the industry will spend $602,143,000 for additions and extensions to generating, transmission and distribution systems during the present year. This figure is about 86 per cent greater than the estimated expenditures made during 1922 and about 180 per cent more than the 1921 expenditures. Is it any wonder that electric light and power securities have come to be considered one of the safest types of investment possible next to government bonds?

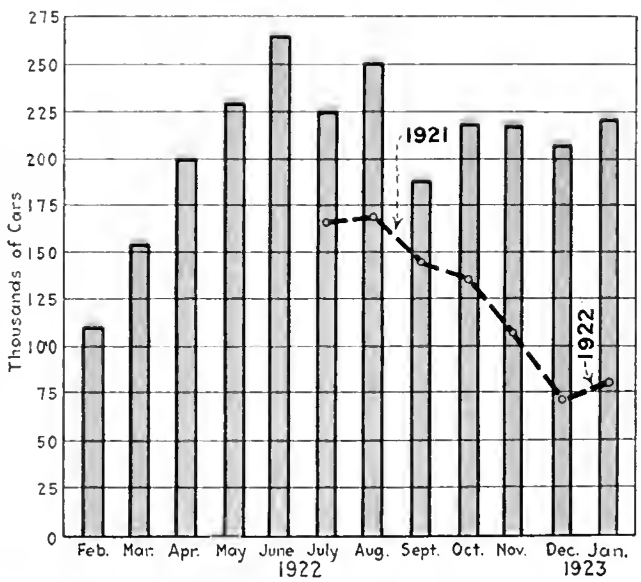
## How the Primary Industries Are Trending



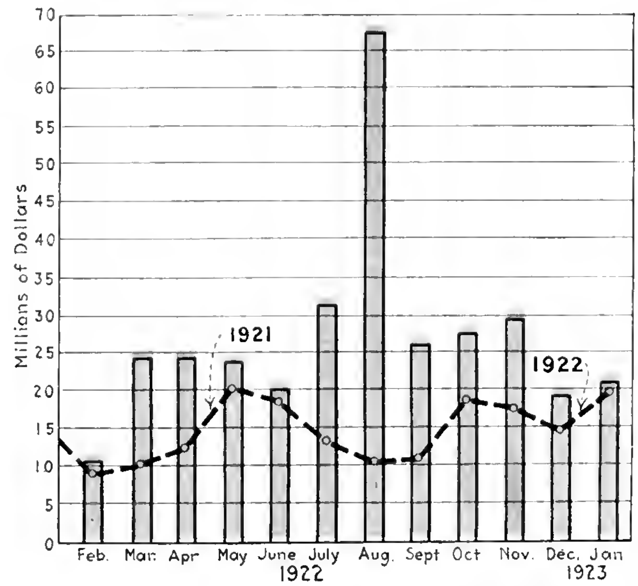

Clay Fire Brick Production



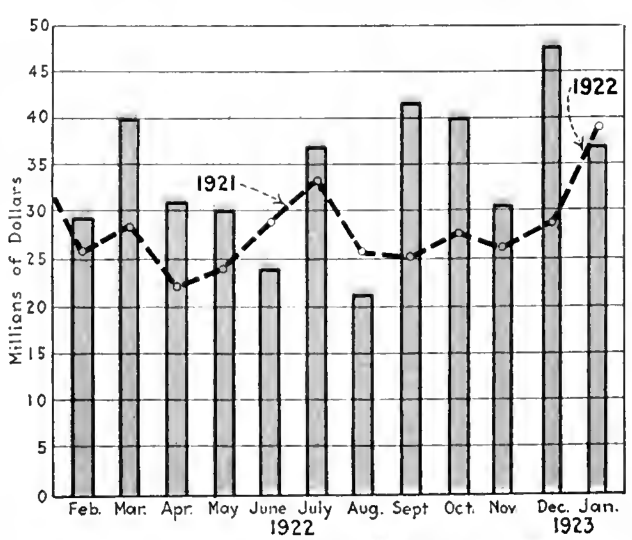

Contracts Awarded for Residential Buildings




Passenger Automobile Production




Contracts Awarded for Industrial Buildings




Fire Losses

## Prospects for Exceptional Spring Activity Crystallizing

GENERAL PROSPERITY, with indications of expansion in the spring, is reflected in the review of the national industrial situation issued by the United States Department of Labor this week. There is very little unemployment reported anywhere in the country, while in some sections, notably in the steel-manufacturing centers, there is a scarcity of unskilled labor. In the typical industrial state of New York factories were taking on more workers; in fact, a shortage in common labor was reported by all districts of the state. Despite the severe weather conditions, building continued active during February and was operating at a faster pace than during January. Prospects for exceptional spring activity have crystallized into actual development in practically every section of the country.

Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

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# National Versus State Rights in Water Power

NOT until the United States Supreme Court passes on the question will the rights of the federal and state governments to the water powers of navigable streams be definitely and finally fixed. The federal water-power law of 1920 is generally regarded as a constructive measure. Under it, as the record shows, water-power development has received great impetus. Not only does the law satisfy the conservationists, but it favors state and municipal governments without discouraging private corporations from also engaging in the business, which is a real achievement. That Governor Smith of New York should question the constitutionality of the federal law ought not to give the industry much concern. He is clearly within his rights in so doing, and since the highest court of the land will some day have to pass on the matter the issue might just as well be raised now and by a state which can well present and amply defend its case.

It is none the less an unfortunate condition that pending the outcome of the litigation water-power development in New York will be under a cloud and prospective investors in hydro-electric properties will be discouraged, if not actually deterred, from buying the securities of such companies, much to the detriment of the electrical industry and the growth of many a community. But such temporary handicaps cannot be avoided. They serve the course of orderly justice, and, however irritating they may be, they do not alter the fact that the American people are set on having their water powers developed and no governor or state can alter that determination or stay that program.

This, of course, has nothing to do with state development of water power in New York. That is a horse of another color. What water power is now developed in the state, and it is an appreciable amount, greater than is developed in the whole of Sweden, has been due to private enterprise, and private enterprise is still willing to engage in the work if it receives half a chance. Under the circumstances, therefore, state development is not only uncalled for, but is hardly likely to be sanctioned by either the voters or their representatives at Albany. The Empire State may be all sorts of things, but it is still the Empire State, and its interests are too important and too complex to permit it to be shoved off the well-built road of experience and sanity into the unpaved byways of adventure and socialism.

# William Edward Mitchell

*An electrical engineer of ability and force whose power to organize and to inspire loyalty and enthusiasm has made him an influence in the public utility world.*

TO BE the leader in the design, erection and operation of an electric power system totaling over 200,000 kw. in generator capacity, with 1,500 miles of transmission lines and with particular problems due to its phenomenally rapid growth, shows the ability of a man as an electrical engineer. But to be the recognized human leader to whom the individuals in his organization, from the top to the bottom, turn in time of trouble—personal or otherwise—marks a much larger ability. Such a man is William E. Mitchell, assistant general manager of the Alabama Power Company and one to whom the organization looks as a leading spirit.

Mr. Mitchell was born in Massachusetts, in 1882, of Scotch ancestors. After graduation in electrical engineering at the Massachusetts Institute of Technology, he spent two years in the test course of the General Electric Company, then six years in Brazil with two large power companies in construction and operation, becoming the electrical engineer of the Bahia Tramway, Light & Power Company.

In 1912 he removed to Alabama, where the Alabama Power Company was being organized, and was made the electrical engineer of that company during construction, and then operating manager as soon as the company's steam and hydro-electric plants were ready to deliver power. Mr. Mitchell continued to guide the destinies of the operating end of the company until the world war indicated the need for a strong man to direct the activities of the Anniston Steel Company, a subsidiary producing electric furnace steel for war purposes. Mr. Mitchell was made managing director of the steel company. After the termination of the war he returned to the Alabama Power Company as assistant general manager.

In the eleven years of its existence the Alabama Power Company has grown to be one of the first twenty largest power systems in America. In the building up of this magnificent property in an almost virgin territory William E. Mitchell played a very prominent part. He possesses the necessary physique, experience and magnetism to lead and inspire his organization. All the ruggedness and other traits of character which one associates with men who contend with the forces of nature in the mountains and rivers are his, and like most men who are of the pioneer type he is intensely human.

Mr. Mitchell has been active in National Electric Light Association work in the Southeastern Section, being a past-president and a member of various committees.

# Editorial Comment

Electrical World, March 24, 1923

Volume 81 Number 12

### A Co-operative Opportunity That Should Be Grasped

CONSPICUOUS among the opportunities for co-operation that the future of the electrical industry holds is the chance for increased mutual service between manufacturers and users of equipment. To utilize this opportunity to the full, manufacturers' engineers should be kept in the field to gain the viewpoint of operating, construction and maintenance engineers. Thus fortified, modifications of equipment can be made to meet operating conditions more effectively since the design will have a practical as well as a theoretical basis. On the other hand, many users of equipment will be wise enough frankly to relate their experiences and their troubles. In some cases operating companies can greatly help by permitting the use of their systems or equipment as was done by a number of companies last year. When this is done, the results of the co-operative study by maker and user should be made available to the entire industry and not confined to a favored few. Both manufacturer and operator will benefit considerably if operating conditions are outlined clearly and specifically in ordering equipment and if trouble with existing installations is both recorded and reported.

### The Technique of Post Office Illumination

THE tardy but welcome awakening of the Post Office Department to the essential character of good lighting was celebrated editorially in the ELECTRICAL WORLD a few weeks ago. This week it is glad to put on record in more complete form the recommendations of the Public Health Service on the lighting of post offices that were made at the request of the department and are the evidence that its slumber is over. In many respects the report is a notable one—a signpost on the road of progress that cannot be disregarded. To a certain degree the lighting of post offices occupies a unique position in the art of artificial lighting, and this must be borne in mind in using the report as a guide to practice. Post office lighting is not, indeed, really comparable with those normal requirements of clerical work with which it is likely to be confused. In the first place, post office work involves two distinct working planes—horizontal and vertical—both of which must be brought to a suitable degree of illumination. This at once applies two limitations in luminaire design, a condition quite unusual and one that explains what would otherwise seem to be very needless detail of specification. Second, the work involves the speed element to a degree most exceptional in clerical work, and this in turn, as shown by many recent experiments, brings need for a much higher degree of illumination than would be needed, for example, in ordinary bookkeeping. Finally, the objects worked upon are varied and often extremely bad in color and contrast, thanks especially to the abominable window envelopes, which present a condition similar to the one caused by use of tracing cloth, notorious for requiring exceptionally strong lighting.

It is not surprising, therefore, to find a value of 10 foot-candles initial set as the standard for post office workers. Considering the conditions and the certainty of the standard falling presently to 7 or 8 foot-candles, the basis is none too high from the standpoint of real efficiency. Another commendable feature is that the specific brightness of the globes is kept low and linked to the light flux of the lamp, so that there may be no overloading of the globe for the sake of cheapness, a fault which seriously impairs the usefulness of many commercial units. The report is a piece of constructive work of real value to the art of lighting, and it deserves to be appreciated and acted upon.

### Contrasts in Attitudes on Public Relations

CONTRASTS in the method of attacking the public relations problem were presented at the joint session of the recent conventions of the Oklahoma Utilities Association and Southwest Geographic Division, N. E. L. A. John W. Shartel in a few minutes' extemporaneous talk excoriated the public, the politicians, the legislators and the utility commissions for their unfair attitude toward utilities. Henry S. Ives, an insurance man, in what he frankly said was intended to be an alarmist effort, painted in somber colors all the possible horrors of state socialism in business. On the other hand, Labert St. Clair, in a homely little story of Aunt Sally Ann Dusenbury, the typical friend, confidente and indispensable village angel, painted the public as "just folks" who can be reached and touched by a little understanding human treatment. John W. Gleed, in an equally homely and forcible manner, emphasized the same thing and told his hearers that escape from too drastic state regulation and extreme political action lies entirely in the hands of utility men themselves, because in dealing with the American public they are simply meeting average human beings who are trying amid perplexing circumstances to be fair and to do the right thing. The method of helping the public to be decent and right is the method so little tried of "Do unto others as ye would they should do unto you."

Messrs. Shartel and Ives may have relieved their feelings and may have aroused a few who lay in lethargy; but Messrs. St. Clair and Gleed have caught a vision of the fact that in the hands of business men, and in their hands alone, lies the determination of the question of how far government will enter into business. Government is now in utility affairs principally because men early in the utility business—from the steam railroad to the central station—could not see that self-regulation is the only substitute for governmental regulation and that one or the other must exist.

Similar arguments apply in other fields of business,

and some of the recent occurrences in the commercial and industrial world, notably in the coal industry, furnish an interesting study as to why the governmental authorities get into business. Until business learns to practice self-regulation the march of government into business, with all its painful mistakes, inefficiency and economic blunders, will continue. Speeches such as those of Messrs. Shartel and Ives are likely only to add fuel to the flames. Why waste the energy? The attitude of Messrs. St Clair and Gleed represents the best thinking of progressive men in all utility fields.

## Co-operation Will Hasten the Use of Electrical Energy on the Farm

STRIPPED of the excess verbiage with which it is sometimes surrounded, the problem of using electrical energy on the farm is purely an economic one. On the one hand, the electrical industry has a service to sell; it must be able to sell that service at a profit. On the other hand, the farmer wants to buy that service; he must be able to use it at a profit. The American farm is a producing agency and as such has its producing and sales problems. These problems are in no way different in principle from those of any other business; but in organization features the agricultural industry is different from others, since it consists of small units with all the limitations that small units must have when big problems are being faced.

The farmer, in spite of opinions to the contrary, is a real user of power. The best supply and use of this power is basically a technical problem. Other industries in the past quarter of a century have attained a development in the use of power that is a direct result of the degree to which it has been possible to bring the best of technical talent to bear on their problems; but the farmer has not had the advantage of tremendous business organizations and the consequent power to deal with technical and business problems in the most efficient way. This lack of individual ability to handle technical problems is being supplied by the development of the experimental stations and agricultural engineering schools of America. These have already done a tremendous technical work in the development of agriculture. With them must lie the burden of the research work involved in the solution of the entire problem of farm power. The electrical industry has much to offer to help in this work. The more it co-operates with the technical research agencies established for the benefit of agriculture, the more rapid will be the progress toward a final solution of the problem of the use of electrical energy on the farm.

## Inductive Effect on Radio Receivers a Future Problem

IN THE last year the term "inductive interference" has taken on a new meaning of rather serious import. This time it is not the signal interests that are involved but the section of the general public which is making intensive use of the radio receiver. Physical hazards due to the installation of an antenna close to light and power lines were the trouble brought to the attention of the central-station operator in the first few months of the development. Now the novice is learning that, while static disturbances may be the explanation of a great many of his receiving troubles, some of the troubles styled static may be due to other causes. A number of cases have been noted where wise amateurs have taken a loop and a simple receiving set, located faults on a transmission or distribution system and asked the power company to eliminate them.

The seriousness of the situation is that the people affected represent an influential section of the public. As they find there are cases in which power circuits cause inductive effects they will, in ignorance, naturally lay other troubles to the same source. The suggestion of one utility operator that the existence of such trouble should not be admitted will not help the situation. Whether he wants to or not, the central-station operator must pay attention to this phase of radio development and keep the confidence of his public so that any cases of inductive effects will be reported to him first and he will have an opportunity to straighten them out or educate the complainant to the fact that there are other sources of trouble and also that there are some inductive effects that are normal and cannot be eliminated without serious curtailment of electric light and power service. The opportunity is now present to guide radio development and prevent interference questions from getting before public regulatory bodies. Ignoring them only makes them more acute with a slight postponement of the day of reckoning.

## "Our Representative the Contractor"

THERE is nothing new in the idea that the contractor represents the central-station company at least as an indirect solicitor of business. But it is not so generally realized that many a new customer's ideas of the central-station organization are formed by the contractor's opinion of the utility. The contractor and his men enter a residence or a business establishment to install wiring, and very often a discussion of the local electric service company and its practices follows during the period of work. If the customer's contact with the utility has been confined to the application clerk, and if relations are not good between the electric company and the contractor, an initial prejudice may be formed in the consumer's mind which is very hard to dislodge.

In a community where the utility plays fairly with the contractor and vice versa the new customer starts with the impression that all is well with the local electrical industry. He may not put it into words, but this establishes a groundwork of confidence which encourages the purchase of electrical devices and the provision of a wiring installation somewhere nearly adequate to the local conditions and opportunities. There is still a vast amount of ignorance anent things electrical on the part of the public, and it is to the vital interest of the industry that local trade relations shall be excellent.

Where merchandising is done on a list-price basis, with fair dealing and open competition, good feeling is pretty sure to abound. Where the central station works in accord with the contractor, taking into consideration his views when framing its service rules, giving him when feasible an opportunity to share in special appliance campaigns, and in general treating him as "one of the family," popular confidence also in the local electrical interests is enhanced and prosperity is stimulated. An embittered contractor, on the other hand, constantly struggling to make both

ends meet across the gap of price cutting or other concessions in a community where the electrical league spirit has found no outlet, can do as much harm to the electrical trade as a "sore" utility employee. Square dealing between all branches of the industry is its own justification, but in realizing this central-station executives will do well to ponder the contact of the contractor-dealer with the customer and its potentialities for good.

## Shall the Central Stations Establish a Research Organization?

THE central-station industry has attained a velocity which gives it a tremendous momentum. Every operating company is strained almost to the breaking point to satisfy the demands for light and power service. Every company rushes from the completion of a generating station to the installation of new feeders, transformers and substations in order to keep pace with the rapid increases in load. Clauses in rate systems are added or changed overnight to take advantage of new applications of electricity and new conditions in the ever-expanding loads. The manufacturers continually bring out new or more efficient apparatus. Is it any wonder that men in the operating organization find their time fully occupied with the daily operating duties?

But the rapid growth and expansion of central-station properties and operations inevitably have brought about conditions on the systems which do not result in economical or the most efficient operation. Men engaged in building new stations and new lines have little time to study the efficiency or economy of the existing systems after they are installed and still less time to engage in developmental research for future needs. Yet load conditions change on the old installations; power transformers become overloaded or underloaded; feeders become too large or too small for the loads they carry; the distribution layout becomes inadequate or cumbersome as the population shifts in locality or occupation; the power stations contain equipment that might economically be replaced by new and more efficient apparatus; substation apparatus gets obselete rapidly, and practice changes as new developments occur. Changing needs and advanced technical information make possible research developments that would secure more efficient operation.

Just recently there has been a very decided recognition of the conditions outlined, and a marked trend toward greater efficiency in operation is noticed. In most cases the management has recognized that the operating staff is too busy with necessary, even if semi-routine, duties to devote any time to efficiency studies, and in many cases a new department has been established for carrying out studies designed to secure greater efficiency, more economical distribution of equipment or better apparatus for obtaining desired results. In some companies this department devotes its energies to power production, studies the power-station equipment in the existing plants and works out the design problems for new stations in so far as they deal with thermodynamics; in other cases certain men study the distribution system to determine the most economical layout for copper and transformers, and in still other instances men are detailed to study problems connected with the operation of some particular part of the system. In nearly every instance these special-duty men are relieved of operating routine and are selected for their technical ability. They have proved their value and become increasingly important as a system grows in magnitude. In one instance college professors are used to advantage during the summer; in other organizations specially selected technical men work under the direction of the chief executive. These men prepare special reports on power-factor-corrective apparatus or rates, transformer capacity for industrial installations, relative merits of distribution systems, economic layouts for feeders and substations, and also do some research work in testing out new equipment developed by manufacturers, or even develop equipment for special operating requirements.

This move has a real importance and is warranted by existing conditions. Major economies are being obtained on many systems and the extent of this movement cannot be gaged. It is a good time to question whether the specialists in the ranks of the manufacturers should longer be called upon to serve as the research men and technical advisers for the operating companies—whether they cannot apply their skill much more effectively to the development of new equipment or technique. Furthermore, the properties on which the research problems exist are usually large and widely scattered and are complicated by local conditions which make it imperative that the special problem men be familiar with the system continuously. Many of the problems are largely economic and involve confidential information.

It has been definitely recommended by some who are studying the question that steps be taken to develop a co-operative research organization, backed and financed by the central-station industry, which will apply itself to the technical problems. Certainly, some method of advancing co-operative work along such lines would prove of advantage. If such plan is to be carried out, thought should be devoted to securing development along sound lines and steps can be taken immediately to avoid duplication of effort on the part of individual companies.

## What Does Appliance Servicing Cost the Central Station?

ONE of the problems under consideration in central-station commercial circles in many parts of the country is how to reduce the cost of appliance servicing. In too many cases this has been overlooked, and the need of more data upon the subject is undeniable. Practice varies considerably in operating companies as to repair cost accounting, rules as to guarantees, minimum billing and no billing at all! One important operating syndicate is now making a thorough study of the whole subject in the hope of arriving at some real costs and thereby sounding the safe depths of the commercial channel for future passage and a standardized course, if feasible. It is a safe bet that appliance servicing costs more than is ordinarily credited to it, not only in the central-station field but among electrical retailers in general. In some cases efforts appear to be fairly successful along the line of combining servicing work with other customer-contact activities; in other communities the public accepts minimum charges for repairs as a matter of course. Further steps toward assembling and studying servicing costs will yield valuable information to the industry if the results are made generally available by operating companies.

# Water-Power Resources Aid Norway

The upper view shows a valley in Norway before the development of its water-power resources. The lower view shows the same valley after the site has been developed for the Rjukan station, which supplies power to the large saltpeter factory. About 100,000 hp. is utilized in Norway for making saltpeter by electrical processes. Furnaces of 4,000 kw. of the Birkeland-Eyde type are used in this factory in the city of Rjukan. These furnaces use a strong electromagnetic field to spread and draw out the arc.

# Water Powers of Norway

## A Realization of Its Vast Power Resources Has Brought the Scandinavian Kingdom to the Front as an Industrial Nation—In Norway More than 5 Hp. per Capita Is Available from Hydro-Electric Developments

By C. N. ANDERSON

THE general idea of Norway is of a land full of milk and honey because of the prevalence of cheap electrical power. As the result of an extended tour of the kingdom the author of this article describes the whole Norwegian situation in a way that co-ordinates the engineering developments and their effect on industrial and social conditions. In studying costs the reader must consider the relative purchasing power of money in Norway and the United States, but the data afforded are interesting and valuable to all conservationists.

IN ACTUAL power, Norway has more hydraulic horsepower than any other country in Europe, and when one takes population or area into account it leads the world. With a maximum of 12,000,000 available horsepower distributed over less than 125,000 square miles and among a little more than 2,000,000 people, there is an average of 100 hp. per square mile and more than 5 hp. per individual. Compare this with the United States, with 6 hp. to 10 hp. per square mile and from ¼ hp. to ½ hp. per individual. Of the 12,000,000 hp., 1,650,000 is developed, leaving an enormous amount waiting for a market or for the capital to develop it. The first electrical power station in Norway was built in 1885. Today there are more than two thousand, and few buildings, urban or rural, are without electric lighting and few homes without electric stoves and cooking apparatus.

The uses to which the power is put are many and varied. One-quarter of it is used directly by sawmills, pulp, paper and grist mills. Of the remainder approximately 10 per cent is used for light, 10 per cent for heat, 60 per cent is utilized by large electrochemical, electrometallurgical and electrothermal industries and 20 per cent by railways and for miscellaneous purposes. Just what the future consumption will be is a matter of speculation. With a continued increase in population at the same rate at which it has increased in the past hundred years it will be another century before the present population will be doubled. Allowing 1 kw. per individual at that time, 1,500,000 kw. for heating city buildings and 500,000 kw. for railways, there is still left from 2,000,000 kw. to 3,000,000 kw. for the use of the large industries.

The reason for the large allotment to individual use is that a strong feeling against capitalism prevails and every means is being taken—almost to the extent of absurdity—to hinder anything but community development of Norway's greatest natural resource. "It belongs to the people and it is the people who shall reap the benefits" is the cry. Public ownership is, however, no better here than anywhere else—probably worse. Norway is not a rich country and cannot appropriate at one time enough money to carry a development through within a few years, but rather appropriates a little at a time. This means that the work is spread out over a long series of years, enthusiasm wanes, progress slackens, personnel changes and so do plans.

Moreover, some of the plant designers are addicted to extravagance when the community is to pay the bills—trying to incorporate every little whim, to include every possible piece of apparatus, so that it will be impossible for any one else to say: "We have something that you haven't." Such practices can only result in a more expensive output and a decrease in demand.

Low as the cost of energy is, a consumers' strike is not an unheard-of thing in Norway. The cost figures given below are for the year 1919 at normal rate of exchange:

| | Range | Average |
|---|---|---|
| Horsepower-year | \$15.00—\$65.00 | \$25.00 |
| Kilowatt-year—light and heat | 35.00— 90.00 | 45.00 |
| Kilowatt-hour—light | 0.06— 0.20 | 0.08 |
| Kilowatt-hour—power | 0.025— 0.15 | 0.05 |

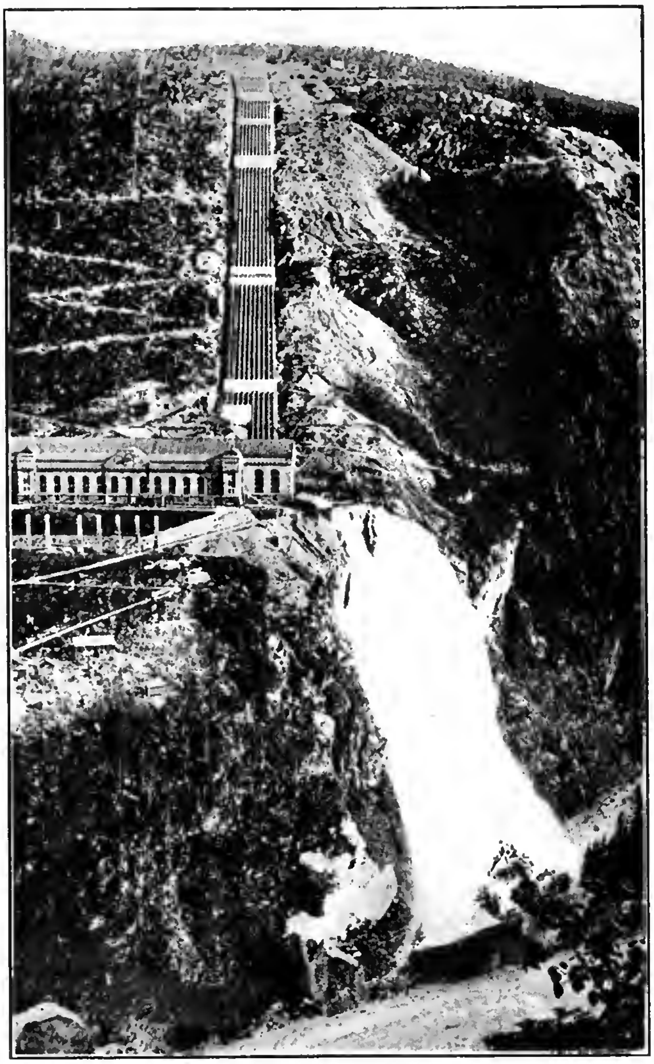
As these prices were under pre-war contracts and continued through the period of inflation the equivalent cost in dollars at the present time is from one-half to three-quarters of the figures given. One notable

AT SARPSFOSS 58,000 HP. IS UTILIZED BY TWO POWER STATIONS, ONE OF WHICH USES THE ENERGY TO PRODUCE CELLULOSE

example of cheap power is the case of the city of Christiania, which buys from Kykkelsrud, under a contract not expiring before 1948, 20,000 kw. at 35 kroner ($9 normal exchange, $6 present) per kilowatt-year. At a later date 4,000 kw. additional was contracted for at five times the previous price.

In contrast with the American farmstead, practically all of the farm buildings not too far back in the mountains are supplied with electricity for light, heat and power. The farmsteads are not large, so that where the land is tillable at all the different homes are so near together that one transformer is sufficient for several farms. Voltage and frequency for the most part have wide limits, and transformer losses are not taken into account, for the reason that the energy is sold by the kilowatt-year. The common voltage is 220. Power consumption is limited to the amount to which the consumer is entitled by a time-acting relay called a "vipper," of which there are several types. This intermittently breaks the circuit when the power consumption exceeds the predetermined amount.

There has been considerable discussion about the exportation of power. Sweden is fairly well supplied, with the possible exception of the territory on the Norwegian frontier. Denmark, on the other hand, is dependent entirely on steam generation, and at present there is much discussion over the projected export of 100,000 kw. to that country. There is so much skepticism, however, arising from the conditions which are to be met, the problem of financing the undertaking and the question whether Norway can afford to contract away a hundredth part of her power that it will probably be many years before the exportation will become a reality. The plan would be to transmit power either by high-tension direct-current cable from Arendal or Christiansand under Skagerrak to Jutland, a distance of a hundred miles, or by an alternating-current transmission line along the Swedish coast to the vicinity of Gothenburg and then by cable under Kattegat to the island of Laesö and then to Fredrikshavn. Copenhagen is already supplied by power from Trollhättan, Sweden.



THE RJUKAN 1 STATION DEVELOPS 162,000 HP. AND SUPPLIES POWER TO SALTPETER FACTORIES

The power utilized by the large industries is devoted to the manufacture of carborundum at Eydehavn near Arendal; ferro-chrome, ferro-silicum, and ferro-molybdenum at Meraker, Tysse, Eydehavn and Sarpsborg; carbide and cyanamide at Odda, Bjölvo, Meraker, Kragerö, Sarpsborg and Saude (under development); aluminum at Eydehavn, Christiansand and Höyanger; sodium at Fredrikstad, copper and nickel at Kopperaaen and Sulitelma, iron at Ulefoss, steel at Stavanger, saltpeter at Christiansand, Notodden and Rjukan and in other smaller cities.

Of these, the saltpeter industry is the largest, and the town of Rjukan, with its good homes and shops, parks, public library and waterworks, bountifully supplied with electricity, is an excellent example of how engineers may bring modern civilization to what a few years before was an almost inaccessible wilderness.

Norway can be divided more or less naturally from both a geographical and a hydraulic standpoint into two divisions—northern Norway and southern Norway. The former consists of a long narrow strip extending from the Russian frontier east of Nord Kyn and Nord Cape, the two most northerly points on the mainland of Europe, to the vicinity of Trondhjem. Here the peninsula widens out into the lobe which is usually called Sydlige Norge. This part not only has the most inhabitants but also 80 per cent of the available water power.

The mountain divide which runs approximately north and south in Norway, a little to the west of the median meridian, forms a divide for the streams. On the west side the streams are numerous and short and consequently have high heads without an exceptionally large amount of water, in spite of the fact that they are in the region of greatest rainfall. On the east side the streams are longer and heads are not so high, but there is a larger amount of water on account of the large drainage areas. A convenient grouping of the waterfalls can be made by dividing the country into northern Norway, western Norway, southern Norway, and central and eastern Norway, as follows:

| Section | Hp. Available | Hp. Developed |
|---|---|---|
| Northern Norway | 2,700,000 | 152,000 |
| Western Norway | 5,050,000 | 500,000 |
| Southern Norway | 2,180,000 | 622,000 |
| Central and Eastern | 2,610,000 | 380,000 |
| Total | 12,710,000 Hp. | 1,654,000 Hp |

The available power does not include waterfalls, in which pre-war construction would cost more than $125 per turbine-horsepower, or falls which without regu-

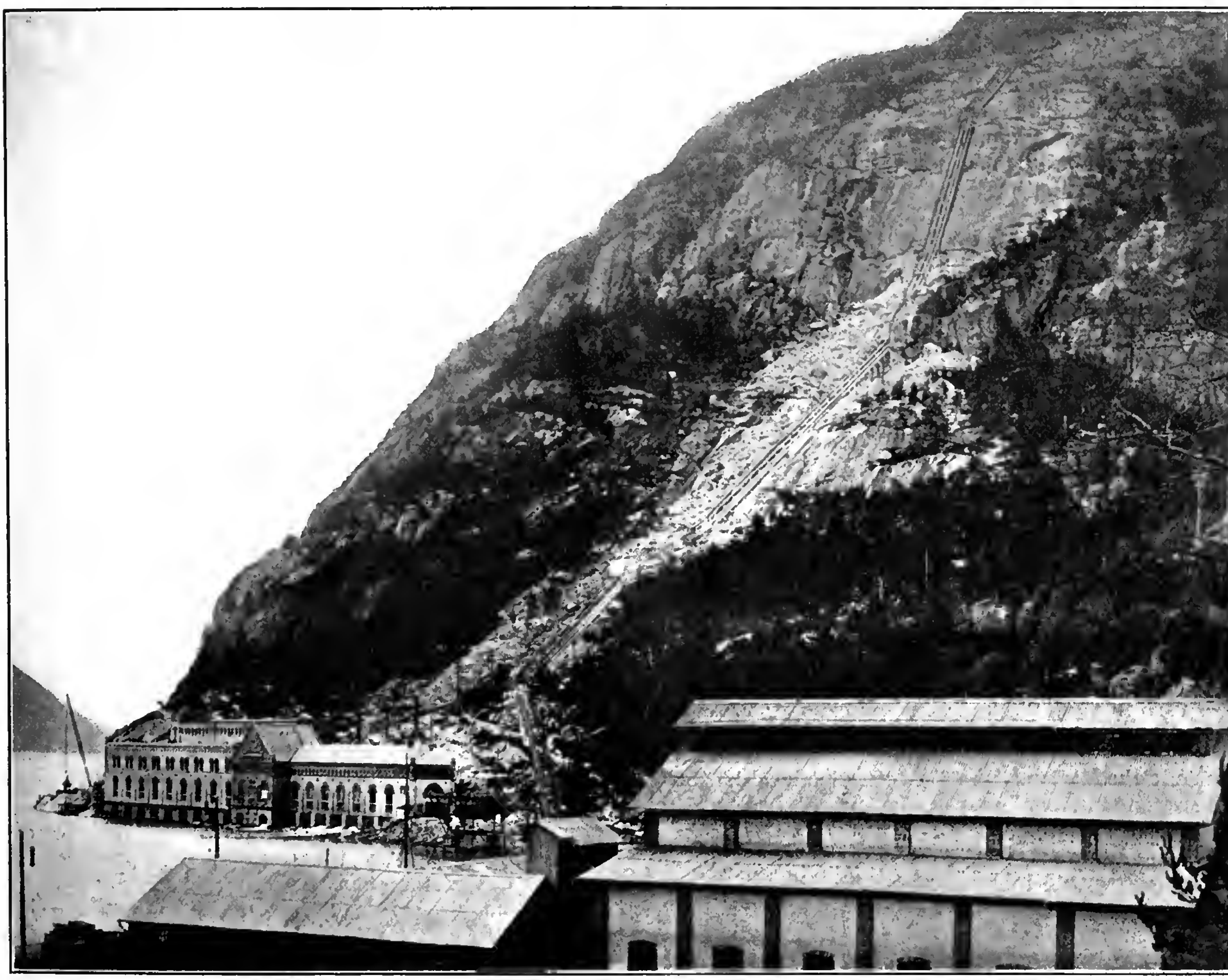
lation would give 1,000 hp. If other sites are included, the total would be increased by 20 per cent.

### Water Powers of Northern and Western Norway

The water powers of the provinces of Finmark and Troms are for the most part not large but may be of great importance in supplying light and heat for the scattered inhabitants, who live by artificial light for a large part of the year. At present only a few sites are developed, one supplying Hammerfest, the most northerly city in the world, which lies 200 miles within the Arctic Circle. Another, Kaafjord, supplies power and light to an observatory where many investigations of the aurora borealis have been made.

The largest developed power site in northern Norway is on the River Fykanaaga, usually referred to as the Glomfjord development. It is situated on the Glomfjord, 30 miles south of Bodö, 20 miles north of the Arctic Circle and close to Svartisen, the only known glacier in Europe which descends right down to the sea. As there was no natural place for the power station, the river was diverted through a tunnel into the sea and the power house built directly across the old channel. As a first development there are installed two Pelton turbines of 25,000 hp. each and one of 27,500 hp. with a head of 1,450 ft. Each turbine has two runners with one nozzle for each runner. There is only one turbine bearing, the other end being coupled to the generator shaft, which is equipped with two bearings. The generators have a continuous output of 22,000 kva. at 80 per cent power factor and are operated at 25 cycles and 14,000 volts to 15,000 volts. The total available horsepower is 143,000.

Numerous sites are found along the fjords on the west coast of Norway. Of these fjords, Sognefjord is the longest and one of those most frequented by tourists. About 100 miles long, it is nowhere more than 4 miles wide, and in some places almost sheer mountain walls rise above waters 4,000 ft. deep. In the mysterious recesses of its gloomy gorges the old Norse mythology had its home, and they should be the last retreat of those trolls and gnomes by whom they were believed to be inhabited long after faith in Odin, Thor and Freya had been abandoned. In some of the deep ravines the light of the sun does not penetrate for months.

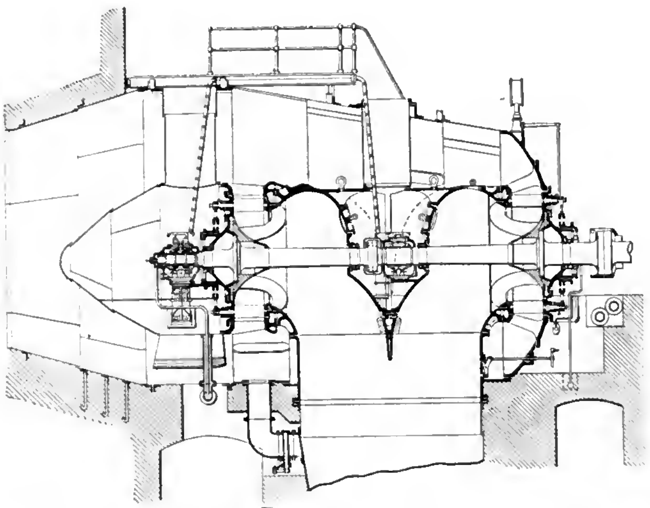


TYSSEDAL STATION DEVELOPS 142,000 HP. WITH A HEAD OF 1,277 FT. AND SUPPLIES POWER TO CARBIDE AND CYANAMID FACTORIES

Aalesund and the immediate community are supplied with light and power from the power station at Tafjord, where two generators with a capacity of 7,300 hp. each are installed. This is the only development in Norway in which the transmission is at a higher voltage than

65,000 volts. Here the transmission voltage is 150,000. The Hoyanger plant of the Norsk Aluminum Company is situated on the Hoyangerfjord, an arm of the Sognefjord. Here are installed seven 4,500-hp. generators driven by Pelton turbines. Each generator is rated at 300 volts, 10,000 amp., direct-current, and they are said to be the largest direct-current generators in the world driven by water power. The problem of regulation was a little difficult in that the generators were required to work under heads of from 1,840 ft. to 2,460 ft. and under conditions in which the load was often thrown entirely on or entirely off.

The Bjölvo power station on the Hardangerfjord is unique for several reasons. The river is very short and has a drainage area of 25 square miles only. There is a small natural regulation basin in the Bjösegrönvandet from which a tunnel leads down to the distribution basin, then through a 1,500-m. tunnel and finally through penstocks from a point 1,485 ft. above sea level



HORIZONTAL DRUM TYPES OF DOUBLE FRANCIS TURBINES ARE USED IN THE VAMMA STATION. EACH UNIT DEVELOPS 12,000 HP. AT 214 R.P.M. UNDER A 90-FT. HEAD

down to the station. The total effective head is 2,860 ft. There is only one penstock at present, 5 ft. 10 in. in diameter at the top and 2 ft. 8 in. at the bottom. The lower part of the penstock is of ½-in. steel pipes reinforced by 1½-in. x 4-in. steel bands 12 in. apart center to center. The three 12,300-hp. units are driven by Pelton turbines. The generators are three-phase, rated at 10,750 kva., 12,000 volts, 50 cycles, 375 r.p.m., with direct-connected 77-kw. exciters. This station has the high-tension apparatus mounted out of doors—one of the few such installations in Europe. No trouble has ever been experienced, although the station is in a region where it rains three hundred days out of the year and at times the apparatus is almost buried with snow.

The largest developed site on the west coast is at Tyssedal. The drainage area of the system is less than 200 square miles and is composed for the most part of a bare mountainous section at an average of 3,500 ft. above sea level. In this section lie numerous small lakes which empty into a larger lake, Ringedalsvand, 3 miles from Sörfjorden and 1,500 ft. above sea level. At the outlet of this lake there is one of the largest dams in Scandinavia, with a length of 1,700 ft. and a height up to 110 ft. The regulation basin can hold 300,000,000 cu.m. and can be regulated through 155 ft. Two tunnels, more than 2 miles in length through solid bedrock, conduct the water down to the distribution basin 1,400 ft. above the sea, from which five penstocks lead down to the station. There are installed fifteen Pelton units of various capacities aggregating 141,840 hp. In order to utilize the head between the distribution basin and the level of the drainage area it is planned to construct a second station at Ringedalsvand which will be as large as, if not larger than, the present development.

There are five sites in the Saude drainage system, not far from Stavanger, two of which are developed. American machinery is used.

### WATER POWERS OF SOUTHERN NORWAY

Most of Telemarken is drained by two large river systems, Eidselven and Tinnelven, which unite in the Nordsjö, the outlet of which (Skienselven) flows by Skien and empties into Langesundfjord at Porsgrund. There are several large sites on Eidselven, but only a very small portion of the power is developed. Tinnelven is fed chiefly from Maarelven and Maanelven through the Tinnsjö. The regulating basin of Mösvand, 3,000 ft. above sea level, serves six stations—Rjukan I, Rjukan II, Aarlifoss, Svaelgfoss, Lienfoss and Tinfoss.

The Rjukan I (Vemork) station was built by the Badische Anilin & Sodafabrik, with 80 per cent of German capital, to supply power to the saltpeter works at Rjukan. It was set in operation in 1912, and with its 162,000 hp. it stands near the top of the list of world's hydro-electric power stations. It was built at a time when much of the machinery of the size required was more or less in the experimental stage. In fact, the whole station was built with more or less skepticism. For that reason we find it half way up the mountain side, and for a long time much of the power went to waste. Later Rjukan II (Saaheim) was built, 4 miles away, to develop power from the discharge water of Rjukan I. A gain of about 325 ft. is made by placing the Rjukan II station down where it is instead of at the bottom of the gorge below Rjukan I. If the development were being made today, the whole station would no doubt be placed at the site of Rjukan II and the whole head utilized by the one plant. On account of the deep and narrow valley in which Rjukan lies, one does not see the sun directly for nearly six months out of the year. In order to make conditions better and also to facilitate transportation, the saltpeter factories would probably be placed 10 miles farther down the valley, on the shore of the Tinnsjöen.

From the distribution basin nearly a thousand feet above the station eleven penstocks from 4 ft. to 6 ft. in diameter conduct the water down. Each penstock is divided to supply one turbine. These are of the double Pelton type with two nozzles for each runner. The turbine efficiencies have recently been raised from 70 to 88 per cent by a slight change in the needle and bucket design.

On account of the lack of confidence at the time of installation in the construction of a single generator of the size necessary, each generator consists of two entirely separate generators on the same shaft inclosed in the same generator housing. They have their own excitation regulation and are fed from their individual transmission lines. The three-phase unit is rated at 14,500 hp., 16,800 kva., 11,000 volts and 50 cycles.

The Saaheim station is within the limits of the town of Rjukan, about 4 miles below the Vemork

station. From the discharge canal of the latter station the water is led down to the Saaheim station by means of a tunnel blasted out of solid rock. This tunnel is a little over 100 sq.ft. in cross-section and has a possible delivery of 2,275 cu.ft. per second. It lies from 100 ft. to 200 ft. deep in the side of the mountain, sloping about 40 ft. in the four miles, ending in a distribution basin blasted out of solid rock inside the mountain. From the distribution basin there go nine penstocks laid in three separate tunnels also blasted out of bedrock. The reason for the grouping is to insure safety in case any of the penstocks should burst. The station building is well built from both the practical and the architectural standpoint. It is constructed entirely of reinforced concrete and houses the furnaces of the saltpeter factory as well as the power station. This combination was resorted to chiefly for one reason and was incidentally made advantageous from two other standpoints. The main reason was to avoid the paying of several million kroner for a new concession, the concession under which the present arrangement was built being an old one and under old laws. In carrying out the plan the transmission system was considerably simplified. The method adopted is such that the necessary cooling of gases takes place in their transport to the saltpeter factory, two-thirds of a mile distant. The gases are first passed through steam boilers which furnish power for three steam turbines and the steam used in the manufacture of saltpeter.

The generator bay in the main building houses the ten twin-runner turbine-driven Pelton units. The turbines of three of the units are equipped with directly connected oil pumps, which not only present a good appearance but take up no space to speak of and are very dependable. The generators are three-phase, operating at 9,500 volts and 18,800 kva., with directly connected exciters. The total output is 150,000 hp.

The switching is of the simplest. One divided bus makes it possible to have any one generator supply power to any furnace. This is rarely necessary, however. It is so only in case one generator unit and a furnace not corresponding to it become inoperative at the same time. For the most part, each generator supplies its corresponding furnace direct, with instrument transformers and excess-current relays on the second floor, knife switches and bus on the third floor, and knife switches on the fourth floor to the choke coils and furnaces in another part of the building. There is no automatic protection except the excess-current relays which operate circuit breakers in the excitation system.

Aarlifoss, Lienfoss, Svaelgfoss and Tinnfoss form a group of stations in the vicinity of Notodden.

The Nore Falls are about 40 miles northwest of Kongsberg and have more than 300,000 hp. available. The sites are owned and are being developed by the state. The work has been spread over several years and numerous plans have been studied. At present work is proceeding slowly with the dam and tunnels.

Vittingfoss and Hakavik are interesting stations, the former being one of the few vertical-shaft installations in Norway. The latter supplies power for the Christiania-Drammen railway, which was changed over from steam last summer.

Nearly the whole of the eastern and central section of Norway is drained by the River Glommen. It is Norway's largest river system and drains one-eighth of its area. There are four or five large undeveloped sites in upper Glommen, but interest is largely directed to the group of five large stations situated within a few miles of each other near the mouth of the river.

Raanaasfoss is 30 miles east of Christiania and has 48,000 hp. of the available 72,000 hp. developed. It is a fine example of power-house construction and is unique in several respects. Two large sector gates 165 ft. long in the middle of the 660-ft. dam are among the largest of their kind. On one end is a rolling gate 150 ft. long and 21 ft. high. The Francis turbines are of horizontal double-runner type, set in open flumes, requiring 3,500 cu.ft. per second under the 40-ft. head for a full load of 11,200 hp. at 107 r.p.m. On account of the low head and the exceptionally low speed, these turbines are unique. The generators are monstrous affairs with rotors 26 ft. in diameter. They have a capacity of 12,000 kva. at 7,500 volts and 50 cycles. Four of them are installed.

The Mörkfoss-Solbergfoss development is at present under construction, and 194,500 hp. will eventually be developed under a head of 70 ft. The dam is built directly across the river, with an auxiliary station placed directly over the old channel housing three 15,000-hp. units. The main station is to be parallel with the river channel and will contain thirteen 11,500-hp. turbine-driven units. All modern European practices are made use of in this station. There are two low-tension buses, but the plan is to operate the generator and transformer as a unit and to parallel on the high-tension side by means of two sets of buses each sectionalized for two units to which the outgoing lines are connected by oil breakers and knife switches. The transformers are equipped with Petersen coils. This station is being built by the Norwegian state and the Christiania commune.

### Low-Head Stations Occur on Glommen

The Vamma power station is a fine example of a modern large low-head station and has been in operation since 1915, furnishing power to Christiania through the Kykkelsrud station and to Fredrikstad and Fredrikshald through the Hafslund station. The dam is 920 ft. long and 130 ft. high. The entrance to the fifteen penstocks is protected from floating débris by trash racks provided with electric heating to prevent the formation of ice. The two 70-ft. and 90-ft. rolling gates are also provided with electric heating. The power house is very attractive, with a plaster frieze on the wall of the generator room and air outlets attractively latticed. Seven units of from 12,000 hp. to 15,000 hp. are installed. The horizontal twin turbines are of Francis type. More than 150,000 hp. is available.

The Kykkelsrud station, with 46,000 hp. of its available 65,000 hp. developed, is situated almost within walking distance of the Vamma and Mörkfoss-Solbergfoss stations. It was built twenty years ago and so is of old design, with old machines and old switching equipment. Two Swiss turbines of obsolete design have the gate opening varied by a cylinder which, moving up and down, varies the width of the opening and also the effective width of the runner. A set of seven siphons used to keep the level of the dam constant is interesting.

Most of the power from this station is transmitted by means of cable to a very modern transformer station a few hundred feet distant, which in turn transmits the power to the city of Christiania. A telephone oper-

ated by means of carrier current over the high-tension power lines is in very satisfactory operation between this transformer station and the corresponding one at Toien, near Christiania. This is one of the earliest carrier-current installations in Norway.

One of the very first stations in Norway was built at Sarpsborg. The power available here is utilized by two other power stations—Hafslung and Borregaard. The dam is common to these two plants and the regulation is taken care of by a company that transports logs on the river. The stations are not particularly interesting except from the standpoint of noting the development made in power-house design and machinery in the past twenty-five years. Part of the power of the Borregaard station is used in three electric boilers in which the electric current flows through the water between two electrodes. Each boiler has a capacity of 2,000 kw., 4,400 lb. of steam per hour, corresponding to 2,500 tons of coal per year. The annual saving is calculated at $20,000.

The foregoing is an attempt to give an idea of the status of water powers and their development in Norway at the present time, detailed descriptions being far beyond the limits of this article. Norway has a high density of electrical power and her solution of its disposal is going to be of interest. The fine examples of hydro-electric engineering which now exist in that country and her success in bringing electric light and power within the reach of the isolated peasant are an excellent beginning, but the replacement of black coal by "white" on her railroads and merchant marine, the financing and developing of a market for her large industries and the extension of the power network to every nook and crevice in the land form no small task.

# Illumination of Post Offices

## Experts, After Investigation, Advocate a Standard System Throughout the Country that Will Insure 10 Foot-Candles on Working Planes

AT THE request of the postmaster-general, the Office of Industrial Hygiene of the United States Public Health Service made a survey of one old and one comparatively new post office to determine whether the prevailing illumination is sufficient, and of such character and strength as will promote the greatest efficiency of the occupants. The conclusions are now available, and were briefly reported in the Feb. 24 issue of the ELECTRICAL WORLD. They are interesting in their details not only as they bear on post office lighting but for their relevancy to illumination in general. The report says in part:

"The illumination in the post offices studied was found to be low in intensity and unsatisfactory in quality. Glare is prominent, shadows are numerous, lights are improperly spaced and improperly located in relation to work, and the intensity of illumination is irregular and unequal. The actual mean illumination in these post offices is generally below the state codes of lighting requirements and is generally lower than the mean illumination which is furnished employees doing similar work in private industries.

"There seems to be a definite relation between certain diseases of the eye and defects of the vision and the amount of illumination under which similar groups of workers were occupied. In this respect it was found that the employees at the old post office, the majority of whom were working under an average illumination of 2 to 3 foot-candles, had less than normal vision and a greater number of certain defects than the employees at the new post office, the majority of whom were working under an illumination of 3 to 4 foot-candles and a not inconsiderable number under part-time daylight.

"The higher the intensity of illumination up to a certain point, varying with the visual acuity of the eye, the more rapidly was the work performed. Those having normal or nearly normal eyes worked most rapidly under an intensity of artificial illumination of between 8 and 10 foot-candles. Those with eye defects showed less fatigue when working under higher intensities of illumination than when working under lower intensities.

"It is believed that the installation of the proper illumination would result in a large pecuniary saving to the post office, would also tend to reduce eye fatigue and defects resulting therefrom, and would conserve the eyesight of the employees.

### PRESENT SYSTEM SHOULD BE CHANGED

"The present illumination in the post offices should be changed. There should be installed in the general workrooms and offices systems of totally inclosing units, of the diffusing or light-directing type, giving a general intensity when first installed of 10 foot-candles everywhere on a horizontal working plane 45 in. above the floor. All local lighting should be done away with.

"The lighting unit to be installed in the general workrooms of the post office should be of such quality of glass and of such shape and size that its surface brightness at any point would not exceed 2.5 cp. per square inch when used with an incandescent lamp or other source of light emitting 3,100 lumens. This unit should have an output of at least 80 per cent of that of the clear lamp and a spherical distribution of its candlepower such that at least 8 per cent of the light emitted by the clear lamp would be emitted by the unit through the zone from 0 deg. to 30 deg., at least 28 per cent from 0 deg. to 60 deg., at least 48 per cent from 0 deg. to 90 deg., and at least 25 per cent from 90 deg. to 180 deg.

"The lighting unit for the offices of the post office should be of such quality of glass and of such shape and size that its surface brightness at any point would not exceed 2 cp. per square inch when used with an incandescent lamp or other source of light emitting 3,100 lumens. This unit should have an output of at least 80 per cent of that of the clear lamp and a spherical distribution of its candlepower such that at least 8 per cent of the light emitted by the clear lamp would be emitted by the unit through the zone from 0 deg. to 30 deg., at least 23 per cent from 0 deg. to 60 deg., at

least 43 per cent from 0 deg. to 90 deg., and at least 35 per cent from 90 deg. to 180 deg.

"Both the units for the general workrooms and the offices should be such in number and so spaced that the brightness of the units measured in lumens per square foot would not be more than one hundred times as great as the intensity of the illumination, measured in foot-candles, produced by them on a horizontal plane 45 in. above the floor.

"In order to obtain the recommended intensity of illumination of 10 foot-candles on the working plane it would be necessary to use about 2 watts per square foot of floor area in the general workrooms of the post office. The best spacing and mounting height of these lamps and the best size of lamps to use will depend on the height of the ceiling and the height of the working plane.

"The relation of the separation cases, tables and desks to the lights should be such that no shadows fall upon the working plane. In order to accomplish this result, where it is necessary to move the lighting fixtures, detachable fixtures may be used.

"In the case of the illumination of separation cases the relation of the separation cases to the lights should be such that the centers of the units would be 1 ft. in front of the plane of the vertical face of the pigeonholes.

"Care of the lighting should be placed in the hands of one man, who should be responsible for the upkeep and care of the units. He should make a daily round of the building and replace all burnt-out lamps and broken fixtures. He should cause the lighting units to be cleaned once a week, or as often as is necessary to keep them clean. He should see that the walls and ceilings are kept in good condition, so as to serve as good reflecting surfaces for the light. He should make measurements once a month with a foot-candle meter, in order to see that the uniformity and constancy of the illumination are maintained.

All the lights of a work area should be on one switch, and this switch should be under the control of a foreman, so that one light could not be turned on to the exclusion of the others.

### REQUIREMENTS OF ILLUMINATION FOR POST-OFFICE WORK

"In practically all post-office work there are two working planes, the primary plane being approximately horizontal, the secondary being vertical. Most of the eyework involves either reading or writing and thus pertains to a single surface in contrast to work requiring use of depth, such as machine work, millinery or tailoring. This is true of both vertical and horizontal planes. The height of the horizontal working plane, usually 45 in. above the floor, varies somewhat as the mail passes through the hands of the worker, while the distance of the vertical plane from the eye remains nearly the same, being the surface of the separation cases.

"There are many different colors and combinations of colors among the mail matter, although black ink on a light or white surface predominates. There are many combinations, however, which are distinctly difficult to read, handicapping the worker and straining his eyes. Such combinations are a dark background with an ink of the same color but slightly lighter shade, and colors which do not give any great contrast, such as black on blue, brown on buff, purple on violet, and red on red. The envelopes coming from central Europe are nearly all colored. To read the addresses on the foreign mail and to distinguish the marking on foreign stamps a particularly good light is required. In the money-order and registry departments the Post Office Department uses blue and red cards and blanks, which must be handled in large numbers by employees and which are difficult to read and tiring to the eyes. Frequently glossy-surfaced envelopes are used, and in recent years window envelopes, which render the reading of addresses less easy. Names and addresses are often difficult to read. This is particularly true of wrappers for newspapers and magazines, of longhand addresses and of foreign mail. These conditions require great concentration of vision.

"Some kinds of work require more light than others. For instance, clerks require more light than laborers. The 'American Standard Code of Lighting' gives 5 to 10 foot-candles as necessary for the former and 2 to 5 foot-candles for the latter. The eye work done in the post office can be for the most part classed with the eye work of other office workers and in some parts is as difficult as that for which the 'American Standard Code of Lighting' recommends 10 to 20 foot-candles and above. Since the general level of artificial illumination is rapidly rising in this country, it is impossible to say what the best illumination for post-office work will ultimately be found to be, but it is probable that it will be found to be higher than that indicated at the present time.

### GENERAL LEVEL OF ILLUMINATION INCREASING

"That the general level of illumination is rapidly increasing is shown by reference to figures given in the textbooks and lighting codes published during the last ten years. For instance, Bell, in 'The Art of Illumination,' published in 1912, says: 'All classes of clerical and office work can be performed easily under an illumination of 3 to 4 foot-candles,' and in 'Light and Its Use and Misuse, a Primer of Illumination,' prepared under the direction of the Illuminating Engineering Society, published during the same year, it is stated that 'ordinary reading, writing, or work on white or light-colored material, can comfortably be carried on by most people with an illumination of 2 to 3 foot-candles.' Clewell, in 'Factory Lighting,' published in 1913, gives 3 foot-candles as a good working intensity for office lighting. In 'Principles of Interior Illumination,' 1917, Cravath, Harrison and Pierce give 3 to 7 foot-candles as desirable illumination for office work, and Croft in the same year, in 'Practical Electric Illumination,' recommended 4 foot-candles for office work. The 'Code of Lighting for Factories, Mills, and Other Work Places,' published by the United States Public Health Service in 1919, recommends 4 to 8 foot-candles for office work. In the 'American Standard Code of Lighting,' published in 1922, this recommendation is advanced to 5 to 10 foot-candles. The recommendations of the state codes of lighting, beginning with the Pennsylvania code in 1916, show that much higher standards have prevailed during the last six years, and they also show a tendency toward a still higher level. For instance, Wisconsin in 1917 recommended 3.5 to 6 foot-candles, and in 1921, 4 to 15 foot-candles, for office work. The 'Code of Lighting for School Buildings,' prepared by the Illuminating Engineering Society in 1918, recommended 3.5 to 6 foot-candles for class and study rooms, with a minimum of 3 foot-candles, whereas the 'School Lighting Code' of the State of Wisconsin for 1921 rec-

ommended 8 foot-candles and higher, with a minimum of 5 foot-candles, for the same class of work.

"The recommendations of the state codes, arranged chronologically, are given in the table.

"One cause for the increase in the intensity of illumination recommended for various eye occupations may be that the great progress made in the manufacture and design of lighting units, globes and reflectors has made it possible to have higher intensities of illumination without increased brightness of the source, so that lamps of high wattage can now be inclosed in opal or other diffusing globes without causing objectionable glare from the high brightness of the surface of the units. Almost as important as sufficient illumination is the reduction of glare. Intensity of illumination and glare may be considered as the two elements of the subject, and one is almost as fundamental as the other.

### Glare and Surface Brightness

"Glare is caused by intrusion of non-useful light on the retina of the eye. No matter how well illuminated the objects on the working plane may be, clear vision of them may be destroyed by bright images of foreign objects in the field of vision.

"Glare may be produced by bright sources of light in the field of vision, by a large source of light close to the eye, by a light lying within a small angle from the object looked at, by a light standing out against a dark background, by exposing the eye to a source of light over a long period of time, and by light reflected into the eye from polished surfaces or glossy paper.

"The elements of glare are, then: (1) The brightness of the object producing it; (2) the angle of glare, or the angle that the line joining the eye to the object being looked at makes with the line joining the eye to the object producing the glare; (3) the distance from the eye to the object producing the glare; (4) the extent of the surface of the object producing the glare; (5) the contrast of the brightness of the surface of the object producing the glare with the brightness of the surface being looked at; (6) the time of exposure of the eye to the object producing glare.

### General Versus Local Lighting

"A distinction must be drawn between general and local lighting. In general lighting the units are so placed as to distance apart and height above the working plane and are of such power that they give an even distribution of the required illumination, 8 foot-candles, for example, all over the working plane. Local lighting is produced by single units so placed that they produce illumination only over small areas; they are illustrated by desk lights and bracket lights over separation cases. Good practice today indicates that local lighting should never be used as a regular thing, but only temporarily in emergencies. General lighting gives a higher illumination for the same number of watts used and is therefore more economical. This is due to the fact that a small number of high-wattage lamps are used rather than a large number of low-wattage lamps. High-wattage lamps produce more light per watt than low-wattage lamps.

"Since a marked increase in speed and accuracy in the work of the post office was found when the illumination was raised to 8 foot-candles, it was deemed desirable to calculate the decrease in the cost of labor and the increase in the cost of lighting and to balance one against the other to find out if any pecuniary saving would be effected by increasing the intensity of lighting in the office at which the survey was made, and if so what this would amount to.

"The actual power consumed in this post office for lighting during the calendar year 1921 was 1,113,320 kw.-hr. The cost of this power, based upon the minimum rate per kilowatt-hour under the contract with the lighting company, was, for the calendar year 1921, $26,334. The cost of replacing lamps under the present system during the year was $6,587, which makes a total cost of $32,921.

"With the above-mentioned consumption the mean illumination in this post office was 3.6 foot-candles. To find out what the consumption of power would be if this illumination were raised to 10 foot-candles, the present consumption must be multiplied by the factor 2.25. This factor is less than that required to multiply the present illumination of 3.6 foot-candles in order to obtain 10 foot-candles, because the total number of outlets is supposed to remain the same, while the illumination from a lamp increases more rapidly than does its wattage.

"The increased wattage required on this basis would bring the consumption to 2,438,080 kw.-hr., at a cost of $57,670, and the cost of replacing lamps to $14,820, a total annual cost of $72,490. The increase in the cost for the higher intensity of illumination is therefore the difference between $72,490 and the present cost of $32,921, or about $39,500.

ILLUMINATION FOR OFFICE WORK RECOMMENDED IN THE STATE CODES OF LIGHTING

| Year and State | Intensities in Foot-Candles — Good Practice | Intensities in Foot-Candles — Minimum |
|---|---|---|
| 1916—Pennsylvania | 4.0- 8.0 | 3.0 |
| 1917—Wisconsin | 3.5- 6.0 | 2.75 |
| 1918—New Jersey | 4.0- 8.0 | 3.0 |
| 1919—California | 4.0-12.0 | .. |
| 1919—Oregon | 4.0- 8.0 | 3.0 |
| 1920—Ohio | 4.0-12.0 | 3.0 |
| 1921—Wisconsin | 4.0-15.0 | 3.0 |
| 1922—Massachusetts | ... | 3.0 |

"The total pay roll for this post office for 1921 amounted to $6,746,039. Since investigation shows that only about one-half of the time of the workers is spent under artificial illumination, about one-half of this amount, or about $3,373,000, will represent the amount paid when working under artificial illumination.

"In the speed and accuracy tests it was found that for the letter separators there was an average increase in speed, or decrease in the times of separation, of at least 4.4 per cent when going from 3.6 to 8 foot-candles. Since all the work in the post office, with the exception of that done by the laborers, depends primarily upon the use of the eyes, and since in the post office for which these calculations are being made the laborers constitute less than 6 per cent of all the regular employees, it may be assumed that the same relative increase of speed would prevail in all the divisions of the post office under the same relative increase in illumination. If, then, 4.4 per cent is taken as the value of the percentage change in speed due to an increase of the illumination from 3.6 to 8 foot-candles, to find the pecuniary gain 4.4 per cent of $3,373,000 must be taken, which gives about $148,400.

"Deducting from this saving of $148,400 the increase in cost of energy and lamps, about $39,500, we get a net saving for this post office of about $109,000, or more than twice the increased cost of illumination."

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GOVERNOR SMITH IN HIS MESSAGE CONTENDED THAT THE WATER POWER OF THE MIGHTY NIAGARA SHOULD NOT BE PUT TO USE OUTSIDE OF NEW YORK STATE

# New York State's Water Power

## Reasons Why It Must Not Be Isolated or Developed Individually—Advantages of Interstate Transmission and Superpower Systems Which Embrace Steam-Driven as Well as Water-Power Stations

By GEN. GUY E. TRIPP

*Chairman Westinghouse Electric & Manufacturing Company*

ONE of the most important things that can be done today to insure the increased prosperity of a people is to place within their reach a cheap, abundant and reliable supply of electric power. Both the Governor of New York and the Governor of Pennsylvania recognize this fact, and both have recently taken active steps to provide their respective states with such a supply from water power. But they are advocating diametrically opposite methods for accomplishing the desired result.

Governor Smith of New York wishes to develop New York's water powers for the exclusive benefit of New Yorkers and declares that any plan to divert this energy to territory outside of the state "must be resisted with all the power we can bring to our command."

Governor Pinchot of Pennsylvania, on the other hand, wishes to bring about a unified national development of water power, and it is clear that he even includes Canada in his plans.

Which is right? At first sight, Governor Smith's plan of reserving the resources of the state for the use of the state is quite likely to appeal much more strongly to New Yorkers than Governor Pinchot's; nevertheless, in spite of Governor Smith's undoubted desire to serve the state in the most effective manner, a very serious fallacy is involved in his recommendations.

Suppose Governor Smith, with the best intentions in the world, had advocated a plan for devoting New York's railroads solely for the service of New Yorkers and had proposed that all railroad connections with other states should be broken. Such a plan would be instantly greeted with indignant protest. Every one would realize that it would destroy our splendid interstate railway systems and, without conferring the slightest advantage upon New York, would be disastrous to the nation as a whole.

No less disastrous to both New York and the United States would be the isolation of New York's splendid water powers. Why this is true should become clear when certain facts about water power are understood.

### CONDITIONS OF WATER-POWER DEVELOPMENT

In the first place, few water powers are of much value if developed individually. The upper waters of the Hudson, for example, can generate over 500,000 hp. for the greater part of the year, but in dry seasons the flow (as shown by the last report of the New York Water Power Commission) may not be sufficient for the generation of 5,000 hp. Similar conditions apply to all other rivers in this part of the world, excepting only the Niagara and the St. Lawrence, which have an approximately uniform flow because they are fed from the enormous reservoirs of the Great Lakes. Consequently, in order to make power available all the year around, steam plants are almost always operated in conjunction with hydro-electric plants.

Second, electricity can be produced from two or more neighboring water powers more cheaply if the water-power plants are joined together in a single system and supplemented by a single large steam plant than if each water power is developed separately and is supplemented by a small steam plant. In the unified system the variations in the flow of the rivers tend to equalize each other, since no two rivers are at the lowest point

at exactly the same time, and less power from steam is needed; the large steam plant consumes less coal than the small plants to produce a given amount of power; the overhead expense is less, and there is less variation in the demand for power because of the increased diversity of use by the larger number of people served. All manufacturers understand that costs are much less with large-quantity production at a fairly uniform rate than they are with production in small quantities at an irregular rate. This condition is especially true in the manufacture of power.

Finally, when several water powers are interconnected, a considerable area of country is inclosed by the connecting transmission lines. By installing suitable service lines electric service can easily be given to the whole area thus inclosed. With the water powers developed separately, however, the energy from each is inevitably sent to the nearest congested district, and the regions not actually traversed by the transmission lines are unable to obtain electricity except at a prohibitive distribution cost.

### Ideal System for Northeastern States

Since the larger the system the cheaper it can produce power and the more people it can economically serve, the ideal system for the northeastern part of the United States is one that would extend from Maine to Ohio and from Canada to Maryland and would receive the energy of every water power in the area covered. With such a system, all of the now wasted water power in this district would be put to useful work, and though supplementary steam plants would still be necessary, they would be called upon for the minimum amount of power and, since they would be of the largest and most efficient type, they would consume fuel with the highest obtainable economy. Furthermore, they would be established in the coal regions and at points of convenient access along the coast, so that a large part of the railroad facilities now devoted for hauling coal would be released for other purposes. Both the power supplied by the water powers and the demand for electricity by the communities served would, of course, vary constantly, but the great network of transmission lines would act as an equalizing reservoir and would make up deficiencies at one point from surpluses at others.

### What New York Will Lose if She Isolates Her Water Power

If New York's water powers form an integral part of this great system, all of her people will be able to obtain electricity at the lowest possible cost; but if that state is determined to isolate herself electrically, she will prevent the creation of the system and will not only injure her own citizens but everybody else in this section of the country. She will not be able to use all of her water power for a long time to come, and she will therefore allow the excess to waste instead of developing it for the benefit of other states that need it badly. If, through a prolonged drought, fuel shortage or other causes, she experiences a temporary power famine, she will not be able to draw on the surpluses that may exist in other states. Since her water-power development will be incomplete, her transmission network will also be incomplete, and many of her citizens will be unable to get power.

Under the plan of state monopolization the chief sale of power will be to existing municipalities. These will tend to become more and more congested, and living conditions, especially in New York City, will g worse and worse. But with power properly and wi distributed the population will tend to spread out the more open country, and thus the deplorable t ency toward overpopulation of our cities may checked.

### Interstate System Makes More Power Availab

While an interstate power system takes power of a state, it in equal degree brings power into state. The most important of all water power northeastern America are not in New York at all. are in Canada and on the Canadian boundary. If York isolates her own power, she could not consist ask another commonwealth to supply her with po New York, therefore, would thus cut herself off this vast power supply which she and her neighbo states are certain to need urgently within a genera or two.

In a strictly technical sense, New York may the legal and moral right to monopolize her w powers. If so, the coal-producing states have an e right to monopolize their coal for the benefit of t citizens. If New York were to be deprived of coa of power generated by coal in the Pennsylvania fields, she would be badly off and would viole denounce such action as anti-social and anti-Ameri Yet her administration proposes to pursue a prec similar course with reference to water power.

Finally, if New York does devote all her water po to her own use, she will not be able to produce i cheaply as she could by co-operating with her ne bors, because she will sacrifice the advantages of la quantity production; she will not be able to secure full benefits arising from the co-ordination of w powers and steam plants, and she will not be abl obtain power generated in the Pennsylvania coal fi

### An Interconnected System Produces Cheape and More Reliable Power

"After eighteen years of study and work on problem," writes Governor Pinchot to Governor Sn "I have come confidently to expect the growth nation-wide interlocking power system. . . . freedom of commerce among the several states, unrestricted exchange across state lines of ser goods and resources, guaranteed by the Federal stitution, is the strongest man-made basis of the p perity of each state. This consideration applies only to energy riding in a coal car but equally to en flowing over a wire, whether the burning of fuel o falling of water was the source. Furthermore, r cheap power cannot be supplied to consumers u the burning of coal and the flowing of water contri their energy to a common reservoir for the com supply of industries, farms, homes and railroads. a system must transcend state lines and is likel become nation-wide."

Thus are the views of a statesman in agree with conclusions of the engineer. Back of both li one desire—to bring to the people of the United S and Canada the greatest possible prosperity. Ne state politics nor private interest must interfere the proper development of our water power. The v of our rivers is a resource of the nation; it mu utilized so as to benefit the nation as a whole, a will thus best benefit each state and each indiv citizen.

# Indiana Company Changes to 60 Cycles

## Indiana Service Corporation Shifts Both Railway and Commercial Service—Customers' Motors Changed on Second-Hand-Price Allowance Basis—Old Rotary Converters Altered for Use

SERVICE at 25 cycles to commercial consumers exists to a considerable extent in Indiana and Ohio. Its history began with the development of the interurban electric railways in those states, when 25-cycle rotary equipment was considered as the only kind that could be successfully used. The commercial service was developed along the railway lines where the establishment of 60-cycle service seemed economically impossible. With the development of 60-cycle railway equipment and the existing tendency which makes 25-cycle equipment special and higher in cost, the problem of changing to 60-cycle service everywhere is becoming a pressing one.

### Problem Facing Indiana Service Corporation

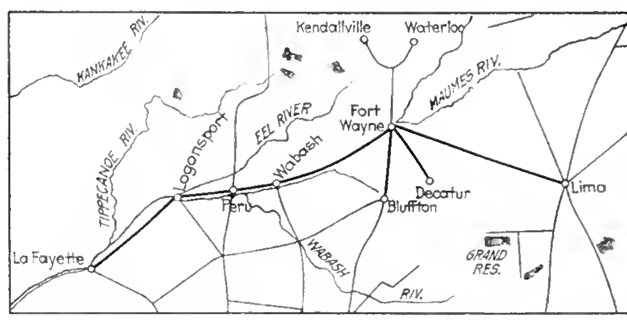
Until two years ago the west side of Fort Wayne was served from 25-cycle circuits. The interurban system of the Indiana Service Corporation centering at Fort Wayne comprises four lines, one to Lima, Ohio, one to Decatur, one to Bluffton and one to Lafayette, the three last named all in Indiana. The line to Decatur has always been served at 60 cycles, the Fort Wayne steam electric plant having been originally built with both 25-cycle and 60-cycle generators. The other three lines have been served at 25 cycles, and in addition to the railway service commercial service at 25 cycles developed on the Lafayette division in thirteen towns and some small scattering points and in five towns on the Bluffton division.

The present 25-cycle equipment in the Fort Wayne plant consists of two 1,500-kw. turbo-generators, and the 25-cycle territory has been served with 33-kv., three-phase delta-connected lines with No. 2 A. W. G. copper conductors. In addition to the service outlined power is supplied to the Fort Wayne & Northwestern Railway, running north of Fort Wayne, and to the Union Traction Company and Winona Interurban Railway electric lines through a connection at Peru, Ind. All three of these lines belong to other companies.

The important problems presented when it was decided to change all service to 60 cycles were: (1) On what basis should the motor equipment of commercial consumers, including motors in household service, be changed? (2) How could the railway equipment be changed with the least expense? and (3) What change, if any, would have to be made in transmission and distribution line equipment.

### Customer's Equipment Problem

Although the changes were decided on several years ago and the service on the west side of Fort Wayne and on the Bluffton division has been changed, it was obviously impossible to make a simultaneous change over the entire system. The changes on the Lafayette and Lima divisions are now under way. One community is taken at a time, and a thorough survey of the customer's equipment is made to determine the exact size, type and number of motors that must be changed. The second-hand value of the customers' motors is then ascertained and a standard offer made to each customer. For all motors over 1 hp. in size the consumer is asked to pay the difference between the second-hand value of the equipment and the price of the new 60-cycle equipment. In all cases of fractional-horsepower motors, such as those on washing machines and other household equipment, the company traded the new equipment for the old on an even basis. In all cases the offer has specified that the cost of installing the new and removing the old equipment shall be assumed by the company. It is interesting to note that so far almost no trouble has been met. Only three or four controversies have arisen, and these have not been serious. The existing condition in the manufacture of 25-cycle equipment, which places it on a non-standard basis and therefore makes it more expensive and difficult to obtain, is one of the arguments used in convincing consumers that the change is of benefit to them. Moreover, the opportunity afforded to improve the efficiency of old installations by the installation of equipment better suited to the work has played a part in bringing about acceptance of the proposal. It is believed that a frank, clear-cut statement of the reasons for the change, with patience and tact in telling the story, is the chief factor in persuading customers.




SYSTEM OF THE INDIANA SERVICE CORPORATION WHICH IS BEING MADE ALL 60-CYCLE

The railway lines except that to Decatur were constructed for 25-cycle service. Along the 25-cycle lines commercial service had grown up. The west side of Fort Wayne also originally had 25-cycle service. This service and that of the Bluffton division have been changed. Similar changes are now under way on the Lafayette and Lima divisions.

In making the actual change to 60-cycle service in any town all customers' equipment needing change is gone over thoroughly and complete plans for the replacement of each motor are made. These are carried out so far that the only work to be done at the final change-over is the shifting of motors. Foundations and foundation bolts for the new motor are placed and the pulleys needed to obtain the proper speeds are on hand with the new motors, which are set close to the old equipment ready for the shift. At the time of the actual change-over the important motors are changed over-night so that industrial concerns are not hampered by shutdowns. The old starting compensators are utilized throughout, and so far no trouble has been experienced. A change in compensators in most cases would

have meant the added cost of compensators plus a much greater expense in rewiring, as disturbance of old wiring involves compliance with wiring ordinances that might reach far. The sizes of motors changed range up to 250 hp., though the largest number are small, 10-hp. and 15-hp. sizes predominating. The customers are fully warned of the change and the time at which it is to be made by newspaper, motion-picture and such other advertising means as are available. The customers with household appliances are warned that the changes will be made on certain days and are asked to arrange household work so that the motor equipment need not be used on those days. Approximately three or four days is needed for these changes.

The meter problem is handled by the installation of new meters. The old meters in most cases have been changed for 60-cycle use by the replacement of current and potential coils, though some of the older types could not be handled thus and had to be scrapped or traded to the manufacturers.

Distribution transformers required no shift at all, and there were no changes in either the service or transmission lines required. Naturally, some difficulties with special equipment were encountered, though no serious troubles developed. In one case it was necessary to replace the impellers in direct-driven centrifugal pumps at a water pumping station because the motor speed could not be matched closely enough in 60-cycle equipment. A number of merchandise establishments are equipped with coffee grinders, meat choppers and other like machines in which the motors are built into the equipment. By working with the manufacturers of the equipment it was possible to promote arrangements whereby new motor equipment was supplied by negotiation between the customer and the manufacturer without any participation by the central-station company. Another problem was that of the small battery charging rectifiers employed in garage work which use the two-element vacuum tube. Material was ordered to change these over. On one man's insistence that he could do no more than burn one up, a trial showed that the chargers apparently needed no changing, and they are now operating on 60 cycles without any modification and no indication of trouble.

### The Railway Problem

Obviously the rotary-converter equipment was unusable. These machines and their transformer equipment varied in size between 200 kw. and 450 kw. When the question whether the transformers could be used for the new rotary equipment was raised the various manufacturers said that it would be impossible to do so satisfactorily. The old rotaries were 25-cycle three-phase, with 33,000/370-volt step-down transformers. The new equipment is all 60-cycle, 500-kw., six-phase, requiring a transformer secondary voltage of approximately 445. The old transformers were partly of the shell and partly of the core type. After some experimenting it was found that one of the middle primary coils in the shell-type transformers could be cut out of circuit and left dead. This gave the proper ratio, maintained the balance of stresses due to magnetic forces and left the transformers with the four $2\frac{1}{2}$ per cent voltage regulation taps intact.

The same procedure was adopted with the core-type transformers, except that they were dismantled and an equal amount of primary winding was removed from each core leg. When reassembled wood spacing blocks were fitted in the space of the removed coils. Part of the transformers are of the type with external reactance and part have reactance built into the transformers. With the changes it was found that the reactances are approximately the same as would be supplied in new transformers to match the new rotaries. Though the windings are being operated at a higher voltage per turn than they were designed for, it has so far been impossible to discover any bad effects from the practice.

Of course, the transformers did not match the new rotary equipment as to capacities. This was disregarded as each substation has ample transformer equipment to handle present loads. When load developments necessitate or depreciation and other causes eliminate the old transformers, new equipment to match the rotaries will be purchased. Since new rotaries had to be purchased and one size could be adopted as a standard, it is felt that the operating and maintenance advantages of such standardization justified the course adopted and that economic and operating conditions could be safely left to care for the transformer situation in the future. As a matter of fact, the discrepancy in rotary and transformer capacities is not so wide as it would seem, since the transformers are designed on the old basis of rating and the rotaries are rated on the basis of present standards.

### Frequency Changers Would Not Save Expense

In considering the various methods of establishing 60-cycle service the obvious one of handling the railway circuits through frequency changers was investigated. The result showed that the costs of this method and of the one adopted were about equal, with the disadvantage against the frequency-changer method of loss of efficiency in conversion and an expensive change later as the old 25-cycle equipment reached its life limit.

In making the changes town by town the method on the Lafayette division is typical. An interconnection for 60-cycle service with another company exists at Lafayette, making it possible by opening the line disconnecting switches installed at each substation to operate one section of the transmission line at 60 cycles and the other at 25 cycles. A 500-kw. portable substation is used to handle the service at any substation temporarily while the new rotary and its control panel, which is purchased as a part of the new rotary equipment, is installed ready to cut into service. The portable substation is then moved to the next location.

In several instances service in small communities had been supplied at 2,300 volts through step-up transformers connected to the 370-volt rotary circuits. In these cases 33-kv. step-down lighting transformers are being installed. However, this has no bearing on the change to 60-cycle service. These things are merely incidents of by-gone practice which it is possible to change and put on a better basis.

In handling the railway signal systems the only changes found necessary were the substitution of new magnet coils for the old. Some question was raised as to whether more transmission insulator trouble would be experienced on the 60-cycle service. Just why the question should be raised is not understood, but there are no indications of such a result.

The service to the interconnected railway lines is being handled in the case of the Fort Wayne Northwestern Railway by a change to 60-cycle service along exactly the same lines by that company. In the handling of the changes for commercial service the details are

being worked out by the same man who is handling the changes on the Indiana Service Corporation system, where these dealings with consumers were all placed in the hands of one man with the necessary qualifications of technical knowledge, tact and patience. The question of handling the railway interconnection at Peru is not settled as it has not yet been reached.

One experience that has been satisfactory is the ability to dispose of the old motors. Other 25-cycle systems in the territory are expanding their commercial service, and the demand, particularly for the small sizes, has been good. Larger sizes have proved harder to sell, though so far, by success in selling the motors taken out, the expense of the changes has been kept to the cost of shifting equipment. In all there are about three thousand consumers involved in addition to the electric railway service, and the progress of the work so far done has been most gratifying.

# Major Changes in National Electrical Code

**Covering of Overhead Conductors and Separation of Meters Dropped—Solid Neutrals, 15-Amp. Fuses and Twelve Outlets per Circuit Allowed—Proximity of Radio and Power Circuits Included—Changes in Motor-Circuit Protection**

THE outcome of the final action of the electrical committee of the National Fire Protection Association on the proposed revisions of the National Electrical Code has been made available to the ELECTRICAL WORLD, in so far as the major changes are concerned, through the courtesy of Dana Pierce, chairman of the committee and vice-president of the Underwriters' Laboratories. The decisions were based on very careful considerations of written and oral discussions of the proposed changes received prior to and including the day of the public hearing in New York, namely, March 12. Owing to the fact that numerous changes in phraseology as well as actual requirements were made and because the entire code will be rearranged and reclassified, it is doubtful how soon printed copies of it will be available. However, the committee believes that the rearrangement of the code will greatly facilitate its use as a reference book and hence will justify the change.

### SOLID NEUTRALS BY PERMISSION

As reported last week in the ELECTRICAL WORLD, solid neutrals or ground circuits will be permitted on two-wire and three-wire branch circuits by permission of the inspection department.

That is, omission of the fuses in these conductors will be allowed by permission. Permission is required to assure that the system to which the branch circuit is attached is properly grounded and that an identified grounded conductor is carried throughout the installation.

The omission of the fuse in the grounded side of branch circuits, it is considered by the committee, should be a part of a more general method of wiring which includes also the grounding of secondary circuits in a thoroughly reliable and permanent manner and use in installations of an identified grounded wire throughout the building properly connected to all fittings. Proper grounding of circuits and the polarization of wiring is not universal by any means yet, and it is felt that the omission of the fuse in the neutral should, therefore, be allowed at present only in places where the inspection department has determined that the grounding and polarization is provided. It is expected that such permission will be given by inspection departments for systems, cities and parts of cities where this program is known to have been actually carried out, rather than by a separate ruling on new buildings in every case.

### 15-AMP. FUSES FOR 125-VOLT CIRCUITS

Instead of placing a maximum limit of 10 amp. on 125-volt branch-circuit fuses, the code now allows 15 amp. for ordinary branch circuits and 40 amp. for circuits designed for "Mogul" sockets. The old limitation of 660 watts per branch circuit has been abolished. Not more than twelve outlets are now allowed on two-wire branch and each side of three-wire circulits except by special permission. Also, eight "Mogul" sockets may be connected per branch circuit if fused for 40 amp. In this case the sockets, receptacles and fixtures shall be wired with conductors not smaller than No. 12, and the taps from branch circuit wires to the point of suspension of the outlets, receptacles or fixtures shall not exceed 18 in. Where heating appliances requiring 660 watts or less are to be used they may be connected to ordinary branch circuits, but if more than 660 watts is required special circuits must be installed and the fuses shall not exceed 15 amp. rating.

### DELETE METER SEPARATION AND OVERHEAD-WIRE COVERING

To electric service companies the dropping of the proposed ruling on separation of gas and electric meters and the proposed requirement of a protective covering for overhead circuits operating at voltages up to 5,000 will no doubt be a great relief.

In view of the extensive discussion on the proposed requirement that outlet boxes be at least 1½ in. deep, the committee revised the ruling to the effect that it is recommended that side-wall and partition outlets in concealed new-building work now under construction be provided with a depth approximating 1½ in. This space is considered essential to accomodate splices.

### CHANGES IN MOTOR-CIRCUIT PROTECTION

Protection of motor circuits underwent considerable revision. For example, motors may be grouped on one set of fuses if the demand on the circuit does not exceed 15 amp. or 1,200 watts. Fuses are no longer required in addition to circuit breakers on switchboards, or where subject to competent supervision, or where next back on the line there is protective apparatus set

## Some of the Important 1923 Amendments to the National Electrical Code

**Rule 8c. Motors.** *Amend to read:* Motors may be grouped under the protection of a single set of fuses provided the rated capacity of the fuses does not exceed 15 amp. and the total wattage of the circuit does not exceed 1,200, or provided each motor is protected by thermal cut-outs. The number and size of the motors grouped with thermal cut-out protection need be limited only by the maximum size of the fuses with which the thermal cut-outs can be safely used, and each thermal cut-out must be marked to indicate the size of this fuse.

Fuses are not required in addition to circuit breakers (a) on main switchboards, (b) where otherwise subject to competent supervision, or (c) where next back on the line there are fuses rated or a circuit breaker set at not over 300 per cent of the motor nameplate rating, (d) for circuits above the capacity for which there are no standard fuses.

Where the motor-running protective device is shunted during the starting period the motor and the portions of the motor branch circuit between the motor and its running protective device are considered as being sufficiently protected during the starting period by the next overload protective device back on the line if the rating of this fuse or the setting of this circuit breaker is not over 300 per cent of the motor nameplate current rating.

### Size and Protection of Conductors of Motor Circuits

Conductors carrying the current of only one motor must have a carrying capacity of at least 110 per cent of the nameplate current rating of the motor, the actual size to be determined by the rating of the fuses or the setting of the circuit breaker protecting them.

Automatic overload protective devices may be omitted at the point where conductors carrying the current of only one motor are connected to the mains, provided their current-carrying capacity is at least one-third that of the mains, the length of the conductors between the mains and the motor protective devices is not greater than 15 ft. and they are suitably protected from mechanical injury.

**Rule 8f. Motor Switches.** *Amend to read:*

In places where combustible dust is thrown into suspension in the air in sufficient quantity to produce explosive mixtures, such as in flour mills, grain elevators, etc., or where it is impracticable to prevent dust or flying material collecting in dangerous quantities on or in motors, all motors shall be either of the totally inclosed type or shall be placed in separate dust-tight rooms or non-combustible housings. Such rooms or housings shall be effectively ventilated from a source of clean air.

**Rule 15Aj. Method of Grounding When Protective Grounding Is Required.** *Amend to read:*

Where the secondary system is grounded at the service, the equipment, metal raceway and the like may, with permission of the inspection department, be connected to the circuit grounding conductor but otherwise shall have a separate grounding conductor.

**Rule 15 Am. Switchboard Instruments.** *Add new section to read:*

Where meters and instruments are used with current and potential transformers, the cases of the meters and instruments may be connected to the secondary circuits of the current and potential transformers and grounded for the purpose of avoiding errors due to electrostatic action, in which case No. 12 B. & S. gage copper wire or larger shall be used for the grounding conductor.

**Rule 23d. Fuses for Branch Circuits.** *Amend to read:*

For the purpose of this section the terms "branch circuits" and "outlets" are defined as follows:

"Branch circuit" is that portion of a wiring system extending beyond the final set of fuses or circuit breakers protecting it, and at points on which current is taken to supply fixtures, lamps, heaters, motors and current-consuming devices generally; such points are designated as "outlets."

By special permission of the inspection department, two-wire branch circuits from systems having grounded neutral or one side grounded, and where the grounded conductor is identified and properly connected, may be protected by a fuse in the ungrounded wire, no fuse being placed in the grounded wire. Otherwise two-wire branch circuits shall be protected by a fuse in each wire.

Three-wire branch circuits may be run from direct-current or single-phase alternating-current systems having a grounded neutral, in which case the neutrals of the branch circuits shall not be fused. The neutrals of such circuits shall not be interconnected except at the center of distribution.

Branch circuits in general, and except as described below, shall be protected by fuses of no greater rated capacity than: 15 amp. at 125 volts or less, 10 amp. at 126 to 250 volts.

Fixture wire or flexible cord of No. 18 or No. 16 gage shall be considered as properly protected by 15-amp. fuses. Receptacles for attachment plugs (convenience outlets) are strongly recommended in order to facilitate the use of electrical appliances, which otherwise must be connected to sockets designed primarily only as lamp holders.

On a two-wire branch circuit and on either side of a three-wire branch circuit the number of outlets shall not exceed twelve except by special permission.

Branch circuits supplying only sockets or receptacles of the "Mogul" type shall have the wires protected by fuses having a rated capacity not greater than: 40 amp. at 125 volts or less, 20 amp. at 126 to 250 volts.

The number of "Mogul" sockets on a two-wire branch circuit and on either side of a three-wire branch circuit shall not exceed eight except by special permission.

Mogul sockets and receptacles and the fixtures with which they are used, shall be wired with conductors of not less than No. 12 B. & S. gage. Taps from circuit wires to the points of suspension of such sockets, receptacles and fixtures shall not be over 18 in. in length in order to be considered protected by fuses specified above.

**Rule 26a. Wires.** *Substitute for the first paragraph:*

For the conductor sizes No. 8 and smaller the neutral conductor on all three-wire circuits and one conductor on all two-wire circuits shall have continuous identifying marker readily distinguishing it from the other conductors.

**Rule 28. Interior Conduits.** *b. Amend to read:*

Concealed extensions from existing branch circuit outlets in buildings of fireproof construction, may be made by means of approved flexible or rigid conduit, not smaller than $\frac{5}{16}$ in., or other forms of metal raceways approved for the purpose, and fittings containing one No. 14 B. & S. gage rubber-covered wire. This conduit is not to run in concealed spaces but is to be laid on the face of the fireproofing and may be plastered over. Extensions of this kind shall be confined to the room or suite in which they originate.

**Rule 43. Electric Cranes.** *c. Switches and Cut-outs. 3. Amend to read:*

Where there is more than one motor on a crane, each motor with its leads must be separately protected by an automatic cut-out in accordance with No. 8c, except that where two motors operate a single hoist, carriage, truck or bridge and are controlled as a unit by one controller, the pair of motors with their leads may be protected by a single automatic cut-out. The cut-out should be located in the cab when there is one.

**Rule 47. Primary Wires.** *Amend to read:*

*b.* Air-break disconnectors shall be installed between oil switches which are used as service switches and the supply wires.

**Rule 86a. Radio Equipment. For Receiving Stations Only.** *Amend to read:*

Antennas outside of buildings shall be kept well away from all electric light and power wires for any circuit of more than 600 volts and from railway, trolley or feeder wires so as to avoid the possibility of contact between the antennas and such wires under accidental conditions.

Antennas where placed in proximity to electric light and power wires of less than 600 volts shall be constructed and installed in strong and durable manner and shall be located and provided with suitable clearances so as to prevent accidental contact with such wires by sagging.

at not more than 300 per cent of the motor nameplate rating. The actual size of motor-circuit conductors shall be determined by the setting of the protective apparatus. In places where combustible dust is thrown into suspension in sufficient quantity to produce explosive mixtures, totally inclosed motors shall hereafter be required or the motors shall be set in dust-tight housings. Another important change is that automatic overload protection may be omitted at the point where conductors carrying the current of only one motor are connected to the mains, provided the motor circuit has a carrying capacity at least one-third of the mains and provided the length of the conductors between the tap-in point and the motor productive device is not greater than 15 ft.

### PROXIMITY OF RADIO AND POWER CIRCUITS

So far as the relation between radio antennas and power circuits is concerned, the requirement now is that antennas shall be kept away from lines energized at 600 volts and over. Below this voltage ample clearance and rugged construction must be provided.

Other changes were made in the code which will have their effect on all branches of the electrical industry. For instance, where the secondary system is grounded at the service, equipment grounds and the like may be connected to the circuit-grounding conductor by permission from the inspection department.

### IDENTIFIED GROUND CONDUCTOR REQUIRED

All the grounding conductors of circuits consisting of No. 8 and smaller conductors must have an identifying color (white or natural gray). This applies to the neutral of three-wire circuits and the grounded conductors of two-wire circuits.

No circuit fused for more than 20 amp. is allowed in a metal raceway, and circuits of different systems are not permitted in the same conduit.

According to the revised code, one-conductor or two-conductor armored cable is allowed for concealed extensions in fireproof buildings if laid on the fireproofing. This also applies to one-conductor flexible conduit not smaller than $\frac{5}{16}$ in. in diameter.

For decorative and theater lighting circuits the outlets connected per branch circuit cannot demand more than 15 amp.

A new requirement of particular significance to industrial concerns is the one that requires separate automatic cut-outs for each motor on cranes where more than one motor is required. An exception is made where two motors operate a single hoist carriage, truck or bridge and are controlled as a unit by one controller.

### AIR-BREAK DISCONNECT FOR PRIMARY SERVICE

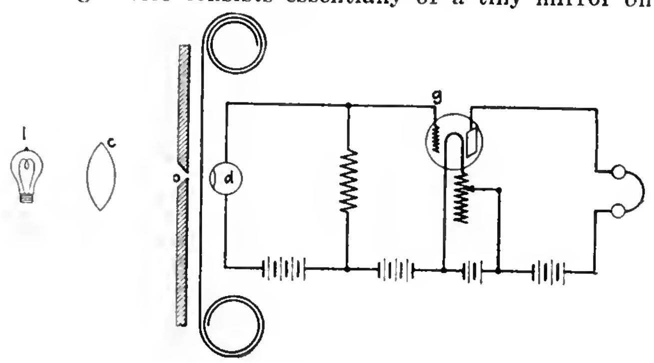
Where oil switches are used as service switches on connections taken from primary wires, an air-break disconnector is required between the oil switch and the supply. Switching and motor rooms for 601-volt to 5,000-volt circuits must be closed to unqualified persons.

The major addition to the code so far as fuses are concerned is the requirement of identifying marking to indicate their rating. For 250-volt fuses of 15 amp. or less a navy-blue label is required, and for fuses of greater rating green labels are required. Plug fuses of less than 15 amp. shall be distinguished by a hexagonal window or recess in the top, and the label shall also be hexagonal.

## Some Details of the "Pallophotophone"

MORE details of the "pallophotophone," a device for recording and reproducing sound to which reference was made a short time ago in the ELECTRICAL WORLD, are given below and by the accompanying illustrations.

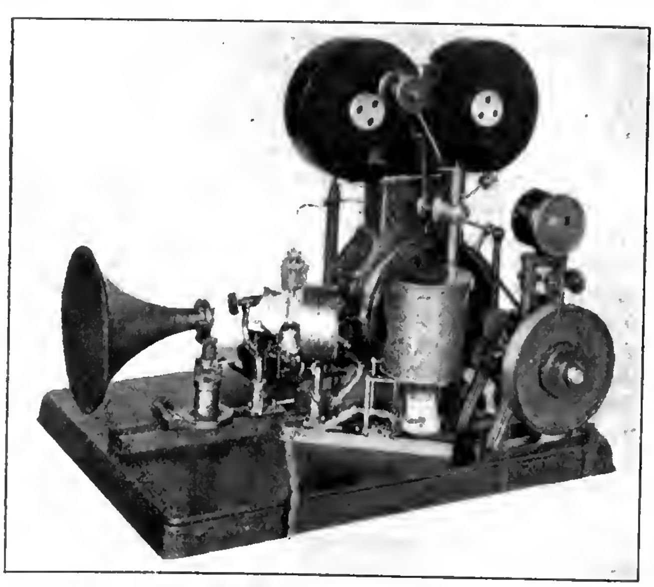
There are two distinct devices in this apparatus, one for recording sound and one for reproducing the sound, either of which may be used independently. The recording device consists essentially of a tiny mirror on




CIRCUIT DIAGRAM SHOWING APPARATUS USED

which is reflected a beam of light. This mirror is attached to a delicately adjusted vibrating diaphragm, and when sound waves cause the diaphragm to vibrate, the mirror oscillates and the ray of light causes the projection of corresponding oscillations upon a strip of photographic film which passes in front of the mirror in a continuous motion. The film is then developed in the usual way and when developed shows a succession of delicate dark markings which constitute the sound record.

In the reproducing system the operation of the apparatus is as follows: A photo-electric cell and two batteries are connected in circuit with the grid of a vacuum tube. Any change in the resistance of the cell will produce a corresponding change in the electromotive force impressed on the grid. When the film carrying the sound record passes between the cell and the light, the varying degrees of light which it permits to fall on the cell cause a varying amount of electron emission



VIEW OF ASSEMBLED UNIT OF "PALLOPHOTOPHONE"

in the cell and thereby create a potential difference in the grid circuit. Current then flows in that circuit in amounts directly proportional to the intensities of the light admitted to the cell through the film and at frequencies corresponding to the frequency of the vibrations recorded on the film. The remainder of the circuit and its action are similar to those of the standard radio transmitting equipment.

# Electric Plowing in Europe

### Implement Is Pulled by Caterpillar Tractor with Induction Motor Drive—Automatic Flexible Feeder of Bare Aluminum Feature of Swedish Invention

PLOWING the fields is by far the hardest labor on a farm and that which requires the greatest amount of energy per unit area, with the exception, perhaps, of water-spray irrigation. Much attention, therefore, has been devoted to the problem of designing an electric plowing outfit which will be cheap enough in actual use to compete with teams and gasoline tractors. Central-station men in rural districts naturally look upon the electric plow with much favor, since its adoption will mean a substantial increase in energy consumption per acre of the electrified area, resulting in a correspondingly better utilization of existing distribution plants. According to a survey recently made in Germany, the average yearly consumption for rural purposes is about 8.5 kw.-hr. per acre of cultivated electrified area. Electric plowing of a field takes from 16 kw.-hr. to 32 kw.-hr. per acre. Thus if 80 per cent of the ground is electrically plowed each year, the adoption of electric plowing will increase the energy consumption per unit area to from two and a half to four times its present value.

In Europe there are three radically different electric plowing systems in use, which may be called, for simplicity, the French, German and Swedish systems. The French system, which has been developed, among others, by the Compagnie d'Entreprises Electromécanique in Paris, makes use of a heavy motor wagon with two hoist drums, the plow being pulled back and forth by means of a long steel cable wound alternately on the two drums. The cable surrounds the field and has to be guided by two fixed drums and two other drums attached to anchoring wagons, one on each side of the field.

In the German system, which is due to the Siemens-Schuckert Company, two separate motor wagons are employed, each, with an 80-hp. motor. These wagons move stepwise one on each side of the field and pull the plow back and forth between them. An alternative scheme is to use only one motor wagon, the other one being replaced by an anchoring car with a free drum to double the cable back.

In the Swedish system Captain E. Grafström of Stockholm made a radical departure from former practice in electric plowing in designing his "electrotank," a caterpillar electric tractor which may be used not only for plowing but also for pulling harvesting machines and similar implements, and which therefore seems better than the cable-pull systems suited to compete with the gasoline tractor.

The "electrotank" equipment consists of two main parts, a stationary cable car and the tractor proper, connected to the car by an aërial feeder. The tractor is provided with a steering wheel and gear shift and is driven by a 15-hp., 500-volt, three-phase induction motor working on a worm reduction gear. The tractor weighs about 400 lb. and has a reverse and two normal speeds of about 131 ft. and 196 ft. per minute. The main feature of the invention is the aërial feeder, which consists of a flexible band of aluminum, built like a rope ladder, the three phases being carried parallel to each other in the same horizontal plane and kept apart by insulating spacers. The feeder is attached to a mast 20 ft. high on the tank and runs from there through free air to a similar mast on the cable car. The tractor mast is of steel tubing and the feeder band is joined to its top by a slip-ring arrangement permitting the tractor to move freely about its own axis. The mast on the cable car is hollow and made of wood, the bare feeder being carried down through the mast to an insulating drum, where it is rolled up in such a way that each phase coils concentrically on itself and no short circuits can occur. The drum automatically pays out the flexible feeder as the tank moves away from the cable car, the feeder always being kept taut by an automatic regulating device built on the slip-clutch principle and driven by a small induction motor. Some difficulties

GERMAN, FRENCH AND SWEDISH ELECTRIC PLOWING SYSTEMS HAVE BEEN DEVELOPED IN EUROPE

at first were encountered due to breaking of the aluminum band, but with a more recent design of regulator the tank may safely take ditches and other obstacles.

The length of the feeder is 738 ft. and the "electrotank" thus is free to move within a circle with a diameter of 1,476 ft. Furrows 1,300 ft. long thus may be made in one stroke and a field of about 37 acres may be plowed without moving the cable car.

The energy consumption is about 17 kw.-hr. per acre, while the power varies from 12 hp. to 30 hp. The energy cost, therefore is about 50 cents an acre, at the rate of 3 cents per kilowatt-hour, and thus compares favorably with the cost of other plowing systems.

## Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

### National Aspects of Water-Power Development

*To the Editors of the* ELECTRICAL WORLD:

I note the letter of Francis A. J. FitzGerald on the "National Aspects of Niagara Falls Development," in which he criticises some of the statements made in my article on the "Pit River Power and Transmission Problem," printed in the ELECTRICAL WORLD for Jan. 27. Mr. FitzGerald should not have quoted incomplete sentences or statements.

I did not imply that there was no transmission of power from Niagara. I said: "To attempt to find a local demand for the *whole* of these large powers, as was done at Niagara, because in the early days of the electrical industry there were no transmission systems developed, is uneconomic and unsound for the industry and from a standpoint of national stability. For to be stable we should have the industries of the country diversified and spread out over the country as much as possible, building up the smaller communities as well as the large centers. At present places like Niagara, New York City, Boston, Philadelphia, Chicago and other places have much cheaper power than obtains in the smaller cities and towns. This does not make for a healthy growth of the states and nation. We need a transmission system which will take the power from the large producing centers to the smaller as well as the larger consumption centers and more nearly equalize power conditions in small and large cities."

Again I said: "It is not sound practice to allow *all* the water powers of Niagara to be used locally to the advantage of a few industries, but part of this power should be required to flow out into the smaller cities to help them prosper. Similarly, the water power of Muscle Shoals and other sites of great potentiality should not all be used locally to the advantage of a few industries, but a very large proportion of this power should find a market through the construction of transmission lines that will take it to available markets and build up present communities. In that way we will spread out the advantages of water power among more people, and this will in turn create a more favorable public opinion for the logical development of water power and transmission systems to meet the needs of the states and nation."

The real economic and political problem is given in the statement that there must be "created a more favorable public opinion for the logical development of water power." We cannot expect public opinion to favor the release of a reasonable amount of water for power at Niagara for local or other uses unless we get more people to know that they will get some direct benefits. It is a crime to have the waste going on at Niagara while we deplete our coal mines and talk about shortage of labor.

I believe the Niagara developments are a wonderful thing and that their local use was fully justified in the initial period of water-power developments, "because we had no transmission system developed." But if we are to get more water released for power for the use of industries at Niagara it seems inevitable that we must also take *part* of this power out to the smaller communities to get a more favorable public opinion. If it is wrong to give Henry Ford all the Muscle Shoals power to use locally, then it is also wrong to apply practically all the water powers at Niagara, St. Lawrence and other places to local use.

There can be no argument that the real solution of the power problem requires that it be cheaper to transmit energy electrically than to transport energy in the form of coal by rail. There can also be no argument that the transmission system must be commensurate with the large power units and stations. For the same reason that the size of the power units at Niagara and other places has increased ten times in the last ten or fifteen years the capacity of the transmission systems must be correspondingly enlarged. These are some of the economic reasons for the 220,000-volt transmission system.

If we apply reason to the water-power and transmission problems of the country, a plan can be worked out that will be a great benefit not only to the electrical industry but to the country as a whole. For the logical solution of the water-power and transmission problem will largely solve the coal and labor problems with benefit to all. F. G. BAUM.

San Francisco, Cal.

### Neglected "Safety First" Precautions

*To the Editors of the* ELECTRICAL WORLD:

We hear a great deal in these days of safety first and accident prevention campaigns, methods and systems, and they do much toward the end intended. It takes only the intelligence of a child to understand the danger of contact with 500-volt transmission lines, yet are these really the most dangerous features of the modern electric power plant? One does not think of any great danger from an ordinary 110-volt alternating-current lamp socket, nor from the composition of finishes for the handles of dusters or brooms, nor from the amount of conducting matter in paints used on ladders, insulating stools and other woodenware one sees daily in all power plants. To the danger from possible live lamp sockets I can testify from personal experience. While inspecting some apparatus on a shelf 10 ft. above the floor and holding a drop light inclosed in a wire guard in my right hand, in order to insure myself against a possible fall I grasped a cold 1½-in. steam pipe with my left hand. Instantly I found that my left hand had closed on the steam pipe with a death-like grip. I put forth my greatest possible effort to release my grip on the pipe, but it was utterly impossible to do so, and I realized the danger I was in. The thought flashed into my mind that the only thing to do was to let my body swing off the ladder, and this I did. I have no memory of what happened until I was

again on the floor standing on my feet with a severely sprained foot, considerable skin abrasion and a partly smashed ladder. I was still grasping the lamp just as I was holding it when the ground was formed. On investigation I found that a single strand of the flexible cord was in contact with the shell of the lamp socket, thereby energizing both socket and lamp guard with 110 volts to ground.

The accident related will indicate the care that should be taken when making the extension cords that are often used inside of boilers and penstocks and in so many places of low resistance to ground circuits. The use of portable lights tapped to the usual 550-volt railroad circuit lamp cluster should be absolutely forbidden as defective material or careless workmanship can easily result in injury or death. The finish on the handles of dusters and brooms often causes severe shock from moderate potentials. This, too, I can attest from experience. I advocate that all extension lights be made so as to preclude the possibility of a socket and guard becoming alive; that the quality of the finish on broom and duster and switch-hook handles and fuse tongs be of very high resistance. Paint on any of these articles must be forbidden in place of insulating varnish.

FREDERICK L. ROTH,
Assistant Chief Electrician.
Cos Cob Power Plant, N. Y., N. H. & H. R.R.

## Automatic Operation of Hydro-Electric Plants

*To the Editor of the* ELECTRICAL WORLD:

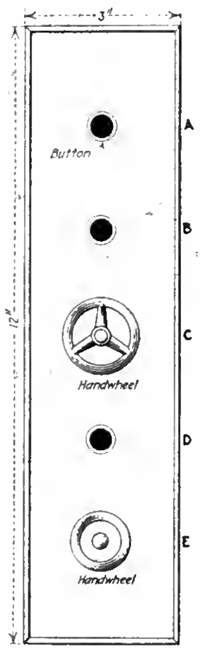
The discussion in the ELECTRICAL WORLD regarding automatic hydro-electric plants has been very interesting. In the early spring of 1922 I had a good opportunity to make studies into the merits of automatic hydro-electric plants while installing and wiring the automatic equipment at the Breakwater plant of the Peninsular Power Company. This station consists of two 2,000-kva. generators and is entirely automatic. Since it has been in operation there never has been any doubt regarding its superior operating and economic features.

The automatic hydro plants are a distinct success, and the only limitation at present is that they will not attend to load dispatcher's requirements regarding line switching. To my knowledge there is not any safe method of opening a line switch automatically so that linemen can work on the line affected.

It has been proved to be economical to save the wages and housing cost of from two to three operators by operating small plants automatically. It will therefore be equally economical to design or change over larger plants to semi-automatic control, thereby dispensing with several operators. With semi-automatic control one switchboard operator could operate a large station where hand control might require an assistant switchboard operator and perhaps a governor man and a pump man to assist him.

The engineer who has the opportunity to design a large hydro-electric station at this time is indeed fortunate as manufacturers are able to supply him with governors and automatic electrical equipment which will safeguard his installation better than any operator could with manual control. Besides that, the starting and stopping of main units is far more satisfactory with automatic equipment. A 400,000-kw. plant consisting of eight 50,000-kw. units could readily be controlled as far as operation is concerned by one man. The controls of eight 50,000-kw. generators could be mounted on a panel 1 ft. high and 2 ft. wide. This panel would be mounted on the operator's desk. I would suggest that the generators each have separate excitation and an individual Tirrill voltage regulator. Assuming that there are times when a long high-voltage transmission line must be energized by building up the voltage gradually, this should also be taken care of automatically.

The diagram shows a 1-ft. x 3-in. panel section allotted to the control of one 50,000-kw. unit. Pulling the button *A* would start a generator and would stop it after the generator had backed off its load. It may be well to explain that there never would be any need of an operator stopping a generator quickly, as the generator is protected in every possible way by automatic devices, taking all emergency operations away from the operator.




If it is desired to build the voltage up on a long high-voltage line, the operator will pull the *B* button as well as the *A* button, and the excitation of the generator will be so controlled automatically that this function will be taken care of quickly and in a neater way than with hand control. Perhaps it might be advisable to eliminate the *B* control and let the generator "think for itself" by connecting the secondary leads of a line or bus potential transformer so that when this potential transformer is energized the generator will get on the line in the usual way, while if the potential transformer is dead the generator will bring the voltage up properly for energizing a high-voltage line. *C* is a voltage-adjusting rheostat for the Tirrill regulator. By means of these eight rheostats the alternating-current voltage can be kept at the desired value and the power factor as it affects the generators regulated. *D* is to control the load of the generators with the ordinary paralleling motor if desired. It could also be arranged to prevent turning load control over to float switches or a distant load dispatcher. *E* controls a gate-opening-limit stop on the governor, thus enabling the operator to carry any set load. Perhaps it would be a good idea to have a remotely controlled indicator in view of the operator to show the governor-gate opening at all times. The line-control panels in a station of this kind should also be grouped very compactly, and instead of standardizing on one size of the meters they should have dials only large enough to get the desired results. For instance, a 50,000-kw. meter should have a large dial while a power factor or exciter voltmeter would need only a very small dial.

I made the statement that one man could handle the operation of a station of this size or even larger. There would, however, be maintenance and cleaning to be attended to which would require other help, depending on local conditions. In selecting the size of a crew in a plant of this kind the number of men needed for maintenance would compare closely with the number needed in the same plant if it were hand-operated.

I predict that the steam station will also be controlled in a similar manner in the future. Bringing a large steam turbine up to speed and on the line automatically is not going to be too complicated a problem for engineers to solve, and when it is solved the method will be far superior to manual operation.

L. W. WYSS,
Peninsular Power Company.
Iron Mountain, Mich.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Relay as Ground Detector for D.C. Control Bus

WHERE lamps as ground indicators are installed on direct-current control buses very annoying operating troubles are often encountered. Consequently the New York & Queens Electric Light & Power Company has done away with these lamp ground detectors and substituted for them a differential relay, the use of which has so far proved to be very satisfactory.

In order to be sure whether or not the direct-current system was free from accidental grounds, it was formerly the practice to install lamps on the direct-current bus, as shown in Fig. 1. When neither side of the bus was grounded, the lamps burned at half the direct-current bus voltage, but when either side became grounded the lamp on the opposite side burned with full voltage while on the grounded side the lamp was extinguished. With the lamp ground detector on the bus, it was found that transformer banks or feeders would often trip out without apparent cause. The operator would reclose the switches twice, but they would trip out immediately, and the operator would then leave the circuit off. The lamp ground detector would then show the direct-current system to be free from grounds. However, when the control wiring of the circuit which had tripped out was tested it would be found to be grounded, and after the removal of the ground the circuit would function properly with no further trouble.

The trouble was found to be due to a ground occurring on the control wiring between the "CO" relays and the "HG" relays, which were used to separate the relay trip leads on the oil-circuit-breaker circuits. Fig. 1 schematically shows the control connections on a typical feeder circuit. The wiring would accidentally become grounded say between points *A* and *B*. This would mean that the negative bus would be grounded through the "HG" relay on the particular oil switch that was closed at the time. The current taken by the lamp and "HG" relay in series between the grounded side and the ungrounded side of the bus was sufficient to cause the "HG" relay to operate and trip the breaker.

In order to avoid trouble of this sort, for which the lamp ground detectors were more or less responsible, they were removed and an entirely new system was installed for the detection of grounds on the direct

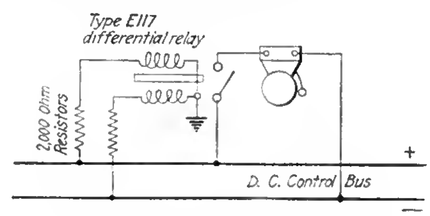



FIG. 2—DIFFERENTIAL RELAY AS GROUND DETECTOR

current bus, as shown in Fig. 2. A type E-117 Western Electric differentially wound telegraph relay, which operates on a few milliamperes, was installed with 2,000 ohms resistance in each side and with the middle point of the winding solidly grounded. In addition to operation on a current of such small magnitude that no other equipment would be affected, this relay is equipped with contacts that may be connected to ring a bell, light a lamp on the operator's desk or give any other desirable indication of trouble. In our substations a 110-volt bell is used.

This system has been in operation for over two years and has been found to be entirely reliable and satisfactory. It is now installed as part of the standard equipment on the direct-current buses for the operation of oil circuit breakers.

J. E. GOODALE,
Electrical Design Engineer.
New York & Queens Electric Light & Power Company,
Long Island City, N. Y.

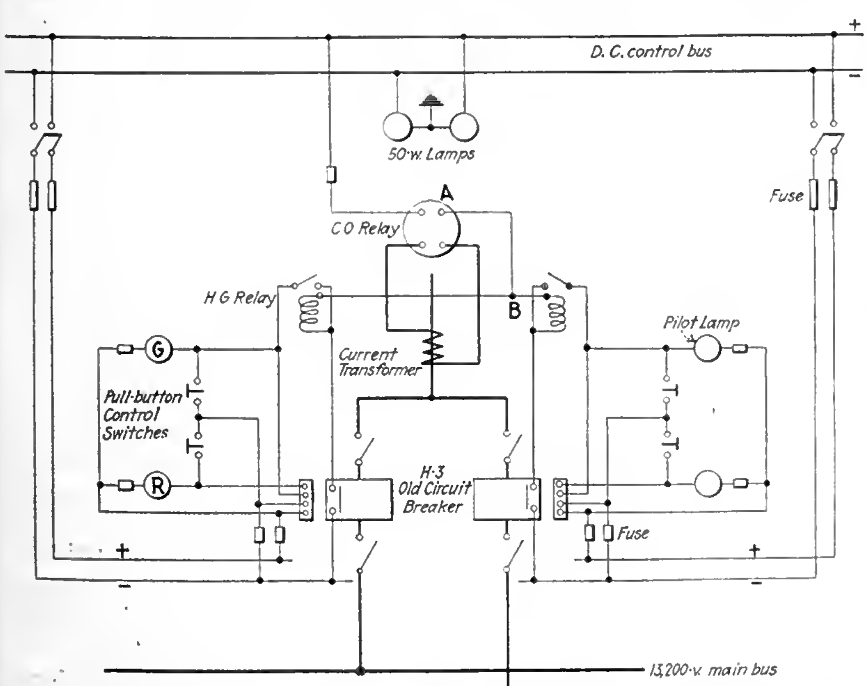



FIG. 1—GROUNDING OF CONTROL WIRE BETWEEN RELAYS CAUSES CIRCUIT TO OPEN

## Respiratory Protection in Street Manholes

WORKERS in street manholes for telephone and electric power conduits often encounter irrespirable atmospheres due to leakage of artificial or natural gas, sewer gas or gases caused by electrolysis. Inquiries received by the Bureau of Mines and

conferences between members of the bureau and engineers who have to deal with manholes have disclosed the need at times of respiratory protection for workers in manholes. It is planned by the bureau to obtain samples of contaminated air from manholes and to test various masks in them. Recommendations for protection of workers in manholes will be published. This experimental work is being conducted at the Pittsburgh (Pa.) experiment station of the bureau.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Starting Rotary Converters from the A.C. Side

ON ROTARY converters equipped with brush-lifting devices all brushes except the pilot brushes should be lifted from the commutator. If the brushes are left down, short-circuit currents occur in the coils undergoing commutation, resulting in severe sparking when this current is interrupted and in the burning of the commutator and brushes. Starting switches are provided to impress less than the normal voltage across the alternating-current end of the machine as the current must be limited to a safe value.

Proper polarity is essential as reversed polarity would cause the machine to act as a short circuit to a bus already energized. Therefore, when the machine has reached maximum speed with the switch in the starting position, the shunt-field switch is closed when the voltmeter needle swings in the positive direction. Sometimes it is impossible to make a machine build up in the proper direction by means of the reversing switch. In this event, when running on the starting side, the oil switch should be opened for a few seconds and closed again. Opening the switch for the proper period will cause the armature to slip one pole space from its original position. Opening it for too long or too short a period will cause the armature to slip two poles, or none, either of which conditions leaves the polarity as before. Consequently, if the first attempt to reverse the polarity by this method is not successful, it should be tried again with a longer or shorter period of opening the oil circuit breakers.

If it is attempted to operate compound-wound machines in parallel without equalizing connections, one machine will take all the load and also feed back into the others and operate them as motors. Equalizer buses and switches are provided to cause proper division of the load current among the series fields, thereby overcoming this tendency.

These general instructions for operating rotary converters with the following definite instructions as to each successive step to take in starting are part of the operating code of the Philadelphia Electric Company:

1. If the machine has a brush-lifting mechanism, see that the direct-current brushes are raised and that only the pilot brushes remain on the commutator. Otherwise all the brushes must remain down.
2. If a main field break-up and reversing switch is provided, see that this switch is left open. If a field reversing switch only is provided, see that this switch is left closed in the running position, unless the switch is provided with a field discharge resistance, in which case it should be left open.
3. See that the booster-field switch is open.
4. Cut in all the main-field resistance and connect the voltmeter by plug, dial switch or other means to the machine being started.
5. If the transformer bank supplying the rotary converter is air-cooled by an individual motor-driven fan, start the fan; if air-cooled from a common air duct, open the transformer dampers; if water-cooled, turn on the cooling water. Where fans are supplied for cooling the rotary converter, start these fans.
6. Throw the alternating-current starting switch to the starting position.
7. If necessary to obtain the voltmeter reading, close the negative bus switch.
8. Close the oil switch, at the same time observing the alternating-current ammeter.
9. If the main-field switch, as stated in Rule 2 above, is left open, observe the direct-current voltmeter, and when the needle swings in a positive direction, close the main-field switch in the running position. Where the main-field switch is left closed, note the direction in which the voltmeter needle comes to rest.

In either case, if the field builds up in the reverse direction, as indicated by a negative voltmeter reading, throw the main-field switch to the reverse position; then, when the voltmeter needle swings slightly to the positive side of the scale, throw the main-field switch to the running position.

If a machine does not build up in the right direction after several trials of the above method, proceed as follows: With the starting switch in the starting position, open the oil switch and close it again in a few seconds. In case the voltage does not build up correctly, repeat the above operation, keeping the oil switch open for a slightly shorter or longer period of time as may be found necessary.

10. Close the booster-field switch.
11. Throw the alternating-current starting switch to the running position.
12. Lower the main brushes on the commutator.
13. Close the equalizer and series-field switches. (The series-field switch is provided only on machines having a shunt around the series field on the main-field spool.)
14. Close the neutral switch (on three-wire converters).
15. Where knife switches are provided in series with circuit breakers, close the circuit breakers.
16. Adjust the direct-current voltage to that of the bus.
17. Close the negative bus switch, if it has not been closed under Rule 7.
18. Close the positive bus switch.
19. Load the converter by field adjustment.

## Hot Stoker Rams

HOT upper stoker rams may be caused either by the burning out of the ram-box cap in the front wall or by an obstruction over the ram, preventing coal from feeding. In either case the coal in the hopper will become ignited, which will heat the rams and ram boxes. Hot lower rams are caused by clinker formation between the tuyères or by insufficient feeding of coal by the rams, which allows the hot coal to come in contact with the lower rams. Typical instructions for taking care of hot stoker rams are part of the operating code of the Philadelphia Electric Company and are given below:

### HOT UPPER RAMS

1. Break the arch over the ram with air agitators or by hand, or should there be an obstruction, dig the coal out of the hopper and remove it.
2. Feed green coal to the ram.

### HOT LOWER RAMS CAUSED BY FIRE BEING TOO THIN

1. Increase the stoker speed.
2. Reduce the drafts when possible.
3. Put the long stroke on the ram.

### HOT LOWER RAMS CAUSED BY CLINKERS

1. Put the long stroke on the ram, alternating with the normal stroke to break up the clinker.
2. Put U-pins on the end of the lower-ram driving bar outside of the driving link to draw the ram further out of the fire.
3. Dislodge the clinker with bars from the side doors.
4. Reduce the air blast, if it is possible to hold steam.
5. If this fails, take the boiler off the line and remove the clinker.

# Regulations Proposed for Installation of Pulverized-Fuel Systems

REGULATIONS covering the installation of pulverized-fuel systems have been prepared by a subcommittee of the National Fire Protection Association and approved by the main committee on dust explosion hazards and will be recommended to the annual meeting of the association for tentative adoption at Chicago on May 8-10, 1923.

Any one interested in these regulations and desiring to suggest additions or changes should communicate prior to the May meeting with David J. Price, United States Bureau of Chemistry, Washington, D. C.

Some of the major requirements as set forth in the regulations may be found in the accompanying tabulation. The general regulations for Class A and Class B systems relate to location and construction of apparatus, ventilation and dust collection, static dust, crusher and pulverizer, magnetic separators, dust collectors, driers and fire protection. Mechanical details such as piping, joints, valves, storage and furnace bins, screw conveyors, etc., are specified in the regulations for each of the various types.

An instruction card emphasizing precautions to observe in operating pulverized-fuel plants must be posted in a conspicuous place in the pulverizing plant, the boiler plant and in buildings where pulverized fuel is used. Among the major precautions to be included on this card are:

The use of shavings or other similar light combustible materials for starting fires in drier furnace is prohibited.

In Class B systems, if the fuel supply line becomes clogged, the furnace shall be immediately cut off and the secondary air stopped. When the obstruction has been cleared and before starting the fan a thorough examination shall be made to insure the removal of smoldering particles of fuel.

## Some Regulations Covering Installation and Operation of Pulverized Fuel Equipment to Be Voted On May 8-10, 1923

*Class A.*—Indirect, or those in which the fuel is intimately mixed with air only at the point or points where used and involving storage bins at points of consumption.

*Class B.*—Direct, or those in which the pulverized fuel is fed to a fan by which it is blown as a combustible mixture through large pipe to furnaces or other points of combustion. In the case of circulating systems of this class the unused fuel is returned to the initial point to again be blown through the line.

*Unit System.*—Those in which the fuel is pulverized at or near the point or points of use and delivered directly from the pulverizer into the furnace by means of fan or blower, which may be an integral part of the apparatus, the air being admitted in the apparatus or in conjunction with the fuel.

### General Regulations

*Class A and Class B Systems*

*Location.* — The processes of crushing, drying and pulverizing fuel shall be accomplished in a separate building used for no other purposes.

*Construction.*—In order to prevent accumulations of dust, the design of the building shall be such and the structural members so shaped and assembled as to present the least possible extent of surface on which dust can lodge. In order that the venting of explosions may be more readily facilitated, a portion of the exterior walls equal to not less than 10 per cent of the combined area of the inclosing walls shall be of glass, provided that when in a building with other processes not more than 40 per cent of the aggregate area of the exterior walls shall be of such material.

*Ventilation and Dust Collection.*—The atmosphere of the room shall be kept as free as possible from suspended or floating dust by means of approved dust-collecting systems, the collection of dust to take place as near the point of origin as possible.

*Static Dust.*—Portable tanks containing compressed air may be used provided that no electrical equipment is operated inside the pulverizing room in connection therewith.

*Magnetic Separator.*—A magnetic separator shall be provided for each system employing pulverizing mills and installed between the crusher and the drier.

*Driers.*—The drier and drier furnace shall be separated from other equipment in the pulverizer house by means of incombustible partitions constructed of material having a fire resistance of not less than one hour based upon the standard specifications for fire tests and materials of construction. Pulverized coal exceeding a temperature of 150 deg. F. shall not be stored in any bin.

### Class A Systems

*Storage and Furnace Bins.*—Storage and furnace bins shall be located as far from furnaces as is consistent with operating requirements. Bins . . . shall be so shaped that no material will be left in the corners under normal emptying operation of the bin. All bins shall be equipped with a reliable gaging device so that the quantity of fuel in the bin may be readily determined without exposing contents.

*Screw Conveyors.*—Systems using screw conveyors for handling pulverized fuel shall be arranged with driving power applied at the discharge end. In no plant shall coal-storage bins, conveying machinery or fuel-pipe lines be used as supports for electric lighting or power lines other than those installed in conduit. Machinery and all other parts comprising the crushing, drying, pulverizing and conveying system shall be electrically grounded in an effective manner.

### Class B Systems

*Blowers.*—The primary blower shall be operated and maintained at a rate producing a primary air pressure higher than that of the secondary or booster. Motor circuits for primary blower and booster fan shall be protected by the same circuit-breaker switch or other protective device, so that the stopping of either will cause the simultaneous stopping of the other.

### Unit Systems

*Pulverizer.*—Power for operation of the pulverizer shall be controlled remotely at a readily accessible location and at the mill.

*Magnetic Separator.*—A magnetic separator shall be provided for each system.

*Vent.* — A pressure-relief vent discharging to the outside air shall be provided in the discharge of every pulverizer, having discharge pipe greater than 4 in. in diameter and exceeding 20 ft. in length. All pulverizers shall be constructed as dust-tight as practicable and so operated as to avoid emission of dust.

All stationary lights shall be protected with vapor-proof globes and wire guards. Only daylight or hand flashlamps shall be used when inspecting coal-storage bins and pulverizing and coal conveying apparatus. All conveying and distributing piping shall be inspected daily and any leaks that are found promptly repaired.

FIELD EDITOR ELECTRICAL WORLD.
New York, N.Y.

# Maintaining Dielectric Strength of Oil

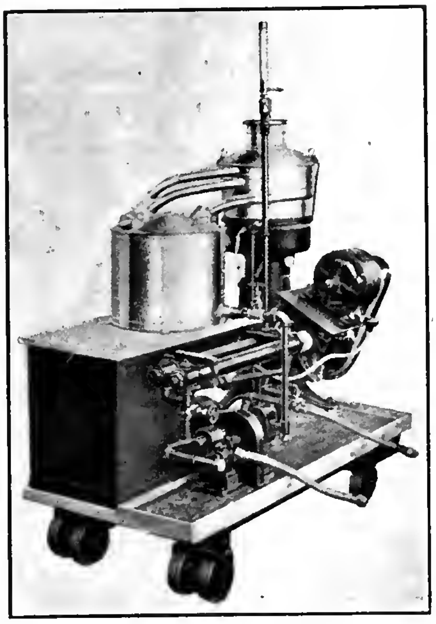
**Dehydration of Transformer Oil by Centrifugal Separator Is Proving Successful—Advantages Are Speed and Economy—Apparatus Can Also Be Used for Purifying Lubricating Oil**

EXPERIMENTS conducted during the past three years by one large central station company located in the East have demonstrated that the method of separation by centrifugal force can be successfully applied to the problem of removing water from transformer oil. As an illustration of a typical experiment in dehydration of transformer oil by a centrifugal separator the following test may be cited:

The transformer used was a 625-kva. unit, 2,300/440 volts, containing No. 12 transil oil. The temperature varied between 42 deg. and 48 deg. C. during the test. Approximately 530 gal. of oil were run through the separator, at a rate of 50 gal. to 150 gal. per hour. This speed could have been exceeded except for local conditions, a rate as high as 350 gal. an hour having been obtained in other tests. The dielectric strength of the oil was determined in each case by averaging the breakdown value obtained by testing five samples of oil in an oil test cup with ½-in. electrodes, 0.2 in. apart. The transformer was not in service at the time. The results of these tests are given in the accompanying table. In similar tests using a gap with 1-in. electrodes 0.1 in. apart dielectric strength as high as 32,000 volts have been obtained.

The apparatus now used for the dehydration of transformer oil is the result of the experiments made in the last three years. It consists of a motor-driven centrifugal separator, together with an electric driving motor, pumps, heater and oil tank, all mounted upon a movable platform. The fact that the apparatus is portable makes it possible to move it easily from one location in the power house to another or to roll it up a gangway onto a motor truck and carry it to various substations. At a large generating station it can remain permanently piped to all of the transformers and be used solely for their dehydration, but where there is not a sufficient number of units to keep one separator busy all the time the portability feature is a great asset.

The general practice in using this equipment is to draw off a sample of oil from the bottom of each transformer once a month and send it to the company's laboratory for testing. In this testing the 0.02-in. gap is habitually used because it is thought to give more reliable results. When the dielectric value of the sample of oil falls below 26,000 volts, the transformer is dehydrated by the centrifugal separator.



CENTRIFUGAL SEPARATOR PROVING SUCCESSFUL FOR PURIFYING OIL

The advantages which have been found to result from the use of the centrifugal separator for dehydrating transformer oil have been, primarily, increased speed and decreased cost. It was usually necessary with the blotter press to run the oil through the filter at least three times in order to purify it thoroughly. A transformer containing 2,400 gal. of oil would require forty-eight hours for dehydration by a medium-sized filter. Additional time would be required for changing blotters, taking apart and putting together the apparatus. On the other hand, a centrifugal separator could probably purify that quantity of oil in about twelve hours.

Not only is it possible for fewer men and fewer machines to do the work by the new method, but there is also the additional advantage that it is frequently possible to take a transformer out of service for a short period for dehydration, when it might be quite impossible to keep it out for many hours. The centrifugal separator therefore makes it feasible at times to dehydrate the oil completely under circumstances such that it could not be done by the slower filter press.

An illustration of the usefulness of speedy dehydration is furnished by the following experience with a transformer. It was discovered that a small pinhole leak in the copper tubing was allowing a minute quantity of water to mingle with the oil. Although the rate of leakage was low, nevertheless the dielectric value of the oil was rapidly reduced. It was most important that the transformer remain in service, so a portable centrifugal separator was brought over and set to work, while the transformer remained alive. After the oil had been dehydrated once the separator was left in place and tests were taken of the oil every hour. Whenever the dielectric value fell below 30,000 volts the purifiefir was set to work to restore it to the vicinity of 50,000 volts. In this way it was possible to keep the transformer in service for several days in spite of the leak at a time of peak demand when the loss of any apparatus would have been a serious inconvenience.

The existence of some solid matter in the transformer oil is clearly shown whenever the centrifugal separator is cleaned. A kind of sludge somewhat resembling vaseline is found to have gathered in the dirt pockets. This is probably composed

DIELECTRIC STRENGTH OF OIL IN A 625-KVA. TRANSFORMER UNDER TEST

| Time | Dielectric Strength of Oil at Intake, in Volts | Dielectric Strength of Oil at Outlet, in Volts |
|---|---|---|
| 8:15 a. m. | 14,000 | 21,000* |
| 8:30 a. m. | First oil repeated | 40,000 |
| 8:45 a. m. | 29,000 | 42,000 |
| 9:30 a. m. | 45,000 | 48,000 |
| 9:45 a. m. | 46,000 | † |
| 10:15 a. m. | 49,000 | † |
| 10:45 a. m. | 50,000 | † |
| 11:30 a. m. | 49,000 | † |
| 12:30 p. m. | 51,000 | † |

* This oil was not considered fit to be returned to the transformer and was put through separator again.

† No breakdown values obtained—dielectric strength above 52,000 volts, the capacity of the testing machine being 52,000 volts.

of metallic particles from the terminals, ingredients of the insulating varnish and so forth. The sludge accumulates so slowly, however, that it is possible to treat a transformer completely without its being necessary to stop the separator for cleaning. In this respect the centrifugal separator possesses a distinct advantage over the press filter, whose blotters have to be frequently renewed. The time required for taking apart the machine, cleaning out the dirt pockets and putting it together again is about forty-five minutes.

There are now many installations of this type of apparatus. The blotter-press method has not been altogether abandoned, because it is thought to be superior for removal of some foreign substances, such as the carbon in switch oils. Apparatus for both methods is therefore kept available, and its use is governed by the circumstance of a particular case.

Carbon has been successfully removed from switch oil by washing with soap, allowing the mixture to settle and then dehydrating the oil. By this process the dielectric value of the oil was brought back to standard and its clearness restored.

Where a unit must remain alive during dehydration there is a possibility that the first oil coming through the separator will not be fit to be returned, and if it should be poured back into the case, a breakdown might result. If, however, the oil in the transformer be of fairly high dielectric strength to begin with, or if the unit be dead during the dehydration, this danger will be avoided. It should then be possible to utilize the centrifugal separator readily and to accomplish improved speed and reduced costs in the removal of moisture from transformer oils. The fact that the same machine can be used after a slight change for the purpose of purifying lubricating oil brings it within the reach of smaller companies as well as those which use power on a large scale.

New York, N. Y. J. A. Miller, Jr.

## Restoring Flooded Generators to Service

The superintendent of construction and maintenance of a power company operating in the Southern States declares that he is not afraid to place back in service a generator which has been totally submerged in water. His confidence is based on experience with 6,600-volt generators which were submerged during the record flood of 1919. The coils were dried out by short-circuiting the phase leads and operating the generators at such speed and excitation as would maintain the rated allowable overload current in the windings. In general this drying-out process required about two weeks for each unit, whereas it would have required at least thirty days to rewind the generators if coils had been immediately available and a longer delay would have ensued if the coils had had to be shipped. Moreover, the cost of rewinding would have been about $25,000 per unit.

The length of time that the coils should be subjected to the drying current was determined by megger readings. No definite resistance was selected as the limiting value. Instead megger readings were taken from the start of the drying process. The curve plotted between time and resistance dropped off rapidly immediately after starting the process and then rose at a gradually decreasing rate until the resistant became constant. After the resistance had been constant for twenty-four hours the generator was considered ready for service.

Field Editor Electrical World.
New York, N. Y.

____________ POWER COMPANY

RECORD OF DRYING ____ NO ____ MAKE ____ VOLTS ____ AMP. ____ K. V. A. ____

AT ____ STATION. ____ BY ____ PROCESS. ____ DATE ____

| TIME | AMP. | VOLTS | AMP. FIELD | VOLTS FIELD | TEMP. COILS | TEMP. IRON | TEMP. INCOING AIR | VACUUM | MEGGER | MEGGER | MEGGER | LOG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7.00 A.M. | | | | | | | | | | | | |
| 7.30 | | | | | | | | | | | | |
| 8.00 | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 3.30 | | | | | | | | | | | | |
| 4.00 | | | | | | | | | | | | WEATHER 7 A. M. |
| 4.30 | | | | | | | | | | | | " 12 N. |
| 5.00 | | | | | | | | | | | | " 7 P. M. |
| 5.30 | | | | | | | | | | | | " 12 M. N. |
| 6.00 | | | | | | | | | | | | SIGNED |
| 6.30 A.M. | | | | | | | | | | | | O. K. |

THIS RECORD MUST BE KEPT IN DUPLICATE, AND ORIGINAL MAILED TO CHARLOTTE OFFICE EACH DAY

TYPICAL DRYING OUT DATA FORM FOR GENERATORS THAT HAVE BEEN TOTALLY SUBMERGED DURING A FLOOD

## Pole Treatment Does Not Affect Conductivity

The question as to whether treated poles have less resistance than untreated poles and for that reason are a source of danger to linemen called upon to work on them has been a subject of considerable discussion, particularly where poles treated throughout their full length are used. A committee of the American Wood Preservers' Association reporting at its convention last January had the following to say on the subject:

*Poles.*—Your committee has decided that for all practical purposes the conductivity question as related to poles holds no interest for the following reasons:

1. The distribution engineer is concerned with insulator and cross-arm resistance, the pole resistance forming but a small fraction of the circuit to the ground.
2. Creosote and gas oil are the preservatives in general use for pole preservation, and the experimental data show that they increase resistivity of timber.
3. Steel poles and cross-arms are in common use on transmission lines.

We have asked the opinion of the N. E. L. A., and it agrees that pole conductivity does not enter seriously into transmission or distribution line construction.

*Tests on the Conductivity of Treated Wood.*—A number of investigators have studied this effect and have covered the subject thoroughly at least from a qualitative standpoint. J. T. Butterfield found that:

1. The resistance varies inversely with the amount of water present, the moisture being between the limits of 15 per cent and 50 per cent, also inversely with the length of the tie and with the temperature.
2. The resistance is lowest when with the grain and highest along the year rings or radial lines.
3. Treatment with a soluble salt does change the resistance of the tie and varies approximately inversely as the amount of salt present.
4. Creosote does not decrease the resistance.
5. All the data obtained tended to establish the view that the conductivity of wood is due to the presence of an electrolyte in the pores of the wood formed by an aqueous solution of the salts found in the natural timber or of salts artificially introduced.

Various tests and observations on ties made over a period running back to 1914 were submitted by the committee at this meeting.

The conclusions quoted are borne out in these data in that creosote-oil treatment in which pole users are interested does not decrease the natural wood resistance to the flow of electricity. Treatments utilizing soluble salts do change the resistance of any wooden poles.

Field Editor Electrical World.
Chicago, Ill.

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## Central-Station and Community Growth Inseparable

How the interests of an expanding community tie in with the development of a great central-station system is being shown in a group of advertisements now being published at Boston as planned by the Edison Electric Illuminating Company upon themes suggested by recent progress in its public service. The first three of these displays, which have been carried in daily suburban and financial newspapers in the company's territory of about 700 sq. miles on a regular time schedule, are reproduced herewith. The first draws a lesson from the peak-output record attained by the system on Dec. 21 last, the anniversary of the landing of the Pilgrims at Plymouth. The "set-up" emphasizes the two advances the date signified and calls attention to the fact that in meeting service requirements of a growing community the previous record output of the company was exceeded by 24 per cent. The contribution of the individual demand for service to the growth of company and community is featured.

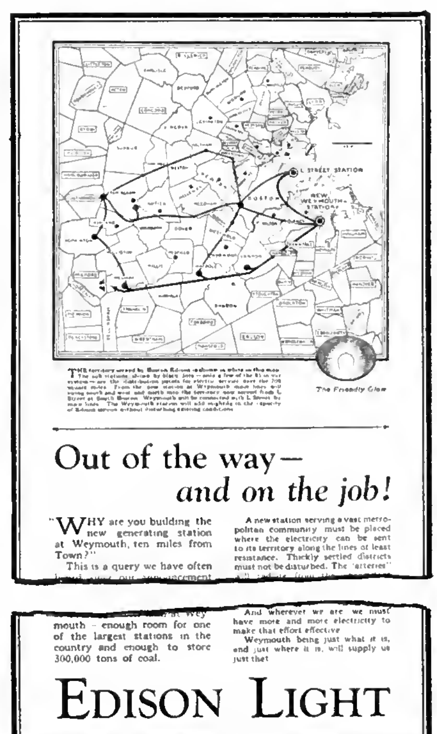
A look ahead to the new Weymouth generating station is the basis of the second display, which emphasizes the need of foresight in anticipating the electrical growth of the community through arithmetical studies of load development and available facilities. The third insert goes a step farther and shows how the new 300,000-kw. station to be built at Weymouth will serve the entire metropolitan and suburban area of Greater Boston, with major tie lines to the principal substations and to the present L Street Station in Boston proper. The controlling factors in the decision to locate at Weymouth are set forth, and the diversity of interests served by the company from the farms of Millis to the tidewater industrial plants of Boston and Chelsea are outlined. Later advertisements will point out the importance of coal and the unity of interest in the development of both the community and company.

## Use of Electricity Reduces Number of Fires

Because of its increased application in the household and in industrial plants electricity is a potent factor in fire prevention. It has reduced the number of fires in Denver, Col., by more than 95 per cent in the last five years, according to a study and survey recently completed by Fire Chief Healy of the Denver City Fire Department. The increased demand for electricity for light, heat and power purposes has curtailed the actual number of conflagrations by at least 95 per cent, he believes. In short, not more than one fire in a thousand—probably even fewer—is caused by electricity when used properly.

Chief Healy grouped the few fires of electrical origin in the following three general classes: Fires over which ordinary precautions exert little control, such as conflagrations due to interference with transmission lines by falling trees, storms and the like, lightning and static electricity;






ADVERTISEMENTS CO-ORDINATING THE DEVELOPMENT OF COMMUNITY AND CENTRAL STATION

fires caused by abuse and carelessness in the use of electric appliances, and lastly, tampering with fuses and the use of other material than approved fuses; deterioration of installations and defective equipment.

The Denver Fire Department is gratified to report that few fires are actually attributed to defective equipment, he declared. The relative number due to such causes as neglect to disconnect flat-irons shows some tendency to increase.

Twenty-four conflagrations occurring in Denver over a period of two years which were attributed to electricity were shown by Chief Healy to be due to other causes entirely.

## Cooking Schools Stimulate Range Sales

TO PROMOTE the sale of electric ranges by educating the housewife in the use of this appliance the electrical interests of Portland, Ore., and Seattle, Tacoma and Spokane, Wash., recently joined daily newspapers to conduct electric cooking schools in each of these cities. Results proved highly satisfactory from the point of attendance, and the schools proved to be an excellent means of arousing interest in electric cooking.

The plan was first to sell the idea to a newspaper in each of the cities and have the school conducted under its auspices as the "*News-Tribune* Electrical Cooking School." The advertising and additional prestige gained amply repaid the newspaper for its support. Advertising by the power companies, electrical dealers and merchants whose products were used in the school, together with news items on electric cooking and concerning the school, created a strong appeal. A large hall was obtained in which merchants and manufacturers who participated in the advertising were allowed to maintain display booths and give out samples but not to solicit sales.

ATTENDANCE AT FOUR ELECTRIC COOKING SCHOOLS

| City | Population | No. Days School Was Conducted | Maximum Attendance | Average Attendance | Entries in Baking Contestt |
|---|---|---|---|---|---|
| Seattle | 315,000 | 5 | 1,500 | 1,000 | 987 |
| Spokane | 104,000 | 5 | 650 | 500 | 627 |
| Tacoma | 97,000 | 5 | 1,400 | 1,200 | 1,164 |
| *Portland | 258,000 | 5 | 600 | 600 | 620 |

* The largest hall available in Portland had a seating capacity of only 600. It is interesting to note tha Tacoma, with the smallest population of all of the four cities, had the largest attendance.

The success of such an undertaking depends largely upon the demonstrator, who should have a pleasing personality, be a good speaker, be familiar with every phase of the culinary art and be able to present the superior features of the electric range. For this purpose the services of Miss Bernice Lowen, home economist of the Edison Electric Appliance Company of Chicago, were secured.

Interest was maintained by holding a baking contest on the last day of each school, when prizes were awarded for the best loaf of bread, the best cake and the best pie entered. An electric range, a washing machine and a vacuum cleaner were given as first prizes for these entries. In addition to the first prize ten other prizes were awarded in each division. The entries were judged by the standard scale adopted by the bakers' association. All entries in the baking contest were accepted with the understanding that they would not be returned. These were sold instead, and in most cases the money was given to charity. A question box conducted by the demonstrator also proved valuable in spreading the story of electrical cooking.

The results of this method of educating the housewife to the superiority of the electric range are largely intangible, although a number of direct sales resulted. It is probable, however, that the full benefit will not be felt for many months. The interest created by the schools and the results which may be expected can best be judged from the accompanying attendance figures.

Power companies were quick to foresee the benefits of the cooking schools and lent their whole-hearted support. The free advertising which every one concerned received in the news columns of the papers sponsoring the schools would have cost thousands of dollars had a like amount of advertising space been bought. Much credit for the success of the undertaking is due Ray W. Turnball, Northwest district manager of the Edison Electric Appliance Company, who conducted the schools and was in charge of the entire program.

## Southern California Edison Sets New-Business Bogey

THE Southern California Edison Company has set up 100,000 hp. as the minimum amount of new business to be obtained during 1923. To

ONE SESSION OF THE TACOMA "NEWS-TRIBUNE" ELECTRICAL COOKING SCHOOL

reach this mark the company has sixty salesmen in the field actively engaged in obtaining lighting, heating, cooking and power business. An electric range and water-heater campaign has just been launched, and a quota of 1,500 ranges and 500 water heaters has been established. Present indications are that the added business will far exceed the mark established as 30,000 hp. in additional load has already been signed up.

The company has been enjoying a steady growth in business for some time past, the territory served containing a rapidly increasing population. Many new homes are in course of construction, new industries are being started, and established plants are increasing their facilities. This, together with the intensive development work which the salesmen are doing, has enabled the company during the first two months to sign up almost one-third of the year's minimum quota.

## Acquainting the Public with Utility Personnel

PERSONAL acquaintance of customers and the public with the members of a central-station organization is a valuable asset to the utility. To promote this idea the Utica (N. Y.) Gas & Electric Company recently displayed in its window an organization chart and photographs of its executives and its departmental groups which aroused much favorable comment in the community. As shown in the accompanying cut, the chart, which also is reproduced separately, was made the central feature of the display, and the line of authority and the functions of each individual or department were traced, beginning with the stockholder and terminating with the clerk or laborer.

Photographs of the executive officers, the "company council" made up of department heads, the superintendents' association, and group pictures of the staffs of the financial, operating, commercial, purchasing and suburban departments, together with a reproduction of an assemblage of more than a thousand people who attended the company picnic last summer, were included.

The chart and photographs, overtopped with a card bearing the caption "The Organization Back of Utica Gas & Electric Company's Service," were mounted on a background of copper-colored velvet, with a distinct headpiece or canopy of mulberry-colored velvet. Behind the canopy and concealed from the eye was an arrangement of several powerful incandescent lamps mounted in reflectors which illuminated the exhibit without glare, successfully overcoming the reflections and shadows from the buildings on the opposite side of the street. Incidentally, the Utica company retains the services of a professional window trimmer, who has charge of this work, and the displays are always of a high order.

Differently colored cords were arranged from the chart to the photographs of the executive departmental orzanizations, enabling the public to visualize the personnel of each department and its relation to the whole. It also made it possible for friends and acquaintances of individual employees to trace their connection with the company from this photograph back to the organization chart.

During the two weeks of the showing thousands of people inspected the exhibit and many complimentary remarks were passed on its originality and completeness. A number of business men and manufacturers expressed themselves as being so impressed with the display that they were going to prepare a similar one for their own companies.

The employees of the Utica company were thoroughly pleased by the public's interest, which was reflected to them through the medium of personal comment when they met with friends and acquaintances.

The company gained tremendously through the impression which it left with the individual, who visualized an organization of sufficient breadth

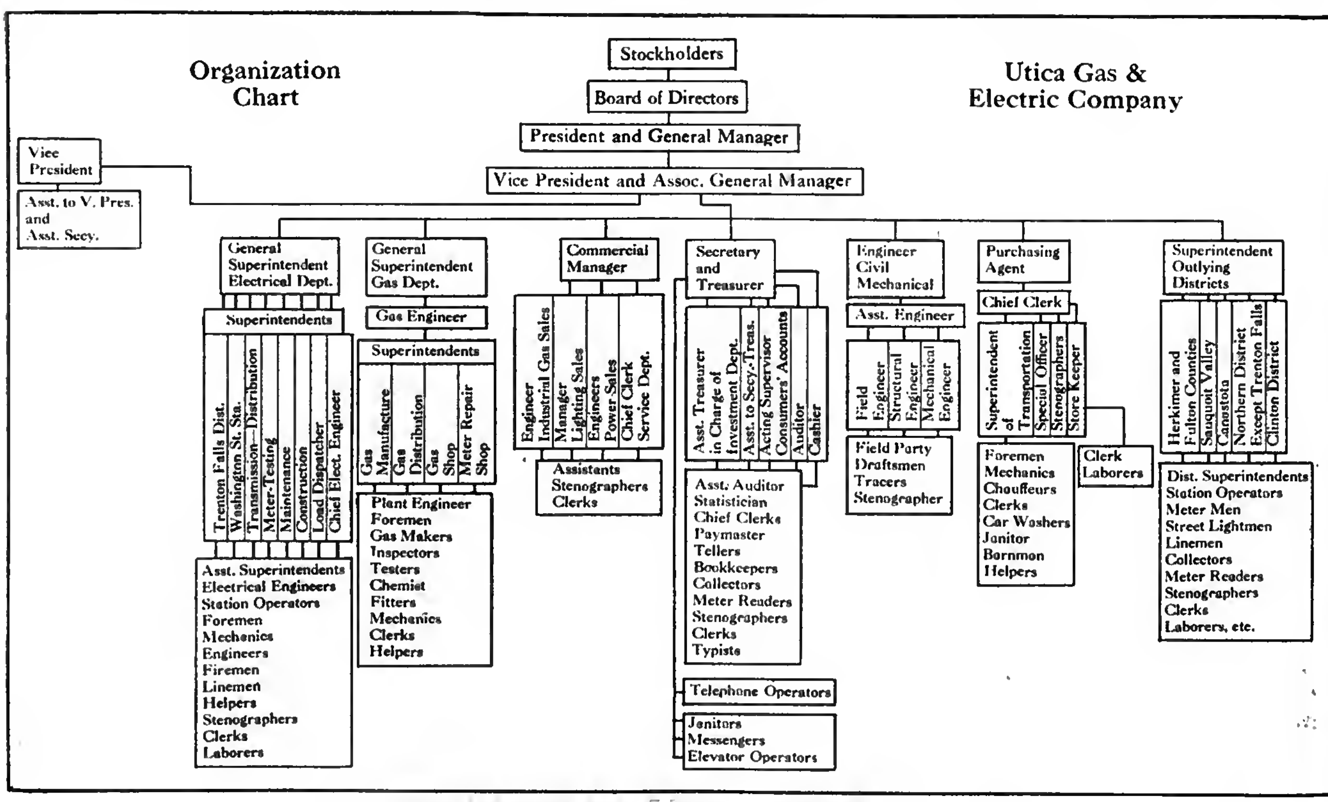
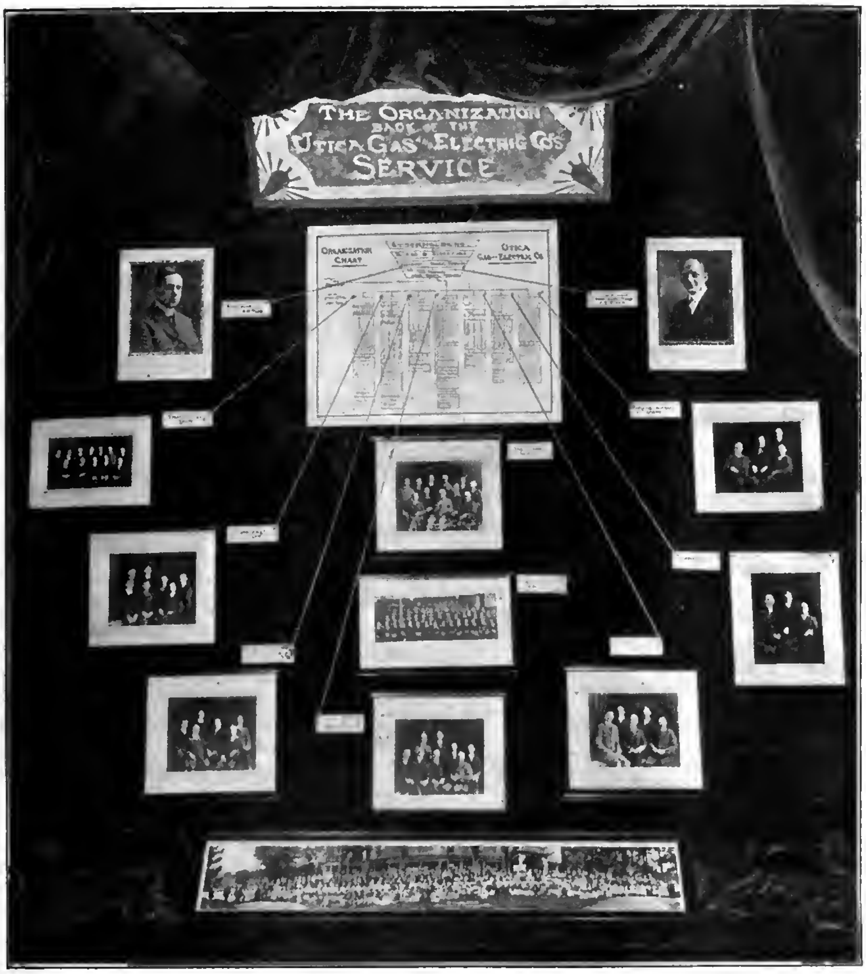



CHART SHOWING ORGANIZATION OF UTICA GAS & ELECTRIC COMPANY




WINDOW DISPLAY SHOWS COMPANY'S PERSONNEL AND ORGANIZATION

and scope, subdivided into departments all of which were necessary to give him an adequate and reliable service indispensable in his daily, commercial and home life. It also gave the public a clearer conception of the size of the staff and the number of high-grade men required to direct and carry on the company's work.

## Maintaining a Permanent Sales Force

THE value of a permanent central-station selling organization was demonstrated in the number of new customers added to the lines of the Scranton (Pa.) Electric Company during the past year. In spite of the fact that the territory served by the company is the heart of the anthracite coal region which went through the depressing influence of a six months' coal strike, the company increased its electric customers from 39,000 to 44,000, or nearly 13 per cent.

E. W. Osborn, new-business manager of the Scranton Electric Company, states that this substantial increase under the prevailing conditions was possible because the company has developed a system of organizing and paying its sales force on a basis which encourages the salesmen to remain with the company. Nine salesmen are employed, who cover the entire territory, which is divided into districts. These salesmen handle all classes of business with the exception of industrial power, for which the company maintains a special department in charge of a power engineer.

Salesmen are paid on a salary plus commission basis, the salary starting at $80 per month and increasing $5 per month each year until it reaches $100. In addition to this, various commissions are paid. For a new residence customer 50 per cent of the first month's bill is paid as a commission and on store or commercial customers the commission is 25 per cent of the first month's bill. For successions—that is, where a customer moves out and another moves in—the commission is 10 per cent. On appliance sales a 5 per cent commission on the selling price up to $75 is allowed, and for appliances selling above that amount 3 per cent is allowed.

Under this method salesmen are able to earn from $2,000 to $3,000 annually, and it has enabled the company to build up a permanent sales force which accomplishes very satisfactory results from year to year. The company does not put on special selling campaigns, and appliances are sold on a cash or thirty-day basis, no deferred payment plans having been offered to customers.

## What Other Companies Are Doing

**Chicago, Ill.**—For furthering the sale of stock the Public Service Company of Northern Illinois has printed an attractive folder, on which appear views of two main generating plants together with a map of northern Illinois, showing the territory served. One of the plants pictured is the contemplated 250,000-kw. station at Waukegan. Charts are also shown giving the yearly increases in gross business since 1912.

**Minneapolis, Minn.**—During 1922 the Northern States Power Company wired 7,407 old houses, which is 203 more than were wired in 1921 and about ten times the number wired ten years ago. According to H. E. Young, sales manager of the company, Minneapolis, with a population of 400,000, now has 99,000 homes, of which 80,000 are equipped for electricity. However, many of the 19,000 unwired houses will never be wired because their dilapidated condition requires that they be torn down and replaced by modern structures. During the past ten years the number of old houses wired in Minneapolis was 42,285.

**Pawtucket, R. I.** — An electric home will be established in April, 1923, under the auspices of the Blackstone Valley Gas & Electric Company and the central station, jobber and dealer interests identified with the Rhode Island Electrical League.

**Brooklyn, N. Y.**—Nine hundred and thirty-four employees of the Brooklyn Edison Company are enrolled in the co-operative courses which the company and the Brooklyn Polytechnic Institute are conducting. These employees represent 21.5 per cent of the personnel of the company. Seventy-one per cent of the employees in the secretary's department are listed for instruction, 57 per cent of one engineering department and 44 per cent of the sales department.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Modern Management Methods in the Power Plant.*—B. ROBINSON.—The author discusses methods of analyzing power-plant performances and shows how to remedy defects in equipment. He also goes into detail on the importance of correct methods being used by the fireman.—*Industrial Management*, February, 1923.

*Flow of Water in Turbine-Draft Tube.*—O. MIYAGI.—An investigation of the water flow through draft tubes in which the water is conducted vertically downward to the tailrace. The author considers the energy lost by the frictional resistance in the draft tube and a sole plate, kinetic energy rejected at the end of the tube, the minimum loss and the determination of the best form of tube. He gives a numerical example illustrating his method.—*Technology Reports of the Tohoku Imperial University, Vol. III, No.* 1.

*Feed-Water Deaëration.*—The details of a closed feed-water system which has recently been designed and installed in a power plant by an English company for the complete deaëration of boiler-feed water is described. This system deaërates water only for supplying the boilers and economizers and their connections, and it is claimed that, as the operation is mechanical and automatic, the usual difficulties of adjustment have been entirely eliminated.—*Electrician*, Jan. 19, 1923.

## Generation, Control and Switching

*Safeguarding Workmen in Hydro-Electric Stations.*—RALPH BROWN.—Proper protection of workmen in power plants jeopardizes not only the lives of those who are responsible for plant maintenance and operation but also the equipment and the service rendered by the plant. The author gives the details of a plan that has been adopted with a high degree of satisfaction for the protection of workmen and increased operating efficiency. Although this system has been worked out especially for a large hydro-electric station, it could be easily modified to apply to steam plants.—*Power*, Feb. 20, 1923.

*Construction Details of Large Turbo-Generators*—E. ROTH.—An elaborate practical paper, written primarily for designers of large steam-turbine-driven generators, showing the great advance made in this branch of engineering during the last ten years. While in 1913 a 7,500-kva. machine was built to run at 1,500 r.p.m., a modern 20,000-kva. set operates at 3,000 r.p.m. Rotor construction has undergone a great variety of changes until now the distributed field winding upon a core, built up of a few heavy steel disks, seems to be generally used for the largest units. Rotor bands for holding the winding, previously made of bronze, are now made of an unmagnetic steel, which gives greater strength. The testing speed of French generators is 10 per cent above normal running speed. As yet no uniform system of ventilation has been adopted, the author showing nine diagrams of systems being used at present. Internal-temperature measurement with thermocouples is advocated as the most reliable method. In two-pole machines a momentary short-circuit current of thirty times normal may be expected. Very high testing voltages insure a reliable operation in service. The recently built 45,000-kva. generators for Gennevilliers, designed for 6,000 volts, have been submitted successfully to an 18,000-volt, one-minute test. The rotor windings should stand ten times normal voltage. A circumferential rotor speed of 130 m. per second seems to be about the limit for the present. The paper is illustrated with thirty-six valuable photographs.—*Revue Générale de l'Electricité*, Jan. 27, 1923.

## Transmission, Substations and Distribution

*Wave Form and Power Factor of Mercury-Arc Rectifiers.*—H. JUNGMICHL.—This highly mathematical paper develops the primary wave form for customary transformer connections of rectifiers and proves the results by means of oscillograms. The formulas hold true only for anode and direct-current circuits free of inductance and neglect stray fields of the transformer. The influence of the magnetizing current upon the wave form is shown on oscillograms. From the form of the primary current wave the author calculates the power factor, differentiating between the power factor in the winding and that of the feeder. It is also shown how the power factor may be calculated for two three-phase rectifiers operating in parallel six-phase connection.—*Elektrotechnik und Maschinenbau*, Jan. 21, 1923.

*Safe and Economical Ways of Hanging Electric Cables in Mine Shafts.*—F. W. CRAMER.—It is essential to efficiency that the electric cables in mines be properly designed and installed. If they are so planned and erected, they may be forgotten with safety, but if haphazard construction and the wrong cable is used, the feeder system may be a source of continuous trouble. One danger is the stretching of the copper cable, thereby lowering its capacity. Protecting lashing, cable clamps and cable supports which bend the cable into desired shapes are among the subjects discussed.—*Coal Age*, Feb. 15, 1923.

## Units, Measurements and Instruments

*Resistivity of Vitreous Materials.*—L. L. HOLLADAY.—The writer has investigated the resistivity of various types of glasses and has found that all results seemed to follow a general law which had not been heretofore generally recognized. Eleven specimens of glass were tested through a temperature range of 20 deg. to 500 deg. C., the results being plotted.—*Journal of the Franklin Institute*, February, 1923.

*Test Code for Instruments and Apparatus.*—The A. S. M. E. committee on power test codes is now engaged in the revision of the codes as issued in 1915. The preliminary drafts of Chapters 1 and 2 are given. These deal respectively with general considerations and with the accuracy of measuring instruments. The instruments and apparatus here considered are those used for measuring physical and chemical quantities in connection with tests of power equipment of various sorts.—*Mechanical Engineering*, February, 1923.

*Water Rheostat for* 30,000 *Volts.*—J. REYVAL.—A new 1,900 kva. single-phase generator was added to a French hydro-electric power house, and it was found desirable to make full-load tests of this new machine after it was installed. As the voltage of the generator was only 850, it would have been necessary to provide a rheostat heavy enough to carry as much as 1,500 amp., which was not deemed advisable. It was decided to connect the generator to its step-up transformer (850 volts to 30,000 volts) and to build a water rheostat to consume a current of some 40 amp. at about 30,000 volts. The electrodes were made of heavy steel plates 1 m. square, placed on insulators across the tailrace water, 2.4 m. apart, and were so arranged as to lower or raise them.—*Revue Générale de l'Electricité*, Jan. 20, 1923.

## Illumination

*Illuminating Engineering Society Papers.*—This issue of the *Transactions* contains three papers presented at the Swampscott convention last September. They are "The Cost of Daylight," by M. Luckiesh and L. L. Holladay; "Lighting for Motion-Picture Studios," by F. S. Mills, and "Flicker Photometry," by C. E. Ferree and G. Rand. Abstracts of the first two may be found in the convention report, ELECTRICAL WORLD, Oct. 7, 1922, page 760, and of the latter in the ELECTRICAL WORLD for Nov. 4, 1922, page 1004. The complete discussion of the three papers is also given in the *Transactions*.—*Transactions of the I. E. S.*, February, 1923.

*A Highly Developed Engine-house Lighting System.*—The wiring system of the New York Central engine house at Solvay, near Syracuse, N. Y., distributes power for motors, for motor-generator welding sets and for lighting purposes that really furnishes enough light and distributes it where it is needed without glare. A sufficient number of switches of a rugged type also make it convenient to burn only the lights that are needed. A description of the lighting system is given, illustrated with layout diagrams and photographs of typical points of interest, such as distribution panels, engine switches, control equipment for lighting equipment, etc.—*Railway Electrical Engineer*, February, 1923.

### Motors and Control

*Electricity as Applied to Mines.*—J. C. STEWART.—The types of generators, motors and cables used in collieries are explained and the factors governing the use of each particular type are discussed. A brief outline of the mechanical plant used in conjunction with motors is given, including pumps, haulages, coal cutters and winders.—*Journal of the Institution of (British) Electrical Engineers*, January, 1923.

*Electricity in the Chemical Industries.*—The use of electric drive in the chemical industry involves very severe operating conditions for the motors. Very often the atmospheric conditions are damp and corrosive, and with water, steam and gases present in abundance it sometimes appears that electric drive would involve heavy maintenance charges. However, modern electrical development has surmounted these inherent difficulties. Winding and control gear are protected, and with this provision it is possible to use apparatus that is otherwise standard. In discussing this problem, the author considers the handling of liquors, pumps, uses of compressed air, handling of solids, crushing operations, etc. —*Electrical News*, Feb. 1, 1923.

*Electrical Equipment for Grain Elevator.*—J. ANDREUCETTI.—When rebuilding the Chicago and Northwestern grain elevator at Chicago it was found necessary to renew a considerable portion of the electrical apparatus. The apparatus now consists of dust-proof distribution panel cabinets and vapor-proof lighting units with all new conduits and wiring run in such a manner as to insure reliable and safe operation. In this plant there are 190 motors in all, varying from 1.5 hp. to 140 hp., totaling 8,027 hp.—*Railway Electrical Engineer*, February, 1923.

### Heat Application and Material Handling

*Electric Heat Storage Stoves.*—Where electric energy is cheaply available during off-peak hours, as in most small-size hydro-electric plants, the use is suggested of electrically heated stoves, which are charged during the night hours and discharged during the day. Fully charged the oven reaches an outside temperature of about 100 deg. C. As a rule a complete cycle of eight hours' charging and sixteen hours' discharging is recommended. During this cycle the stove temperature will vary from 30 deg. to 100 deg., while the room will be kept between 20 deg. and 25 deg. C. The stoves are made in five sizes from 3-kw. to 15-kw. capacity, sufficient for rooms of 4,000 cu.m. to 100,000 cu.m. — *Siemens Zeitschrift*, January, 1923.

*Coal Handling by Suction.*—The installation of an interesting pneumatic coal-handling equipment has recently been completed at the Brimsdown (England) power station of the North Metropolitan Electric Power Supply Company. The equipment performs three distinct handling operations by means of one receiver and vacuum pump. Coal can be discharged from barges lying in an arm of the canal alongside the station at the rate of 50 tons per hour, or by means of a simple linking up of piping coal can be taken from the dumps and conveyed to the bunkers. Provision has been made for withdrawing coal from a tipping hopper below a railway track by operation of change-over valves adjacent to the receiver. A description, illustrated by diagrams, is given of this installation. —*Electrical Times*, Feb. 15, 1923.

### Traction

*Electrification of the Hungarian Railways.*—L. VEREBELY.—The planned electrification of 1,385 km. of the railroads of Hungary is expected to result in a 60 per cent coal saving over present conditions. No definite system has, as yet, been decided upon, but an agreement has been reached between the Hungarian government and the Hungarian firm of Ganz to test one of the latter's split-phase locomotives on part of a main road. The locomotive will be properly equipped for a thorough test of one year. The overhead wire of the test stretch of 15 km. carries 50-cycle, 15,000-volt, single-phase current, from which is fed a phase converter on the engine delivering 420-volt to 750-volt, three-phase current to the locomotive motors. On the locomotive, installed at half height, are two motors of 1,360 hp. each, with a double winding on both the stator and the rotor, giving four economical speeds. Triangular connecting rods transmit the motor power over a blind shaft to the five driving axles. The locomotive weighs complete 72 tons.—*Elektrotechnik und Maschinenbau*, Jan. 14, 1923.

*Electric Haulage for Mines.*—A. F. Brosky.—One of the troubles most often encountered in mine railway systems is the derailment of locomotives and cars. Wearing down of locomotive tires is the most frequent cause of derailment. Reports received from several mechanical engineers at mines indicate that they are practically unanimous in the belief that a locomotive should never be allowed to become more than an inch lower by wearing of the wheels. Several of the other causes for derailment are also discussed.—*Coal Age*, Feb. 8, 1923.

### Electrochemistry, Electrophysics and Batteries

*Copper.* — The Bureau of Standards plans to issue from time to time circulars on individual metals or alloys, with the idea of grouping in these circulars all the information which the bureau has as a result of its tests and investigations, together with that available in all records of published tests and investigations of such materials. This circular on copper deals primarily with the physical properties of the metal. All of the factors, except a few statistics of production, such as methods of manufacture, presence of impurities, etc., are discussed only in their relation to these physical properties. The data and information have been put in the form of tables and curves, the curves being reproduced in such dimensions that accurate interpolation of the values on them is possible by the use of a rule graduated in decimal parts of a centimeter.—*Circular No. 73 of the Bureau of Standards.*

### Telegraphy, Telephony, Radio and Signals

*Control of High-Frequency Current with Iron-Core Choke Coils and Superimposed Direct Current.*—L. PUNGS.—The necessity of easy control of large amounts of alternating currents of high frequency for radio-telephonic and radio-telegraphic use is discussed. By means of an iron-core choke coil with two windings, one for the high-frequency current and the second carrying direct current, the former can be easily controlled by variations of the latter. The paper gives several connection diagrams for the application of this method for radio telephony. — *Elektrotechnische Zeitschrift*, Jan. 25, 1923.

*Alternating-Current Cable Telegraphy.*—LOUIS COHEN.—The author discusses the so-called arrival curves for an impressed sinusoidal electromotive force on a cable with and without terminal apparatus and then compares his results with those of former investigators on the subject. The paper is limited to a consideration of fundamental principles.—*Journal of the Franklin Institute*, February, 1923.

### Miscellaneous

*The Structure of Carbon Steels.*—H. S. RAWDON and S. EPSTEIN.—A study of the microstructure of hardened and tempered carbon steels has been carried out on a series of six steels ranging from 0.07 and 1.12 per cent carbon. These were hardened by water-quenching from different temperatures ranging from 750 deg. to 1,250 deg. C. The investigation consisted largely of microscopic examination, supplemented by a study of the scleroscope hardness of the quenched and of the tempered steels.—*Journal of the Franklin Institute*, February, 1923.

# News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

## New York Water-Power Regulation

### Attempt of the Governor to Commit State to a Policy of Government Ownership and Operation Is Not Likely to Meet Success

GOVERNOR SMITH'S program for the State of New York to own and develop its water-power resources and to distribute hydro-electric energy to municipalities has met with such opposition in the Assembly that its passage at this session of the Legislature is unlikely.

The eyes of the Governor are fastened on the Niagara and St. Lawrence Rivers, both of which possess magnificent hydro-electric possibilities and both of which are international boundary and navigable streams over which the federal government exercises control.

At present there is an international treaty governing the diversion of water for power and other purposes above the falls at Niagara Falls, and an attempt has been made to draft another treaty between Canada and the United States with reference to the further canalization of the St. Lawrence River and the erection of dams for that and power purposes on the river.

A survey has been made by the International Joint Commission, which has submitted a report and recommendations to both Washington and Ottawa; but no action has been taken by either government. There is also a suit pending before the United States Supreme Court in which the State of New York questions the constitutionality of the federal water-power law and the right of the federal government to control the water powers in the boundary and navigable streams in the State of New York. A decision in this case is expected shortly.

#### The Existing Law

During the administration of Governor Miller a law patterned after the federal water-power law was enacted in New York. Under this law a water-power commission of the state grants licenses for water-power development for a period of fifty years. A fee is charged and preference is given to the applicant whose plans are best adapted properly to develop, conserve and utilize the water power of the locality.

It was the contention of Governor Miller at the time that regulated private development was preferable to state or municipal development, and he advocated the adoption of a policy which would make it practicable for private initiative to undertake the task under safeguards which would protect the public interest. Governor Smith, in fulfillment of election pledges and the platform of the Democratic party, now seeks to set aside that legislation.

Outside of the Barge Canal, the Niagara and the St. Lawrence Rivers, the two latter being involved in litigation, there are few choice water-power sites available. There is a possibility of further development on the feeders and upper reaches of the Hudson River, but the sites are all owned by paper mills and power companies. Moreover, before these water powers can be developed it will be necessary to obtain the sanction of the proper river-regulating commission.

#### River Regulation

River regulation is an established policy of the state and serves a double purpose. By the construction of dams and reservoirs seasonal floods are held in restraint and control. In addition, these dams and reservoirs permit the proper development of the hydro-electric power in the streams involved. Under the river-regulating law the state can condemn property for the construction of dams. River-regulating districts are mapped out and the cost of improvements is assessed upon the property benefited. The boards are required by law to prepare a statement of the amount of water power, if any, which, consistently with the proper regulation of the flow of the river, may be developed by the withdrawal of water for power purposes.

The Black River Commission is now constructing dams on the Black River on the petition of water-power owners who will bear the expense. Last year a similar commission was appointed for the Upper Hudson on the request of the cities of Albany and Troy and others which seek to be relieved of the menace of floods. There is no indication that the Governor seeks to wipe out these commissions.

#### Bringing Power to New York City

Chief talk in political circles centers on bringing Niagara or St. Lawrence River power to New York City and on developing the Delaware River. The latter stream rises in New York State and for a distance forms the boundary between New York and Pennsylvania and between Pennsylvania and New Jersey. The Delaware River is navigable from the ocean to Trenton, N. J., but the rights on part of it are tied up by grants antedating the Constitution of the United States. New York is seeking to come to an understanding with the other two states over the river by means of a tri-state treaty. New Jersey has already passed enabling legislation, but the other two states have not yet acted. The plan published by New York calls for the use of the water of the Delaware chiefly for drinking and sanitary purposes in New York City. If the water is to be consumed, there will be little left for water-power development or for navigation, and a pretty legal battle is sure to ensue.

As for bringing Niagara or St. Lawrence River power to New York, the dream of cheap power is likely to remain a dream and nothing more. It is, of course, feasible to transmit electricity for this distance, or any distance for that matter, if no regard is to be given to cost or to reliability of service. There are those who contend that it is cheaper to develop electricity in steam stations and that even if hydro-electricity were transmitted to New York City in bulk, steam stations would still be necessary, with the result that costs would be higher instead of lower. It probably would be necessary to make the installation, however, before the contentions made on either side of the controversy could be proved. Meanwhile the large electric light and power companies in the affected district continue to build huge steam-driven central stations, which would indicate that they do not regard the proposed transmission of hydro-electric energy as menacing their investment.

#### Up-State Enthusiasts

On the other hand, persons who are enthusiastic over the prospect of developing the boundary streams rob the politicians of their thunder by claiming that the power would be absorbed by up-state industries and cities and that there would be none left for the metropolis. This, they contended, is a better use for the power since it helps to spread industry over the state and makes for better living, transportation and industrial conditions. In no case, however, has any evidence been provided which would show that private

enterprise is not willing and competent to undertake the work of developing the water powers of the state with better results and better service than could be obtained under state ownership and operation. These are the arguments which have been put before the legislators at Albany. The financial menace of state development has also been brought to their attention, and at present the line-up is such that the Governor's program is blocked.

# Hydro Power for New York City

### Engineers Discuss Relative Advantages of Steam and Hydro-Electric Service and Availability of Niagara and St. Lawrence Power for Long-Distance Use

BEFORE a well-attended joint meeting of the metropolitan sections of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers held in New York on Wednesday evening, the availability of hydro-electric power for the New York-New Jersey metropolitan district was discussed at length. Calvert Townley presided, and F. W. Scheidenhelm, a consulting hydraulic engineer, made the co-ordinating statement of the problem.

An approximate estimate of the available water power in the Hudson, Delaware and Susquehanna Rivers was given by W. S. Murray, who also gave the power requirements of the district and the probable cost of delivering Niagara power to New York and St. Lawrence power to New England. Much of the information was obtained from studies made in connection with the Superpower Survey of the United States Geological Survey and from subsequent surveys. Mr. Murray pointed out that steam stations would have to continue to generate the bulk of the power required in the district and that with every water power in the section developed hydro-electric energy would be available for only one-third of the load. He told of superpower stations erected since the government report was published and paid a tribute to the efficiency of electric light and power production by central stations.

#### SERVICE REQUIREMENTS OF NEW YORK

George A. Orrok of the New York Edison Company painted an impressive picture of the service requirements of the metropolis and of the precautions taken to keep the community supplied with energy at any and all times and under all sorts of conditions. He referred to the enormous loads which are thrown on the New York Edison system, sometimes for only a few moments, in the daytime owing to sudden storms and squalls. On Feb. 28, when New York City was shrouded by a London fog, the normal load of 120,000 kw. increased to 435,000 kw. in two and a half hours and remained at approximately that value for eight hours. Mr. Orrok showed how vital continuous service is to the city and intimated that a block of hydro-electric power could be absorbed in New York if the price was right.

The next two speakers, F. A. Allner of the Pennsylvania Water & Power Company of Baltimore and Lorin E. Imlay of the Niagara Falls Power Company, told of the early troubles of hydro-electric and transmission systems and showed how with experience and advances in the art reliability in generation and transmission has been secured. Mr. Allner's Holtwood station in the Susquehanna River supplies electricity to Lancaster, Pa., and to Baltimore, being operated in conjunction with huge steam stations in the latter city. He showed how the stations are operated to best advantage and how during periods of low water the peaks are carried by the hydro station and during periods of high water the procedure is reversed.

Mr. Imlay reviewed the operations of the Niagara, Lockport & Ontario system and predicted the exhaustion of nearby coal fields in the near future, intimating that hydro-electric power would have to be relied on more and more by the industries of the state.

Contributions to the discussion were made by John P. Hogan, a consulting engineer of New York, and W. S. Finlay, Jr., vice-president of the American Water Works & Electric Company. The latter compared the service in the metropolitan district with that obtainable elsewhere and contended that such excellent service must of necessity be costly. He doubted whether inferior service at cheaper cost would be acceptable and said the issue would have to be decided before long. The district could absorb considerable hydro-electric power of right quality and price. One of the speakers suggested that by means of interconnections it might be possible and profitable for the steam stations of New York to sell supplementary power to nearby hydro-electric systems.

## Asks $710,000 for Vischer's Ferry and Crescent Dam

In a special message to the Legislature asking for the appropriation of $710,000 to finish the state water-power development on the Barge Canal at Crescent Dam and Vischer's Ferry, on which $1,000,000 has already been expended, Governor Smith of New York suggests that the law be amended to permit the Superintendent of Public Works, the State Engineer and the Attorney-General to negotiate with the municipalities in the capital district, where the plants are, for delivery to them of this power at cost for ultimate sale to consumers. He also suggests that, inasmuch as engineers estimate that power from these plants will be available only 60 per cent of the time, these municipalities might be asked to generate auxiliary power themselves, or possibly the state might do so, in order to have available at all times sufficient firm power to meet the requirements of users in the capital district.

The plant at Crescent Dam is completed with the exception of the tailrace and contains two units capable of developing 8,000 hp. At Vischer's Ferry, where it is the intention to install similar equipment, the two plants to be run as one, only the foundation has been laid.

## Governor Smith Retreats

### He Now Says that "Interstate Exchange of Electrical Energy" Is "Probably Not Far Off"

IN ANSWER to the letter from Governor Pinchot of Pennsylvania asking him to discontinue the suit brought in the name of New York State against the Federal Power Commission and pointing out the impolicy and impracticability of New York's attempting to confine the use of her water power within the state borders (see ELECTRICAL WORLD, March 17, page 646), Governor Smith of New York, while maintaining his determination to contest federal control of the water powers on the navigable rivers of the state, goes on to say:

"I agree with you that the time is probably not far off when there will be an interstate exchange of electrical energy, in which event, of course, the State of New York would be one unit. Nothing contained in or contemplated by the state's suit to test the constitutionality of the federal water power act need interfere with the eventual accomplishment of that purpose. The State of New York may ultimately determine that the people of the State of Pennsylvania, or for that matter of any other state, would be considered in the distribution of electrical energy. When that happens, however, with New York's property it should be done by New York and not by the federal government. We need no federal assistance to promote useful helpfulness and consideration between the states."

This utterance indicates a marked modification of the opinion expressed by Governor Smith in the message on water power sent by him to the New York State Legislature, when he said:

"The bed of our streams over which power-creating water flows belongs to the state, or, better still, to its citizens. Our use and control of the same is threatened. I am credibly advised that a strong and determined propaganda is now being spread in support of a plan to divert the electrical energy from our border streams to territory outside the state. This we must resist with all the power that we can bring to our command."

# Conference Discusses Radio Chaos

## Organized Co-operation Imperative in Face of Lack of Legislation—Reallocation of Wave Bands to Alleviate Interference Is Favored—Recommendations of Radio Inspectors

A CONFERENCE called by Secretary of Commerce Hoover to consider the chaotic condition in which radio transmission has been left by the failure of Congress to take action was held in Washington on Tuesday and Wednesday of this week. In opening the meeting Secretary Hoover offered to suggest to the President that the wave length reserved to the government (600 m. to 1,600 m.) be opened to broadcasting, at least in the lower part of its range. Since the last conference, one year ago, he said, the number of broadcasting stations has increased from 60 to 588 and the number of receiving stations has more than doubled and now is somewhere between one and a half and two and a half millions. He called for organized co-operation to meet the emergency.

Virtually all who participated in the conference recognized the paramount interest of the public and favored a reallocation of wave bands. Maintenance of wave lengths by transmitting stations was declared imperative.

### Discussion on Broadcasting

Gen. G. O. Squier, U. S. A., saw no reason why the government's reserved wave lengths could not be thrown open and expressed faith in co-operation stimulated by the Secretary of Commerce. Commander D. C. Bingham, U. S. N., said the needs of ships and aircraft must not be overlooked. Civic bodies must, he said, co-operate, for there are not enough practicable wave bands for all. Dr. A. N. Goldsmith, secretary of the Institute of Radio Engineers, thought that economic reasons would cause the discontinuance of high-class broadcasting unless it can be protected. Hiram Percy Maxim of the American Radio League suggested the exclusion of advertising. C. B. Cooper favored regulating schedules rather than wave lengths. E. H. Armstrong, Columbia University, announced that if proper wave bands can be allocated apparatus which can receive from any station in the land will be ready in a year or two.

Two suggestions that met with considerable approval were made by J. V. L. Hogan, consulting engineer. Because of the relative number of channels available above and below 600 m., he contended, the higher-frequency range should be allotted to telegraphy and the lower range to telephony. To make policing stations unnecessary, he suggested that recording wave-length meters be required in every transmitting station.

F. P. Guthrie, United States Shipping Board, promised co-operation, and representatives of the Post Office, Agricultural and Treasury Departments expressed their warm interest in the subject. Leo Fitzpatrick, speaking for the newspapers, thought the government radio inspectors would form a good nucleus of a force to alleviate interference. J. H. Dellinger, Bureau of Standards, spoke of the increasing use both of electron-tube oscillators and of shorter wave lengths as important factors.

A recommendation covering an allocation of wave lengths between 150 m. and 3,850 m., prepared by a committee of radio inspectors, acting at the instance of Mr. Hoover, was submitted by W. D. Terrell, their chief. The allocations were based on the existence of 22,740 transmitting stations.

"Heretofore," said the report, "the broadcasting service has been limited to the specific wave lengths of 360, 400, and 485 m. The committee has provided six bands of wave lengths for the broadcasting service (320, 380, 390, 430, 675, 725 m.), two of which are within the government reservation. This arrangement will permit the reception of signals from several stations operating simultaneously in close proximity with the minimum interference possible under our present limitations, provided receiving apparatus of reasonable selectivity is employed and adjusted efficiently."

Mr. Terrell thought an expensive policing system necessary to the maintenance of wave lengths. Paul Godley urged allowing amateurs shorter wave lengths, and K. B. Warner outlined the field organization they have already achieved in a voluntary effort to avoid interference.

Other experts discussed the transmission of motion pictures, told of successful voluntary co-operation of eighteen broadcasting stations near San Francisco, and described the successful staggering of wave bands according to the nature of the program and the location of the station.

Ship interference caused much animadversion. It was said to reach even to the Middle West. One speaker urged that ships be compelled to substitute continuous-wave sets for spark sets.

### Public Hearing Backs Conferees

At a public hearing on Wednesday stress was laid on the same points emphasized previously by the members of the conference and the inspectors. A representative of the General Electric Company, Mr. Edwards, said its broadcasting, rated at from 1½ kw. to 2 kw. at 400 m., is received regularly in Hawaii and had been picked up on the west coast of Panama; E. F. W. Alexanderson said that the Radio Corporation desired three wave bands—transatlantic, ship-to-shore and for broadcasting; R. A. Weagant urged high-power stations on special wave bands for long-distance broadcasting; C. N. Jansky described co-operative methods in Minneapolis and St. Paul, and Allen M. Perry, engineering editor ELECTRICAL WORLD, suggested gathering through the newspapers public opinion on what kind of broadcasting is objectionable.

Simultaneous sending at 360 m. and 400 m. was discussed. A representative of the Society of American Composers and Authors dwelt on the copyright complication that arises in broadcasting music and said legal proceedings might be necessary to protect composers. The Federal Telephone & Telegraph Company, Buffalo, requested a wave length of 300 m. to 500 m. for broadcasting, but urged the elimination of harmonics in this band. Strenuous objection was raised to interspersing other than broadcasting wave bands between broadcasting frequencies. Amateurs should not be limited further, it was contended, but the transmission equipment should be limited in character for wave lengths above 200 m.

# New Peoria Plant with Initial Rating of 53,300 Hp.

The Illinois Electric Power Company, a subsidiary of the Commonwealth Power Corporation, has acquired property rights in a site on the Illinois River opposite Peoria, Ill., and will immediately begin the construction of a generating station with an initial rating of 53,300 hp. and an ultimate capacity of 133,000 hp. The company will also construct more than 65 miles of 120,000-volt transmission lines connecting with the distributing system of the Central Illinois Light Company at Peoria and with that of the Illinois Power Company at Springfield, thus forming a physical interconnection of these three properties. With the added capacity of the new station, the combined companies will have a generating capacity of more than 102,000 hp.

# New England Power's Program to Cost $3,000,000

Construction work to cost in the vicinity of $3,000,000 is planned by the New England Power Company, Worcester, Mass., in the near future. The company has petitioned the Massachusetts Department of Public Utilities for the right to issue 30,000 shares of common stock at $100 per share to cover the following prospective outlays, grouped under "Davis Bridge," "Pittsfield" and "miscellaneous": Davis Bridge—Two-circuit, 110,000-volt line to Millbury, Mass., $1,890,182; extension of Millbury substation, $240,600; synchronous condenser, 10,000 kva., for Millbury, $107,455; improvements at No. 5 station near Hoosac Tunnel, 70,000-volt bus structure, $75,850. Pittsfield—24-mile, 66,000-volt line to Massachusetts-New York state line, $259,200; Lanesboro substation, $130,000; increased capacity Adams substation, $40,000; second circuit Davis Bridge to No. 5 station, $41,000; additional equipment for this circuit, $30,000. Miscellaneous—Additional transformer capacity, Fitchburg and Ware, Mass., $123,300; 22,000-volt line, Ware to Otis Mills, $12,000; Otis Mills substation, $24,400; sundry expenses, $240,785.

## A. I. E. E. Nominations

**"Directors' Nominees" Selected—Prof. Harris J. Ryan of Stanford for President**

AT THE meeting of the board of directors of the American Institute of Electrical Engineers held in New York on March 16 the report of the committee of tellers on its canvass of the nomination ballots cast for candidates for the Institute offices falling vacant July 31, 1923, was presented.

As required by the constitution of the Institute, the board then selected by ballot its list of "directors' nominees," with the following result:

For president—Harris J. Ryan, Stanford University, Cal.

For vice-presidents—District No. 2 (Middle Eastern), William F. James, Philadelphia; district No. 4 (Southern), H. E. Bussey, Atlanta; district No. 6 (North Central), Herbert S. Sands, Denver; district No. 8 (Pacific), J. E. Macdonald, Los Angeles; district No. 10 (Canada), S. E. M. Henderson, Toronto.

For managers—H. P. Charlesworth, New York; William M. McConahey, Pittsburgh; W. K. Vanderpoel, Newark, N. J.

For treasurer—George A. Hamilton, Elizabeth, N. J.

The election ballots, including the names of the directors' nominees and all other eligible candidates, will be mailed to the membership prior to April 1.

## New British Specification for Motors and Generators

The British Engineering Standards Association has just issued a publication, No. 168-1923, giving the British standard specification for electrical performance of industrial electric motors and generators with class A insulation. This publication is the action resulting in Great Britain from the recent meeting of the advisory committee on ratings of the International Electrotechnical Commission in Geneva, when a 40-deg. rating with a two-hour 25 per cent overload was authorized for certain classes of industrial motors in addition to the former I. E. C. standard of 50 deg. continuous.

As noted in the letter of transmittal from C. le Maistre, secretary of the association, the specification applies to industrial electric motors and generators for 1 b.hp., 1 kw. or 1 kva. and upward per 1,000 r.p.m., having windings insulated with class A material (impregnated cotton, paper or silk), wound for voltages not exceeding 7,000 and having either a continuous or a short-time rating.

In the words of the secretary: "Stated briefly, the new British standard rating is: Temperature rise (on rated load), 40 deg. C.; temperature rise for totally inclosed machines and machines with short-time ratings, 50 deg. C.; dielectric test, 1,000 volts plus twice rated voltage; momentary overload, short-time-rated machines, 100 per cent for thirty seconds; momentary overload, continuous-rated machines, 50 per cent for five seconds; sustained overloads, short-time ratings and all totally inclosed machines, none; sustained overloads, continuous rating, 25 per cent for two hours except for small machines. No provision is made for tests of temperature rise after the sustained overloads."

The entire specification is quite complete and detailed. It is the first of a series designed to supersede the British "Standardization Rules for Electrical Machinery" (Publication No. 72-1917).

## To Expand Tests on Insulating Materials

At a meeting of the committee on insulating materials of the American Society for Testing Materials held in New York last week three new tentative standards were considered for submission to the society in June. These include a method of testing insulating materials for puncture and flashover voltages at radio frequency, a method of testing electrical insulating materials for thermo conductivity, and methods of test for pothead and splicing compounds. Details of these standards will be available in reprint form for advance study by the first of May.

It was agreed to expand the existing tentative method of testing sheet insulating materials for dielectric strength to include cambric tape, a procedure for tapes having been devised. There will be added to the existing methods of testing insulating varnishes a non-volatile matter test, a draining test (working viscosity) and an evaporation test. The existing method of test for power factor and dielectric constant of molded insulating materials at radio frequencies will be expanded to take care of sheet materials and compounds.

An extensive discussion was had of the results of the long investigation of four methods of determining the sludge-forming propensities of transformer oils and a final recommendation to the society was agreed upon. It was agreed that the annual report should include a quite extensive discussion of this subject. It was also agreed that the annual report should include as an appendix a convenient and accurate method of testing insulating materials for power factor and dielectric constant at normal commercial frequencies which has been brought to the attention of the committee. It is particularly suited to tests of liquid insulations and compounds over a wide range of temperatures.

The annual report is also to include an appendix describing a new method for determining the relative rate of deterioration of transformer oils. The results of an investigation of the effect of the rate of application of potential on the apparent dielectric strength of insulating materials will also be included in the report.

## To Cross the Sierras

**California and Nevada Companies to Be Connected by a Transmontane Transmission Line**

AN AGREEMENT between the Pacific Gas & Electric Company of San Francisco and the Truckee River General Electric Company of Reno, Nev., for the construction of a transmission line over the Sierra Nevada Mountains has recently been reached, according to E. W. Florence, manager of the Sacramento division of the first-named company. The Truckee General Electric Company serves a mining load in the Comstock district, and the revival of mining there has greatly increased the demand made upon the company.

To meet this increased demand arrangements have been made for the Pacific Gas & Electric Company to supply additional power to the Nevada company. A line will be constructed from the Drum power house on Bear River, near Towle, Cal., over the summit of the Sierra Nevada Mountains and will connect with the lines of the Truckee company at Verdi, Nev. The construction of the lines over the mountains will have to be of extremely rugged construction because of the heavy snows in the region, the snow often reaching a depth of from 5 ft. to 20 ft. The lines of the Truckee company will have to be increased in size in order to care for the larger load that will be handled by the company. The Truckee General Electric Company now serves the cities of Reno, Carson and Virginia City and the surrounding territory.

## Providence Company to Build 125,000-Kva. Switch House

On March 8 the Narragansett Electric Lighting Company sustained an interruption of service during the early morning hours on account of short circuits in cable and switch equipment at the South Street generating station.

For more than a year the company has been studying the development of its cable and switch-handling equipment. The accident has given increased impetus to its plans, and a switch house embodying the latest ideas in isolated-phase design will soon be built. It is hoped to have the new installation completed inside of twelve months. Dwight P. Robinson & Company, New York, have been planning this development for the Narragansett company, and engineers of the General Electric and Westinghouse companies have also been in consultation. During the interim before the new switch house can be placed in service temporary changes will be effected along the line of greater separation of existing cables, the installation of fireproof barriers in the more congested sections, the division of the cable vault into two sections at South Street and the placing of various disconnecting switches outdoors.

## Appliances Lose Ground

**Southwest Division Men Hear Opinion to This Effect—Good Commercial and Technical Sessions**

THAT the appliance industry is steadily losing ground in relation to its sales possibilities in the electrified home was the assertion made by Martin L. Pierce, promotion and research manager of the Hoover Company, North Canton, Ohio, in discussing the potential market for electric appliances before the March 16 meeting of the convention of the Southwestern Geographic Division of the National Electric Light Association at Oklahoma City, of which the opening session was reported last week. If the rate of increase in electrical appliances and the increase in wired homes during 1921 and 1922 continue for the next ten years, he said that only 20 per cent of the electrified homes will have electric cleaners, as compared with the present 40 per cent, and that the same statement applies to all appliances.

Mr. Pierce recommended settlement on a standard-cost basis of doing business such as other lines of industry have adopted and a merchandising campaign that will last twelve months of the year. Standardization of electrical appliances, elimination of poor equipment and standardization of trade discounts were urged.

A. K. Baylor told of the work of the Joint Committee on Business Development, and a committee was appointed to take up the work of organizing the various branches of the electrical industry in the five states of the division for business development work.

Organization of employees' clubs is not a charitable undertaking into which a company must put a great deal of expense, J. H. Gill said, in presenting the report of the committee dealing with employee organizations. Such organizations are more successful if self-supporting and managed by employees themselves. The committee presented a model form of organization for such clubs.

E. W. Hodges, manager of the Arkansas Utility Information Bureau, made a plea for greater service in building up the community and said that while utilities have always been community builders, they have many times gained the reputation of being "hard-boiled" because they have not told their stories properly and shown their community the place they occupy in its welfare. He advocated reaching every class of citizens personally with utility facts.

### Commercial Section

In the Commercial Section meetings the problem of ice-plant loads was the subject of a discussion led by R. I. Brown, who spoke on standby or fixed charges in the energy rates. A form of rate in which the four months from November to February are considered off-peak and in which some modification of the demand charges is made was attacked on the ground that the utility could not ordinarily make use of the unused capacity in these months and therefore could not, in justice to itself, remit any part of the demand charges. The question as to whether such a rate is discrimination against other power consumers was also raised. A form of rate in which the summer demand is taken as twice the winter demand in order to compensate for the off-load period of the year was discussed by E. H. Kifer of San Antonio, Tex. This rate was said to have been very successful and to meet the common objection from the ice-plant owner to the payment of fixed charges during the winter months.

J. R. McCoy of Dallas, Tex., presented figures to show that the electric motor-driven plant for ice manufacture is most desirable because it requires the least amount of building space and the least amount of skilled labor and shows the least depreciation. With electrical energy at 1.5 cents, coal at $4.50 at the boiler room and fuel oil at 5 cents per gallon, the manufacturing costs of ice, including operating and fixed charges, were shown to be $2.17 per ton for an electric motor-driven plant, $2.34 with a uniflow steam-engine drive, $2.32 with a Diesel engine and $2.38 with a semi-Diesel engine. Although plant power costs in the electrically driven plant were shown to be 32 per cent of the cost, with fuel costs in the other plants at 11 to 14 per cent of the total, the lower investment, labor and maintenance costs give the electrically driven plant the advantage.

### Technical Section

In the Technical Section meetings the treatment of boiler-feed water was advocated by C. B. Oliver of Dallas, Tex., who said that a test of boiler water daily, "flowing down" two to five times daily and regular feeding of chemicals in small quantities were the three requisites for successful operation of a small system. The material needed is a 50-gal. steel barrel, a supply of soda ash (58 per cent light), a water-testing outfit and the necessary connections to the feed-pump line. Before any treating is undertaken, Mr. Oliver said, an analysis of the water by a competent chemist is essential.

A maintenance schedule for Diesel engines was outlined by J. L. Schneitter of Dallas, Tex., who named inspections for each part of the engine, a maintenance calendar listing the time and frequency of inspections and a suitable report sheet as the essentials of such a schedule.

The combined registration of the Oklahoma Utilities Association and the Southwestern Geographic Division of the N. E. L. A. was more than 600, and the sessions were enthusiastic all the way through. Officers elected for the Southwestern Geographic Division are: President, J. W. Carpenter; vice-presidents, C. J. Griffith of Arkansas, W. E. Clements of Louisiana, J. L. Longino of Mississippi, J. F. Owens of Oklahoma and A. H. Warren of Texas. C. E. McBride of Dallas was re-elected treasurer.

## St. Louis Has Well-Attended Electrical Exposition

The electrical exposition held in the Coliseum, St. Louis, March 12 to 17 inclusive, was a success both electrically and financially. More than thirty-five thousand persons attended during the week, notwithstanding some inclement weather. Several thousand articles portrayed development of electricity in industry, commerce, art and the home.

Special artistic effects made a striking setting for the exposition. A "sunburst" in various colors bore the sign "Electricity," which gradually changed to "Prosperity." Gauzy blue material veiled the ceiling and was made at intervals to appear like a starlit sky and at other times like daylight by a 100,000-cp. light source supplied by the General Electric Company and suspended in the center of the building. A chromatic fountain and an electric storm were among other illuminative features.

There were eighty-one exhibitors, including the Union Electric Light & Power Company, the Bell Telephone Company, the Westinghouse Electric & Manufacturing Company and the General Electric Company. C. E. Michel, sales manager of the Union Electric Light & Power Company, was president of the exposition company.

## Division Meetings Planned for Contractor-Dealers

At an executive committee meeting of the Association of Electragists International held in New York City on March 14-15 a transcontinental trip was planned to be undertaken by James R. Strong and Laurence W. Davis, president and director of promotion and development respectively of that organization. The object of this trip, which will begin about the middle of June and end some time in August, is to hold divisional and other meetings of the membership. A plan is now being worked out whereby divisional meetings will become regular features in the future under the direction of and arranged by the association headquarters.

The tentative itinerary of the headquarters officials' coming trip includes Pittsfield, Mass., Chicago, Omaha, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle; Vancouver, Calgary, Moose Jaw and Regina, Canada; Minneapolis and St. Paul.

## States May Forbid Change of Existing Contract Rates

The Arkansas law prohibiting the Arkansas Railroad Commission from changing gas and other rates existing at the time authority to change rates was given to the commission is not discriminatory and comes within the power of the state, the United States Supreme Court has declared in effect, in reviewing an action brought by the Arkansas Natural Gas Company against the Railroad Commission.

The company sought an injunction

against orders for reduced rates to certain consumers which maintained in effect contracts with the Little Rock Gas & Fuel Company and the Consumers' Gas Company, the latter being a Hot Springs distributing company. The United States District Court granted the injunction in the first instance and denied it in the latter, the company appealing. The company sought a flat rate for city-gate delivery to the distributing companies, instead of the divisional rate which existed in the contracts, alleging that poor management made this divisional rate confiscatory.

# Illinois Utility Men Hold Practical Meet

## Educational Courses, Appliance Surveys, Prevention of Theft of Energy and the Merchandising of Appliances Are Leading Topics at Convention

PUBLIC utility educational courses at universities received emphatic indorsement from the third convention of the Illinois Utilities Association, held in Chicago on March 14 and 15. In addition to the speakers on this topic named in the preliminary report last week (page 647), Bert H. Peck of St. Louis and D. W. Snyder expressed their approval of the movement, which Dean Heilman of Northwestern University said would do much to provide utility organizations with a voice.

Edward Taylor, General Electric Company, Chicago, discussing the paper already noticed on "Remote-Controlled Substations," by H. E. Wulfing, Commonwealth Edison Company, before the Electric Section, held that a further use could be made of such a synchronized control for extending lines already in use. These substations have been so successful, he said, that inspections had been reduced from two a day to two a week.

How to handle customers caught stealing electricity was discussed at some length. In most such cases the meter is immediately removed to force the customer to come to the office and pay up before service is again given him. Mr. Williamson, Moline, Ill., stated that, upon this final settlement, his company installs a new type of inclosed service switch, conduit and meter flush to the wall which goes far to prevent tampering. He felt that legislation for prevention of energy theft could be well sponsored by the Illinois State Electric Association. Mr. Larkin, Public Service Company of Northern Illinois, said he found ten jumpers upon a single inspection trip in the South Chicago steel mill district.

### A Story of Finance

The annual banquet was held Wednesday evening with Britton I. Budd as toastmaster. E. Hill Leith, Halsey, Stuart & Company, presented the financial story of public utilities. He figured the wealth of the entire United States back in 1858 to be equal to the present value of all public utilities—$16,000,000,000. With the country's total wealth today between $250,000,000,000 and $300,000,000,000, progress would depend upon the progress of the individual utilities. Mr. Leith enumerated five essential factors in financing utilities—cultivation of public appreciation of the needs of the industry, recognition of the fundamental principle that utilities must exist without competition, a vision of the next five years' developments, and a sense of the importance of common stock and of the growing necessity for non-par-value stock.

During the Thursday morning session E. W. Lloyd, Commonwealth Edison Company, spoke of the work of the Joint Committee for Business Development and urged the selection of local correspondents for the committees formed by the central stations and contractor-dealers in the various cities.

B. J. Mullaney, director Illinois Committee on Public Utility Information, told of the 108,000 column-inches of utility news that had been published by the newspapers during the past four years. Reviewing the work of the committee, Mr. Mullaney declared that during 1919 and 1920 many legislative bills were offered in the Illinois Legislature which were hostile to the utility industries, while in 1922 not a single such bill was presented.

### Merchandising Appliances

The afternoon session was given over to merchandising problems. H. B. Gear, Commonwealth Edison Company, explained his paper surveying the electrical appliances used in Chicago. One peculiar item he found was that the number of washing machines in medium-sized houses averaged 46.2 per cent, while for apartments it was only 8.2 per cent. The flatiron was found to be the leader, while percolators were fewest in number.

The development of the "Mazda" lamp was described by F. T. Benson, General Electric Company, who demonstrated the new 30,000-watt incandescent lamp designed primarily for motion-picture work. He prophesied that the time would come when central stations would consider a change in their rates from an energy to a candlepower basis.

"Merchandising Domestic Appliances" was considered by R. S. Bell, United Appliance Company, Akron, who described the systems in use in northern Ohio. Weekly sales meetings lasting one hour are held in each district which are addressed by manufacturers' representatives and two or three salesmen. Regarding remuneration, Mr. Bell found it advisable to pay his district managers a salary plus a percentage of net profits, to pay his floor saleswomen a salary plus a small commission on all personal sales, and to pay the outside salesman a salary and commission, or a straight commission upon showing actual sales ability.

A. M. Floyd, Commonwealth Edison Company, spoke on electric cooking and cited a Chicago installation where a monthly saving of $65 was effected as compared with the old fuel-type range. Daniel Seymour, Edison Electric Appliance Company, said bakers save a half ounce of dough per loaf by electrical baking. In one case this raised production from 600 loaves to 695.

The officers for the ensuing year are: President, D. W. Snyder, Jr., Bloomington; vice-president, Bert H. Peck, St. Louis; secretary-treasurer, R. V. Prather, Springfield. The new members of the executive committee are R. S. Wallace, Peoria; H. O. Channon, Quincy; B. J. Denman, Davenport, and C. D. Ingersoll, Canton.

# Indiana Companies Suffer from Heavy Storm

A heavy storm of wind and rain which swept over a large section of the Middle West last week, causing severe losses in Nebraska, Oklahoma and other states, made itself felt in Indiana, particularly in the southern part. Many industries in the northern half of Indianapolis were without light or power for twelve hours because of the destruction of poles and cables belonging to the Indianapolis Light & Heat Company. The Merchants' Heat & Light Company seemed to suffer less. The Indianapolis Street Railway and the interurban companies operating into Indianapolis were forced to suspend service for longer or shorter periods. The transmission wires of the Interstate Public Service Company between Shelbyville and Columbus were put out of commission and many poles went down. Electric light and street-car service in South Bend was crippled, and electric light service in Evansville was interrupted for some time. Traffic in Muncie was paralyzed by the breakdown of the Anderson power plant of the Union Traction Company.

# Pittsburgh Utilities Corporation Is Formed

The detailed reorganization plan of the United Railways Investment Company, providing for the formation of a new corporation to be known as the Pittsburgh Utilities Corporation, has been announced by letters sent out by Mason B. Starring, president, to the stockholders. According to the plan the new corporation will take over from the company 480,000 shares of common capital stock of the Philadelphia Company, now pledged to secure an issue of bonds maturing May 1, 1926.

The object of the plan, the president's letter says, is to free the company from debt by retiring the existing bond issues and other funded indebtedness and by retiring both classes of dividend certificates, thereby removing restrictions against payment of cash dividends.

# Detroit Goes to Pulverized Fuel

### New Trenton Channel Station to Be Connected with Marysville by Semicircular 130-Mile, 120,000-Volt Transmission Line, Which Will Tie in with Other Lines

UTILIZING powdered fuel under the boilers of its new Trenton Channel station, the Detroit Edison Company purposes to meet the needs of its rapidly growing load by building a 130-mile, 120,000-volt double-circuit steel-tower line from that station through a half circle to its Marysville station. This high-tension line will be connected to the existing 24,000-volt, three-phase network at four transformer stations. Eventually 24,000-volt radial feeders will distribute the energy in the outlying territory from each of these transformer stations, so that there will be the same number of transformations from a generating station to any consumer.

In order to serve the heavy industrial load just north of the new Trenton Channel station, now under construction, a 120,000-volt line will be built from the switching station near Trenton Channel. The entire output of the Trenton Channel station will be transmitted at 120,000 volts in these districts, and the tie with the Marysville station affords a second source of supply. For heavy industrial loads in this district 23,000-volt feeders can be used from two or more transformer stations to give continuity of service.

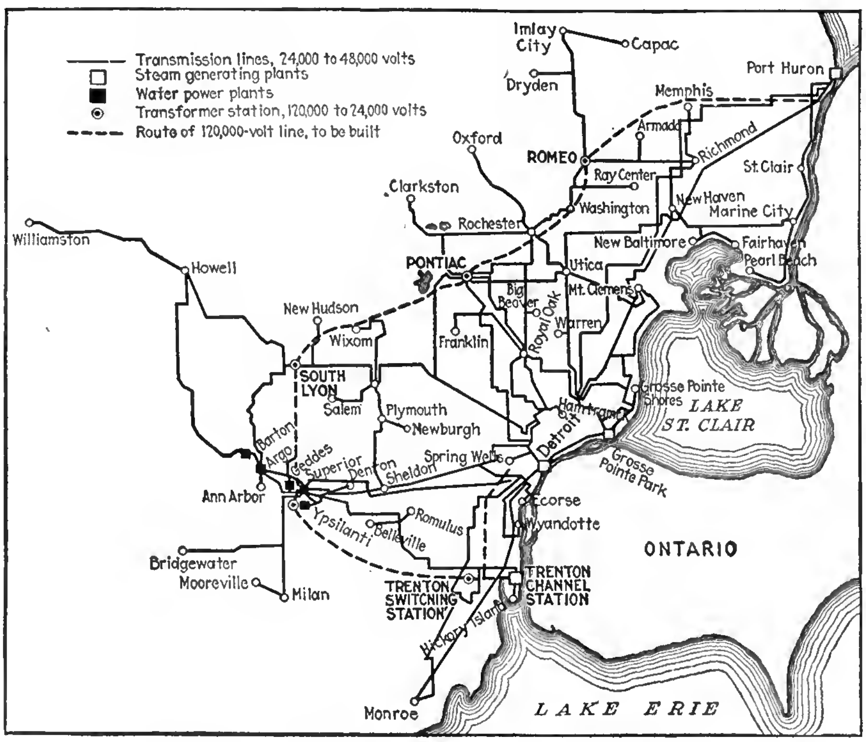
For the city of Detroit the Connors Creek and Delray stations will distribute energy at 24,000 volts, and these two stations are tied in with duplicate tie lines. The Marysville station will provide service for its local service and in addition will be tied to the high-tension system and the 24,000-volt network. At present there are two 48,000-volt lines from the city to Marysville, two others south to Monroe, one west to Ann Arbor and two northwest to Pontiac. Thus the systems now used are 24,000-volt underground cables of No. 2/0 size to substations in the city and 24,000-volt and 48,000-volt No. 0 overhead lines to outlying substations, and to these will be added the outer 120,000-volt high-tension line. All city distribution is underground at 24,000 volts to substations from which secondaries operate at 4,600 volts, three-phase, three-wire, with some 2,300-volt residential service.

At present the Detroit Edison Company operates three plants which normally feed independent groups but have tie-line connections as outlined. The Connors Creek station has 180,000 kva. installed, the Delray station has 120,000 kva., and the new Marysville station, which began operation in October, has 40,000 kva. The daily peak load on the system is about 250,000 kw., with an annual output in 1922 of 1,105,211,100 kw.-hr. The new Trenton Channel station has the foundations installed and is expected to be in operation within eighteen months. It will eventually contain six 50,000-kva. units, two of which will be installed to start with.

#### Pulverized Fuel Adopted

The new station will contain an initial installation of six type W Stirling boilers of about 2,900 hp. rating and will, as already mentioned, utilize pulverized fuel in the furnaces and main unit bleeding for the feed-water system. The changes in sizes of boilers and in practices in power production are well illustrated by the stations of the Detroit Edison Company. The Delray station contains nine 2,365-hp. boilers, two 1,300-hp. boilers and twenty-four 500-hp. boilers. The 500-hp. and two or three other boilers are equipped with economizers and the station uses open feed-water heaters and, for the most part, reciprocal steam-driven auxiliaries.

It is interesting to note, however, that when the older power house No. 1 turbine room at Delray was re-equipped in 1922 recourse was had to steam extraction from the main turbines for feed heating, with electrically driven auxiliaries. The arrangement is extremely simple since steam is bled from but one turbine stage and the proximity of the newer plant (power house No. 2) makes possible the omission of house turbines affording an independent supply of auxiliary power. The auxiliary system proposed for Trenton Channel, however, is the outgrowth of this earlier system, which has established its merit through these years of successful operation.




MAP OF DETROIT EDISON SYSTEM, SHOWING COMING CONSTRUCTION

#### Connors Creek Practice

The Connors Creek station uses fourteen 2,365-hp. boilers with electrically driven auxiliaries and a vacuum system of feed-water heating in which the condensate from the main units is used as circulating water in the barometric condensers, which receive steam from the auxiliary turbo-generators. The evaporator system of make-up is also used.

In the Marysville station there are four 2,820-hp. boilers and all auxiliaries are electric with the exception of one reserve boiler-feed pump and a general service pump. The feed-heating system utilizes surface condensers with outside air coolers with evaporators for make-up water. The house turbines are bled for heating the building.

The Detroit Edison system is growing rapidly and serves a territory extending more than 100 miles north and south and more than 75 miles east and west. It has a system load factor of about 68 per cent and has taken a leading part in making new developments.

# To Study New England Power

Charles T. Main of Boston, an industrial engineer, has accepted the chairmanship of the committee authorized by the executive committee of the Associated Industries of Massachusetts to make a survey of the power situation in New England. Associated with him will be Prof. Dugald C. Jackson, head of the department of electrical engineering, Massachusetts Institute of Technology; Henry I. Harriman, president of the New England Power Company, and George L. Finch, engineering superintendent of the Hood Rubber Company.

# Brief News Notes

**North Carolina State College Holds Meter School.**—A school for electric metermen has just been held for the first time at the State College, Raleigh, N. C., under the auspices of the department of electrical engineering. The college made no charge for tuition, and in addition to the teaching staff of the department a number of the largest electric companies in the country agreed to furnish experts to assist with instruction and equipment.

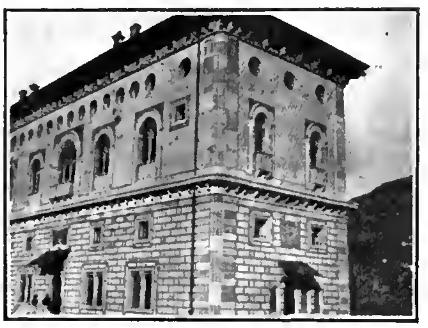
**New Unit to Be Added at Roosevelt Dam.**—An additional 7,500-kw. unit for further utilization of water at the Roosevelt Dam on Salt River, Ariz., will be installed by the Salt River Valley Water Users' Association. Nineteen control gates will be added in the spillways of the dam, and another dam and power house will be constructed further down the river to control the release of water for irrigation to permit of higher load factor on the present power plant at the dam. The Water Users' Association will issue $1,800,000 in 6 per cent bonds for financing the project. It is planned to have the new unit ready for operation within a year.

**Interstate Public Service Company Grows.**—A considerable increase in the business of the Interstate Public Service Company of Indianapolis in 1922 over the preceding year is shown in the president's annual report. A transmission line is being constructed between Cambridge City and Newcastle and plans have been made for important additions to the company's plants at Shelbyville and Jeffersonville. The report shows that the number of customers served by the company's utility plants was increased by 4,492 in the year. The connected lighting load was increased 11.8 per cent and the power load of Dec. 31 was 10.2 per cent greater than at the close of 1921. The total kilowatt-hours sold increased 25.2 per cent. Merchandise business shows a 50 per cent increase. The financial report showed gross earnings for the year of $4,276,665.78 and net earnings of $963,821.

**Geological Survey Issues Power Map of Kentucky.**—A map of Kentucky showing the locations of the power stations and transmission lines used in public service in that state and the names of the public utility companies has just been published by the United States Geological Survey. This map, which measures about 27 in. x 63 in. and is on a scale of about 8 miles to the inch, is the latest of the series of state power maps published by the Geological Survey. The others are of New York, Pennsylvania; Maine, New Hampshire and Vermont; Massachusetts, Rhode Island and Connecticut; Maryland, Delaware and the District of Columbia; New Jersey, Virginia, Indiana, and West Virginia. These maps may be purchased from the director of the United States Geological Survey for 50 cents each.

**Research Graduate Assistantships.**—The engineering experiment station of the University of Illinois again calls attention to the fact that, to assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the university maintains fourteen research graduate assistantships. Two other such assistantships have been established under the patronage of the Illinois Gas Association. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics or applied chemistry. This year the latest date for filing applications has been extended to April 1. Additional information may be obtained by addressing the director of the experiment station at Urbana.

**How They Do It in Italy.**—The accompanying picture is not of a millionaire's suburban villa, but merely the



"switch cabin" or substation of the Acciaierie Lombarde of Milan at Morbegno, Italy, near Como, the beautiful "home town" of Alessandro Volta. The company is installing a new high-tension line, and the building embodies its conception of what a substation should look like.

**Some California Projects.**—Applications for permits to appropriate water in California received by the State Department of Public Works during February included several relating to power projects. Of these the largest is that contemplated by W. H. Samson of Corning, who sought permission to use 1,250 sec.-ft. and 200,000 acre-feet of water from Clear Creek to be diverted into Shasta County. The application says that it is proposed to develop 128,000 hp. H. L. Shannon of San Francisco made application for a permit to appropriate 150 sec.-ft. of water from the Sacramento River, in Tehama County, with which to develop approximately 10,200 hp. A permit has been granted to P. B. Cross of San Francisco to appropriate water from Deer Creek, in Tehama County, for developing approximately 18,600 hp., and another has been issued to the Utica Mining Company of San Francisco for 6,144 acre-feet of water per year from Highland Creek, in Tuolumne and Calaveras Counties, to develop about 3,300 hp.

# Associations and Societies

**Northwest Electric Light & Power Association.**—The annual convention of the Northwest Electric Light and Power Association, to be held in Seattle, has been set for June 27-30. N. W. Brockett is chairman of the program committee.

**National Association of Manufacturers.**—The twenty-eighth annual convention of the National Association of Manufacturers of the United States of America will be held at the Waldorf-Astoria, New York City, on May 14 to May 16.

**Chamber of Commerce of the United States.** — "Transportation in All Its Phases in the United States" and "Europe and Europe's Affairs" will be the two major topics considered at the eleventh annual meeting of the Chamber of Commerce of the United States in New York, May 7 to 10.

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### Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Middle West Division, N. E. L. A.—St. Louis, April 11-12 H. M. Davis, Bankers' Life Bldg., Lincoln.

American Society of Mechanical Engineers—Pacific Coast meeting, Los Angeles, April 16-18; general convention, Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society — New York, April 25-28.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13.

# Recent Court Decisions

**Intercorporate Relations and Extension of Service.**—Declaring that a public service corporation cannot minimize the duty it owes to the public by incorporating a portion of its distributing system, the New York Supreme Court held, in People ex rel. Woodhaven Gaslight Company vs. Nixon, that in considering the expense involved in an extension of gas service the New York Public Service Commission did right to consider the relation that existed between the company concerned and its parent company, which exercised absolute control over the defendant and three other distributing companies, and was not necessarily limited to a consideration of the expense with relation either to the capitalization or stated income of the relator. (196 N. Y. S. 623.)*

**Power to Enjoin Illegal Operation.**—The mere fact that a commission has no power to enforce its order cannot successfully be urged as a denial of the power to make the order when that power is expressly given it by statute, declared the Supreme Court of Califoria in reviewing an order of the California Railroad Commission requiring the Motor Transit Company to cease alleged illegal operation. As a practical matter of procedure, the court said, such an order is proper. If the order so given by the commission is obeyed, then no further legal steps are necessary. It is only when such order is disregarded that it becomes necessary for the commission to institute an action in the courts to secure its enforcement. Until such order is given there is no basis upon which the commission can ask the aid of the courts. (209 Pac. 586.)

**The Wisconsin Emergency-Rate Ruling.**—The decision of the Supreme Court of Wisconsin overthrowing the uniform rates established by the Railroad Commission for cities included in the "loop" district of the Wisconsin-Minnesota Light & Power Company led, as already recorded in the news columns of the ELECTRICAL WORLD, to the adoption of emergency rates by that company until such time as the commission can determine proper charges on the unit plan now made obligatory. The commission refused to recognize these rates, wishing to revert temporarily to the rates previous to the abortive establishment of the "loop" plan, but the United States District Court granted to the company an injunction restraining the commission from interference with the emergency rates adopted by the company for Eau Claire, Chippewa Falls and Menomonie. In granting the injunction the court said: "If this proceeding were to fix definitely a fair and reasonable rate, we would doubtless say the burden is upon the utility. But such is not the purpose of the present suit. The utility is seeking to avoid the effect of a confiscatory rate. With the confiscatory character of the rate established, are we not required, as between the municipalities and the utility, temporarily to adjust the rates so as to avoid confiscation? . . . We are not at all sanguine that the good-faith efforts of the commission to carry out the rule announced by the Supreme Court will result in any easy and prompt disposition of the case. Whether its final determination be speedy or long delayed, whether it result in a substantial change in rate or not, the utility should, pending such hearing, be protected against an obviously confiscatory rate."

**Protection of Crossing Wires.** — In Farne vs. Pennsylvania Lighting Company damages were awarded for the death of a telephone lineman caused by the breaking of a wire with which he was working and its coming into contact with both an electric light wire and a trolley wire. The Supreme Court of Pennsylvania reversed the award, holding that it had not been established that the electric light wires were insufficiently insulated, as claimed by the plaintiff, and that there was evidence that the telephone wire became charged from contact with the trolley wire. The court also found that plaintiff's claim that it was customary for electric service companies to provide a "cradle" at points where telephone lines crossed above the transmission wires in order to prevent contact should a telephone wire sag or break was not sufficiently sustained, and said that the primary cause of the accident was the subjection of the old, worn-out telephone wire to a strain greater than it could withstand. (119 At. 537.)

**Limited Power of Appellate Court Over Excessive Damages.**—Sustaining the verdict for plaintiff found by the trial court in Smith vs. San Joaquin Light & Power Corporation, the California District Court of Appeal held that where a seven-year-old boy grasped a live wire hanging from an electric light pole to within a foot or two of the ground near the side of a public highway on which he was walking, the company was liable for injury, even though the accident arose in connection with rewiring being done by an independent contractor and though the wire was broken by the leaves of a large palm being blown against it. It was the defendant's duty to protect its wires from such danger. The court refused to reduce the damages awarded for the forced amputation of the child's arm below the elbow — $20,000 — declaring that it had power over excessive damages only where a point of law was involved or where the damages suggested at first blush prejudice, passion or corruption on the part of the jury. A rehearing of this case was subsequently denied by the Supreme Court of the state. (211 Pac. 843.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**Approval of Contract Cannot Waive Provisions of Law.**—In giving its approval to a contract for furnishing electrical energy entered into for three years between the Indiana Power Company and the city of Linton, the Indiana Public Service Commission took occasion to emphasize the mutual understanding of the commission, the city and the company that no contract or order could change the law applicable to public utility rates and service or waive the rights of the public.

**Extensions Into New Territory.**—In ordering the Springfield Gas & Electric Company to make an extension, under conditions, to serve an agricultural customer the Missouri Public Service Commission declared that an electric utility should not be required to add a new consumer to a line extended into new territory to serve other consumers who have contributed to the cost, have secured a right-of-way for their own personal service and have otherwise obligated themselves in connection with the extension, unless the additional applicant obligates himself to take service under the same conditions as the others.

**Service in Adjacent Territory.** — In adjudicating a complaint brought by the West Penn Power Company against the Vandergrift Electric Light & Power Company, the Pennsylvania Public Service Commission said that a public utility company incorporated for the purpose of supplying electricity to the public in a township and to "persons, partnerships, corporations and associations residing therein and adjacent thereto" cannot, under the adjacent-territory clause, extend its service beyond specifically designated territory into other adjoining municipal divisions in which another corporation is chartered to furnish a like service without a certificate of public convenience, even if "adjacent" persons is to be construed as meaning adjacent territory.

**North Dakota Commission Changes Opinion.** — Until quite recently the North Dakota Board of Railroad Commissioners had considered that historical costs have an almost controlling bearing upon a valuation, basing this opinion upon the requirement of the statutes that the value as determined by the commission "shall be such sum as represents as nearly as can be ascertained the money honestly and prudently invested in the property." Recently, in adjudicating a complaint brought against the Bismarck Water Supply Company, the commission announced that it had shifted its position, careful study of the authorities having convinced it that the words just quoted have a wider significance and a less restricted meaning than the actual number of dollars put into the property at its inception.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## G. N. Tidd Elected President American Gas & Electric

George N. Tidd, who has been associated with the American Gas & Electric Company for the last twelve years as vice-president and general manager in charge of operation, was elected president of the company at a meeting held March 14. Mr. Tidd is succeeding R. E. Breed, who was elected to the chairmanship of the board of directors. During the twelve years that Mr. Tidd served as vice-president and general manager the company attained a

G. N. TIDD

growth that ranks it with the foremost operating companies in the industry, and it was largely Mr. Tidd's foresight and courage that made possible the Windsor power plant of the Ohio Power Company, the first large power plant to be erected at the mouth of a coal mine. He has been a strong advocate of interconnections between large power systems, and under his management this policy has been pursued in Ohio. The latest example of his progressiveness is the 215,000-kw. plant of the Ohio Power Company on the Muskingum River below Zanesville which is now under construction.

S. Z. Mitchell was appointed chairman of the executive committee; Frank B. Ball, formerly secretary and treasurer, was elected vice-president and secretary, and F. W. Drager, formerly assistant treasurer, was elected treasurer.

**Gilbert Nerby** of North Menomonie has been appointed to succeed L. G. Webb, resigned, as district manager of the Menomonie office of the Wisconsin-Minnesota Light & Power Company. Mr. Nerby has been associated with the company for the last six years in the capacity of electrician. Mr. Webb, as was announced in the March 17 issue of the ELECTRICAL WORLD, tendered his resignation to enter into the real-estate business in Madison, Wis.

**Herbert Baker Flowers** has resigned as vice-president and general manager of the United Railways of Baltimore to become president of the New Orleans Public Service Corporation. Mr. Flowers became general manager of the United in 1919 and in 1920 was elected second vice-president of the company, continuing to discharge the functions of general manager.

**Charles G. Du Bois**, president of the Western Electric Company, accompanied by Vice-president H. F. Albright and Philip L. Thomson, advertising manager, sailed for Europe on the Aquitania on Tuesday, March 20. They plan to spend two months abroad, visiting the European factories and offices of the Western Electric Company.

**J. Rowland Bibbins**, formerly manager of the department of transportation, United States Chamber of Commerce, Washington, is now engaged in private consulting practice in transportation development, with offices in the same city. Previous to his association with the Chamber of Commerce Mr. Bibbins was supervising engineer with the Arnold Company of Chicago.

**Harry A. Arthur**, formerly of Stone & Webster, Inc., Boston, and the American International Corporation, New York, has been elected president of G. Amsinck & Company, Inc., of New York. Mr. Arthur was associated with Stone & Webster for more than ten years, spending much of that time in the field with electric light and power companies under Stone & Webster management. Ronald C. Shepard, formerly with the McGraw-Hill Publishing Company and prior to that with Stone & Webster, has been appointed vice-president and treasurer of the Amsinck company. During the world war Messrs. Arthur and Shepard were engaged in executive capacities with the American International Shipbuilding Corporation in the construction and operation of the Hog Island shipbuilding yards.

**H. U. Wallace** has been appointed assistant general manager of the Little Rock (Ark.) Railway & Electric Company. Mr. Wallace, who is well known in utility circles in the Middle West, has had an unusually active and interesting career. In 1894 he became identified with the Illinois Central Railroad and served as superintendent and chief engineer until 1905. Subsequently he followed private consulting engineering work and later became general manager of the Chicago, Lake Shore & South Bend Interurban. The year 1912 found Mr. Wallace at Boulder, Col., serving as vice-president and general manager of the Western Light & Power Company, where he remained until 1918, when he accepted an appointment as major in charge of engineering and construction, Quartermaster's Department, with headquarters at Washington, D. C. He left the army in the spring of 1919, and from that time until his recent appointment he was engaged in private practice.

## C. W. Bradley Assistant to President Budd

Charles W. Bradley of Chicago, gas engineer of the Public Service Company of Northern Illinois in charge of all gas plants, has been appointed assistant to President B. I. Budd of that com-

C. W. BRADLEY

pany. Mr. Bradley was born in 1873 and was graduated from Cornell University in 1896 in engineering. The following year he went to Chicago and became superintendent of stations for the old Chicago Gas Light & Coke Company, afterward consolidated with the present People's Gas Light & Coke Company. Mr. Bradley remained there until 1905, when he became gas engineer for the Northwestern Gas Light & Coke Company. When the last-named company was absorbed into the Public Service Company of Northern Illinois, in 1913, Mr. Bradley came into the latter organization.

**Prof. Lester P. Breckenridge**, chairman of the department of mechanical engineering at Yale University, will retire from active teaching in June. Professor Breckenridge went to Yale from the University of Illinois fourteen years ago. He was graduated from the Sheffield Scientific School in 1881. Professor Breckenridge was at one time in charge of the boiler division, U. S. Geological Survey, fuel testing plant, St. Louis and he has written a number of bulletins on fuel conservation.

## R. U. Muffley Washington Coast Utilities Manager

R. U. Muffley, formerly superintendent of light and power of the Bellingham division of the Puget Sound Power & Light Company, has been named manager of the Washington Coast Utilities properties recently acquired by the company first named. The properties of the Washington Coast Utilities, comprising seven electric, gas, water and telephone companies, will be operated as a separate unit for the present, under the direction of Mr. Muffley. His first work in the utility field was with the Fairmont Electric Light Company of Minnesota, back in 1899. In 1903 he went to the Pacific Coast and took a position with the Globe Electric Company, and in the following year he became affiliated with the organization of the Whatcom County Railway & Light Company. This company absorbed the electric properties of the Bellingham Bay Improvement Company in 1906, and in 1908 Mr. Muffley was named superintendent of distribution. In 1911 he was promoted to the position of superintendent of light and power in charge of all light and power plants, street-railway lines and a gas plant owned by the company, which position he held until his recent transfer to the post of manager of the Washington Coast Utilities Properties. C. F. Terrell of the Seattle division has succeeded Mr. Muffley at Bellingham.

R. U. MUFFLEY

**Chase Donaldson**, formerly appraisal engineer with the American Gas & Electric Company, has resigned and is now an investigator for security issues with Hayden, Stone & Company, New York City.

**J. T. Fulwiler**, formerly connected with the Western Electric Company in Atlanta, Savannah and New Orleans, is now representing J. H. Parker & Son, Inc., Parkersburg, W. Va., throughout Arkansas, Oklahoma, Texas, New Mexico and Louisiana, with headquarters in Dallas, Tex.

**C. E. Chapple** is now chairman of the Fort William (Ont.) Light, Telephone & Street Railway System, replacing Charles Birkett.

**Albert Uhl**, formerly connected with the Henry Newgard Company as sales engineer, has joined the Nordlie Electric Company, Chicago.

**Harvey Clark Pond**, general sales manager of the Arrow Electric Company, Hartford, Conn., has been elected a member of the board of directors.

**E. A. Graham**, formerly connected with the Electric Bond & Share Company, New York City, has gone to Cienfuegos, Cuba, where he will be with the Compañia Electrica de Cienfuegos.

**A. H. Favreau** has replaced George W. Cook as superintendent of the Southern Illinois Railway & Power Company, Harrisburg, Ill. Fred L. Shimer has been made general superintendent and M. H. Wetlaw has been appointed as general agent.

**Paul P. Ashworth**, distribution engineer of the Utah Power & Light Company, has been unanimously re-elected to represent the Utah Section of the American Institute of Electrical Engineers on the governing board of the Engineering Council of Utah. His term of office will expire Jan. 1, 1925.

**R. J. S. Pigott**, formerly connected with the Crosby Steam Gage & Valve Company of Boston, as works manager, has recently become associated with Stevens & Wood, Inc., as mechanical engineer in charge of all the power and industrial work of the company. Mr. Pigott has been retained by the Boston company in a consulting capacity.

**C. V. Woodward** has been appointed manager of the Baltimore office of the Westinghouse Electric & Manufacturing Company, and F. C. Reed has been made manager of the Huntington (W. Va.) office. Other changes in the branch offices include the appointment of R. J. Ross as assistant manager of the transportation division of the Philadelphia office and of W. F. James to the managership of the industrial division, succeeding R. F. Moon, who has resigned to accept the vice-presidency of the Atlantic Elevator Company of New York.

**Kenneth V. Laird** has been placed in charge of a new department recently organized by the Capital Electric Company of Salt Lake City, Utah, which covers Utah, southern Idaho and parts of Nevada and Wyoming as an electrical jobber. This department is to be known as the transmission and street lighting department and has been organized for the purpose of affording technical service to customers in the working out of their problems. Mr. Laird is a graduate in electrical engineering of the University of California with the class of 1914. Prior to the war he was a member of the staff of the Anaconda Copper Mining Company in connection with the Cottrell process. More lately he was electrical engineer for the Gillert Engineering Company of Philadelphia.

## Dr. Merrill Heads Engineering Council of Utah

Dr. Joseph Merrill, dean of the Engineering College of the University of Utah, has been elected president of the Engineering Council of Utah. He has been active in the organization of the Engineering Council, which is an affiliation of all of the engineering societies of Utah, representing about fifteen hundred men of the engineering profession. Dr. Merrill received his bachelor of science degree from the University of Michigan in 1893 and continued his studies at the Johns Hopkins University, receiving his Ph.D. from that institution in 1899. He was assistant professor of chemistry at the University of Utah in 1897, director of the Utah State School of Mines at the University of Utah in 1898, and since 1899 has been professor of physics and electrical engineering of that institution.

JOSEPH MERRILL

Dr. Merrill has done extensive research work in electrical engineering. He has been very active in the Utah Section of the American Institute of Electrical Engineers and served as chairman of that section during the association year 1920-1921.

# Obituary

**Henry H. Ashley**, president of the Hazard Manufacturing Company, manufacturing cable at Wilkes-Barre, Pa., died recently.

**Alexander Lodyguine**, inventor of many electrical and chemical processes, died on March 16 at the Brooklyn Hospital after a long illness. Mr. Lodyguine, who was seventy-five years old, was a member of the American Institute of Electrical Engineers and of the American Electrochemical Society. Among his inventions were a carbon incandescent lamp, a flying torpedo, electrical heating and hardening furnaces, a storage battery and chemical apparatus.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Stabilizing the Sale of Commodities*

**Reasons for Favorable Merchandising Outlook—Quality Versus Price as a Trade Factor—Incentives to Sales Effort**

By A. G. Kimball
President Landers, Frary & Clark, New Britain, Conn.

OUT of the war and the subsequent short period of depression has come a new prosperity which presents a great opportunity for every one in the merchandising field and especially to those engaged in marketing household conveniences. Prohibition, the servant problem and the modern woman are primary factors in the development of electrical merchandise sales.

A great deal of the money formerly spent for the "fifty-seven varieties of liquid joy" is now available for home conveniences. A greater percentage of the family income than formerly is now expended by women in the homes of the country, and even among conservative people much more entertaining is done than in years past. There is increased interest in the appointments, conveniences and luxuries of home life, with a tendency toward the purchase of more refinements of living, which all together make a considerable market for electrical products that previously did not exist.

From all indications the scarcity of servants will continue many years. The desire for individual freedom, unwillingness to perform "menial" service, the demand for stated hours of work, and shorter hours at that, combined with unwillingness to tie one's self down, contribute to the shortage of domestic help. Competent servants are hard to obtain and insist on modern conveniences as a condition for remaining.

Women are now performing household tasks who would not have thought of this work ten years ago. The demand for household conveniences grows apace. *Electrical Merchandising's* forecast of household sales prospects in electrical appliances has exceeded the estimates of manufacturers and yet has been found accurate in the light of past experience. This journal estimates that in 1923 $160,000,000 will be expended in this country for electrical household devices and conveniences. A building boom is in progress throughout the country. Manufacturers of builders' hardware cannot keep up with orders. All new homes are potential customers of the electrical industry. It is estimated that the number of wired homes in the United States will increase from six and one-half million in 1921 to eleven million by 1924—virtually doubling the number having electric service.

### Let the Central Station Back "Quality" Products

Each newly wired home means a new customer for the central station. The central station has in its tie-in with its customers an advantage comparable to that of the department store with its "charge accounts." Twenty million establishments in this country are engaged in the housekeeping business. In reaching out into this potential market for the sale of electrical devices the central-station company has the best opportunity possessed by any branch of the industry.

It is generally true that where a central station is actively merchandising in a community it creates more business than formerly existed there in the appliance field for every one engaged in the local supply of electrical commodities, provided that the central station maintains a proper policy. It is to the interest of the entire industry that list prices be maintained, although sales stimulation of one kind or another is favored on occasion. Special sales are desirable once in a while—every woman loves a bargain—as in department store merchandising, but these special sales should prevail for a limited period only, with reductions on the cheaper brands of goods and the maintenance of profits on regular lines.

The department store has studied every phase of the merchandising problem and worked out its plans, analyzing the details of buying, selling and service. The electrical industry needs to do the same thing. The question of turnover, for example, needs more thorough consideration.

As electrical manufacturers, we believe it is a mistake for merchandisers to buy of all producers of electrical commodities. It is better to feature one or two brands, to be headquarters in a community for particular products. More business is done than in cases where the retailer handles a big variety of goods. Fewer "frozen" stocks or sacrifice sales develop under a policy of concentration, which means more incentive for the manufacturer and jobber to co-operate with the dealer who does not attempt to cover too great a variety of lines.

It is a temptation for the buyer to "fall for" some of the bargains offered by relatively unknown producers, and so a policy of concentration leads to the creation of fewer choked-up stocks.

### Cheaper Merchandise Threatens Market

As a result of the expiration of the Marsh patent a decided tendency toward the production of lower-grade merchandise can be seen and central stations and other retailers will make a mistake if they buy from cheaper producers who sacrifice quality to price. Business cannot be built up on price, and there is going to be a real battle between price and quality in electrical merchandising. The manufacturer's reputation is the best guarantee of the appliance.

What should the central station do to go after this business in an aggressive manner? Some one with real merchandising ability and instincts should be put in charge of this end of the business. Too often in the past a purely technical man has been in charge of sales activities.

*From an address before the Merchandising Bureau, New England Division, N. E. L. A., at Hartford, Conn., March 14, 1923.

A vital question is how to keep such employees. Some plan should be worked out so that the merchandising man may in some way be made a partner in this business, as on a salary and bonus basis. In the past too much emphasis has been placed on the lighting load as a revenue producer. There is a far greater opportunity in appliances. If all central stations could be given the name "The Blank Electric Company," it would facilitate the sales activities of the industry. Try to serve the public when people enter the utility office. Don't permit any employee to "bark" at the public. Things jar in a public utility that would never be given a second thought in private industry.

A courteous and intelligent person at or near the door is essential. In general, manufacturers stand ready to co-operate to the utmost in developing the merchandising field in the electrical industry, which offers tremendous opportunities for progressive organizations.

# Police Power Needed in Maintaining Quality

### Devices Sold for Use in the Home Should Be Protected by an Approval from the Central-Station Industry that Each Utility Could Enforce

By S. D. Levings
Treasurer Betts Electric & Manufacturing Corporation, New York

SOMETHING definite and positive should be done to protect the purchasing public against electrical devices of inferior quality. The Underwriters' Laboratories are not vested with the police power that would enable them to eradicate from the market cheap and hazardous devices. They afford purely a moral protection for the insurance company and the insured, and it is a well-known fact that very few fires occur in homes employing non-approved apparatus, where the insurance companies refuse for that reason to pay the loss covered by the policy. The question therefore is: Could an organization established by the central-station companies themselves exert the power the underwriters do not possess by disseminating information on approved apparatus through the central stations direct to the consumer?

#### Effect on the Trade

It may be said that this is not the function of a public utility. But surely it would protect the public and improve the service and so would be in the public interest. I believe that it would be effective because a strong influence would be exerted if the consumer were to receive regularly with his bill a list of apparatus that was approved with a statement that the central station could not be held responsible for trouble or improper functioning of the service if devices other than those approved should be used.

Such an approval should not tend to uphold the big manufacturer in opposition to the smaller manufacturer, for there are many smaller concerns that manufacture electrical apparatus superior in quality, workmanship and functioning to that made by some of the larger manufacturers; but it should influence the jobber and the dealer in their purchasing.

The dealer buys generally on one or two bases—that of his own judgment, based on first-hand information, or that of judgment based upon sales effort directed to him on the part of the manufacturer. With two articles side by side of known quality, he will buy the low-priced, which generally is of inferior quality, unless the higher-priced article has been so extensively advertised by the manufacturer as to create a demand from which the dealer can automatically benefit. The jobber buys an article for which there is a demand, and the manufacturer who cheapens his product to spend the savings in advertising can certainly make headway against a manufacturer of a high-grade article who does not possess a large enough advertising appropriation to compete with him.

But in approving a device all such aspects should be eliminated from consideration. The only question to be determined would be the suitability of a device for use by the novice, and I would further eliminate any apparatus not sold at retail to the householder. Thus, I do not believe it would be necessary to pass upon fixtures, conduit, conduit fittings, wire, switches and similar things, as the standards on this class of goods are pretty well recognized and a manufacturer who cannot live up to the building code requirements, the various underwriters' rules and local ordinances has little chance of doing much damage.

I have in mind a specific accessory device, a double socket. The body of the plug is made of bakelite, the best insulation obtainable. There is no porcelain in any part of its construction to cause trouble through breakage. There are no internal connections of any kind. Brass shells are eliminated. There is a spring contact at every point. Purely on the technical merits, it is clear that the absence of fragile porcelain parts is a distinct advantage to the consumer. The elimination of soldered connections, which are only as good as the workman who makes them and which are liable to open on overloads and to cause high-resistance joints, is a decided advantage. Trouble due to arcing contacts in sockets with solid connections are avoided because there is not a solid contact in this plug.

Now, it would seem that every electrical man of experience would wish to adopt this device. The manufacturer has been told on all sides that he has a wonderful article but that, inasmuch as he has not created a demand, purchasers of two-way sockets will not become interested. I know of no more striking illustration of the lack of appreciation on the part of the trade of quality for the sake of quality.

#### Where the People Look

The indorsement of such institutions and periodicals as the Tribune Institute, *Good Housekeeping* and the *Modern Priscilla* is of value and interest, but the public certainly does not look to such organizations for technical electrical advice. It naturally looks to the central stations for such information.

I do not believe that it would be a difficult matter to test or to arrive at a method of analyzing the quality of the various devices used in the home. As a matter of fact, I believe that a specification for general points of construction and performance should be written for each type of such devices and that their testing should be made in strict accordance with such specifications.

I feel that the time is coming when the central-station companies will have to take a firm stand in the matter of the quality of apparatus

that is to be attached to their lines; and as no one station could stand the burden of the work involved, it appears as though a concerted effort would be necessary, with a common fund to carry on the work in a scientific and proper manner. I agree that it would be folly to put this work in the hands of any but the central stations. Certainly they cannot be accused of bias.

The whole object of the idea would be to protect the patrons of the utilities, who expect and are entitled not only to electric service but to service in a broader sense in all that pertains to their use of energy.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## January Electrical Exports Show Gain

Total exports of electrical machinery, apparatus and appurtenances for the month of January were $6,400,943, a gain of $1,587,199 over January, 1922, when the total amounted to $4,813,744. The following figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR JANUARY, 1923, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

| Articles | Value — January 1922 | Value — January 1923 |
|---|---|---|
| Turbines | $202,304 | $175,111 |
| Generators: | | |
| Direct-current— | | |
| Under 500 kw | 42,505 | 60,374 |
| 500 kw. and over | 169,675 | 130,406 |
| Alternating-current— | | |
| Under 2,000 kva | 4,952 | 19,819 |
| 2,000 kva. and over | 79,876 | 99,890 |
| Accessories and parts for generators | 250,605 | 90,108 |
| Self-contained lighting outfits | 39,776 | 66,246 |
| Batteries: | | |
| Primary | 74,126 | 97,324 |
| Storage | 51,701 | 221,721 |
| Transforming and converting apparatus: | | |
| Transformers— | | |
| Power | 83,953 | 192,153 |
| Other | 106,633 | 35,471 |
| Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters | 67,872 | 53,701 |
| Transmission and distribution apparatus: | | |
| Switchboard panels, except telephones | 44,766 | 132,168 |
| Switches and circuit breakers above 10 amp | 175,382 | 220,987 |
| Fuses and fuse blocks | 13,259 | 17,898 |
| Meters and measuring instruments: | | |
| Watt-hour and other measuring instruments | 66,116 | 19,184 |
| Volt, watt and ampere meters and other recording indicating and testing apparatus | 68,006 | 64,859 |
| Lightning arresters, choke coils, reactors, and other protective devices | 14,230 | 48,149 |
| Motors, starters and controllers: | | |
| Motors under 1 hp | 36,146 | 73,112 |
| Stationary motors, 1 to 200 hp | 146,523 | 193,386 |
| Stationary motors over 200 hp | 3,681 | 45,087 |
| Railway motors | 390 | 21,995 |
| Electric locomotives— | | |
| Railway | 17,505 | 874,739 |
| Mining and industrial | 8,926 | 6,170 |
| Other motors | 65,563 | 7,023 |
| Rheostats, controllers and other starting and controlling equipment | 73,501 | 116,270 |
| Accessories and parts for motors | 146,521 | 100,696 |
| Electrical appliances, etc: | | |
| Electric fans | 46,395 | 48,972 |
| Electric lamps: | | |
| Incandescent— | | |
| Carbon-filament | 3,050 | 3,357 |
| Metal-filament | 95,057 | 82,541 |
| Other electric lamps | 17,350 | 18,142 |
| Flashlights | 14,855 | 27,450 |
| Searchlights and projectors | 140,040 | 38,557 |
| Motor-driven household devices | 22,704 | 46,970 |
| Domestic heating and cooking devices | 38,540 | 55,989 |
| Industrial electric furnaces and ovens | 22,951 | 8,960 |
| Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc | 41,703 | 34,229 |
| Signal and communication devices: | | |
| Radio and wireless apparatus | 9,274 | 141,577 |
| Telegraph apparatus | 25,380 | 392,992 |
| Magneto telephones | * | 490 |
| Other telephones | 370,055 | 28,467 |
| Magneto switchboards | * | 20,242 |
| Other telephone switchboards | * | 18,125 |
| Railway signals, switches and attachments | 45,901 | 32,616 |
| Bells, buzzers, annunciators and alarms | 4,043 | 6,032 |
| Other electrical apparatus and appurtenances: | | |
| Spark plugs, magnetos, and other ignition apparatus | 104,311 | 68,055 |
| Insulating material | 56,498 | 66,828 |
| Metal conduit, outlet and switch boxes | 53,655 | 16,089 |
| Sockets, receptacles and lighting switches | 10,738 | 68,589 |
| Other wiring supplies and fixtures | 79,375 | 153,108 |
| Other electrical apparatus not elsewhere specified | 838,313 | 804,528 |
| Globes and shades for lighting fixtures | 35,272 | 27,235 |
| Electrical glassware, except for lighting | 12,082 | 15,332 |
| Electrical porcelain | 103,923 | 138,134 |
| Electrical carbons, carbon brushes and electrodes | 19,543 | 146,938 |
| Insulated wire and cable (iron and steel) | 80,618 | 68,237 |
| Other manufactures of aluminum | 40,602 | 53,395 |
| Copper: | | |
| Bare wire | 64,486 | 212,282 |
| Insulated wire and cable | 234,537 | 209,508 |
| Total electrical exports | $4,813,744 | $,400,943 |

* Not separately stated prior to Jan. 1, 1923.

## Aluminum Output Gained 25 per Cent in 1922

The value of new aluminum produced in the United States during the year 1922, according to the United States Geological Survey, was $13,622,000, an increase of about 25 per cent over 1921. During the first half of the year the price was 20 cents a pound. In September, when the tariff went into effect, the price advanced to 23 cents, where it remained until the end of the year. The price is now 26 cents.

Imports for the first nine months of the year amounted to 31,482,893 lb., compared with 26,177,852 lb. for the corresponding period in 1921. Value of manufactured articles of aluminum during the same period was $1,486,177, compared with $1,635,106 imported during the first nine months of 1921. Figures for the last three months of 1922 are not yet available.

## Atlanta Collections Improving

Collections in the Atlanta district showed little change during last month, and jobbers reported their collections quite satisfactory. There is still some tendency toward slowness by the small contractors, but even this element is showing signs of increasing promptness. Industrial companies and public utilities are liquidating their accounts more promptly, and jobbers report that credit is easier and more liberal than has been the case for some time past as they anticipate excellent conditions later in the spring. Money continues easy, as is evidenced by the heavy building activities throughout the territory.

## The Metal Market

### No Sign of Weakening Price—Export Market Quiet—February Shipments 180,000,000 Lb.

Practically all producers continue to hold their copper at 17 cents delivered. There is no sign among most producers of weakening on this quotation, and, being well sold up, they seem willing to wait two or three weeks if necessary for the demand to reassert itself. The export market has been more quiet than usual, at prices that have netted producers approximately the same as domestic business.

Foreign and domestic shipments of copper during February totaled 180,000,000 lb. With allowance for the shorter month and holidays in February, this figure maintained the same high rate as in January, when the largest shipments in the peace-time history of the industry were made, totaling 210,000,000 lb. Refining output during February amounted to about 160,000,000 lb., resulting in reduction of refined stocks by 20,000,000 lb. On March 1 these stocks totaled 255,000,000 lb., compared with 275,000,000 lb. on Feb. 1. Indications point to the shipment of a total of 225,000,000 lb. in March.

NEW YORK METAL MARKET PRICES

| | Mar. 14, 1923 Cents per Pound | Mar. 21, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 16.75 | 17.00 |
| Lead, Am. S. & R. price | 8.15 | 8.25 |
| Antimony | 8.75 | 8.75 |
| Nickel, ingot | 30.00 | 30.00 |
| Zinc, spot | 7.50 | 7.50 |
| Tin, Straits | 46.00 | 47.25 |
| Aluminum, 98 to 99 per cent | 25.50 | 26.00 |

# The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

SLIGHT improvement in orders throughout the United States is noticeable following buying on the rising market for porcelain, copper and brass products after decided rises in raw materials during the greater part of the last four weeks. Along the Pacific Coast the demand for rubber-covered wire, which was marked up 2 per cent last week, has slowed up owing to the heavy stocks now in the hands of the contractor-dealers, who bought far in advance in anticipation of higher prices. In that territory the conduit situation is unimproved, deliveries are slow, and factories will accept orders subject to price on date of shipment. In the South electrical business is experiencing a wholesome demand as excellent weather conditions have permitted building activities to go ahead rapidly. In the Middle West industrial-equipment sales of commodities to the utilities are growing with stiffening prices. Other business incident to newly constructed buildings is, however, delayed to some extent by labor difficulties. In the East business continues very active, with some improvement in the delivery situation, although railroad embargoes are still bothering shipments of raw materials. In New England there is talk of strikes in the textile industry. Radio sales are well maintained and appliances are receiving unusual attention for this time of the year. Collections generally are much improved.

**Boston** Business continues very active, and there is moderate improvement in the delivery situation, although railroad embargoes are widespread. Building contracts awarded in New England for the week ended March 13 totaled $4,654,200, against $3,974,100 for the same week last year. A deadlock in the building industry at Boston regarding wage increases has caused cancellations of contracts exceeding $2,000,000, and it is not unlikely that a struggle to establish the open shop may occur this spring. Strikes threaten the textile industry at Fall River and New Bedford, Mass. Important new central-station construction is contemplated at Worcester, Mass., and Providence, R. I. Spring demand is opening in line material and appliance sales are showing up well. New England electrical factories are extremely busy.

**New York** Prices all through the copper and brass lines continue strong, following rises in the raw-material market. Insulators, poles and meters are moving in greater volume to the utilities, and wiring devices, fixtures and appliances are receiving more interest than one month ago. Electrical manufacturers throughout this territory are very busy filling spring and summer orders and are having less difficulty in obtaining raw materials from the inland. Heater sales during the last three months have been far in excess of any like period of three years back as a result of intensive sales efforts in the form of newspaper advertising, more attractive displays and the coal shortage. Business in second-hand motors is said to be more brisk than two weeks ago.

**Baltimore** General market conditions are holding their own, with very good prospects for the late spring and summer seasons. There is but small demand for flatirons and a good many of the jobbers are understocked. Motors and transformers are keeping steady and wire has had an active week.

**Atlanta** Business in electrical lines is increasing steadily. Excellent weather conditions have permitted building activities to go ahead rapidly and a healthy demand is to be noted in all electrical building materials. Irons are selling briskly. One jobber is in the midst of a statewide campaign and reports excellent results with ample stocks to meet the demand. Another jobber anticipates sales campaigns beginning April 1. Demand for batteries of all types continues active and sales are considerably in excess of the same time last year. The outlook in this line is bright, and satisfactory stocks and firm prices are the rule.

**Pittsburgh** Jobbers report fair business from utilities and industrials. The price trend in practically all commodities in this territory is upward, and yet business seems to be getting stronger as each week goes by. Radio shows a marked improvement, and, as previously reported, people demand a better class of equipment than ever before. Business among the building trades continues to improve.

**Cleveland** General business conditions are much improved. Construction is delayed somewhat by labor difficulties, although builders' plans included an extensive program for spring. Conduit stocks are low and also tend to hamper building operations to some degree. Industrial equipment sales are good, and prices of pole-line hardware, wiring devices, armored cable and high-tension equipment are stiffening. Deliveries are lengthening again, although railroads report their rolling stock to be greater. Appliances are in very good demand, particular strength in cleaners being noticed. Central stations report power sales increasing and meters are in good demand. Radio prices are declining, although sales are active. Collections are reported as improved.

**Chicago** Demand for staples, including wire, switches and wiring devices, is continuing firmly. Stocks are normal with the exception of conduit and porcelain. The call for motors is growing and more apprehension is given to the scheduling of shipments than to the cost of motors, which has remained firm. Demand for poles remains active and stocks are fairly normal with firm prices. Call for radio is steady and stocks are normal with the exception of a few commodities, including the 1.5-volt vacuum tube. The tape market has noticed no fluctuations, since both the rubber and the cotton grade have a steady call.

**St. Paul-Minneapolis** The extreme cold weather during the last few days has stopped construction and all outside work has slowed up considerably. Dealers are ordering from hand to mouth. Wire is still going up. The conduit situation is very serious, with acute shortages in small sizes. Radio has slowed up.

**Denver** Increased prices of electrical materials dependent on copper and steel are not uniform, and, because of the uncertain market, no heavy buying for stock is being done. Central-station buying is consistent and indicative of considerable activity later. Jobbers report improvement in stocks, but in several lines, owing to the large demand, manufacturers are making short shipments. Wire stocks, however, are ample, while larger sizes of conduit are short. Recent blizzards have impaired all transmission lines, but no serious damage has been reported. Range makers are surveying territory closely for development of electric cookery campaigns. Appliance sales are picking up.

**St. Louis** Production and distribution of merchandise in this district for the past month have been relatively larger in volume than is usual at this season of the year and have shown large gains over the corresponding period of the two preceding years. Practically all building materials have increased in price. Wholesalers report that their customers are taking advantage of prompt payment discounts to a greater extent than they have done for more than two years. Dealers in electrical appliances report large sales, all lines showing an increase over last year.

**Portland-Seattle** Lumber production reached a new high post-war peak last week. Increased lumber prices are reflected in higher prices for poles and cross-arms. Deliveries on cross-arms are very slow owing to the greatly increased demand. A 2 per cent increase in rubber cov-

# Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Conduit Boxes, Rectifiers
and Instruments

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Radio | Tape | Batteries | Irons |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boston** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Act | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Low | Nml. | Low | Low | High | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **New York** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act | Sdy. | Act. | Act. | Sdy. | Act. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **Baltimore** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. | Sdy. | Slow |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Act | Act. | Act. |
| Supply | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | High | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Act. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Sdy. |
| Supply | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Act. | Act. | Sdy. | Slow | Act. | Sdy. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **St. Paul-Minneap.** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Sdy. | Sdy |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Inc. | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Slow | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow | Act. | Slow | Sdy. | Act. | Act. | Act. | Slow | Act. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Act. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | High | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Act |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Low |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Dec. | Dec. | Firm | Inc. | Firm | Inc. | Inc. | Firm | Dec. | Firm | Firm | Firm | Firm | Firm |

ered wire is reported. Demand for this wire has slackened somewhat owing to heavy stocks recently purchased by contractor-dealers in anticipation of a rising market. The conduit situation is unimproved. Deliveries are slow and factories will accept orders only subject to price on date of shipment. Since the expiration of the patent rights on resistor wires, inferior irons have appeared on the market. Jobbers are preparing for this competitive situation by handling a second-grade iron, which is good but not so expensive as the standard lines. Sockets and snap switches have advanced about 7 per cent. Credits are freer except in the contractor-dealer class. Collections have slowed up materially, the average length of time for outstanding accounts in the Northwest for February being fifty-seven days.

## Salt Lake City

The mining industry has recovered something of its old-time prosperity, five silver-lead mines alone depositing $600,000 each month in Salt Lake City banks from net earnings. The wool industry is also well stabilized, prices being at a high level. Sugar-beet growers continue to get bonus money on their 1922 crop as sugar prices tend upward. It is predicted that a building boom, unprecedented in Utah's history, will be launched this spring. Merchandise generally is moving better. Collections are much improved.

## San Franeiseo

California jobbers have cautioned their salesmen to watch all quotations and delivery promises because of changing markets, shortages of labor and raw materials in the East. Many large orders have been reported, this being a season of annual requirement purchases, such as eleven cars of fiber conduit, about $100,000 worth of paper cable for underground work in San Francisco and nearly 500,000 ft. of rubber-covered wire for overseas shipment. It is reported that electrical work in the new government tubercular and service sanitarium will amount to approximately $150,000. Radio business is improving steadily. Better broadcasting service is largely responsible for this.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## G. E. Erie Works to Make Same Type Transformers as Built at Pittsfield

To care for the increased transformer business of the General Electric Company, it is announced that arrangements have been made for the Erie works of the company to manufacture transformers of the same type as those built at the Pittsfield works. It is expected that production will be started some time next month.

Erie-built transformers will be manufactured along the engineering lines directed from the Pittsfield works. They will average in sizes from 1,000 kw. to 5,000 kw. in capacity and will be for voltage as high as 66,000.

## Anaconda Copper Advances Wages

The Anaconda Copper Mining Company has advanced miners' wages in the Butte district 50 cents a day, according to an announcement made last week. This is not the first advance in miners' wages announced in the copper industry since the beginning of the year, but it is the first action to be taken by one of the larger companies. It is expected that the advance by Anaconda will force other companies to announce a similar increase.

## Marshall Moves to St. Louis

The Marshall Electric Company, Chicago, originator of the Marshall system of constant-potential charging for storage batteries, will move its offices to St. Louis March 26. It will occupy the second floor at 3225 Locust Street. Harry B. Marshall is president, D. P. Ruger vice-president, and Thomas Marshall treasurer.

## Form Electric Club of Brooklyn

The Electric Club of Brooklyn has been incorporated with offices at 503 Myrtle Avenue, Brooklyn, N. Y. W. J. Shannon is president, D. M. Carr is vice-president, H. W. Bishop is treasurer, and A. Stone is secretary.

According to an announcement issued by the new club, its purposes are: "To foster trade or commerce for the interests of those having a trade, business, financial or professional interest in the electrical industry; to reform abuses relative thereto, and to secure freedom from unjust or unlawful exactions; to diffuse accurate and reliable information as to the standing of merchants or other matters; to procure uniformity and certainty in the customs and usage of trade and commerce and of those having a trade, business, financial or professional interest in the electrical industry; to settle differences between members, to promote a more enlarged and friendly intercourse between business in the electrical industry, and to enjoy as a corporation every right and privilege whatsoever to the fullest extent, pursuant to and in conformity with the acts of the Legislature of the State of New York relating to membership corporations."

## Torrington Company's Changes in New York

The Torrington Company, Torrington, Conn., has opened up a Torrington shop at 9-11 East Thirty-seventh Street, New York City, which will also be the headquarters for its New York sales office, its Eastern division sales headquarters and its general sales office for the entire vacuum-cleaner business, which is in charge of C. M. Bunnell as general sales manager.

## Charter Purchases Mietz Oil Engine Business

The Charter Gas Engine Company, Sterling, Ill., announces the purchase of the entire "Mietz" oil engine (also known as "Mietz & Weiss") business, heretofore carried on at 128 Mott Street and 430 East Nineteenth Street, New York City, by the August Mietz Corporation and the Reliance Oil Engine Corporation. This effects a merger and consolidation, under one management, of two of the oldest internal combustion engines in the world.

The "Mietz" oil engine was the pioneer semi-Diesel oil engine of the world. The first "Mietz" oil engine was built in 1895 by Mietz & Weiss, and since that time there has been placed in service about 375,000 hp. in all parts of the world.

The Charter Gas Engine Company is now moving from New York City to its plant at Sterling all of the physical assets comprising the "Mietz" engine and in the meantime is filling repair orders from New York City, so that there will be no interruption in repair service to "Mietz" engine users.

## Despatch Appoints J. R. Eves

The Despatch Manufacturing Company, Minneapolis, manufacturer of electric ovens, has appointed J. R. Eves as its heating specialist and engineer to serve as the district manager in the Buffalo territory, at 81 Eighteenth Street.

## Mine & Smelter Appointment

M. H. Carpenter, former manager of the San Francisco branch of the Mine & Smelter Supply Company, El Paso, Tex., electrical apparatus and supplies, has been appointed El Paso manager and will assume his new duties on April 1. Mr. Carpenter is well known to the mining trade of the West, having been with the Mine & Smelter firm for a number of years.

## Benjamin Electric Sales Gain 25 per Cent

The 1922 financial report of the Benjamin Electric Manufacturing Company, Chicago, showed the improved condition of the company over 1921. The balance for Dec. 31, 1922, totaled $272,317.64, while that of Jan. 2, 1922, was $122,390.64.

President R. B. Benjamin's report said in part: "There was a marked improvement in business activity during 1922, sales for the year showing an increase of more than 25 per cent over those of 1921, which resulted in a net profit for the company of $203,723.94. This compares with a loss in 1921 of $643,374.38, largely due to depreciation of inventory. During the year our 8 per cent five-year serial gold notes were amortized by the sale of $1,500,000 6 per cent first-mortgage fifteen-year sinking-fund gold bonds, thus lowering the high interest rate and burdensome maturities." The surplus accounts for the year 1922 are as shown in the accompanying table.

| | | |
|---|---|---|
| Balance—Jan. 2, 1922 | | $122,390.64 |
| Add: Profits for year | | 203,723.94 |
| | | $326,114.58 |
| Deduct: Dividends paid and accrued—first preferred | $48,650.00 | |
| Federal taxes paid | 2,040.00 | |
| Sundry adjustments | 3,106.94 | |
| | | 53,796.94 |
| Balance, Dec. 31, 1922 | | $272,317.64 |

## Standard Underground Cable Will Move to New Building in April

The Standard Underground Cable Company will move its general offices and Pittsburgh sales office from the Westinghouse Building, where it has been established for many years, to the company's new factory and office building at 100-108 Seventeenth Street early in April.

The new building is a four-story, brick-and-steel structure just completed and occupying the entire block between Sixteenth and Seventeenth Streets. This block was the site of the company's first factory, erected in 1883.

The Standard Underground Cable Company also announces the opening of a branch of its St. Louis sales office in the Scarritt Arcade Building, 817-819 Walnut Street, Kansas City. E. H. Shutt, who has been with the com-

pany for several years, will be in charge of the new office as district sales agent.

### Order for 2,000 Distribution Transformers Goes to Westinghouse

The Southern California Edison Company has placed with the Westinghouse Electric & Manufacturing Company an order for 2,000 distribution transformers, amounting to approximately half a million dollars. The size of the contract, which is one of the largest ever placed for such apparatus, can be estimated by the fact that there are more than thirty carloads of transformers in the order.

The transformers are to be used mainly for supplying power for motors for irrigating farm lands in southern California. This part of the state is dependent for practically all of its water supply upon wells, from which the water is pumped by electricity and distributed over the land in irrigation ditches, and for this reason the Southern California Edison Company is carrying out an extensive developmen of distribution lines throughout the territory which it serves.

### Gibb Opens Cleveland Office

The Gibb Instrument Company, Bay City, Mich., manufacturer of electric equipment, has opened a sales office in Cleveland, at 2104 East Superior Avenue, which will be in charge of W. O. Little.

### Storage Battery Firms Report $6,921,195 Profit from Sales

The Electric Storage Battery Company and the Willard Storage Battery Company, Philadelphia, in their consolidated balance sheet as of Dec. 31, 1922, show gross sales, less cost of manufacture, including all expenses incident thereto, of $11,966,681. Selling, administrative and general expenses, including salaries, commissions, engineering and branch office expenses, were $5,045,486. Profit from sales amounted to $6,921,195, and other income, $649,644. The listed profit before allowance for federal income tax was $7,570,834. Dividends paid during the year 1922 amounted to $3,196,685. The federal income tax for the year 1922 is estimated at $885,000.

### Federal Electric's Gross Earnings Gained $657,994

For 1922 the Federal Electric Company, Inc., Chicago, showed a gain in gross earnings over 1921 of $657,994. The total income from all sources during 1922 was $4,997,775.98. After deducting manufacturing expenses, net interest on expenses, the net income for the year carried to surplus amounted to $80,365.66. There was charged off from the surplus account $215,610.64. Samuel Insull, chairman of the board, in his annual report explained this as follows:

"For many years the company has carried on its balance sheet, under the caption "deferred charges," an item principally made up of the original cost of developing its branch offices and the brokerage upon the sale of its preferred stock. It has now been deemed wise to begin to make some substantial reductions in this item, and you will note in the surplus account an item of $215,610.64, which means that this amount has been taken from the deferred charges and has been charged against the surplus of the company."

### Monitor Controller Changes in Sales Organization

The Monitor Controller Company, Baltimore, manufacturer of the "just-press-a-button system" of automatic motor control for all kinds of motor-driven machinery, announces that C. J. Mundo has been appointed in charge of its Pittsburgh office in the Union Arcade Building, Pittsburgh.

G. H. Armstrong, who was formerly in charge of the Pittsburgh office, has been moved to Cincinnati with offices at 307 First National Bank Building. Mr. Armstrong's territory will comprise southwstern Ohio, southern Indiana and Kentucky.

**William Ryle & Company,** manufacturers of silk for electrical purposes, announce the removal of their office and salesroom to 381 Fourth Avenue, New York City.

**Charles G. Schwartz,** 217 Centre Street, New York City, manufacturer and dealer in electric motors, etc., has purchased the former seven-story plant of F. G. Smith, Inc., manufacturer of pianos, Fulton Street, Brooklyn, at a bankruptcy sale, for an amount of $47,000, and will use the factory for his business.

**The Royal Electric Supply Company,** 125 North Fourth Street, Philadelphia, has leased the building at 145-7 North Fourth Street for extensions in its business.

**The Master Electric Company,** Dayton, Ohio, announces the appointment of Herbert O. Sauer as sales service manager. Mr. Sauer's former experience has been in the advertising business with the National Cash Register Company.

**The Jeannin Electric Company,** Toledo, Ohio, manufacturer of motors, has appointed D. D. Gill, 712 Ferguson Building, Pittsburgh, as its representative in the western Pennsylvania and West Virginia territory.

**The Howell Electric Motors Company,** Howell, Mich., manufacturer of "Red Band" motors, recently opened a New York City office at 17 East Forty-second Street. R. W. Baker is in charge as district manager. A complete stock is now being carried in its New York City warehouse.

**The Cummings Manufacturing Company,** Indianapolis, manufacturer of battery boxes and kindred equipment, is moving into a new plant at 1118 South Harding Street, to provide for extensive increase in production.

## Western Electric's Record-Breaking Year

Gross sales of the Western Electric Company in 1922 amounted to $210,941,000, a gain of $21,176,000 over 1921 and the largest volume of business in the company's history, according to the annual report of President Charles G. Du Bois. Of this volume, $158,614,000 was sold to the associated companies of the Bell System and $52,327,000 to others. The net earnings for the year amounted to $9,235,890, from which was paid interest and amortization of bond discount of $3,904,097 and dividends of $4,186,857, leaving a balance carried to common stock of $1,144,936. The net earnings amounted to 7.7 per cent on the average investment for the year.

A careful survey of the prospects, according to President Du Bois, indicates that the billings in 1923 will somewhat exceed those for 1922. The unfilled orders at the end of 1922 aggregated $62,000,000, a smaller figure than at the end of either of the two preceding years. This is due to the greater expedition in completion of orders on account of the company's larger manufacturing facilities.

During the year the company paid off $15,000,000 of first mortgage bonds by funds secured from the sale of 150,000 shares of common stock to its common stockholders. It called for redemption its issue of $28,600,000 of 7 per cent convertible bonds. The holders of $24,679,600 worth of these bonds converted into the company's 7 per cent preferred stock, and the balance was paid off at 102. This preferred stock is owned by 8,698 shareholders, the average holding being twenty-eight shares. The company's financial position has been still further improved by reducing the bills payable from $29,050,000 to $12,000,000. Current assets and current liabilities are both somewhat less than at the end of the previous year, leaving the net working capital substantially the same at $70,469,326.

During 1922 the economic and industrial condition in foreign countries with few exceptions showed little or no improvement. Notwithstanding adverse conditions, the sales of the International Western Electric Company, which conducts the export and foreign business of the Western Electric Company, were in 1922 approximately $35,000,000 reckoned at current rates of exchange. This figure includes the sales of the principal foreign affiliated companies.

## New Incorporations

THE MORGANTOWN ELECTRIC COMPANY, Bowling Green, Ky., has been organized by Dr. A. M. Rowe, L. C. Alderson and H. W. Sublett.

THE CUMBERLAND HYDRO-ELECTRIC POWER COMPANY, Frankfort, Ky., has been chartered with a capital stock of $100,000 by Charles H. Morris, Frankfort; Samuel A. Tescher and Harny A. Mansfield, both of Indianapolis, Ind.

THE ELKTON (MD.) ELECTRIC COMPANY, INC., has been incorporated by John H. Ware, Jr., Phillip H. Close and Roy F. Simons. The company is capitalized at $100,000 and proposes to acquire and operate properties of Gilpins Falls Hydro-Electric Trust Estate.

THE RIPLEY (MISS.) ELECTRICAL LIGHTING & POWER CORPORATION has been chartered with a capital stock of $15,000 by Charles T. Nelms, Lee Cox and T. C. Hines.

## Foreign Trade Notes

AUTOMATIC TELEPHONES BEING CONSIDERED FOR JESSELTON, BORNEO.—The installation of automatic telephones in Jesselton, British North Borneo, according to *Commerce Reports*, is under consideration.

RADIO TELEGRAPH STATIONS FOR AMAZON VALLEY, BRAZIL.—Credit for the purpose of acquiring fourteen radio receiving stations, *Commerce Reports* states, has been asked by the Brazilian Minister of Transportation and Public Works. It is proposed to install these stations, which will be equipped with audion receivers and low-frequency amplifiers, in the States of Acre and Amazonas.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in South Africa (No. 5,777) of electric meat choppers and other supplies for butchers, dairy utensils and weighing apparatus.

An agency is desired in Brazil (No. 5,791) for electric welding machinery.

EQUIPMENT FOR POWER PLANTS WANTED IN CHINA.—Electric generating machinery to furnish electricity in ten towns in the Antung, China, consular district, *Commerce Reports* states, is desired by a Chinese firm, which is reported to have contracts to install these plants. The capacities of the proposed plants range from 11 kw. to 110 kw., or sufficient to supply 700 to 5,000 16-cp. lamps. The firm wishes to act as agent for an American manufacturer who desires representation in the district tributary to Antung. Further particulars may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., or district offices by referring to file No. 85,923.

EQUIPMENT FOR THE MANGAHAO POWER SCHEME, NEW ZEALAND.—Tenders will be received by the Public Works Department, Wellington, New Zealand, until May 29 for two petrol engines, generators and accessories and six single-phase transformers in connection with the Mangahao electric power scheme. Tenders will also be received until May 1 for oil filtering and testing sets in connection with the Mangahao project.

ELECTRIC CRANES FOR ANTWERP, BELGIUM.—Tenders will be received by the municipality of Antwerp for fifteen 2½-ton electric cranes for use at the Bassin Canal, Antwerp. Each crane to be provided with four motors, operating on direct current at 550 volts.

HIGH POWER WIRELESS STATION FOR AUSTRALIA.—Tenders will be received by the Amalgamated Wireless (Australia), Ltd., 97 Clarence Street, Sydney, Australia, until April 30 for furnishing and erecting a high-power duplex station within 100 miles of Sydney or Melbourne, capable of direct communication with England. Suitable corresponding stations to be provided in England and Canada.

POWER STATION FOR CHANGCHOW, CHINA.—A power station is being erected at Changchow, China, at a cost of $500,000, by the Chen Hwa Electric Company.

BRONZE AND COPPER WIRE FOR AUSTRALIA.—Tenders will be received by the Postmaster-General's Department, Australia, until April 10 for 700 tons of bronze wire and 1,900 tons of copper wire for the Post and Telegraph Department. Specifications and tender forms may be obtained of D. B. Edwards, official secretary, in charge of the office of the Australian Commissioner, 44 Whitehall Street, New York City.

## New Apparatus and Publications

WATER SOFTENER.—Bulletin No. 509 distributed by the Graver Corporation, East Chicago, Ind., describes the Graver "Zeolite" water-softening equipment.

THERAPEUTIC LAMP.—A new therapeutic lamp, known as "Q-Ray," has recently been placed on the market by S. Robert Schwartz & Brother, 546 Broadway, New York City.

ENTRANCE SWITCH.—The Palmer Electric & Manufacturing Company, 175 Fifth Street, Cambridge, Mass., has recently placed on the market a new type of entrance switch, known as the "Universal" meter-service switch.

CENTRIFUGAL PUMPS.—Bulletin No. 1,632-F issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes and illustrates its centrifugal pumps and centrifugal pumping units for power plants, waterworks and industrial plants.

AUTOMATIC TIME SWITCH.—An automatic time switch for henneries, known as the "Cackle" time switch, is being distributed by A. Hall Berry, 73 Murray Street, New York City.

ELECTRIC CLEANER.—The Hoover Suction Sweeper Company, North Canton, Ohio, has developed a new electric cleaner, household size, known as model No. 541.

ELECTRIC ELEVATING TRUCK.—The Cowan Truck Company, 80 Water Street, Holyoke, Mass., is distributing a leaflet, covering its new model "LLT" electric elevating truck.

ELECTRIC DISHWASHER.—An electric household dishwasher, "Hydrola," is being manufactured by the Hydrola Dishwasher Company, Hillsdale, Mich.

ELECTRIC TRAFFIC SIGNALS.—A bulletin describing three electrical directing traffic markers is being distributed by the Traffic Control, Inc., Milwaukee.

STEAM TURBINES.—"De Laval Equipment in a Textile Mill" is the title of a bulletin issued by the De Laval Steam Turbine Company, Trenton, N. J., which describes the use of low-pressure steam in a manufacturing plant for process purposes supplied from a turbine of special design.

LUMBER REGISTER.—The Industrial Service Company, Alisky Building, Portland, Ore., has issued a complete directory of the lumber industry and allied industries of the Northwest. It contains more than 6,400 names and indicates the type of mill and machinery it is equipped with, and also whether the power used is steam or electricity.

FACTORY BUILDINGS.—The Austin Company, Cleveland, has published a booklet entitled "Multi-Story or Single-Story—Which?" in which a comparison of the relative advantages and disadvantages of multi-story and single-story factory buildings is made.

RANGE BOILER COVER.—A new range boiler cover for use in connection with the "A & F" and other electric water heaters has been developed by the Arthur & Fowler Company, Spokane, Wash. The Washington Electric Supply Company, South 132 Monroe Street, Spokane, Wash., is distributor.

MOTOR DRIVE FOR AMMONIA COMPRESSORS.—"Synchronous Motor Drive for Ammonia Compressors" is the title of bulletin No. 41,316 issued by the General Electric Company, Schenectady, N. Y., which gives a brief treatment of the development of ice-making machines with suggestions as to the trend of progress.

INSULATION.—The Mica Insulator Company, 68 Church Street, New York City, has developed an insulation, known as "Armatite," which is made for all insulating and protective purposes.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

MILO, ME.—The Milo Electric Light & Power Company has petitioned the Public Utilities Commission for permission to purchase the property and holdings of the Sebac (Me.) Dam Company.

BOSTON, MASS.—The Edison Electric Illuminating Company plans to build an addition to its substation No. 12, on Chatham Street.

CAMBRIDGE, MASS.—Additions will be made to the power plant of the Atheneum Press, Ginn & Company, within the next year, which will include the installation of a 500-kw., 125-volt direct-current generating set. G. H. Kimball is superintendent of power department.

WORCESTER, MASS.—The New England Power Company has applied to the Department of Public Utilities for authority to issue $3,000,000 in capital stock, the proceeds to be used for the erection of transmission lines from Adams to Pittsfield, for construction work at Davis Bridge, N. H., and for other extensions and improvements.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company contemplates the construction of a new switch house, to cost about $1,000,000.

SOUTH NORWALK, CONN.—Extensions to the municipal electric plant, to cost about $300,000, are under consideration.

## Middle Atlantic States

BUFFALO, N. Y.—The Superior Elevator Company will install electric power equipment in connection with extensions to its grain elevator on the Buffalo River, to cost about $275,000.

CHATHAM, N. Y.—The Chatham Electric Light, Heat & Power Company has applied to the Public Service Commission for a franchise to extend its transmission line to Nassau through the villages of Brainard and East Nassau.

FILLMORE, N. Y.—Extensions and improvements contemplated by the Genesee Valley Power Company this spring include the erection of a 13,200-volt transmission line from East Koy to Portageville, the installation of a second 750-kva., 13,200-volt transformer bank, a second high-voltage lightning arrester and making several changes in the switching equipment at the outdoor substation at the Wiscoy hydro-electric plant. H. G. Young is superintendent.

HOOSICK FALLS, N. Y.—Plans are under consideration by the Board of Trustees for the installation of an ornamental lighting system.

NEW YORK, N. Y.—The United Electric Light & Power Company plans to build an electric generating plant on Locust Avenue, near 139th Street, Bronx, to cost about $800,000. Thomas E. Murray, 55 Duane Street, is engineer.

NEW YORK, N. Y.—The New York Edison Company will build a substation on Canal Place near 140th Street, to cost about $250,000. William Whitehall, 709 Sixth Avenue, is architect.

UTICA, N. Y.—Electric power equipment will be installed in the proposed new ice-manufacturing and ice-cream plant of the Dairyman's League Co-operative Association, 222 Lafayette Street, to cost about $100,000.

WATERVLIET, N. Y.—The London Steam Turbine Company, 50 Church Street, New York, plans to build a power house at its proposed plant for the manufacture of engines, to cost about $150,000.

MORRISTOWN, N. J.—The Central Jersey Power & Light Company, recently organized with a capital of $2,000,000, has acquired the Commonwealth Electric Company and the Morris & Somerset Electric Company and will merge the properties. Extensions and improvements are contemplated.

HANOVER, PA.—The Metropolitan Edison Company has issued $1,000,000 in bonds, the proceeds to be used to acquire the

Hanover Power Company and its subsidiary organizations, and for proposed extensions and improvements.

MARTIN'S CREEK, PA. — The Alpha Portland Cement Company and not the Atlas Portland Cement Company, as stated in these columns last week, will make extensions and improvements in the power plant at its local mills.

McKEE'S ROCKS, PA.—The W. L. Singer Ice Company plans to rebuild its power house, recently damaged by fire, including ice department, causing a loss of about $75,000.

PHILADELPHIA, PA. — Electric power equipment will be installed in the proposed addition to the plant of Stephen F. Whitman & Son, Inc., 415 Race Street, to cost about $500,000.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad Company will build a power plant in connection with its proposed car dumper at Port Richmond, to cost about $1,500,000.

READING, PA.—The plant of the Reading Ice & Cold Storage Company will be equipped for electrical operation throughout, at a cost of about $90,000.

CUMBERLAND, MD. — The West Penn Power Company contemplates extensions and improvements to the system of the Edison Electric Illuminating Company, recently acquired.

HAGERSTOWN, MD. — The Maryland Glass Sand Company is planning to install a power plant at its works near Hancock and to equip all departments for electrical operation.

FRANKLIN, W. VA.—Plans are being prepared for the construction of a municipal electric plant on the South Branch of the Potomac River.

HUNTINGTON, W. VA.—Bids will be received by the United State Engineer Office until March 27 for two switchboards (Circular 104).

NORTH EMPORIA, VA. — The Little-Dewey Veneer Company contemplates the construction of a power house at its proposed local mill.

STUART, VA.—W. H. Clark, owner of the local electric plant, is in the market for an 80-kw. electric generator set, with auxiliary machinery.

SUFFOLK, VA.—The ice and cold-storage plant of N. R. Withers is being remodeled. The entire plant will be equipped with electrically driven machinery. Henry B. Reardon, Jr., Norfolk, is consulting engineer.

WASHINGTON, D. C.—Bids will be received by the Commissioners of the District of Columbia, District Building, until March 28 for furnishing and installing an electric time and bell system in the Shaw Junior High School.

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 5 for furnishing watt-hour meters, motors, steel conduit, Pierce pins, receptacles, sockets, white hard-horn fiber, varnished silk, spark plugs, vacuum tubes, etc.

## North Central States

DETROIT, MICH. — The Ford Motor Company will build a generator plant at its factory, to cost about $45,000, exclusive of machinery.

JACKSON, MICH.—The Michigan Seating Company will build a power house, 75 ft. by 130 ft. at its plant.

MARYSVILLE, OHIO.—Bids will be received by the Department of Public Welfare, Ninth and Oak Streets, Columbus, until April 4 for construction of cottage, to cost $150,000; superintendent cottage, $35,000, and power plant and chimney, $20,000, at the Reformatory for Women at Marysville.

WARREN, OHIO. — The Ohio Public Service Company has issued $2,675,000 in bonds, part of the proceeds to be used for extensions.

CHINNVILLE, KY.—The Kentucky Refractories Company, Ironton, contemplates the construction of a power house in connection with its proposed local refractory plant, to cost about $80,000.

LOUISVILLE, KY.—The Louisville Gas & Electric Company contemplates extensions and improvements to its hydro-electric plant at Ohio Falls.

OWENSBORO, KY.—Bolger & Medley plan to install a power house in connection with a new brick and tile products plant, to cost about $65,000.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company is planning extensions and improvements during the present year involving an expenditure of about $1,250,000. The proposed work will include the installation of a 27,000-hp. turbine with boilers, condensers and the erection of a large smokestack at the Kentucky Avenue power station; installation of a storage battery and direct-current motor-generator sets in substation in the rear of central offices; installation of new cables in conduits in the downtown business district; installation of copper cables, both aërial and underground; construction of an 8,000-hp. substation at Speedway City, and a substation at Keystone Avenue and the L. E. & W. railroad to furnish electricity for lamps and motors for Broad Ripple district.

JASPER, IND.—Work will begin at once on improvements to the municipal power plant, to cost about $60,000. J. R. Lowe, 111 Third Street, Louisville, Ky., is consulting engineer.

KOKOMO, IND. — The Public Service Commission has authorized the Northern Indiana Power Company to issue $218,000 in capital stock and $470,000 in bonds, the proceeds to be used for improvements, including the erection of a transmission line from Kokomo to Converse, from Kokomo to Noblesville and from there to Sheridan. Improvements will be made to the substations at Kirklin, Noblesville, Kokomo and other places.

MARSEILLES, ILL. — Electric power equipment will be installed in the proposed baking plant to be erected by the National Biscuit Company, to cost about $500,000. A. G. Zimmerman, 85 Ninth Avenue, New York, is architect.

GREEN BAY, WIS.—The installation of ornamental lamps in Bay View Beach Park, Whitney Park and possibly other parks is under consideration.

WABENO, WIS.—The Wabeno Lighting Company contemplates improvements to its plant, including the installation of a new engine.

WAUSAU, WIS.—The Wisconsin Valley Electric Company contemplates installing a new generator and turbine at its Jersey City power plant.

WHITEWATER, WIS.—Plans are under way by the Wisconsin Gas & Electric Company, Racine, for the erection of a 132,000-volt transmission line from the new generating plant of the Milwaukee Electric Railway & Light Company on the lake shore to Whitewater. A site on South Franklin Street has been acquired for the substation.

WILLMAR, MINN.—Plans are being prepared for a municipal electric power plant, to cost about $100,000. Cory & Lecoco, Aberdeen, S. D., are engineers.

CEDAR RAPIDS, IOWA. — The Iowa Railway & Light Company is planning to erect a 33,000-volt transmission line between Boone and Nevada, 24 miles. The proposed line will also connect up the generating stations at Cedar Rapids, Boone and Perry.

FORT MADISON, IOWA.—Improvements are contemplated by the Fort Madison Electric Company, involving an expenditure of about $50,000.

KANSAS CITY, MO.—The Council is considering the construction of a new fire house, the purchase of fire-alarm equipment, underground cables and equipment, etc., to cost about $216,000.

LAKE NORDEN, S. D.—Steps have been taken by business men of Lake Norden and Hayti to secure an improved lighting system for both towns. The question of having transmission lines extended to the towns is under consideration.

ELMDALE, KAN. — A special election will be held on April 2 to vote on the proposal to issue $12,000 in bonds for the erection of a transmission line from Cottonwood Falls to Elmdale.

FREDONIA, KAN.—At an election held recently the proposal to issue $150,000 in bonds for the installation of a municipal electric light plant was carried.

TOPEKA, KAN.—The Ismert & Hincke Milling Company, Washington and Tenth Streets, plans to build a power house in connection with other plant extensions.

WICHITA, KAN.—Bids, it is reported, will soon be asked by the city manager for the installation of a new fire-alarm system, to cost about $60,000.

## Southern States

GREENSBORO, N. C.—Plans are being prepared for the installation of ornamental lamps on portions of Market and Washington Streets. The street-lighting service is furnished by the North Carolina Public Service Company.

CHARLESTON, S. C.—The F. P. Burton Lumber Company plans to rebuild its power house and mill, recently destroyed by fire with loss of about $400,000.

AUSTELL, GA.—Plans for the proposed chair-manufacturing plant to be erected by Charles J. Shelverton and associates include a power plant.

ROME, GA.—Electric power equipment will be installed in the proposed addition to be erected at the Berryton Cotton Mills, to cost about $160,000.

GAINESVILLE, FLA.—A bond issue of $300,000 is being arranged for extensions to the municipal power plant and waterworks and sewerage system.

MIAMI, FLA.—The Coral Gables Utilities Company, recently organized with a capital stock of $500,000, has tentative plans for the construction of a power plant and system. George E. Merrick is president.

SEBRING, FLA.—Plans are under consideration for extensions and improvements in the municipal light and water plant, recently acquired from the Sebring Light & Water Company.

CHATTANOOGA, TENN.—The Tennessee Electric Power Company is preparing plans for a 20,000-hp. hydro-electric plant at Grand Falls. It is also proposed to build a 27,000-hp. steam-operated electric plant at Hales Bar. The cost of the plant is estimated at about $3,000,000.

KNOXVILLE, TENN.—The Knox Porcelain Company, recently organized will install a power plant in connection with its proposed local works for the manufacture of electrical porcelain specialties. J. N. House is president.

ROCKWOOD, TENN.—The Roane Iron Company, Chattanooga, plans to build a power plant at its local ironworks. The equipment will include a 1,500 kw. turbo-generator.

EUTAW, ALA.—A bond issue of $45,000 has been sold, the proceeds to be used to establish a municipal lighting plant and waterworks.

TUSKEGEE, ALA.—The West Memphis Lumber Company, Memphis, Tenn., plans to build a power plant at its proposed local lumber mill, to cost about $100,000.

HERMITAGE, ARK.—M. C. Sanders is organizing a company to construct and operate a power plant for local service.

ALEXANDRIA, LA.—The Missouri Pacific Railroad Company and the Texas Pacific Railroad Company, St. Louis, Mo., plan to build a power house in connection with new joint shops, to cost about $1,000,000.

NEW ORLEANS, LA.—The Todd Shipyards Corporation, 25 Broadway, New York, will build a power house in connection with its proposed drydock and shipbuilding plant, to cost about $3,000,000.

HELENA, OKLA. — Extensions to the municipal electric distribution system are under consideration. J. D. Bomford, Masonic Temple Building, Enid, is engineer.

PAULS VALLEY, OKLA.—Plans have been completed and bids, it is understood, will be called at once for the construction of a transmission line for municipal service. V. V. Long & Company, 1300 Colcord Building, Oklahoma City, are engineers.

BYERS, TEX.—Steps have been taken by the Chamber of Commerce for a municipal lighting plant and ice-manufacturing plant.

CHILDRESS, TEX.—The Texas Central Power Company has authorized plans for the construction of electric power plants, with ice-manufacturing plants adjoining, at Childress, Vernon and Beeville. The total cost is estimated at $225,000.

DALLAS, TEX.—The Dallas Mill Company, recently organized with a capital stock of $1,000,000, plans to build a power plant in connection with its cotton mill, to be erected on the Love Aviation Field.

DALLAS, TEX.—Plans are under consideration by the St. Louis & Southwestern Railroad Company, known as the Cotton Belt Railroad, Cotton Belt Building, and the Texas Electric Railroad Company for equipping the railroad from Plano to Greenville for electrical operation. The cost is estimated at about $600,000. J. G. Hailey is electrical engineer of the Texas Electric Railroad.

DEL RIO, TEX. — The Texas Central Power Company is planning to reconstruct its local distribution system this summer.

EL PASO, TEX.—Plans are under way for the installation of an ornamental lighting system in the business district.

ENNIS, TEX.—Plans have been approved for a municipal electric plant, to cost $50,000, for which, it is understood, bids will soon be asked.

FORT WORTH, TEX.—The Trinity & Brazos Valley Railroad Company contemplates the construction of a large substation

in connection with the electrification of its line from Hillsboro to Cleburne, to cost about $150,000.

HARLINGEN, TEX. — Negotiations are under way between E. B. Neiswanger and associates for the purchase of the municipal electric plant. If the deal goes through a new central station will be built. The proposal to sell the plant will be submitted to the voters on April 10.

KOSSE, TEX.—The Kosse Light & Power Company contemplates extensions and improvements to its system. Its capital stock has been increased from $12,000 to $25,000.

SMITH'S BLUFF, TEX.—The Humphreys-Pure Oil Company, Pure Oil Building, Columbus, Ohio, plans to build a power plant in connection with a local oil refinery, to cost about $2,500,000.

TERRELL, TEX.—The Texas Power & Light Company, Dallas, is extending its high-tension transmission line from Terrell to Wills Point, a distance of 12 miles.

WACO, TEX.—The Waco Lime & Products Company, recently organized, contemplates the construction of a new local plant, including power house, to cost about $125,000. B. F. Litsinger is president.

WILLS POINT, TEX.—An election will be held on April 3 to vote on the proposal to issue $25,000 in bonds to establish a municipal electric light light and power plant.

## Pacific and Mountain States

PROSSER, WASH.—The installation of a municipal electric plant is under consideration.

SEATTLE, WASH.—Bids will be received by the city of Seattle until April 13 for the erection of 100 miles of 165,000-volt transmission line and telephone line from the Gorge Creek plant of the Skagit River development. The line will transmit power from the Gorge Creek plant to a substation outside of the city. Specifications will be complete March 30. Further information may be obtained at the office of the Skagit River Development, Alaska Building. C. F. Uhden is chief engineer.

VANCOUVER, WASH. — The Clarke County Water, Light & Power Company, recently organized, is having plans prepared for a transmission system for service at Sifton, Battle Ground, Brush Prairie, Orchards and vicinity, to cost about $50,000.

VANCOUVER, WASH.—A new substation (to cost about $50,000) is being erected here by the Northwestern Electric Company, Portland, Ore. The company also plans to erect a 66,000-volt transmission line from Camas to Vancouver, to cost about $75,000.

VERNONIA, ORE.—The Vernonia Light & Power Company has begun preliminary work on the erection of its electric distribution system within the city limits. Work will soon begin on the construction of the dam in Rock Creek, about 9 miles from here.

HUNTINGTON BEACH, CAL. — Plans are under consideration for the installation of a lighting system on the state highway, to cost about $20,000.

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission until March 27 for potential transformers and current transformers (Spec. P-306-350)

MODESTO, CAL.—The Modesto Irrigation District plans to erect electric substations, transmission and distributing lines to cost about $300,000. Percy Jones is chief engineer.

SAN FRANCISCO, CAL.—Arrangements are being made for the installation of a third generating unit of 22,000 kw. capacity in the Caribou plant on the North Fork of the Feather River of the Great Western Power Company of California. Bids will soon be called for hydraulic and electrical equipment. The cost is estimated at about $1,500,000.

SAN FRANCISCO, CAL.—Work will soon begin on the second of the chain of power houses on the Pit River to be erected by the Pacific Gas & Electric Company, which will ultimately develop more than 600,000 hp. The plant which will be known as Pit River plant No. 3, will be equipped with three 27,000 kva. units and will cost about $17,000,000. The plant will operate under a static head of 313 ft. The plant will be located about 12 miles below Pit River No. 1 and will involve construction of a diversion dam 125 ft. high and a tunnel 22,000 ft. in length, having a carrying capacity of 3,000 cu.ft. per second.

PHOENIX, ARIZ.—An additional 7,500-kw. generating unit will be installed at the hydro-electric plant at the Roosevelt Dam on Salt River by the Salt River Valley Water Users' Association. Nineteen control gates will be added in the spillways of the dam, and another dam and power house will be built further down the river to control the release of water for irrigation to permit of higher load factor on the present plant at the dam. The Water Users' Association will issue $1,800,000 in bonds for financing the project.

BUTTE, MONT.—Arrangements are being made by the Montana Power Company to begin work on the construction of its Mystic Lake hydro-electric plant. The purposed plant will be located in the gorge of the Rosebud River, in the Beartooth Mountains, 43 miles from Columbus, and will have a capacity of 15,000 hp.

COLORADO SPRINGS, COL.—The City Council has passed an ordinance providing for the installation of an ornamental street-lighting system on East Platte Avenue, to cost about $17,528.

GOLDEN, COL.—The City Council has granted the Golden Cycle Mining Company permission to erect an electric transmission line from the Pikeview mine to the mill on the West Side.

## Canada

ST. JOHN, N. B.—The installation of a new lighting system, to cost about $79,000, has been recommended to the City Council by B. Wilson, electrical engineer.

STOUFFVILLE, ONT.—The ratepayers have approved a bylaw appropriating $11,000 to secure Hydro power from Bond Lake.

THOROLD, ONT.—The purchase of a switchboard and lead-covered cable is contemplated by the Public Utilities Commission.

TIMMINS, ONT.—The Northern Canada Power Company is planning to build a fourth hydro-electric plant on the Mattagami River at Kenogamissee Falls, to develop 5,000 hp. under a 70-ft. head. The cost including transmission line is estimated at $750,000.

WOODSTOCK, ONT.—Extensions to the municipal electric light and power system, to cost about $25,000, are under consideration by the Public Utilities Commission.

## Electrical Patents

**Announced by U. S. Patent Office**

(Issued Feb. 27, 1923)

1,447,107. ELECTRIC HEATER; E. A. Umble, Denver, Col. App. filed May 2, 1921. Heating metallic objects by immersion liquid.

1,447,134. PROTECTIVE DEVICE FOR ELECTRIC FLATIRONS; W. T. Hoofnagle, Glen Ridge, N. J. App. filed Feb. 10, 1921. Fusible plug opens circuit of predetermined temperature.

1,447,140. PROCESS OF EXTRACTING PRECIOUS METALS; C. C. McBride, Sanger, Cal. App. filed April 23, 1921. By electrolytic process.

1,447,143. MANUFACTURE OF LEAD ALLOYS; W. Matheslus, Charlottenburg, Germany. App. filed Oct. 21, 1922. Alkaline earth metals produced by electrolyzing their fused salts.

1,447,163. COMMUTATING MEANS FOR DYNAMO-ELECTRIC MACHINES; F. T. Hague and O. Needham, Pittsburgh, Pa. App. filed March 9, 1918. Neutralizing transformer electromotive forces produced by exciting field.

1,447,164. MULTIPLE WINDING FOR ALTERNATING-CURRENT MACHINES; F. T. Hague, Pittsburgh, Pa. App. filed Jan. 16, 1919. For low-voltage, high-current alternating-current generators.

1,447,165. RADIO METHOD AND APPARATUS; F. A. Kolster, Washington, D. C. App. filed Jan. 30, 1919. Directional sending and receiving apparatus.

(Issued March 6, 1923)

1,447,171. SWITCH; R. B. Benjamin and E. A. Detrick, Chicago, Ill. App. filed June 21, 1915. Full switches for lamp sockets.

1,447,172. ELECTRICAL SWITCH; R. B. Benjamin, Chicago, Ill., and T. H. Harris, Dayton, Ohio. App. filed Sept. 11, 1917. Pull switch for electric light fixtures.

1,447,181. HEATING PAN; W. Richmond, Chicago, Ill. App. filed March 26, 1920. Thermostatically controlled pad for treating mastoid or sinus conditions.

1,447,194. THERMAL CONTROLLER FOR ELECTRIC MOTORS AND THE LIKE; J. R. White, Washington, D. C. App. filed July 3, 1919. Rheostat contact arm consists of a spring held in place by magnet when circuit is closed.

1,447,204. PLURAL MODULATION AND DEMODULATION CITCUITS; L. Espenschied, Queens, N. Y. App. filed Sept. 30, 1919. Multiplex transmission of radio signals.

1,447,214. RADIATOR HEATER; J. A. Kurrus, East St. Louis, Ill. App. filed June 14, 1921. Small electric heater for automobile radiators to prevent freezing of water.

1,447,236. MAGNETIC REPULSION OR ATTRACTION RELAY; C. H. Chaney, Detroit, Mich. App. filed Dec. 15, 1920. Automatic regulator for electric furnaces.

1,447,238. LIGHTING FIXTURE; D. Crownfield, Cambridge, Mass. App. filed Dec. 3, 1919. Double reflectors used for diffused lighting.

1,447,241. ELECTRICAL SYSTEM FOR AUTOMOBILES; G. Fornaca, Turin, Italy. App. filed Jan. 12, 1920. Motor-generator for automobiles.

1,447,282. GENERATOR; L. A. Darling, Philadelphia, Pa. App. filed April 30, 1919. Turbo-generator unit for steam locomotives.

1,447,318. BATTERY-CHARGING SYSTEM; A. H. Neuland, Jersey City, N. J. App. filed Dec. 17, 1917. Automobile battery-charging system.

1,447,357. FLEXIBLE ELECTRODE; D. B. Price, Newtonville, Mass. App. filed Feb. 13, 1920. Non-corrosive terminals for storage batteries.

1,447,359. VENTILATED LINE INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Nov. 26, 1918. A point midway between supporting pin and line.

1,447,399. DEVICE AND METHOD FOR MAKING STEREOSCOPIC X-RAY PICTURES; L. W. Pease, Chicago, Ill. App. filed June 6, 1919. Arrangement of special film plate.

1,447,405. LENS RING; E. R. Barany, Brooklyn, N. Y. App. filed July 26, 1922. For flashlight cases.

1,447,430. SCREEN FOR X-RAY PHOTOGRAPHY; G. W. Richardson, Chicago, Ill. App. filed Feb. 27, 1919.

1,447,464. STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES; E. Friedrichs, Stuttgart, Germany. App. filed Aug. 11, 1921.

1,447,477. ELECTRICAL STARTER FOR EXPLOSIVE ENGINES; G. K. Knapp, Nuremberg, Germany. App. filed Oct. 11, 1920.

1,447,480. ELECTRIC SYSTEM; S. J. Matthews, Fort Clinton, Ohio. App. filed March 7, 1917. Small plant for lighting, heating, power, etc.

1,447,481. THERMIONIC VALVE; H. Morris-Airey and G. Shearing, Portsmouth, and S. R. Mullard, Southfield, London, England. App. filed Aug. 22, 1921. Conductor and seal for thermionic valve.

1,447,509. TELEPHONE METERING SYSTEM; A. M. Crichton, Uniontown, Pa. App. filed April 13, 1920. Meter on subscriber's instrument must be partially actuated before getting central.

1,447,517. AUTOMATIC TEMPERATURE-CONTROL MEANS FOR ELECTRIC FURNACES; T. A. Reid, East Orange, N. J. App. filed Aug. 6, 1920. Thermocouple inserted in the furnace maintains through suitable apparatus predetermined temperature.

1,447,531. REVOLVING TELEPHONE STAND; E. F. Carlson, Brooklyn, N. Y. App. filed Nov. 3, 1921. Compact arrangement of a number of telephones on one stand.

1,447,532. GAS IGNITER; H. S. Cederholm, Wellington, New Zealand. App. filed March 3, 1921. Fine platinum wire heated by small battery.

1,447,570. SYSTEM OF CONTROL OF ELECTRICAL CIRCUITS; W. H. Powell, Milwaukee, Wis. App. filed April 22, 1918. Control of armature reaction for booster rotary converters.

1,447,574. ELECTRIC TOASTER; E. A. Rutenber, Milwaukee, Wis. App. filed March 28, 1922. Automatically turns bread when side is lowered.

1,447,593. FURNACE; W. R. Macklind, Chicago, Ill. App. filed Jan. 24, 1920. Continuous rotary furnaces, for treating lithopone.

1,447,646. SELENIUM CELL OR BRIDGE; C. W. Cherry, Boston, Mass. App. filed April 13, 1922. Large active surface area provided.

1,447,657. ELECTRODE FOR ALKALINE STORAGE BATTERIES; P. G. and E. Roesel, Paris, France. App. filed Sept. 14, 1920.

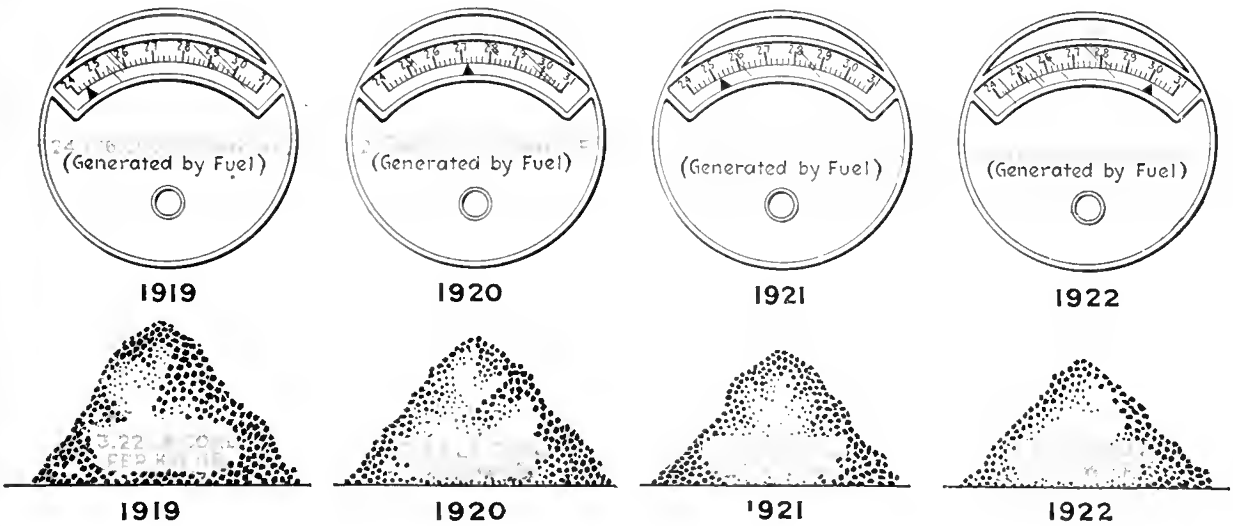
1,447,730. ELECTRIC WRITING INSTRUMENT; C. R. Post, New Rochelle, N. Y. App. filed Nov. 24, 1920. Electrical heated stylus for check or document writing.

1,447,747 AND 1,447,748. METHOD OF AND APPARATUS FOR OPERATING SYNCHRONOUS TELEGRAPH SYSTEM; G. R. Benjamin, Jersey City, N. J. App. filed Aug. 8, 1919. Automatic cable transmitters for synchronous printing telegraph systems.

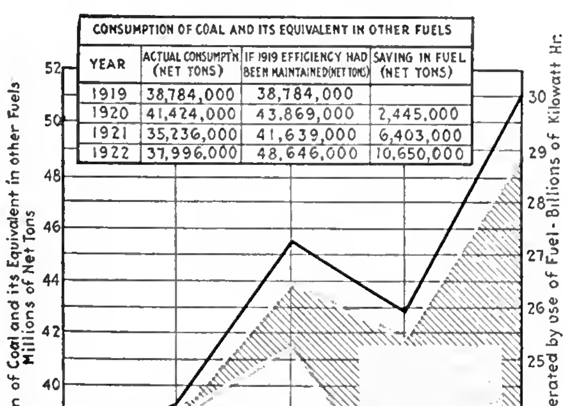
# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## 19,498,000 Net Tons of Coal Saved in Three Years by Central Stations Through Increased Efficiency in Fuel Consumption




## Increased Efficiency In Fuel Consumption Saved Central Stations $92,128,000 In Three Years



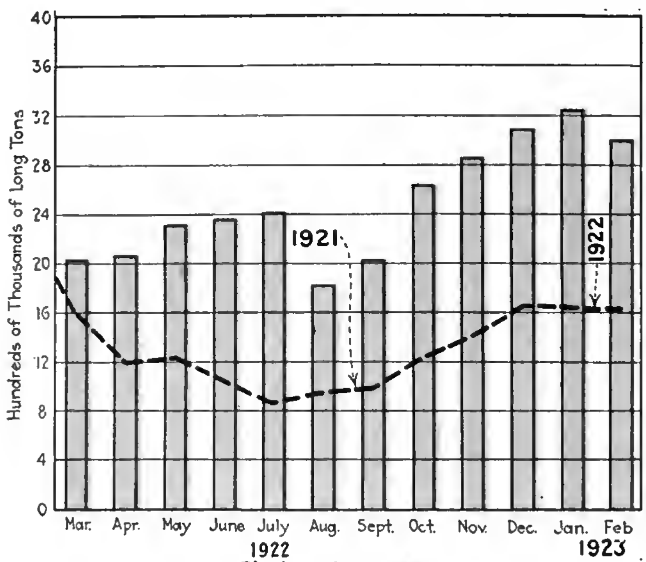

CONSUMPTION OF COAL AND ITS EQUIVALENT IN OTHER FUELS

| YEAR | ACTUAL CONSUMPT'N (NET TONS) | IF 1919 EFFICIENCY HAD BEEN MAINTAINED (NET TONS) | SAVING IN FUEL (NET TONS) |
|---|---|---|---|
| 1919 | 38,784,000 | 38,784,000 | |
| 1920 | 41,424,000 | 43,869,000 | 2,445,000 |
| 1921 | 35,236,000 | 41,639,000 | 6,403,000 |
| 1922 | 37,996,000 | 48,646,000 | 10,650,000 |

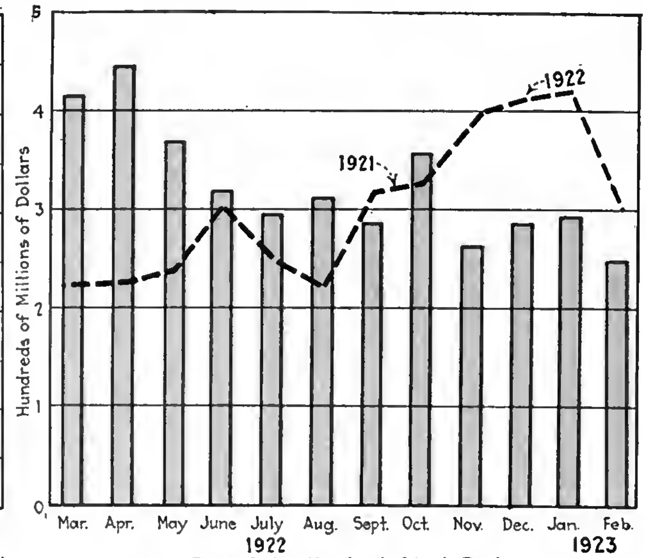
## An Accomplishment in Increased Efficiency

EFFICIENCY of operation is one of the prime essentials of modern industry, and the elimination of waste has become the great problem of the engineer. The results of the studies which the United States Geological Survey has made of the consumption of coal per kilowatt-hour of electrical energy manufactured point to large gains in the efficient operation of the boiler room. A saving of almost three-quarters of a pound of coal per kilowatt-hour means not only cheaper production of power, but also a saving of many millions of tons of coal annually. Not only is the industry itself deriving large results from the more efficient consumption of coal, but the industry is rendering large service to the public in thus conserving fuel. More than nineteen million tons of coal were saved in three years by the central station, a quantity of fuel which represents almost two-thirds of the annual consumption of coal by the public utility generating plants of the country, including electric railway plants. The figures indicate that an even higher efficiency in fuel consumption may be expected in the future.

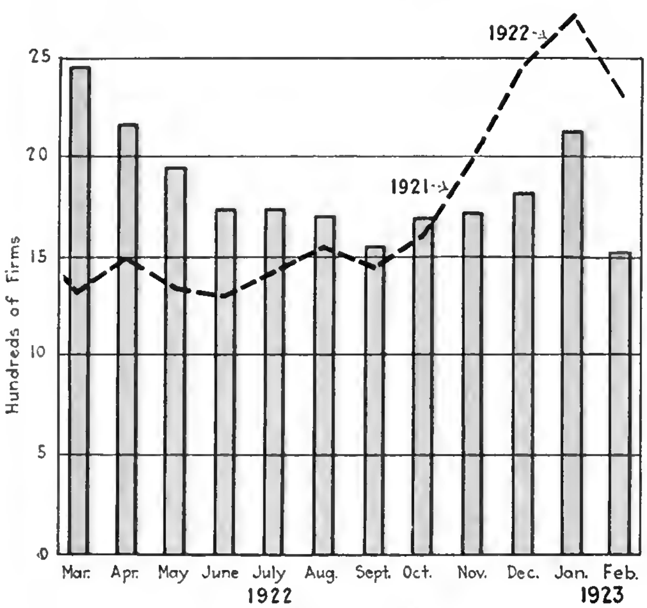
## How the Primary Industries Are Trending



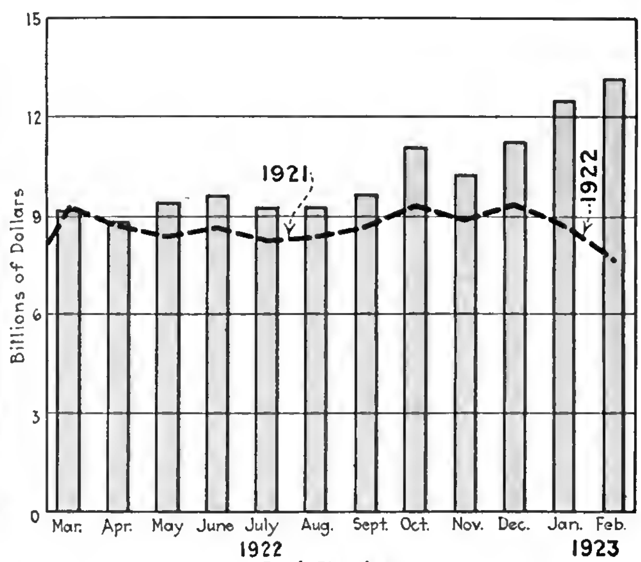

Pig-iron Production




Total Bond Sales, New York Stock Exchange

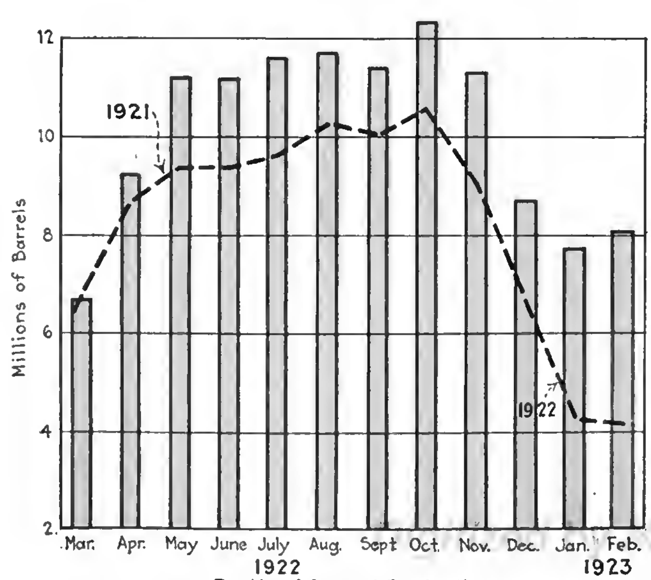



Business Failures




Bank Clearings

(Outside of New York City)




Portland Cement Production

## An Indicator of Record Construction

February being from two to three days shorter than the other months of the year, it is inexpedient to compare the total output of any commodity during February with the output of that commodity during any other month. But the fact that the output of Portland cement during February was almost double that reported for February last year is significant. Cement production in February of last year was almost three and a half million barrels under the January output, while this year the February output is about two hundred thousand barrels over that reported for January. Only a large construction program for the spring throughout the country could call for such large quantities of cement. The record construction witnessed during the past year is evidently in a fair way toward being eclipsed. And a large building program means large purchases of electrical appliances and supplies, and ultimately increased electrical energy requirements.

# Electrical World

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## The Practical Aspects of Power Transmission

AS THE cost of coal rises, decade by decade, the value of water power in any country tends steadily to rise. Naturally the cost of hydro-electric plant construction and development likewise tends to increase with time, but the value of the potential energy in high-level water is always augmenting. This is but another way of saying that as the industrial application of petrified solar heat, millions of years old, rises in price the value of solar-heat energy, a few months old, in lifting the top layers of the oceans to mountain levels steadily appreciates. On the other hand, the waterfalls that are most readily accessible, least entangled with artificial restrictions, and nearest to a power market, are the ones that naturally first become developed; while the more expensive, remote and handicapped waterfalls have to wait longer before men will venture their savings upon developing them. Eventually, we may expect to see a great hydro-electric development of power in all parts of the world, but the limit to which it can be carried depends upon the cost at which power can be produced by other and competitive means.

There is no limiting distance recognized in engineering as fixing the range of electric power transportation over one and the same continent. If it were necessary to carry power electrically from the Atlantic to the Pacific Coast, it is probable that engineers would undertake the project. They could not, however, do so in competition with locally produced power at the motor end of the line. The entire question of electric power transmission is a technical one circumscribed by economics.

The project of a long power-transmission line involves a consideration of electrical principles, with experience in their application and of economics in execution. There is no possible way of reducing the entire project to a formula. Rather is the solution of the problem to be regarded as a judicious compromise among many formulas. Among the matters to be decided are the routing of the line, the number and spacing of the towers with a view to their safe loading, the number of conductors, their spacing and arrangement, the nature of the conductors and their suspension for safety from ice and wind, the nature and support of the insulators, the character of lightning protection, the switching facilities, the transformer installations, the generator, motor and protective apparatus.

In designing a line each of these elements, as well as various others, must receive careful attention from the standpoint of cost, delivery, installation, repairs and renewal. The best conditions from the standpoint of one element will probably not be the best from the standpoint of another element. The finally accepted design will have to be a compromise among a number of competing aims. Nevertheless, the designer of each should know the best conditions for each element considered by itself and should apply the appropriate formulas for the summarizing of those conditions in arithmetical form.

When we consider the purely electrical side of this large problem of long transmission lines, we recognize that hyperbolic-function theory is the simplest and shortest way to arrive at numerical results. It seems likely, however, that before long it will be recognized as desirable to construct a model artificial line in advance of the actual one and to test its behavior under various and complex conditions simulating those of expected practical service.

# David Barker Rushmore

*An engineer and executive who has helped build the light and power industry and has contributed largely to engineering societies and associations.*

THE magnitude and importance of the power and mining divisions of the electrical industry result from the hard and intelligent work of engineers in these fields. In this work the power and mining department of the General Electric Company has had a large part, and with this department David B. Rushmore has long been intimately associated.

Through his personal influence and work he built up and organized a competent engineering staff for the department, losing no chance to widen its activities. Not the least of his contributions to the department and to industry as a whole has been his power to arouse the enthusiasm of engineers in their work and to put into practice the idea of co-operation between engineers. He has devoted much of his time to engineering society activities and has encouraged young engineers to contribute to their programs. Because of his recent appointment to the consulting engineering staff of the General Electric Company he should be able to contribute still more to the industry from his wide experience and knowledge.

Aside from his executive duties. Mr. Rushmore has found time to specialize on the equipment used in power production and transmission and has contributed many articles to the technical press on alternating-current and direct-current machinery, hydro-electric equipment and high-tension phenomena.

Mr. Rushmore was born in Old Westbury, N. Y., in 1873. After graduation at Swarthmore College (from which school he received the degree of C. E. in 1897) he went to Cornell and gained an M. E. degree in 1895. His early work was with the Pond Machine Tool Company, the Westinghouse Electric & Manufacturing Company and the Royal Electric Company of Montreal. In 1899 he joined the staff of the Stanley Electric Manufacturing Company of Pittsfield, and he entered the employ of the General Electric Company in 1905. Since 1907 he has been the directing head of the power and mining department.

Mr. Rushmore is a fellow of the American Institute of Electrical Engineers, member of the American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Mining Engineers, American Mining Congress, National Electric Light Association, New York Electrical Society, Société Française des Electriciens (France), Institution of Electrical Engineers (Great Britain), American Electrochemical Society, American Iron and Steel Institute and various other clubs and organizations.

# Editorial Comment

Electrical World, March 31, 1923

Volume 81 Number 13

### Public Enlightenment on Engineering Questions

NEXT in importance to knowing a thing is knowing how to impart the knowledge to others in such a way that they also will know it, and it is this accomplishment that many engineers and educators lack. Indeed, there are few men who, with the gifts of Huxley, can popularize science in a way to make it understood and appreciated. Most leaders in scientific thought, while they do not possess the genius of Einstein, like him are unable to express themselves in a language understood by the rank and file. Unfortunately, many engineers are also in this class.

For example, there was a symposium in New York last week on the possibility of bringing water power to the metropolis. At least half a dozen engineers of wide repute contributed to the discussion, which at the moment is of great popular and political significance. The opportunity for enlightening the politicians and the public was there. There was no question of the competency of those on the program to speak authoritatively, nor was there any doubt of popular interest in the subject matter, and yet the daily papers found little to report. Apparently the discussion was all over the heads of the populace and information on a vital engineering and civic topic sadly needed at this juncture was not obtainable. Reputable and high-class dailies have expressed a willingness and a desire to print more on engineering and scientific matters in their columns. They complain, however, that chief dependence has, in the words of one of them, to be placed on "interested and intelligent amateurs," because experts usually either will not or cannot make themselves intelligible to ordinary readers. News that is of "a nature so technical and abstract that it can be understood only by the possessors of a highly specialized education and a highly specialized language" does not commend itself to the editors of the newspapers. In discussing questions on which the public has a right to be informed engineers will do well to bear the limitations of the layman in mind.

### Radio Has Serious Phases for the Central Station

JUST how deeply radio has permeated daily life was evident at the recent meeting of the Technical Section of the National Electric Light Association in New York City. Naturally, as a topic of conversation, it holds first place with the "fans," but in other and more important ways it wormed itself into most of the committee deliberations.

As an operating asset both straight radio and carrier current received much attention, particularly among those interested in the operation of large transmission systems. As a producer of hazards because of the erection of antennas in close proximity to light and power wires it attracted very serious notice. Complaints from the radio-using public of inductive effects from power systems due both to normal and to abnormal system conditions also came up for discussion.

One may call the development a fad or a craze, but it is apparent from the expressions of central-station operators over the entire country that so long as the development continues it is likely to produce problems for the central-station operator to meet and solve. The situation must be met in each community in accord with local conditions. The N. E. L. A. committee dealing with safety and accident prevention has already recommended definite educational measures concerning the hazards to be avoided, and other committees of the same association have been formed to consider various phases of the development. The situation is such that central-station operators must as a self-protective measure meet it before it becomes so acute that legislative action is threatened.

### Line Wires Shield Each Other from Wind Velocity Effects

THAT a definite shielding effect exists between ice-covered telephone and telegraph conductors carried on the same cross-arm and that a similar shielding effect exists between wires carried on different cross-arms at a distance of about two feet are important conclusions drawn from a series of tests described by P. J. Howe of the Western Union Telegraph Company in a paper presented at the February meeting of the American Institute of Electrical Engineers. The conditions under which the tests were conducted are closely described, and it is indicated that results of these tests should not be made the basis of predicting what might be learned from research work under different conditions of conductor arrangement and cross-arm spacing. It is also held that the amount of shielding on any number of wires increases with the wind velocity and vice versa, and that the shielding at any wind velocity increases or decreases with the number of wires.

The subject is one that has been more or less hotly discussed in arguments over the safety code and crossing specifications. It is only one of several possible factors that may explain the action of lines which, under severe weather conditions, appear to stand up beneath loads that calculations indicate should cause failure. The investigation described by Mr. Howe shows that a very definite shielding effect does exist and that allowances which have been made for this effect in the past are conservative. The paper deserves close study by those interested in the subject of line design and opens a question as to why this type of research work cannot be broadened and the entire subject of loading in the design of lines of all types be investigated in the same way.

Objection frequently has been raised that such research work is expensive, particularly when applied to

any considerable length of line and to heavy lines. The objection is valid, but enough time and money have been spent in fighting over differences of opinion on the subject, without sufficient data on which to base conclusions, to have settled the entire controversy if the expenditures could have been directed into the proper channels. Mr. Howe's paper goes far toward confirming some claims made on the subject of shielding. It hints at possibilities for extending the investigation much farther.

## Engineering Requirements of Switching Deserve Deeper Study

TO THE lay visitor to the bus and switch room of a modern central station during normal operation what could look more peacefully uninteresting than the concrete compartments, switch and instrument mountings and cable runs which usually occupy the foreground of such quarters? The importance of switch-house design is not outwardly apparent as long as conditions are quiet. Even the central-station engineer falls into the habit sometimes of taking this part of his plant equipment pretty much for granted until some unexpected line or station disturbance puts a heavy strain upon the installation and perhaps causes a shutdown of generating machinery or other damage. With the growth of interconnection and loads, it is important to look more closely into the problems of switching and energy control lest disasters to service result from the concentration of excessive power at inadequately protected points.

Not a few companies fail, apparently, to realize that switching facilities by falling behind the requirements of rapidly increasing loads may imperceptibly approach the point of failure until some heavy transient wave of energy causes a breakdown. Confidence in apparatus which has served well for long periods is often too firmly intrenched, considering the magnitude of the systems involved. The importance of analyzing the possibilities of power concentration in connection with the expansion of generating plants and the growth of tie lines and then of investigating the suitability of the existing equipment for continuous operation in the face of these potentialities is, however, manifest.

Such an investigation should include as thorough a study as possible of recurring short circuits and their effects on plant; of the tendency of particular oil switches, bus sections or feeders to develop trouble; of the adequacy of existing switch and instrument transformer cells, dimensions and mountings, including the standards of separation adopted to isolate the effects of explosions, blow-outs, arcing and fires, and of the fitness of particular spacings, types of control apparatus and general arrangement of switch-house detail in the light of existing requirements. The crowding of cables leaving a plant into constricted space, the grouping of exciter lead wiring into a single channel, the proximity of high-voltage wiring to auxiliary cable runs, the warnings of the log-sheet record of minor arcing grounds and failures of terminal apparatus—these and other points obviously deserve frank consideration in studying the adequacy of installations undergoing development.

It is a question whether the wider separation of phases and the complete isolation of adjacent oil circuit breakers, instrument transformers, etc., will insure adequately against disastrous interruptions of service by short circuits which concentrate into such limited space as a single breaker or bus section the huge amounts of energy nowadays on tap in large plants and interconnected systems. Bus and feeder reactors are bound increasingly to receive expert consideration as means of limiting the destructive effects of short circuits in particular installations. Any reasonable means of reducing the strain upon switching mechanisms and of cutting down the force of the "bumps" which abnormal conditions are capable of imposing upon a system deserves careful consideration by qualified engineers. Natural as is the tendency to rely indefinitely upon an existing switch installation or transformer group, it is unwise to put this kind of trust into plant equipment which changing conditions may rapidly be rendering obsolete.

The industry cannot have the benefits of superstations and interconnections without paying the price of modernizing its switching and transforming equipment.

## The Static Condenser in Motor Service

EVERY one well remembers that the early days of the induction motor witnessed a constant struggle with power factor and that about thirty years ago William Stanley introduced static condensers to improve the power factor of his two-phase motors with measurable success. The vicissitudes of motor development, however, shifted the line of activity into another direction, and it was presently found that both two-phase and three-phase motors when loaded could be brought up to a power factor of thoroughly practicable magnitude without any auxiliaries. As time has gone on and motor service has greatly increased, the trouble with lagging current has grown more and more considerable until it again is one of the rather serious problems of central-station working. With the new call for help the static condenser has come back chiefly as an adjunct of the individual motor, and a number of the biggest stations are quietly experimenting to see what the modern condenser intelligently applied will do as a remedial agent.

Some interesting light has been thrown on the situation as it now exists by Clifford W. Bates of the Philadelphia Electric Company. The data which have been made available refer to two-phase motors, but their application to the three-phase form is evident. It goes without saying that a condenser of proper capacity will correct the power factor or even transform the lagging current into a leading one in a perfectly obvious way. Mr. Bates' diagrams are based on the 220-volt motors in customary use, and indeed no one would think seriously of working condensers on any lower pressure than 220 volts. Under these conditions, assuming an average 60-cycle modern motor, the necessary size of condenser can be readily expressed practically by a certain electrostatic capacity per horsepower rating. To obtain unity power factor at full load takes about 15 mf. per phase per horsepower of rating. This, however, gives a leading current at light loads, as might be expected, so that it is probably better to use considerably less condenser capacity—say about two-thirds as much as in the ordinary case.

Just at this point comes up the most interesting part of the investigation: Each harmonic which exists in the electromotive force is responsible for its due cur-

rent effect in the condenser, and owing to the very high frequency of some of the harmonics the ripples caused by them rise to a magnitude which seriously affects measurements of the current and give a net corrective effect which may be materially different from that due to the nominal frequency and condenser capacity. The harmonic effect is considerable at times, so that the actual correction of power factor secured by the condensers may be much less than that expected. The remedy lies in the insertion of a series reactance sufficient to offset the condensance effect on the troublesome harmonics.

The upshot of the Philadelphia investigation is to show very neatly how intricate theory assumes practical importance in cases with which the engineer has to deal. It points still again to the desirability of substantial adherence to the sine wave in alternating-current working. Harmonics will be always with us, but they have no virtues which should encourage their cultivation.

## Some Outstanding Problems of Interconnection

SO MANY sermons on interconnection have been preached in the ELECTRICAL WORLD that it might easily be suspected of turning over the barrel. Just now the matter is coming up in somewhat different form in relation to the working out of physical difficulties which are implied in any large-scale scheme of interconnection. The particular reference is not to the questions of strategy or finance, which in a way are likely to settle themselves, but to those practical difficulties brought about by the outstanding differences of voltage and of frequency which beset any attempt to co-ordinate physically the electric supply systems of a large territory. It is a big problem which has already been tackled here and there and is now being considered on a large scale by a state utility organization in the Northeast.

Passing over the practical advantages of interconnection as such in any large district, and particularly in the eastern part of the country, a very wide variety of voltages are found, as well as three or four frequencies in sufficient use to make their consideration necessary. Of voltages used for primary distribution and transmission there are a dozen or more, representing all the irregular upward steps of working pressure for the last five and twenty years. When it comes to planning a practical general scheme of interconnection, quite aside from any superpower lines, all these divers voltages must be taken into account.

The general feeling is that 66,000-volt lines, which are already common, would form a substantial framework for state interconnections if the lines are constructed so that they can be converted to 110,000 volts when it becomes necessary. The difficulty of voltage relations does not lie here, but in the various lower voltages which form minor systems and which are likely to be involved in any problem of interconnection. As a practical matter the differences are likely to be settled by linking transformers, shifting the load from one pressure to the other. This is the cheapest temporary way out of the difficulty, because transformers are by far the least expensive part of any big plant. Nevertheless, every effort should be made to bring two contiguous systems ultimately to the same standard distributing voltages, because, if they are to interchange on a large scale, it is better to unify the system when this can be done without unreasonable expense than to adopt the mere palliative of arranging to shift part of the power. The cost of special transformers for anything like a complete interchange is likely to outrun the expense of replacing or reconnecting the main transformers of the smaller member. Fortunately, such changes do not generally have to be made all at once and can usually be worked out at a relatively modest expense.

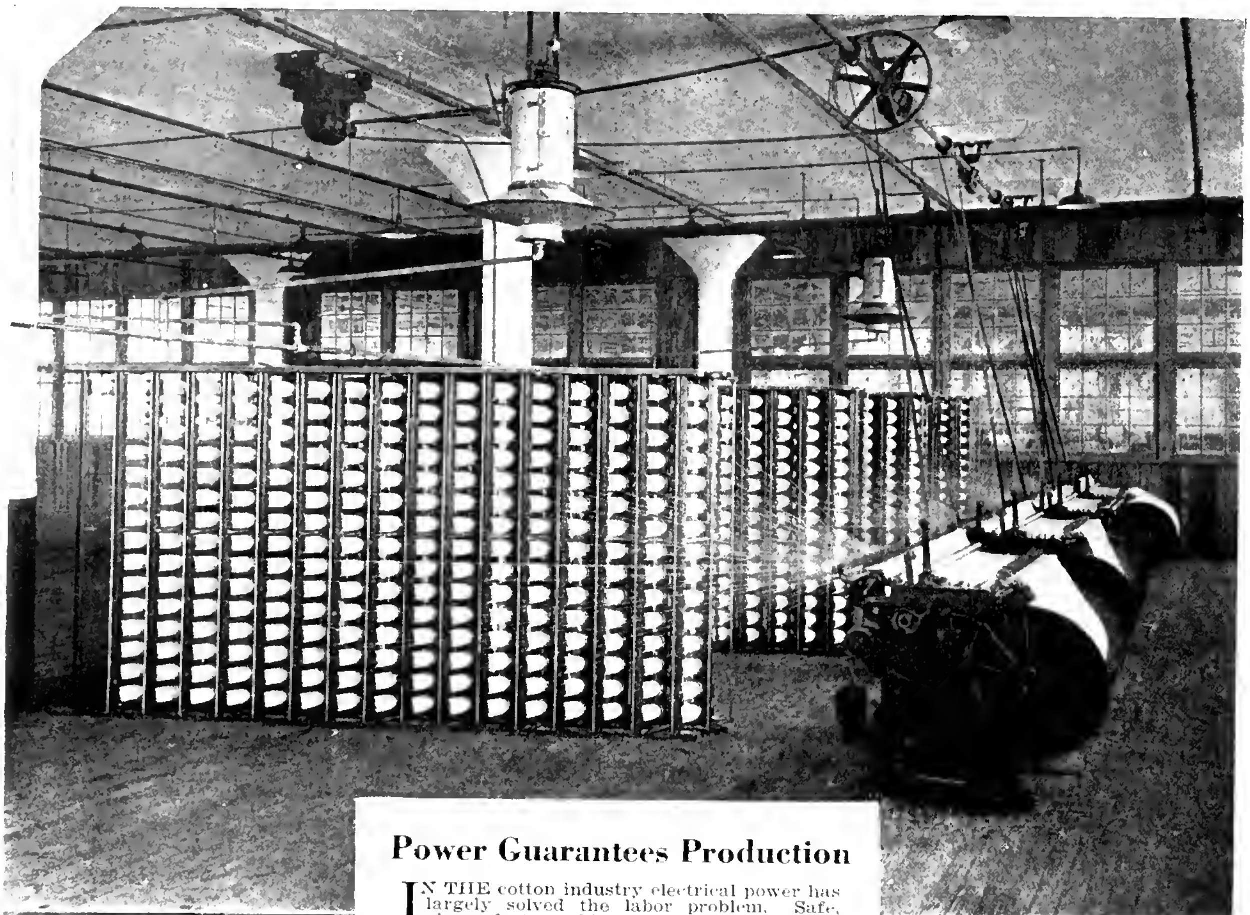
The matter of frequencies is more serious. Frequency changers are expensive, and if a large amount of energy must be interchanged, the costs may run into high figures. Engineers now very well know that the extensive use of 25 cycles in the earlier stages of electric development was a grave mistake. It was not necessary for motor work or for long-distance transmission, and it was positively disadvantageous for lighting of every kind. The unfortunate part of the matter is that the investments in 25-cycle machinery came to be so heavy in the earlier days that a change is financially no small matter. Still, reports indicate that its gradual realization is almost universally expected by the central-station and power-transmission managers who have to deal with interconnection. It is at least safe to say that the various intermediate frequencies are likely soon to disappear in all save some of the very largest systems which have too heavy a stake involved to give them up for the present.

Certainly, a vast deal can be and will be done for the unification of both voltage and frequency. It is a big task which should be undertaken in a nation-wide way to permit exchanges of surplus energy and as a preliminary to the still greater but not necessarily immediate task of trunk-line distribution of energy. Involved in this larger problem as regards frequency is the application of transmitted power to railway working on a large scale. It is time for all to take hold with a will and see how far the undeniable practical difficulties which now exist can be smoothed out by united effort.

Possibly the best mode of attack is for all state or geographical sections of utility organizations to study practical problems and solutions in their territorial situation, working in close co-operation with adjacent territories and the rest of the country through a national committee representing all of the organizations.

## The Salesman as a Good Influence

ASIDE from and beyond all thought of the profits that come from all the selling that the salesmen do, every central-station company needs an active sales department for the influence that it exerts on the rest of the organization. Utility men are apt to be a bit inbred, introspective and prone to look upon this institution of theirs as the thing of chief importance. They have the service to provide. They are the ones to whom the householder must come. And so the salesman's natural commercial attitude, his eagerness to please his customer, his readiness to see the public's side of any argument, acts as leaven in the dough. No man can have his livelihood depend upon the sale of goods without discovering and remembering that, after all, the customer is king.



## Power Guarantees Production

IN THE cotton industry electrical power has largely solved the labor problem. Safe, clean, fast machines have been developed to the extent that attendance is reduced to a minimum. All of the production processes are of a character that require a co-ordination of many movements to secure a uniform and perfect product. The small electric motor and electrical control devices are particularly well adapted to this industry.

Upper view—Warpers in Musgrove mill at Gaffney, S. C.

Lower view—Weave room in Stonecutter mills, Spindale, N. C.

# High Efficiency Oil-Burning Station

## Use of Most Economical Equipment Is Just as Important as Though Plant Were Designed for Continuous Full-Load Operation—Graphic Meters Enable Operators to Keep Check on Plant Economy

By C. H. DELANY
*Assistant Engineer of Operation Pacific Gas & Electric Company*

THE necessity for steam-electric generating plants as auxiliaries to hydro-electric systems has been recognized ever since hydro-electric generation became a factor in industrial progress. The Pacific Gas & Electric Company, in addition to its twenty-eight hydro-electric plants, operates four steam plants, the combined capacity of which is about 40 per cent of the capacity of the hydro-electric plants. A new unit added to the company's station "C" steam plant in Oakland in 1920 has shown excellent results in plant economy. On first thought it might appear that for a stand-by station where full load is carried only occasionally it is not worth while to install the most economical equipment. When, however, the matter is considered carefully, it is quickly found that the most economical turbine is just as desirable for a stand-by plant as for a plant carrying a steady load. With an economical turbine fewer boilers are required so that there is a saving in first cost. Then, again, fewer boilers must be kept hot when standing by ready to pick up the full load on the station. As there is a continuous loss due to keeping the boilers hot for this purpose, it is evident that the fewer boilers necessary the more economical the operation of the station will be.

OPEN FEED-WATER HEATERS AND FEED PUMPS USED IN THE STATION

The unit referred to is a 12,500-kw. horizontal turbo-generator and is installed in a station that was already provided with two vertical turbo-generators. The first of these latter units was installed in 1909 at the time the station was built. This was a 9,000-kw. Curtis turbine. A second Curtis vertical unit of 12,000 kw. capacity was added to the station in 1911. There had been no further addition to the generating capacity of the station until 1920, when the new unit referred to above was installed. The two older units were designed for a pressure of 200 lb. at the boilers and 175 lb. at the turbines and a superheat of only 100 deg. F. With the advance in steam pressures that has occurred during the last few years, it was felt that a higher pressure and temperature should be adopted for the new unit. A separate installation of boilers was therefore made, built for a pressure of 250 lb. and 150 deg. F. superheat, and the turbine was designed for 225 lb. pressure at the throttle.

This station, being an auxiliary to a very large hydro-electric system, has a greater variation of load than is ordinarily found in a steam station. First, there is the seasonal variation due to the change in the amount of water available for the hydro-electric plants. The climate of California is unusual in that there is practically no rain during the summer months, so that the hydro-electric stations must depend on the winter rains and snows, together with whatever water-storage systems are available. Fortunately, the mountains in California are so high that the winter snows are not melted until late in the summer, so that the greatest storage is obtained from the deep beds of snow lying on the mountains during the spring and early summer. In addition reservoirs have been constructed in connection with several of the hydro-electric plants, but there are many other plants where there is no artificial storage. Consequently, as soon as the stream flow is reduced by the disappearing of the snow in the mountains many of the hydro-electric plants are unable to deliver their full quota of power to the system, and it is then necessary for the steam stations to generate up to their full capacity. On the other hand, during the early spring and late winter, when heavy rains occur, there is a large run-off available for the hydro-electric plants, so that at this season of the year the generation of the steam plants can be kept down to a minimum. There is thus a variation in steam generation of from only 6 per cent or 7 per cent of the total monthly generation of the system in the spring up to more than 50 per cent of the total generation during the late summer and early fall.

In addition to this seasonal variation there is a daily variation due to the usual daily change in the lighting and industrial load. All electric systems have their lowest load in the early morning hours, between midnight and 6 a.m. In the case of the hydro-electric

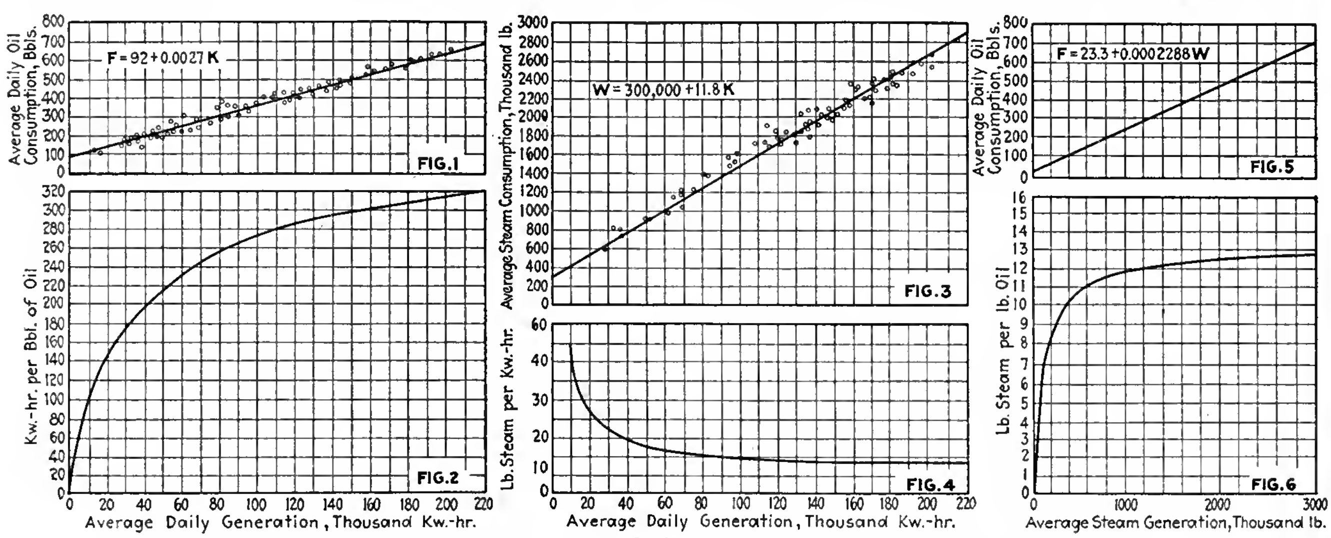
system this light load is less than the capacity of the hydro-electric plants, and if any of the power at this time of day is generated by steam, there is an economic loss, owing to the fact that the water available at the hydro-electric plants flows on without being used. Consequently it is customary to reduce the loads on the steam plants to zero during the early morning hours. In other words, the steam plants take the brunt of this daily variation in load. Besides the seasonal and daily variation in load, there is always the possibility of a sudden change in load on the steam plant due to trouble developing on the many miles of transmission lines passing over rough country and exposed to storms of all kinds. The steam plants are, therefore, kept in readiness to pick up instantaneously a load equal to their full capacity. This frequently causes very sudden peaks to occur for short periods of time.

Owing to these sudden demands for power and extreme variation in load, the operation of auxiliary steam plants is more difficult than the operation of ordinary steam plants supplying the entire power for a public utility. Liberal boiler capacity must be installed to enable the station to pick up the sudden load without loss of steam pressure, and in the operation of the boilers it is necessary to take special means of keeping them hot ready for these emergencies. Fortunately, the fuel used in California is oil, which has many advantages over coal in connection with the sudden taking on of extra load and the elimination of stand-by losses in the boiler room.

### Description of Equipment

Briefly, the equipment installed in connection with the new unit is as follows: The turbine is a horizontal G.E. 12,500-kw. unit, operating at 1,800 r.p.m., directly connected to a three-phase, 60-cycle, 12,000-volt generator. The condenser is of the surface type, containing 25,000 sq.ft. of cooling surface, designed to produce 28½ in. of vacuum when using salt water at a temperature of 60 deg. There are six Stirling boilers rated at 823 hp. each, erected in three batteries of two boilers each and equipped with superheaters for 150 deg. F. superheat. Each battery is provided with a steel smokestack 90 in. in diameter and 150 ft. in height. The boilers are provided with steam-atomizing oil burners capable of operating them at 150 per cent of their rating. With this overload it is possible to carry the full load on the turbine with only five boilers, so that one boiler may be shut down for cleaning and overhauling at any time. This makes the full capacity of the turbine always available for the system and facilitates the maintenance of the boilers.

In addition to the main units, the installation includes all auxiliary apparatus necessary for a complete power plant. The condenser auxiliaries include four "rado-jets" for removing the non-condensible gases from the condenser, two hot-well pumps, one motor-driven and one turbo-driven, and a circulating water pump driven by a geared steam turbine. The circulating pump is connected into the main circulating system of the plant, which was already provided with one motor-driven and one engine-driven pump. These pumps deliver into a common main which supplies water to all three condensers. Thus a main unit is never dependent upon a single circulating water pump for its supply of cooling water. An oil filter is provided to filter the lubricating oil for the turbine, using the well-known continuous bypass system. The generator is provided with an air washer to insure that the cooling air shall be pure and clean. The two older steam turbines in this plant are also equipped with air washers, and the three air washers are connected to a single pumping system for their water supply.




FIGS. 1 TO 6—OPERATING RESULTS OF A 12,500-KW. TURBINE FOR A NINE-MONTH PERIOD

The boiler auxiliaries consist of feed-water pumps and feed-water heaters, oil pumps and oil heaters. The two feed-water heaters are of the open type. This type of heater is of material assistance in purifying the feed water, as the air and dissolved gases are driven out of the water when it is heated at atmospheric pressure, and moreover some of the scale-forming matter in the water deposits in the heaters instead of being carried on into the boilers. The heaters are provided with large storage compartments, so that an ample supply of pure hot water is available at all times. The heaters are set on an elevated platform to give ample head to the feed pumps. The feed pumps are of the centrifugal type and are driven by steam turbines. The oil heaters are of the coil type having external joints so that any leak in a joint of the coil is immediately noticed and can be promptly stopped. The oil passes through the inside of the coils at a high velocity, and thus a good heat transfer is obtained. The oil pumps are of the piston reciprocating type and each pump is of sufficient size to supply fuel oil to the whole plant, the old boilers as well as the new. The fuel-oil storage tank has a capacity of 15,000 barrels and is

surrounded by a concrete retaining wall of sufficient capacity to hold its entire contents in case of a leak, thus protecting the surrounding property.

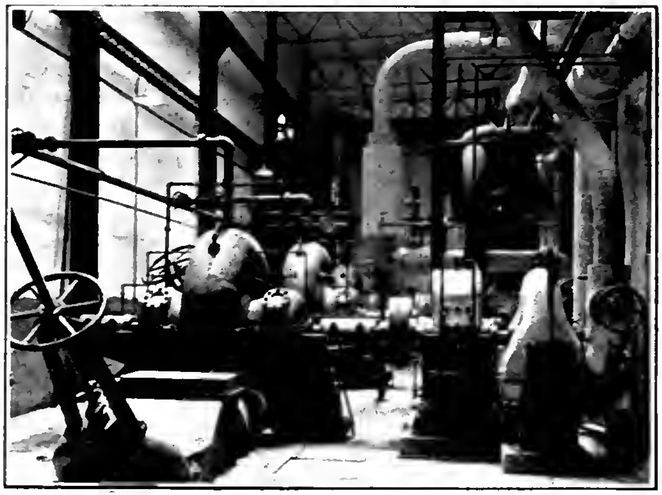
### Graphic Meters Used

An important feature of the installation is the extensive use of measuring devices that have been provided for keeping records of the efficiency of the plant and assisting the operating men in knowing just what results they are obtaining. In modern engineering practice it is becoming more and more apparent that a complete installation of meters is essential to securing high efficiencies of steam plants. Each boiler is equipped with its own individual flow meter. Each meter is practically three separate meters in one case, but all three record their information on one and the same chart. The steam-flow part of the meter records the steam output of the boiler in percentage of boiler rating, showing at a glance just what load the boiler is carrying. On the same chart the air-flow pen records the amount of air the fireman admits to his furnace and fires. The air-flow mechanism is entirely separate from the steam-flow mechanism, with the exception that the records are traced on the same chart. By means of an Orsat gas analyzer the flue gases are analyzed and the fires and air supply are adjusted to give the desired amount of excess air and $CO_2$. The air-flow mechanism of the meter is then adjusted to coincide with the steam-flow record at the existing rate of steaming. This setting is then checked at different rates of steam output to make sure the adjustments are correct. In the same meter casing, and recording on the same chart, a thermometer is provided that indicates and records the temperature of the superheated steam. This consists of the well-known nitrogen bulb and flexible tube connected to a helical spring which actuates the recording pen. This record shows any defects in the superheater, or any water that may be carried over with the steam.

The feed water supplied to the boilers is measured by a flow meter connected to the feed line between the pumps and boilers. This meter is equipped with two recording pens and an integrator. One of the recording pens shows a continuous record of the flow of water from the feed pumps to the boilers. The second pen shows on the same chart a continuous record of the feed-water temperature. The integrating attachment works in conjunction with the mechanism that records the rate of flow of the feed water and records the total flow of water fed into the boilers during any period of time. From this information the evaporation per pound of fuel burned and the total steam used in the plant per kilowatt-hour generated may be determined. Another Bailey meter, type C-6, is provided on the hotwell discharge line to measure the condensate from the main turbine. This meter has only one recording pen and an integrator, the recording pen showing at all times how much water is leaving the condenser, and the integrator giving the total flow for any period of time. From the records of this meter the water rate of the turbine may be determined.

### Steam Flow Meter Used

The steam supplied to the oil burners is measured by an integrating, indicating and recording flow meter. The indicating scale being visible for some distance, the fireman is always able to tell how much steam he is using to atomize his oil, without having to walk up to the meter to read it. The recording pen shows a continuous record of how the fireman handles his steam, and the integrating attachment gives the total steam passing by the meter in any period of time. From these records the percentage of atomizing steam to total steam generation and the pounds of steam used for atomizing per pound of oil burned may be readily calculated. The total oil supplied to the boilers is measured in the oil-storage tank and by oil meters. Owing to the fact that the oil pumps supply both the new and the old sections of the plant, it is necessary to use oil meters to determine the amount of oil used in the two sections of the station. Two oil meters are provided, one for the old and one for the new portion of the plant. The total of the readings of these two meters is checked against the measurements of the oil-storage tank, and any difference is proportioned as a correction of the two meters. The total of the two meters checks closely the oil-tank measurement.



CIRCULATING-WATER PUMP WITH A CAPACITY OF 30,000 G.P.M. THESE PUMPS DISCHARGE INTO A COMMON MAIN FOR SUPPLYING THE THREE CONDENSERS

### High Efficiency Obtained

The results obtained from the operation of the unit are shown in the accompanying diagrams. Fig. 1 shows the daily generation in kilowatt-hours plotted against the average daily oil consumption. Each point in the diagram represents one day's operation as taken from the daily records. The straight line drawn

OIL BURNERS ARE INSTALLED ON SIX 8,230-SQ.FT. STIRLING BOILERS

through these points represents the average performance of the station. Fig. 2 shows kilowatt-hours per barrel of oil as determined from the average straight line of Fig. 1. Fig. 3 shows the generation in kilowatt-hours plotted against the average steam consumption of the plant. The steam consumption shown on this diagram is taken from the records of the flow meter on the feed-water line, corrected by deducting estimated amounts to allow for blowing down the boilers. This steam consumption, therefore, includes the steam used by the auxiliaries as well as by the main turbine. Fig. 4 shows the pounds of steam per kilowatt-hour as deduced from the average straight line drawn through the points of Fig. 3.

PACIFIC GAS AND ELECTRIC COMPANY

WEEKLY EFFICIENCY REPORT

TURBINE NO. 3, STATION "C" OAKLAND WEEK ENDING ______ 192 ______

| | | SUN. | MON. | TUE. | WED. |
|---|---|---|---|---|---|
| K.W.H. Generated | | | | | |
| Oil Used | Bbls. | | | | |
| Oil Required, Standard | Bbls. | | | | |
| K.W.H. Per Bbl. Actual | | | | | |
| K.W.H. Per Bbl. Standard | | | | | |
| Operating Efficiency | % | | | | |
| Capacity Load Factor | % | | | | |
| Turbine Hrs. Run | Hrs. | | | | |
| Turbine Load, Maximum | K.W. | | | | |
| Corresponding Vacuum | Ins. | | | | |
| Time To Drop 1 In. Vac. | Min. | | | | |
| Total Feed Water | Lbs. | | | | |
| Deduct For Blowing Down | Lbs. | | | | |
| Total Steam Generated | Lbs. | | | | |
| Steam Used By Burners | % | | | | |
| Steam Used By Main Turbine | Lbs. | | | | |
| Steam Used By Auxiliaries | % | | | | |
| Steam Generated per K.W.H. | Lbs. | | | | |
| Steam Used By Turbine per K.W.H. | Lbs. | | | | |
| Water Evaporated per Lb. Oil | Lbs. | | | | |
| Maximum Feed Water Temp. | °F. | | | | |
| Minimum Feed Water Temp. | °F. | | | | |
| | | | | | |
| | | | | | |

Exhaust Steam Escaped To Atmosphere At Loads Less Than ______

Flue Gas Analysis

Taken During Week on Boilers No. ______

| | | Best | Worst | Aver. | REMARKS:- |
|---|---|---|---|---|---|
| Boiler No. | | | | | |
| $CO_2$ | | | | | |
| O | | | | | |
| CO | | | | | |
| Temp. Breeching | | | | | |
| Excess Air | % | | | | SIGNED |
| Loss to Stack | % | | | | |

FIG. 7—WEEKLY EFFICIENCY REPORT FOR A STATION UNIT

The straight line in Fig. 1 may be represented by the equation.

$$F = 92 + 0.0027\,K$$

where $F$ = barrels of fuel oil burned in twenty-four hours and $K$ = kilowatt-hours generated in twenty-four hours.

If the plant operates purely as a stand-by without carrying any load, $K$ becomes zero and $F = 92$. This means that 92 barrels of fuel oil a day is required to operate the plant at zero load. When the plant is generating, there is an additional oil consumption of 0.0027 barrel for every kilowatt-hour generated. If the plant were operated at full load for twenty-four hours the total generation would be 300,000 kw.-hr. and the oil consumption would be $92 + 0.0027 \times 300{,}000 = 902$ barrels. The economy of the station, therefore, at full load is equivalent to 332 kw.-hr. per barrel, or 1 kw.-hr. from 18,700 B.t.u. While this figure has never been maintained for twenty-four hours, owing to the variation in the load, it has been very closely approximated for periods of eight hours.

The straight line drawn through the points of Fig. 3 may be represented by the equation

$$W = 300{,}000 + 11.8\,K$$

where $W$ is the pounds water evaporated in twenty-four hours and $K$ is the kilowatt-hours generated in twenty-four hours. For zero load $W$ is equal to 300,000, which is the quantity of steam required to keep the main turbine and auxiliaries turning over. In addition to this, 11.8 lb. of steam is required for every kilowatt-hour generated.

By combining the two equations mentioned above and eliminating $K$ it is possible to obtain a relation between the oil consumption and the steam generated. This relation is shown by the equation

$$F = 23.3 + 0.0002288\,W.$$

The straight line derived from this equation has been plotted in Fig. 5, and Fig. 6 shows the pounds of steam evaporated per pound of oil as calculated from the same equation. In this last equation if we let $W$ equal zero, we have $F = 23.3$, which means that if no steam is taken away from the boilers, it is necessary to burn 23.3 barrels of oil per day merely to keep the boilers hot, ready to generate steam when required. In other words, the stand-by losses in the boiler room, or what in coal-burning plants is commonly called the "banking loss," amounts to 23.3 barrels of oil per day. The difference between this figure and the 92 barrels which must be burned per day to keep the machinery turning over, namely 68.7 barrels, represents the engine-room stand-by loss due to the steam required to run the main turbine at zero load and keep the auxiliaries in operation.

Owing to the fact that this is largely a stand-by plant, the figures for zero load as deduced from the diagrams are of particular interest. The excellent results obtained from this station are due in some measure to the methods of keeping records and tabulating results in its operation. Fig. 7 shows the weekly efficiency report blank. This report tabulates for each day the more important data entering into the question of efficient operation. The data for the various items mentioned are obtained from the measuring instruments already described. The items given are confined to such information as is of assistance in checking up efficiency and ascertaining where the losses occur. The third item on the efficiency report, "Oil required, standard," represents the average oil required for the particular load on the day under consideration. This average is obtained from the straight diagonal lines given in Fig. 1. The operating efficiency is the ratio of the standard oil required to the oil used. This item, therefore, gives an exact comparison of the result obtained each day with the average results over a considerable period of time, thus enabling the men in charge of the plant to keep a check on themselves and assisting them to keep the efficiency of the station up to par. A report of this nature is found to be of great help in maintaining the efficiency of the station.

# Power-Factor Correction with Static Condensers

## An Analysis of the Use of Static Condensers for Power-Factor Correction at Individual Motors Shows that Harmonics May Affect Performance—Excess Current Varies with Voltage Wave

By CLIFFORD W. BATES
*Research Engineer Philadelphia Electric Company*

WHETHER to apply power-factor corrective devices at the substation, near the customer's service switch or at the individual motors is a question much discussed by central-station engineers, but equally pertinent questions arise as to the actual performance to be expected if static condensers are used at the individual motors. An analysis of the effect to be expected when using static condensers at individual motors of a size sufficient to warrant the employment of a single power-factor correction device shows worthwhile results which appear in the accompanying curves.

These curves apply directly to 220-volt, 60-cycle, two-phase induction motors, and the calculations are based on a 20-hp., 900-r.p.m., squirrel-cage motor of normal design. Since the characteristics of all induction motors of normal design are very similar for all sizes from 5 hp. to 200 hp., this motor is typical of all squirrel-cage motors except those wound for abnormally low speed.

Condensers of equal capacity are connected across the terminals of each phase of the motor and are therefore connected to and disconnected from the lines simultaneously with the motor.

The variation of power factor with the load on an induction motor of fixed size is shown in Fig. 1. Each individual curve shows the change for a fixed value of capacity. The value of the capacity is expressed in microfarads per phase per horsepower of the motor rating. For example, in applying these to a 20-hp. motor the curved marked 6 corresponds to 120 mf. per phase or 240 mf. for the entire motor.

It will be seen that a condenser of practically 15 mf. per phase per horsepower is required to give unity power factor at full load, but a condenser of this size will cause a leading current at smaller loads. A condenser of about 11 mf. per phase per horsepower will just compensate the magnetizing current of the motor at no load and will hold the power factor up to 99 per cent, or slightly higher at full load. This size, therefore, is preferable as it is cheaper.

In Fig. 2 is shown the relation between the total kilovolt-amperes input (both phases) and the load of induction motors operated in parallel with condensers of various sizes. The size of condensers is expressed in the same way as in Fig. 1. The line current is proportional to the total kva. and may be found by dividing the total kva. by 0.44 or multiplying by 2.27 to obtain the current per terminal.

These curves assume an approximate sine wave of current in the condenser. This is almost never the case unless inductive reactance is used in series with the condenser of each phase. The reason is: The voltage applied to a condenser contains small deviations from a sine wave, due to tooth ripples produced by the generator, to magnetic saturation or to other causes. This is equivalent to the simultaneous application of voltages of various frequencies, each of which will produce its current in the condenser proportional to the magnitude of the voltage and to the frequency. A ripple which is hardly noticeable in the voltage wave will, therefore, be magnified enormously in the condenser-current wave. For example, a 5 per cent eleventh

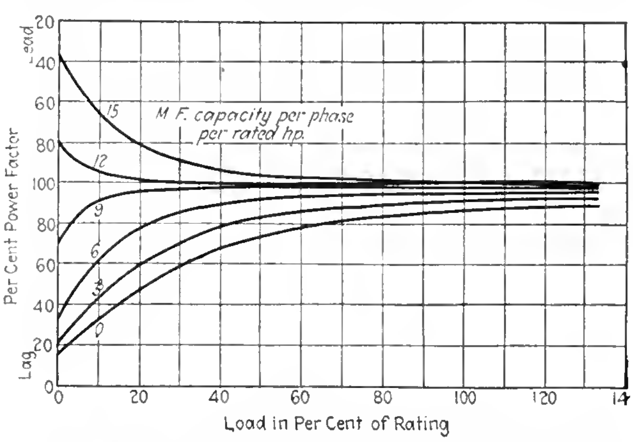



FIG. 1—RELATION BETWEEN POWER FACTOR AND LOAD OF 220-VOLT, 60-CYCLE, TWO-PHASE INDUCTION MOTORS IN PARALLEL WITH STATIC CONDENSERS OF VARIOUS SIZES

harmonic ripple in the voltage will cause a 55 per cent eleventh harmonic ripple in the condenser current.

If the capacity of the condensers is measured with alternating current, using an ammeter and a voltmeter, the apparent capacity will be too high, since the measured current will include the harmonics as well as the fundamental sine wave. (The current as measured by an ammeter is the square root of the sum of the squares of the currents of all of the component frequencies.) If the condenser measured as above is applied to an induction motor and a power factor test is made of the combination, the current as measured will again be too large by these harmonics, and the apparent power factor will be too low. The result, therefore, is that the apparent correction is not so large as the actual correction (based on the fundamental frequency), and the actual correction is smaller than is anticipated from tests on the condensers. The resulting correction may, therefore, be very different from that expected.

The excess current due to the harmonics will vary of course with the wave form of the voltage, but in the absence of specific information regarding the presence or absence of any particular harmonic it is necessary to provide for the elimination of all harmonics. This may be accomplished by introducing

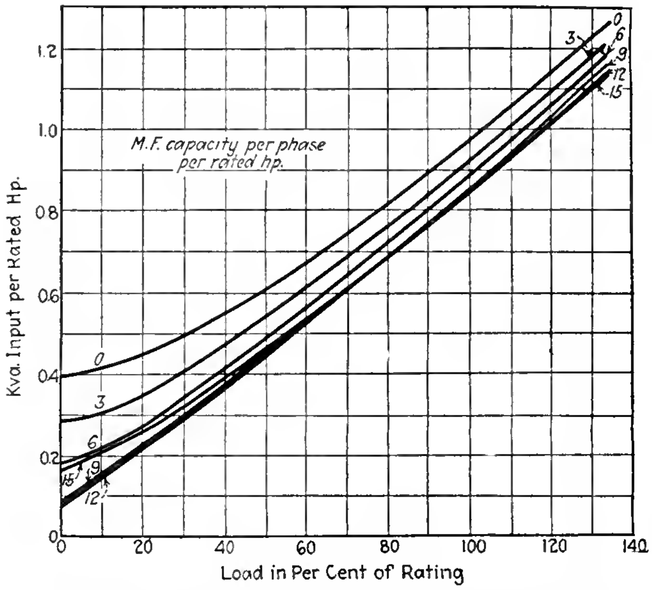



FIG. 2 — RELATION OF KVA. INPUT AND LOAD OF 220-VOLT, 60-CYCLE, TWO-PHASE INDUCTION MOTORS IN PARALLEL WITH STATIC CONDENSERS OF VARIOUS SIZES

inductive reactance in series with the condensers. In the case of high-voltage condensers this inductive reactance may be supplied by the transformers introduced between the condensers and the load.

Calculations have been made based on certain assumptions which show in general the possible magnitude of this effect. The assumptions made were that all harmonics up to the twenty-first were present to some extent, their magnitude being, in percentage, as follows (fundamental 100 per cent): Third, 5.0 per cent; fifth, 4.5; seventh, 4.0; ninth, 3.5; eleventh, 3.0; thirteenth, 2.5; fifteenth, 2.0; seventeenth, 1.5; nineteenth, 1.0; twenty-first, 0.5. The further assumption was made that the resistance of the circuit was equal to 10 per cent of the inductive reactance. The magnitude of the disturbance was calculated for various values of inductive reactance varying from zero to 20 per cent of the condensive reactance.

In addition to eliminating the harmonic currents, as discussed later, the introduction of inductive reactance affects the fundamental current also. When inductive reactance is introduced in series with condensive reactance, the net result is equivalent to the use of reactance whose ohmic value is equal to the difference of the reactance values, which is either inductive or condensive in character, according as the one or the other is the larger. This value will be affected by a change of circuit frequency, but that does not affect the present discussion, as the fundamental frequency is fixed.

Since the inductive reactance is always small compared with the condensive reactance (for fundamental frequency), the net result is equivalent to the use of a larger condenser which has a smaller reactance. Consequently, a smaller condenser may be used when the inductance is introduced. Numerical values may make this clearer. Suppose that an inductive reactance of 20 per cent is connected in series with a condensive reactance of 100 per cent. The net result will be an equivalent condensive reactance of 80 per cent, which would pass 125 per cent of the original current. Both the inductive and condensive reactances should, therefore, be increased by 25 per cent in order to limit the current to the original value. The increase of condensive reactance corresponds to a reduction of the condenser capacity of 20 per cent. It should be noted, however, that the voltage impressed on the condenser is increased by the partial resonance to a value of 125 per cent of the line voltage, the inductive reactance absorbing 20 per cent of this, leaving a net result of 100 per cent of line voltage impressed on the combination.

If the condensers originally used will stand this increased voltage with a suitable margin of safety, a net saving in cost is made; but, if not, a condenser suitable for higher voltage must be used, which may be more expensive.

The reactance for each harmonic frequency is changed according to the order of the harmonic. For the third harmonic the inductive reactance will be three times its fundamental frequency value and the condensive reactance will be one-third.

If the inductive reactance is less than 11.1 per cent of the condensive reactance (for fundamental frequency), the net result is a lower reactance, capacitative in character, and a large third harmonic current will pass. At exactly 11.1 per cent the reactances neutralize each other and the current for this harmonic is limited only by the resistance of the circuit. This is shown in Fig. 3, where under the assumptions made the total current reaches 4.13 times the fundamental current. As the inductive reactance is further increased the net reactance increases rapidly, so that at 20 per cent inductive reactance the excess current due to all harmonics is only 1.2 per cent of the fundamental current. Similar resonance occurs with each harmonic at the appropriate value of inductive reactance.

The figure shows that in order to reduce the harmonics which may exist in a condenser circuit to a negligible value an inductive reactance must be introduced in series. Its value must be somewhat higher than that at which third harmonic resonance occurs, which is 11.1 per cent. The correct value for ordinary purposes is seen to be 18 to 20 per cent of the condensive reactance.

It should be noted that the total current which will be passed by a voltage of the assumed wave form will be about 27 per cent in excess of the fundamental if no inductance is used. This will increase very rapidly with the addition of small inductances, such as might be due to line reactance, current transformers, trip coils, etc., but as the inductance is further increased the excess becomes negligible.

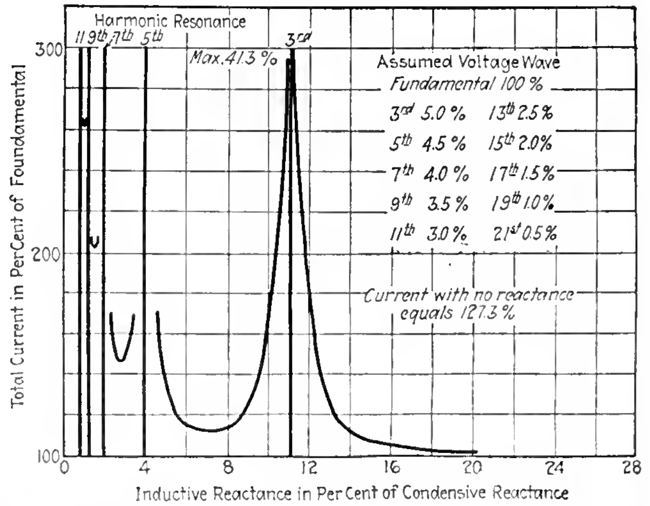



FIG. 3—EFFECT OF INDUCTIVE REACTANCE ON SUPPRESSION OF HARMONICS, THE VOLTAGE WAVE POWER APPLIED TO THE CONDENSER BEING ASSUMED

The curves of Figs. 1 and 2 may be applied to three-phase motors by considering each curve to correspond to a condenser of two-thirds the size as marked, since the total condenser capacity required will be the same for either two-phase or three-phase motors of normal design. The curves may also be used for other voltages by dividing the marked size of condenser by the square of the ratio of the other voltage to 220 volts. For example, if a 440-volt motor were to be investigated, the capacities as marked should be divided by $(440/220)^2$ or 4.

For other frequencies the marked capacity must be multiplied by 60 and divided by the new frequency. For example, to apply to 25-cycle motors, 2.4 times as much capacity would be required, provided the motor characteristics were the same. The characteristics of motors for various frequencies are somewhat different, however, so that the results so obtained might be considerably in error.

The condenser installation must be fused to avoid trouble if a condenser unit breaks down, and this should be done either by fusing each unit or by fusing in groups small enough so that if a fuse blows it will not cause a large decrease in the connected capacity.

An inductive reactance large enough to avoid resonance with all harmonics should be introduced in series with the condensers of each phase. The value should be 18 to 20 per cent of the value of the condensive reactance. This will pass an increased current, permitting the reduction of the condenser capacity. The voltage impressed on the condensers is also increased, requiring operation at a lower factor of safety or the substitution of condensers suitable for the higher voltage.

# Interconnection a National Problem

## Work of the Character Proposed for New York Might Be Copied by Other State Utility Organizations and the Entire Problem Coordinated Under a Committee Representing All State Organizations

WHEN any one looks at a transmission map of his own state showing the various frequencies and primary voltages employed, it may be readily seen that each system has been developed in itself without much forethought being given to possible connection with adjacent systems. Still, most engineers will admit that the most economical utilization of water power and steam plants of different efficiencies, the reduction of reserve equipment and the assurance of the most reliable service under difficult circumstances will be made through more extensive interconnection of adjacent systems.

Recognizing these facts, the transmission lines committee of the Empire State Gas and Electric Association, E. P. Peck, chairman, is starting to consider the possibilities of greater interconnection in New York State. There has been no agreement between any of the companies, and no plan made by any of the companies, in the direction of standardization or interconnection. At present representatives of some companies have shown their willingness to start working on a plan, but even these representatives have not committed themselves to any specific plan and cannot do so until such a plan is drawn up by the committee. Many of the benefits which the New York companies can contemplate through further interconnection can be realized in other sections of the United States, and the method of procedure proposed by the Empire State committee chairman may be enlightening to other groups of companies which are closely related physically.

Mr. Peck made the following statement in starting this new activity of the transmission lines committee:

"There are several outstanding advantages in greater interconnection, some of which apply particularly to New York State. In this state are some very large hydro-electric plants with a continuous power supply throughout the year. Other hydro plants have very large pondage but are subject to seasonal variations. Still other hydro plants are subject to daily and even to hourly changes in available capacity due to variations in the stream flow. There are also steam plants, from the largest to the smallest, under almost every known condition of load factor in operation.

"Substantial interconnection between these various classes of plants," Mr. Peck went on to explain, "would make it possible to load the continuous power plants with continuous loads, load the stream-flow plants with loads in proportion to the available water, and let the plants with storage save water at times when the other plants can carry a part of the load, thus permitting them to carry larger loads during the heavy load hours. The operation of steam plants would, of course, vary with conditions, but their operation would be largely reduced, with a resulting saving in cost and in coal.

"Substantial interconnection makes it possible to take advantage of a large part of the diversity of different classes of load, thus reducing the total generating capacity required for instantaneous demand. Such interconnection would go far toward relieving power shortage experienced by some companies due to low-water years. A large insurance would be effected against accidents to station and transmission line equipment in the existing systems. Interconnection would often make it possible for one company to postpone the construction of a new plant, as it could take load from some other system which might have recently installed a large plant, thus helping the system with the new plant to carry its plant charges and postpone an investment in its own system. The actual operating advantages are so tremendous that they cannot all be realized at a glance, but it appears safe to say that no companies that have gone into interconnection on a broad scale have ever found it advisable to discontinue these connections.

"Public service corporations must adopt every possible means of reducing cost, and interconnection offers many systems the greatest possible means of affording economies in investment and in operating costs. Economically, the combining of resources is the correct move. It can be delayed, but cannot be delayed indefinitely. The force of economic pressure will undoubtedly in time require that resources be combined.

"Assuming, then, that combination of resources—that

## A National Committee on Interconnection Needed

*By E. P. Peck*

Chairman Transmission Lines Committee,
Empire State Gas and Electric Association

THE matter of interconnection is not a state problem at all, but is a national problem. What is done by any company in New York State may have a very definite bearing on the future of some other company in a relatively distant state. It is a national problem, and if there is any way to start national work in this connection it should certainly be started. In fact, I think the N. E. L. A. could not do better than to appoint a committee to do the same thing for the country as we have started to do for the state. Such a committee would probably first collect data from the country at large. Then it would pick out certain districts where more general interconnection might logically begin and make recommendations for these districts, one at a time.

In our state work we have found it very advisable to keep entirely away from the question of a superpower line in any form or in any location, recognizing, however, that such high-voltage trunk lines must come and that our plan must be such that it will be a logical part of the general system when it is completed.

The work of the national committee may or may not have the same limitations. That, of course, would have to be decided after the conference with the interests concerned.

The national work would be a tremendous undertaking. In fact, it is so large that one may wonder whether the N. E. L. A., with all of its facilities, would undertake the job. However, the results of such a piece of work would be so far-reaching and would save so many hundred million dollars that the effort would be insignificant compared with the return. This assertion, of course, is based on the assumption that a really workable report with recommendations would be made and that the individual interests and companies would consistently follow the recommendations in all of their new construction.

As I see it, no piece of work ever started has been of such size or of as great importance to the industry as this one would be.

is, interconnection—must come, it immediately becomes obvious that there must be some common ground on which different systems can meet. If recommendations can be made which will serve as a guide to all companies interested now or in the future, the thing that apparently must come will come much quicker, much more easily and at a much lower cost. This assumes, of course, that workable standards be set up, that workable recommendations guiding the use of these standards be made, and that the different systems adopt and work in the direction of these standards and recommendations.

"It would seem advisable to set up a plan, perhaps not ideal, because there are too many conflicting factors involved, but a real engineering, working plan. The business and financial end would, of course, be of the greatest importance, but those problems are entirely solvable and do not come within the scope of this committee's work. Recommendations should not be in the direction of applying force to any existing system, but should show a way whereby existing systems can in the future line up, with greater or less speed, with the other systems. There are difficulties, both engineering and financial, but no system, regardless of its size, is larger than the men within it have made it. No system, therefore, is so large that its engineering and its growth cannot be directed by the men in control.

"To get into the details of the problem," Mr. Peck went on, "it would be advisable to divide the work among the following sub-committees: (1) Load, distance and voltage; (2) frequency; (3) line and substation costs; (4) liaison committee with other states. The work of the different committees would be about as follows:

"*Load, Distance and Voltage*—The committee on load, distance and voltage would have the problem of selecting the proper voltage for the lines which will make up the interconnected system.

"This would involve a study of the territory covered by each of the major systems, the distance from the load center or main generating center to the outskirts of that system, the distance between load centers of adjacent systems, the amount of load to be carried from the load center to the outskirts of each individual system and the amount of load which it appears necessary to provide for interconnection between adjacent systems. One very important point to be considered in this connection in the distance between substations, which probably would connect to the primary lines. After considerable study along this line, it is believed that 66,000 volts is the proper voltage for this purpose.

"Running through the whole plan is a background of a trunk transmission line at some much higher voltage which it appears must materialize at some time in the future. A company entering into the interconnection plan could start its work by building all new structures, both substation and transmission, for the recommended voltage. It could buy transformers and major pieces of substation equipment arranged so that it could operate on the voltage now in use but be reconnected later for the standard voltage. In this connection it has appeared advisable to put up all permanent structures so that they could be used later for 110,000 volts, though 66,000 volts appears to be proper for present and future needs.

"*Frequency*—The frequency committee may find it advisable to make a survey or take advantage of a survey which has already been made showing the amount of territory covered by systems of each frequency and the total load carried by systems of each frequency, with an indication of the stated future policy of the systems with regard to the frequency they have adopted for future work. In this connection it would be of value to obtain from the manufacturers statements of the amount of apparatus going through the works or the volume of apparatus manufactured in the past year for each of the frequencies considered, that is, 25, 40, and 60 cycles. They should, if possible, agree on the standard frequency for new work. Evidence indicates that 60 cycles is the frequency for the future.

"*Line and Substation Costs*—This committee should determine the comparative costs of lines and substations for different voltages which most logically could be used for the interconnection, presumably 66,000 and 110,000 volts. Of course, features other than cost may determine the recommended voltage, but a set-up of comparative costs would be of value in the report.

"*Liaison Committee*—While it is true that the work of this committee is necessarily confined in its recommendations to New York State, it is equally true that interconnection cannot stop at the state line. We are vitally interested in knowing what Connecticut, Vermont, Massachusetts, New Jersey and Pennsylvania are planning to do, and each of these states is or will be interconnected with other states. We should, therefore, be in touch with at least the larger companies in the surrounding states to find out what they are doing."

# Electric Sign-Hanging Regulations

## Chicago Adopts a Safety Factor of Nine for Suspension Chains, Minimizing Risk of Signs Falling—Position of Sign Determines Method of Support—Location of Expansion Bolts Important

By HENRY C. HORSTMAN and VICTOR H. TOUSLEY
*Department of Gas and Electricity, City of Chicago*

ELECTRICAL signs in a large city have come to play such an important part in the electrical industry that without proper regulation most such installations would soon become hazardous. Rules for such regulation should consider the construction of signs, their mechanical strength, their factor of safety and their final location. All these items have been considered in the Chicago rules which were adopted in 1902 and amended from time to time. Another reason why regulation is needed is because the number of signs is growing daily. For the first eight months of 1922 the number of permits issued in Chicago was 2,631. In 1921 a total of 12,476 signs, with an aggregate of 963,151 electric lamps, were in operation. Because most of this business is solicited by central-station companies and electrical contractors they must be held responsible for the proper hanging as well as the electrical work. This is distinctly important since falling signs would tend to jeopardize the entire business.

The most common types of electrical signs are depicted in Figs. 1 to 11, which also show the usual means of support. Signs may be built about strong frames of angle iron, but in many cases they are merely light boxes constructed of No. 28 U. S. gage sheet metal. Where wooden signs are permitted, they are usually constructed of 2-in. x 4-in. or 2-in. x 6-in. timbers, to which ⅞-in. boards are fastened. The weight of a typical all-metal sign ranges from 3 lb. to 10 lb. per square foot, although 5 lb. per square foot perhaps is a fair average. Some of the smaller signs are often suspended from pipes and arranged to swing under them.

The number of chain supports per sign, the manner of attachment and the number and descriptions of chains and rigid braces used for guying are given in Tables I to IV. Table I shows the number of supports required, calculated on a basis of a 30-deg. angle for supporting chains, which makes the stress upon the chains equal to about two and two-tenths times the weight of sign. The chains are also calculated with strength enough to carry the total weight of the sign with a minimum safety factor of nine. The total weight of a sign has been taken as a basis because in many cases it is actually carried by the chains, and to make allowance for less might lead to more trouble than the saving was worth. A high safety factor is advisable because even the best galvanizing does not stand up well in large cities burning soft coal. The use of substantial chains as supports is, furthermore, of value in creating a feeling of confidence.

TABLE I—CHAIN SUPPORTS FOR SIGNS*

Each chain must be capable of carrying sign alone. Supports must have at least 5 ft. of wall above them and be 8 in. from corners.

| Weight of Sign, Lb. | No. of Chains Needed | Trade Size of Chains | Fastenings to Walls† |
|---|---|---|---|
| 0 to 75 | 1 | 4 | Two expansion bolts |
| 75 to 150 | 2 | 4 | Two expansion bolts per chain in different places |
| 150 to 300 | 2 | 8 | One bolt through wall, or equivalent |
| 300 to 450 | 2 | 10 | Two bolts through wall or equivalent |

* Where expansion bolts are arranged so that supports or guys make an angle of about 60 deg. with sign, or where they are attached to strong ledges, side walls, posts or columns so as to avoid outward pull, or where machine or lag screws enter strong timber or iron frames, or where chains pass onto roofs to strong structures or anchorage; these methods of supporting will be considered as equivalent to bolt through wall; but each such case is dependent upon approval of the inspection bureau.

† No support or guy to spread less than 30 deg. nor to be attached back of center of gravity.

TABLE II—CHAIN GUYS FOR EACH SIDE OF SIGN*

(Upper figure is the size and lower figure the required number of guys)

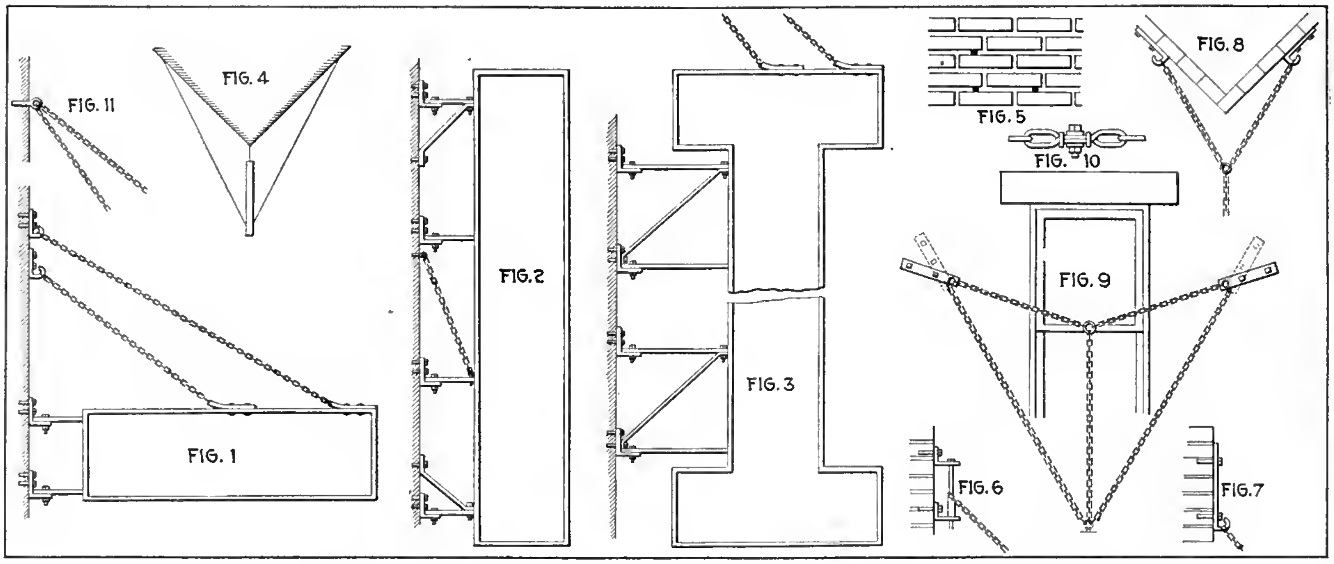
| Height, Ft. | Length of Sign (Horizontal), Feet† 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Height, Ft. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 1 |
| 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>4 | 4<br>4 | 2 |
| 3 | 4 | 4 | 4 | 4 | 4 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>4 | 4<br>4 | 4<br>4 | 4<br>4 | 4<br>4 | 4<br>4 | 3 |
| 4 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | .. | 4<br>2 | 4<br>4 | 4<br>4 | 4<br>4 | 4<br>4 | 8<br>4 | 8<br>4 | 8<br>4 | 8<br>4 | 4 |
| 5 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | .. | .. | .. | 4<br>4 | 4<br>4 | 8<br>4 | 8<br>4 | 8<br>4 | 8<br>4 | 8<br>4 | 5 |
| 6 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 8<br>2 | 8<br>2 | .. | .. | .. | .. | .. | 8<br>4 | 8<br>4 | 8<br>4 | 8<br>4 | 8<br>4 | 6 |
| 7 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 8<br>2 | 8<br>2 | .. | .. | .. | .. | .. | .. | .. | 8<br>4 | 8<br>4 | 8<br>4 | 7 |
| 8 | 4<br>2 | 4<br>2 | 4<br>2 | 4<br>2 | 8<br>2 | 8<br>2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 8<br>4 | 8 |
| 9 | 4<br>2 | 4<br>2 | 4<br>2 | 8<br>2 | 8<br>2 | 8<br>2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 10 | 4<br>2 | 4<br>2 | 4<br>2 | 8<br>2 | 8<br>2 | 8<br>2 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |

*For larger signs provide No. 8.0 guy for each 30 sq.ft.
†Chain trade numbers require a 0 to be added, as 1.0, 2.0.

It is advisable to use chains for supports rather than cables because of the greater liability of the latter to rust. In the tables only two sizes of chain, Nos. 4.0 and 8.0, are considered. This is done for the purpose of simplification in the interest of sign hangers as well as inspectors. The tensile strength of welded chains is usually taken as 60 per cent of the tensile strength of the material out of which they are made.

The side guys given in Table II are calculated for a minimum safety factor of two and one-third. There are several reasons for this comparatively low figure. One is that the wind pressure taken at 20 lb. per square foot is about four times as great as the weight of the sign per square foot, and if side guys were selected with the same precautions as are taken for the supports, they would look extremely heavy and be apt to expose the inspection bureau to ridicule. Furthermore, this wind may last only a few minutes. Another reason is that should the guys give way the sign will not fall to the walk if properly supported, or at least not without pedestrians receiving warning.

All of the above calculations have been based upon angles of 30 deg. because this angle is often the most advantageous, and at corner signs it is about the greatest obtainable.




FIGS. 1 TO 11—VARIOUS METHODS OF SIGN SUSPENSION ACCORDING TO POSITION OF INSTALLATION. FIG. 9 SHOWS THE METHOD OF HANGING A SIGN BEFORE WINDOWS

The number of square feet allowable per rigid brace of given diameter and length is given in Tables III and IV and has been calculated from the following formula:

Square feet of sign surface =

$$[15{,}000 - (L/R)]A \div 44.$$

$L$ is the length of the brace, $R$ its radius of gyration, $A$ its area in metal, 44 the stress per square foot which a wind pressure of 20 lb. (9.07 kg.) per square foot exerts upon a brace arranged at an agle of 30 deg. The radii of gyration for pipes are found by the formula

$$R = (\sqrt{D^2 + d^2}) \div 4,$$

$D$ being outside and $d$ inside diameter of pipe.

The stresses are calculated according to

$$W(\sqrt{L^2 + H^2}) \div H.$$

Here $W$ stands for total weight of sign or total wind pressure, $L$ for distance from point of sign attachment to building line, $H$ for height of attachment above sign. The radii of gyration for angle irons are taken from tables.

In general, long horizontal signs may be looked upon as depending mainly upon the chains for supports, while the long vertical signs are held mostly by their rear supports. If the rear supports are well braced, as shown in the figures, the guys will need only to keep the signs from falling out. The rear supports are therefore subject merely to a shearing strain.

Fig. 5 shows the usual method of using expansion bolts with reference to joints in brick or tile walls. Whether it is best to place these bolts in the joints or in the bricks themselves is an open question. In some cases the back of the brick is broken out in the process of drilling; in others the brick is loosened from its bed of mortar. If placed as shown in the sketch, chances of accident are reduced to a minimum. Thousands of bolts have been fastened in this manner, and so far as can be recalled none of them have given way sufficiently to let a sign fall. In some cases, however, they have been known to split thin-veneer stone into which they were fastened. Wooden plugs have also been driven into holes drilled into the brick walls and spikes then driven into the wood, but these pull out quite often.

Methods of attaching chains to walls by means of expansion bolts are shown in Figs. 6 and 7. It is always best to hang the chain near the bottom of the bolt, because when so attached should the lower bolt give way the fault will show at once, while the upper one may still carry the entire load. If the stress is thrown too much upon the upper one, it will be the first to give way, thus allowing the lower iron to be broken off.

Attaching signs to corners of buildings is shown in Fig. 8. There is very little outward pull on expansion bolts so arranged, and this method may be taken as equivalent to a bolt through the wall. The two methods shown in Fig. 9 are often used where it is necessary to place a sign directly under a window or other obstruction, but spreading chains meeting at the sign are not looked upon with much favor. The signs that have fallen in Chicago have been knocked loose by objects falling upon them or their supporting chains. Such chains offer a double chance for accidents of this nature. Nor is such an arrangement to be recommended for guying. In a storm the wind pressure on an average sign will be about four times as great as the weight and will therefore tend to lift a sign provided with such chains. The method shown in

TABLE III—CAPACITY IN SQUARE FEET OF SIGN SURFACE FOR PIPE BRACES

| Diameter of Pipe | Outside Diameter Pipe | Length of Brace. (Not More than 40 Sq. Ft. on One Brace) 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 18 | 20 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ½ | 0.82 | 38 | 22 | 15 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| ¾ | 1.03 | .. | .. | 40 | 28 | 15 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 1 | 1.29 | .. | .. | .. | .. | 54 | 33 | 18 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 1¼ | 1.65 | .. | .. | .. | .. | .. | .. | 70 | 53 | 37 | 21 | .. | .. | .. | .. | .. | .. | .. |
| 1½ | 1.89 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 56 | 41 | 23 | .. | .. | .. | .. | .. |
| 2 | 2.36 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 78 | 60 | 25 | .. | .. |
| 2½ | 2.86 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 95 | 48 |

TABLE IV—CAPACITY IN SQUARE FEET OF SIGN SURFACE FOR ANGLE IRONS

| Dimension of Angle Iron, In. | Length of Brace. (Not More than 40 Sq. Ft. on One Brace) 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 x 1 x ⅛ | 12 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 1¼ x 1¼ x ⅛ | 37 | 20 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 1½ x 1½ x ⅛ | 57 | 41 | 25 | 8 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 1¾ x 1¾ x ⅛ | .. | .. | 61 | 28 | 12 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 2 x 2 x ⅛ | .. | .. | .. | 49 | 32 | 16 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 2½ x 2½ x ¼ | .. | .. | .. | .. | .. | 58 | 41 | 25 | .. | .. | .. | .. | .. | .. | .. |
| 3 x 3 x ¼ | .. | .. | .. | .. | .. | .. | .. | .. | 92 | 56 | 24 | .. | .. | .. | .. |
| 3½ x 3½ x ¼ | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 77 | 42 | 9 | .. |
| 4 x 4 x ¼ | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 59 |

the center of the figure is preferable, but in some cases the spreading chains seem to offer the only solution.

Some extracts from the Chicago rules are given below. They are arranged so that the important points can be easily checked by sign hangers and inspectors:

*Construction and Erection.*—All signs must be of metal and arranged to swing. No sign over 6 ft. long shall exceed half its length in height, nor be less than 9 ft. above walk, nor its rear end more than 2 ft. from building, nor project beyond curb line, nor obstruct fire escapes, nor be attached to them. All metal must be galvanized or protected in an equivalent manner, and the maker's name as well as dimensions and weight of sign must be marked upon it.

*Supports and Guys.*—Supports and guys must be provided and attached in accordance with Tables I to IV.

*Special Approval.*—Signs weighing more than 450 lb., or having a surface of over 75 sq.ft., or held by diverging supports, guys or supports arranged at angles of less than 30 deg. must be especially approved in construction as well as hanging.

*Special Rules and Fittings.*—Signs must not be fastened to window sills or frames. Expansion bolts, split links, turnbuckles, machine or lag screws and bolts used to splice chains must not be less than ½ in. in diameter. Turnbuckles must be provided to distribute strains and keep chains taut. Chains must not cause side strain on links. Pipe braces must not have joints near center and must be closed at ends by welding or approved fittings.

# Basis of Success in Customer Ownership

### A New Service by the Public Utility Affording Opportunity for Investment and for Savings—Plain Dealing and Truth Essential in Putting This Opportunity Before the Public—Good Name the Vital Factor

By WARREN R. VOORHIS
*Vice-President American Water Works & Electric Company, New York*

THE work done by the public utilities of this country is an invaluable contribution to the happiness, the comfort and the welfare of all the people. This service of light, heat, water, communication and transportation is so constant, so universal and so essential that the average man accepts it much as he does the forces of nature, without giving thought to the financial and economic problems of the agencies which furnish it for him.

But at the present time, nearly everywhere, public utilities are offering to their patrons still another form of service, and if it is performed with wisdom and intelligence, it cannot fail to change the public attitude toward utilities from one of indifference to an attitude of useful interest and co-operation. In many cities of the country, the local utility company is offering to its patrons an opportunity to become partners in the enterprise by the investment of savings in the securities of the company. The public response has been most remarkable; it constitutes an outstanding feature of modern utility financing. The office of the public utility has become something more than a place to which the consumer goes to pay his bill; he goes there to invest his savings. The postman brings him, besides his bill for service rendered, news of the business in which he is interested together with his dividend check.

The value to the utility of this changing relationship is so obvious that it needs no extended comment. A utility must grow and extend its service as its community increases in wealth and population. If it can finance its needs in some part by successfully inviting to partnership the savings of its patrons, its situation is most fortunate. The resulting friendly co-operative spirit is hardly less valuable.

This article deals with this relationship from the viewpoint of the consumer. The prosperity of this or any other nation depends largely upon the disposition and ability of its average citizen to save steadily and invest his savings with wisdom. Perhaps no one thing contributes more to human happiness than does the gradual accumulation of some fund, however modest, as a protection against the hazard of sickness and the certainty of old age. Innumerable speeches, sermons, essays and warnings have been issued on this subject, and not too much has been said. But the most effective way to induce saving is the offer of a sound and accessible opportunity. This is the new service of the public utility to the public.

### PROTECTION TO SAVINGS

The offer is made to the class of people who most need the opportunity. The hundreds of millions of dollars which have been so invested in the past few years are made up of innumerable contributions from people of modest means, many of whom never before saved anything or made any form of investment. In a recent offer of preferred stock made by a water company with which I am familiar more than $1,200,000 was taken, and the average subscription was less than $400. About 50 per cent of the whole was taken by people who paid at the rate of $5 per month upon each hundred-dollar share.

If people need be taught the habit of saving, no less do they need the opportunity to invest with wisdom. Nothing is more pathetic than the story of men and women who have saved during years of rigorous self-denial, only to have the accumulation swept away in some visionary or dishonest scheme which lacks every characteristic of a sound investment. A preventive against such a calamity, better than all warnings, prosecutions and prison sentences for the perpetrators of such frauds is the presence of an opportunity for safe investment placed at the very door of the man who has saved a little money and who wants to put it to work.

This is the service which the public utilities of this country have an opportunity to offer to their patrons and consumers. It is hardly second in importance to the primary service which they render.

Every consideration, moral or legal, and the plainest dictates of enlightened self-interest demand that this service be offered and given with as much wisdom, intelligence and consideration for the welfare of the consumer as is employed in giving the primary physical service to him.

The opportunity to invest savings will be taken in the main by people who are industrious and intelligent but who have had little or no experience in the judging of investments. Most of them never before invested a dollar in any form of security. They do not grasp the significance of a balance sheet at a glance. The responsibility of the officers of a public utility who put out these securities is, therefore, very great indeed.

It is a wise regulation in many states that all such securities issued shall be first approved by public authority; but, of course, this does not absolve the officers of the utility from responsibility. The officers, the operators and the consumers of a public utility constitute a mutually dependent group of people. There can be no harmony unless there is complete fairness and honesty in the relationship, and certainly this must be true in the matter of investment.

The utility which has a satisfied body of patrons as a partner is happily situated. A public utility which puts out more preferred stock than the equity in the property will bear, or which promises more dividends than the earnings will justify, is laying up untold trouble for itself in the years to come. I would not care to be the operator of a public utility which passes its dividends upon the securities which it has distributed to its patrons. The future public response to all these public utility offerings will depend much upon the amount of prudence and wisdom employed by the utilities in their creation.

### Plain Dealing and Truth Required

The utility which expects to offer its securities to its patrons with any success must speak and write about the offer in a language which they can understand. The average utility patron does not understand the technical terms of a modern bond circular. The number of people who do is even less than the number of people who pretend to understand a modern bond circular. A majority of the subscribers will not know the difference between bonds and stock. They will not distinguish between assets and liabilities, as set out in the balance sheet. "Depreciation," "maintenance," "fixed charges," "reproduction cost," "ratio of earnings to interest and dividends"—all these terms have not yet been passed into the vocabulary of the ordinary household.

But the story of a public utility offering is really a simple one, for public utility financing is in its essentials one of the simplest forms of financing. I should be one of the foremost living authorities on the subject of publicity for public utility preferred stock offerings. I have tried letters, circulars, slogans, billboards, street cars, motion picture slides, postcards, newspapers and the word of mouth of salesmen, some of them high-class and some who could not come in out of the rain without help.

But I am not a foremost living authority. I only know that the truth must be told, and should be told in the simplest possible way and in the fewest number of words which will contain the story.

There is a plain and simple way to tell nearly everything. Only the very young expert physician upon the witness stand uses heavy language that confuses the jury; the old doctor says the same thing in the language of the plowed field.

The nature and extent of the property, the future requirements of the business, the use to be made of the new money, the amount of earnings left after operating expenses, out of which dividends can be paid, the public regulation and approval which should assure continued protection to consumer and investor, the past record of performance—these facts, expressed in the language of the shop and farm, are bound to be interesting and effective.

### Good Name the Vital Factor

When a man goes to a bank to borrow money, the bank investigates the security offered and then he considers that which he calls the "moral risk." By that term he means the general character and repute of the man in the community where he lives. If this "moral risk" is very good, I think the banker will look to that almost as much as to the paper security which is offered.

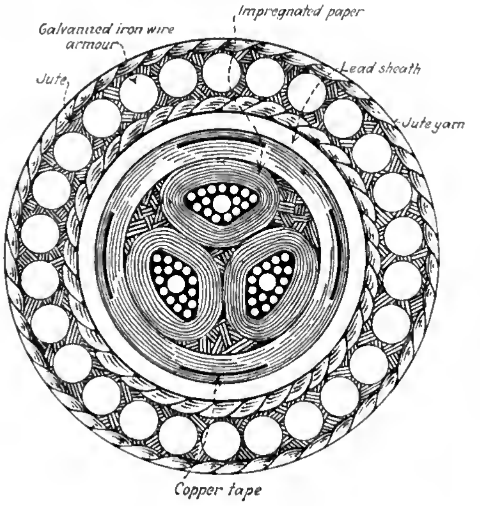
The public utility which offers its securities to its consumers will find that they will weigh the moral risk. It will weigh with them as much as any other factor. A patron who cannot analyze the balance sheet of a utility knows very well indeed the reputation which it has in the town for honesty and fair dealing. If a public utility decides to offer its securities to its own consumers, it will find that its record of long years of fair, courteous and honest operation will be more valuable than any publicity it can put out.

So it seems to me that the future success of what has come to be called "customer ownership" rests almost entirely with the public utilities themselves. That public utility which has pursued a uniform course of fair dealing with its patrons, which will accept full responsibility for the character of the security offered, keeping in mind the fiduciary relationship; which explains its needs and its problems to its consumers in a plain, straightforward way, will find itself in a partnership which will add very much to its value to the community.

It will have given a new and a valuable service to its consumers.

## Japan Now Claims Longest Submarine Power Cable in the World

THE submarine cable which has recently been laid and is now transmitting power from Niihama to Shisakajima, Shikoku, Japan, is asserted to be the longest of its kind in the world. The cable is about 13




CROSS-SECTION OF CABLE

miles long and consists of twenty-three factory lengths, each measuring 3,000 ft. The cable is composed of three sector-shaped conductors having a cross-sectional area of 100,000 circ.mils each. Each conductor is in-

sulated with impregnated paper, and the three conductors are wrapped with the same material and inclosed in a lead sheath. Around the sheath is a jute bedding wrapped with galvanized-iron-wire armor served with jute yarn. The cable contains four copper tapes within the outer belt insulation. These tapes serve as a protection for the power conductors and are also used for two telephone circuits. The finished cable is 3 in. in diameter and weighs 6.3 tons per 1,000 ft. It was tested at 30,000 volts at the factory, and at a pressure exceeding the working pressure (namely, 11,000 volts) by 50 per cent after the cable was laid. The cable was manufactured by the Sumitomo Electric Wire & Cable Works, Ltd. Laying of the cable was supervised by engineers of the same works and the installation was completed without any serious troubles.

# Inert Gas Over Oil in New Transformer

## Eliminates Oxidation of Oil and Serves as Cushion to Relieve Tank During Internal Explosions—Constitutes an Important Development in High-Voltage Apparatus

By L. H. HILL
*Transformer Engineering Department,*
*Westinghouse Electric & Manufacturing Company*

THE protection of insulating oil from deterioration and the elimination of the possibility of explosions in power transformers have been live problems for many years, and they have become more and more acute as larger and larger units are built.

The life of a mineral oil is intimately connected with the formation of deposits known as sludge. Oils obtained from the same shipment after having had similar refining treatment may when they are used in transformers be found to differ much in their sludging characteristics. Some oils go bad after a year or two, while others with proper care function well after as much as twenty years of service. The latter record is exceptional, however, because it involved a transformer which was never permitted to work at any overload, and because the oil was kept cool continuously. Moreover, it was a highly refined product. Other oils, though possessing many excellent physical and chemical properties, are fast sludge formers. Many chemist-years have been spent trying to ascertain the nature and mechanism of sludge formation, yet up to date, in spite of the many tests devised, no suitable quick quantitative method has been forthcoming which would indicate a true index of sludge formation.

Kissling's[1] oxidation method has been ordinarily used for testing transformer oils. Oil is kept at 150 deg. C. for fifty hours while oxygen is slowly passed through it. At times a piece of copper gauze is placed at the inlet of the air to act as a catalyst. The official French transformer oil specifications[2] call for a modification in the method by heating the oil from five hours to five days. Only naturally occurring catalysts are present, none being introduced. After the oil has been treated with oxygen or air, it is extracted with alcoholic soda and the sludge precipitated with light naphtha. The results are interpreted as "tar-forming," "coke-forming," "resinification constants" or "sludging" numbers.

The Waters[3] carbonization test depends upon the oxidation of the oil in the air at 250 deg. C. for two hours and thirty minutes. After cooling under prescribed conditions, petroleum ether is used to dissolve the thickened oil. The next day the precipitate is filtered and the dried weight calculated to represent the "carbonization value."

[1]*Chem. Zeitung,* 30 (1906), 932; 32 (1908), 938; 33 (1909), 521.
[2]Union des Syndicates de l'Electricité, Paris.
[3]Circular Bureau of Standards No. 99, 1920.

The Nastjukoff[4] formalite reaction modified by Westinghouse is used as an index to the sludging value of transformer oils. The insoluble condensation products from the treatment of oil with concentrated sulphuric acid and formaldehyde are collected on a Gooch filter, washed with petroleum ether, dried and weighed.

Herr's[5] methylal sulphuric acid condensation, the Etard's[6] oxidation of petroleum hydrocarbons, the Rohland[7] clay adsorption of unsaturates, the Michies[8] sludge test, the sulphur dioxide method[9], the selenium oxychloride test[10], the Babcock[11] absorption test, the acid heat test[12], the iodine and Maumene[12] number, are attempts to measure the possible oxidizibility or, rather, the durability of an oil.

### Temperature Influences Carbonization

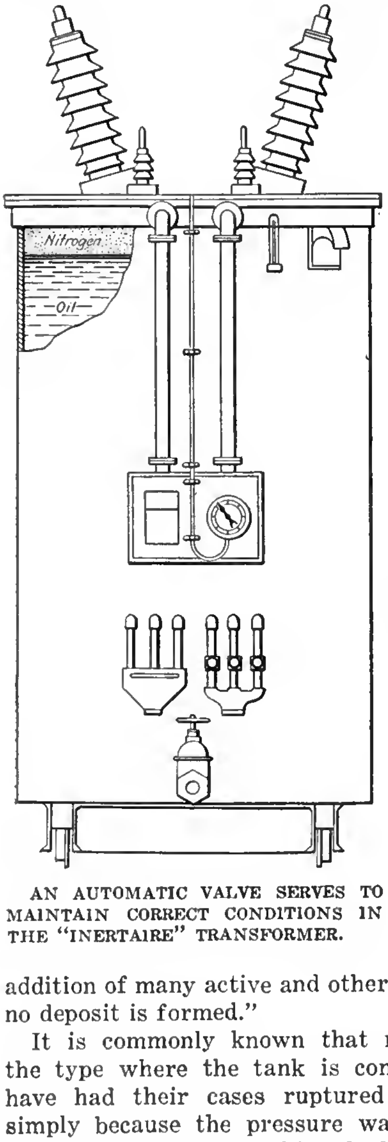
In all the carbonization, gumming, sludging or oxidation tests the temperature control and the impurities present or added have a decided influence on the amount of precipitate formed. But it is a most significant fact that transformer-oil sludging phenomena are intimately tied up with the presence of oxygen. To demonstrate readily the effect of sludging in air and non-sludging in the absence of air, it is only necessary to heat the oil in an open and in a closed tube to a temperature where sludge formation is greatly accelerated. A great many tests of this kind at varying temperatures up to 200 deg. C. show that sludge formation is greatly hastened by a rise in temperature in the presence of air. Many catalysts have been tried out in connection with the sludging phenomena over the same temperature range.

[4]*Petroleum,* 4 (1909), 1336; *Chem. Zeitung,* 34 (1909), 893.
[5]F. V. Herr, *Chem. Zeitung,* 34, 893.
[6]F. Schulz, *Petroleum,* 6, 189.
[7]Rohland, *Brochem. Zeitung,* 23, 278-280.
[8]*Journal Institute Electrical Engineers,* 51, 213-218 (1913).
[9]Edelean, *Chem. Zeitung,* 38, 391.
[10]Rodman and Ford, Scientific Paper, Westinghouse Electric & Manufacturing Company, 1920.
[11]Quartermaster Corps, U. S. Army, Specifications No. 2-21A, Nov. 15, 1920; Waters, Technical Paper No. 73, 1916.
[12]*Journal of Industrial Engineering Chemistry,* 3, 815 (1911).

The products in both the natural and catalytic oxidation are the same[13].

It is common experience in transformer practice to have to filter the oil on account of its deterioration due to oxidation; in fact that is one of the main reasons given for the use of the conservator type of transformer, that is, to lessen the deterioration of the oil through reducing its contact with the air. Data have been obtained from elaborate tests in the Research Department of the Westinghouse Company which show the rate of oxidation of transformer oil with air and with oxygen and the absence of oxidation with nitrogen over the oil. For example, quoting from an experiment made by C. J. Rodman:

"Heating the oil at 200 deg. C. for fifteen days in an open tube (⅝ in. in diameter by 8 in. long) in contact with air a dense deposit was formed within the oil, which when washed with petroleum ether on a filter and dried showed 12.3 per cent sludge. A similar experiment was made, except that the oil was heated in the presence of an inert gas—nitrogen. In this case no deposit was formed and the oil remained the same natural clear color. The same comparison is obtained at lower temperatures but lengthening the time of heating. When heating a good transformer oil in the absence of oxygen or air, even with the addition of many active and otherwise harmful catalysts, no deposit is formed."



AN AUTOMATIC VALVE SERVES TO MAINTAIN CORRECT CONDITIONS IN THE "INERTAIRE" TRANSFORMER.

It is commonly known that many transformers of the type where the tank is completely filled with oil have had their cases ruptured by internal pressure simply because the pressure was transmitted directly to the case, and something had to go. On the other hand there are records of many other cases of trouble in which an air space existed above the oil level where the internal pressure has bursted a relief diaphragm without rupturing the tank at all. In these cases the air has served as a cushion to take the edge off of the very sudden increase of pressure.

The "Inertaire" transformer, utilizing a cushion of inert gas above the oil level, was developed as a solution of the foregoing problems. With this system deoxygenating and dehydrating means are provided for removing oxygen and moisture from the air in the casing, leaving a dry, inert gas, nitrogen.

This type of transformer requires bushings similar to those that have always been used in transformers having an air space above the oil level and such transformers are used for the highest operating voltage. The bushings for the conservator type of transformer can be a little shorter on their inner ends, owing to their entire immersion in oil, but this is a matter of no practical importance and is certainly no practical objection to the use of inert gas.

A sketch illustrating the "Inertaire" transformer construction is indicated herewith. The cabinet shown on the side of the tank contains the special compound used as a deoxygenating material, a dehydrator and a new type of valve, employing neither springs, counterweights or sliding members, which relieves gas from the tank at say 3 lb. to 5 lb. pressure and admits air at a relatively low vacuum, a pound or less.

### Functioning of Apparatus

The apparatus functions as follows:

When the oil in the case increased in volume owing to an increase in its temperature, the pressure of the gas above the oil level tends to increase. If the load curve is such that the pressure is reached at which the valve in the cabinet releases to atmosphere, the excess gas escapes. This release of gas to the atmosphere obviously has no effect on the oxygen or moisture content of the gas in the space above the oil.

When, on the other hand, the temperature of the oil decreases, the reverse action takes place. If the load curve should be such that the oil cools sufficiently to bring the pressure to a value slightly below atmosphere, the valve again opens, this time admitting air to the cabinet. As this air is drawn through the cabinet, it passes through the dehydrator and porous deoxygenating compound contained in the lower part of the box, where moisture and oxygen in it are removed. This practically pure and dry nitrogen is then drawn through the pipes shown on the side of the tank into the gas body above the oil level.

It is obvious, of course, that the cycle thus described takes place intermittently, the frequency depending largely on the load curve. Power transformers operating at full load for days at a time will pass through comparatively few of such operations. In any case it will be noted that the exhausting of gas from the cushion and the inhaling of pure dry nitrogen is in itself a method of removing oxygen and moisture from the gas above the oil.

When the transformer is first put into service the gas cushion may be made inert either by diffusion to the deoxygenator or by starting with the tank filled with oil and drawing the air in through the deoxygenating material as the oil is pumped out to the proper level.

With the gas space once deprived of its oxygen the rest is automatic. If the pressure drops below atmospheric, the valve opens and allows the air to be drawn through the deoxygenating and dehydrating means into the tank as pure dry nitrogen.

The function of this valve is seen to be threefold: (1) To reduce the amount of air interchange between atmosphere and tank by allowing the pressure to build up to a safe value before releasing; (2) to eliminate the entrance of air into the tank through possible leaks by providing at the proper time a low resistance path; (3) to isolate at all other times the inert gas body from the atmosphere.

The dehydrator used with this construction is of a new type which does not possess the undesirable characteristics of the familiar calcium-chloride breather, whi

[13] *Berichte*, 53B, 66-71 (1920).

simply absorbs the moisture from the air and which, if not properly attended to, may actually be a hydrator rather than a dehydrator.

The advantages of a transformer casing provided with a gas cushion of nitrogen are many. In the first place, the insulating oil is maintained at all times dry and free from contact with oxygen. Extensive experiments have shown that transformer oil in a nitrogen atmosphere when subjected to the most harsh treatment does not deteriorate or even change color. The same oil when given the same treatment in an atmosphere of air sludges badly and otherwise deteriorates. Transformer oil absorbs approximately 10 to 15 per cent of air by volume at normal temperatures, but after heating to operating temperatures most of this is driven off in the "Inertaire" transformer and is gradually replaced by nitrogen in approximately the same proportion. Since oxygen absorbed in the oil is necessarily in contact with it, it contributes considerably to the sludging or oxidation phenomenon; hence its replacement by an inert gas is an excellent step toward the preservation of the oil.

Another important feature is that the casing is not completely filled with oil as in the overflow or expansion-tank type of construction. This construction was developed in order to eliminate some of the disadvantages of the plain, ordinary tank first used with a cushion of air above the oil. It involves the use of an auxiliary tank elevated above the main tank and connected thereto by means of a small pipe. The design is such that with the oil at its lowest temperature the main tank and the lower portion of the expansion tank contain oil. The auxiliary tank is of such size that the expansion of the oil in the main tank is not sufficient to overflow the auxiliary structure.

While this construction has advantages over the simple tank with air over the oil, it also has disadvantages. Perhaps the greatest of these is the fact that the main tank is completely filled with oil. Under certain conditions, owing either to the fault of the transformer itself or to the switching apparatus controlling it, arcing under the oil level may take place. When this happens large quantities of gas are evolved, due to the breaking down of the oil. In effect, this rapid gas evolution may simulate an explosion with a steep wave front below the oil level. With a tank completely filled with oil there is no compressible medium in the casing to take the shock of this wave, and the result is that the weakest part of the structure must fail. Attempts have been made to remove this hazard by mounting on the cover an elbow with a weak diaphragm on one end. To prevent the spilling of oil when this diaphragm ruptures it is necessary that the elbow be elevated above the cover to a point above the maximum oil level in the overflow tank. This means that there is a pocket of oil of comparatively small cross-section between the cover of the tank and the diaphragm which is supposed to rupture in case of internal distress. The fact that a small gas cushion is also present between this plug of oil and the diaphragm makes it still further uncertain that the device will operate.

It is generally recognized that with this expansion tank type of construction it is entirely possible that a failure of the transformer may cause manholes to be blown off, with a stream of oil following them, or cover belts to be stretched, allowing oil to run out of the auxiliary tank into the station.

It is an important function of the gas-cushioned transformer casing to eliminate even the possibility of this sort of disaster. A cushion of compressible gas is always present above the oil level; hence the first shock of a pressure wave may be absorbed, allowing a relief diaphragm time to act and expel the gas evolved. This action combined with a new type of diaphragm structure which eliminates gas pockets between the diaphragm and the cover of the tank protects the apparatus from danger due to a failure under the oil level.

The insulating oil in the overflow tank construction is in contact with the atmosphere, and some contamination is therefore possible. In addition, the very nature of the construction, with the expansion tank elevated above the main tank, means trouble due to the head of oil causing seepage leaks through gaskets around the cover and bushings. When it is necessary to open the main tank for inspection purposes or otherwise, it is necessary to drain the oil from the conservator and part of the main tank to a point below the cover. This in many cases presents a problem as to the disposition of this oil while the tank is open.

The advantages of the inert gas-cushioned structure over the simple type with the air space over the oil are self-evident. With this structure there is always the possibility of the ignition of a mixture of air and hydrogen or volatile hydrocarbons evolved in case of arcing under the oil level, and the contamination of the oil by moisture or oxidation.

With the modern tendency toward larger and higher voltage units and with the insistent demands for absolutely reliable service, the general adoption of the inert gas-cushioned transformer casing bids fair to be one of the most important developments in high-voltage power apparatus. Acknowledgment is made to C. J. Rodman for the material on sludge formation.

## Forest Protection Benefits Stream Flow

THE value of the assured protection of the forest cover in relation to the development of water power is, says the report of the National Forest Reservation Commission for the last fiscal year, apparently fully realized in hydro-electric developments which are now being made on streams the upper basins of which are within the purchase units within which lands are being acquired for Eastern national forests. On the Tallulah and Chattooga Rivers, the headwaters of which are largely protected by the Savannah purchase unit, there have already been installed four units.

With three additional power units, the total generating capacity will be increased to 175,000 kw. and the total storage capacity will be nearly 9,000,000,000 cu.ft. This storage will be so augmented upon the completion of the entire eleven power units that it is expected that more than 95 per cent of the discharge of these two streams, the largest headwaters of the Savannah River, will be controlled.

A similar development is now in progress on the Little Tennessee River, which is one of the important head streams of the Tennessee. The waters of the Little Tennessee River are protected by the Nantahala unit and a portion of the Savannah purchase unit. By a series of reservoirs it is designed to control more than 90 per cent of the discharge. The initial unit, for power generation only, consisting of a dam about 200 ft. high, has been constructed, developing more than 90,000 hp. The presence of the protection of forest cover to the basins on which the storage reservoirs are located is stressed, since this assures low turbidity, slight silting and permanency in storage.

## Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

### A "Yardstick" for Grading Public Utilities

*To the Editors of the* ELECTRICAL WORLD:

Allow me to indorse the view expressed in an editorial printed in the ELECTRICAL WORLD for Feb. 17 that there is a "yardstick" needed with which to grade utilities. In my experience as a valuation engineer, using original cost, reproduction new, tax values, etc., and studying operating conditions also, I have been impressed with the fact that wide gaps exist between the various measuring units so far devised and that they ought somehow to be brought nearer together. I should like to suggest as one form of "yardstick" a method that has often brought out the real point in a general problem for me. I know that it is used by many utility men, but I also know from experience that there are a great many who have never used it or do not understand its significance.

We must admit that the utility game is a business, very much restricted in some ways, but still a business, and as such it must be conducted for profit. To my mind, however, it is no more restricted than any other business which operates as a monopoly for the greatest net profit and is in a measure governed by the same laws. Whatever is left after the expenses are paid goes toward reserves for depreciation, taxes, return on investment and profit. With this in mind, let me submit my "yardstick." It is this:

Let $V$ = commercial value of the business,
$R$ = operating ratio in per cent,
$F$ = fixed charges in per cent,
$G$ = gross revenue per year.

Then $V = G(100 - R)/F$.

Taking an example, suppose that after taxes are paid a utility's operating ratio is 64 per cent, and that its fixed charges are then depreciation, 4 per cent, and interest, which can be assumed to be 8 per cent, or that the total fixed charges are 12 per cent in this case and gross revenue \$100,000 per year. Our equation then becomes:

$$V = \$100,000 \times (100 - 64) \div 12 = \$100,000 \times 3 = \$300,000.$$

Here, then, is our measure of this utility. Suppose we look at the books of the concern and find that this utility has \$500,000 plant assets. Now we may go to work to answer the question involved.

Let us make some more assumptions. Possibly this utility's expenses should be reduced; maybe it needs a rate increase to increase revenues. Either one of these measures will improve the operating ratio. Maybe service is poor and revenues are low for that reason. Maybe there has been too much high-priced construction, perhaps some foolish construction. Possibly the business is still undeveloped and it may be necessary to make rate changes before development can be attempted. I might add here that rate changes do not always mean rate reductions. Some of my readers might be surprised if they, for instance, converted oil-engine costs into an equivalent demand and energy charge, and I believe too much attention has been given heretofore to cutting costs and insufficient attention paid to what our competitors really can do.

Possibly fixed charges were estimated too high. Suppose we choose 4 per cent depreciation and 6 per cent interest, or 10 per cent total. Then:

$$V = \$100,000 \times (100 - 64) \div 10 = \$360,000.$$

I do this to show that it is very important to make the proper assumptions as to the so-called fixed conditions which hold with any particular property. Investigation might disclose that business could be increased 10 per cent and operating expenses cut 10 per cent and that 10 per cent was the right fixed charge. Then:

$$V = \$100,000 \times (100 - 53) \div 10 = \$470,000.$$

This now almost balances our assumed book value and shows a nearly healthy financial and operating condition. There is a temptation here to juggle the values in this equation until it fits the case. This, however, destroys its value as a guide.

I have discussed this subject merely to bring home again to some, and possibly for the first time to others, the importance of this "blanket yardstick," which really covers the whole field of operations of any particular utility, or, in fact, any business which keeps a proper accounting record.

G. H. PIKE,
Valuation Engineer.
United Light & Power System,
Abilene, Kan.

### American Success in China

*To the Editors of the* ELECTRICAL WORLD:

We desire to correct a wrong impression given by an article published in the ELECTRICAL WORLD of Sept. 2, 1922, entitled "Outlook in China." A statement was made as follows: "Contracts for complete systems are generally awarded to some European firm in Shanghai, Hongkong or some other large city."

Our agents in China, Andersen, Meyer & Company, Ltd., have asked me to call your attention to certain facts which show that it is far from the truth that European firms generally get the contract for electric lighting plants in China. I quote from Andersen, Meyer & Company's letter certain facts showing what the representatives of an American firm have accomplished in China:

"We claim as an American organization that we have installed more power plants and with larger output than any other contracting house in China and have followed out very much the same procedure as the ELECTRICAL WORLD asserts to have been followed by European competitors. As instance of this we have during 1922 contracted for the complete installation of the only four large power-plant extensions awarded in China.

"We would mention for your information a number of power plants which have been fully equipped by Andersen, Meyer & Company, as follows: Mukden, Kwangtung, Kirin, Harbin, Tientsin (several large cotton-mill power plants, average rating 2,000 kw. to 3,000 kw.), Hankow, Hangchow, Foochow, Amoy, Canton, Shanghai Chinese native city, etc.

"In addition to the above, we have supplied power plants in small sizes to most of the inland cities of China and have supplied similar plants to more than twenty-five cotton mills, principally in Shanghai and the northern territory, including Tientsin and Manchuria. We have secured not only more contracts in Manchuria than has any other firm, but a larger volume of business than any corporation trading in the Orient. We have at present in course of construction or installation one 40,000-spindle cotton mill complete with power-plant equipment, a large extension to the Mukden government electric light works, an extension to Kirin Electric Company and a new plant for Tung Liap Chen.

"As a matter of fact, if we eliminate the power plant

of the Shanghai Municipal Council, in which the General Electric Company has generating equipment of over 50,000 kw. in a total of 100,000 kw., there are few, if any, power plants in China which have been equipped with European plants." L. M. NICHOLS,

Director Commercial Research.
International General Electric Company,
New York, N. Y.

[The article referred to was written jointly by R. A. Lundquist of the United States Bureau of Foreign and Domestic Commerce and P. S. Smith, associate editor of *Ingeniería Internacional.* Mr. Lundquist says: "In all Oriental countries there are two classes of people—the Oriental and the European—classification being by race and not nationality. The term 'European' in export parlance would therefore embrace the 'American.' Moreover, Andersen, Meyer & Company, although agents for American electrical products, are a Danish firm. The statement as it appeared in the article, therefore, should not be considered a reflection upon American activity or progress in the Orient."—EDITORS.]

## A Practicable Neon Night Lamp

*To the Editors of the* ELECTRICAL WORLD:

Apropos of the little neon sign lamps described in the columns of the ELECTRICAL WORLD not many weeks ago, I was fortunate enough to receive from one of my friends a neon night lamp of the type noted as in some little use in England within the last year. The interesting feature of the specimen I have before me is that it is an alternating-current lamp for use on 110-volt circuits, which makes it therefore practicable for household use. It is in a short bulb, about 55 mm. in diameter, and fitted with the ordinary Edison base; manufacturer, Philips. Within the exhausted bulb two thick wires come out of the seal, each a full millimeter in diameter. The two are coiled in a parallel helix with about 2 mm. between the turns. The length of the helix is about 25 mm. and its diameter slightly less, containing five turns of each electrode. It is stiff enough to hold its position, and the two free ends are turned down into the center of the helix, where they terminate in two tiny opposed plates about 3 mm. x 1.5 mm. in size and approximately 3 mm. apart. The wire in the stem below the seal forms a compact spiral. The convolutions of the helix with the terminal plates form a little distributed condenser, between the turns of which the characteristic neon glow appears when the lamp is put in circuit. It starts showing a distinct glow at a little over 80 volts. The color is chiefly orange red with the little purple tinge given by a relatively small blue component of the spectrum.

The total amount of light is roughly about ⅓ cp., ample for seeing a watch face or finding the way about a room otherwise dark. At approximately the voltage designed the lamp takes nearly 25 milliamperes, or, the power factor being somewhat over 90, a shade less than 2½ watts. The efficiency is low both intrinsically and on account of the unfavorable color of the light, but the little lamp does give for the most trivial amount of energy enough light to serve its purpose. Dipped yellow to cut out the blue component, it would make a very useful dark-room light, and it certainly is interesting to find an operative neon lamp on this scale.

So far as I am aware, the lamps are not now being made in this country, but they are very likely to make their appearance one of these days and to find a certain amount of use. The energy taken by the sample I have is too small to start a meter unless it is just on the point of creeping, but it is also so small that it may well be cheerfully forgotten, as in the case of a bell-ringing transformer, particularly as there is a distinct advertising value in the little night lamp that unquestionably would tend to increase paying consumption. At all events, it is one of the neatest little applications of the low-resistance characteristics of neon that one could wish to see. Probably the sign lamp will come into more extensive use than the smaller one, but the value of the latter as an occasional convenience is well worth consideration. LOUIS BELL.

Boston, Mass.

## Non-Porous Porcelain and How to Obtain It

*To the Editors of the* ELECTRICAL WORLD:

Anent the editorial in issue of the ELECTRICAL WORLD of Feb. 3 referring to a paper submitted at the Vancouver A.I.E.E. Convention by C. C. Farr and H. E. R. Phillpot on fuchsin dye tests to determine porosity of porcelain insulators, it would appear that much of an educational nature is yet to be done before the proper understanding of the porosity phase of porcelain is appreciated by the engineering fraternity in the light of modern progress in the ceramic art.

One important fact which seems to have been overlooked in every discussion listened to or published article read is that the porcelain tested by Messrs. Farr and Phillpot was made many years ago and is not in the least representative of modern American porcelain turned out by potteries manufacturing insulators for transmission and distribution of power in up-to-date plants and with modern equipment and properly developed technique.

Porosity in porcelain is caused solely by insufficient vitrification; that is, by not being fired at a temperature sufficiently high and for a sufficient period to close the tubes or pores inherent in clay products. There is probably no manufacturer of prominence today who does not fully understand this. If, then, insulators are still being sold which have even a slight tendency to porosity, the maker is guilty of culpable negligence or worse. Porous porcelain is inexcusable in the light of the present knowledge of ceramics.

Another point conspicuous by its absence in the discussion pro and con concerning fuchsin penetration is that if the test were to be utilized as a standard basis of acceptance of insulators, none obviously, could be used. The reason for this is, of course, that the tested insulators must be destroyed. If but a certain percentage of the total be tested, say 1 or 2 per cent, there is no assurance that the other 98 or 99 per cent are not porous. The testing of a sample may tell the porosity of that one insulator. Certainly it tells nothing about any other one of the hundreds or thousands involved. How, then, may sound conclusions be drawn from porosity tests so far as their application to commercial shipments of insulators is concerned? The only result is possibly to satisfy the investigator as to the probability of moisture absorption by the tested sample. Patently, the more sane method of obtaining non-porous porcelain is to deal only with makers of unquestioned reliability, responsibility and integrity. Porosity is a much-feared bugaboo which seems to hold a peculiar fascination for investigators, but which should not afford a moment's perturbation of mind to a purchaser in this day and age. Any buyer can easily and fully safeguard himself against porous insulators, and without exercising any unusual ingenuity in the accomplishment of this much-desired result. S. L. CASE,

Insulator Engineer.
Westinghouse Electric & Manufacturing Company,
San Francisco, Cal.

# Central Station and Industrial Practice

**Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants**

## Hydro Construction Work Directed by Radio

RADIO was used in the winter in the Sierra Nevada Mountains of Fresno County, Calif., to direct the activities of five hundred men who were in camp behind 30 miles of almost impassable snowdrifts to push forward the construction of a tunnel. This tunnel is part of the hydro-electric development project of the Southern California Edison Company, which is carrying on a program for the development of a million and a quarter horsepower derived from the San Joaquin River and Big Creek and other mountain streams.

The entire program called for approximately five thousand men, including the five hundred working on the upper end of the long tunnel over the crest of the Kaiser Range. The direction of the men was controlled by radio from the headquarters of the resident engineer at Cascada, the construction headquarters. The success of radio was so thoroughly demonstrated last winter, not only in directing the work of the men who were beyond wire communication, but in picking up and carrying on communication with the general offices of the company in Los Angeles, a distance of 270 miles, that facilities were greatly augmented in preparation for this winter's work and new apparatus was placed in service.

There are now three combined radio, telegraph and telephone stations in operation and one more radio station is being installed. The headquarters station at Cascada is at an elevation of 5,000 ft., in a canyon approximately 2,000 ft. deep, with abrupt walls on three sides. The second station is at the construction camp on the shore of Florence Lake, which is the southern portal of the Florence Lake tunnel, at an elevation of 7,000 ft., and about 7½ miles in a direct line northeast of Cascada. The third is at a construction entrance camp over the Kaiser Range, which is about 8 miles in a direct line north of the south portal of Huntington Lake. This station is only 300 ft. higher than the portal station, but there is a mountain pass about 2,000 ft. high between them. Tests carried on showed that to communicate a predetermined distance in this district it was necessary to use about twenty-five times more power than was needed near Los Angeles. The three transmitters being used are rated at ½ kw. and contain one tube. Each set was designed originally for continuous-wave telegraph, but they have been equipped for telephone or buzzer modulated telegraph.

THE USE OF RADIO BY THE SOUTHERN CALIFORNIA EDISON COMPANY HAS PROVED VERY SUCCESSFUL

To furnish power for the boring of tunnels a 30,000-volt transmission line has been built between Cascada and the two mountain camps. The radio sets give a rapid and reliable means of communication during transmission-line trouble and in handling switching and operating line orders. The transmitter at Cascada obtains its filament current from the 110-volt supply and its plate current from a 1,500-volt generator belt driven by a 2-hp. induction motor. The radio power plants at Huntington Lake and at the construction entrance camp each consist of a 220-volt, three-phase motor coupled to a 32-volt direct-current generator and belted to a 1,500-volt direct-current generator. Under normal operation the 32-volt direct-current generator furnishes power for the filament and the 1,500-volt direct-current generator supplies the plate. During a failure of the 30,000-volt transmission line the 32-volt generator operates as a motor from the storage batteries of the mine locomotives used in the tunnel work.

HOUSING FOR MOUNTAIN RADIO SETS

At radio receiving stations over the Kaiser Range in the Sierra Nevada Mountains orders are received from headquarters directing the work of five hundred marooned tunnel workers on the Southern California Edison Company's hydro-electric development project.

The antenna at Cascada is of the

inverted L type, 140 ft. high at the free end, 90 ft. at the station end and 120 ft. between spreaders. Five No. 8 copper wires spaced 4 ft. apart are used. At the Huntington Lake Camp a T aërial is installed, which is 140 ft. high and 175 ft. between spreaders. At the construction camp a T aërial 90 ft. high and 150 ft. between spreaders is used. The radiation from each of these antennas is about 2.4 amp. at 540 m., which is the normal operating wave length.

VERNE D. ELLIOTT,
Electrical Engineer.
Southern California Edison Company,
Los Angeles, Cal.

## Estimated Cost of 6,000-Kw. Outdoor Substation

THE Pittsfield (Mass.) Electric Company is building an outdoor switching and transforming station adjacent to its Silver Lake generating plant, in order to receive high-tension energy from the Turners Falls Power & Electric Company upon completion of an interconnection between the two systems. The ultimate capacity of the switching station will be 20,000 kw. The estimated cost of the initial installation, which includes structural steel, transformers for 6,000 kw. and other electrical equipment, is given in the accompanying table.

ESTIMATED COST OF OUTDOOR SWITCHING AND TRANSFORMING STATION

| | |
|---|---|
| Structural steel | $6,500 |
| Circuit breakers and switchboard | 60,000 |
| Wire and cable | 1,280 |
| Insulators and bus connections | 9,582 |
| Conduits | 469 |
| High-tension metering equipment | 5,500 |
| Four 2,000-kva., 114,000/2,100/4,150-volt transformers | 32,100 |
| Foundations and erection | 10,000 |
| Engineering | 3,400 |
| Total | $128,831 |

Cost per kilowatt, $21.47

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Favors the Venting of Transformers

OIL conservators have several advantages in connection with transformers and may be absolutely essential where the units are operated on lines rated at 220 kv., but their use is accompanied by operating and maintenance inconveniences that have induced at least one large company to vent the transformers directly to the air without any intermediate chloride breather or the like. This practice applies to all transformers used on the system, even including the 110-kv. units.

The chief objection to maintaining a head on the oil in the transformer tank is that unless eternal vigilance is practiced the oil will leak out through the gaskets around the head and manhole on the tank. To avoid this trouble labor of higher grade than is necessary on non-conservator tanks must be employed whenever the top of the tank or a manhole is opened and closed. Furthermore, the oil must be drawn down below the top of the tank before the top can be opened for any purpose whatsoever. This may, according to the company, entail considerable delay at times when every moment is valuable.

Because of these reasons the company has adopted the open-vent system allowing free circulation of air above the oil. No deterioration of oil whatsoever has been observed in transformers so vented for several years. However, the transformers have been operated at very low temperatures. On other systems the advantages of oil conservators may be more important than they are on this system, so that they should not be abandoned or their advantages overlooked where they are now used unless conditions are carefully compared.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Instructions for Shutting Down Rotary Converters

WHEN shutting down rotary converters the load must be reduced to avoid throwing a sudden burden upon the other units in operation and thereby possibly tripping them out of service. If a rotary converter should be shut down from the alternating-current side first or if a total interruption of the alternating-current supply should occur, the machine would run as a direct-current motor and its speed might increase to a dangerous point. This is particularly true of a compound-wound rotary, which, because of the reversal of current in its series-field winding, operates as a differential compound motor with its well-known tendency to "run away." For this reason a standard rotary converter installation includes both a reverse current and an overspeed circuit-breaker-tripping device.

The voltage must be allowed to fall to a low value before the shunt-field switch is opened in order to prevent a bad arc.

The following instructions for shutting down rotary converters are given in the operating code employed by the Philadelphia Electric Company. The instructions for starting rotary converters may be found in the preceding issue of the ELECTRICAL WORLD:

1. Reduce the load on the converter to be taken off to as low a value as possible.
2. Trip the direct-current circuit breakers.
3. Open the positive and negative bus switches.
4. Open the rotary oil switch.
5. Open the starting, series field, equalizer and neutral switches.
6. Open the main-field switch and the booster-field switch after the voltage has decreased to a low value.
7. Raise the direct-current brushes (where a brush-lifting device is provided).
8. If the transformer bank is air-cooled by an individual motor-driven fan, shut down the fan; if air-cooled from a common air duct, close the transformer dampers; if water-cooled, shut off the cooling water.
9. Shut down the fan for supplying air to the rotor.

## Preventing Holes in Stoker-Fired Fuel Beds

HOLES in the fire bed are usually caused by stoppage of coal feed. They are developed by uneven resistance of the fire bed to the passage of air, a condition which occurs when the fire is clinkered or too thick elsewhere, or on account of an improper relation of stoker speed to wind box pressure, according to the operating code of the Philadelphia Electric Company. Holes in the clinker crusher pit are caused by improper adjustment of the crusher doors or by excessive speed of the crusher rolls.

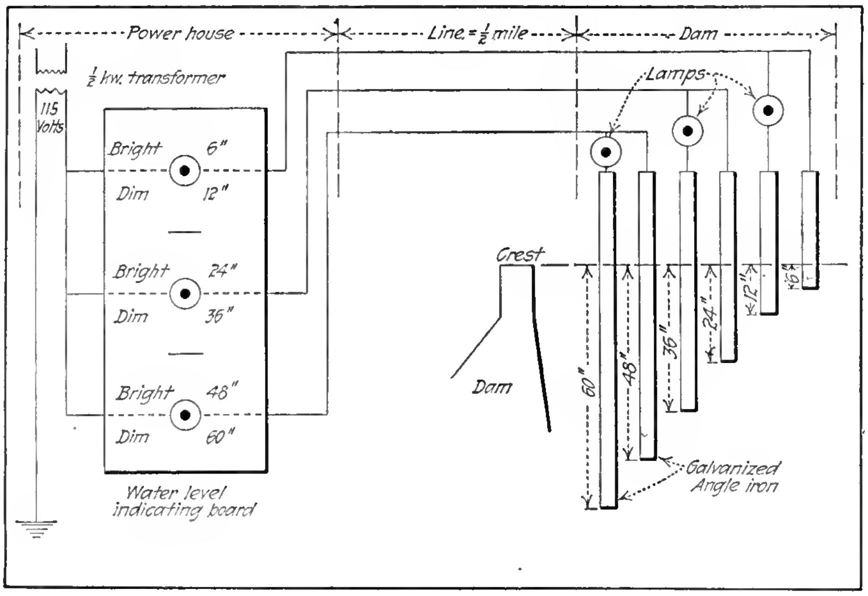
Following are the remedies as given in the above code:

1. Increase the stoker speed, cutting out the sections in which the fire may become too heavy.
2. Decrease the forced draft, if possible.
3. When a hole is near the front wall open the extension damper in the section in which the hole occurs.
4. See that coal is feeding into the rams at which holes occur and, if it is not, use wooden rods to force the coal to the rams.
5. If a hole is in the rear, put on the long stroke and close the extension damper.

## Water-Level Indicator for Small Hydro Plants

WHERE two or more hydro-electric plants operate in series on the same stream it is essential that some means be provided for accurately indicating the elevation of the water at all times in the lower dams, which in general are only diversion dams with but limited storage capacity. As the elevation of the water in dams between plants is dependent upon the adjustment of the load between them, a visual indication of the elevation of the water of such a dam is of great convenience in properly adjusting the load.

A very simple arrangement requiring a minimum amount of wiring and signal lines, the indications of which are independent of voltage variations and delicately adjusted resistances, has been used with success under the following conditions. The water for the upper plant on the river is supplied from a storage reservoir, the tailrace from this plant discharges into the river, and the water is again held by a small diversion dam about a half mile below. The water for the lower plant passes from this dam by a 5-ft. x6-ft. tunnel, the entrance of which is submerged 10 ft. below the crest of the dam. This tunnel carries the water to a small reservoir, from which point the penstocks go to the lower plant. If the water in the dam goes more than 5 ft. below the crest the pressure on the tunnel is not sufficient to supply the lower plant with the proper quantity of water to run up to capacity because of the small slope of the tunnel. It is the practice therefore to keep the elevation of the water in this dam between the limits of 6 in. and 60 in. below the crest. As the dam is of sufficient size to carry the full load of the plant for over an hour between these limits, the adjustment of the load between plants is not very difficult.




RELIABILITY IS A FEATURE OF THIS WATER-LEVEL INDICATOR

The indicating apparatus is installed in the lower plant and consists essentially of the following: An oak board painted black is mounted on one side of the switchboard where it is at all times visible to the operator of the plant. On this board three 110-volt lamps are mounted, the lettering and wiring being as shown in the accompanying illustration. Current is supplied from a small transformer and one side of the secondary is grounded. At the dam six pieces of galvanized angle iron are rigidly mounted on a wooden framework, and the lengths of the pieces are accurately adjusted to 6, 12, 24, 36, 48 and 60 in. below the crest of the dam. Three lamps are wired in circuit as shown, and three wires are run between the dam and the indicating board at the plant.

When the water in the dam is more than 60 in. below the crest there is no circuit and no lamps show up on the indicating board. As soon as the water reaches 60 in. there will be two lamps in circuit in series and the corresponding lamp on the indicating board will show up dim on half voltage. When an elevation of 48 in. is reached the lamp on the 60 in. iron is shunted out and the lamp on the indicating board burns brightly on full voltage. In the same way the board indicates the elevation for the four upper values. With a little experience an operator can tell the elevation within a few inches by the degree of brightness of the lamps, though for all practical purposes a knowledge of the elevation within a foot is sufficient except when the water is near the crest. At this point an indication is given for 6 in. to prevent the loss of any water over the top of the dam.

FREDERICK KRUG,
Superintendent of Hydro-Electric Plants.
Porto Rico Railway, Light & Power Co.,
Bayamon, Porto Rico.

## Illuminating Switchboard Instrument Scales

SATISFACTORY illumination of switchboard instruments — i. e., sufficient intensity to read the scales and detect the pointers without having glare—is apparently far from realization in most stations. It is not only a problem of properly placing the illuminant and diffusing the light, but of securing a dull finish on the board and instruments and selecting sufficient contrast between the scales, their background and the pointer. Both black and white scales with markings and pointers in the opposite color have been tried and each type has its advocates, one side contending that it is easier to detect the position of a white pointer on a black scale with white marking, whereas the other side contends that an instrument with a white scale and black pointer can be read at a greater distance.

The change from gooseneck lighting fixtures over groups of instruments to a lighting trough along the top of the board was some improvement and permitted more flexible arrangements of instruments with equal illumination. However, it still produces glare in some cases, especially where an attempt is made to secure fairly high-scale illumination intensity. One of the best forms of illumination witnessed recently is that where a translucent glass skylight is provided over and in front of the switchboard, daylight coming through in daytime and electric light from units placed above the skylight during other times. In another station very good illumination is provided by trough reflectors placed along the upper back edge of a benchboard running parallel to and in front of the instrument board.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

# Changing from 7,800 to 13,200 Volts

**Five Generators Rewound by The United Electric Light & Power Company Without Interrupting Service—45,000-Volt Underground Cable Used**

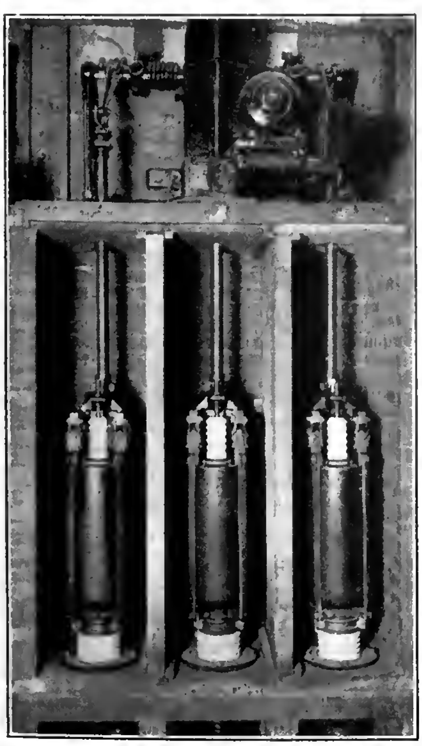
WITH the opening of The United Electric Light & Power Company's Hell Gate station in 1922 a study of generating and transmission economics indicated that a certain proportion of the Sherman Creek station, put in service December, 1913, should be changed from the original generating voltage of 7,800 to the higher 13,200-volt standard. The original design of the station called for a total capacity of 120,000 kw., but the primary installation consisted only of three 15,000-kw., 19,000-kva. turbo-generators furnishing energy at 60 cycles and 7,800 volts. As the demand warranted, the station was completed by adding, one at a time, three 60-cycle units of 22,000-kw., 25,900 kva. rating each. This was subsequent to the installing of two 25-cycle units of 20,000 kw. each soon after the station went into operation, precipitated by a contract to furnish energy at 25 cycles to the New York, New Haven & Hartford Railroad. These deliver energy at three-phase, but the generators have a special single-phase rating of 14,300 kva., required by the characteristics of the service.

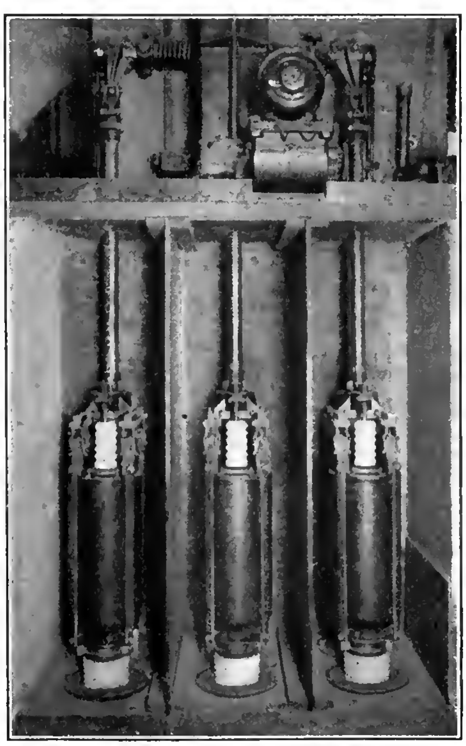
Up to the time of the change-over a portion of the 60-cycle energy was transmitted over radial feeders to nearby substations at 7,800 volts, and the remainder—for transmission to more distant points—was stepped up by transformers in the station to 13,200 volts. For this latter service all the switching was at the generated voltage, 7,800, the transformer being considered a part of the feeder.

There were three sections of bus in duplicate for the 60-cycle service, connected to form a ring, so it was decided to change two of these bus sections to the higher voltage as well as five of the six generators. By working according to a program no considerable loss of service of apparatus or feeders was experienced. The generators were taken out of service one at a time and rewound, for the higher voltage, two of the old frames and three new frames being employed. Coincident with this the switching equipment was changed so that as each generator was ready for service it could be connected to the proper equipment. By tying the two voltages together through transformers it was possible to keep a balance between the generator capacity and feeder capacity changed over.


FEEDER REACTOR AND POTENTIAL TRANSFORMER COMPARTMENT

Because it was impossible to secure delivery of several switches at the time that the change over from 7,800 volts to 13,200 volts was started, much manipulating of the few extra switches on hand was necessary for continued service. With only four spare switches on hand, four switches were torn down from their compartments in the northeast





SPACE FORMERLY OCCUPIED BY 7,800-VOLT SWITCHES MADE AVAILABLE FOR 13,200-VOLT BREAKERS BY SUITABLE BARRIERS

Left—2,000-amp. type H-6 oil switch mounted for service at 7,800 volts before remodeling for 13,200-volt service.

Center—2,000-amp. type H-6 oil-switch compartment rebuilt for service at 13,200 volts.

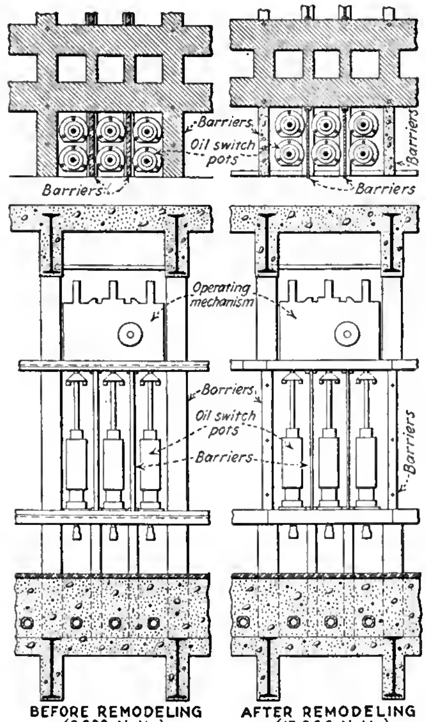
Right—Type H-203 oil switch mounted for 13,200 volts in space formerly occupied by H-3 switch that operated at 7,800 volts.

corner of the building, where the change-over took place, and were set up again where space permitted in the southwest section. Then the feeders were brought over in a similar manner and connected to the switches in the southwest corner. The interchanging of the apparatus to the extent of seven groups was completed before the compartments were rebuilt for the higher voltage. Subsequently the remaining switches and feeders were shifted, one or two at a time, and the compartments reconstructed, until thirteen groups had been changed over to the higher voltage.

Most of the work was done between midnight and 4 o'clock in the morning, on Sundays and during the summer months. It required from May, 1920, to November, 1921, to accomplish the complete transformation.

At this writing the three 15,000-kw. units and one 22,000-kw. unit have been put into operation at the higher voltage. The remaining unit to be changed has been rewound for the higher voltage but has been connected delta for operation at 7,800 volts until the equipment changes have been further advanced.

Oil switches at this station are of the General Electric type H-3 in sizes up to 1,500 amp. and type H-6 in 2,000-amp. and 3,000-amp. sizes. The former were installed in cells of 51-in. centers separated by 8-in. brick walls. The phases of each switch were separated by removable Alberine barriers 2½ in. thick, leaving a cell 15 in. wide for each oil tank. The H-6 switches are mounted on 61¼ in. centers with walls of the same thickness but with phase barriers 2½ in. thick. The arrangement of the steel of the building as well as the space limitations precluded any plan which would require more space per switch; yet the oil switch itself would be suitable for the higher voltage if mounted with larger spacing. To meet these conditions the 8-in. brick walls were replaced with precast reinforced-concrete slabs, 4 in. thick, set into the back wall. The phase barriers were replaced with ½-in. barriers of ebony transite.




REDUCING WALL AND BARRIER THICKNESS PROVIDES ROOM FOR 13,200-VOLT SWITCHES

It was necessary to replace entirely all of the reactors with new ones designed for the higher voltage. These could not be designed to be contained in the space as provided. It was found, however, that a coil could be designed which would not require any more width, so that it was only necessary to build the compartments to allow more space in a direction at right angles to the line of the switches.

On account of the increase in station capacity over the original design and the advisability of maintaining an adequate system of tie connections with the Hell Gate station and with the stations of the allied companies, it was found necessary to increase the switchboard capacity over that originally installed. In the original design each exciter and each transformer bank for house service was fed from an individual switch in the same manner as an outgoing feeder. To release these switches a house bus with the necessary equipment was installed, fed through reactors from the 7,800-volt bus. Installed on this structure is the equipment for eight feeders to exciters and auxiliary transformers. It is equipped with General Electric type K132B switches.

Transmission economics pointed to a further change in the supply to the territory north of the station. As a preliminary to a general system of high-voltage service a 45,000-volt cable connection is being installed between the Sherman Creek station and the New Rochelle station of the Westchester Lighting Company. To supply this at Sherman Creek, outdoor transformers have been installed which step the voltage up from 13,200 to 45,000. The present installation consists of six oil-cooled, single-phase transformers of 4,200 kva. each, star-connected on the high side and delta-connected on the low. The 45,000-volt service is over three single-conductor, lead-covered cables installed in the standard duct system.

Arrangements are being made toward increasing the boiler capacity either by installing new boilers or making elaborate changes on a number of those now installed.

FIELD EDITOR, ELECTRICAL WORLD.
New York, N. Y.

OUTDOOR TRANSFORMER STATION WILL ENERGIZE 45,000-VOLT UNDERGROUND CABLE TO OUTLYING DISTRICT

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## Profitable Merchandising

**By Careful Attention to Territory Conditions, Methods of Selling and Rapid Stock Turnover an Illinois Central Station Realizes a Neat Profit on Appliance Sales**

IN PUTTING its appliance sales on a profit-making basis the Bloomington & Normal (Ill.) Railway & Light Company has demonstrated the possibilities of this business as a revenue producer for the central-station company when proper consideration is given to the nature of the territory served, the goods handled and the manner of selling. The field served by the company takes in Bloomington and Normal. Ill., with a combined population of 33,650, and through transmission lines about a dozen small towns within a radius of 30 miles. The total population of the territory is approximately 50,000. In addition to supplying electric light and power service in this territory the company operates the street railway and furnishes steam heat in Bloomington.

### Method of Operation

The organization of the company provides for a local manager in each small town or group of towns. This is necessary in order to give adequate service, and these men, because of the variety of work they are called upon to perform, must be rather versatile in their experience. Their work incident to the actual operation of the system requires only a part of their time and the rest is available for other effort. Most of these towns, with populations of less than 1,500, have no shops which sell electrical appliances or do the work of an electrical contractor. The sale of electrical energy alone does not provide enough revenue to pay the local manager and leave a return for the company. It is nevertheless necessary to have a man on hand in case anything goes wrong. The natural result is to use the spare time of the local manager in merchandising electrical appliances. In these smaller towns the local manager also does the wiring work of the community.

An ample stock of appliances is kept at the headquarters offices, and there too the company is in the merchandising business. Originally merchandising was conducted under the office and electric distribution departments without a definite line of authority and without an aggressive selling policy. Even this arrangement helped to reduce operating costs in the small towns, but the profit it earned was small.

### Development the Result of Necessity

D. W. Snyder, Jr., manager of the company, says: "In 1919 rising costs, coupled with the inability to increase rates, caused us to turn to the one department which was not regulated as to rates and which would not require a great deal of new capital to develop. We established a merchandising department in charge of a commercial manager, ranking him with the other department heads. This department handles all merchandising and new business except certain types of industrial business which remain in the electrical distribution department.

"The policies of the new department were: (1) To do no housewiring in the cities or towns where there were electrical contractors able to do the work, (2) to sell only those appliances which had merit and would stay sold, (3) to co-operate with local dealers and to maintain fair prices, (4) to so conduct the merchandising department that electric energy sales would increase, the use of electric appliances would become popularized, and generally to better the service to the community.

"Results were immediate and satisfactory. New records for sales volume, net profits and meter connections were made. The next year, 1920, showed still better records. Daily sales that year averaged $500 and the net revenue earned was $36,244.50, from which was deducted $9,153.85 for advertising and new-business development expense, which we charged to the merchandising department to offset office rent and other items of general overhead. In addition to the above earnings, the merchandise department made possible many savings in operating expense. The average merchandising stock was $28,000, which includes the stocks in the small towns. The stock had a turnover of five and a quarter times in 1920. Approximately $25,000 was tied up in accounts, some of it being on time payments on which interest was charged. Those accounts could have been discounted through a bank or discount corporation, but instead we carried them ourselves. In a short time the company built up a revolving fund sufficient to carry the time-payment accounts.

"The results shown in Table I were reached in a small town of 1,300 population and show the value of the merchandising department. The

TABLE I—APPLIANCE SALES IN TOWN OF 1,300

| Appliance | No. | Amount |
|---|---|---|
| Vacuum cleaners | 24 | $1,563.25 |
| Washing machines | 11 | 1,544.00 |
| Heating appliances | 56 | 902.20 |
| Fans | 3 | 84.00 |
| Motors | 6 | 390.00 |
| Lamps, wiring, etc. | | 3,499.41 |
| Total | | $7,982.86 |
| Expense | | 5,437.60 |
| Gross profit | | $2,545.26 |
| Advertising (local) | $208.00 | |
| Portion commercial manager's salary | 155.00 | |
| Miscellaneous expense | 120.00 | 483.00 |
| Net profit | | $2,062.26 |
| Local stock on hand (average) | | 950.00 |

capital investment in the local stock was kept low compared with the volume of sales as the central stock could be drawn on when needed."

In directing his department the commercial manager uses sales talks, educational letters and tabulated reports of the business done in each town. This serves to keep up the enthusiasm and creates a spirit of friendly rivalry which is a great sales help. All members of the staff are paid salaries except the men who sell vacuum cleaners. These are sold

on the co-operative plan by which the district manager for the manufacturer furnishes the trained salesmen and supervises their work. This plan rids the commercial manager of the need for giving his detailed attention to sales of electric cleaners and releases his time for other matters. Nearly every month some one appliance is featured in special sales effort, but seldom, if ever, is there any cut in the price. Most of the appliances are demonstrated, sold and serviced in the homes of customers.

### Importance of Advertising

Mr. Snyder says: "Advertising, backing up the personal solicitation, is the most important part of the sales promotion work." That Mr. Snyder believes this is shown by the fact that he devotes approximately 4 per cent of the gross sales to advertising, most of it going into newspapers. A separate advertisement is used for each appliance. "It is advisable to keep in mind," he says, "that a newspaper advertisement is like a display window—if it is cluttered up with several things, it becomes less effective. It is the same as with salesmen; if they concentrate on one appliance they can sell it effectively, whereas divided effort results in divided and diminished volume. Some days we have as many as three advertisements in one issue of a newspaper. We advertise three and four times per week in both local papers, and in the smaller towns where there are weekly papers we use them regularly.

"One of the daily papers carries an electrical page every other week on which many of the dealers and contractors advertise. This feature gives us a page devoted in both advertising and news to electrical matters. The electrical page is the result of the broad way in which the electrical dealers of the city have come to look at the joint problems of those in the appliance selling business.

"In recent years we have been heavy newspaper advertisers, and at one time some of the contractor-dealers thought the advertising done by the central station was aimed at them. It was pointed out, however, that the advertising was intended to attract the buying power of the public to electrical lines, and we suggested that the dealers increase their advertising expenditures, not in the spirit of competing against one another, but rather as a concerted effort on the part of the electrical trade competing against the field. The combined sales of the contractor-dealers each year since that time have shown healthy increases, which proves the soundness of the theory. In addition to the newspaper advertising we carry cards in the street cars and follow up 'prospects' by using letters and inclosures with our mail."

The extent to which one appliance can be "put across" depends on its quality and degree of usefulness to the householder. Table II shows how generally the Bloomington & Normal Railway & Light Company has sold the vacuum cleaner to customers.

These figures show the results which can be obtained by organization, concentration and persistence. More than 20 per cent of the homes in these towns have bought vacuum cleaners. Mr. Snyder says: "There is no such thing as saturation, at least so far as we now see it, as the number of new customers each year exceeds the number of cleaners and washing machines which the company has been able to sell. For the last four years our company has averaged nearly one hundred new customers per month, and our sales of these appliances have not nearly reached this proportion."

"Through selling electrical appliances," says Mr. Snyder, "we have been able to have a good man at each point ready for any emergency which might arise. We have built up our system and loaded our lines through wiring the small-town homes and selling them energy-using household appliances and have brought up our earnings per capita. It is our belief that the central-station company owes it to its customers to maintain a properly organized merchandising department, not as a competitor of the contractor-dealer, but to co-operate with him in serving the already existing needs and to develop the almost untouched field before us."

TABLE II—VACUUM CLEANER SALES

| Town | Population | Wired Homes | No. Cleaners Sold | Wired Homes per Cleaner | Population per Cleaner |
|---|---|---|---|---|---|
| Bloomington | 33,650 | 6,686 | 1,559 | 4.29 | 21.59 |
| El Paso-Hudson | 2,097 | 556 | 113 | 4.93 | 18.56 |
| Gridley | 890 | 300 | 63 | 4.76 | 14.13 |
| Flanagan | 637 | 167 | 19 | 8.79 | 33.53 |
| Chenoa | 1,314 | 374 | 75 | 4.99 | 17.52 |
| Lexington | 1,301 | 304 | 72 | 4.22 | 18.07 |
| Morton | 1,194 | 395 | 23 | 17.17 | 51.95 |
| Tremont | 976 | 181 | 6 | 30.17 | 162.67 |
| Total | 42,059 | 8,963 | 1,930 | 4.64 | 21.79 |

## Improved Lighting of 32 Stores Adds Revenue

SOME remarkable results have been achieved by the Cleveland Illuminating Company through improving the quality of illumination in stores and at the same time increasing the lighting load in existing installations. Two illuminating experts in a period of sixty days have increased the annual revenue from thirty-two small stores by about $4,000 and improved the service in many others.

A small district in the city was chosen for the work, the very large stores in the section being passed over until a later time. The two men took two weeks to make a survey of the lighting in the stores and entered the survey data in detail on cards. A total of 388 stores were surveyed, and 233 of these were selected as needing attention at once to improve the illumination. A group of 100 stores at a time received letters offering the service of the illuminating experts, and these letters were followed up with cards, literature and personal visits. About 25 per cent of all the stores returned an inclosed postal card asking the company men to call. The fifty-two stores obtained from the cards were increased by fourteen other stores obtained incidentally, so that a total of sixty-six stores were treated by the experts. Thirty-two of these stores installed larger lamps and new fixtures, cleaned old fixtures, raised and lowered fixtures or rearranged their illumination. Thirty-four others have decided to make changes in accordance with the recommendations of the experts.

The whole idea of the new department is to render better service, and in many cases no new revenue was obtained, but the lighting service was improved by cleaning or rearranging the existing installation. The service has been well received by the customers and has proved profitable to the company. The plan is to work one district at a time until it is completely serviced and then proceed to take up successive sections of the city.

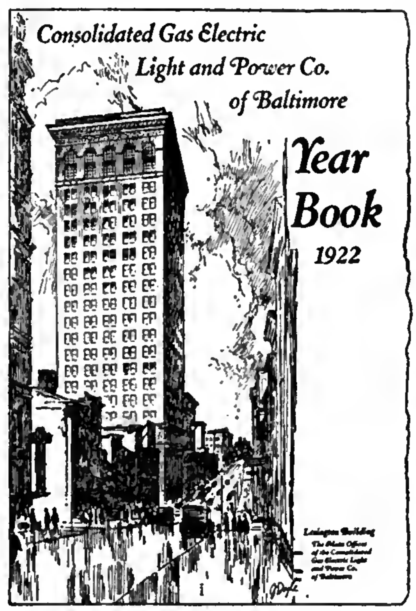
## Baltimore Company Gives Full Information in Year Book

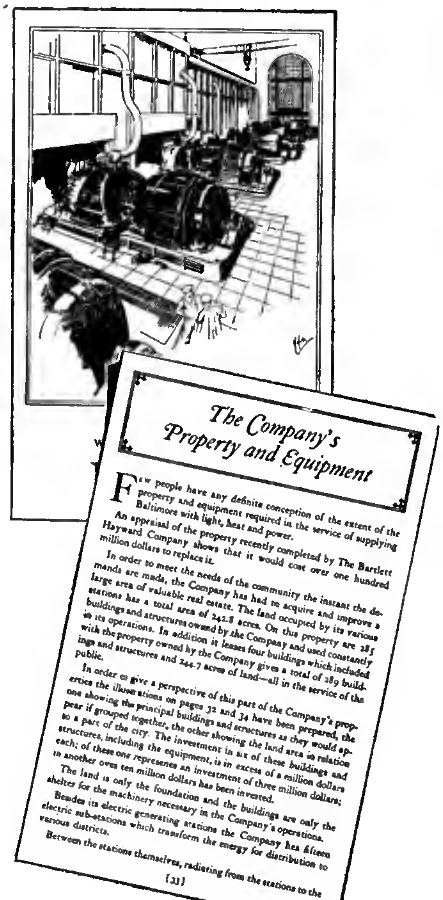
THE Consolidated Gas, Electric Light & Power Company of Baltimore has done a notable thing in publishing for the benefit of its shareholders and the public a year book which gives in A B C form all the information that stockholders want bearing upon the condition of their property. The year book, which is edited by Arthur W. Hawks, Jr., of the Baltimore company, fills a long-felt want, and other electric light and power companies could emulate it with profit.

Many annual reports are wholly unintelligible to the average stockholder. He studies the figures sometimes, but when he has finished he knows about as much of the condition of the property the report deals with as he did before. This confusion and apparent obscurity are obviated in the Baltimore company's book.

There are nearly seven thousand residents of Baltimore and vicinity who own shares of stock in the company. More than a thousand of these are employees and by far the greater number own from one to ten shares. The management of the company believes that these stockholders have just as much right to know the true condition of the company as have the men who sit on the board of directors or those who own big blocks of stocks. For this reason the year book has been published. This policy is set forth in the preface:

"Public service is a public trust and, though the year book is issued primarily for the company's stockholders and other investors in its securities, copies will be available to all who are interested in the company's affairs, either as customers, as prospective investors, or as students of the history of the growth of Baltimore with which its Gas & Electric Company is inseparably connected. The Consolidated Gas, Electric Light & Power Company of Baltimore is not of Baltimore by name and place of business only. It is of Baltimore by inception, by organization and by ownership. It is not owned by a few capitalists. It is owned by 10,375 stockholders, the majority of whom live in Baltimore and vicinity. It is operated by Baltimore men and women for the benefit of the people of Baltimore as well as in the interests of the stockholders. Its allied services of electricity and gas are intimately interwoven in every activity of the life of the city. The welfare and progress of Baltimore are the welfare and progress of its Gas & Electric Company."


COVER AND SOME INTERESTING PAGES FROM BALTIMORE COMPANY'S YEAR BOOK

## Results of Central-Station Publicity*

**Organization of Information Bureaus —N. E. L. A. Opportunities and Progress in Telling of the Industry**

BY C. L. EDGAR

President Edison Electric Illuminating Company of Boston

THERE are at the present time nineteen public utility information bureaus, established in twenty-seven states, and two bureaus in the course of formation. The managers of these various bureaus meet at least twice a year—once at the National Gas Association convention and once at the National Electric Light Association convention. They compare notes, consult with one another and have a little convention of their own. I attended one of their luncheons and meetings in Atlantic City last spring and was very much impressed with the character of the men and with the breadth of their vision.

There are 127 companies in the New England bureau, the running cost of which is about $20,000 per

*From an address before the New England Division, N. E. L. A., March 8, 1923.

year. The bureau issues about 2,500 weekly bulletins, 1,000 of these going to newspapers throughout New England. J. B. Groce, the director and his assistants clip all the daily papers and those of the weekly publications which have any considerable circulation. The material sent out by this bureau has been copied by every daily newspaper in New England—that is to say, the articles sent out have been used in the news or editorial columns. Many of these articles have been published at least six months after the bulletin was issued, thus proving conclusively that the newspapers feel that this material is of value and keep it on file for future reference. One recent editorial was composed of parts of six bureau articles published at different times. Up to date there have been copied about 125 pages equal in size to the first page of the Boston *Herald*. This includes only the papers that are clipped. It is generally considered that the smaller papers which are not clipped would add 25 to 33⅓ per cent to this amount. It is, therefore, safe to assume that from 150 to 175 pages of this material have been reproduced in New England newspapers during the last eighteen months. At advertising rates this would cost $150,000 to $175,000.

It has been a liberal education to come into contact with the men connected with the other branches of the industry. We meet at luncheon every Monday. Two representatives of the Boston Consolidated Gas Company, two from the street railways, two from the New England Telephone & Telegraph Company, two from the electric companies and two representing combination gas and electric companies compose the committee. The attendance at these meetings is bound to carry the conviction that the committee takes the matter seriously.

In spite of what has been said, I want to voice a note of warning. The work of the bureau is not intended to take the place of company activity. It is merely to supplement it. It is to show us how to advertise and to get publicity. I think the majority of the members of the bureau have looked at the question from this standpoint. I don't believe that many of them have "lain down on their jobs" and said to themselves, "As long as the bureau is doing this work, why worry?"

Two hundred of the leading central stations in the country are spending $3,000,000 a year in advertising. This means about one-third of 1 per cent of their gross earnings. In the Boston Edison company we are spending 1 per cent, which is three times the average, and I am perfectly willing to admit that I do not think that we spend enough. We all ought to spend more. The average manufacturer spends from 2 to 5 per cent of his earnings. This would mean in the case of the Boston Edison company three-quarters of a million dollars per year. Of course, I could not see my way clear to suggest such an amount as this, but it does show where we stand on the question of advertising compared with the manufacturing industry.

### N.E.L.A. to Spend $100,000 on Advertising

This year the National Electric Light Association will spend $100,000 on advertising—some of it out of the association's own treasury and some of it underwritten by the larger central-station companies. The bulk of this is going into farm magazines.

Another activity of the national organization has to do with the advertising campaign of the manufacturers. They have, of course, been accustomed to spend large amounts of money each year in advertising their products. As a result of conferences with the officials of the association they are now giving a certain percentage of their advertising space to telling our story. We are thus really getting the benefit of their advertising campaign.

One of the most interesting lines of advertising promoted by the N. E. L. A. is in the development of motion pictures. Now that this country has become a nation of "movie" patrons, it is well that our industry should take advantage of this fact to the fullest extent. The national organization has got out two films which have been shown in hundreds of theaters before many thousands of people. It is now preparing a third film for this same purpose. The Boston Edison company has also made a film telling the history and operation of the company from the coal mine to the customer. This film is to be shown at least once a day at the national convention of the Association to be held in New York in June. It cost between $4,000 and $5,000 and is the starting point of tremendous possibilities in bringing the activities of our industry to the favorable attention of the people.

## What Other Companies Are Doing

**Atlanta, Ga.**—The employees of the Georgia Railway & Power Company have organized an association known as the Power Club and elected F. A. Brine president. The objects of the organization are to foster and promote the interests of its members through association, to encourage their active participation in amusements, athletics and other educational and helpful activities, and to work for their mutual advancement.

**Colorado.**—The Colorado Power Company of Denver recently sponsored a moving picture which was displayed in many of the cities of the state. The picture was entitled "Yours to Command" and showed what electricity would do for the housewife and the public in general.

**Cushing, Okla.**—A fire on Feb. 10 destroyed the power plant of the Minnesota Light & Power Company, which served this city. The Oklahoma Gas & Electric Company connected its high-tension transmission line within a short time, gave Cushing service and as a result secured a ten-year contract to supply power wholesale, the Minnesota company selling it at retail.

**Bucksport, Me.**—As an immediate result of the extension of service by the Central Maine Power Company into the Castine district forty-eight of 102 homes located along the line have been connected with the system and various local industries are receiving attention, with the prospect of new enterprises coming into the Penobscot territory.

**Boston, Mass.**—As a means of increasing the use of electric appliances by central-station employees, three manufacturers are offering electric ranges to the employees of the Edison Electric Illuminating Company at 50 per cent discount off list. The offer is made in the belief that employees, by using electric ranges in their homes, will be better able to talk to customers about the advantages of these appliances.

**Providence, R. I.**—Rapid progress is being made on the six new buildings which will constitute the general service plant of the Narragansett Electric Lighting Company on Melrose Street, Providence. One feature of the plant will be a newly equipped meter-testing laboratory designed for artificial control of both temperature and humidity.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Development of Small Water Powers.* —R. P. HART.—The application of remote control to substation and generating plants has a ready application to the utilization of small water powers. As a typical instance of this, the author describes a water-power site redeveloped with a remotely controlled station and operated in parallel with another plant 3,000 ft. away. This plant consists of a 225-kva., 2,300-volt, 600-r.p.m., 60-cycle, three-phase alternator, to which a 125-volt exciter is directly connected. — *Power*, Jan. 30, 1923.

*Power Plant Using Natural Steam.*— W. WIEDER.—Natural steam at a pressure of 3 atmospheres flowing from wells drilled in volcanic strata at Larderello, Italy, is used in a 7,500-kw. plant. To avoid corrosion of the turbine blades the steam, which contains about 5 per cent non-condensing gases and emerges at a temperature of 180 deg. C., is used to heat a water evaporator. This steam operates the turbine, running at a speed of 3,000 r.p.m. Three-phase, 5,000-volt, 50-cycle energy is generated, and this is stepped up to 36,000 volts for feeding four transmission lines, supplying metallurgical and chemical establishments. Several 16,000-volt lines supply nearby customers. A new geothermic plant in Lago, intended for 10,000 kw., is under serious consideration. Considering the necessity of evaporators, the large-type turbines and pipe lines due to the low pressure and the considerable losses in these the economy of this plant is not so high as might be expected.—*Elektrotechnische Zeitschrift*, Feb. 8, 1923.

*Automatic Control Apparatus for Control of Oil-Burning Furnaces.*—A temperature and pressure controller for use in connection with furnaces and boilers, which is asserted to save from 10 per cent to 30 per cent in fuel oil, is described. This device uses either air or steam for atomizing the oil.— *Iron Age*, March 1, 1923.

## Generation, Control and Switching

*Present Status of Overvoltage Protection.*—G. BENISCHKE. — The author criticises some of the apparatus now used to avoid disturbances due to excess voltages. He claims that if any other effective protective apparatus is installed, the use of a grounding wire above the transmission wires is without value. Small overvoltages can be easily taken care of with water-jet grounding devices or large ohmic resistances permanently connected to the lines. The best protection against large overvoltages is still the horn gap with a series resistance and a sufficiently large choke coil. Recently introduced oil-immersed resistors, with a contactor either to shunt a part of the existing resistance or to introduce a previously shunted resistance, are rejected by the author on account of their moving parts. He prefers a horn gap with a magnetic blow-out. A satisfactory protection against large overvoltages is possible only with several horn gaps on the same line and an iron-core choke coil in the branch toward the consumer. Little attention is being paid to the proper design of these choke coils. It is essential, the author points out, that their self-induction per unit length of winding shall be many times higher than that of the line ahead of it. A coil consisting of a few turns, 1 cm. or 2 cm. apart (bed-spring type), he claims, is absolutely useless and coils with open iron cores are advocated instead. Disk coils wound like a watch spring with a ribbon of copper and a ribbon of iron, insulated from each other, are effective choke coils. Praise is given to a new brush discharge protector which consists of two flat electrodes separated by an air gap and a tumbler-shaped glass vessel. Beyond a critical voltage brush discharge takes place between the electrodes and over the rim of the glass. Condensers and aluminum or lead peroxide arresters are now condemned even by those who originally advocated them as they cause overvoltages. The effect of quenching choke coils and quenching transformers, lately looked upon as the universal overvoltage protectors and used frequently quite promiscuously, is not fully known as yet. Having caused a number of transformer breakdowns, the further installation of these coils was not recommended at a recent meeting of German operating engineers. One of the safest means to avoid overvoltages is to prevent higher harmonics in the wave form, which can be achieved by a short-circuit damping winding in the pole pieces of the generators and synchronous motors.—*Elektrotechnik und Maschinenbau*, Feb. 18, 1923.

*Frequency Conversion by Third-Class Conductor.*—C. P. STEINMETZ.—Attention is drawn to the so-called "third-class conductors"—a class to which arcs and gas discharges belong—in which the voltage decreases with increase of current. It is shown that these conductors can be considered as a combination of a negative resistance with a source of power and as such are capable of transforming the low machine frequency into a high oscillation frequency of alternating currents. Their presence in an electric system may thereby produce cumulative oscillations. The general equations are then derived for a system comprising a third-class conductor shunted by an inductive circuit containing capacity and supplied with voltage over an inductive circuit from an alternating low-frequency source.—*Journal of the A. I. E. E.*, March, 1923.

## Transmission, Substations and Distribution

*Polymorphous Machines.*—G. M. PESTARINI.—An interesting study of the so-called polymorphous machines—viz., machines which are able to link up two systems of different characteristics and transform electrical energy is given. With the practical use of those machines the reliability of the electrical energy would be increased. The author discusses the transformation of direct-current energy from constant voltage to constant current, transformation from polyphase alternating current to direct current and the reverse, transformation from polyphase current to polyphase current of different frequency, from single-phase current to balanced polyphase current and vice versa, and from pulsating energy to continuous energy. Industrial applications are also described and electrical railway operations with polymorphous machines investigated. — *Elettrotecnica*, Dec. 5 and Dec. 15, 1922.

*Artificial Electric Lines.*—H. NUKIYAMA and Y. SHOJI—A "T" and "Π" section of an artificial line may be combined in a series in order to make the frequency characteristics of the artificial line more close to those of the uniform line to be represented. The authors treat the combined T and Π line as a homogeneous line by suitable combinations of the neighboring sections of each.—*Journal of Institute of Electrical Engineers of Japan*, February, 1923.

## Units, Measurements and Instruments

*Measurement of Radio Signals*—C. R. ENGLUND.—A portable compact measuring unit for incoming signal strengths has been worked out capable of measuring from 3.5 microvolts per meter up at 23,500 cycles. The measurements are made by a primary comparison with a locally generated electromotive force by means of a highly selective receiving unit and a 600-ohm artificial line box especially made for this purpose.—*Proceedings of the Institute of Radio Engineers*, February, 1923.

*Various Photo-Electrical Investigations.* — W. W. COBLENTZ. — Miscellaneous data which were obtained in connection with the general investigations of photo-electrical investigations are given in this paper. Data are given on the photo-electrical sensitivity of artificial preparations of molybdenum sulphide, molybdenite, stibnite and iodine. The effect of heat and

electrical treatment upon the photo-electrical sensitivity of molybdenite and stibnite and the spectrophoto-electrical curves of cuprous oxide and of lead antimony sulphide are also given.—*Scientific Papers No.* 462, *Bureau of Standards.*

## Motors and Control

*Industrial Power.*—J. A. BURNETT.—The author first demonstrates the advantages of electric power for industrial plants and then discusses in detail the various features involved. Comparisons of direct current and alternating current for power, operation of motors, bearings and lubrication, range of voltage and power-factor characteristics are among the more important points discussed.—*Electrical News,* Jan. 15 and Feb. 1, 1923.

*Calculation of Steps for Motor Starters.*—L. BINDER.—The author develops a simple graphical method to determine starter steps for motors. With slight variations this method can be used for all types of direct-current or alternating-current motors. Full details are given for the series direct-current motor, the shunt direct-current motor with field shunting, the alternating-current series motor and the three-phase induction motor.—*Elektrische Betrieb,* Feb. 10, 1923.

*Electric Drive in Coal Mines.* — W. PHILIPPI.—The extremely low efficiency of compressed-air drive for drills, coal cutters, fans, etc., in coal mines is forcibly established by an elaborate report made after a study of twenty-six mines and the advantages of introducing the electric drive are described. The danger of igniting explosive gases from sparks or arcs due to the electric drive has been virtually eliminated by using interlocked contacts and switches with breaker under oil, or within a chamber equipped with plate protectors. Three-phase current only is considered, because it gives the simplest and safest motor. The author described the latest electric-driven coal drills, reciprocating hammers, coal cutters, firing switches, ventilators, shake conveyors and various other equipment suitable for electric drive. — *Elektrotechnische Zeitschrift,* Jan. 18, 1923.

## Heat Applications and Material Handling

*Electric Arc Welding Apparatus and Equipment.*— J. CALDWELL.—The author deals with the physical features of the iron arc as used for welding ferrous metals as far as those features are known, indicating some of the lacunas in present knowledge, and describes the general types of apparatus, with examples of each type, and some of recent design which promise well. Operating or workshop methods are touched on only so far as they illustrate or determine, or are determined by, the physics of the welding arc and the practical requirements of welding.—*Journal of the Institution of (British) Electrical Engineers,* February, 1923.

## Electrophysics, Electrochemistry and Batteries

*Gases in Metals.*—LOUIS JORDAN and F. E. SWINDELLS.—The determination of combined nitrogen in iron and steel and the change in the form of nitrogen by heat treatment are investigated. It has been found that the treatment of certain steels increased the amount of nitrogen as determined by the Allen method. This increase has been found in an electric furnace silico-manganese steel, in a plain carbon steel from the outside pressure of an autoclave plate and in a series of electrolytic iron ingots. — *Scientific Paper No.* 457, *Bureau of Standards.*

*Permanent Magnet Steel.*—E. GUMLICH.—Extensive research work carried on in the Physikalisch Technische Reichsanstalt (the Bureau of Standards of Germany) with various steel alloys suitable for permanent magnets resulted in the discovery of an alloy steel with considerably improved magnetic properties. Based upon previous tests on iron-manganese steel with an addition of cobalt, the saturation of the steel has been increased beyond values previously known on chromium and tungsten steel. A further improvement was achieved by adding 5 per cent of chromium, resulting in a three times higher product of remanence and coercive force. Tabulations are given with full test data of the new steel alloys, depending on the method of tempering the steel in water or in oil and the tempering temperature. The best results were obtained with an alloy containing 1.1 per cent carbon, 3.5 per cent manganese, 36 per cent cobalt, 4.8 per cent chromium and 54.6 per cent iron.—*Elektrotechnische Zeitschrift,* Feb. 15, 1923.

## Telegraphy, Telephony, Radio and Signals

*Relations of Carrier and Side Bands in Radio Transmission.*—R. V. L. HARTLEY.—The modulation of a carrier wave by a signal wave and the subsequent reproduction of the signal wave are discussed in terms of the sustained sinusoidal components into which the various waves may be resolved. The conception of a modulated wave as being made up of a carrier component and two side bands is explained. The saving in frequency range resulting from transmitting a single side band is emphasized. Equations are derived for the distortion of the reproduced wave in terms of that of the modulated wave. The effect on the signal of various typical distortions of the radio wave is examined for both single and double sideband transmission, as is also that of altering the phase of the locally supplied carrier and of altering its frequency. The resulting distortion of the signal is found, in general, to be more serious for telephony when both side bands are used and for telegraphy when only one is used.—*Proceedings of the Institute of Radio Engineers.*—February, 1923.

*Super-Regenerative Circuits.* — A. RINGEL.—The author presents fifteen different super-regenerative circuits. In these circuits the variation frequency is applied both to the grid and the plate of the regenerative tube and radio-frequency amplification is used. Arrangements are described for different forms of circuits for the oscillator, and the constants and dimensions of the various coils, condensers, etc., are given.—*Wireless Age,* March, 1923.

*Electric Oscillation in Three-Phase Aërial Line.*—S. BEKKU.—The author has developed a series for calculating the inductance interference of parallel lines, such as a power line alongside a telephone circuit, for any value of the coefficients of magnetic induction and has obtained results indicating that, where there are $n$ wires, $n$ traveling waves of different propagation velocities exist on each wire in general.—*Journal of Institute of Electrical Engineers of Japan,* February, 1923.

## Traction

*Present Status of Railway Motors.*—K. SACHS.—The author gives a critical account of the latest types of railway motors for direct-current, single-phase and three-phase operation. Six sectional drawings and six photographs of motors that are given should be of particular interest to designers. A narrow-gage direct-current street-railway motor with an unusual ball-bearing arrangement and a 1,390-hp. three-phase locomotive motor for the Italian railways call for attention.—*Elektrotechnik und Maschinenbau,* Jan. 1, 1923.

*New Repair Shops at Boston.*—The extensive repair shops which the Boston Elevated Railway is now building near the Everett terminal will occupy a tract of 22½ acres, making them one of the largest of the kind in the world. How the work will be routed through the various departments, which are so arranged as to keep the travel of heavy parts to a minimum, is the principal subject discussed.—*Electric Railway Journal,* Feb. 10, 1923.

## Miscellaneous

*Electricity in Therapeutics.* — DR. LOUIS SAMENGO.—Two papers presented at the medical congress held in Buenos Aires in October, 1922, and reprinted in French. One deals with the transillumination of the sphenoidal sinuses by a nasal pharyngoscope through which an electric wire is carried connected with a minute lamp operating on 5 volts. The other concerns a "thermo-injector," the liquid contained in which is heated through the electrical connection of the syringe to a 15-volt regulator. By means of this regulator the voltage on the syringe can be varied from 3 volts to 15 volts and by adjustment each division of the regulator can be made to correspond to a distance temperature, permitting the injection of the liquid at a constant gradation of heat.—*La Semana Medica* (Buenos Aires), No. 47, 1922, and No. 1, 1923.

# New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

## La Navigation Fluviale et les Forces Hydrauliques en Suisse

By Dr. Victor Jaunin. Lausanne: Giesser & Held. 322 pages, maps and many illustrations.

## State Power Plants in Sweden

Published by the Royal Board of Waterfalls in Sweden. Upsala: Almquist & Wiksells. 170 pp., with maps and many illustrations.

These two volumes have much in common. They are both complete records of the vast hydro-electric developments which are being carried on in Switzerland and in Sweden respectively. Both countries, being without coal deposits of any size, established many years ago special boards to investigate and control all their water powers, a task which in Sweden became so large that in 1913 a number of subsidiary administrations had to be created to handle effectively the vast amount of engineering work involved.

Switzerland for its part is not only harnessing on a large scale its plentiful water powers, but is establishing at the same time a national canal system, permitting navigation and cheap transportation within its own boundaries and with its neighbors, France, Italy, Austria and Germany, a complete connection between the rivers Rhone and Rhine being the ultimate goal. The available waterpower energy of Switzerland has been estimated at roughly 3,000,000 hp. Of this 840,000 hp. is now utilized in 835 large central stations and 38,000 hp. in 6,025 small stations. An interesting part of the book is the detailed description of a number of the largest Swiss hydro-electric stations. To be sure, nearly all of these plants are so large and contain so many important and modern features that descriptions of them have already appeared in the technical press. Details of some of the plants with very high head, such as, for example, the Ritom station with a hydraulic head of over 2,600 ft., are of especial note.

The book on the Swedish power plants is of a much more technical character and written especially for the designer of station layouts, going down to the minutest detail. Sectional drawings form therefore a large portion of the illustrations. The volume contains a complete description of the large hydro-electric plants at Trollhättan (115,000 kw., 50 kv.), Porjus (58,500 kw., 80 kv.), Alvkarleby (61,250 kw., 70 kv.) and Motala (30,000 kw., 70 kv.), as well as of the Västeras steam plant (38,000 kw., 120 kv.).

A 220,000-volt, three-phase, 50-cycle trunk-line system, covering the lower half of Sweden, will be completed by the end of 1935. A number of transmission lines, operating now at 120,000 volts, are built with sufficient clearances to permit an increase to 220,000 volts in the future. Some of these Swedish plants show great originality in their design. For example, the entire power house of the Porjus station is subterranean, blasted and hewn into solid bedrock. Another instance is the side wall of the Alvkarleby station, which forms the retaining wall of the upstream canal.

A. PALME.

## Machinery Foundations and Erection

By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 685 pages, illustrated.

A practical book on machinery foundations has long been needed, and the one under notice is the result of several years' work on the subject by the author. Material has been collected from many sources on all the problems and methods of building, designing or changing foundations and has been studied and presented in a logical, clear and useful form for those engineers who lack the time or training to study the usually difficult mathematical treatises on the subject. The author has written a workable book for all kinds of engineers which is certain to be used as a field guide in construction work.

In one division of the book he gives the fundamental formulas relating to foundations, in a second section he discusses the foundation accessory equipment and detail parts, while still another portion of the book takes up the complete foundations for specific machinery. Methods employed for erecting machinery after the foundations are built are clearly stated in the last part of the book. Interspersed throughout are problems which treat of the text matter. Mr. Croft has used pictures to convey major ideas. This volume keeps up the standard of his other works in excellency of make-up, clearness of expression and good illustrations.

## L'Union d'Electricité et la Centrale de Gennevilliers

By Ernest Mercier, general manager of the Union d'Electricité. Paris: Revue Industrielle.

This pamphlet, of which an English edition will be issued shortly, is devoted especially to the superpower plant at Gennevilliers, near Paris, which was covered in a leading article in the issue of the ELECTRICAL WORLD for July 29, 1922. An account is given of the formation of the present company, which was organized within the past few years by the aggregation of a number of small electric lighting and power companies. An account of the program of the present company and the way in which it is being carried on is also given. There are numerous details of the Gennevilliers plant, elaborately illustrated, and there is some information regarding other power plants owned by the company. This pamphlet is the one referred to in the footnote printed in connection with the ELECTRICAL WORLD article mentioned.

## Corso Teorico-Pratico di Elettrotecnica

By Prof. Luigi Lombardi. Milan: Casa Editrice Dottore Francesco Vallardi. Third edition. Two volumes, 1,411 pages, illustrated.

In no clearer way than in these volumes can problems concerning the theory and construction of electrical machinery and their different applications be analyzed and presented to young students. Professor Lombardi rightly avoids that dry form in which a textbook so often appears and presents his subject matter interestingly, discussing it in an exhaustive way which makes the treatise more worth the consideration of professionals as well as students. The latter with the aid of this book will undoubtedly become acquainted not only with the theoretical solution of numerous electrical problems but also with the application of theories to practical cases.

In the first volume the author, in dealing with the production of electrical energy and after explaining the theoretical side of machinery construction at length, passes in review and discusses in detail different practices followed by the most important European and American manufacturers and the resultant characteristics of their products. In the other volume transformation, distribution and the use of electrical energy are presented and illustrated in the same clear, thorough form. While the theories of the science could not be better explained and while American scientists receive their just share of credit for what has been done on this side of the Atlantic, we feel that in the discussion of the different practices and methods of construction of electrical apparatus the American manufacturer does not receive, especially in regard to motor and generator construction, the degree of credit that he deserves. Perhaps the difficulty of obtaining data from him, first-hand, accounts for this. Nevertheless, the book has remarkable merit and is worth keeping in any library.

PHILIP TORCHIO.

# Books Received

**"Mechanical World" Electrical Pocket Book, 1923.** London: Emmott & Company, Ltd. 326 pages, illustrated.

**Electricity and Its Application to Automotive Vehicles.** By Paul McDowell Stone. New York: D. Van Nostrand Company. 844 pages, illustrated.

**Der Drehstrommotor.** By Julius Heubach. Vol. II. Berlin: Julius Springer. 599 pages, illustrated.

**Power Stations.** By Thomas E. Murray. 178 pages, illustrated.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## New Use for Carrier Radio

**Trouble Reports Are Telephoned Over Feeder and Trolley Wires in New York City**

THE Third Avenue Railway Company, in conjunction with the General Electric Company, has completed a series of experiments in New York City in which radio carrier currents are used on the feeders and trolley wires of its overhead-trolley system as a means of communication between points on the system. Transmitters and receivers similar in many respects to those used in radio broadcasting have been employed, and satisfactory communication has been established between substations and dispatchers' offices and trolley cars.

At a special demonstration of this means of communication held on Monday of this week a surface car carrying the radio equipment ran up and down the St. Ann's Avenue line, about a mile and a half in length, in which distance the operators communicated at will with the Brook Avenue substation. This car was in charge of Walter J. Quinn, electrical engineer of the railway company, and Edward Austin, engineer of the General Electric Company.

### What Has Been Accomplished

Discussing what has been accomplished toward more rapid means of communication between points on the line in surface operation, Mr. Quinn said:

"The wires and feeders form a network covering the entire system which furnishes ready means of contact with all strategic points and also the means by which emergency motor vehicles may instantly make contact and be placed in communication with the central dispatching point. We have found that by a suitable modification of the conventional radio transmitting system the output of the transmitting station in the form of high-frequency carrier currents is modulated by the voice through suitable amplifier and modulator tubes."

Mr. Quinn explained that at the receiving point, which may be at any place on the network, a radio receiving set may be coupled to the trolley wire, which permits the listener to receive the communication by the use of ordinary telephone receivers. Both at the point of origin of the message and at the receiving point facilities may be provided for two-way conversation; that is, each operator may talk as well as listen. Simultaneous transmission and reception is possible without the use of switches alternately connecting the transmitter and receiver to the trolley wire.

No interference, he said, will be caused to the users of short-wave broadcasting receivers by the presence of carrier currents on the trolley system, owing to the long wave lengths employed in the carrier-current system and to the fact that the long-wave carrier currents are guided by the trolley wires and there is no appreciable radiation from them.

## Business Conditions Improve

**Heads of the N. E. L. A. Geographic Sections Report on General Conditions Throughout the Country, Particularly with Reference to Electric Light and Power Industry**

GENERAL business conditions, and particularly those in the electric light and power industry, are showing steady improvement according to statements of representatives of all the geographic divisions in attendance at the national executive committee meeting of the National Electric Light Association held in Chicago, March 23. It was also reported that although much radical legislation aimed at public utilities has been introduced in the legislatures, comparatively little of this class of legislation will be enacted into laws, many state legislatures having adjourned without any action whatsoever, thus indicating a trend of public opinion toward sane and fair treatment of utilities.

A very perceptible swing toward more widespread customer ownership of stocks and bonds of public utilities is manifested throughout the country, and this, it is thought, has had much to do with increasing public confidence and support for the electric light and power industry.

The business of individual companies during 1922 showed a very healthy increase, as was indicated in the annual dues of the association, which have increased approximately 12 per cent, and the feeling of the principal companies toward the national organization is indicated by the fact that no resignations have been recorded.

### Convention Plans

Drafts of reports by the four national sections and by the national committees were submitted in brief and approved for presentation before the convention to be held in New York next June. The general convention plans were discussed and committees were authorized to proceed with detailed arrangements for the several sessions. Among the chief reports submitted was one by E. W. Lloyd, chairman of the Joint Committee for Business Development, who spoke of the co-operative work being done by that committee. The committee is now energetically at work, many of the misapprehensions and misunderstandings regarding its activities having been cleared up. It is Mr. Lloyd's expectation that the joint committee will make an admirable presentation of its plans and a report of its various activities at the convention in June.

The committee on relations with the educational institutions is working out details for a national program whereby it is hoped that lectures and courses on public utility subjects will become a part of the curricula of the leading universities and colleges of the country.

## Public Relations Meetings

**Executive Committee of N. E. L. A. Section Plans for Advertising and Publicity**

AT THE meeting of the executive committee of the Public Relations National Section of the National Electric Light Association held in Chicago on March 22 the reports presented indicated that marked progress had been made in the activities of the section. Definite advertising and publicity plans were outlined and approved, and the preparation and production of a third motion-picture film was indorsed and was approved on the following day by the executive committee of the parent association.

Announcement was made that the Public Relations National Section will hold three afternoon sessions during the convention next June. The first of these will be devoted to general business and the presentation of reports of committees. At the second session the work of state committees and general advertising and publicity topics will be discussed, while at the third session there will be a symposium of public relations activities presented by five state commissioners and five leading executives of the industry.

## New York Water-Power Bill

**Provisions of Measure Introduced to Carry Out Governor Smith's Recommendations**

A BILL introduced into the New York State Legislature on March 22 to carry out the recommendations made by Governor Smith in his special message on water-power development makes an appropriation of $1,000,000, to be immediately available, but contains no indication of and puts no limitation upon ultimate cost. The bill is confined to development on the Niagara and St. Lawrence Rivers and is therefore necessarily conditional on the outcome of the pending litigation between New York State and the Federal Power Board.

Elaborate machinery is set up by the bill. A bureau is established to be headed by the State Engineer and Surveyor, acting as Commissioner of Hydro-Electric Power. Sites on which no work has been begun may be condemned, development may be undertaken by the state on these sites or on sites owned by it, and transmission lines may be constructed by the state. All existing transmission lines are declared common carriers and put under the control of the bureau. Municipalities receiving power may compel its transmission over privately owned lines or may build their own transmission system. No provision is contained to oblige a municipality to obtain a certificate of convenience and necessity from the Public Service Commission before engaging in this business, nor is there any clause for compensation of private companies whose business may be injured or for referendum to the voters of a municipality of the issue of state or private service. Rates are to be controlled by the Commissioner of Hydro-Electric Power.

OTHER BILLS OF ELECTRICAL INTEREST

Among other bills introduced into the Senate at Albany are one to limit to 15 cents per lineal foot the cost of laying service pipes or wires of an electric light corporation connecting main line with meter in building or premises; one authorizing New York City to construct electric power houses at city-owned reservoirs in the Croton and Catskill watersheds, build a transmission system and dispose of the energy generated, and one providing for laying of wires and conduits for electric light and telephone service under private roads or streets on which owner has right of access to or egress from property.

In the Assembly a bill has been introduced requiring the electrification of all steam railroads in New York City.

## Pinchot's Power Bills In

Bills designed to carry out Governor Pinchot's plans for power development in Pennsylvania were introduced in the lower house at Harrisburg on Wednesday. One bill provides for a "giant power survey board" and carries an appropriation of $35,000 for the work. Another creates a commission to negotiate with New York and New Jersey for regulation of the Delaware River and utilization of the river for power. Other bills give the Water Supply Commission and Forestry Department added authority to facilitate the early development of electric power throughout the state.

## Joint Fuel Committee Closes Washington Office

Announcement is made by Chairman John W. Lieb of the joint fuel committee representing the national electric light and power, electric railway and gas associations that the Washington office of the committee, which has been in charge of Col. John Price Jackson, will be closed Saturday, March 31. This action has been determined upon because of the general improvement of the fuel situation, although there are isolated instances in which assistance will continue to be needed. Any member companies having difficulty in obtaining fuel supplies are advised to correspond directly with N. E. L. A. headquarters in New York after April 1.

## Big Advertising Program for N. E. L. A. Convention

Letters have been sent to all manufacturer members of the National Electric Light Association announcing that the exhibition committee, Frank H. Gale chairman, has determined that it will not be feasible to hold an exhibition in connection with the convention of the association in New York City next June. The manufacturer members, however, have been requested to co-operate in a huge advertising and publicity program during the week of the convention for the purpose of stimulating interest in electrical devices and electrical service generally. In this connection they have been requested to urge their dealer representatives in New York City to make special show-window displays during convention week, to urge dealers to give particular attention to newspaper advertising space and to arrange special exhibits.

# Recommendations of Radio Conference

**Department of Commerce Is Asked to Enlarge Both the Broadcasting and the Amateur Fields by Opening Up and Readjusting Wave Bands**

THE second national radio conference, whose deliberations at Washington last week were reported by the ELECTRICAL WORLD (page 708), has announced its recommendations to the Secretary of Commerce. It finds that the interference experienced by broadcasters and listeners can be relieved by the opening up of a new wide band of waves by the government and a new assignment of individual wave lengths to broadcasting stations. This can be made possible by the opening up of what were previously government reserved waves and the shifting of certain ship waves out of the broadcasting wave bands. The Department of Commerce, acting under its present authority, will be able to establish and enforce the new regulations and thus bring order in the radio world.

Boiled down, the important recommendations of the conference are these:

Previously all broadcasting was concentrated on three wave lengths, 360, 400 and 485 m. Now a new field extending from 222 m. to 545 m. can be created for the purpose. Within that field individual wave lengths can be assigned to stations and be divided into two classes. The higher-power class A stations, corresponding to the present class B stations, can use the wave lengths between 288 m. and 545 m., while lower-powered stations (new class B stations) can use the waves from 222 m. to 286 m. This will enable the higher-power stations distributed in fifty localities and powerful enough to cover the United States to be within the reach of every listener. Suitable wave lengths are provided in the recommendations for the existing lower-power stations, numbering more than five hundred.

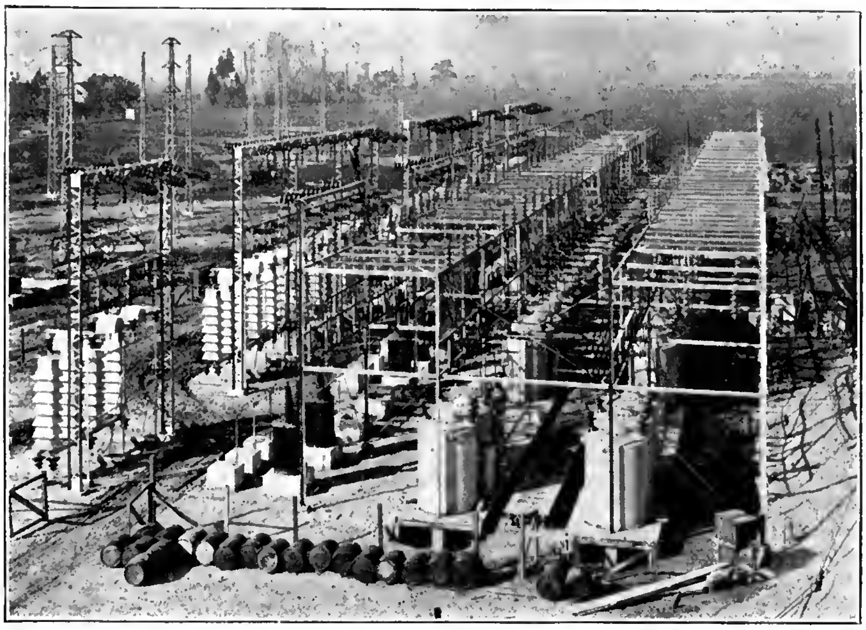
The report urges that the field of amateur activity be extended by allotting a band extending from 150 m. to 222 m. in place of the waves up to 200 m. now used. The band from 200 m. to 222 m. can be reserved for high-grade continuous-wave telegraph transmitting stations operating under special license. Technical and training school licenses can also occupy this band. The report confines spark amateur radio-telegraph stations to the band measuring 175 m. to 200 m. Ships using 450-m. waves should keep silent between 7 and 11 p. m. and as soon as possible readjust their equipment for transmission on wave lengths above 600 m. Another recommendation is that simultaneous rebroadcasting be permitted as a service only on a broadcasting wave length and with the authorization of the original broadcaster and of the Department of Commerce.

The new regulations recommended are based on a plan submitted by the radio inspectors of the Department of Commerce and include elements from other plans submitted by the Radio Section of the Associated Manufacturers of Electrical Supplies, the National Radio Chamber of Commerce, the Institute of Radio Engineers, the American newspaper broadcasting stations and several other groups of those concerned with radio.

## Laguna Bell Substation

### Rapid Progress on Southern California Edison Structure for Transforming 220,000-Volt Energy

THE 60,000-volt bus at the new Laguna Bell substation of the Southern California Edison Company has just been placed in operation and the 220,000-volt equipment is rapidly being placed. This substation is a short distance southwest of the city of Los Angeles, and it will constitute another terminus similar to Eagle Rock and a very important switching station on the 60,000-volt Edison system. After the Big Creek lines are changed over to 220,200-volt operation it will be the means of utilizing 220,000-volt power at a point very close to the load center of a rapidly growing industrial section of Los Angeles and southern California.



THIRTEEN 60,000-VOLT LINES WILL RADIATE FROM THE NEW LAGUNA BELL SUBSTATION

The main Big Creek transmission line will be tapped a few miles before it terminates at Eagle Rock substation, and two 30-mile, 220,000-volt steel-tower lines will skirt the city of Los Angeles' to Laguna Bell. Double-bus construction will be provided on the 220,000-volt, 60,000-volt and 15,000-volt buses to provide maximum continuity of service. Iron pipes mounted on pillar insulators with no overhead steel construction will be used for the 220,000-volt buses. The 220,000-volt switches will have an interrupting capacity of about 2,000 amp. at 220,000 volts. A bank of transformers consisting of three 20,000-kva. units will be used to step down from 220,000 volts to 60,000 volts at present, although ultimately two such banks will be used. A concrete building is being erected which will house a 30,000-kva. synchronous condenser. This condenser will be used for line regulation and power-factor control and will be tapped off the 60,000-volt bus. Wherever possible outgoing 60,000-volt lines will utilize balanced relays as protective equipment so that a defective transmission line will be quickly isolated. Each of the outgoing 60,000-volt lines will also be provided with oxide-film outdoor-type lightning arresters.

The 60,000-volt circuit breakers are interesting owing to their size and the fact that they are of the multi-break type where a number of breaks in series are utilized to break the arc when the switches are opened under short circuit. Extreme care and much thought have been given to the designing of an adequate system of grounding for the neutrals of the 220,000-volt transformers and for the station grounds. Drilled wells will constitute part of this grounding plan. Approximately 27 acres of land have been purchased, and the greater part of this will be utilized in the ultimate outdoor station construction. The cost of the present program is more than $1,000,000. It is expected that the installation of the 220,000-volt equipment will be completed and the station ready for operation by the early summer.

## Odd Public Service Situation in Superior

An unusual situation prevails in Superior, Wis., which has been served by the Superior Water, Light & Power Company. The citizens voted recently to purchase the three public service plants of the company—electric, gas and water—and the Wisconsin Railroad Commission has already ordered the transfer of the two plants first named and set a price. The city, however, has not issued bonds to cover the acquisition, and it is held that it is too near its debt limit to be able to do so. On the other hand, the contention is made that the public utility company can, if it wishes, mandamus the city to fulfill the bargain and that the city will then have to dig up the price in some manner. This the company has evinced no desire to do.

Newspaper correspondents after consultation with the authorities at Madison state positively that the city owns the plants, but the attorney for the company states unequivocally that the city does not own them. The special attorney for the city wants more information before venturing an opinion.

## Georgia Railway & Power Boosts State

More than two hundred representative citizens of north Georgia, including Mayor Sims of Atlanta, Governor-elect Walker and others, attended a dinner given by the Georgia Railway & Power Company on March 17 for the frankly stated purpose of arousing interest in the utilization of electric power to build up the resources of the state. Preston S. Arkwright, president of the company, said:

"North Georgia's wonderful resources must be turned into manufactured products. Somebody else has always reaped the profit on the manufacture of raw materials raised in the South. Our resources must be utilized at home, our manufacturing must be done at home, if we are to make the profits that we should from our products. Regardless of all factors entering into the cost of power, our company is prepared to furnish electricity to all of the communities it serves at one and the same price, its single motive being the development of these communities to their highest productive power."

Resolutions were adopted providing for the formation of an association to be known as "Georgians, Inc." Its object will be to connect the different communities served by the water-power resources of the Georgia Railway & Power Company and to strive in every possible way to advertise the resources and manufacturing possibilities of that section of the state.

## Mitchell Dam Plant Goes Into Service

Service from the Alabama Power Company's plant at Mitchell Dam, on the Coosa River, began on Monday last, when the water began to flow through the giant wheel. The new power source is expected to relieve the company to some extent of the need to generate steam power during the season of high water. Fifty-two per cent of the company's power in 1922 was steam-generated. During the period of low flow in the Coosa, however, the plants at Lock 12 and Mitchell Dam will drop from their maximum capacities of 110,000 hp. and 120,000 hp. respectively to 30,000 hp. and 40,000 hp. each, necessitating the operation of the company's Gadsden and Gorgas steam plants and the Sheffield plant leased from the government. All the power which will be generated was contracted for before the first yard of concrete was poured, officials announced.

## Pittsburgh Makes Plans

**Local Men Getting Ready for April Session of A. I. E. E.—Program Tentatively Arranged**

A ROYAL welcome and a fine program will be ready for the visiting members of the American Institute of Electrical Engineers at the national convention in Pittsburgh on April 24-26. The local convention committee has been very active in its preparations and has made the most of the opportunities for entertainment and education in the Pittsburgh industrial district.

The keynote of the convention will be the operation, protection and control of transmission and distribution systems. The protective-devices committee has assembled operating data and experiences on grounded and ungrounded systems and has obtained authoritative papers on relays, reactors and accessory apparatus. In the light of field experience a decision should be reached on many heretofore debatable practices.

In addition to this program a group of papers on electric furnace design and operation will be presented and also several papers on a diversity of subjects. The program should prove particularly attractive to engineers in central-station organizations and in industrial plants.

### WESTINGHOUSE PLANT VISIT

One of the features of the convention will be a visit on April 26 to the works of the Westinghouse company. The members will inspect the works in small groups and opportunity will be given to visit the broadcasting station KDKA and the studio. A special feature of the trip will be a demonstration of lightning-arrester tests, with the application of the oscillograph to picture the phenomena in detail. In the evening the visitors will be the guests of the Westinghouse company at a dinner and cabaret entertainment.

Headquarters during the convention will be at the William Penn Hotel, where arrangements have been made for convention buffet lunches. A banquet will be held at the hotel on Wednesday at 6:30 p.m., when speakers of national prominence will discuss topics of vital interest to the engineering profession.

On Friday arrangements have been made to visit points of interest in the Pittsburgh district. The power stations, transmission lines, substations and distribution systems of the Duquesne Light Company and West Penn Power Company have many interesting features, and in addition the Pittsburgh district affords opportunity for visits to steel mills, glass works, coal mines, insulator works and many industrial plants, including that of the H. J. Heinze Company.

An outline of the tentative program follows:

TUESDAY, APRIL 24

*Morning.*—Registration and committee meetings.

*Afternoon.*—"The Neutral Grounding Reactor," W. W. Lewis; "Experience with Peterson Coil," J. M. Oliver and W. W. Eberhardt; "Economical Value of Resistance in the Grounded (Neutral," H. H. Dewey; "Grounding on Step-up Transmission Systems," P. H. Chase; "Grounding on Generator Voltage Transmission Systems," E. C. Stone.

*Evening.* — "Surges on Transmission Lines," J. Slepian and J. F. Peters; "Third-Class Conductors and Mechanism of the Arcing Ground," Dr. C. P. Steinmetz.

WEDNESDAY, APRIL 25

*Morning.*—"Some Problems in Electric Furnace Operation," F. V. Andrae; "Electric Furnaces," A. N. Anderson and B. D. Sakwallata; "Some Fuel Determinations on the Southern Pacific System," A. H. Babcock; "Heating a Cotton-Weave Shed by Electricity," C. T. Guilford, "Electric Furnace Design," F. Hodson.

*Afternoon.*—"Relay System of Duquesne Light Company," H. P. Sleeper; "Ground Selector Relay Scheme," P. Ackerman; "The Distance Relay for Automatically Sectionalizing Electrical Networks," L. N. Crichton; "Lighting and Control Equipment for Eastman Theater," Messrs. Jones and Mott.

*Evening.*—Banquet.

THURSDAY, APRIL 26

*Morning.*—"Survey of Lightning Disturbances," M. McLaren; "Experience with Reactors," N. L. Pollard; "Short-Circuit Forces on Reactor Supports," R. E. Doherty and F. E. Kierstead; report of sub-committee on proposed insulator tests and specifications.

## Middle Western N. E. L. A. Transportation Plans

Arrangements for two special trains from Chicago for the delegates to the June N. E. L. A. convention at New York have been made by Godfrey H. Atkin, master of transportation. These trains will leave Chicago at 10:30 a.m., Sunday, June 3. One train, known as the "Blue Special," will run over the New York Central Railroad, and the other, the "Red Special," will run over the Pennsylvania lines. Special Pullmans from Denver, Minneapolis and Kansas City will be attached to the "Red Special," and special sleepers from Detroit and Cleveland will be attached to the "Blue Special." A rate of one and one-half fares for the round trip has been granted to all delegates. This rate will apply to all parts of the country.

Further information can be obtained from the following assistant masters of transportation: Clarence L. Law, New York Edison Company; H. K. Mohr, Philadelphia Electric Company; Charles B. Burleigh, General Electric Company, Boston; Frank Gale, General Electric Company, Schenectady, N. Y.; J. C. McQuiston, Westinghouse Electric & Manufacturing Company, Pittsburgh; H. N. Sibbald, National Lamp Works, Cleveland; Herbert Silvester, Detroit Edison Company, Ann Arbor; W. E. Clement, New Orleans Public Service Company, New Orleans; Erick W. Smith, General Electric Company, St. Louis; A. E. Bettis, Kansas City Power & Light Company, Kansas City; H. E. Young, Northern States Power Company, Minneapolis; E. A. Phinney, Jefferson County Power & Light Company, Golden, Col.; W. H. Somers, Puget Sound Power & Light Company, Seattle; Earl Fisher, Pacific Gas & Electric Company, San Francisco, and K. E. Van Kuran, Westinghouse Electric & Manufacturing Company, Los Angeles. Mr. Atkin's address is 713 Marquette Building, Chicago.

## Erie Lighting Is Sold

**Becomes a Part of Penn Public Service Corporation, Operating Plants from the Lake to Maryland**

OFFICIAL announcement has been made that a controlling interest in the Erie Lighting Company of Erie, Pa., has been purchased by the Penn Public Service Corporation, which is extending its territory and will include steam and hydro-electric plants scattered from Erie on the northwest and Warren on the northeast south to the Clarion River and continuing through Jefferson, Indiana, Clearfield, Center, Cambria and Somerset Counties to the Maryland state line. Fred B. Hofft, vice-president of the Erie company, in announcing the merger said last week:

"The Penn Public Service Corporation now furnishes service to approximately fifty communities south of Forest County and has recently taken over the Warren properties. The service is furnished from a number of large interconnected power plants at the mouths of the coal mines, and in addition power will be received from the Clarion River hydro-electric system.

"The same interests that control the Penn Public Service Corporation also control the Clarion River Power Company, and power from this development will be taken by the Penn Public Service Corporation. The development of the hydro-electric power available at Clarion River is to be by means of three large dams and power plants, the first of which, located at Piney, is now under construction and will be in operation early in 1924.

### TOTAL CAPACITY OF 260,000 HP.

"The combined facilities of the three developments will provide a hydro-electric generating capacity of over 260,000 hp. In addition to this water power, the Penn Public Service Corporation has five large steam generating stations adjacent to the mouths of coal mines. The largest plant is at Seward, Pa., and was put into service in October, 1921.

"The Front Street station of the Erie Lighting Company will be enlarged and become one of the main generating stations in this transmission system by connecting through high-voltage transmission lines with the general system into which these large steam plants and the Clarion River hydro-electric development will feed."

## Billion-Dollar Capital for the A. T. & T.

On Tuesday of this week the proposal of the directors of the American Telephone & Telegraph Company to increase its capital stock from $750,000,000 to $1,000,000,000 was ratified at a special meeting of stockholders. This action puts the company at the head in point of financial size of all corporations in America, if not in the world. Its nearest rivals are the United States Steel Corporation and the Standard Oil Company of New Jersey.

## Fourteen Projects Halted

**Arizona's Failure to Ratify Colorado Pact Holds Up Many Plans Already Worked Out**

FAILURE to ratify the Colorado River compact is regarded by federal officials as a greater calamity to the West than is generally appreciated at present. The fourteen major projects which have been halted by the action of Arizona would, if allowed to proceed, contribute very importantly to the prosperity of the entire West. It happens that Arizona itself is affected adversely as much as, if not more than, any other single state. The only encouraging aspect of the situation is that the compact stands and can be ratified at any time in the future.

The Girand project at Diamond Creek involves the ultimate investment of $70,000,000. The initial investment would be two-thirds of that amount. This project, of which Arizona would be virtually the sole beneficiary, is delayed indefinitely along with the other thirteen projects.

Another of the large projects which is delayed is that of the Southern California Edison Company, which contemplated a series of undertakings, the most important of which was the great reservoir at Lee's Ferry. That company was prepared to begin preliminary investigation and work immediately on the ratification of the compact. In that instance the delay is likely to work against the best interests of the Colorado basin, since it is forcing the Southern California Edison Company to commit itself more and more to the development of higher-cost power on the headwaters of the San Joaquin. The Imperial Valley suffers from the fact that the development planned by the Southern California Edison Company would have done much to remove the flood menace on the lower river.

The Flaming Gorge project of the Utah Power & Light Company on Green River is another of the big projects halted by the failure to ratify. That company is ready to go ahead with its project, which would develop 100,000 hp. and create a storage of 1,500,000 acre-feet.

The plans of the Denver Gas & Electric Company for the development of power at Kremmling, on the Colorado, have been interfered with seriously. The Denver Gas & Electric Company had planned to store the annual run-off and to develop 60,000 hp.

Though the remaining projects on the river have not reached the same definite stage as those mentioned, it is probable that most of them would go through in the near future were the uncertainty in regard to the river removed.

## Flathead Lake Development Faces Long Delay

The project of the Rocky Mountain Power Company which involves the development of 270,000 hp. at the outlet of Flathead Lake bids fair to be tied up in much the same manner as the projects on the Colorado River. Officials of the State of Washington are urging that the Federal Power Commission take no action on the application of the Rocky Mountain Power Company until the survey of the Columbia Basin project, recently authorized by Congress, is complete and action has been taken by Congress on the report. Since the feasibility of the three-hundred-million-dollar Columbia Basin project is questioned seriously, it is apparent that a long period of years is certain to elapse before the point can be settled. It is almost apparent that the power project cannot afford to wait for its settlement.

In a brief received in support of the plea for delay made by the State of Washington it is claimed that the state has made a detailed study of the question extending over six years, whereas the federal engineers have made only a hasty examination. The state officials lay great stress on the findings of General Goethals. The commission authorized by Congress to study the project will consist of Francis M. Goodwin, the Assistant Secretary of the Interior, chairman, and Arthur P. Davis, Director of the Reclamation Service. Homer J. Galt of the Reclamation Service will be the engineer in charge of the field work. The investigation of the Umatilla Rapids project, in Oregon, will be conducted by a separate body.

# Badger State Men Discuss Vital Topics

**Electric Section of Utilities Association Considers Rural Lines, New State Electrical Code and Public-Relations Problems—Convention Draws 400 Delegates**

RURAL-LINE problems and the interpretation of the new State Electrical Code played a prominent part in the Electric Section meetings of the first joint convention of the Wisconsin Utilities Association, held at Milwaukee on March 22-23. R. G. Walter, Madison, chairman of the committee on rural lines, showed in his report that on thirty-two rural extensions studied the average power loss was 45.4 per cent with an average monthly consumption of 28.7 kw.-hr. Commenting on this fact, R. M. Howard, Winona, declared that the average power factor of 33.9 per cent checked the 30 per cent found in the Iowa tests. Since the report showed in one installation a time saving of thirty minutes, he calculated that this saving on a 20-cent hourly basis could be explained as the monthly rural service charge of $3.

C. R. Phenicie, Green Bay, chairman of the Electric Section, divided the farmer classes into two groups—those who were not willing to build their own private plants but were willing to pay a high rate for energy and those who preferred to sink their money in a private plant rather than pay a high rate for energy. Mr. Phenicie felt that here was an excellent opportunity for earnest publicity explaining the advantages of the service before the reasons were given for the extra service charges. The discussion following indicated that sales on appliances to farmers would be one means of increasing the energy consumed, which in turn would lower and eventually wipe out the rural-service charge. The problem of how to charge customers added after the line is built was held to be best handled by keeping the investment equal between the group members.

President J. P. Pulliam's address to the joint convention Thursday morning emphasized the absolute necessity of keeping the utility story before the public, especially because $25,000,000 will be spent this year by Wisconsin public service companies. Since a large portion of this will come direct from customers, he urged that more time be spent in presenting the industry's problems to the people of the state.

In considering a utility man's place in the community, Fred E. Schornstein, Eau Claire, insisted that unless such a man was at the heart of all community affairs he was not serving his community as he ought.

In the afternoon session of the Electric Section George E. Wagner, Madison, presented a review of the courses given at the University of Wisconsin to sixty-five metermen last January.

C. W. Place Chicago, then spoke on automatic stations and their applications. He considered them from the viewpoint of service improvement over manual control. With about 500 installations now operating or being constructed, Mr. Place asserted their value in giving good service far outweighed their cost. C. V. Seastone, Madison, stated that the installation of an automatic hydro-electric plant on Pine River had saved his company $7,000.

### Inductive Co-ordination

The round-table discussion on inductive co-ordination was led by L. N. Boisen, Chicago, and A. J. Goedjen, Milwaukee, who explained the third report of the joint general committee of the N. E. L. A. and the Bell System. Local supply lines can be placed upon joint poles when conditions are satisfactory, but long transmission lines on opposite sides of the road are preferable unless a large number of service-wire crossings are required, said the report.

The importance of "selling" the commercial department to the employees was emphasized by W. T. Bracken, Beloit, at the Sales Section meeting. Since service was a commodity as salable as other goods, he saw no reason why an effective sales department could not be built up as in other industries. Thomas Casey, Chicago, speaking on electrical merchandising, felt that the biggest factor was knowledge of the product itself.

On Friday morning there were two-minute reports on the year's activities of the various sections.

James P. Barnes, president Louisville Railway Company, maintained that one of the reasons why utilities had sometimes failed in trying to bring about good relations was failure to present their case in understandable language. Too often they spoke a technical jargon that was not comprehended. Mr. Barnes characterized publicity as a two-edged sword, which, powerful when under steady control, would turn ruthlessly upon its holder once this control was lost.

At the afternoon session a round-table discussion was held on the Wisconsin State Electrical Code. G. G. Post, Milwaukee, explained portions of the code affecting central stations by stating that the code's purpose was to improve service by requiring good construction. However, he felt that barriers for 7,500-volt oil circuit breakers were unnecessary on circuits carrying light loads.

The effect of the code on the fire insurance rates of electric utilities was considered by Frank R. Daniels, Milwaukee, who said that in 1921 Wisconsin had the lowest fire loss in the country. While he felt that the code did not cover all subjects as well as possible, he did consider barriers an important item in reducing fire losses.

Charles B. Hayden, Railroad Commission of Wisconsin, failed to see how a utility could legally lock a service entrance switch which is owned by a customer, but he saw no reason why a seal wouldn't work as well. The question of installing two grounds at the service entrance was answered by Mr. Hayden, who said that the neutral should be grounded to the cabinet and then a ground be run direct to the water pipe.

The value of painted numbers for poles versus aluminum markers was discussed by E. J. Kallevang, C. R. Phenicie and R. G. Walter. The uniformity of aluminum markers and their ease of placement were overbalanced, it was considered, by their causing a climbing hazard to linemen and by their inconspicuousness, which necessitated a pole checker's leaving the road to read numbers.

### New Officers

This convention drew an attendance of 400 delegates. The officers elected for the ensuing year are: President, Harold L. Geisse, Wisconsin Valley Electric Company, Wausau; vice-president, Bruno Rahn, Milwaukee Gas Light Company, Milwaukee; treasurer, G. C. Neff, Wisconsin Power, Light & Heat Company, Madison; executive secretary, John N. Cadby, Madison. For the Electric Section the officers are: Chairman, G. A. Mills, Wisconsin-Minnesota Light & Power Company, Eau Claire; vice-chairman, M. H. Frank. A constitutional amendment added two sections—a sales and an accounting section. This gives the association a total of five sections.

## Engineering Council to Investigate Coal Storage

Decision to undertake a nation-wide coal-storage investigation was reached by the executive board of the American Engineering Council of the Federated American Engineering Societies at its meeting in Cincinnati on March 23-24. General indorsement of the plan for government reorganization submitted to Congress with the approval of President Harding and his Cabinet and continuance of the committee on transportation, headed by Max Toltz of St. Paul, were other outstanding features of the meeting, which was called by President Mortimer E. Cooley the most successful since the federation was organized.

The personnel of the committee to conduct the coal inquiry, which is to be made unless there is objection from the constituent societies, will be announced later by President Cooley. Both the Coal Commission and the Department of Commerce look with favor upon the proposed survey. Each of these agencies is making studies of certain features of the coal industry, but neither agency will be in a position to give sufficient consideration to the engineering and economic phases of coal storage. The work of the three agencies can, the executive committee holds, be so coordinated as to avoid all duplication, confusion and conflict. The specific object of the survey is to determine the facts relating to the engineering, chemical and economic factors involved in storage at the mine and elsewhere.

The executive board voted to cooperate in the movement to bring about uniform safety legislation, to broaden the program of its reforestation committee, to study the question of constituting the American Engineering Council a clearing house on elimination of waste, to further American participation in the proposed world power conference in London in 1924, and to work with the National Safety Council in plans for conservation week. It was voted to hold the next meeting of the board in St. Paul on June 8-9.

## Ferguson Attacks Institutional Power Plants

Declaring that many thousands of dollars of the public money are wasted by permitting state institutions to generate their own electricity instead of purchasing it from central-station lines, Vice-president Samuel Ferguson of the Hartford (Conn.) Electric Light Company recently discussed the fundamental economies of utility service before the appropriations committee of the Connecticut Legislature. It was pointed out that seven of the major institutions of Connecticut were asking for $377,000 for revamping old power plants. Mr. Ferguson stated that no private corporation could afford to maintain these little "two-for-a-cent power houses" and that every industry in Hartford with one exception has for the sake of economy scrapped its private power plant and become a central-station customer. In reply to an inquiry by Chairman Rogers of the committee whether the institutions were not utilizing steam in connection with heating in their power production, Mr. Ferguson said that the maximum demands for heating and for illumination are about fourteen hours apart.

## Middle West Utilities Has Prosperous Year

Along with its annual report showing combined surplus earnings for the year of $1,500,077, the Middle West Utilities Company has published photographs and tabulations of its holdings in 633 communities in fifteen states of the Union that give a comprehensive idea of the company's rapid growth. The gross earnings for the year 1922 totaled $29,870,702. After deducting operating expenses, interest on bonded indebtedness and other fixed charges, total earnings accruing to the company were $4,048,438. The gross earnings of the subsidiary companies were greater by $3,522,458 than for the year 1921. Of this increase $1,336,278 was contributed by new properties and the remainder came from the properties that were included in the 1921 report. A most remarkable showing is in the progress the company has made toward the distribution of securities, as shown by the number of stockholders, which stood at 6,063 in 1918, 6,902 in 1919, 10,491 in 1920, 23,621 in 1921 and 40,032 at the end of 1922.

## San Francisco to Have Testing Laboratory

A Pacific Coast testing laboratory similar to those already established in New York and Chicago will be opened in San Francisco about April 1 by the Underwriters' Laboratories, Inc., according to an announcement made by A. R. Small, vice-president of the organization at a recent meeting of the San Francisco Electrical Development League. The visit made by Mr. Small to the Pacific Coast, together with the announcement of the establishment of the Pacific Coast Laboratory, marks the culmination of a movement that had its inception previous to the world war. So important has the electrical industry become on the Pacific Coast that it was felt even then that Western manufacturers who desired to have their products passed by the Underwriters' Laboratories should not be compelled to undergo the expense and time involved in sending specimens to Chicago.

The laboratory will be installed at 615 Commercial Street. It will contain the latest equipment for testing electrical devices, appliances and materials and will be on a par with the New York establishment. R. J. Larrabee, resident electrical engineer for the Underwriters' Laboratories, will be in charge of the staff of experts to be employed. Charles Lum will act as district agent for the organization, with headquarters in San Francisco.

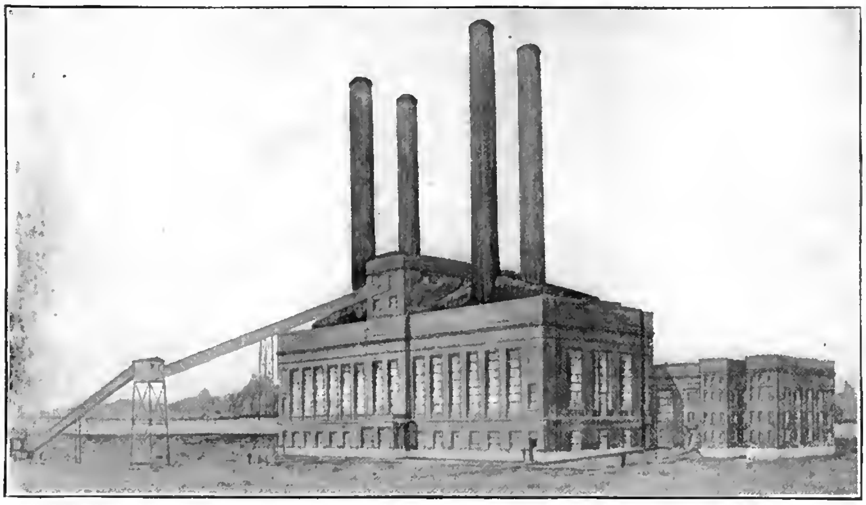
## Governor of Tennessee for Abolishing Commission

Asserting that the Tennessee Railroad and Public Utilities Commission as set up in 1919 has failed to please the people of the state and that there is an overwhelming public sentiment against it in the large cities, Governor Austin Peay of Tennessee has called on the Legislature to abolish the commission, saying last week in an official message:

"It is my own judgment that you should repeal the act of 1919 creating the utilities commission in this state without delay. I think you should not substitute any involved machinery for local regulation to which blame might be laid by the people if they become dissatisfied with the repeal of the present act, in event unexpected consequences result and they do not obtain the expected relief from such repeal. A simple statute should follow conferring power upon all municipalities to contract with their utilities both for public and private rates and service and such power as may be necessary to relieve orders which have been imposed on them by the State Commissioners since the act of 1919; such action reviewing increased charges through such orders, of course, to be subject to review in the courts to prevent any unreasonable or confiscatory action."

Governor Peay admits that among the smaller municipalities there is a sentiment for continuing the commission with some alteration of its powers and functions. Proposed changes in the law were stated in the ELECTRICAL WORLD in the issue for March 17, page 650.

## Wabash River Station, Indiana Electric Corporation



As already announced in the ELECTRICAL WORLD, Stone & Webster are to build this power house at Maxville, Ind., on the Wabash River, not far from Terre Haute and in the heart of the Indiana coal fields. It will have an initial rating of 40,000 kw. and an ultimate capacity of 100,000 kw. It will be connected with Indianapolis, 75 miles distant, by 133,000-volt, two-circuit, steel-tower lines and will be a very important unit in the system of the Central Indiana Power Company, serving seventy Indiana cities.

The two 20,000-kw. Westinghouse generating units to be first installed will be three-phase, operating at 60 cycles and 13,200 volts, and they will work under 300 lb. steam pressure, 650 deg. total temperature and 29 inches vacuum. Each of these turbines will be served by a 40,000-sq.ft. Westinghouse radial-flow, two-compartment surface condenser that is rigidly connected to the turbine exhaust and supported by springs. Circulating water to each condenser will be supplied by two 20,000-gal.-per-minute motor-driven circulating pumps. Two condensate pumps will be supplied for each condenser, one of which will be a spare. The air-removal apparatus will consist of Westinghouse two-stage air ejectors with surface intermediate and after condensers. There will be three air-ejector units, one of which is to be used as a common spare for the two condensers.

The entire feed-water heating will be accomplished by the use of a closed primary and secondary heater receiving steam bled from the main turbines. The approximate temperature of the condensate leaving the low-pressure heater will be 150 deg., and the final temperature from the high-pressure heater will be 208 deg. Evaporators will be used for purifying the make-up water.

A 2,000-kw., three-phase, 60-cycle, 2,300-volt non-condensing house turbogenerator will float on the line as a synchronous motor, the steam end running idly under a partial vacuum, which will be made by a small connection to the main condensers. The governor mechanism will be so designed that on any small reduction in the speed of the synchronous motor, caused by a reduced voltage or a complete loss of power on the main bus line, the steam end of the house turbine will immediately take the load and furnish the necessary auxiliary power. Excitation will be taken from directly connected exciters on each main turbine, and in addition a 150 kw. dual-drive exciter set will be installed.

## Brief News Notes

**Better Industrial Lighting Sought in Colorado.**—A bill is now before the Legislature of Colorado to bring about better lighting in industrial plants. It is patterned after the Oregon law.

**University of Michigan's Meter Course.**—An electric meter course will be held in the University of Michigan, Ann Arbor, during the week beginning April 9. On the opening day W. L. Wadsworth of Minneapolis, chairman of the meter committee of the National Electric Light Association, will address the students.

**The Supreme Court Ben Avon Decision.**—A noteworthy pamphlet on this important judicial utterance has been brought out for distribution by H. C. Hopson of 61 Broadway, New York City. It contains the series of decisions in this case covering questions of utility valuation and fair return, together with a "foreword" setting forth the salient points involved.

**Neola, Iowa, Splits Almost Even on Retaining Municipal Plant.** — Neola, Iowa, has decided by a majority of twenty-nine to retain its municipal electric lighting system, 241 voters being for it and 212 against. Just before the election the Town Council lowered the lighting rates to meet those of the Iowa Service Company, which had been seeking to purchase the plant.

**Cold Weather Interferes with Newfoundland's Power.**—Five feet of ice on the interior lakes of Newfoundland this month caused serious interruption in the supply of electricity generated on these lakes and carried to St. Johns, the capital of the island. Street cars were unable to run, factories shut down, newspapers had to suspend issue and the city lighting system was threatened.

**Construction Work on St. Paul Station Begun.**—Preliminary construction work on the new 100,000-hp. generating plant at St. Paul has been started. This plant will be known as the High Bridge station, the site being a 50-acre tract on the Mississippi River at High Bridge. A large warehouse and a storeroom 350 ft. long have been built. Two railroad trestles are being rushed to completion before the frost is out of the ground.

**Undeveloped Power Sites in Nova Scotia.**—The Nova Scotia Power Commission estimates the water power available in sites actually known and investigated at 300,000 hp. Exploitation of these sites has so far reached a total of only 47,000 hp., or about 16 per cent of the possible development. There is a total of 260,000 hp. in sites

of more than 1,000 hp. capacity, all of which are regarded by the Power Commission as of practical commercial importance.

**Kansas City Power Securities Corporation.**—This company, which owns all the common stock of the Kansas City Power & Light Company, reports for the twelve months ended Dec. 31, 1922, gross earnings of $7,864,817, an increase of $1,054,080 over the preceding year, and, net earnings of $3,683,268, an increase of $643,539. After the deduction of interest and amortization charges and dividends on preferred stock there remained $2,045,077 for depreciation and common-stock dividends, an increase of $484,408.

**General Gas & Electric Corporation to Build Plants at Easton and Middleton, Pa.**—Proceeds from the sale of 10,000 shares of General Gas & Electric Corporation cumulative participating preferred stock, soon to be placed on the market, will be used to expand that company's properties in Pennsylvania, according to announcement by W. S. Barstow, president of the corporation. The company will use a large part of the proceeds to construct two steam generating plants, one on the Delaware River near Easton, Pa., and the other on the Susquehanna at Middleton, Pa.

**St. Louis "Muny" Theater to Have Sound-Amplifying Devices.**—Electrical equipment designed to render speech and singing on the stage audible to persons occupying seats in the furthermost parts of the auditorium will be installed at the St. Louis Open-Air Municipal Theater. This equipment will include a Bell loud speaker and an amplifier. The theater, which is in Forest Park, has a depth of 256 ft. and is 225 ft. wide. The difference in elevation between the orchestra pit and the furthest row of seats is 53 ft. The seating capacity is approximately 10,000.

**Five New England States Interconnected.**—Additional transmission line construction is contemplated by the New England Power Company to interconnect its system with the Hudson River Power Company by a 66,000-volt extension from the Adams-Pittsfield (Mass.) district into eastern New York State. When this is done, with the completion of a tie line now under way between Hartford, Conn., and Agawam, Mass., every New England state except Maine will be interconnected, with lines extending into New York on the west and running to the Atlantic seaboard on the east.

**Project for Cacapon River.**—A declaration of intention filed with the Federal Power Commission by the Cacapon Electric Company of Martinsburg, W. Va., reveals plans for a large development on the Cacapon River at Edes Fort, in Morgan County, W. Va. The Cacapon is a tributary of the Potomac and was relied upon by Major Max Tyler, in his report on the development of the Great Falls of the Potomac, as one of the large reservoir sites to regulate the flow at Great Falls. The proposed development at Edes Fort includes a dam 170 ft. high and the storage of 6,000,000,000 cu. ft., to be drawn upon in the development of 27,000 hp.

**Gifts for Cape Town Electrical Laboratory Solicited.** — Prof. N. C. Woodfin, lecturer in electrotechnics at the Cape Technical College, Cape Town, South Africa, is endeavoring to supplement the electrical laboratory equipment at that institution by gifts from manufacturers of apparatus rated at from about 0.5 kw. up to about 5 kw., such as series dynamos, rotary converters, transformers, frequency indicators, rheostats or circuit breakers. American manufacturers who are willing to supply such apparatus will, he thinks, receive a splendid advertisement from the permanent exhibit that its installation in the laboratory would bring.

**Maine Utilities Consolidate.** — The York County Power Company and the Westbrook Electric Company, which have been controlled by the Cumberland County Power & Light Company, Portland, Me., for several years, have been formally acquired by the last-named company under approval of the Maine Public Utilities Commission. The Cumberland County company has been authorized to issue $1,494,000 in preferred stock to effect the transfer of all assets of these companies to itself. Electric service is now supplied by the Cumberland County system from the territory north and west of Portland to and including many coast resorts lying south of the city as well as to the Portland district proper.

**Curing Pneumonia by Electricity.**—Physicians connected with St. Mary's Hospital, Hoboken, N. J., report remarkable success in treating pneumonia by an electrical process. The method consists of the application of 2½-in. x 5-in. plates to the chest and the back and the passing of an electrical current through the lungs. This increases the temperatures within the lungs, and its beneficial effect in pneumonia is said to be in breaking up congestion. Heat treatments previously in use did not raise the internal lung temperature sufficiently to clear these organs. The treatments, which have been used only in extreme cases, last twenty minutes and are given twice a day, the current being increased gradually and then gradually decreased. There is no electric shock.

**Indiana Utilities Change Hands.**—The purchase of electric lighting and power plants at Martinsville, Spencer and Gosport, Ind., involving about half a million dollars, has been completed, subject to the approval of the commission. A controlling interest in these companies has been held by the Public Service Securities Corporation of Cincinnati, which has operated the properties for several years. The holdings include the Martinsville Gas & Electric Company, the Morgan County Light & Power Company, the Spencer Light, Power, Heat & Water Company and the Gosport Electric Company. The deal apparently is in accord with the program of developing the light and power business in southern and western Indiana started by the Joseph Brewer interests, the properties lying within striking distance of the proposed high-power transmission line of the Central Indiana Power Company, now constructing a superpower station on the Wabash River south of Terre Haute.

# Associations and Societies

**American Electrochemical Society.**—The forty-third semi-annual meeting of this society will be held at the Hotel Commodore, New York City, on May 3 to 5, 1923. The principal attraction of the technical program will be a whole-day session on the general topic "The Production and Application of the Rarer Metals." The arrangements for this session are in charge of Dr. F. M. Becket of the Electrometallurgical Corporation, New York City. Another session will be devoted to a discussion of "Electrode Potentials," led by Dr. William G. Horsch of the Chile Exploration Company, New York.

### Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Middle West Division, N. E. L. A.—St. Louis, April 11-12 H. M. Davis, Bankers' Life Bldg., Lincoln.

American Society of Mechanical Engineers—Pacific Coast meeting, Los Angeles, April 16-18; general convention, Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society — New York, April 25-28.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan. 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13.

## Commission Rulings

**Sinking Fund to Retire Capital Disapproved.** — The establishment of a sinking fund for the retirement of capital, in addition to the regular depreciation allowances, has been disapproved by the Idaho Public Utilities Commission in a case concerning the Kellogg Power & Water Company. The company contemplated an additional investment and upon this investment desired an allowance of 8 per cent annually and in addition wished to set up a sinking fund out of operating expenses to retire the capital. The commission said that this was equivalent to asking the public to buy the plant and also pay interest on its cost.

**Rules Governing Rehearings.** — In granting a rehearing in a case involving the refusal of the Batesville Electric Light & Power Company to extend service, the Indiana Public Service Commission held that a party not an original petitioner in a proceeding which has been started by the commission on its own motion has the right to ask for a rehearing if the petitioner is clearly a person or corporation in interest. A contention that additional service has been given to other citizens since a petitioner's request for service has been refused on the ground that a public utility is overloaded constitutes an allegation of discrimination which calls for a rehearing.

**Doubt Thrown on Theory of Accrued Depreciation.**—In its contested valuation of the Alabama Power Company's property the Public Service Commission of Alabama expressed doubt of the correctness of the theory that public utility property should be valued according to age and probable duration of life of the constituent parts, since what a utility company sells is service, not a pole, a mile of copper wire or a generator. The matter of accrued depreciation, it held, should not enter greatly into consideration by the rate-making body if the utility property is kept in such a state of efficiency and maintenance that the public is furnished an extraordinarily efficient class of service.

**"Free Service" to City in Return for Use of Streets Not Objectionable.**—The North Dakota Board of Railroad Commissioners held that no discrimination inhered in a contract entered into between the Midwest Power Company and the city of Enderlin by which a small amount of electricity was furnished to the city without charge in return for the use of streets and alleys. It also held that consumers of this company located near the generating plant should not be penalized by the excessive line loss incident to transmission to a neighboring town. The total operating revenues and expenses of the steam-heating and electric departments of the company were considered together in view of the fact that the physical property of the two utilities was so interwoven that it was inadvisable to attempt to separate them. Meter rates for street lighting were declared the only fair method, though the present flat-rate basis was not upset, the rates being found not discriminatory.

**Valuing Developed and Undeveloped Water-Power Sites.**—The contested valuation of the property of the Alabama Power Company made by the Alabama Public Service Commission in the case now awaiting rehearing contained, among other pronouncements, decisions to the following effect: Water power should not be valued by determining the original cost of the water-power site since it is the power and not the site which is to be valued and it is beyond the province of the commission to explore into the future to determine what power sites are going to be developed and what the power therefrom will be worth. Developed water power should be valued at an amount equal to the capitalized savings by use of water power instead of steam power generated in the best manner possible. No value should be assigned to the undeveloped water powers. The capitalized saving by the use of water power was divided by the commission, half being assigned to the utility and half to the public.

**North Dakota Board's Change of Valuation Method.**—In establishing rates for the Western Electric Company of Jamestown, N. D., the North Dakota Board of Railroad Commissioners put into effect its changed method of arriving at values, it having, as already reported in this column, abandoned the historical-cost basis on which it had long worked. It will now base its findings on reproduction cost less depreciation. Explaining this departure, which was brought about by a study of court rulings, the chairman of the board said: "It is a matter of common knowledge that prices of materials have greatly increased since the world war and that to date there is no indication that prices will ever return to the pre-war level. There probably has never been a period when it was so difficult to determine with any degree of accuracy what the prices of materials entering into the construction of a utility will cost as of a future date. Prices continue to fluctuate, and though several years have elapsed since the close of the war, neither labor nor materials have declined to anything like pre-war prices. We doubt if they ever will. Until a permanent level has been reached we cannot attempt to find the so-called 'normal results.' Neither can we prophesy as to the range of prices in the future. We must apply reasonable judgment to all the facts before us and find a value which, in our judgment, represents the fair value of the property used and useful as of the time when the inquiry is made regarding rates. By fair value is meant fair both to the utility and to the consumer."

## Recent Court Decisions

**What Constitutes a Reasonably Safe Place to Work?** — The Kansas City Court of Appeals has sustained a verdict of $5,000 damages awarded in Pyle vs. Kansas City Light & Power Company for injury sustained by an employee who fell over a piece of timber and was precipitated down a flight of stairs. The floor where the timber was lying was alleged to have been insufficiently lighted. The court found that "assumed risk" was not in issue and that it could legally be held that the man injured had not had a reasonably safe place to work. (246 S. W. 979.)*

**Rate Must Have Approval of Commission Before Promulgation.** — Until the rate established by the rate-making authority for the service of a public utility has been set aside by a court of competent jurisdiction the utility has no right to promulgate a rate of its own or to make an added charge for the services rendered. So finding, the Supreme Court of Kansas has affirmed judgment for the plaintiffs in two cases brought against the Citizens' Light, Heat & Power Company (by the State ex rel. Hopkins and by Kilworth et al.) relating to the imposition in Lawrence of a service charge for gas in addition to the established rate. (212 Pac. 86.)

**What Constitutes a Competing Company?**—Asserting (in Commonwealth ex rel. Page Milling Company vs. Shenandoah River Light & Power Corporation) that where a milling company organized and its stockholders controlled an electric company, which transferred its assets to a power company, and the power company contracted to furnish the milling company power at a rate less than that fixed by schedules subsequently filed with the Corporation Commission, the relations between the milling company and electric company did not affect the jurisdiction of the Corporation Commission to establish a rate higher than the contract rate, the Supreme Court of Appeals of Virginia declared that the milling company was not a competing company in the sense of being excepted from those to whom a public utility must furnish service. Nor was there any basis for the claim that by an increase in the power company's rates the milling company's property was taken without compensation or without due process of law. Neither of these reasons therefore operated to prevent the commission from raising the contract rates, which, however, could be done only after investigation and a finding of facts and not by a mere failure to suspend a rate filed with it. (115 S. E. 695.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## Fogarty and Doolittle New North American Executives

James F. Fogarty and Frederick W. Doolittle were elected additional vice-presidents of the North American Company at the annual meeting of the board of directors held on March 21. For the past twenty years Mr. Fogarty has been connected with the company in various capacities and during the greater part of his long service he has been intimately in contact with the financing of the company and its subsidiaries. He entered its employ as stenographer in November, 1902. In January, 1910, he became assistant secretary and in March, 1912, was elected secretary and assistant treasurer. He still retains the office of secretary. Mr. Fogarty has for several years been a director of the North American Company. He is also vice-president and director of the North American Edison Company and secretary and director of various subsidiary companies of the North American Company.

For several years Mr. Doolittle has been intimately connected with the activities of the North American Company and its subsidiaries as a special rate and valuation engineer, with his headquarters at Milwaukee. Mr. Doolittle was born in Hopkinton, Iowa, in 1883. He is a graduate of Princeton University and of the University of Colorado. He taught engineering at the University of Colorado and the University of Wisconsin and assisted in the development of the statistical department of the Wisconsin Railroad Commission. From there he went to Springfield, Ill., where he did similar organization work for the first Illinois Public Utilities Commission. Since 1916 Mr. Doolittle has been retained as consulting engineer by the North American Company and its subsidiaries and has handled investigations of new properties and rate and valuation cases for these companies before various commissions. Mr. Doolittle assumes the duties of his new office April 1.

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F. W. DOOLITTLE

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J. F. FOGARTY

## Dr. Hutchinson with Sanderson & Porter

It is not surprising that when Sanderson & Porter decided to extend their activities to include railroad electrification they should select to direct the newly organized railroad electrification department Dr. Cary T. Hutchinson, who for thirty years has kept in close touch with practice and problems both here and abroad. In 1891 the firm of Sprague, Duncan & Hutchinson built for Henry Villard the first heavy electric locomotive constructed in this country. The Baltimore & Ohio Railroad Company engaged Duncan & Hutchinson as consulting engineers for the first steam railroad electrification in the United States—built through Baltimore in 1895. From 1906 to 1908 Dr. Hutchinson was engaged by the Great Northern Railway to take charge of the design and construction of the electric equipment of its road over the Cascade Mountains, the first three-phase electrification in the United States. Later the Illinois Central Railroad, which had under consideration the difficult problems involved in its Chicago terminals, appointed Dr. Hutchinson a member of its electrification commission. In 1920 he was selected to take charge of the railway electrification division of the Superpower Survey. He initiated and was the chief engineer of the 100,000-hp. hydro-electric development on the Susquehanna River at Holtwood, Pa., and he has since been connected as consulting engineer with important hydro-electric developments in California, Canada and Mexico. In addition to these activities, Dr. Hutchinson was for a time in charge of the department of electrical engineering at Johns Hopkins University and has written a variety of engineering papers on mathematical and physical topics.

## H. B. Flowers Leaves Baltimore

Herbert Baker Flowers has resigned as vice-president and general manager of the United Railways & Electric Company, Baltimore, to become president of the New Orleans Public Service Company, the successor to the New Orleans Railway & Light Company. For the present Mr. Flowers' duties at Baltimore will be performed by the assistant general managers. Mr. Flowers became general manager of the United company in 1919, when he was promoted from assistant general manager to succeed J. R. Pratt, made vice-president.

Graduated from the law school of the University of Michigan in 1903 and from the engineering school of that university in 1905, Mr. Flowers entered the operating department of the Detroit United Railway. About ten years ago he went to Baltimore to take a position with the United Railways & Electric Company as assistant superintendent of transportation. In 1917 he became assistant general manager. Mr. Flowers is the representative of the American Electric Railway Association on the sectional committee of the American Engineering Standards Committee appointed to formulate a uniform code of colors for traffic signals.

R. S. Hecht, whom Mr. Flowers is succeeding, will retain the chairmanship of the board and continue his supervision of the financial affairs of the New Orleans Company. Mr. Hecht is a prominent figure in the financial and banking activities of New Orleans, and it was largely through him that a workable reorganization plan was effected. A. L. Kempster has been re-elected vice-president and general manager.

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H. B. FLOWERS

# Manufacturing and Markets

**Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News**

## Discrimination Between Customers

**A Wholesaler Is Determined Not by the Quantity He Buys, but by How He Sells**

GREAT interest has been aroused in manufacturing and trade circles over the decision of the United States Circuit Court of Appeals in the Mennen case. If the decision, which is adverse to the Federal Trade Commision, is upheld by the Supreme Court, it will affect not only the matter of price maintenance but also the continuance of the jobber as a factor in distribution. It will also make it easier for independent retailers to meet the competition of chain stores and other combinations. A wholesaler is, according to this finding, determined not by the quantity he buys, but by how he sells.

Commenting on the decision and its effect on the electrical supply business, Franz Neilson of New York City, general counsel of the Association of Electragists International, said:

The Federal Trade Commission has met with a setback in its effort to stop the Mennen Company from taking action in pursuance of its own notion as to who should receive wholesalers' prices on Mennen goods and who should not.

It was the aim of the commission in this case to shape matters so that the only basis upon which there could be any discrimination in prices for goods of the same quality would be the quantity basis. In other words, the commission in its order directed the Mennen Company not to sell its products, when of a uniform quality, at other than absolutely the same price in the same quantity to all purchasers, whether they are retailers, wholesalers, consumers, chain stores or co-operative purchasing associations.

The order was issued by the commission in March, 1922, but this month it was set aside by the United States Circuit Court of Appeals.

The decision of the Circuit Court and the robust language used in the opinion by Judge Rogers are refreshing to business men, not only to the manufacturers, wholesalers and jobbers, but also to that great body of retailers who are frankly retailers and who do not attempt to absorb the profits of both the middleman and the jobber.

The decision means that nothing in the anti-trust laws is to be construed to prevent any business house from following the practices upon which business in the past has been developed and maintained. That is, the following practices may be continued: Payment of a differential discount to middlemen to compensate for their distribution service; refusing at will to sell to any one; selling at will to wholesalers at the same price as to retailers.

In fine, the individual manufacturer, wholesaler or retailer may sell to whom he please at what price he chooses to fix. He may decline to sell to any one for any reason, even if it may be because he does not like the color of the customer's eyebrows. He may give his goods away. But he must not attempt to bind the person to whom he sells. The purchaser must have no more chains on him after he becomes the possessor of the goods than the seller had when they were in his possession.

Apparently, the only limitation on this right of free sale is the very proper one (as set forth in the Clayton act) that the seller should not "discriminate in price between different purchasers where the effect of such discrimination may be to lessen competition or tend to create a monopoly in any line of commerce."

An example of the sort of discrimination prohibited by the Clayton act would be the action of a gasoline producer in picking out a particular territory in which to sell his product below his cost for the purpose and with the result of driving out a competitor.

Making a distinction between a wholesaler and a retailer is *not* the discrimination which is condemned.

All this refers to individual action. It does not mean that any group or association in any trade may determine who are and who are not wholesalers or jobbers in that particular trade. Whether one is a wholesaler or a retailer is a question of fact, not dependent upon the quantities purchased, and the individual seller must determine that question of fact for himself and act accordingly.

## Failures Among Jobbers—A Warning

**Facts About the Mortality Among Electrical Jobbers During the Last Bad Times—Why They Failed**

By E. W. Rockafellow

Assistant General Sales Manager Western Electric Company

E. W. Rockafellow

LAST November, with the assistance of the managers of our branch houses, I endeavored to compile a list of the jobbers of electrical supplies who had succumbed to the bad times during 1921 and the first half of 1922. I knew that there had been a large number who had gone to the wall. Some few were houses of prominence. Most of them were "semi-jobbers," who had come in on the tide of inflation during the war and after war booms and when the pinch grew too severe for them went into bankruptcy, sold out to some older and established jobbing concern, or got out of the business in some other way. But the greater number, of course, were out-and-out failures.

My list was not complete. It was impossible to run down the name of every little "fly-by-night jobber" who sprang up as a parasite on the prosperous era and then faded away before the first adversity, but there were finally fifty names in line, and the geographical distribution of these firms is interesting evidence of how general was the condition. The greater number were in the East. But there were many in the Middle West and some in the South. The Far West was not affected to a like extent by the stresses of this economic upheaval and does not appear on the list.

Two were in Boston, fifteen in New York City, three in Philadelphia, four in Pittsburgh, one in

## Are We Running Into Another 1920?

AFTER the accompanying article by Mr. Rockafellow was in type one of the editors took a proof to him for his final approval and while discussing the unusually heavy buying in the market during the last few weeks, he said:

"Is the electrical industry again running into the same inflated condition as in 1920? Is this abnormal buying to continue until we have passed the highest prices of that most difficult year? Consumers are pyramiding orders—placing them for far more than normal requirements by ordering for months ahead on the more important materials and commodities—copper, porcelain, iron conduit, schedule material, hardware, poles, transformers and power cables.

"This buying is all very fine for the time being. Optimism in bunches. Order books crowded with many millions of dollars of new business. What good is it if not paid for with real money? And what use are these heavy orders if in a few months these consumers become frightened and start tearing up their contracts? What is to become of the goods now being produced to fill these contracts? Does the electrical industry wish to go through another period of readjustment, and do the manufacturers and jobbers wish to lose all that they make this year?

"More confidence in the business of the industry is evident, but this must not be allowed to develop into overconfidence. With increased buying of copper have come higher wages for labor in the mines, which will be paid for by the consumer. If production in this field continues at an abnormal rate, wages and the prices of raw material will advance and excessive competition will result for both."

Richmond, three in Atlanta, three in Chicago, one in Davenport, one in Cleveland, one in Louisville, two in Evansville, one in Cincinnati, four in Detroit, one in Omaha, one in Norfolk, Neb., one in Rapid City, S. D., two in Minneapolis, one in St. Paul, one in Duluth, two in St. Louis and one in San Antonio, Tex.

### TOO MANY JOBBERS

The fundamental reason why there were so many failures of electrical jobbers through this period of stress is easy to state. There were too many jobbers. There were too many real and so-called semi-jobbers in existence at the end of the war boom to make it possible for them all to survive long when business once settled down to normal volume. And they were doomed to early death just as soon as any real condition of business depression developed.

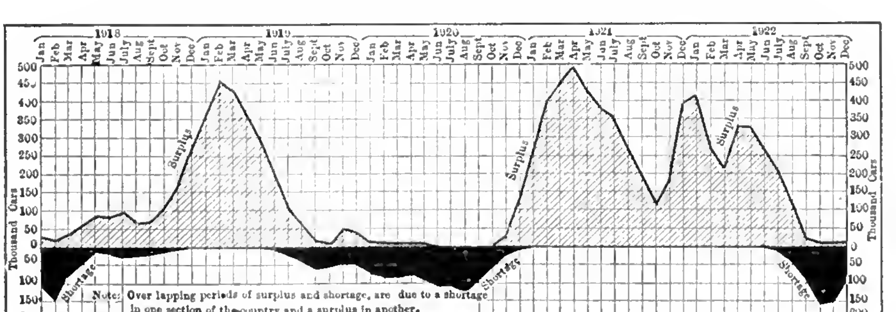
Why were there too many jobbers? There were too many because during the fat years of plenty there seemed to be an unlimited amount of electrical business to be had. Every contractor-dealer whose business grew to proportions where he was using or selling a considerable amount of electrical materials began to get the ambition to be a jobber and make some of the "easy money" that the wholesaler was supposed to be hauling in. But what was far worse, a very large number of manufacturers who should have known better were carried away by their enthusiasm to recognize these aspirants as jobbers.

They were eager to establish more and more outlets, feeling that they would thus obtain a greater proportion of the business. They forgot that the amount of possible consumption of a commodity in a community is not materially affected by the appointment of more wholesale distributors. If it was a case of appointing more retailers who would advertise and sell the commodity or contractors who would install it, thus creating more demand for the line, the sales might be affected. But doubling the number of jobbers can accomplish very little more than to reduce the volume of the business that each can do and thus pare down profit and increase selling cost on that line.

Moreover, a very large percentage of these jobbers who were imposed upon the distributing machinery of the electrical industry by the misplaced zeal of men overexcited by the prosperity of boom times were in no way qualified to be jobbers. They lacked the financial resources. They lacked the experience. They lacked the character and good name by which credit must be supported. They lacked the stock, the catalog, the organization, the ability to serve —yes, and they lacked the customers necessary to a jobbing house that is to do an economic job. They could go ahead during the boom when all that was necessary was to take orders, but when they ran into a buyers' market and were compelled to sell and serve, they were not able to compete with the real jobbers and so they died.

All this is history. But it is experience that is of very vital import right now. For we are again experiencing a period of expansion. The spirit of inflation once more is in the air. Factories are receiving so many orders that it appears as if buyers were already forgetting the evils that inevitably follow "pyramiding." But the lesson of this list of bankrupt jobbers must not and cannot be ignored. It is a warning that every contractor and dealer should keep in mind whenever he feels a hankering for wholesale business. It is a warning to every manufacturer. They were the ones who unmeaningly caused the death of very many of these jobbers by permitting and enabling them to go into a business for which they were neither fitted nor equipped, and they were the ones who suffered the greater part of the losses incurred.

## Five-Year Record of Car Surplus and Shortage




THE chart above, prepared from records of the American Railway Association, shows the trend of surpluses and shortages in freight-car equipment for the five-year period 1918 to 1923.

Attention is directed to the large available surplus of equipment during the fall of 1918, the first seven months of 1919, the entire year of 1921 and the first eight months of 1922. Subsequent to August, 1922, car shortage throughout the country existed to a marked degree, yet it will be noted that when freight-car shortage was at its peak in October, 1922, this figure did not in any way approach the volume of surplus cars during the preceding periods of less demand.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Wiring Device Production Is Active with Rising Prices

Upward tendencies in the prices of wiring devices combined with heavy absorption of these products into building jobs throughout the country have put severe pressure upon manufacturers of this class of materials since the first of the year. Jobbers' stocks had been sharply reduced prior to Jan. 1 by the fall demand and desire to show a low inventory at the turn of the year. Widespread buying has resulted, and this has been quickened as factory prices have stiffened until at present it is difficult for the manufacturer to accumulate more than a moderate stock. Policies vary considerably as to factory stocking in this branch of the trade, but there is a general feeling among manufacturers that this is the jobber's function rather than the wiring-device maker's, and it is a satisfaction in production circles to be again filling orders for distributors' shelves as well as to meet the current demands of the market.

Representative opinion in manufacturing circles seems to preclude any serious danger of a runaway market for wiring devices at this time. Jobbers are buying with conservatism, delivery conditions within reasonable radius of the factories are improving, and the requirements of the coming spring and summer construction programs are pretty well realized. Little evidence of pyramiding orders is in sight, and the wiring-device makers are so far able to keep pretty well up with the demand without operating their plants to any extent overtime or at night. Considerable satisfaction is being expressed in jobbing circles relative to the price schedules now in effect on such material as sockets. In typical cases, for example, jobbers are distributing pull sockets in case lots at about 37.5 cents net, whereas in the not distant past these were moving to the contractor-dealer at 30 cents or even lower under acute competition. One prominent producer stated last week that too many jobbers have been trying in the past to sell such items as sockets on the basis of a 5 per cent profit, and this, he held, is utterly inadequate to cover costs and overhead. There has unquestionably been a growing feeling on the part of not a few jobbers that the spread between the factory price and the price paid by the ultimate consumer might fairly be divided so that the jobber will obtain a larger proportion of this without injustice to the contractor-dealer.

Transportation conditions constitute a primary difficulty in this branch of trade, but manufacturers are meeting customers' requirements reasonably well by recourse to selected rail shipment, water and motor-truck service. Railroad embargoes have been on in some districts for many weeks, but by roundabout routing the more troublesome situations are being relieved. Stocks of raw material are being built up as fast as possible, and no serious shortages are reported in Eastern manufacturing circles. One house, however, had over $100,000 worth of porcelain on hand a few days ago, and considerable money is for the time being tied up in brass and other material.

## Instrument Business Reported Excellent

Conditions are unusually favorable at present in the electrical instrument field for an excellent business. While industrial plant expansion has been greatly restricted since the war, changes in production methods and modifications in the use of plant have led to a large amount of electrical material and apparatus buying which has been reflected in the instrument trade as well as elsewhere. This is particularly apparent in industrial electric heating installations, where the requirements of accurate control of processes and energy measurement bearing upon rates and plant economies have led to the more extensive use of both indicating and recording equipment.

The higher-grade radio sets are utilizing a considerable quantity of small indicating instruments, and the requirements of the automobile industry continue to grow, the sale of panel-type voltmeters and ammeters being commensurate with the volume of car production. The continued rapid expansion of the central station is also absorbing a large quantity of measuring apparatus. Skilled labor is none too plentiful, but raw materials are being secured with reasonable success by instrument makers, and prices are firm without much reported change from month to month.

## Delinquent Accounts Are Much Lower

Reports from the National Electrical Credit Association show that the number of delinquent accounts reported for January and February, 1923, were much lower than for the same period in 1922. This was especially true in the Central Division, where the number of accounts in February, 1923, was 635 as against 838 in February, 1922, with respective total amounts of $69,996.47 and $97,311.30. The average account for February, 1923, was lower than either that of February, 1922, or that of January, 1923.

In the New York territory the February, 1923, report totaled only 283, valued at $36,045, as against 393 with a value of $63,082 in February, 1922. For the same period the average amount was $127 against $160. The February accounts for Philadelphia were increased by fifty, raising the total average amount to $152.73. In New England the February, 1923, accounts were only forty-eight, with a value of $51.99—a decrease over the same period in 1922 of eleven accounts and a difference in the average value of $36.40. The February, 1923, delinquent accounts for the Pacific Coast numbered sixteen, with a total value of $283.04. The tabulated list of accounts for January and February is as shown in table above.

DELINQUENT ACCOUNTS IN JANUARY AND FEBRUARY

| Branch and Month | Number of Delinquent Accounts Reported | Total Amount | Average Amount |
|---|---|---|---|
| Central Division: | | | |
| January 1922.. | 820 | $93,956.53 | $118.24 |
| January 1923.. | 809 | 88,811.52 | 109.78 |
| February 1922.. | 838 | 97,311.30 | 116.12 |
| February 1923.. | 635 | 69,996.47 | 107.49 |
| New York: | | | |
| January 1922.. | 325 | 48,429.00 | 150.00 |
| January 1923.. | 392 | 54,452.00 | 139.00 |
| February 1922.. | 393 | 63,082.00 | 160.00 |
| February 1923.. | 283 | 36,045.00 | 127.00 |
| Philadelphia: | | | |
| January 1922.. | 216 | 32,449.17 | 150.23 |
| January 1923.. | 212 | 30,786.13 | 145.22 |
| February 1922.. | 126 | 16,878.00 | 133.95 |
| February 1923.. | 176 | 26,881.67 | 152.73 |
| New England: | | | |
| January 1922.. | 3 | 454.48 | 151.49 |
| January 1923.. | 66 | 7,805.66 | 118.27 |
| February 1922.. | 59 | 5,214.64 | 88.39 |
| February 1923. | 48 | 2,495.35 | 51.99 |
| Pacific Coast: | | | |
| January 1922.. | 16 | 2,002.00 | 125.12 |
| January 1923.. | 12 | 1,087.20 | 90.60 |
| February 1922.. | 14 | 806.45 | 57.63 |
| February 1923.. | 15 | 4,245.63 | 283.04 |

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.0322 | $0.0303 | $0.0239 |
| Cold finished shafting, per lb. | 0.0406 | 0.0397 | 0.0333 |
| Brass rods, per lb. | 0.1870 | 0.1804 | 0.15 |
| Solder (half and half), per lb. | 0.2887 | 0.2617 | 0.20 |
| Cotton waste, per lb. | 0.1181 | 0.1181 | 0.109 |
| Washers, cast iron (½-in.), per 100 lb. | 4.33 | 4.33 | 3.83 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.11 |
| Machine oil, per gal. | 0.349 | 0.349 | 0.40 |
| Belting, leather, medium, off list | 49% | 49% | 46¼% |
| Machine bolts, up to 1-in. x 30-in., off list | 51⅓% | 51⅓% | 64½% |

## The Metal Market

**Prices Show No Tendency to Weaken—Copper Quoted at Highest Price Since October, 1920**

Prices in the metal market show no tendency to weaken owing to the continued excellent business of metal consumers in most parts of the country and the large amount of metal they are taking on a contract basis.

With practically all producers asking 17⅜ cents delivered, copper is quoted at the highest price since October, 1920, when it passed that level on its downward movement. It is interesting to note that until last week the resumption of the advance was not inspired so much by the demands of domestic consumers as by speculative dealings abroad. When the price wavered at 17 cents and was weak in London two or three weeks ago, there was considerable short selling on the London market by international interests who thought a reaction was due. The copper which they sold short was quickly picked up. However, the reaction in price was not so marked nor so long continued as they expected and in seeking to cover at around 16.60 to 16.75 cents they quickly pushed the price back to 17 cents and even beyond.

NEW YORK METAL MARKET PRICES

| | Mar. 21, 1923 Cents per Pound | Mar. 28, 1923 Cents per Pound |
|---|---|---|
| Copper | | |
| Electrolytic | 17.00 | 17.37½ |
| Lead, Am. S. & R. price | 8.25 | 8.25 |
| Antimony | 8.75 | 8.75 |
| Nickel, ingot | 30.00 | 30.00 |
| Zinc, spot | 7.50 | 7.65 |
| Tin, Straits | 47.25 | 48.00 |
| Aluminum, 98 to 99 per cent | 26.00 | 26.00 |

## The Week in Trade

**Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

TREND of prices is still upward, with sales somewhat slower than one or two weeks ago. In some sections of the country expressions of fear are heard that the momentum of rising prices and rapid business expansion may bring about depression in the market unless checked within a few weeks. Some reaction is already being felt in the Far West in the delay or abandonment of important investment projects.

**Boston** The trend toward larger volume of business continues. Rail embargoes have been slightly relaxed and short stocks have been to some extent relieved during the week. The trend of prices is still upward. Building contracts let have decreased somewhat. Central-station buying of line material is more active and pole replacements due to flood conditions are imminent in the interior valleys. Money is easy, and, despite the growth of trade, little evidence appears of inflation. There is a shortage of radio equipment and insulating material.

**New York** A slight falling off in sales to the dealers and contractors is noted in jobbing circles following the unusually heavy buying during the last three weeks with the rising market for copper, porcelain and other raw materials. This decrease in activity seems to be well taken by most of the distributors, as they are of the opinion that overstocked shelves in face of present prospects will result in depression in later months. Central-station orders to the manufacturers are increasing gradually. Much improvement in radio business is evident with no signs of a let-up in demand during the next few weeks. Collections are gradually improving.

**Baltimore** Market conditions are very bright at the present time. The price trend of practically every article is on the increase. Conduit boxes are remarkably active and motors show quite a decided activity. The market on wire in all forms is very active with prices very much on the increase at the present time. The past week has been most encouraging to the jobbers, while the prospects for the future are excellent.

**Atlanta** The electrical business as a whole continues good. Jobbers report that vacuum cleaners are growing more popular every day and sales are considerably in excess of those for this time last year. With the opening up of spring and the launching of proposed sales campaigns the demand should pick up even more. Good stocks are in the territory. Electric sign sales are being pushed and good results are reported. The movement of electric ranges is reported satisfactory, particularly in the small towns where sales campaigns are under way. General price increases are reported in cable, bare copper and weatherproof wire, but these have served in no way to check the demand for these articles.

**Pittsburgh** Prices during the week to a great extent remain firm with slight increases in wire and cable, although there is a tendency for quite an increase in pole-line material. Business generally is good and increasing every day. A slight spirit of pessimism is seen among the electrical interests, due to the steady increase of prices, as these continued increases have a tendency to cause an unsettled condition. Business among the contractor-dealers is fairly good, although not in proportion to the home building that is being done. Investigation shows that a good many of the small homes that at being built in the suburban districts are not being wired.

**Cleveland** Electrical sales keep pace with general business, improvement being more pronounced in industrial equipment, with central-station business showing much stability. Construction of apartment houses and single dwellings has accelerated appliance sales to a fair degree, and the market for meters is reported to be more active. Poles, pole-line hardware, porcelain and wiring devices are in good demand with the advent of the repairing season. Conduit stocks have recovered in a small way, and the demand is quite brisk. Farm-lighting plant sales are slow.

**Chicago** Buying is steady and prices generally are firm, with the exception of conduit. Difficulty is experienced in obtaining satisfactory shipping dates since deliveries are promised from four to twelve weeks. Pipe advanced two to three points this week. Pole-line hardware demand has been active despite the recent advance of about 10 per cent. Jobbers and manufacturers report exceptionally good sales, although stocks are somewhat depleted. Fiber prices have advanced 16 per cent and stocks are still low.

**St. Louis** Business conditions in electrical lines, according to manufacturers and jobbers, are very satisfactory. There is an exceptional demand for motors and transformers for industrial purposes, and deliveries from the manufacturers are slowing up. Owing to freight congestion considerable difficulty is being encountered in getting shipments through. Stocks of wire and conduit are still low with deliveries promised for sixty days or longer and shipments uncertain. Many prospects are reported for industrial heating equipment for a variety of different uses. Exceptionally large sales of vacuum cleaners and washing machines are reported.

**St. Paul-Minneapolis** Jobbers say dealers believe the peak of the price rise has been reached, and buying on the rising market that was started late in February has stopped. Jobbers also say business is normal for this time of the year. Inquiries coming in and other indications point to greatly increased activities next month. The conduit situation is declared serious.

**Denver** Building permits for the first three months of 1923 are in excess of $4,000,000, a 40 per cent advance over the same period of last year. Jobbers' stocks are not overloaded, and few if any contractors have surplus supplies. Even central stations are conservative in placing

# Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Farm Lighting Plants, Signal Apparatus, and Electric Tools

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Radio | Conduit Boxes | Rectifiers | Instruments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boston** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Act | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Act. |
| Supply | Nml. | Nml. | Nml. | Nml. | Low | Low | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Low | Nml. |
| Price trend | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Dec. | Firm | Firm | Firm |
| **New York** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act | Sdy. | Act. | Act. | Sdy. | Act. | Act. |
| Supply | Nml. | Nml. | Nml. | Nml. | Low | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Low | Nml. |
| Price trend | Inc. | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Dec. | Firm | Firm | Firm |
| **Baltimore** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Act. | Slow | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Act | Act. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Aot. | Act. | Sdy. | Act. | Sdy. | Act. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Sdy. |
| Supply | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Act. | Act. | Act | Sdy. | Act. | Sdy. | Act. | Act | Act. | Act. | Act. | Act. | Act. | Act | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **St. Paul-Minneap.** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Slow | Sdy. | Act | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Inc. | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Slow | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act | Act | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow | Act. | Slow | Sdy. | Act. | Act. | Act. | Slow | Act. | Act | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Sdy. | Slow | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | High | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm. |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Inc | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Dec. | Dec. | Firm | Inc. | Firm | Ino. | Inc. | Firm | Dec. | Firm | Firm | Firm | Firm | Firm |

orders unless for specific improvements. Apparently the experience of several years back is responsible for the caution now being exercised. In the southern part of the state extensive range campaigns have been started, while in Denver an industrial gas movement is imposing several obstacles in the way of electric development.

**Salt Lake City** Building activity will be in full swing within several weeks. The market for mining machinery and equipment has not been so active in several years, indicating a rapid return to capacity production as well as much new development of new mineral projects. Coal mines are producing on a large scale.

**Portland-Seattle** Shipping is once more in the ascendency and the employment situation is good. Weather conditions in the wheat country are favorable for a large crop this summer, and building construction is very active. The price trend in material as well as wages is upward. While present reports generally are good, there is a fear expressed in certain sections that the momentum of rising prices and business expansion may carry the movement beyond the point where this prosperous condition can be maintained, resulting in depression. In some sections a reaction against rising costs is already being felt in the delay or in the abandonment of important investment projects. The building activity of the Northwest creates an ever-increasing demand for meters. Deliveries are improving and at present are very satisfactory. Precision instruments are reported in active demand by the schools and colleges throughout the territory.

**San Francisco** Business continues good with well-assorted orders, adequate stocks and fair prospects. Collections show very slow improvement, running close to seventy days. A flexible-cord shortage threatens because of the oversold condition of factories and there now exist in some quarters very low prices. Several appliance manufacturers are supplementing their standard flatirons, pads, toasters and the like by cheaper lines.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Chile Copper to Sell Production Through Subsidiary

The Chile Copper Company, control of which was recently acquired by the Anaconda Copper Mining Company, will in the future sell its own production through its subsidiary and operating company, the Chile Exploration Company. The sales will be handled by Edward Mosehauer, who until recently was sales manager of the United Metals Selling Company. The Chile Copper Company, it is said, is producing 18,000,000 lb. of copper monthly, and it is pointed out that with this amount of copper to sell the Chile Exploration Company will rank among the five largest sellers of the red metal in this country.

## To Hold Power Show April 2-7

The Power Show, one of the series of specialized electrical shows being held this spring by the New York Edison Company for manufacturers, is scheduled for the week of April 2-7. It will be held in the Irving Place Showroom, Irving Place and Fifteenth Street, and the exhibits will include industrial power equipment, ventilating apparatus, electrically operated refrigerating machinery and electric elevator equipment.

## Knox Porcelain Will Soon Start Erection of $75,000 Plant

The Knox Porcelain Company, Knoxville, Tenn., recently organized with a capital of $370,000, has acquired about five acres and will soon commence the erection of the first unit of its proposed plant to manufacture electrical porcelain products. It will include a power house, machine shop and other buildings, estimated to cost $75,000. Later two additional units will be built. J. N. House is president.

## Radio Corporation May Show Income of $3,000,000

The Radio Corporation of America is expected to show income after depreciation, charges, etc., for the year ended Dec. 31, 1922, of approximately $3,000,000. This compares with $426,799 balance after charges applied to amortization of patents in the year 1921. The capital stock of the company as of Dec. 31, 1921, consisted of 3,955,974 shares (par $5) preferred and 5,732,000 shares (no par) common, against which the balance sheet showed an equity of $2.11 a common share. No dividends have been declared on either class, but a preferred dividend becomes cumulative at the close of 1923.

Gross sales booked during the year 1921 totaled $1,468,919. Sales in January, 1923, are said to have reached about $1,500,000, and in February, 1923, approximately $2,000,000. Since October, when the slump in demand for radio apparatus terminated upon absorption of jobbers' and dealers' surplus stocks, there has been a steady increase in the sales of radio products.

## Westinghouse Makes Changes in Los Angeles Office

A number of changes in the Los Angeles office of the Westinghouse Electric & Manufacturing Company have been announced by W. S. Rugg, general sales manager of the company. The power division has been changed to the central station division and J. C. Jones has been appointed manager. Mr. Jones is also in charge of the sale of supply apparatus in that territory. The railway division has been changed to the transportation division and G. B. Kirker has been appointed manager. A merchandising division has been established with J. H. Jamison as manager, and an engineering division has also been established with R. A. Hopkins as manager.

## Establishes Second Branch in South America

The A. H. Keleher Company, 44 Whitehall Street, New York City, direct factory representative for electrical exporting, announces the establishment of a branch office in Rio de Janeiro, Brazil, which is in charge of Burton W. Peabody. Another branch of the Keleher company, under the name of Keleher & Libert, is in Buenos Aires.

## To Manufacture and Sell Heating Apparatus

The Electric Furnace and Equipment Company, Kansas City, recently incorporated with a capital of $300,000, announces that it will develop, produce, manufacture, sell and dispose of heating apparatus and all equipment and appurtenances thereto. Incorporators: H. J. Plagens, H. N. Olsen, F. H. Longacre, F. R. Andrews and Mrs. F. H. Longacre.

## Tubular Woven Fabric Expands

Increasing business at the factory of the Tubular Woven Fabric Company, Pawtucket, R. I., will necessitate the early building of additional storehouse and shipping department facilities. The company reports marked activity in the demand for non-metallic flexible conduit, notwithstanding adverse transportation conditions. Northern New England is absorbing large quantities of this class of material, and the factory is running full time.

## U. S. Steel Net Income for 1922 Amounted to $58,840,801

The twenty-first annual report of the United States Steel Corporation and subsidiary companies as issued on March 21 shows a net income for the year 1922 of $58,840,801.60. The total earnings were, after deducting all expenses incident to operations, including ordinary repairs and maintenance (approximately $88,000,000) and taxes (including reserve for federal income taxes), $109,788,916.32. The balance of earnings after deducting interest on outstanding bonds and mortages of the subsidiary companies, which amounted to $8,259,605.93, was $101,529,310.39. Charges and allowances for depletion and depreciation were applied as follows, viz.: To depreciation and replacement reserves and sinking funds on bonds of subsidiary companies, $33,382,624.09; to sinking funds and bonds of the United States Steel Corporation, $9,305,884.70.

## Merger of Dayton Jobbers

Merger of the M. D. Larkin Supply Company and the William Hall Electric Company, electrical supply jobbers, Dayton, Ohio, with an authorized capital stock of $1,200,000, has been announced by Maurice D. Larkin, president of the new company, which is now being operated under the name of the M. D. Larkin Company.

With the announcement of the consolidation, President Larkin also stated the company will later erect a modern six-story office and mercantile building that will meet the needs of the new company. This structure will house the offices as well as the various departments and will provide 85,000 additional square feet of floor space.

Through the merger, the M. D. Larkin Supply Company and the William Hall Electric Company are absorbed. Although the latter firm will operate its electrical division of the new company under its present name, it will be owned and supervised by the M. D. Larkin Company.

## General Electric Completes Atlanta Warehouse

The General Electric Company has announced the completion in Atlanta of a four-story reinforced-concrete warehouse, equipped with all facilities for prompt and efficient handling of orders. The initial building has a floor space of 64,000 sq.ft., and provision is made for later increase to 100,000 sq.ft. as conditions warrant. The warehouse is located on the Southern Railroad with an inside car siding and inside motor truck pits with electric cranes operating over the pits.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency is desired in Egypt (No. 5,830) of general electrical appliances, motors, generators and engines.

Purchase and agency is desired in Switzerland (No. 5,831) of radio telegraph and telephone apparatus.

Purchase is desired in Norway (No. 5,832) of radio receiving outfits.

Agency and purchase is desired in France (No. 5,838) for trucks and automobiles (electric vehicles).

ELECTRICAL EQUIPMENT FOR RAILWAY, BOMBAY, INDIA. — Bids will be received by the directors of the Great Indian Peninsula Railway Company, 48 Copthall Avenue, E. C. W., London, England, until April 24 for equipment for electrification of Bombay suburban lines as follows: (1) Transformers; (2) cables; (3) switchgear and accessories; (4) converter sets. Further information may be obtained from Merz & McLellan, 32 Victoria Street, Westminster, S. W. 1, consulting engineers.

CONCESSION GRANTED TO UTILIZE WATER POWER OF THE DANUBE RIVER, AUSTRIA. — The Oberösterreichische Wasserkraft und Elektricitäts Gesellschaft of Linz has been granted a concession to use a maximum of 10,000 hp. from the Danube River to generate electricity.

PROPOSED DISTRIBUTION SYSTEM FOR SEINE DEPARTMENT, FRANCE.—The Ouest-Lumière Company has applied for a concession to build a distribution system to supply electricity in twenty-four communes in the Seine Department.

INCREASE IN ELECTRICAL DEVELOPMENT FOR RAILWAY PURPOSES IN FRANCE.—At present about 2,000,000 hp. is being used in French industries, and the energy to be employed in railway electrification, according to *Commerce Reports*, is expected to increase this to 3,000,000 hp. within the next two years. Expenditures proposed for 1923 on the Midi Railroad include 124,000,000 francs for the electrification of 1,500 km. (932 miles) of line. The Paris-Orleans line plans to spend 90,000,000 francs this year, part of which will be for power-plant construction. The state railroad electrification program calls for an expenditure of 45,000,000 francs principally in the Paris district, and the Paris-Lyons-Mediterranean Railway calls for an expenditure of 11,000,000 francs, which is to be used on the line between Culoz and Modane.

## New Apparatus and Publications

TOOLS FOR HIGH-VOLTAGE WORK.—Bulletin No. 2, entitled "Hot Line Tools," issued by the W. T. Safety Tool Company, Inc., Decatur, Ill., covers the company's line of tools for high-voltage work.

GRAPHIC INSTRUMENTS. — Bulletin No. 223 issued by the Esterline-Angus Company, Indianapolis, describes several unusual uses to which its graphic instruments have been successfully applied.

OUTDOOR BUS SUPPORTS.—Schweitzer & Conrad, Inc., 4,435 Ravenswood Avenue, Chicago, is distributing bulletin No. 203, covering its "S. & C." outdoor bus supports.

FARM-LIGHTING PLANTS, BATTERY-CHARGING APPARATUS, ETC. — The Main Electric Company, Cleveland, is distributing bulletin No. 175, describing its farm-lighting plants, battery-charging apparatus, radiophone receiving sets, automobile batteries, etc.

LIGHTING FIXTURES.—The St. Louis Brass Manufacturing Company has brought out a line of residence lighting fixtures, known as "Polycraft."

TIME SWITCH.—A new electric time switch for controlling lamps in show windows, electric signs, etc., has been developed by the United States Time Switch Company, Denver.

ELECTRIC BLOWER.—An electric hand blower for removing dust from electrical apparatus has been developed by the United States Electrical Tool Company, Cincinnati, Ohio.

WASHING MACHINE. — An electric washer of the oscillating type, "Greyhound," has been developed by the Meadows Manufacturing Company, Bloomington, Ill.

PRESSURE AND VACUUM GAGES.—Catalog No. 1,006 issued by the Bristol Company, Waterbury, Conn., covers its various types of "Bristol" pressure and vacuum recording gages. The catalog also gives a great variety of charts showing the adaptability of the gages to practically every application where pressure of liquids, gases, steam or air is required to be measured.

MOTOR-GENERATORS, DYNAMOTORS AND ROTARY CONVERTERS. — Bulletin No. 242 issued by the Electric Specialty Company, Stamford, Conn., describes the "Esco" motor-generator sets, dynamotors and rotary converters.

STEAM TURBINES. — The De Laval Steam Turbine Company, Trenton, N. J., is distributing a leaflet entitled "De Laval Equipment in a By-Product Plant," in which it advocates the use of steam turbines for driving heavy machinery exposed to carbon dust and grit.

ELECTRIC VACUUM CLEANER.—The Hurley Machine Company, 24 East Jackson Boulevard, Chicago, has recently placed on the market a new vacuum cleaner, known as the "Hurley Thor No. 77 electric brush-type cleaner."

THEATER LIGHTING.—"The Control of Lighting in Theaters" is the title of bulletin No. 28 issued by the Frank Adam Electric Company, St. Louis, the purpose of which is to give some standardized practice for lighting theaters.

## New Incorporations

THE MARIANNA (FLA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $250,000. The officers are: G. M. Thomas, president, and F. M. Golson, secretary and treasurer.

THE BARBOURSVILLE (WEST VA.) WATER & LIGHT COMPANY has been chartered with a capital stock of $50,000 by H. E. and P. E. Love.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

CAMBRIDGE, MASS. — The Cambridge Electric Light Company is planning to place its wires underground in the congested districts during the coming year. Welles E. Holmes is treasurer and manager.

CONCORD, MASS. — Plans are under consideration for utilizing fuel oil in the municipal electric plant; also for the installation of a new steam end on the Westinghouse-Parsons turbine. Everett E. Pierce is business manager.

HOLYOKE, MASS.—The American Writing Paper Company plans to equip its mills for electrical operation to replace present water-power service.

HOLYOKE, MASS.—The remodeling of the entire electric plant is under consideration by the Municipal Gas and Electric Department. A. W. Darby is superintendent.

PRINCETON, MASS.—The transmission and distribution lines of the municipal electric lighting system are to be extended about 6 miles this spring. F. W. Bryant is manager.

SPRINGFIELD, MASS.—Electric power equipment will be installed in the proposed new ice and refrigerating plant to be erected by the Eastern States Refrigerating Company, to cost about $200,000.

WAKEFIELD, MASS.—The commissioners of the municipal electric light plant will erect a 13,000-volt transmission line from Woburn to the new substation and will install an ornamental lighting system in the business district, covering about ½ mile. S. H. Brooks is manager.

HARTFORD, CONN.—The Veeder Manufacturing Company will make extensions to its power house in connection with extensions in its mechanical counter manufacturing plant. Buck & Sheldon, 60 Prospect Street, are architects and engineers.

## Middle Atlantic States

BROCKPORT, N. Y.—Plans for the proposed addition to the plant of the Moore-Shafer Shoe Company include a power plant of about 200 hp. capacity.

CAZENOVIA, N. Y.—The construction of a single-phase, 2,200-volt rural line, 2 miles long, and several underground extensions are under consideration by the Cazenovia Electric Company. R. Philip Hart is manager.

CHELSEA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 16 for an ice-making and refrigerating plant at the United States Veterans' Hospital, Chelsea.

CHURCHVILLE, N. Y. — At a recent election the voters authorized the construction of a new power house and the purchase of new pumping equipment. R. E. Gaskin Company, Cutler Building, Rochester, is engineer.

LOCKPORT, N. Y.—The Council has authorized preliminary estimates to be secured of cost of a municipal power plant. Donald S. Moore is city engineer.

MONTICELLO, N. Y.—The Murray Electric Light & Power Company is planning to erect a 33,000-volt transmission line to Liberty, a distance of 12 miles.

NEW YORK, N. Y.—The Huasteca Petroleum Company, 120 Broadway, has plans for a power plant at its oil refinery at Tampico, Mexico, to cost about $5,000,000. Work has been started on the second refining plant unit.

POTSDAM, N. Y. — The St. Lawrence Transmission Company contemplates extending its high-tension system in the towns of Fowler, Rossie and Macomb. The cost is estimated at $100,000.

WATERTOWN, N. Y. — The Northern New York Utilities Company will build a two-story machine and service works, to cost $100,000.

ALLENTOWN, PA. — Electric power equipment will be installed in the proposed cold-storage plant to be built by John L. Lordan, Allentown, and associates in connection with a warehouse, to cost about $400,000.

CLEARFIELD, PA. — The Penn Public Service Company has arranged a merger with the Erie (Pa.) Lighting Company, Erie, to construct plants and system to operate in eight counties in Western Pennsylvania.

HARRISBURG, PA. — The North Penn Power Company, recently organized, has acquired and will merge the following power companies: Blossburg Electric Light & Power, Morris Run Electric, Mansfield Electric, Bloss, Ward, Tioga, Nelson, Richmon, Osceola, Lawrence, Westfield, Elkland, Deerfield and Duncan Township Electric companies; Knoxville, Elkland, Westfield and Lawrenceville Interborough Electric companies. Plans are being made for the erection of additional transmission lines. Samuel W. Fleming, Jr., is president.

MEDIA, PA.—Improvements are contemplated to the municipal electric light and water plant, including the installation of a new boiler and waterwheel. P. E. Ahern is superintendent.

NEWPORT, PA.—Frank Warren, Y. M. C. A. Building, Harrisburg, is at the head of a project to construct and operate a hydro-electric power plant in Newport, to cost about $525,000.

PHILADELPHIA, PA. — The Philadelphia Electric Company has filed plans for an addition to its power plant at Beach and Palmer Streets, to cost about $2,300,000. John T. Windrim, Commonwealth Building, is architect.

RINGTOWN, PA.—The Ringtown Electric Light, Heat & Power Company contemplates extending its lines into the rural districts. J. A. Yost is secretary and manager.

TATAMY, PA.—The Tatamy Light, Heat & Power Company contemplates the erection of 3 miles of transmission and distribution lines, opening up new territory, and establishing a wholesale salesroom for electric devices, including motors, electric ranges, heaters, fixtures, house wiring and material. A. C. Messenger is general manager.

ANNAPOLIS, MD.—Bids will be received by the Bureau of Supplies and Accounts, Washington, D. C., until April 3, for a 50-kw. generating set, oil-engine-driven (Schedule 637).

BALTIMORE, MD.—The H. E. Crook Company, Inc., 28 Light Street, plans to build a power house in connection with its proposed drydock and ship repair works at the foot of McComas Street. The cost of the project is estimated at $1,000,000.

PRINCESS ANNE, MD.—Improvements are contemplated to the local electric plant, owned by Everett C. Carman, during 1923, including the installation of one 50-hp. oil engine directly connected to a 40-kva. alternator and one 100-hp. oil engine directly connected to a 75-kva. alternator.

WILLIAMSPORT, MD. — The Potomac Public Service Company contemplates the construction of an additional unit at its local hydro-electric power plant.

FREDERICKSBURG, VA.—The Rappahannock Electric Light & Power Company, it is reported, contemplates extensions to its electric power plant to increase the capacity by 400 hp.

MARTINSVILLE, VA. — The American Dining Room Furniture Company will build a power house in connection with its proposed local factory, to cost about $90,000.

RICHMOND, VA.—Bids will be received at the office of the Director of Public Utilities, City Hall, Richmond, until April 18 for construction of a mechanical filter plant, including six electrically driven centrifugal pumps. Fuller & McClintock, 170 Broadway, New York City, are engineers. E. W. Trafford is director of public utilities.

WASHINGTON, D. C.—Bids will be received by the Commissioners of the District of Columbia, District Building, until April 13 for electric lighting fixtures for public schools.

## North Central States

GRAND HAVEN, MICH.—Improvements are contemplated to the municipal electric light plant, including an addition to building, installation of an additional turbo-generator of 1,500 kw. to 2,000 kw. capacity, a 200-hp. boiler, new piping, etc. Paul R. Taylor is city manager.

KALAMAZOO, MICH.—The Kalamazoo Vegetable Parchment Company has issued $1,700,000 in bonds, part of the proceeds to be used for the completion of a power plant and addition to the mill.

L'ANSE, MICH. — The officials of the L'Anse hydro-electric plant plan to erect about 2 miles of transmission lines this year. F. H. Monson is superintendent.

MONROE, MICH.—The Monroe Board & Lining Company, First National Bank Building, contemplates the construction of a power house in connection with its proposed paper mill.

PORTLAND, MICH.—The installation of a 200-hp. Diesel engine and generator in the municipal electric plant is under consideration. E. L. Jenkins is manager.

SHEPHERD, MICH. — The Municipal Electric Light & Power Company contemplates rebuilding its distribution lines and street-lighting system, the latter to be a series system, to be operated from a tub transformer already installed. Harry L. Post is superintendent.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 6 for a transformer house for the division of light and power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 6 for furnishing "Mazda" lamps to the various departments of the city, board of education and public library, all the lamps required for a period of one year, in the amount of approximately $50,000.

EAST PALESTINE, OHIO.—The installation of a 500-kw. generator in the municipal electric plant is under consideration. F. W. Reese is clerk.

MARYSVILLE, OHIO. — The Marysville Light & Water Company is planning to install a new street-lighting system, using series "Mazda" lamps, and to make extensive repairs and rebuild system in Marysville and Milford Center. G. C. Wilkins is superintendent.

MARTINS FERRY, OHIO.—Bonds to the amount of $400,000 have been authorized for the construction of a combined electric light and water plant. The lighting plant to have a capacity of 2,000 kw. Surveys have been made for the proposed plant, but as yet an engineer has not been engaged. J. W. Tush is superintendent.

TORONTO, OHIO.—Bids will be received by the board of trustees of public affairs of the village of Toronto until April 10 for furnishing one 2,000,000-gal.-per-day motor-driven centrifugal high-lift pump and one 2,000,000-gal. per-day motor-driven centrifugal low-lift pump, with necessary electrical installations, pipings, etc. Hudson & Myron, Wabash Building, Pittsburgh, Pa., are engineers.

GARY, IND.—The Gary Street Railway Company plans to build a substation in the Glen Park district.

PEORIA, ILL. — The Illinois Electric Power Company, successor to the Illinois-Edison Company, has issued $3,500,000 in bonds, the proceeds to be used for the construction of a steam-driven power plant on the Illinois River near Peoria, to have a capacity of 53,000 hp.

CAMERON, WIS. — Agitation has been started by local business men relative to the construction of a dam and hydro-electric plant, for which surveys already have been made. Capital to carry out the project, it is understood, will be available as soon as flowage rights have been secured.

IRON RIVER, WIS. — The Iron River Light, Water & Telegraph Company has applied to the Railroad Commission for permission to replace its dam in the Iron River with a larger one in order to secure more power for its system.

PARK FALLS, WIS. — The Flambeau Power Company has petitioned the Railroad Commission for permission to raise and enlarge its Lower Park Falls Dam.

PORT WASHINGTON, WIS.—The Council contemplates installing a central heating plant in the water and light plant, also new boilers, etc., and an addition to the power house. The cost is estimated at about $125,000.

THREE LAKES, WIS.—Bids are being received by H. M. Olkowski, town clerk, for the erection of a 10-mile high-tension transmission line and a street-lighting system.

MIZPAH, MINN.—The Northern Light & Power Company is planning to extend its transmission line to Gemmel, a distance of 5½ miles. G. J. Holt is owner and manager.

CEDAR FALLS, IOWA.—The installation of new boilers in the municipal electric and water plant is under consideration. C. H. Streeter is superintendent.

EDDYVILLE, IOWA.—A multiple single-lamp electrolier system, consisting of twenty-four posts and fittings and about 2,000 ft. of three-wire underground cable, will be installed. The rebuilding of some distribution lines is under consideration. C. E. Chord is superintendent of the municipal electric plant.

IDA GROVE, IOWA. — The Ida Grove Electric Light Company is planning to replace its present boilers with three 150-hp. Frost boilers. William J. Fawcett is manager.

MAQUOKETA, IOWA.—Bonds have been voted for $70,000 for a municipal power plant and system. Burns & McDonnell, Interstate Building, Kansas City, Mo., are consulting engineers.

MUSCATINE, IOWA.—Bids will be received by the board of electric light trustees of the city of Muscatine until April 18 for construction of an electric light plant, distribution system, substation and ornamental lighting system. Plans and specifications may be obtained from Arthur L. Mullergren, Gates Building, Kansas City, Mo., consulting engineer. B. C. Benham is clerk of board.

WATERLOO, IOWA.—The installation of a 12,500-kva. turbo-generator with surface condenser and auxiliaries is under consideration by the Citizens' Gas & Electric Company.

PALMYRA, MO.—The Light and Water Department is considering the installation of a directly connected oil-engine unit of 100 hp. or 150 hp. in the municipal electric light plant. H. M. Howard is superintendent.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service, City Hall, until April 10 for 500 concrete electric lamp standards, to cost about $17,000. Glassware for same, to cost about $17,500, will be purchased at a later date.

TRENTON, MO.—Bids will be received by Burns & McDonnell, Interstate Building, Kansas City, Mo., engineers, until April 3 for improvements to the waterworks and filtration plant, including seven new motor-driven pumps. The cost is estimated at $175,000.

CHANUTE, KAN. — Improvements are contemplated to the municipal electric light plant, including the installation of an additional 1,000-kw. turbine generating unit and accessories. C. F. Stout is superintendent.

COTTONWOOD FALLS, KAN. — The Inter County Electric Company contemplates extending its transmission lines to Elmdale. W. W. Austin is president and manager.

SALINA, KAN.—The Salina Light, Power & Gas Company has issued $950,000 in bonds, part of the proceeds to be used for extensions and improvements.

## Southern States

FAYETTEVILLE, N. C.—Bids will be received by the Public Works Commission until April 5 for electrically operated pumping machinery for the municipal waterworks and sewerage plants. W. C. Olsen, Kinston, is consulting engineer.

NEWBERN, N. C.—The installation of two additional boilers in the municipal electric water and light plant is under consideration. F. G. Godfrey is manager.

ROANOKE RAPIDS, N. C.—Preliminary plans are being prepared by the Roanoke Rapids Power Company for the construction of a hydro-electric power plant, to cost $200,000.

WARSAW, N. C.—Extensions are contemplated to the municipal electric light and power plant, including the installation of a 150-kva. alternator with exciter and uniflow engine. Line extensions are now being made. William P. Kennedy is superintendent.

WESTFIELD, N. C. — Plans are being considered to establish an electric power plant for commercial service. T. T. Joyce is interested in the project.

WORTHVILLE, N. C. — The Leonard Cotton Mills, Inc., contemplates doubling the capacity of its mills, now 5,000 spindles, and installing electric equipment in the present power plant.

CONWAY, S. C.—The Quattlebaum Light & Ice Company contemplates the installation of a 500-kw. turbine or engine-driven generating unit. Paul Quattlebaum is president and manager.

GREENWOOD, S. C.—The Grendel Cotton Mill Company contemplates the construction of a power house in connection with proposed extension to its mill, to cost about $500,000.

PAMPLICO, S. C.—The Wagoner Lumber Company plans to rebuild its power house and mill, recently destroyed by fire, with loss of about $55,000.

WADLEY, GA.—The city officials are considering the purchase of equipment for a municipal electric power plant, to include a 90-kw. generator, 100-hp. steam engine and auxiliary apparatus. F. T. McElreath is deputy clerk.

TARRANT CITY, ALA. — The Creher Shipbuilding Company, Tampa, Fla., plans to build a power house in connection with a local steel fabricating plant.

CHARLESTON, MISS.—The commissioners of the municipal electric plant are considering the purchase of one 60-hp. to 80-hp. oil engine or oil burners for the municipal electric plant. J. M. O'Neal is clerk.

NEWARK, ARK.—Plans are under consideration for the rebuilding of the electric light and power plant, recently destroyed by fire.

BASTROP, LA.—The Yellow Pine Lumber & Paper Company, Orange, Tex., will build a power house in connection with its proposed paper and pulp mill at Morehouse Parish, near Bastrop, to cost about $1,500,000.

LEESVILLE, LA.—The Leesville Light & Waterworks Company, Ltd., contemplates the installation of a 50-kw., 230-volt, direct-current generator directly connected to a simple or uniflow steam engine. W. K. Ferguson is manager.

MELVILLE, LA. — Arrangements are being made to install a complete new electric generating unit in the municipal electric plant and to overhaul the old unit. V. O. Jackson is superintendent.

PONCA CITY, OKLA.—Plans are being prepared for extensions to the municipal power plant, including the installation of additional machinery. A. M. Stalnaker is engineer.

CUERO, TEX.—The Cuero Light & Power Company has appropriated $120,000 for the installation of a 1,500-hp. power plant.

## Pacific and Mountain States

KETTLE FALLS, WASH. — The White Pine Sash Company, Spokane, will build a power plant in connection with its proposed local mill. G. W. Horstkotte, Mohawk Building, Spokane, is engineer.

PASCO, WASH.—Surveys are being made by the Pacific Power & Light Company for the erection of a high-tension transmission line from Pasco through Umatilla to Pendleton, Ore., to cost about $300,000.

H. H. Schoolfield, Portland, is chief engineer of the company.

SEATTLE, WASH.—Bids have been received by the Board of Public Works for the purchase of sites for two new substations for the distribution of energy from the hydro-electric plant at Cedar River and a portion of the Skagit plant.

TACOMA, WASH. — An ordinance has been introduced in the City Council for the purchase of the following electrical supplies: For transformers, $112,000; electric light meters, $75,000, and for ornamental street lamps and posts, $12,000.

FLORENCE, ORE.—The Florence Electric Company is planning to build a hydro-electric plant on Sweet Creek. Extensions of its transmission lines to Mapleton and in other directions are also under consideration.

PORTLAND, ORE.—Contract has been awarded by the Northwestern Electric Company to Parker & Banfield for the construction of the second unit of its steam generating station at the foot of Lincoln Street, which will double the capacity of the plant. In addition the 66,000-volt transmission line will be extended into Vancouver, Wash., to connect with the 11,000-volt line on the Oregon side of the river. The company will also build new substations and will erect additional distribution lines. The cost of the work is estimated at about $500,000.

CARPINTERIA, CAL. — The Southern California Edison Company plans to construct a local substation, to cost about $60,000.

FULLERTON, CAL.—The Southern California Edison Company has arranged an appropriation of $300,000 for extensions and improvements to its system in this section.

INDIO, CAL.—The Interlocking Tile & Sewer Pipe Company, Ontario, Cal., contemplates the construction of a power house in connection with a local plant.

LONG BEACH, CAL.—The Southern California Edison Company contemplates extensions to its system in the Long Beach-San Pedro district involving an expenditure of $1,708,000. Of this amount $1,000,000 will be expended in the High Sierras and for transmission lines to bring energy into this district; the remainder will be used for extensions to transmission lines, erection of new feeder lines, underground construction, improvements to street-lighting system, etc.

LOS ANGELES, CAL.—The Pan-American Petroleum & Transport Company, 120 Broadway, New York, is preparing plans for a power plant at its proposed oil refinery at San Pedro Harbor, to cost about $1,500,000.

MARE ISLAND, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 17 for 104,000 ft. of electric wire for use at the Mare Island Navy Yard (Schedule 645).

MODESTO, CAL.—The Modesto Irrigation District has appropriated $298,400 for the construction of an electric transmission system.

PORTERVILLE, CAL.—The Pacific Gas & Electric Company has appropriated $690,000 for the construction of substations and transmission lines in this section.

SACRAMENTO, CAL.—At an election to be held July 2 the proposal to establish a municipal hydro-electric plant for the city of Sacramento will be submitted to the voters. The cost is estimated at about $8,000,000.

SALIDA, CAL. — Plans are being considered by the Salida Welfare Association for the installation of a lighting system.

SALINAS, CAL. — Extensions and improvements are contemplated by the Coast Valleys Gas & Electric Company, including changing 20 miles of 30-kv. volt line from Soledad to King City to 55 kv., replacement of thirteen 30-kv. station transformers with 55-kv. transformers of 500 kva. each., installation of a new substation at Salinas and the erection of approximately 25 miles of 4-kv. feeder lines. T. W. Snell is superintendent.

SAN BERNARDINA, CAL. — The San Gorgonio Power Company has appropriated $450,000 for the construction of two hydro-electric power plants at Banning and Beaumont respectively.

SOLVANG, CAL.—Plans are being considered for the installation of a municipal power plant and system.

TEHAMA, CAL.—Plans are being prepared by Ralph W. Van Orden, Mills Building, San Francisco, engineer, for a local hydro-electric power plant with capacity of 18,600 hp., to cost about $2,500,000. A company is being organized by P. B. Cross and associates to construct and operate the plant.

TORRANCE, CAL. — The Union Tool Company will build an addition to its power plant in connection with factory extensions.

UKIAH, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in the business district.

GRANGEVILLE, IDAHO.—Surveys are being made by the Grangeville Electric Light & Power Company for a hydro-electric plant on the North Fork of Clearwater River to develop about 4,000 hp., and the erection of a transmission line to Orofino.

PHOENIX, ARIZ.—The Riverside (Cal.) Portland Cement Company plans to build a power house in connection with its proposed cement mill, to cost about $1,000,000.

## Canada

WINNIPEG, MAN.—B. W. Parker, Winnipeg, has applied to the City Council for a franchise to construct and operate a central heating plant in Fort Rouge. Mr. Parker proposes to install a heating plant equipped with an electrical steam generator and also to form a company to operate the proposed plant.

ST. JOHN, N. B.—The Federal Light & Traction Company, 52 William Street, New York, it is reported, contemplates extensions and improvements to the system of the New Brunswick Power Company, recently acquired.

RIDEAU, ONT. — The Hydro-Electric Power Commission of Ontario, Toronto, contemplates improvements in the Rideau system, to cost about $20,000.

MONTREAL, QUE.—The Electric Commission contemplates the installation of conduits in district No. 10, bounded by Craig, Bleury, St. Catherine and St. Lawrence Streets. The cost is estimated at about $150,000. A. Larivière is chief engineer.

MONTREAL, QUE.—H. Morgan & Company contemplate erecting an addition to their store on St. Catherine Street, to cost about $1,500,000, and building a power house at Aylmer and Mayor Streets, to cost $200,000. Barrett & Blackard, Canada Cement Building, are architects.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued March 6, 1923)

1,447,773. RADIO TRANSMISSION CONTROL SYSTEM; L. Espenschied, Queens, N. Y., and R. Brown, East Orange, N. J. App. filed Sept. 15, 1921. Uniform transmitting level maintained.

1,447,779. SYSTEM OF ETHER-WAVE CONTROL; J. H. Hammond, Jr., Gloucester, Mass. App. filed April 10, 1920. Radio transmitting and receiving apparatus.

1,447,785. HIGH-FREQUENCY ELECTRICAL APPLIANCE; E. S. Humphreys, Cleveland, Ohio. App. filed Dec. 27, 1920. For therapeutical treatment.

1,447,792. METHOD OF WELDING WIRES OR RODS ON INTERSECTING LINES; L. S. Lachman and E. Fulda, New York, N. Y. App. filed Feb. 28, 1922. Overlapping end of rod upon edge of opposite member, the rods being assembled between a pair of welding dies.

1,447,793. RADIO RECEIVING SYSTEM; M. Latour, Paris, France. App. filed Aug. 19, 1921. Applies heterodyne action in receiving Hertzian waves.

1,447,797. RELIEF MECHANISM FOR STORAGE BATTERIES; W. P. Loudon, Springfield, Mass. App. filed April 20, 1918. Device for storage batteries used in aëroplanes or the like that allows escape only of gases.

1,447,886. PERMANENT HAIR WAVER; S. S. Rand, New York, N. Y. App. filed Aug. 10, 1920. Operated by electricity.

1,447,892. SMELTING AND ELECTROLYTIC PROCESS; R. Rodrian, New York, N. Y. App. filed March 30, 1921. For making alloys.

1,447,917. ELECTRIC SWITCH; E. M. Wilson, Sandpoint, Idaho. App. filed July 20, 1921. Electromagnetic switch for heating devices.

1,447,952. ELECTRIC RADIATOR; C. A. Head, Royal Oak, Mich. App. filed Feb. 25, 1922. Reservoir of water acts as heating element.

(Issued March 13, 1923)

15,560 (reissue). ELECTRIC DEVICE FOR TREATING AIR; E. R. Case, Toronto, Ontario, Can. App. filed March 22, 1920. Medical appliance to treat air inhaled by sick people.

1,447,969. TELEPHONE HEAD SET; F. Dietrich, Flushing, N. Y. App. filed May 12, 1922. Padded holder for receivers.

1,447,993. METHOD OF CONSTRUCTING ELECTRODYNAMIC ARMATURES; A. T. D. Libby, East Orange, N. J. App. filed Sept. 22, 1919. Method of connecting windings of automobile starter to commutator.

1,448,009. CASING FOR ELECTRICAL APPARATUS; H. O. Stephens, Pittsfield, Mass. App. filed Oct. 2, 1920. For heating apparatus submerged in liquid.

1,448,010. ARTIFICIAL MAGNESIA SPINEL AND PROCESS OF MANUFACTURE; F. J. Tone, Niagara Falls, N. Y. App. filed April 5, 1921. Magnesite and bauxite fused together in electric furnace.

1,448,036. REDUCTION OF OXIDES OF METALS OF THE CHROMIUM GROUP; R. E. Pearson and E. N. Craig, London, England. App. filed July 12, 1921. By passing direct current through mixture.

1,448,037. ELECTROLYSIS OF WATER; R. Pechkranz, Geneva, Switzerland. App. filed July 12, 1922. Water decomposer built on filter-press principle with electrodes of thin sheet metal.

1,448,040. STREET INDICATING AND ADVERTISING DEVICE FOR MOTION VEHICLES; P. Radoccia, Providence, R. I. App. filed Sept. 24, 1921.

1,448,096. STRAIN INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Feb. 21, 1919. Single-unit type.

1,448,116. CONNECTOR FOR ELECTRICAL CONDUCTORS; R. A. Haislip, Montclair, N. J. App. filed May 7, 1920. For making a tap on a wire.

1,448,141. SUPPORT FOR CONDUCTORS; M. W. Manz and S. S. Mathews, Mansfield, Ohio. App. filed March 21, 1922. Supporting trolley wires from catenary or messenger cables.

1,448,142. BATTERY-TESTING DEVICE; J. W. Martin, San Ardo, Cal. App. filed Jan. 10, 1922. Apparatus for testing specific gravity of electrolyte in automobile batteries.

1,448,143. CONDUCTOR SUPPORT; S. S. Matthes, Mansfield, Ohio. App. filed March 25, 1922. Removable conductor support for trolley frogs, switches, etc.

1,448,190. AUTOMATIC ELECTRIC LIGHTING UNIT; W. W. Bucher, Chicago, Ill. App. filed March 2, 1916. Automatic gas-engine generator set.

1,448,195. SUPPORT FOR TROLLEY CONDUCTORS; H. P. Chandler, Mansfield, Ohio. App. filed June 3, 1922. Clamping trolley-wire ear.

1,448,207. WIRELESS-TELEPHONE RECEIVING APPARATUS; W. F. Gehrig, Newark, N. J. App. filed May 11, 1922. Mounting of tuning coil and detector devices for wireless-telephone receiving sets.

1,448,208. ELECTRODE FOR ELECTROLYTIC CELLS; J. Gerstle, Dayton, Ohio. App. filed July 15, 1922. Cathode of insulating material strung with silver wire.

1,448,216. SIGNALING SYSTEM; R. A. Heising, Millburn, N. J. App. filed July 6, 1918. Modulating and amplifying arrangement of the vacuum-tube-type transmitter.

1,448,219. SYSTEM FOR THE GENERATION AND DISTRIBUTION OF ELECTRICAL ENERGY; C. L. Hommel, Detroit, Mich. App. filed Oct. 14, 1915. Automatic gas-engine generator set.

1,448,279. ELECTRODYNAMIC RECEIVER; E. S. Pridham and P. L. Jensen, Oakland, Cal. App. filed April 28, 1920. Moving-coil type of telephone receiver.

1,448,350. TROLLEY-POLE SAFETY APPLIANCE FOR ELECTRIC TRAMS AND THE LIKE; P. M. De C. Ireland, Heidelberg, Victoria, Australia. App. filed April 9, 1921. When pole disengages from wire it automatically lowers to car roof.

1,448,353. FLASHLIGHT; E. R. Barany, Brooklyn, N. Y. App. filed Dec. 21, 1921. Several lamps and reflectors held in one case and focused at same point.

1,448,354. FLASHLIGHT; E. R. Barany, New York, N. Y. App. filed Dec. 21, 1921. Arrangement to locate reflector properly.

1,448,367. FITTING FOR ELECTRICAL CONDUITS, CABLES AND THE LIKE; G. C. Thomas, Jr., Elizabeth, N. J. App. filed May 11, 1922. For protecting wires entering outlet box.

1,448,377. CURRENT-COLLECTING DEVICE; C. Bethel, Wilkinsburg, and T. S. Scott, Pittsburgh, Pa. App. filed July 5, 1922. Brush holder for electric railway motors.

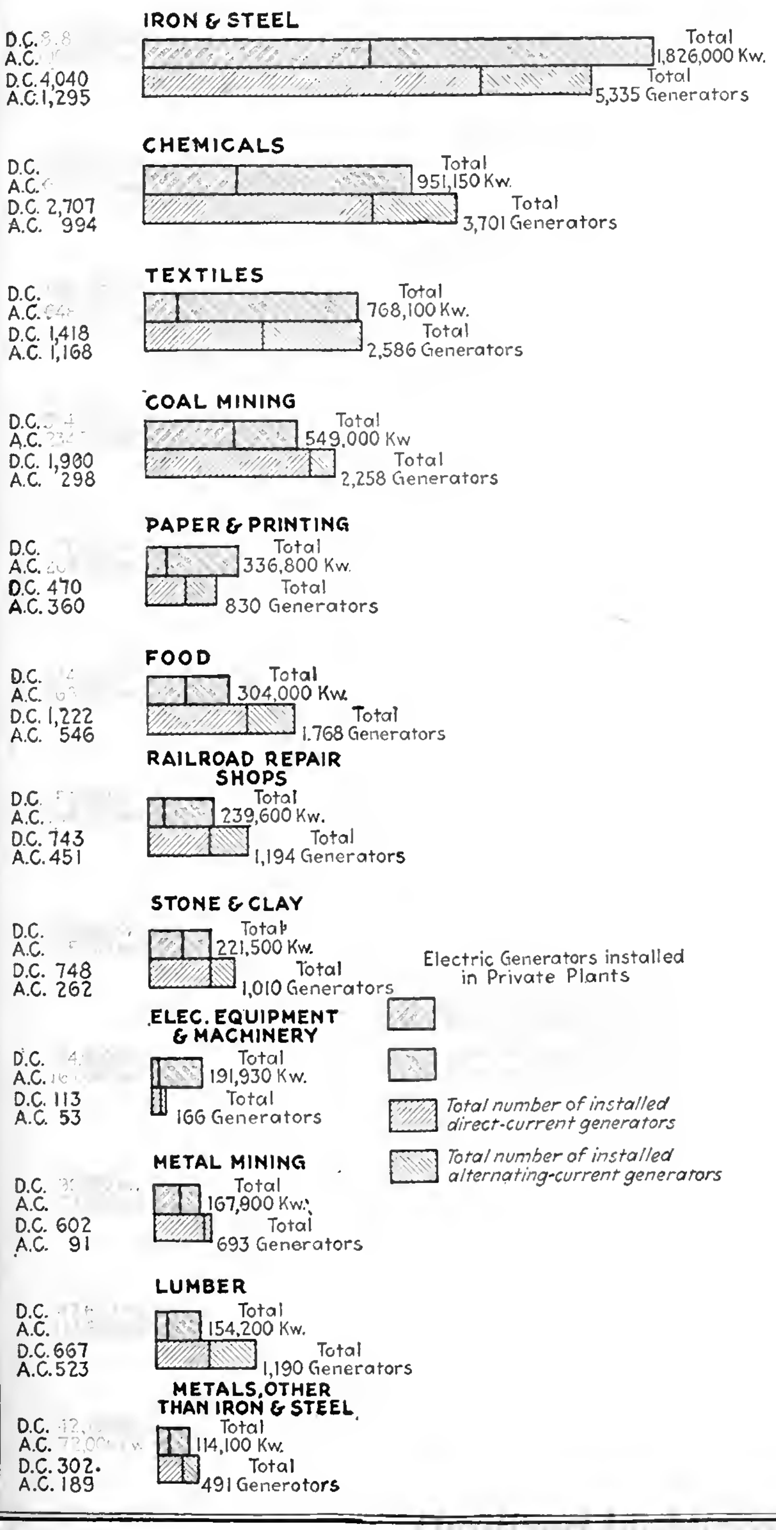
1,448,378. CURRENT-COLLECTING DEVICE; C. Bethel, Wilkinsburg, and T. S. Scott, Pittsburgh, Pa. App. filed July 5, 1922. Brush holders for electric railway motors.

1,448,380. REGULATOR FOR REGENERATIVE CONTROL SYSTEMS; C. A. Boddie, Wilkinsburg, Pa. App. filed Sept. 11, 1920. Railway-motor regeneration.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

### Installed Electric Generators in Private Plants Total 6,130,710 Kw.




## The Breadth of the Field for Future Electrification

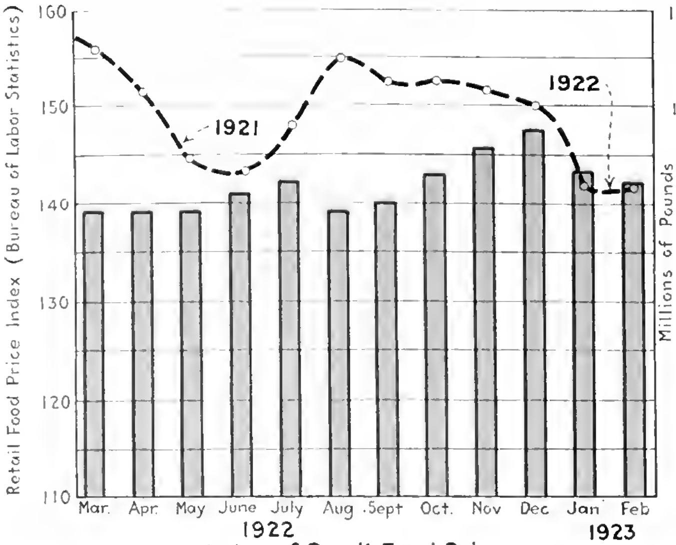
THE electrical industry as a whole is, perhaps, most interested not so much in the past growth and present status of the electrification of industry as in the length and breadth of the field for future electrification. The growth of the lighting load is, of course, dependent largely upon the new residential and office-building construction, although the wiring of old residences will continue to serve as a reservoir for new load for several years to come.

Turning to the future increase in power load, we find two sources of growth. First is the conversion of steam drive to electric drive. The present unelectrified industrial power in the United States totals about 16,000,000 hp. It is probable that as regards a large portion of this primary power electrification is impracticable, but the portion for which future electrification is practicable is of such proportions as to attract the new-business departments of the central-station companies.

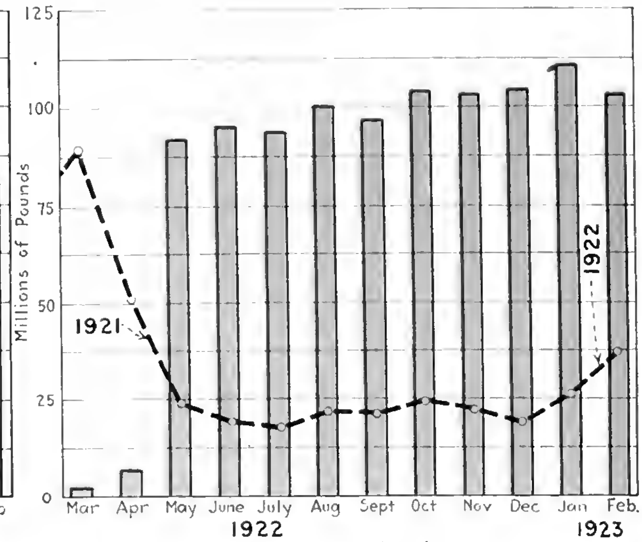
The second source of future growth in the central-station industrial load lies in the factories and mines which are at present electrified from generating plants owned by the manufacturing and mining companies. Low cost, dependability and freedom from responsibility are the arguments which will cause the private generating plants to cease operations and central-station power to be substituted.

It is, of course, too much to assume that in course of time all industry will be electrified, but, notwithstanding this fact, a large field for future industrial power growth is open to the central station.

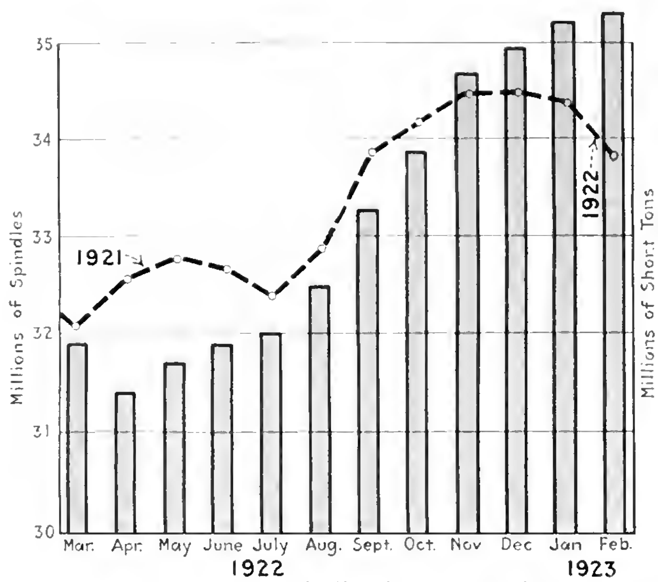
## How the Primary Industries Are Trending



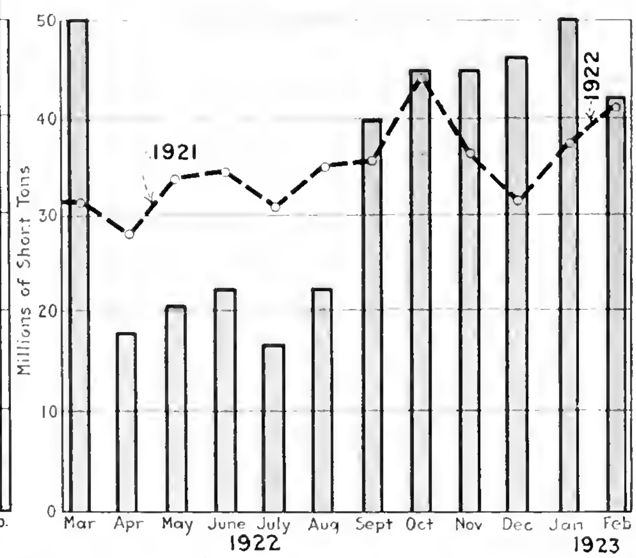

Index of Retail Food Prices



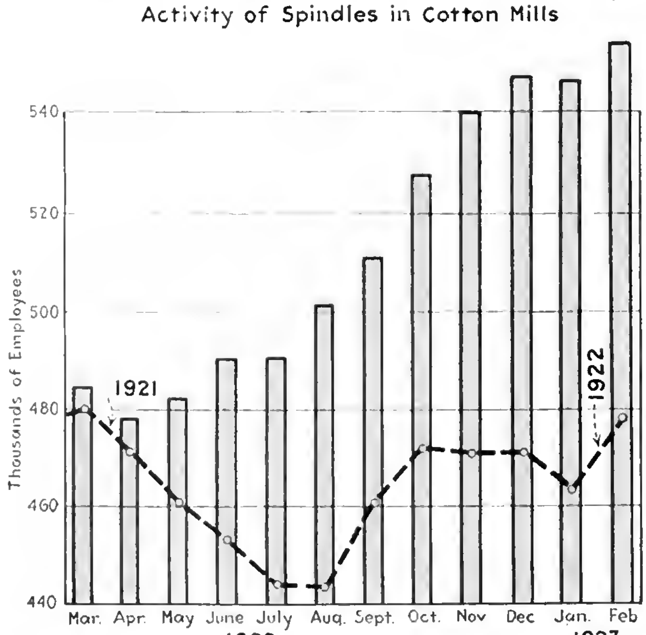

Copper Production




Activity of Spindles in Cotton Mills




Bituminous Coal Production




Employees in Factories of New York State

## A Conservative Attitude Dominates General Business

PRODUCTIVE activity was maintained in February at the high levels reached during January. The Harvard University Committee on Economic Research sums up the present situation as follows: "The prospect of higher prices and expanding business has, strange to say, generated not a little pessimism, a circumstance which indicates that business men have not yet forgotten the lessons of 1919 and 1920. Fear of a 'buyers' strike' is holding down prices of consumers' goods, and inventories of industrial concerns are being examined with care. Doubtless there is not a little hesitation on the part of business men to make commitments at the higher level of prices, but this is not a bad sign in the present phase of the business cycle. So long as a conservative attitude dominates the general business community, the prospect of continued healthy advance remains."

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Harold V. Bozell Editor
Volume 81 New York, Saturday, April 7, 1923 Number 14

# Keep the Public Thinking Constructively

PEOPLE think and people talk. Opinions are formed and opinions are exchanged. And among the subjects in the public mind today public utilities and engineering in general are both prominent. This being the case, it is essential to the advancement of utility service to the public and it is invaluable to the general usefulness of engineering that the public be provided with proper facts so that thoughts and words may be based on truth and not conjecture.

Too often are public utilities and too often are engineers ineffective, hesitant or even backward in telling the truth about their services to the public. The wily and knowing politician is not so hampered and often rides to office on arguments accepted by a misinformed public to its own ultimate detriment. Yet there lies within the power of the utility the same strong weapon used by the politician —publicity—and it should prove the more effective when it is used to tell the truth.

The utility story fairly, fully and frequently told is the best preventive political medicine known. It is worth while telling all the time, continuously and consistently. A public which thinks correctly is much more likely to act correctly when the time to act arrives than one which is either uninformed or misinformed. The human mind is constantly at work, and it is both useful and legitimate to feed it facts upon which to chew.

# Henry Duvall James

*An executive engineer who has contributed largely to the development of industrial control apparatus.*

IN THE industrial applications of electricity a necessity arises so to control the energy or the electrical machines that maximum speed in production and safety to operators will result. One of the younger engineers of the industry who has attained leadership in this type of work and who devotes his energies enthusiastically to further developments in all lines of control is H. D. James. He organized the control engineering department of the Westinghouse Electric & Manufacturing Company and has been and is the first and only manager of this department. He has received about one hundred patents on control systems and has been a prolific, authoritative writer on phases of control, both in the technical magazines and as the author of a book entitled "Controllers for Electric Motors."

Mr. James was born in Baltimore on Sept. 21, 1874, and was graduated from the University of Pennsylvania in 1895, receiving the degree of bachelor of science and a year later the post-graduate degree of mechanical engineer. Soon after his graduation Mr. James entered the employ of the Otis Elevator Company, working at times in Yonkers, N. Y., New York City and Pittsburgh. In this service he received some of his first training and experience with control apparatus. He entered the employ of the Westinghouse Electric & Manufacturing Company on Feb. 1, 1904, and has been with it continuously since. In 1909 he assisted in the organization of the general engineering department of the company and seven years later in the organization of the control engineering department, which up to that time had been a division of the general engineering department. He was appointed manager of the new department in recognition of his efforts and his qualities of leadership. In 1919 he also assisted in the reorganization of the entire sales department of the Westinghouse company.

Mr. James' ability has been recognized by his associates in the electrical industry, as has been evidenced by the fact that he was elected last winter to the presidency of the Engineering Society of Western Pennsylvania, this honor coming to him after he had spent three years as a director and two years as vice-president of this organization. He was also chairman of the sub-committee of the Electric Safety Conference that drew up the safety standards for control apparatus, is chairman of the Control Section of the Electric Power Club and chairman of the industrial power committee of the A. I. E. E. He is secretary of the Westinghouse Club and one of the original fellows of the A. I. E. E.

# Editorial Comment

Electrical World, April 7, 1923
Volume 81 Number 14

## What Can the Consumer Afford to Pay for Electric Service?

SCANT sales of electrical energy will be made to residential customers so long as electric service is sold as a necessity. But there is no definable limit to the individual's expenditure for those things which tend to make life more livable and enjoyable; and the more the sale of electric service for the convenience and pleasure of the customer can be made the guiding principle in central-station residence sales, the more valuable will the residence consumer become as a customer.

It is only in recent days that the residential customer has been considered much more than a user of some light and some appliances; and it is rare to find a central-station commercial organization that visualizes its residential customers as customers are visualized by the automobile industry and by many other commercial concerns that emphasize convenience, style, comfort and luxury as well as utility and necessity. That lighting is still considered the principal home use of electricity is shown by the fact that the average residential bill is still under $30 per annum! Two central-station managers recently even declared their customers extravagant, though there were no abnormal bills—there was merely a rather unusual number of appliances and large-sized lamps were used! The consumer realized the comfort and luxury value of electric service whether the central-station man did or not. These customers had their automobiles and other modern comforts and considered electric service in the same class.

Naturally no definite answer can be made as to what proportion of his income the average consumer should pay for electric service. But a careful analysis of what most consumers can afford to spend with the central station for the improvement of their living conditions will reveal surprising possibilities. A little more imagination on the part of the central-station commercial man will lead both to better business and to better good will toward electric service.

## Keeping Contact with Power Customers

EVERY time a new power customer is obtained a potential source for good or bad public relations is created. Servicing central-station power supply is just as essential as servicing appliances, but there are some critical dissimilarities in the personnel and methods needed for obtaining the same results in the two cases.

In general some high-grade sales engineer has convinced the power customer that he is following a path pointed to by both economic and engineering considerations when he signs a contract for central-station service. Too frequently the existing operating force of the power customer's installation of engines and boilers has not been "sold," and in such cases it remains to oppose and obstruct or is summarily dispensed with, leaving the power customer with no engineering staff. In other instances, even when the existing power engineering staff is "sold" on central-station service, the type of engineering work necessitated under new operating conditions imposes on it a handicap which often leads to trouble and ill feeling.

To offset and prevent such conditions the central-station power salesmen are finding it necessary to act as advisory engineers to the large power customers and to afford them "standby" engineering service. As an organization efficiency move and to bring sufficient technical skill to bear, several companies maintain a small sales engineering force to keep and maintain specialized contact with power customers. One man will handle steel mills, another machine shops, still another large elevator apartments. Many direct advantages result from this practice in the way of obtaining more power load, better power factor and better operating practice, but the indirect advantages of the practice are even more valuable. No surer way exists for maintaining good relations with influential industrial groups and with the engineering personnel outside the central-station organizations. So evident has this become that the practice adopted by some central-station organizations is being widely accepted by others. If the maximum results are to be obtained, the personnel of the advisory staff must be of a high grade and technically competent.

## Electrical Contractors to Be Guided by a Commissioner

THERE are times in the affairs of nations as well as of men when it becomes expedient to place the destinies of the nation or of men in the hands of a single individual. Cabinets or boards are not so expeditious or so efficient, and in not a few instances experience has shown them to be long and narrow and to be composed of wood. A competent individual clothed with the requisite authority and power can bring order out of chaos more quickly, and if he be wise and prudent can couple satisfaction with order and sometimes do much to insure contentment and happiness for a nation or a people.

Taking a leaf out of history, modern business, too, when faced with crises, schisms or dilemmas, now turns to a single individual for guidance or chastisement. Thus baseball has its Landis, the motion-picture industry its Hays, the stage its Thomas, the garment center its Mosessohn, and now the electrical contractors of Greater New York are to have their Eidlitz. For causes too numerous to record, reputable contractors of the metropolis doing an annual business of approximately fifty million dollars have found their occupation becoming unprofitable and rapidly losing every vestige of good will. It will be Mr. Eidlitz's job to rectify this situation. There is no doubt of his competency;

he was the organizer and the first president of the National Electrical Contractors' Association and has been singularly successful in the electrical contracting field. His colleagues have certainly shown great confidence and faith in his ability by voluntarily asking him to serve as the commissioner for them and agreeing to place all their records before him and abide by his decisions. All who are acquainted with the electrical contracting conditions in the Greater City and who know Charles L. Eidlitz will commend the choice. The only way in which he can enforce his decisions is by moral suasion, and while time and experience alone can reveal how successful Mr. Eidlitz will be in exercising his functions as commissioner, he at least begins his labors with the confidence and well wishes of the industry. If the arrangement does not work out well, the fault will not be his. He possesses courage, initiative and an intimate and practical knowledge of the business, and he has reached the age when passion and prejudice will not sway him and where he can be influenced only by what is right and just.

## Take Steps to Give Code Changes Status of American Standard

THE National Electrical Code, changes in which were recently adopted by the electrical committee of the National Fire Protection Association, is essentially a standard of electrical construction, installation and operation, according to which insurance companies judge the insurability of electrical equipment or of buildings in which electricity is used. It has been compiled by the electrical committee and is administered by insurance inspectors, municipal and state inspectors.

In the past the electrical committee has revised the code biennially, after suitable public hearing, and the recent revision was made in this way. But meanwhile the code itself was adopted, by due procedure, as an American standard by the American Engineering Standards Committee, which has a very definite procedure for revisions of its standards. There is now therefore the anomalous, though in this case natural, condition of an American standard code containing revisions which are not American standards. It surely appears that it would be most advantageous to take immediate steps to give the new revisions official status. This could be done practicably, it seems, by some action which would in effect make the present electrical committee, with slight modification, serve as the necessary sectional committee under appropriate sponsorship. The present electrical committee is composed of representatives of the following associations: American Electric Railway Association, American Institute of Electrical Engineers, Associated Factory Mutual Fire Insurance Companies, Association of Electragists International, National Association of Electrical Inspectors, National Board of Fire Underwriters, National Electric Light Association and the United States Bureau of Standards, and representatives of the inspection bureaus of some of the large cities of the country and of certain other interested bodies. This looks like a good foundation for building a sectional committee, and if modifications are made permitting better balance between men who represent electrical associations and insurance men, so that it will be more apparent that the electrical industry itself bears the principal burden of the preparation of the code, such a committee should be fully qualified and should have the full confidence of the industry. In short order the latest changes would be made changes in the American standard and present and future code work would receive an even higher status both legally or strategically and in the estimation of those who conduct their operations according to its precepts. It is to be hoped that some organization will immediately take proper steps to bring this officially to the attention of the American Engineering Standards Committee.

## One-Million-Volt Laboratories

PROGRESS in any art is dependent on discovery, which in turn is dependent on experiment and scientific investigation. This is particularly true of the art of electrical engineering, in which the underlying laws are not visible in their operation, but only in their results, and in which new laws are being uncovered almost daily. The promise of results from study and investigation in such a field is therefore immediately obvious. But this promise has not always been generally recognized. The early history of the development of electrical machinery reveals clearly the intimate relation between improvement and foregoing experiment. There followed, however, a long period in which investigation was practically limited to the technical development of machinery embodying a few great underlying principles, such as the generation of electromotive force by electromagnetic induction, leading to the continuous and alternating current generators and motors and their extension into the simpler problems of transmission. Investigation in this period was generally of the cut-and-try type, the finding of some new material or method of design that would work a little better. In fact, nothing more was needed. The field opened by the successful production of generators, motors and the incandescent lamp was so wide that manufacturers had all they could do to supply the market and improve the efficiency and reliability of existing types.

The change came with the wider demand for the benefits of electric service and the necessity for long-distance transmission. This immediately emphasized the limitations of our knowledge of the number and variety of electrical laws and of the phenomena involved in the transmission of both intelligence and power. At first the tendency was to stick to the old method of empirical effort in solving these new problems. As time went on, however, the inadequacy of this policy was seen, and the importance—in fact, the necessity—of calling upon the best type of scientific investigation was recognized. Laws must be understood before the properties of materials in relation to these laws can be intelligently studied and utilized.

This truth once realized has spread apace, so that now the most elaborate research laboratories are to be found in the manufactories rather than in the universities, their original homes. The industries are voicing the importance of research with great emphasis and are expending large amounts not only in equipping laboratories but in maintaining them in active operation under experts in various fields. In one electrical laboratory of this type the number of employees engaged solely in research reaches well up into the hundreds. The magnitude of the investment placed in these undertakings, which is evidence of the importance attached to scientific research by the management, is indicated by the description of the new high-voltage laboratory of the Westinghouse Electric & Manufactur-

ing Company printed in the ELECTRICAL WORLD this week. This is only one phase of the research work of this company, yet its importance evidently justifies a separate laboratory, covering considerable ground area, special railroad connection and loading facilities, elaborate protective and control devices for the electrical equipment, independent motor-driven generators entailing a total substation capacity of 3,000 kva., liberal provision in the way of clearances, oil tanks, piping, driers, etc., for all types of high-voltage testing, and finally two testing transformers for 1,000,000 volts and 500,000 volts respectively. Of special interest are the several methods provided for the accurate measurement of these high values of voltage and the principles followed in designing the high-tension insulation of the transformers.

At first thought one wonders what, with transmission voltages at a temporary standstill at 220 kv., are the special purposes of these elaborate preparations for study in a field so far beyond the apparent maximum of present practice. The answer is that provision is being made not merely for the testing of insulators, but for the study of laws and the properties of materials in ranges well beyond those of practice, so that reliability against unknown dangers may be provided, efficiency of operation improved and new laws uncovered, and possibly even in anticipation of transmission voltages still higher than any yet mentioned.

## The Graphic Design of Illumination

SINCE scientific lighting became familiar, numberless efforts have been made to reduce the design of illumination in any given working space to the simplest possible terms. The methods of attack on this problem have in general been two—one the method based on the flux of light within the space as a whole and with the introduction of such modifying factors as might be necessary, the other a simplification of the old point-by-point reckoning with the intensity and polar graph of the source as a base. The experience of engineers has long ago shown that each of these methods has merits in particular cases. It has disclosed further the fact that both methods must in a good many instances be supplemented by intelligent judgment or computation. The concrete problem which the illuminating engineer has to face is not the illumination of a space of given dimensions but the illumination of a space of given dimensions devoted to particular specified uses—a final requirement which alters the situation very materially.

A good example is found in the report on the lighting of post offices which we published March 24. Here it has to be taken as one of the fixed conditions of the problem that the illumination must be at a sufficient working intensity for both horizontal and vertical planes and for conditions of visibility by no means normal in other clerical work. This matter aside, it is certainly convenient to have both the flux and the intensity method developed in the simplest feasible way, and the charts devised and explained by Emil Kun, which we publish this week, will afford for certain cases relief from serious computations. The object of the method is to take a short cut to the long series of the point-by-point method through the introduction of a primary plane of lighting determined in the conventional way from the polar curve or actual performance of a typical lighting unit, and then to pass graphically in a way that is clearly explained to the lighting on other and secondary planes that may be necessary for reckoning the whole equivalent illumination. As the reckoning starts from the polar curve of a typical luminaire, or the actual results obtained from it, and then passes to the illumination on one or more planes, the graphic method may be reversed to determine the height of fixture or necessary intensity from the illumination at the primary and secondary planes concerned. Methods of this sort are not infrequently convenient and furnish a useful check on computations made in other ways.

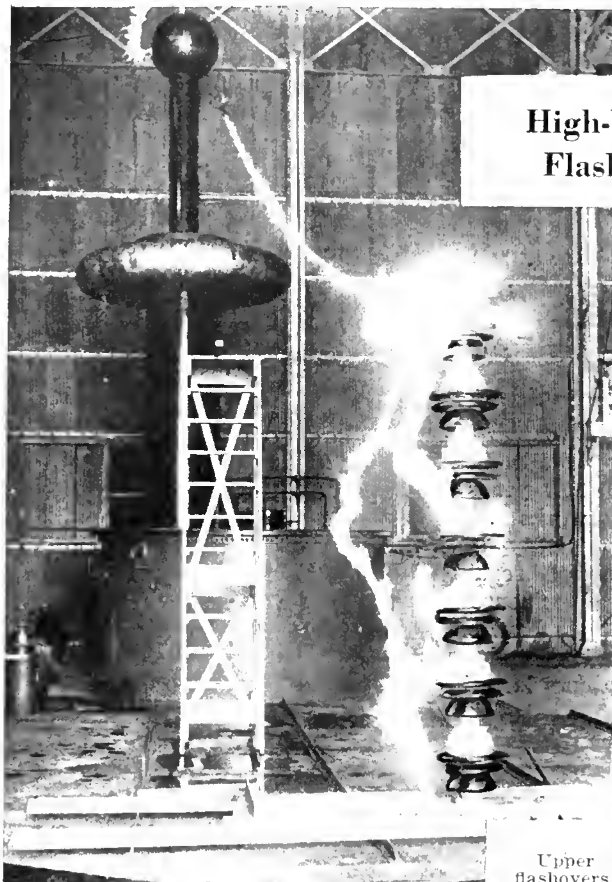
## Making the Most of the Calculating Table

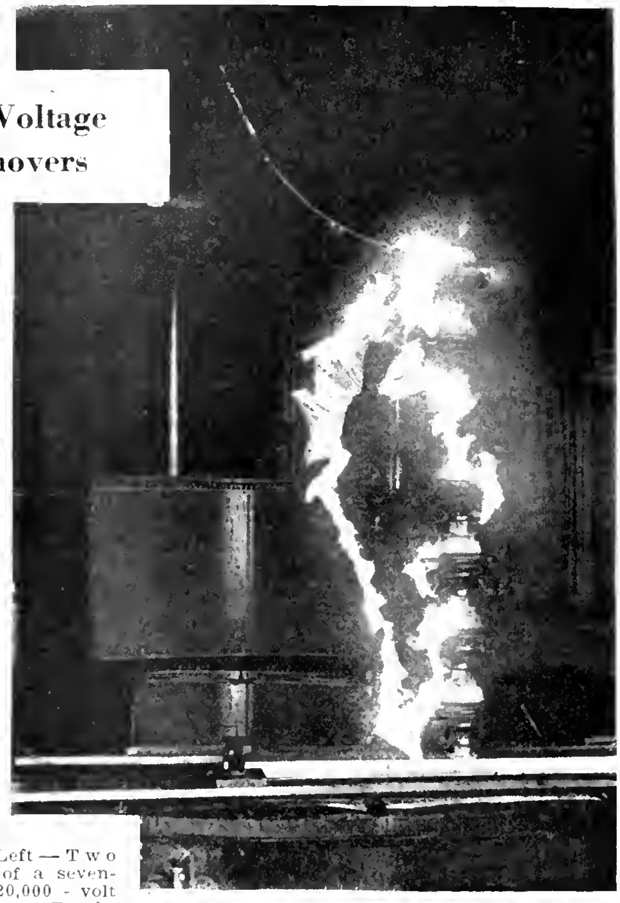
FEW devices have contributed more during the last few years to operating refinement in transmission networks than has the calculating table. Through its use relay settings have been made more accurate, circuit-breaker duties have been more closely defined, and immense labors in the computation of short-circuit values have been reduced to comparatively easy manipulations and tests of electrical system models. These results have been attained at relatively low cost where "home-made" tables have been designed for a particular system, and this is a strong argument for the wider application of this method of analyzing transmission problems.

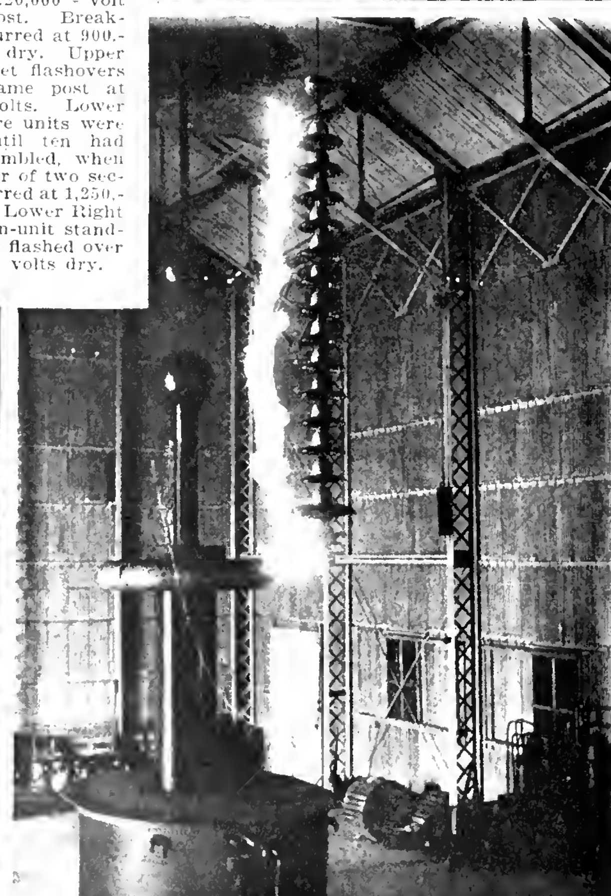
Elsewhere in this issue E. W. Dillard describes the use of a calculating table on the system of the New England Power Company. In this case the table was designed for the particular system using it, so that the flexibility that is characteristic of tables adaptable to any system layout was omitted to save unnecessary expense. Structural simplicity marks the Worcester table and accessories, but these are sufficient to enable careful studies to be made of proposed extensions or changes in lines, transformers and generating stations in relation to the existing network. The company's engineers are to be congratulated upon their solution of the problem of providing an outfit so well combining compactness and simplicity with adequacy for determining short-circuit currents and the requirements of relay operation at any desired point on the system.

Interesting as such devices are to the engineer, there remains the natural query of the executive, "What have they actually accomplished?" Mr. Dillard shows that the solution of the important problem of relay setting has been made much easier by this means and that, as a result of the analysis, the amount of energy to be handled by various circuit breakers has been decreased, thereby contributing to more reliable service and postponing the replacement of earlier installed designs of oil switches. During low-water conditions the company is sometimes obliged to shut down a large part of its hydro-electric equipment, but since this shutting down must be limited by the number of machines required to furnish sufficient energy for relay operation, accurate information as to relay settings is most valuable. More satisfactory knowledge of circuit-breaker requirements in extensions and changes is also available through table tests. All this spells economy of plant investment and efficiency in operation and suggests the value of this method of investigation to far less complex systems than that of the New England Power Company and its interconnected lines.

# High-Voltage Flashovers







Upper Left — Two flashovers of a seven-unit 220,000 - volt switch post. Breakdown occurred at 900,000 volts dry. Upper Right—Wet flashovers of the same post at 650,000 volts. Lower Left—More units were added until ten had been assembled, when a flashover of two seconds occurred at 1,250,000 volts. Lower Right—A fifteen-unit standard string flashed over at 850,000 volts dry.

# Complete Million-Volt Laboratory—Part I

A Thoroughly Equipped Experimental Station Devoted Exclusively to Research Problems in the Use of Very High Voltages and Which Includes a Single-Unit 1,000,000-Volt Transformer

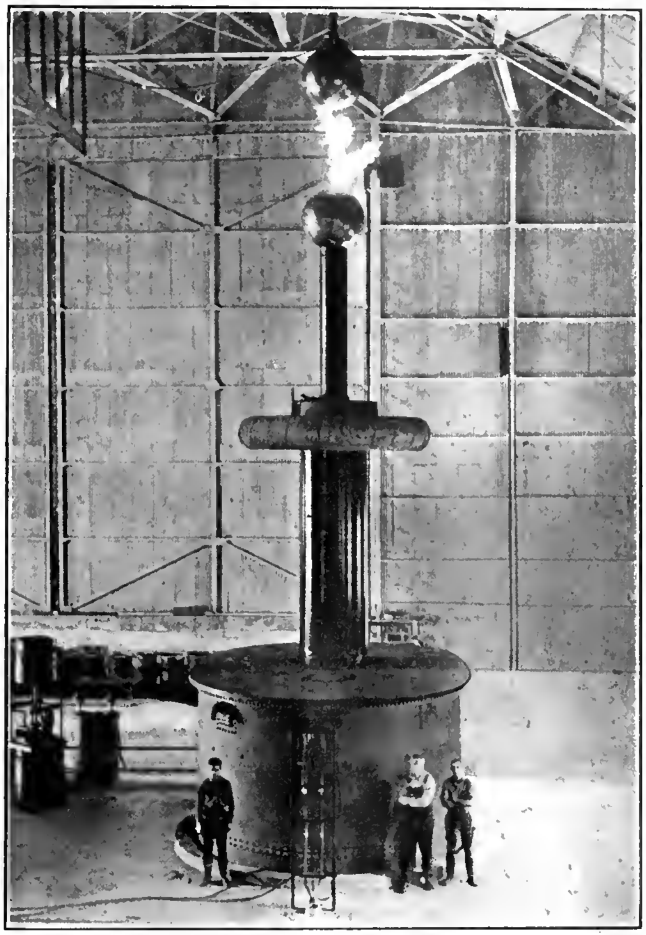
By J. F. PETERS and D. F. MINER
*Engineering Department, Westinghouse Electric & Manufacturing Company*

INDUSTRIAL progress of towns, states and whole nations has become largely dependent upon electric power made low in cost and instantly available. In the United States, because of its great natural resources, large electric systems have grown in capacity and territory served, making available enormous power for electric transportation and development of industries.

Apparatus built for these systems, the voltage of which has climbed higher and higher as economy in transmission of the greater blocks of power has dictated, must be made far more reliable than was necessary when small isolated systems dotted the country. Test voltages for existing apparatus must be provided up to approximately 700,000 volts. Suspension insulator strings, which have sufficient insulation under severe storm conditions for the present 220,000-volt systems, will have a dry flashover voltage around this value. While there is no immediate prospect of need of transmission-line voltages much in excess of 220,000 volts (127,000 volts to grounded neutral), testing facilities for research studies must always be kept far in advance of actual practice.

There is urgent need of thorough investigation of high-voltage problems to obtain data upon which engineers may with confidence design apparatus for installations the magnitude and voltage of which may exceed our present upper limit. These may be demanded sooner than we anticipate. Furthermore, we need information which will help in the solution of difficulties which arise at times in the operation of the present systems.

Because of the expense involved in providing necessary special equipment and maintaining a competent corps of experts, the larger electrical corporations are at present the only ones especially fitted for carrying on this work. Without the expectation of immediate returns, they may spend large sums for these investigations, knowing that the results will ultimately be applied to future equipment to be manufactured. The Westinghouse Electric & Manufacturing Company, early identified with research in high voltage engineering, has, in line with this policy, built and equipped a large laboratory exclusively devoted to high-voltage research and development.



COMPLETE MILLION-VOLT TRANSFORMER, BUSHING AND SPARK GAP WITH A FLASH OVER THE GAP AT 1,200,000 VOLTS

The main laboratory, having a floor space of 110 ft. x 120 ft. and isolated from near-by shop buildings, is equipped with two testing transformers, one for 1,000,000 volts and the other for 500,000 volts. In addition, two large oil tanks with auxiliaries are provided, one for tests of insulation under oil and the other for rain tests of bushings and similar apparatus. The building is so constructed that a clear space of 50 ft. exists from the floor to the lower chords of the truss, giving an unobstructed volume (110 ft. x 120 ft. x 50 ft.) and affording plenty of clearance for the very high potentials used.

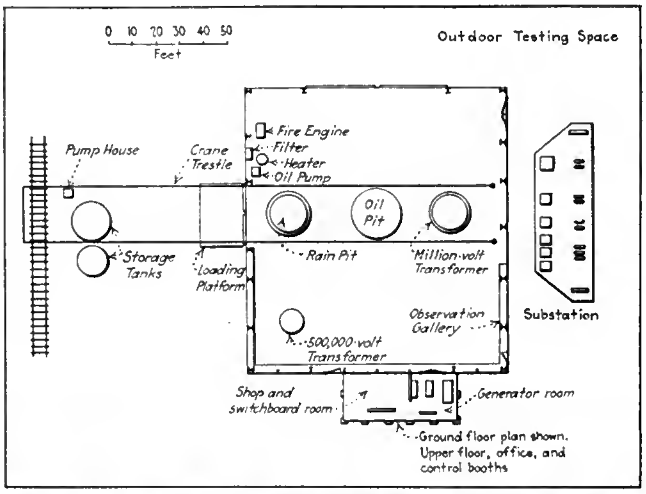
Attached to one side of the main building and partly separated from it by a glass partition is the operating and control building. On the ground floor of this structure the generating equipment, low-voltage switchboards and work shop are installed. On the upper floor are the two transformer operating booths, remote breaker control bench and the office.

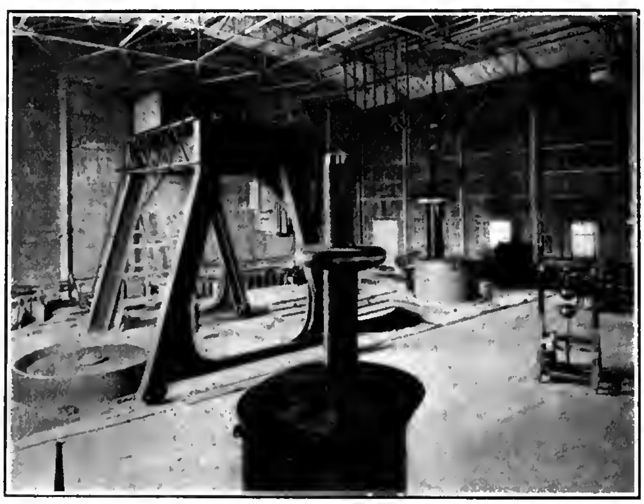
Adjacent to the building, a substation, with the necessary circuit breakers and supply transformers, has been constructed.

On the side of the building opposite the control room two sliding doors may be opened, giving a space 45 ft. x 60 ft., through which high-voltage lines may be taken for outdoor tests.

The question of material handling, so important in industrial plants, offered special problems in this laboratory, for it was desirable that proper facilities be provided for bringing in and setting up apparatus under test, which is usually of considerable size, and for re-

pairs or additions to permanent equipment. For this reason the two large tanks and the million-volt transformer were placed in pits sunk in the floor on a line through the middle of the building. These pits are straddled by a gantry crane of 35 tons capacity with a 5-ton auxiliary. The crane track passes out of the building through a double door, 25 ft. x 45 ft., to a concrete loading platform, and from there out on a trestle over a siding of the Pennsylvania Railroad



INTERIOR VIEW OF THE LABORATORY AND GENERAL LAYOUT; 500,000-VOLT UNIT IN FOREGROUND

tracks. Inside the building transfer at right angles to the crane track is accomplished by means of an electric monorail trolley hoist.

The history of high-voltage testing transformer development shows a progress by steps, keeping pace with improvements in insulation. When the limit of voltage capable of being produced in a single unit was reached the next step was to use two or more transformers in series. When further progress in insulating structures came a return to the single unit was made. This cycle has been traversed several times. In 1891, when potential transformers had reached a limit, a set using several units in connection with an insulating transformer was constructed by C. E. Skinner and C. F. Scott. The next cycle was completed in 1913 by the Westinghouse company, when two 500,000-volt transformers were connected with the common point grounded to produce 1,000,000 volts. During recent years the use of several units in cascade has been advocated, and now again a single unit has been possible.

The present million-volt transformer built by the Westinghouse company represents a real advance in the art brought about by the construction of a single unit for the total voltage. The advantages gained by this construction, involving as it did the solution of serious problems of insulation efficiency and careful stress distribution, are saving of space, convenience of operation and accuracy of voltage measurement.

The new million-volt single unit utilizes insulating space at such efficiency that the whole transformer is not materially larger than an older unit for half the voltage. The new principle, in a word, is the adoption of coils increasing in size and voltage radially instead of axially. The first high-voltage coil starts at ground potential and need not be heavily insulated from the core. Each succeeding coil is at a higher potential and requires greater insulating distance. However, the difference of potential between any two coils is not great and the necessary insulation is small. All these factors lead naturally to the construction used. The high-voltage (secondary) coils are wound on insulating tubes of increasing diameters and decreasing length so that each coil fits inside the next high-voltage tube. The outermost micarta tubes were larger than any previously made and required special mandrels for rolling. The coils are divided into two groups on the two legs of the iron core. Each group consists of seventeen of these nested coils. This arrangement automatically places the coil with the highest voltage furthest from the grounded core. The primary winding, as would be expected, is placed also on a tube immediately surrounding the core.

### STRESS IS UNIFORMLY DISTRIBUTED

Such an ingenious design, a noteworthy achievement by Westinghouse transformer engineers, accomplishes another purpose just as important—the distribution of stress uniformly throughout the winding. To illustrate: If a number of sheets of insulating material were stacked together and a high voltage applied to the top and the bottom connected to ground, the top sheets would assume the greater part of the stress and might indeed fail. The inner portions would not be doing full duty at all. In other words, the stress is not uniformly distributed to all parts throughout the thickness. The most severely stressed material is in danger of failing and that lightly stressed is used inefficiently. Now, if we place metal sheets between the insulating sheets, forming a pile of electrostatic condensers, we find that the stress load is nicely distributed. This condenser principle was discovered by the Westinghouse company and incorporated in transformer terminals known as condenser bushings many years ago. These bushings consist of rolled layers of paper and foil.

The use of the same arrangement has been accomplished in the design of the million-volt transformer and makes possible the construction of a single unit for this voltage with reasonable dimensions. Instead of the metal sheets as in the analogy or foil as in the bushing, the windings themselves form the metal condenser plates. The two ends of each coil (equivalent to a metal cylinder) are not far different in potential, and the tapering difference is exactly matched by similar conditions in the next coil both inside and outside. In order to provide perfect distribution, the area of the condenser elements must be nearly equal. There-

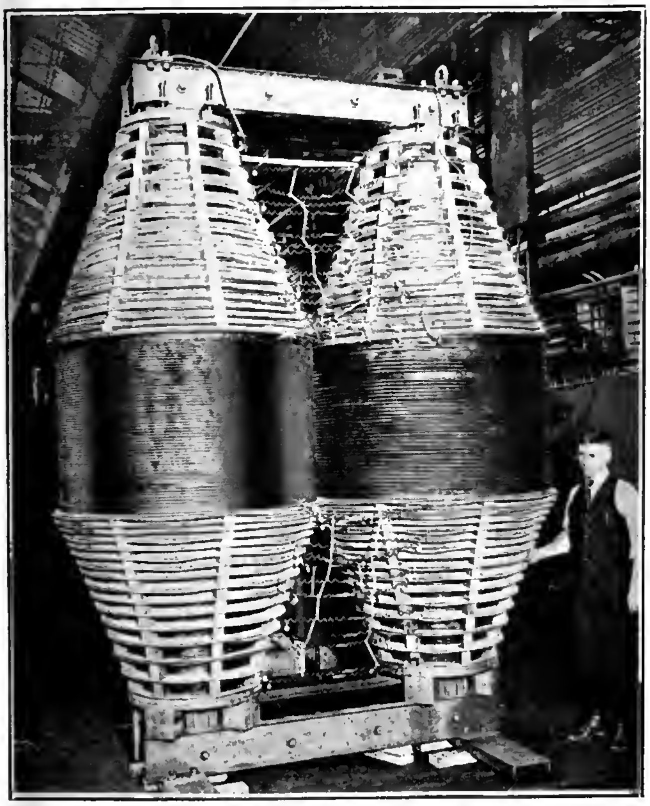
fore, as the diameter increases, the length of cylinders is made correspondingly less.

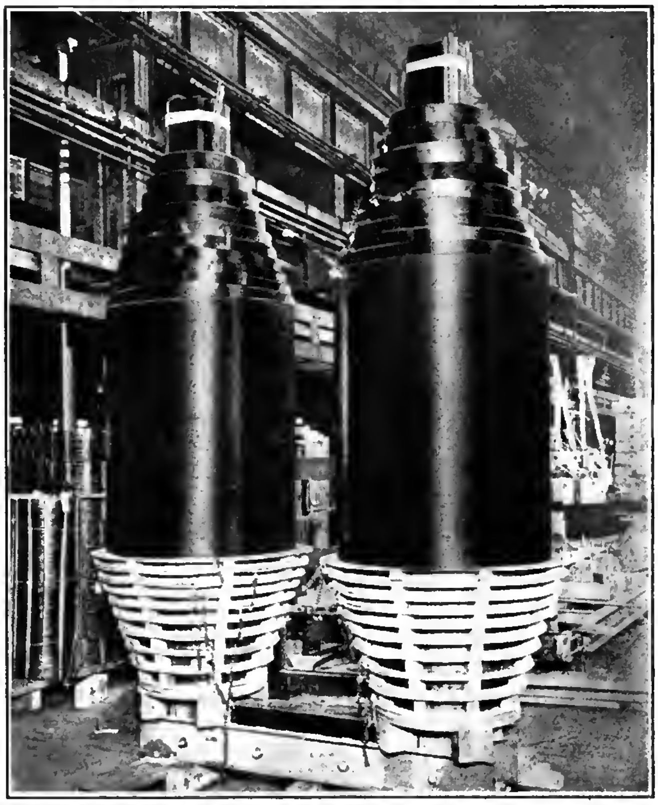
### SAFEGUARDED AGAINST FAILURE

Spacing strips are placed between the cylinders to maintain a concentric position and preserve rigidity. There are two paths by which failure might take place between two parts of a transformer, one by direct puncture of the intervening insulation and the other by creepage along surfaces and over edges. In this transformer the insulating tubes and space filled with oil between tubes protect against puncture. Creepage is prevented by the addition of fullerboard barriers in the form of angle rings which are placed over the ends of the tubes. The use of these offers such a long insulating path that creepage over the edge is prevented.

to the beginning of No. 3, which is on the same leg as No. 1, and so on, alternating back and forth until all the coils on both legs have been connected in series. The end of the thirty-fourth coil is then attached to the wire going to the terminal bushing and thus to the outside.

The transformer tank, which is 13 ft. in diameter by 15 ft. high, is equipped with a special barrier to prevent failure from the transformer coils to the tank. The inside of the tank is lined with many layers of $\frac{1}{4}$-in. fullerboard, separated by oil spaces. This provides an effective insulator outside the transformer. It will be recognized that the outer coils, at a potential of a million volts, must be insulated, first, from the transformer core, which is at ground potential, and, second, from the tank, which is also at ground potential.





CONSTRUCTION FEATURES OF TRANSFORMER COILS

Left—The high-voltage secondary coils on the million-volt unit are wound on insulating tubes of increasing diameters and decreasing length so that each coil fits into the next high-voltage tube.

Right—Failure is prevented by filling the insulating tubes and intervening space with oil, and creepage is prevented by placing angle-ring fullerboard barriers in the ends of the tubes.

Another insulating feature which is important is the protection of coils against surges. Severe testing conditions often result in the sudden release of large energy. This impulse or voltage shock may cause these outer coils to break down and flash over from one turn to the next in an attempt to absorb the energy. A great difference of potential is formed between adjacent turns.

For this reason the outer few coils are wound with heavily insulated cable, and coils farther inside are wound with string separating the wires, to offer greater insulation between turns. The line coil is wound with $\frac{1}{8}$-in. copper with treated cloth insulation $\frac{3}{8}$ in. thick. After the coils are placed on the core legs they are connected in series to add the potential of one to that of the next. Thus the end of No. 1 coil, on one leg, is connected by the beginning of No. 2, which is the first on the other leg. The end of No. 2 winding goes

However difficult it may be to produce a potential of a million volts with a single transformer, it is a greater problem to control and direct this voltage at the terminal. It is one problem to induce this high voltage in the coils and another to bring it outside the tank to be put to some useful purpose. In some existing high-voltage transformers this difficulty is met by placing the transformer in a very large tank of oil, omitting the tank cover and providing a bushing emerging from the surface of the insulating oil. This, of course, leaves the oil open to moisture and dirt and is to be avoided if possible. With a metal tank and cover, the bushing must withstand the million-volt stress between the central conductor and the grounded flange.

Any solid or continuous dielectric interposed in this location would be unsatisfactory, for the unequal distribution of electrostatic stress throughout the cross-section would cause progressive failure. A bushing

utilizing the series-condenser principle of potential gradient equalization was adopted as the only feasible means of bringing the terminal through the cover with a proper factor of safety. This bushing, the largest of its type ever built and the highest voltage bushing in existence, is calculated to be capable of withstanding double transformer voltage, or 2,000,000 volts, for short intervals, imposed upon a radial insulation thickness of less than 18 in. In the factory the largest rolling equipment was too small for this bushing and had to be remodeled. Much greater length and radial dimensions had to be provided, as well as greater strength of head and tail stock to support the extra weight.

The methods used in construction were the same as in any condenser bushing, except that weights of material and dimensions broke all records. The central mandrel of the bushing is made of double extra 6-in. steel pipe. This pipe was carefully turned true and when finished weighed over 1,000 lb. On this pipe were wound the insulation and metal foil. The insulation consists of special treated paper about 0.005 in. thick and 3 in. wide, wound in spiral layers the length of the tube. At intervals as the diameter increases a layer of metal foil wound in a 5-in. spiral strip is added. During the rolling the strips, which are under tension, pass over an electrically heated surface which drives out any traces of moisture and liquefies the coating of the paper so that the layers are cemented together.

The next step was to turn off the ends of each of the hundred layers. The area of condenser cylinders in the bushing must be equal for correct potential distribution. Therefore, as the diameter increases the length is made to decrease. With equal thickness of paper layers the length of cylinders should be a logarithmic function. Ordinarily, a straight conical tapering of the bushing ends is so close to the theoretical curve that the difference is inappreciable. In this million-volt bushing, however, the dimensions are so large that a line drawn through the ends of the steps has a decided curvature.

TABLE I—TRANSFORMER STATISTICS

| | |
|---|---|
| Number high-voltage coils | 34 |
| Total number turns in secondary | 36,000 |
| Total length of wire on secondary, miles | 70 |
| Primary voltage | 5,000 |
| Secondary voltage | 1,000,000 |
| Diameter of tank, ft. | 13 |
| Height of tank, ft. | 15 |
| Rating, kva. | 1,000 |

To provide proper creepage distance over the surface, the hundred layers were stepped off gradually on the upper end, which will be in air, and more abruptly on the lower end, which is to be immersed in oil.

After the rolling and turning had been completed, the bushing was ready for the addition of the metal parts. Banding wire was first wound around the portion of largest diameter, and a cast-iron flange, by which the bushing is supported on the tank cover, was cemented on. A few inches below this flange, at the lower end of the straight section, an iron ring was cemented on to provide mechanical protection when the bushing was laid down. Some idea of the size of the whole unit may be obtained when it is noted that this simple protective ring weighs 150 lb. The lower end of the bushing was fitted with a static shield in the shape of a doughnut which serves to produce a proper distribution of stress around the terminal under oil. The upper end of the bushing was finished with a lifting cap. An insulating tube ¼ in. thick was placed over the top end of the bushing, and the space between this tube and the tapering bushing was filled with insulating gum to prevent entrance of moisture. It is essential that a uniform field be produced between the bushing terminal and the tank cover in order to avoid corona formation and possible flashover of the bushing. The static shield on top is built of wood in shape similar to the lower shield and is covered with sheet metal. It is 10 ft. in diameter and 20 in. thick. Inasmuch as the bushing in this type of transformer is necessarily placed off-center, the usual tank cover would not be symmetrical with the static shield. The cover of the million-volt unit, however, was built with a projecting lip so that a grounded surface concentric with the bushing is obtained. As an added refinement, all manholes and attachments to the tank cover are so fastened that no bolts or other objects project above the flat cover. This prevents corona formation. The finished bushing, exclusive of the upper static shield, weighs nearly 7 tons and contains an amount of material far in excess of any bushing previously designed. Table II shows at a glance the principal weights of this extraordinary condenser terminal.

TABLE II—FINISHED WEIGHTS OF MILLION-VOLT BUSHING

| | Lb. |
|---|---|
| Metal foil | 900 |
| Treated paper | 6,000 |
| Iron pipe | 1,050 |
| Main flange | 475 |
| Other metal parts | 350 |
| Outer micarta tube | 300 |
| Insulating gum | 4,300 |
| Total | 13,375 |

## Department of Commerce Acts on Radio Recommendations

ACTING upon the recommendations made by the recent radio conference at Washington, printed in the ELECTRICAL WORLD for March 31, page 765, Secretary of Commerce Hoover has made the following classification of wave lengths for internal broadcasting:

Class A stations—that is, stations equipped to use power not exceeding 500 watts. In this class it is proposed that the radio inspectors, in co-operation with the station owners, shall assign distinctive wave lengths to each station so far as is possible in the area from 222 m. to 300 m. No station will be required to change from 360 m. unless it so desires.

Class B stations—that is, stations equipped to use from 500 watts to 1,000 watts. In this class it is proposed similarly to offer to license these stations on special wave lengths from 300 m. to 345 m. and from 375 m. to 545 m., having regard to the maintenance of some ship work on 450 m. as outlined above, and again no station will be required to change from 360 m. unless it so desires.

Class C stations—comprising all stations now licensed for 360 m. In this class no new licenses will be issued for stations on 360 m. until the plan is entirely realized. Stations which do not wish to move under the general plan may remain at 360 m.

Under the plan amateurs are given the whole area from 150 m. to 220 m., instead of being fixed upon 200 m. with special licenses at 375 m. The special licenses hitherto issued for amateurs at 375 m. will now be issued at 220 m.

# Operating Characteristics of Rural Lines*

## Prevalence of Unusual Conditions Long Familiar to Engineers—Data Now Being Accumulated Indicate the Actual Operating Characteristics—Factors Which Affect Loads

By V. L. HEIN
*Engineering Extension Department, Iowa State College*

FOR some time engineers in a position to observe the performance of rural tranmission lines have known that unusual conditions prevail, although the absence of actual data has hitherto prevented them from proving this to be so. Now, however, material is gradually being collected which shows the actual operating characteristics.

Since 1919 the engineering extension department of the Iowa State College of Agriculture and Mechanic Arts has been collecting information relative to the electric service given by rural transmission lines. During the past year and a half additional data have been gathered showing power factor, maximum demand, amperes, volts and losses on these lines. Rural lines in different parts of Iowa on which meters were installed were arbitrarily chosen for these tests.

The lines from which the data herein were collected are all of similar construction with the exception of line No. 1, which contains about 6 miles of No. 4 B.W.G. iron wire. They were operated at 6,600 volts to 110 volts, 60 cycles. The meters in every case were connected at the point where power was supplied to the line, so that the total kilowatt-hour input was recorded, thus including the energy actually delivered as well as transformer and line losses. The metering equipment consisted of a fifteen-minute-interval recording-demand watt-hour meter, a graphic voltmeter, a graphic ammeter and the necessary metering transformers. As the metering was all done on the 110-volt side of the transformer, a potential transformer for reducing the voltage and a current transformer for reducing the value of the current were used. This necessitated the use of constants in all calculations for power factor. The values indicated on the demand charts must be multiplied by thirty to obtain the true kilowatt reading.

The demand chart (Fig. 1) shows the great variation

*Published as Bulletin 53 by the Iowa State College of Agriculture and Mechanic Arts.

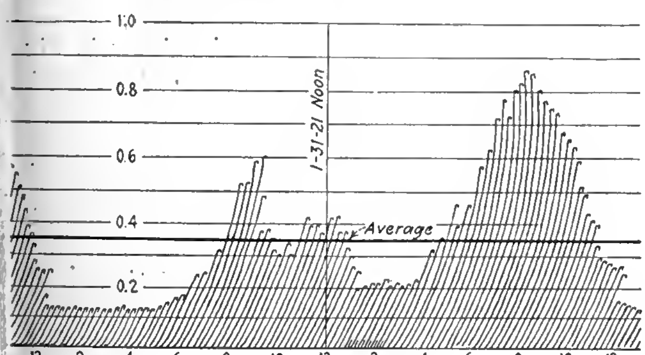



FIG. 1

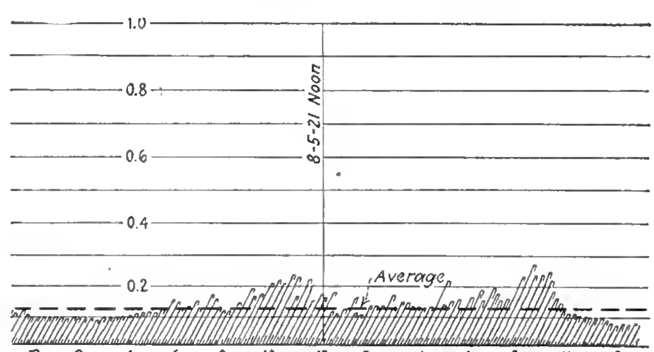



FIG. 3

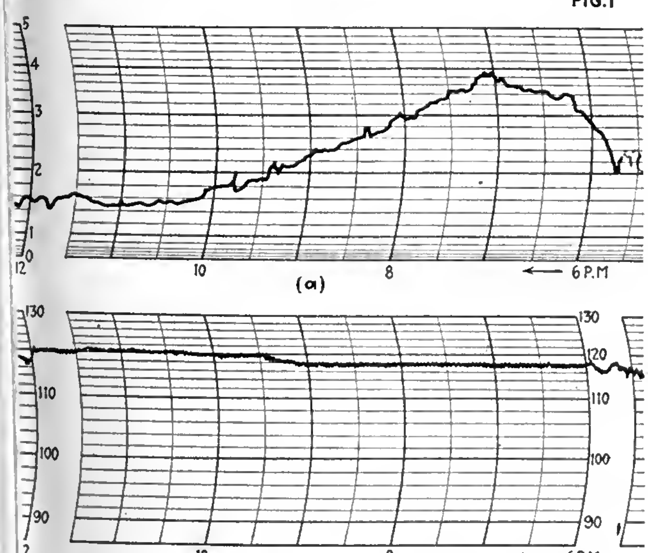



FIG. 2

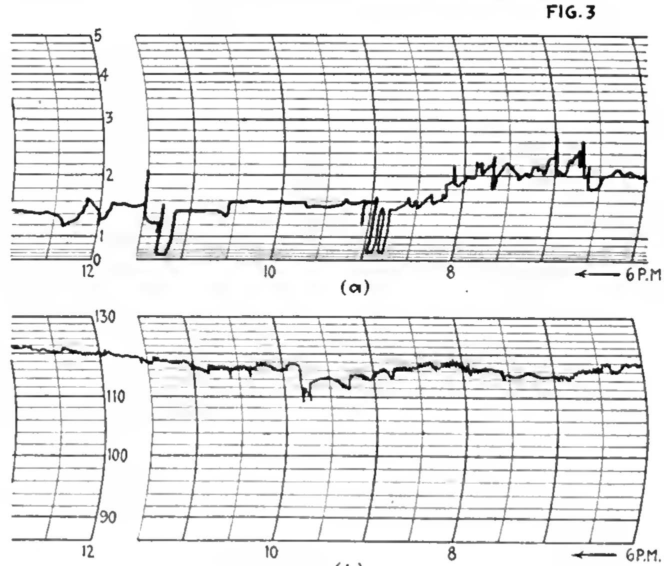
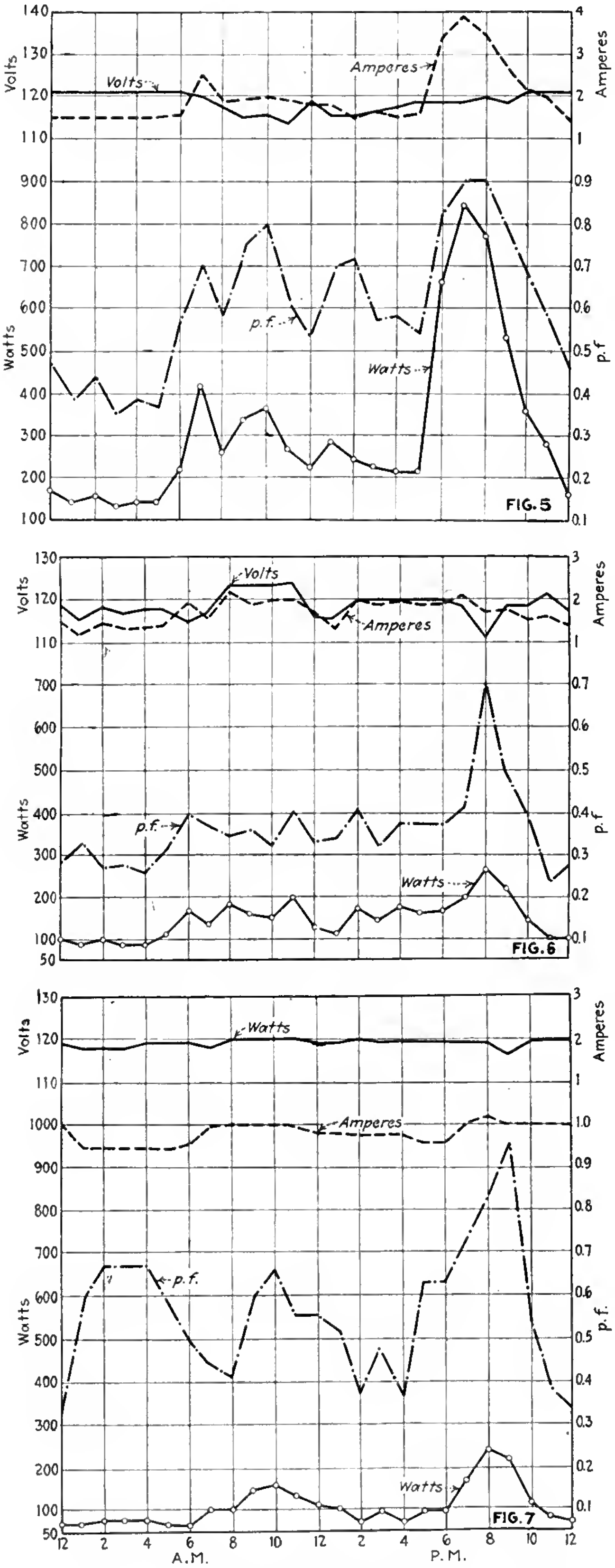



FIG. 4

G. 1—KILOWATT DEMAND OVER TWENTY-FOUR-HOUR PERIOD. MULTIPLY BY 30 TO GET ACTUAL KILOWATTS. FIG. 2—(a) AMMETER RECORD, (b) VOLTMETER RECORD. FIG. 3—MONTH OF AUGUST SHOWS LOW DEMAND. MULTIPLY BY 30 TO GET ACTUAL KILOWATTS. FIG. 4—TYPICAL RECORD OF AVERAGE LINE (a) AMMETER, (b) VOLTMETER




FIGS. 5, 6 AND 7—OPERATING CHARACTERISTICS OF LINES NOS. 1, 2 AND 3 RESPECTIVELY

during the day and night of a line serving thirty-nine rural customers and a small town of four hundred inhabitants at the extreme end of the line. This portion of the chart, which is taken from the record for January, shows a peak considerably above the average but which is one-third less during the summer months.

Particular notice is called to the period between midnight and 5 a.m., which indicates a very nearly constant load. The demand during this period is almost identical every night since it represents the line and core losses of the transformers. The indicated values will be found to check very closely with the total loss of all the transformers connected. Attention is called to the losses as indicated on the following charts over this same period.

The demand chart in Fig. 3 taken from a line having forty customers connected is probably more typical of the demand on existing rural lines. Frequently the evening peak is no greater than peaks occurring during the day. Through the winter months, however, the evening peak is always greater. However, when the weather chart shows that the day was cloudy there would be a greater lighting load of longer duration.

By studying a demand chart of the type shown here a great many things may be detected which will indicate at least some of the characteristics of the load. Weather conditions make an appreciable difference in demand, especially during the evening peak, depending upon whether the day is clear or cloudy. It is also of interest to note that on one day each week the demand is greater than on any other day. Observations so far indicate this day to be Tuesday, probably because of the washing-machine and flatiron load. A study of a series of weekly charts will show also a great deal of similarity for the corresponding days of each week. By knowing the connected load the operating characteristics of the different appliances and motors may be studied from their effect on the demand at the switchboard.

The required current and voltage during an evening peak for line No. 1 are given by the charts in Fig. 2. Readings are for the month of January, so naturally the evening lighting load is high. It should be remembered that this line also serves a small town.

Considerable irregularity of current and voltage is shown for line No. 2 in Fig. 4. The power supply for this line is transmitted a considerable distance at high voltage, which probably accounts for some of the irregularity in voltage. While the average current in this case is low, it does not reach the low limit shown in line No. 3.

A better idea of existing conditions can be obtained from the curves in Figs. 5, 6 and 7, showing operating characteristics for each of the three lines. The charts shown above cover the operation for one day, or portion of a day for each. To obtain data that are characteristic of operating conditions of a line, they should be collected over a twelve-month period in order to show seasonal effects.

Average figures are quoted in the table, which is a brief summary of the data collected during a period of several months.

SUMMARY OF RURAL LINE DATA

| | Line No. 1 | Line No. 2 | Line No. 3 |
|---|---|---|---|
| Miles of line | 22.0 | 30.0 | 27.5 |
| Customers | *39 | 40 | 49 |
| Number of transformers | 32 | 38 | 43 |
| Transformer capacity kva. connected | 165.5 | 128.0 | 87.0 |
| Average transformer capacity kva. per customer | 3.6 | 3.2 | 1.7 |
| Monthly core loss, kw.-hr. | 1,155 | 1,141 | †1,178 |
| Ratio, core loss to energy delivered | 1:54 | ...... | 1:18 |
| Maximum kw. demand (fifteen minutes) | 33.0 | 11.7 | 9.0 |
| Average kw. demand (period of test) | 9.45 | 4.8 | 3.6 |
| Power factor, average | 0.583 | 0.368 | 0.591 |

* County farm included, using 15-hp. motor for grinding and aawing.
† Includes 50 kva. transformer at substation, owned by customers. Master meter on low side of this transformer.

# A Practical Calculating Table

## Resistance Units Take Place of Reactance of Circuits—Sufficiently Accurate for Practical Purposes—Permits Anticipation of Troubles

By E. W. DILLARD

*Assistant Electrical Engineer New England Power Company, Worcester, Mass.*

THERE have been published in several articles various means for estimating mathematically short-circuit current values to be expected from different combinations of electrical apparatus. These calculations can be readily and quickly made for a system with a simple arrangement of equipment, but when applied to an extensive network the calculations are laborious if an exact solution is required. Various approximations have been offered which are, no doubt, reasonably accurate, but the calculations which must be made on an extensive system, involving many networks, require, even with the fastest approximations, prohibitive time, and such a system with its ever-changing conditions, brought about by extensions, developments and variations in load distribution, necessitates a great number of calculations.

The map (Fig. 4) shows the general location of the New England Power System, and the diagram shown in Fig. 2 represents the reactance values of the apparatus in only a part of the system. The entire system must, of course, be considered in short-circuit calculations.

In this diagram the instantaneous reactance of all generators, the reactance of all transformers and the reactance of interconnecting lines are expressed in terms of percentage reactance on a 20,000-kva. base. The diagram has been simplified as much as possible to be concise and yet to contain all the information necessary in estimating a short circuit at any point on the system. It will be appreciated how enormous a task it is to make one calculation, yet operating experience shows that in the course of a single year thousands of calculations are necessary.

In 1917 the New England Power Company constructed a calculating table to expedite this work. This table consists essentially of a representation of each reactance value shown on the diagram (Fig. 2) by a small fixed proportionate resistance unit. The use of variable resistance units was first considered, but as

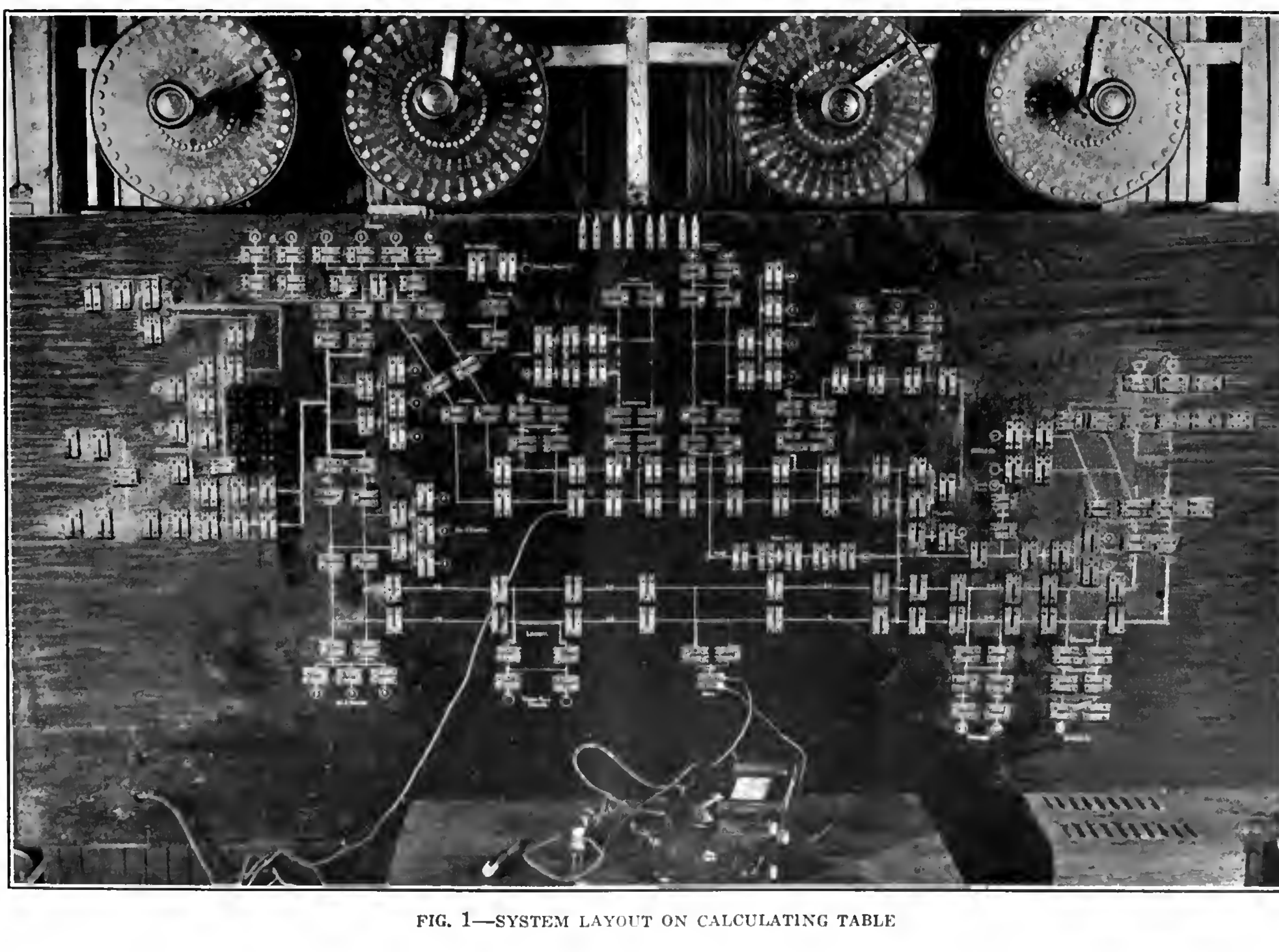


FIG. 1—SYSTEM LAYOUT ON CALCULATING TABLE

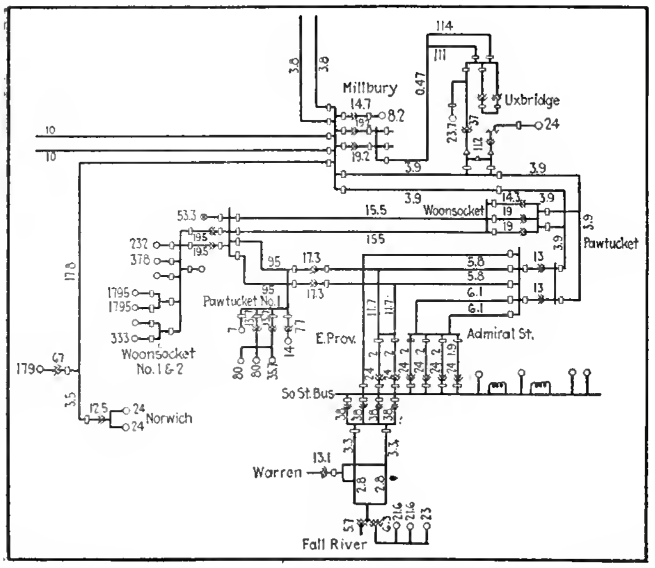



FIG. 2—TO EVERY SECTION OF THE SYSTEM A REACTANCE VALUE HAS HAD TO BE ASSIGNED

This is only one section of the New England Power system, but it serves to indicate the details that must be considered in calculating short-circuit possibilities.

the table was to be designed for calculations on the New England Power Company system only, there seemed to be little justification in abandoning the inexpensive fixed-unit layout for the more expensive, though more flexible, adjustable resistance type.

It was decided to design the table for operation on 110 volts direct current to gain the increased reliability of a moderately high laboratory voltage. The laboratory is equipped with a fifty-cell lead storage battery and a 125-volt direct-current motor-generator set. It was not desirable to use more than about 15 amp. to represent the maximum short circuit to be read on the table, and the resistance units were selected on this basis. The maximum short circuits on the system approximate 750,000 kva., or about 6,600 amp. at 66,000 volts (the primary voltage). For simplicity, it was decided that 1 amp. on the calculating table (110 ohms at 110 volts) should represent 500 amp. at 66,000 volts (57,000 kva.), equivalent to a short circuit of 35.2 per cent on a 20,000-kva. base. Thus, 3.125 ohms becomes the equivalent of 1 per cent reactance on a 20,000-kva. base on the system. Upon this basis resistance tubes were ordered to represent each reactance value shown on the system diagram. These resistance tubes, about $\frac{3}{4}$ in. in diameter and 6 in. long, were mounted compactly under a large office table and wired to test links on the top so arranged as to represent the actual system connections. Fig. 5 shows the arrangement of some units under the table, and Fig. 1 shows the reverse side. For convenience the table was later mounted in the vertical position shown. One side of each resistance unit corresponding to a generator is connected to the positive lead from the direct-current source; the other side is connected to the units representing transformers, these to the units representing lines, etc. A short circuit is established by connecting the negative lead to the point desired. By closing the requisite test links the system condition under consideration can be established at will and varied, if necessary, while the short circuit remains on. By inserting an ammeter in any line or generator upon the system it is possible not only to read the amount of current flowing through this section but to determine also its direction. It is very interesting and also valuable to be able to follow a complete switching operation through in this manner, determining the magnitude of the initial short circuit with its direction through various tie lines, networks, etc., then determining step by step the sequence of operations for a given relay set-up, and determining the duty imposed upon each oil circuit breaker.

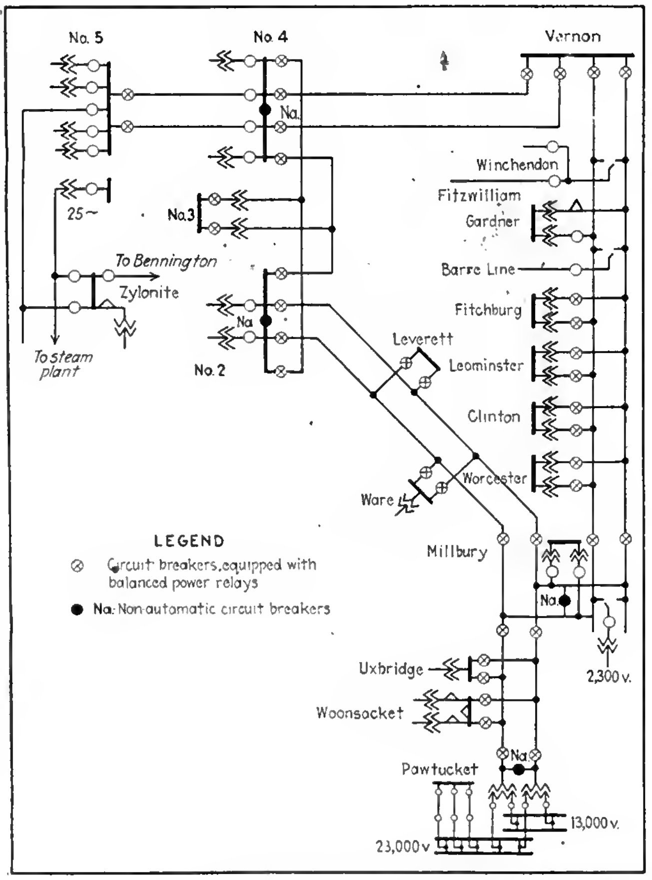



FIG. 3—BALANCED-POWER RELAYS REDUCE CIRCUIT-BREAKER DUTY

### VARIABLE RESISTORS USED IN DEVELOPMENT STUDIES

Immediately above the table are mounted four variable pancake resistance units, which are wired to terminals on the top. Each point of these units is calibrated in ohms and also in per cent reactance. There is also a resistance box from which are brought a number of taps. These five variable units, together with a number of spare resistance tubes, are used to represent proposed developments and extensions to the system on the table when such are required for a particular calculation. A small direct-current motor-generator set is generally used for these tests, and there is mounted on the lower left-hand corner of the board a field rheostat to give voltage control to the generator. Since the original construction there have been numerous changes and additions made to the system, and we have been able to change the table to incorporate these additions with very little work.

In short-circuit calculations reactance values are used instead of impedance values, because a closer approximation is obtained when they are added arithmetically. Fig. 6 illustrates the impedance triangles that might be expected when a simple circuit consisting of a generator, a transformer and a transmission line is short-circuited on the end of the transmission line. The line

$AB$ represents the impedance drop of the generator, the line $BC$ the impedance drop of the transformer, and the line $CD$ the impedance drop of the transmission line, the reactive drops being represented by $X_1$, $X_2$ and $X_3$ respectively. The true short-circuit value would be determined by the line $AD$, but the value of this line cannot be ascertained without a trigonometric calculation. It will be seen that the line $DH$ is virtually the same length as the line $AD$, indicating, therefore, that the error in using $DH$ rather than $AD$ (reactance rather than impedance) is negligible.

### All Important Relay Settings Based on Table Tests

The table is used very extensively in determining the basis for relay settings. No relay setting other than those for unimportant feeder circuits is made unless the values of short-circuit current to be expected under all possible conditions are determined by a series of exhaustive tests. We have found this to be necessary because of the surprisingly wide variation in the extent of short-circuit values during different conditions of load division and plant operation on the system. For instance, during extremely low water conditions it is sometimes desirable to shut down a large part of our hydro-electric capacity, yet this shutting down must be limited to the number of machines required to furnish sufficient energy for the operation of the relays, particularly the switches near the hydro-electric plants. It is, of course, necessary to set the relays high enough to carry the extreme high-load currents of the plants, so we have actually found it necessary to motor machines during low-water periods to give sufficient current to operate these high settings. This fact might have been discovered under rather disastrous conditions had it not been that it was anticipated by exhaustive tests on the short-circuit table.

Each additional generator and each additional transmission line placed in service increases somewhat the short-circuit current through each relay on the system. It is, therefore, necessary, after even minor changes, to calculate the effect of the change upon each individual relay throughout the system.

### Permit Reducing Duty on Breakers

Not only has the short-circuit table been invaluable in relay setting, but it has been equally useful in determining the duty upon oil circuit breakers. Some of our older stations are equipped with earlier types of these breakers whose rupturing capacity is now greatly below the maximum duty that might be imposed upon them. By means of the table we have been able to determine experimentally relay sequences that greatly decrease the amount of energy to be handled by these circuit breakers and have, therefore, postponed, if not prevented, the necessity for replacing them.

For instance, referring to Fig. 3, showing the general scheme of connections of the principal 66,000-volt lines, it was found that the general installation of balanced power relays on these lines would reduce the energy to be handled by the circuit breakers. Thus the double duplicate line extending from No. 2 station to the Millbury substation has been equipped with balanced power relays at No. 2 station, Leverett, Ware and Millbury substations (all of which may be a source of power). If a short circuit occurs just outside the Millbury substation, the total amount of energy flowing into the short circuit will be between 500,000 kva. and 700,000 kva., which is in excess of the rupturing capacity of the Millbury circuit breakers. However, with balanced power relays installed, there is no tendency initially for any circuit breakers to trip other than those at Ware and Millbury. The circuit breaker at Millbury perhaps opens first, but the short circuit, though reduced in value, is not yet interrupted. The circuit breaker at Ware next operates, further reducing the short circuit, and after the Leverett circuit breaker opens the relay at No. 2 station gets its first tendency to operate. It, of course, operates, tripping the last circuit breaker on the bad line, which ruptures the short circuit, but the short circuit is now much lower than it was originally on account of the introduction of the reactance of the line between No. 2 station and Millbury by the selective operation of breakers up

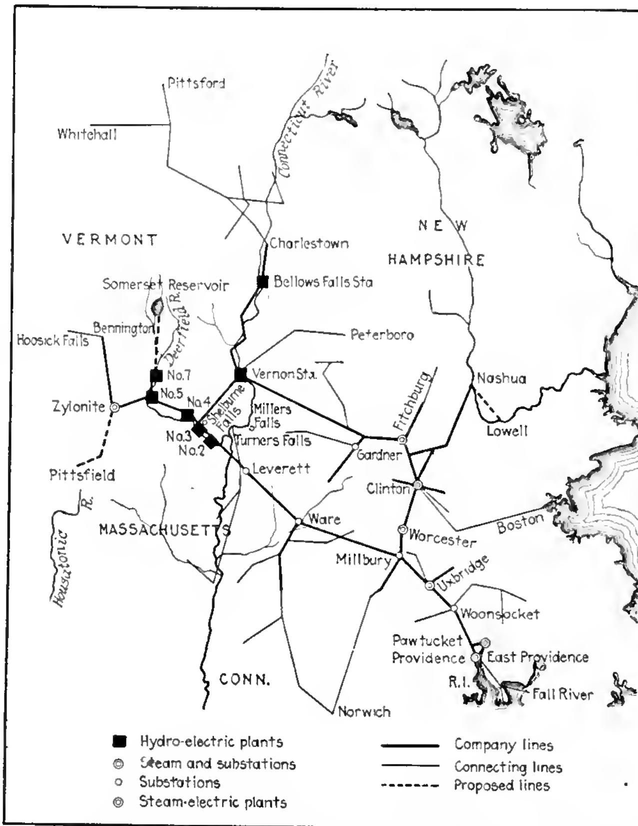



FIG. 4—SYSTEM OF NEW ENGLAND POWER COMPANY, ON WHICH CALCULATING BOARD IS USED WITH GREAT SATISFACTION

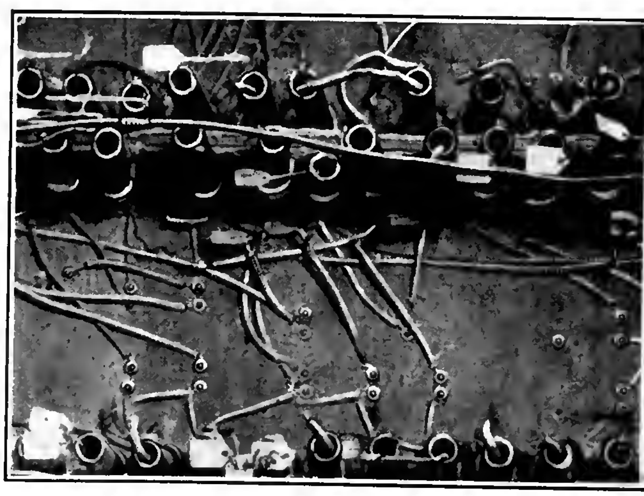


FIG. 5—METHOD OF MOUNTING RESISTORS WHICH TAKES PLACE OF EQUIVALENT REACTANCE OF CIRCUITS

and down the line. In practice it works out that each of these four circuit breakers will open, roughly, about a fourth of the short circuit. (This value, of course, varies somewhat with the location of the short circuit.)

Studies similar to those made for relay settings are made to determine the effect upon circuit breakers of every system extension of any consequence. These studies have at least warned us of the danger points and have been of great value in determining the proper capacity circuit breaker to be used in new installations.

In short-circuit calculations we have not found it practicable to make much use of time-decrement curves. There is connected to the New England Power Company's system somewhat over 500,000 kva. in generator capacity, all of which contributes more or less to any short circuit. Since the maximum short circuit on the high-tension system is within 750,000 kva., this maximum represents a short circuit of a 500,000-kva. system through 66 per cent reactance. There is only a negligible falling off of current after any time value applicable to circuit-breaker operation during a short circuit of such high relative reactance. This statement, of course, does not hold true in regard to the generators in close proximity electrically to the short circuit, for the short circuit of these generators is one of relatively lower reactance. On the other hand, the opposite thing holds true of generators more remote electrically from the short circuit, and it is probably safe to assume that these two factors offset each other.

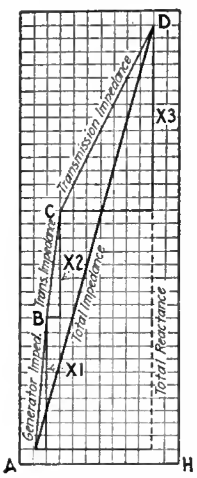



FIG. 6

Small difference between total reactance and total impedance of interconnected system.

Oscillograph tests have been made from time to time, and other data collected, to indicate accurately by an independent means the amount of energy flowing into various short circuits. These data have agreed within reason with those obtained by the calculating table.

# Hydro-Electric Progress in Canada During 1922

FROM data compiled by the Dominion Water Power Branch, Department of the Interior, it is shown that during 1922 the total water-power installation in Canada grew to approximately 3,000,000 hp., of which 240,284 hp. was installed during the year. This figure does not include 190,000 hp. installed during 1922 but only brought into operation after that year had closed. Projects are now under way which will have an ultimate capacity of more than 1,000,000 horsepower.

The details of progress during 1922 are set forth in the accompanying tables. Special attention may be called to the storage development on Stave Lake and Falls Creek, British Columbia, to increase the output of existing plants; the development of the Manitoba Power Company at Great Falls, on the Winnipeg River, where the first unit of 168,000 hp. was put into service in December; the rapid increase of the installation by the Ontario Hydro-Electric Commission at Queenston; the great activity in Quebec, which includes immense developments under way on the Saguenay River and at Gres Falls on the St. Maurice River, and also the steadily maintained progress in the Maritime Provinces.

TABLE I—DEVELOPED AND AVAILABLE WATER POWER IN CANADA

| Province | Turbine Installation in Horsepower: On Jan. 1, 1923 | Turbine Installation in Horsepower: Installed During 1922 | Available Twenty-four-Hour Power at 80 per Cent Efficiency: At Ordinary Minimum Flow, Hp. | Available Twenty-four-Hour Power at 80 per Cent Efficiency: Dependable For Six Months, Hp. |
|---|---|---|---|---|
| British Columbia | 328,977 | 20,200 | 1,931,142 | 5,103,460 |
| Alberta | 33,067 | ....... | 475,281 | 1,137,505 |
| Saskatchewan | ........ | ....... | 513,481 | 1,087,756 |
| Manitoba | 134,025 | 34,900 | 3,270,491 | 5,769,444 |
| Ontario | 1,299,230 | 130,300 | 4,950,300 | 6,808,190 |
| Quebec | 1,073,883 | 43,550 | 6,915,244 | 11,640,052 |
| New Brunswick | 42,039 | 11,100 | 50,406 | 120,807 |
| Nova Scotia | 47,100 | 234 | 20,751 | 128,264 |
| Prince Edward Island | 2,239 | ....... | 3,000 | 5,270 |
| Yukon and Northwest Territories | 13,199 | ....... | 125,220 | 275,250 |
| Total for Canada | 2,973,759 | 240,284 | 18,255,316 | 32,075,998 |

TABLE II—LIST OF CANADIAN HYDRO-ELECTRIC ACTIVITIES IN 1922

| Plan No. | Company or Owner | Plant | Installation Made 1921 and Placed in Operation 1922 | New Installations or Additions 1922, Hp. | Total Present Installation | Installations Under Construction or Actively Projected |
|---|---|---|---|---|---|---|
| 1 | British Columbia Electric Railway Co. | Stave River | ....... | 13,000 | 52,000 | ....... |
| 2 | East Kootenay Power Co., Ltd. | Bull River | ....... | 7,200 | 7,200 | ....... |
| 3 | East Kootenay Power Co., Ltd. | Elk River near Elko | ....... | ....... | ....... | 16,000 |
| 4 | Manitoba Power Co. | Great Falls, Winnipeg River | ....... | 28,000 | 28,000 | 28,000 |
| 5 | City of Winnipeg | Point du Bois, Winnipeg River | 6,900 | 6,900 | 67,100 | ....... |
| 6 | Backus-Brooks Co. | Kenora | ....... | 4,800 | 8,200 | 2,600 |
| 7 | Dryden Paper Co. | Wabigoon River | ....... | ....... | ....... | 1,400 |
| 8 | Town of Thessalon | Little Thessalon River | ....... | 200 | 200 | ....... |
| 9 | Spruce Falls Co. | Kapuskasing | ....... | ....... | ....... | 2,500 |
| 10 | Lower Sturgeon Power Co. | Sturgeon Falls, Mattagami River | ....... | 4,000 | 4,000 | 4,000 |
| 11 | Great Northern Power Co. | Indian Chute, Montreal River | ....... | ....... | ....... | 6,450 |
| 12 | Hydro-Electric Power Comm. of Ontario | Queenston-Chippewa, Niagara River | 110,000 | 110,000 | 220,000 | 220,000 |
| 13 | Canadian General Electric Co. | Nassau, Otonabee River | ....... | 1,300 | 2,700 | ....... |
| 14 | Hydro-Electric Power Comm. of Ontario | Ranney Falls, Trent River | ....... | 10,000 | 10,000 | ....... |
| 15 | Ottawa & Hull Power & Manufacturing Co. | Calumet Falls, Ottawa River | ....... | ....... | ....... | 30,000 |
| 16 | Hull Electric Co. | Paugan Falls, Gatineau River | ....... | ....... | ....... | 100,000 |
| 17 | Cie. Electrique de Rockland | Blanche River | ....... | 400 | 400 | ....... |
| 18 | Montreal Light, Heat & Power Cons. | Cedars Rapids, St. Lawrence River | 22,600 | ....... | 152,200 | 45,200 |
| 19 | Laurentide Power Co. | Grand Mere, St. Maurice River | 44,000 | ....... | 164,000 | ....... |
| 20 | Shawinigan Water & Power Co. | Shawinigan Falls, St. Maurice River | ....... | 43,000 | 191,500 | ....... |
| 21 | St. Maurice Power Co. | Gres Falls, St. Maurice River | ....... | ....... | ....... | 125,000 |
| 22 | Southern Canada Power Co. | Hemming Falls, St. Francis River | ....... | ....... | ....... | 30,000 |
| 23 | Cie. Electrique St. Prime | St. Prime | ....... | 150 | 150 | ....... |
| 24 | Quebec Development Co. | Saguenay River | ....... | ....... | ....... | 350,000 |
| 25 | Lower St. Lawrence Power Co. | Metis River | ....... | ....... | ....... | 3,700 |
| 26 | Maine & New Brunswick Power Co. | Aroostook Falls | ....... | ....... | 5,900 | 2,500 |
| 27 | New Brunswick Electric Power Commission | Musquash River | ....... | 11,100 | 11,100 | ....... |
| 28 | Cambridge & Waterville Hydro-Electric Power Co. | Tupper Lake | ....... | 84 | 84 | ....... |
| 29 | Gaspereau River Light, Heat & Power Co. | Whitrock, Gaspereau River | ....... | 150 | 1,105 | ....... |
| 30 | Nova Scotia Power Commission | St. Margaret Bay | 10,820 | ....... | 10,820 | ....... |
| 31 | Nova Scotia Power Commission | Malay Falls, East River Sheet Harbour | ....... | ....... | ....... | 3,700 |
| | | Totals | 194,320 | 240,284 | ....... | 971,050 |

Note.—In addition to the installations shown in the above table provision has been made in a number of existing plants for extensive additions as the loads increase. In addition also to the projected plants listed there are numerous other projects under study.

# Nomographic Chart for Designing Illumination*

## Applicable to Direct or Indirect Illumination, Using Photometric Curve of Fixture or Intensity Readings in One Plane

BY EMIL KUN
Springfield Gardens, Long Island, N. Y.

A VERY practical method for designing illumination was described in a previous issue of the ELECTRICAL WORLD (October 9, 1920, page 721) by M. M. Samuels and C. O. von Dannenberg. This method is equally and easily applicable to direct and indirect illumination, either by using the photometric curve of the lighting fixture or by obtaining foot-candle intensity readings in one plane with the aid of the foot-candle meter. It involves, however, mathematical calculations, or a graphical solution, which is to be repeated for each point to be determined, in addition to the usual tables containing values of $\cos^3\phi$ or $\cos^3\phi/H^2$ when the photometric curve is used as a starting point.

To simplify the operation and eliminate the use of all tables of coefficients, without sacrificing any of the accuracy of the method, the Nomographic chart shown herewith may be used to determine illumination without the use of any other tables of coefficients or angles. In order to explain the use of the chart the method developed by Messrs. Samuels and von Dannenberg may at first be briefly summarized. When the polar photometric curve of the fixture is used as the basis of calculation, the horizontal intensities are determined in a selected plane, which will be called "primary plane," by the well known formula:

$$I_1 = \frac{\cos^3\phi}{H_1^2}\ \text{cp.}$$

where $\phi$ = angle between the selected light beam and the vertical line,

$H_1$ = height of the focal point of fixture above the primary plane in feet,

cp. = candlepower of the lighting unit at angle from vertical,

$I_1$ = resulting intensity, in foot-candles.

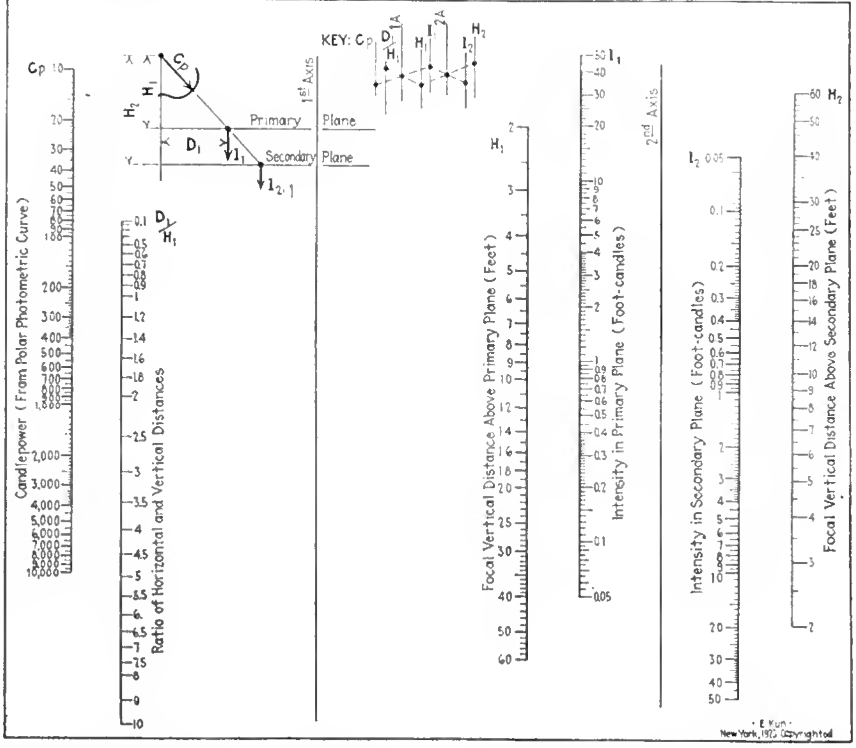
After obtaining a full-intensity curve for this primary plane, intensity curves may be developed from this curve for any other horizontal plane without referring again to the photometric curve. Let $H_2$ be the height of the focal point of fixture above another selected plane, which will be called "secondary plane," and which may be either above or below the primary plane. Then the horizontal intensity of illumination at the intersecting point of this secondary plane and the same light beam will be

$$I_2 = \frac{\cos^3\phi}{H_2^2}\ \text{cp.}$$

But since we are working with the same light beam, this new intensity can be directly determined from the intensity in the primary plane by dividing the above two formulas into each other, and we get:

$$I_2 = \frac{H_1^2}{H_2^2}\ I_1.$$

When using indirect or semi-indirect fixtures the best method is, as Messrs. Samuels and von Dannenberg pointed out, to obtain the intensity curve in one plane by making measurements with the foot-candle meter in a selected "primary plane," and with the fixture stem and ceiling conditions arranged in as close conformity to the conditions under which the fixtures will be used as possible and from this curve to develop intensity curves for other planes. From this intensity curve can also be determined the "fictitious polar curve," which is the polar photometric curve of a hypothetical direct lighting unit producing an illumination equivalent to the illumination on horizontal planes produced by the indirect or semi-indirect fixture under consideration.




CAN SOLVE ILLUMINATION PROBLEMS STARTING WITH CANDLE-POWER OR FOOT-CANDLES

The nomographic chart here reproduced is a combination of the nomographic representations of the two above given formulas, namely:

$$(1)\ I_1 = \frac{\cos^3\phi}{H_1^2}\ \text{cp. and } (2)\ I_2 = \frac{H_1^2}{H_2^2}\ I_1.$$

The first formula is represented by the scales cp., $D_1/H_1$, $H_1$ and $I_1$, and the second by the scales $H_1$, $I_1$, $I_2$ and $H_2$. As noticed, the scales of $H_1$ and $I_1$ are common for both nomographs, and so the problem can be worked out in any direction, starting either with the candlepower of the lighting unit or the measured foot-candle intensity in the primary plane.

To obtain the intensities according to the first formula, points can be selected on the primary plane at distances $D_1$ from the vertical. The values $D_1/H_1$ for each of these points may be easily figured without even a slide rule, especially if the height $H_1$ for this primary plane is selected, for instance 5, 10 or 20 ft., according to the range of the unit. The index line drawn between

# Table I—Data on Output and Peak Load of Largest Generating and Distributing Systems in the United States and Canada

(This table includes all lighting, power and electric railway companies in the United States and Canada having yearly outputs in excess of 100,000,000 kw.-hr.)

| Company | Rank in 1922 | 1922 Peak Load (Kw.) | 1922 Date of Peak Load | 1922 Output for Year (Kw.-Hr.) | 1921 Peak Load (Kw.) | 1921 Date of Peak Load | 1921 Output for Year (Kw.-Hr.) | 1920 Peak Load (Kw.) | 1920 Date of Peak Load | 1920 Output for Year (Kw.-Hr.) | 1919 Peak Load (Kw.) | 1919 Date of Peak Load | 1919 Output for Year (Kw.-Hr.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNITED STATES | | | | | | | | | | | | | |
| Niagara Falls Power Co. | 1 | 328,826 | Nov. 23 | 2,252,249,000 | 298,120 | Dec. 22 | 1,855,120,000 | 303,640 | Apr. 29 | 2,328,326,064 | 275,803 | Dec. 29 | 2,034,608,904 |
| Commonwealth Edison Co. | 2 | 600,000 | Dec. 12 | 2,225,442,875 | 525,640 | Dec. 21 | 1,928,271,943 | 478,820 | Dec. 17 | 1,883,570,000 | 428,630 | Dec. 15 | 1,628,340,000 |
| New York Edison & United Electric Light & Power Co. | 3 | 497,577 | Dec. 20 | 1,659,269,781 | 422,721 | Dec. 14 | 1,475,276,053 | 398,535 | 12/6 and 12/22 | 1,383,070,086 | 330,210 | Nov. 25 | 1,104,521,883 |
| Pacific Gas & Electric Co. | 4 | 293,708 | Nov. 10 | 1,608,940,735 | 265,925 | Nov. 29 | 1,489,088,657 | 259,004 | Dec. 22 | 1,475,678,673 | 244,732 | ...... | 1,267,159,767 |
| Southern California Edison Co. | 5 | 239,160 | Aug. 28 | 1,198,926,369 | 238,480 | Dec. 13 | 1,224,718,196 | 213,450 | July 12 | 1,079,474,091 | 200,020 | July 23 | 1,021,977,519 |
| Detroit Edison Co. | 6 | 254,700 | Dec. 7 | 1,105,211,100 | 201,500 | Nov. 23 | 897,980,200 | 218,800 | June 16 | 1,002,306,000 | 210,000 | Dec. 5 | 872,583,200 |
| Montana Power Co. | 7 | 135,600 | Aug. 10 | 963,662,660 | 116,600 | Jan. 11 | 572,277,989 | 159,700 | Aug. 7 | 1,103,620,644 | 133,500 | June 13 | 865,998,552 |
| Public Service Electric Co. of N. J. | 8 | 249,778 | Dec. 18 | 958,407,194 | 213,502 | Nov. 28 | 821,198,975 | 216,452 | Nov. 16 | 912,899,972 | 207,890 | Dec. 16 | 821,355,239 |
| Philadelphia Electric Co. | 9 | 260,355 | Dec. 14 | 956,910,225 | 213,570 | Dec. 8 | 877,047,595 | 203,624 | Nov. 23 | 910,327,693 | 199,247 | Dec. 18 | 722,615,280 |
| Southern Power Co. | 10 | 233,000 | July — | 910,488,432 | 218,300 | Feb. — | 790,000,000 | 210,000 | Nov. — | 745,873,992 | 196,500 | Dec. — | 585,596,925 |
| Duquesne Light Co. | 11 | 208,980 | Dec. 13 | 858,329,336 | 164,240 | Feb. 1 | 702,897,985 | 162,000 | Jan. 29 | 810,401,406 | 157,900 | Dec. 22 | 623,000,000 |
| Cleveland Electric Illuminating Co. | 12 | 181,112 | Dec. 14 | 688,149,162 | 141,850 | Dec. 15 | 564,819,267 | 155,041 | Sept. 9 | 682,557,097 | 153,878 | Dec. 5 | 576,131,649 |
| West Penn. Power Co. | 13 | 137,354 | Dec. 11 | 634,674,505 | 106,919 | Dec. 21 | 516,829,636 | 104,618 | Nov. 24 | 524,976,000 | 94,130 | Dec. 22 | 417,911,000 |
| Mississippi River Power Co. | 14 | 122,300 | June 14 | 619,837,527 | 117,450 | Nov. 28 | 602,580,980 | 115,650 | Nov. 13 | 644,163,000 | 113,450 | Nov. 18 | 590,488,000 |
| Alabama Power Co. | 15 | 153,100 | Dec. 18 | 607,133,242 | 115,500 | Dec. 20 | 432,991,540 | 97,900 | Sept. 28 | 488,089,061 | 83,100 | Jan. 10 | 347,993,284 |
| Buffalo General Electric Co. | 16 | 142,000 | Dec. 7 | 587,682,340 | 115,000 | Nov. 14 | 479,862,700 | 108,500 | Oct. 26 | 544,293,410 | 106,500 | Nov. 22 | 508,583,680 |
| Great Western Power Co. of California | 17 | 105,910 | Dec. 5 | 572,693,958 | 95,540 | June 7 | 490,584,257 | 80,600 | July 27 | 408,577,754 | 48,000 | May 12 | 213,189,992 |
| Consolidated Gas, Electric Light & Power Co. of Baltimore | 18 | 138,800 | Dec. 13 | 568,669,404 | 108,330 | Nov. 30 | 415,335,614 | 88,990 | Nov. 30 | 429,710,847 | 80,640 | Dec. 5 | 392,201,280 |
| North American Co. (Missouri System) | 19 | 134,100 | Nov. 27 | 554,551,123 | 116,275 | Dec. 9 | 508,893,262 | 105,749 | Dec. 21 | 471,611,047 | 99,498 | Dec. 3 | 408,920,575 |
| Niagara, Lockport & Ontario Power Co. | 20 | 127,000 | Nov. 24 | 552,035,090 | 87,000 | Nov. 2 | 415,153,634 | 88,000 | Jan. 6 | 492,466,460 | ...... | ...... | ...... |
| Brooklyn Edison Co., Inc. | 21 | 164,495 | Dec. 7 | 516,987,870 | 137,800 | Dec. 6 | 438,887,775 | 116,500 | Nov. 30 | 382,963,027 | 105,400 | Jan. 15 | 327,084,075 |
| Pennsylvania Power & Light Co. | 22 | 106,987 | Nov. 14 | 495,344,612 | 84,203 | Sept. 27 | 442,507,974 | 87,685 | Sept. — | 411,639,501 | 81,435 | Nov. — | 342,071,900 |
| Puget Sound Power & Light Co. | 23 | 105,600 | Dec. 4 | 474,042,886 | 99,800 | Dec. 1 | 419,197,581 | 95,725 | Dec. 3 | 472,765,800 | 93,900 | Dec. 18 | 452,209,000 |
| New England Power Co. | 24 | 125,460 | Dec. 14 | 469,993,180 | 112,200 | Nov. 9 | 405,979,457 | 103,450 | Jan. 6 | 430,918,000 | 93,860 | Dec. 9 | 357,303,224 |
| Consumers' Power Co. | 25 | 116,130 | Dec. 4 | 461,840,561 | 95,410 | Dec. 12 | 397,815,027 | 106,924 | May 19 | 476,095,098 | 108,847 | Nov. 28 | 456,230,164 |
| North American Co. (Wisconsin System) | 26 | 134,482 | Dec. 19 | 458,405,215 | 98,887 | Nov. 22 | 375,354,892 | 90,347 | Jan. 6 | 398,619,744 | 97,912 | Dec. 4 | 331,874,192 |
| San Joaquin Light & Power Corp. | 27 | 67,885 | Aug. 4 | 451,390,040 | 61,700 | June 27 | 396,174,690 | 47,180 | Aug. 28 | 299,536,000 | ...... | ...... | ...... |
| Edison Electric Illuminating Co. of Boston | 28 | 133,594 | Dec. 14 | 439,448,099 | 128,200 | Dec. 15 | 375,025,955 | 105,090 | Dec. 9 | 395,076,738 | 103,136 | Dec. 8 | 328,798,850 |
| Utah Power & Light Co. | 29 | 87,158 | Dec. 19 | 428,962,903 | 75,661 | Jan. 8 | 362,908,000 | 85,404 | Nov. — | 519,854,000 | 79,780 | Jan. 14 | 461,531,633 |
| Minneapolis General Electric Co. | 30 | 101,919 | Dec. 7 | 425,916,891 | 83,590 | Dec. 15 | 373,378,515 | 78,010 | Oct. 26 | 359,476,651 | 72,745 | Oct. 24 | 332,264,401 |
| Washington Water Power Co. | 31 | 89,278 | Dec. 12 | 407,657,100 | 70,110 | Nov. 23 | 374,378,300 | 63,955 | Jan. 21 | 351,087,900 | 63,220 | Dec. 3 | 241,761,350 |
| Pennsylvania Water & Power Co. | 32 | 83,000 | June 10 | 373,341,800 | 83,000 | Nov. — | 419,987,000 | 85,000 | Very frequent | 494,624,400 | 87,000 | Nov. — | 512,138,100 |
| Union Gas & Electric Co. | 33 | 100,000 | Dec. 13 | 366,071,350 | 75,000 | 12/14 and 12/23 | 281,537,273 | 65,050 | Dec. 21 | 234,634,375 | ...... | ...... | ...... |
| Public Service Co. of Northern Illinois | 34 | 82,737 | Dec. 19 | 362,220,201 | 80,563 | Dec. 30 | 415,940,095 | ...... | ...... | ...... | ...... | ...... | ...... |
| Tennessee Electric Power Co. | 35 | 82,700 | Dec. 11 | 353,320,559 | 69,100 | May 16 | 342,948,926 | 74,800 | Apr. 30-June 4 | 428,649,835 | 82,300 | Feb. 14 | 422,272,590 |
| Portland Railway, Light & Power Co. | 36 | 71,800 | Dec. 28 | 324,116,190 | 64,800 | Dec. 20 | 298,514,571 | 62,600 | Dec. 6 | 292,318,971 | 56,300 | Dec. 22 | 271,600,300 |
| Los Angeles Bureau of Power and Light | 37 | 75,275 | Dec. 15 | 318,502,702 | 51,900 | Dec. 21 | 300,353,806 | 46,500 | Dec. 29 | 169,489,210 | 24,650 | Apr. 12 | 134,893,270 |
| Georgia Railway & Power Co. | 38 | 80,000 | Nov. 15 | 317,068,699 | 72,000 | 11/3 and 11/28 | 282,084,977 | 76,000 | Apr. 9 | 293,721,290 | 71,200 | Dec. 18 | 262,834,541 |
| Ohio Public Service Co. | 39 | 80,080 | Nov. — | 316,838,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Adirondack Power & Light Corp. | 40 | 81,100 | Dec. 14 | 304,997,551 | 61,500 | Dec. 21 | 243,370,354 | 60,700 | Dec. 2 | 277,100,000 | 66,000 | Dec. 23 | 261,400,000 |
| Narragansett Electric Lighting Co. | 41 | 85,000 | Dec. 4 | 297,400,000 | 72,000 | Nov. 23 | 243,087,000 | 54,000 | Jan. 5-Nov. 6 | 213,232,000 | 57,000 | Dec. 23 | 155,678,890 |
| Pennsylvania-Ohio Electric Co. | 42 | 64,200 | Nov. 20 | 276,936,464 | 45,300 | Nov. 9 | 202,670,200 | 48,900 | Nov. 3 | 255,537,150 | ...... | ...... | ...... |
| Kansas City Power & Light Co. | 43 | 59,490 | Dec. 6 | 253,305,000 | 50,531 | Dec. 23 | 204,752,604 | 35,500 | Dec. 23 | 175,939,618 | ...... | ...... | ...... |
| Potomac Electric Power Co. | 44 | 70,000 | Dec. 20 | 251,984,618 | 65,000 | Dec. 14 | 238,028,571 | 62,000 | Nov. 30 | 225,994,701 | 55,000 | Dec. 17 | 204,008,647 |
| Michigan Northern Power Co. | 45 | 32,449 | Nov. 3 | 246,175,203 | 35,018 | Aug. 14 | 258,249,673 | 35,408 | Nov. 12 | 257,752,195 | 35,794 | Apr. 23 | 264,272,468 |
| Northern Ohio Electric Corp. | 46 | 43,000 | Dec. — | 232,684,874 | 42,000 | Oct. 12 | 187,249,647 | 44,400 | May — | 247,109,963 | ...... | ...... | ...... |
| Virginia Railway & Power Co. | 47 | 54,250 | Dec. 18 | 230,293,745 | 47,000 | Dec. 14 | 208,323,000 | 46,150 | Dec. 22 | 208,517,000 | 42,800 | Dec. 18 | 181,280,000 |
| Toledo Edison Co. | 48 | 58,000 | Dec. 14 | 215,785,945 | 46,700 | Dec. 13 | 179,121,428 | 52,400 | Mar. — | 207,830,610 | 48,220 | Dec. — | 199,771,799 |
| Idaho Power Co. | 49 | 38,323 | July 25 | 212,237,000 | 35,635 | Sept. 1 | 190,215,255 | 34,235 | July — | 184,843,000 | 27,090 | Aug. — | 154,754,000 |
| Appalachian Power Co. | 50 | 42,600 | Dec. 4 | 205,447,368 | 35,600 | Dec. 19 | 154,500,000 | 35,300 | Oct. — | 148,700,000 | ...... | ...... | ...... |
| Great Northern Power Co. | 51 | 43,500 | May 26 | 204,080,336 | 44,200 | Jan. 5 | 204,396,870 | 46,000 | Apr. 20 | 229,146,730 | 48,000 | May 12 | 213,189,992 |
| Turners Falls Power & Electric Co. | 52 | 56,400 | May 16 | 201,796,000 | 57,900 | May 17 | 170,826,000 | 55,500 | May 27 | 212,126,530 | ...... | ...... | ...... |
| Rochester Gas & Electric Corp. | 53 | 53,040 | Nov. 23 | 193,503,573 | 48,734 | Dec. 16 | 185,480,692 | 49,400 | Oct. 29 | 193,601,590 | 42,500 | Dec. 2 | 172,892,249 |
| New Orleans Public Service, Inc. | 54 | 46,500 | Dec. 13 | 188,000,000 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Columbus Railway, Power & Light Co. | 55 | 52,100 | Dec. 14 | 187,785,967 | 38,440 | Dec. 12 | 160,423,240 | ...... | ...... | 153,626,000 | ...... | ...... | ...... |
| Nevada-Calif. Power Co. and Southern Sierras Power Co. | 56 | 36,200 | July 14 | 186,671,850 | 45,700 | 6/6 and 8/8 | 199,452,965 | 32,600 | July 23 | 175,104,808 | 29,200 | ...... | 165,782,785 |
| Texas Power & Light Co. | 57 | 66,560 | Dec. 13 | 183,536,613 | 33,620 | Sept. 22 | 156,851,213 | 33,620 | Oct. 14 | 159,939,831 | 29,000 | Nov. 7 | 121,212,000 |
| Fort Worth Power & Light Co. | 58 | 38,500 | Dec. 21 | 178,790,374 | 29,500 | Oct. 15 | 163,286,500 | ...... | ...... | ...... | ...... | ...... | ...... |
| Northwest Utilities Co. and Eastern Wisc. Electric Co. | 59 | 43,589 | Dec. — | 163,902,506 | 31,885 | Apr. — | 132,788,852 | ...... | ...... | ...... | ...... | ...... | ...... |
| Dayton Power & Light Co. | 60 | 46,500 | Dec. 8 | 159,836,687 | 37,500 | Nov. 28 | 134,588,457 | 31,500 | 5/25 and 9/28 | 129,618,270 | ...... | ...... | ...... |
| Connecticut Light & Power Co. | 61 | 45,706 | Dec 14 | 158,371,247 | 28,255 | Nov. 28 | 101,129,915 | 33,392 | Oct. 12 | 145,111,822 | ...... | ...... | ...... |
| Empire District Electric Co. | 62 | 36,240 | Dec. — | 145,990,000 | 27,700 | Dec. — | 104,687,540 | 36,710 | June — | 148,740,220 | 32,030 | Oct. — | 130,114,100 |
| Yadkin River Power Co. | 63 | 37,000 | Nov. 8 | 142,161,182 | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... |
| Nebraska Power Co. | 64 | 30,200 | Dec. 6 | 140,272,500 | 28,200 | Oct. 28 | 127,758,800 | 25,500 | Nov. 26 | 114,200,500 | 22,600 | Dec. 22 | 97,444,900 |
| Kansas Gas & Electric Co. | 65 | 29,600 | Dec. 7 | 139,167,200 | 25,000 | Dec. — | 130,479,900 | ...... | ...... | ...... | ...... | ...... | ...... |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indiana & Michigan Electric Co. | 67 | 37,450 | Dec. 4 | 136,825,060 | 28,280 | Dec. 16 | 105,593,490 | 27,130 | Nov. 9 | 103,693,910 | 23,100 | Dec. 23 | 84,160,770 |
| Hartford Electric Light Co. | 68 | 56,000 | Dec. 14 | 134,000,000 | 31,700 | Nov. 14 | 97,754,000 | 32,500 | Jan. 9 | 103,000,000 | | | |
| California-Oregon Power Co. | 69 | 27,695 | Dec. 20 | 131,293,165 | 20,270 | Mar. 16 | 133,091,607 | 20,335 | Jan. 28 | 143,025,818 | | | |
| United Light & Railways Co. | 70 | 35,505 | | 129,236,964 | | | | | | | | | |
| Central Maine Power Co. | 71 | 32,500 | Dec. 11, 20, 28 | 128,445,419 | | | | | | | | | |
| Central Illinois Public Service Co. | 72 | 30,800 | Oct. — | 128,345,120 | 26,300 | Dec. — | 114,587,986 | | | | | | |
| Metropolitan Edison Co. | 73 | 32,100 | Nov. 20 | 127,315,007 | 27,900 | Nov. 30 | 99,815,200 | 28,000 | Aug. 10 | 133,994,030 | | | |
| Scranton Electric Co. | 74 | 33,840 | Dec. 18 | 126,207,493 | 27,900 | Dec. 2 | 117,579,851 | 26,580 | Jan. — | 116,387,472 | | | |
| Syracuse Lighting Co. | 75 | 33,686 | Dec. 8 | 124,457,748 | | | | | | | | | |
| Northwestern Electric Co. | 76 | 22,700 | Dec. 29 | 120,698,840 | 22,190 | Dec. 12 | 113,913,335 | 20,600 | Dec. 10 | 112,736,089 | | | |
| New York & Queens Electric Light & Power Co. | 77 | 35,300 | Nov. 15 | 120,011,093 | | | | | | | | | |
| Colorado Power Co. | 78 | 25,777 | July — | 116,711,939 | 25,961 | Mar. 9 | 113,805,044 | 29,078 | Oct. 1 | 116,748,292 | | | |
| Cleveland Municipal Electric Light System | 79 | 25,300 | Dec. 14 | 116,355,460 | | | | | | | | | |
| New Bedford Gas & Edison Light Co. | 80 | 47,500 | Dec. 18 | 115,938,294 | 40,300 | Dec. 21 | 89,857,700 | 33,700 | June 17 | 107,599,392 | | | |
| Tacoma Municipal Electric Light System | 81 | 31,900 | Dec. 5 | 112,546,832 | 28,400 | Dec. 20 | 95,697,600 | 22,700 | Nov. 10 | 120,598,174 | | | |
| Blackstone Valley Gas & Electric Co. | 82 | 38,030 | Dec. 20 | 110,225,488 | | | | | | | | | |
| Houston Light & Power Co. | 83 | 24,200 | Nov. 22 | 108,646,517 | | | | | | | | | |
| Cohoes Power & Light Corp. | 84 | 28,000 | Dec. 20 | 103,195,985 | | | | | | | | | |
| Denver Gas & Electric Light Co. | 85 | 28,800 | Dec. — | 102,631,000 | | | | | | | | | |
| CANADA | | | | | | | | | | | | | |
| Hydro-Electric Power Commission of Ontario | 1 | 460,471 | Dec. 13 | 2,392,092,267 | | | | | | | | | |
| Shawinigan Water & Power Co. | 2 | 250,000 | Dec. 19 | 1,383,390,773 | 160,500 | Dec. 19 | 863,124,240 | 192,200 | Nov. 17 | 1,140,759,076 | 172,900 | Jan. 14 | 1,031,111,695 |
| Ontario Power Co. | 3 | 213,100 | Jan. 30 | 994,000,000 | 151,000 | Jan. 5 | 825,115,600 | 152,000 | Dec. 15 | 1,061,596,054 | 150,000 | Nov. 12 | 949,223,500 |
| Montreal Light, Heat & Power Co. | 4 | 185,550 | Nov. 27 | 945,200,656 | 165,900 | Nov. 16 | 907,231,573 | 169,450 | Nov. 17 | 900,328,757 | 164,415 | Dec. 16 | 852,680,550 |
| City of Winnipeg Hydro-Electric System | 5 | 38,048 | Dec. 11 | 144,509,000 | 34,264 | Nov. 23 | 125,124,855 | | | | | | |
| Toronto Power Co.* | .. | | | | 109,000 | Nov. 28 | 630,468,000 | 109,000 | Dec. 21 | 649,748,800 | 115,000 | Jan. 8 | 548,477,616 |
| Western Power Co. of Canada | .. | | | | 27'200 | Mar. 1 | 122,684,800 | | | | | | |
| ELECTRIC RAILWAYS | | | | | | | | | | | | | |
| Interborough Rapid Transit Co. | 1 | 246,770 | Jan. 24 | 886,223,920 | 242,760 | Dec. 30 | 846,487,668 | 242,020 | Jan. 31 | 816,603,610 | 239,940 | Dec. 19 | 810,158,475 |
| Chicago Surface Lines | 2 | | | 735,246,576 | | | 712,683,840 | | | | | | |
| Brooklyn Rapid Transit Co. | 3 | 118,800 | Jan. 24 | 413,992,125 | 116,000 | Dec. 22 | 383,009,325 | 111,147 | Jan. 15 | 389,784,451 | 111,000 | Dec. 16 | 406,130,443 |
| Philadelphia Rapid Transit Co. | 4 | 110,446 | Dec. 19 | 346,506,580 | 105,303 | Dec. 22 | 333,222,786 | 102,210 | Jan. 14 | 349,027,334 | 101,120 | Dec. 18 | 349,542,666 |
| Boston Elevated Railways Co. | 5 | 78,755 | Dec. 13 | 240,547,615 | 75,905 | Jan. 18 | 223,061,330 | 72,295 | Jan. 14 | 246,312,170 | 71,760 | Mar. 23 | 240,429,915 |
| Pennsylvania R.R. Co., Long Island Plant | 6 | 72,000 | Dec. 30 | 214,906,725 | 64,000 | Dec. 30 | 201,922,210 | 55,200 | Jan. 5 | 199,737,907 | 53,900 | Dec. 19 | 181,017,940 |
| New York Central Railroad Co. | 7 | 48,470 | Jan. 3 | 157,450,819 | 50,750 | Dec. 23 | 149,275,239 | 46,440 | Dec. 27 | 157,132,366 | 44,100 | Dec. 29 | 140,435,406 |
| Twin City Rapid Transit Co. | 8 | 47,005 | Dec. 14 | 145,675,337 | 44,599 | Feb. 8 | 145,517,164 | 42,700 | Dec. 21 | 139,711,248 | 46,612 | Nov. 28 | 133,676,028 |
| Chicago, Milwaukee & St. Paul Ry. Co. | 9 | 12,000 | | 137,747,598 | | | | | | | | | |
| Kansas City Railways Co. | 10 | 40,200 | Dec. 12 | 123,830,190 | 43,500 | Jan. 13 | 129,804,772 | 51,740 | Jan. 8 | 189,172,898 | 49,430 | Oct. 27 | 211,707,571 |

* Purchased by Hydro-Electric Power Commission of Ontario on Nov. 1, 1922. Blank indicates that no report covering year was received.

the values of $D_1$ $H_1$ corresponding to the location of the point under consideration and the point on the $H_1$ scale representing the height of the focal point above this plane will cut the first axis in a point which projected by another index line drawn from the cp. (candlepower) scale will cut the $I_1$ scale at the resulting horizontal intensity.

In order to determine the intensities in the secondary plane, an index line should be drawn between the proper points on the $H_1$ and $H_2$ scales. This index line will cut the second axis line in a point which will be constant for all calculations between the two selected planes. By projecting the values on the $I_1$ scale through this point to the $I_2$ scale, the resulting intensities in the secondary plane may be directly read off. It should, however, be remembered that these corresponding intensities are not above each other on the two planes, but on the same light beam, and for this reason the location of the corresponding points should be determined by drawing up on a piece of paper two horizontal lines representing the two planes, in a suitable scale, and projecting the selected points on the primary plane to the secondary plane from the focal point of the unit.

As may be seen from the above explanation, the chart may be used in either direction. Problems of determining the proper height of the fixture or determining the necessary candlepower values for the unit can be solved almost instantly, without the use of any tables, and with an accuracy which is very close to that of methods involving calculations.

# Eight Systems with Output of 1,000,000,000 Kw. in 1922

### "Electrical World" Survey Indicates, Besides, that Last Year Ninety-two Companies of the United States and Canada Reported Individual Outputs Exceeding 100,000,000 Kw.-Hr.

IN LINE with its policy of keeping in intimate touch with the operations of the central generating plants of the country, the ELECTRICAL WORLD has just completed a survey of the electric generating and distributing companies of the United States and Canada having a total output in excess of a hundred million kilowatt-hours during 1922. A similar survey undertaken during past years indicated that in 1919 there were six companies distributing in excess of a billion kilowatt-hours, in 1920 nine such companies, and in 1921 only five. The present investigation indicates that eight electric light and power companies distributed over a billion kilowatt-hours last year. Of these eight systems, six were operating in the United States and two in Canada. There were also six other systems whose output was very close to the billion mark.

Table I is believed to be a complete list of the electric light and power companies and electric railway companies of the United States and Canada with an output in excess of 100,000,000 kw.-hr. during 1922, giving also their total output and the amount and date of their peak load. Table II lists these companies by sections of the country and gives the proportion of the output which was generated, the proportion purchased and also the distribution of the energy.

Ninety-two electric light and power systems and ten electric railway systems reported an output in excess

## Table II—1922 Detailed Output and Distribution Data for North American Systems

| Section and System | Generated and Purchased Output, in Kilowatt-Hours | | | Distribution of Energy, in Kilowatt-Hours | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total Output | Generated | Purchased | Light | Power | Light and Power | Electric Railways | Other Public Utilities | Inter-Company Business and Line Losses, Etc. |
| **New England States** | | | | | | | | | |
| New England Power Co. | 469,993,180 | 255,641,165 | 214,352,015 | None | 170,067,397 | 170,067,397 | 37,556,495 | 192,580,447 | 69,788,841 |
| Edison Electric Ill. Co. of Boston | 439,448,099 | 419,816,900 | 19,631,199 | ........ | ........ | 281,718,732 | 9,417,886 | 46,898,768 | 101,412,713 |
| Narragansett Electric Light Co. | 297,400,000 | 277,900,000 | 19,500,000 | 30,300,000 | 81,200,000 | 111,500,000 | 422,000 | None | 185,478,000 |
| Turners Falls Pwr. & Elec. Co. | 201,796,000 | 174,550,000 | 27,246,000 | None | 67,055,000 | 67,055,000 | 27,488,000 | 84,306,000 | 22,947,000 |
| Connecticut Light & Power Co. | 158,371,247 | 121,617,882 | 36,753,365 | 22,029,026 | 68,781,996 | 90,811,022 | 19,838,695 | 12,708,874 | 35,012,656 |
| Hartford Electric Light Co. | 134,000,000 | 127,000,000 | 7,000,000 | 30,000,000 | 49,000,000 | 79,000,000 | None | 40,000,000 | 15,000,000 |
| Central Maine Power Co. | 128,445,419 | 115,338,118 | 13,107,301 | 20,154,415 | 59,936,489 | 80,090,904 | 12,435,105 | None | 35,919,410 |
| New Bedford G. & Edison Lt. Co. | 115,938,294 | 115,938,294 | None | 8,704,215 | 81,464,693 | 90,168,908 | 13,269,200 | None | 12,500,186 |
| Blackstone Valley Gas & Elec. Co. | (s) 110,225,488 | 63,599,042 | 46,626,446 | ........ | ........ | 77,736,527 | 4,227,680 | 9,829,860 | 18,431,421 |
| **Middle Atlantic States** | | | | | | | | | |
| Niagara Falls Power Co. | 2,252,249,000 | 2,252,249,000 | None | None | 1,228,918,000 | 1,228,918,000 | 7,116,000 | 897,219,000 | 118,996,000 |
| N. Y. Edison Co. and United Electric Light & Power Co. | 1,659,269,781 | 1,659,249,981 | 19,800 | ........ | ........ | 931,933,806 | 221,511,516 | 12,000,553 | 493,823,906 |
| Public Service Elec. Co. | 958,407,194 | 939,413,040 | 18,994,154 | 200,415,938 | 332,074,985 | 532,490,923 | 213,317,893 | 533,840 | 212,064,538 |
| Philadelphia Elec. Co. | 956,910,225 | 956,910,225 | None | 210,951,724 | 331,171,316 | 542,123,040 | 266,271,402 | 16,347,500 | 132,168,283 |
| Duquesne Light Co. | 858,329,336 | 845,228,690 | 13,100,646 | 177,738,226 | 291,833,319 | 469,571,545 | 225,288,009 | 32,619,316 | 130,850,466 |
| West Penn Power Co. | (a) 634,674,505 | 631,767,550 | 2,906,955 | 53,071,715 | 403,659,376 | 456,731,091 | 53,542,747 | 9,446,691 | 114,953,976 |
| Buffalo General Elec. Co. | 587,682,340 | 95,560,300 | 492,122,040 | 118,552,856 | 319,652,173 | 438,205,029 | 62,429,500 | None | 87,047,811 |
| Niagara, Lockport & Ontario Power Co. | 552,035,090 | 124,827,196 | 427,207,894 | ........ | ........ | 107,099,056 | 84,965,319 | 292,812,827 | 67,157,888 |
| Brooklyn Edison Co. | 516,987,870 | 510,009,000 | 6,978,870 | 167,863,916 | 205,154,534 | 373,018,450 | 1,809,300 | 6,404,550 | 135,755,571 |
| Pennsylvania Power & Light Co. | 495,344,612 | 407,274,915 | 88,069,697 | 46,118,740 | 307,639,612 | 353,758,352 | None | 79,502,206 | 62,084,054 |
| Pennsylvania Water & Power Co. | 373,341,800 | 373,341,800 | None | None | None | None | None | 334,335,100 | 39,006,700 |
| Adirondack Power & Light Corp. | 304,997,551 | 251,336,281 | 53,661,270 | 25,663,429 | 101,939,578 | 127,603,007 | 89,654,099 | 27,884,690 | 59,855,755 |
| Rochester Gas & Elec. Corp. | 193,503,573 | 177,058,214 | 33,610,202 | 73,695,740 | 49,491,040 | 123,186,780 | 40,220,220 | 7,206,730 | 22,889,843 |
| Metropolitan Edison Co. | 127,315,007 | 117,037,540 | 10,277,467 | 12,975,564 | 52,040,760 | 65,016,324 | 24,116,246 | 18,273,839 | 19,908,598 |
| Scranton Elec. Co. | 126,207,493 | 118,839,497 | 7,367,996 | ........ | ........ | ........ | ........ | ........ | ........ |
| Syracuse Lighting Co. | 124,457,748 | 440,486 | 124,017,262 | 22,390,673 | 84,142,891 | 106,533,564 | 2,197,983 | 3,169,120 | 12,557,081 |
| N. Y. & Queens Electric Light & Power Co. | 120,011,093 | 2,828,720 | 117,182,373 | 43,439,703 | 54,349,625 | 97,789,328 | 2,829,850 | None | 19,391,915 |
| Cohoes Power & Light Corp. | 103,195,985 | 102,179,570 | 1,016,415 | 1,962,202 | 44,941,031 | 46,903,233 | None | 46,872,893 | 9,419,859 |
| **South Atlantic States** | | | | | | | | | |
| Southern Power Co. | 910,488,432 | 828,689,140 | 81,799,292 | ........ | ........ | 582,257,032 | 12,953,342 | 137,349,945 | 177,928,113 |
| Consolidated Gas, Electric Light & Power Co. of Baltimore | 568,669,404 | 320,327,104 | 248,342,300 | (b) 96,209,311 | (c) 262,041,626 | 358,250,937 | 143,627,887 | None | 66,790,580 |
| Georgia Railway & Power Co. | 317,068,699 | 269,874,299 | 47,194,400 | 37,954,723 | 115,181,946 | 153,136,669 | 55,320,357 | 51,268,426 | 57,343,247 |
| Potomac Electric Power Co. | 251,984,618 | 251,979,077 | 5,541 | 74,903,160 | 41,886,773 | 116,789,933 | 89,798,929 | 2,500,609 | 42,895,147 |
| Virginia Railway & Power Co. | 230,293,745 | 214,051,055 | 16,242,690 | ........ | ........ | 140,847,022 | 51,099,763 | None | 38,346,960 |
| Appalachian Power Co. | 205,447,368 | 203,657,968 | 1,789,400 | 4,710,356 | 163,616,676 | 168,327,032 | None | 485,230 | 36,635,106 |
| Yadkin River Power Co. | 142,161,182 | 77,217,950 | 64,943,232 | 1,398,399 | 25,307,754 | 26,706,153 | None | 91,376,883 | 24,078,146 |
| **East North Central States** | | | | | | | | | |
| Commonwealth Edison Co. | 2,225,442,875 | 2,207,635,533 | 17,807,342 | (d) 598,229,859 | 555,318,807 | 1,153,548,666 | 735,246,576 | 73,884,430 | 262,763,203 |
| Detroit Edison Co. | 1,105,211,100 | 1,105,210,100 | 1,000 | 221,628,400 | 521,055,500 | 742,683,900 | 123,577,400 | 30,152,200 | 208,797,600 |
| Cleveland Electric Ill. Co. | 688,149,162 | 688,149,162 | None | (e) 119,773,212 | 329,266,124 | 449,039,336 | 138,211,097 | 5,474,950 | 95,423,779 |
| Consumers' Power Co. | 461,840,561 | 442,423,193 | 19,417,368 | 78,686,402 | 201,577,987 | 280,264,389 | 64,596,758 | 1,288,524 | 115,690,890 |
| North American Co. (Wisc. Sys.) | 458,405,215 | 395,963,393 | 62,441,822 | 91,876,579 | 184,861,240 | 276,737,819 | 90,808,258 | 20,763,861 | 70,095,277 |
| Union Gas & Electric Co. | 366,071,350 | 366,071,350 | None | (f) 60,317,902 | 142,154,706 | 202,472,608 | 47,451,884 | 44,159,089 | 71,987,769 |
| Public Service Co. of No. Illinois | (g) 362,220,201 | 366,843,534 | 70,940,377 | (h) 52,972,338 | (i) 152,690,132 | 205,662,470 | 43,276,362 | 42,195,650 | 71,085,719 |
| Ohio Public Service Co. | 316,838,000 | 264,081,000 | 52,757,000 | 24,890,000 | 238,362,000 | 263,252,000 | None | (j) 22,711,000 | 30,875,000 |
| Pennsylvania-Ohio Electric Co. | 276,936,464 | 275,519,815 | 1,416,649 | 37,693,199 | 155,807,457 | 193,500,656 | 36,921,101 | 13,843,768 | 32,670,939 |
| Michigan Northern Power Co. | 246,175,203 | 246,175,203 | None | 3,251 | 245,190,209 | 245,193,460 | 626,100 | None | 355,643 |
| Northern Ohio Electric Corp. | 232,684,874 | 138,634,600 | 94,050,274 | 33,256,445 | (k) 89,369,939 | 122,626,384 | 48,920,798 | (l) 12,770,802 | 48,366,890 |
| Toledo Edison Co. | 215,785,945 | 215,785,945 | None | 44,680,870 | 84,772,380 | 129,453,250 | 51,457,000 | 1,448,280 | 33,427,415 |
| Columbus Ry. Power & Light Co. | 187,785,967 | 187,785,967 | None | 14,462,439 | 99,507,397 | 113,969,836 | 694,977 | None | 73,121,154 |
| Northwest Utilities Co. | 163,902,506 | 134,973,837 | 28,928,669 | 6,131,134 | 11,371,764 | 17,502,898 | None | 125,950,004 | 20,449,604 |
| Dayton Power & Light Co. | 159,836,687 | 159,836,687 | None | 28,462,525 | 73,809,845 | 102,272,370 | 26,249,617 | 4,216,430 | 27,098,270 |
| Indianapolis Light & Heat Co. | 138,356,280 | 138,356,280 | None | 14,818,834 | 83,929,740 | 98,748,574 | None | 9,816,510 | 29,791,196 |
| Indiana & Michigan Electric Co. | 136,825,060 | 136,825,060 | None | ( ) 17,035,919 | 56,865,944 | 73,901,863 | 12,145,652 | 26,714,346 | 24,063,199 |
| United Light & Railways Co. | 129,236,964 | 94,526,209 | 34,710,755 | 28,479,857 | 52,908,151 | 81,388,008 | 25,068,051 | 4,402,395 | 18,378,510 |
| Central Illinois Public Service Co. | 128,345,120 | 79,068,880 | 49,276,240 | 21,974,124 | 50,343,060 | 72,317,184 | None | 12,597,950 | 43,429,986 |
| Cleveland Munic. Elec. Lt. Sys. | 116,355,460 | 116,355,460 | None | ........ | ........ | ........ | ........ | ........ | ........ |
| **West North Central States** | | | | | | | | | |
| Mississippi River Power Co. | 619,837,527 | 612,450,500 | 7,387,027 | None | 124,157,118 | 124,157,118 | None | 435,590,258 | 60,090,151 |
| North American Co. (Missouri System) | 554,551,123 | 263,351,244 | 291,199,879 | 120,267,711 | 181,798,524 | 302,066,235 | 3,297,678 | 179,181,811 | 70,005,399 |
| Minneapolis General Electric Co. | 425,916,891 | 376,763,221 | 49,153,670 | 97,134,650 | 175,653,983 | 272,788,633 | 1,098,310 | 72,392,699 | 79,637,249 |
| Kansas City Power & Light Co. | 253,305,000 | 252,874,000 | 431,000 | 71,903,000 | 121,076,000 | 192,979,000 | None | 13,248,000 | 47,078,000 |
| Great Northern Power Co. | 204,080,336 | 184,894,300 | 19,186,036 | 45,141,385 | 101,818,363 | 146,959,748 | 20,019,551 | (o) None | 37,101,037 |
| Empire District Electric Co. | 145,990,000 | 134,924,000 | 11,066,000 | 8,363,000 | 76,428,000 | 84,791,000 | 11,330,000 | 15,396,000 | 34,473,000 |
| Nebraska Power Co. | 140,272,500 | 140,272,500 | None | 41,342,465 | 58,816,176 | 100,158,641 | None | 20,320,717 | 19,793,142 |
| Kansas Gas & Electric Co. | 139,167,200 | 123,771,400 | 15,395,800 | 24,473,528 | 78,135,016 | 102,608,543 | None | 14,019,185 | 22,539,472 |
| **East South Central States** | | | | | | | | | |
| Alabama Power Co. | 607,133,242 | (p) 601,961,130 | 5,172,112 | 8,844,888 | 291,586,183 | 300,431,071 | (q) | 211,483,168 | 95,219,003 |
| Tennessee Electric Power Co. | 353,320,559 | 347,821,459 | 5,499,100 | 10,939,511 | 122,983,081 | 133,922,592 | 12,076,167 | 158,422,582 | 48,899,218 |
| **West South Central States** | | | | | | | | | |
| New Orleans Public Service, Inc. | 188,000,000 | 188,000,000 | None | 34,000,000 | 45,000,000 | 79,000,000 | 42,000,000 | 28,000,000 | 39,000,000 |
| Texas Power & Light Co. | 183,536,613 | 60,517,540 | 123,019,073 | 19,565,765 | 68,270,720 | 87,836,485 | None | 63,032,708 | 32,667,420 |
| Fort Worth Power & Light Co. | 178,790,374 | 178,710,000 | 80,374 | 15,035,704 | 34,766,421 | 49,802,125 | None | 119,656,805 | 9,331,444 |
| Houston Light & Power Co. | 108,646,517 | 108,640,561 | 5,956 | 22,428,869 | 67,466,326 | 89,895,195 | None | 775,320 | 17,976,002 |
| **Mountain States** | | | | | | | | | |
| Montana Power Co. | 963,662,660 | 963,662,660 | None | 29,283,805 | 672,389,122 | 696,672,927 | 115,296,757 | 15,789,108 | 135,903,868 |
| Utah Power & Light Co. | 428,962,903 | 428,306,173 | 656,730 | 43,878,007 | 250,743,342 | 294,621,349 | None | 57,070,291 | 77,271,263 |
| Idaho Power Co. | 212,237,000 | 203,489,000 | 8,748,000 | 75,271,393 | 76,102,857 | 151,374,250 | (q) | 10,065,683 | 50,797,063 |
| Colorado Power Co. | 116,711,939 | 116,526,059 | 185,880 | 4,040,006 | 23,226,399 | 27,266,405 | 6,106,200 | 67,504,147 | 15,835,187 |
| Denver Gas & Electric Co. | 102,631,000 | 47,667,000 | 54,964,000 | 50,981,000 | 30,944,000 | 81,925,000 | None | None | 20,706,000 |
| **Pacific States** | | | | | | | | | |
| Pacific Gas & Electric Co. | 1,608,940,735 | 1,372,486,323 | 236,454,412 | 159,493,472 | 537,041,748 | 696,535,220 | 246,868,669 | 154,719,110 | 510,817,736 |
| Southern California Edison Co. | 1,198,926,369 | 1,131,422,133 | 67,504,236 | 71,484,750 | 388,812,361 | 460,297,111 | 283,411,584 | 157,324,993 | 297,892,681 |
| Great Western Power Co. | 572,693,958 | 555,143,180 | 17,550,778 | 55,938,977 | 218,297,138 | 274,236,115 | 28,474,234 | 107,089,605 | 162,894,004 |
| Puget Sound Power & Light Co. | 474,042,886 | 415,167,721 | 58,875,165 | ........ | ........ | 371,445,234 | 34,427,029 | None | 68,170,623 |
| San Joaquin Light & Power Co. | 451,390,040 | 451,212,600 | 177,440 | 35,284,975 | 227,181,530 | 262,466,405 | 4,360,228 | 103,556,901 | 81,006,406 |
| Washington Water Power Co. | 407,657,100 | 407,657,100 | None | ........ | ........ | 201,420,831 | 52,413,544 | 84,755,024 | 69,067,701 |
| Portland Ry. Light & Power Co. | 324,116,790 | 323,645,100 | 471,690 | 43,623,410 | 114,139,458 | 157,762,868 | 84,369,572 | 4,207,195 | 77,777,155 |
| Los Angeles Bureau of Pwr. & Lt. | 318,502,702 | 247,747,650 | 70,755,052 | 70,550,163 | 119,769,081 | 190,319,244 | None | 65,575,844 | 61,122,021 |
| Southern Sierras Power Co., & Nevada-California Power Co. | 186,671,850 | 186,259,800 | 412,050 | 6,315,296 | 116,333,596 | 122,648,892 | None | 5,956,605 | 58,066,353 |

## Table II (Continued)

| Section and System | Generated and Purchased Output in Kilowatt-Hours: Total Output | Generated | Purchased | Distribution of Energy, in Kilowatt-Hours: Light | Power | Light and Power | Electric Railways | Other Public Utilities | Inter-Company Business and Line Losses, Etc. |
|---|---|---|---|---|---|---|---|---|---|
| California Oregon Power Co...... | 131,293,165 | 130,124,154 | 1,169,011 | 10,631,861 | 29,290,664 | 39,922,525 | None | 55,289,773 | 36,080,867 |
| Northwestern Electric Co........ | 120,698,840 | 118,276,300 | 2,422,540 | 16,761,409 | 75,306,475 | 92,067,884 | None | 955,290 | 27,675,666 |
| Tacoma Municipal Elec. Lt. Sys.. | 112,546,832 | 104,369,812 | 8,177,020 | 83,535,930 | 53,142,551 | 86,678,481 | 1,189,171 | 701,168 | 23,978,012 |
| **Canada** | | | | | | | | | |
| Hydro-Elec. Pwr. Comm. of Ont.. | 2,392,092,267 | 1,986,469,720 | 405,622,547 | ...... | ...... | ...... | ...... | ...... | ...... |
| Shawinigan Water & Power Co.. | 1,383,390,773 | 1,056,440,673 | 326,950,100 | ...... | ...... | 986,416,767 | (r) | 273,881,292 | 123,092,714 |
| Ontario Power Co............. | 994,000,000 | 732,040,000 | 261,960,000 | None | 308,170,000 | 308,170,000 | None | 685,830,000 | (t) |
| Montreal Light, Heat & Power Co. | 945,200,656 | 713,400,020 | 231,800,636 | ...... | ...... | 900,000,000 | 45,200,656 | None | (t) |
| Winnipeg Municipal Hydro-Electric System.............. | 144,509,000 | 144,509,000 | None | 77,670,248 | 36,295,883 | 113,966,131 | None | 3,512,000 | 26,972,769 |
| **Electric Railway Cos.** | | | | | | | | | |
| Interborough Rapid Transit Co... | 886,223,920 | 885,919,380 | 304,540 | None | 325,486 | 325,486 | 788,191,920 | None | 97,706,514 |
| Chicago Surface Lines.......... | 735,246,576 | None | 735,246,576 | ...... | ...... | ...... | ...... | ...... | ...... |
| Brooklyn Rapid Transit Co...... | 413,992,125 | 413,992,125 | None | None | None | None | ...... | None | ...... |
| Philadelphia Rapid Transit Co... | 346,506,580 | 116,686,993 | 229,819,587 | None | None | None | ...... | None | ...... |
| Boston Elevated Railways Co.... | 240,547,615 | 240,547,615 | | | | | | | |
| Pennsylvania Railroad Co....... | 214,906,725 | 212,399,800 | 2,506,925 | 3,435,530 | 2,012,828 | 5,448,358 | 128,726,650 | 38,720 | 80,692,997 |
| New York Central Railroad Co... | 157,450,819 | 157,450,819 | None | ...... | ...... | ...... | ...... | None | ...... |
| Twin City Rapid Transit Co..... | 145,675,337 | 97,483,549 | 48,191,788 | None | None | None | ...... | ...... | ...... |
| Chicago, Milwaukee & St. Paul Railway Co.............. | 137,747,598 | None | 137,747,598 | None | None | None | ...... | None | ...... |
| Kansas City Railway Co......... | 123,830,190 | 123,830,190 | None | None | None | None | ...... | 505,671 | ...... |

(a) Includes also certain affiliated companies known as the "West Penn System." (b) Reported as "Commercial and residential customers." (c) Reported as "industrial customers." (d) Includes power for electric appliances, which is estimated to be 42,509,000 kw.-hr. (e) Includes 8,327,726 kw.-hr. for municipal street lighting. (f) Includes 10,635,307 kw.-hr. for municipal street lighting. (g) Does not include 75,563,710 kw.-hr. generated at Blue Island station and prorated to the Commonwealth Edison Company. (h) Includes 174,475 kw.-hr. for lighting supplied by company in Commonwealth Edison territory. (i) Includes 16,127 kw.-hr. for power supplied by company in Commonwealth Edison territory. (j) Includes intercompany sales. (k) Includes combined light and power. (l) Includes energy sold to municipalities. (m) Includes 1,925,377 kw.-hr. for municipal lighting and 212,425 kw.-hr. for heating and cooking. (n) Includes 9,078,044 kw.-hr. distribution line losses, 13,696,832 transmission line losses, and 1,288,323 kw.-hr. used by company. (o) Included under "lighting." (p) 6,928,030 kw.-hr. generated at plant of Birmingham Light & Power Co., under joint operation. (q) Included under "Other Public Utilities." (r) Included under "Light and Power." (s) Includes Pawtucket and Woonsocket divisions. (t) Output metered at generating station.

of 100,000,000 kw.-hr. in 1922. The total output of these electric light and power companies was in excess of 41,000,000,000 kw.-hr. Deducting the output of the Canadian systems gives 35,577,290,423 kw.-hr. as the total output of the electric light and power companies in the United States having an annual output in excess of 100,000,000 kw.-hr. This would indicate that about 70 per cent of the total output of the central generating and distributing companies of this country is distributed by ninety-two systems.

The Niagara Falls Power Company leads the country, reporting a total output of 2,252,249,000 kw.-hr., all of which was generated at its own plants. The Commonwealth Edison Company of Chicago, which took the lead in 1921, is a close second, reporting as its output 2,225,442,875 kw.-hr., of which 99.25 per cent was generated in its own plants. The New York Edison Company and the United Electric Light & Power Company, combined, were third, displacing the Pacific Gas & Electric Company. The Hydro-Electric Power Commission of Ontario, however, reported the largest output of all systems in the world, with 2,392,092,267 kw.-hr.

The largest peak load was reported by the Commonwealth Edison Company of Chicago, with 600,000 kw. The New York Edison Company and the United Electric Light & Power Company combined had the second largest peak load, with 497,577 kw.

The larger electric generating and distributing companies are fairly well scattered over the country, although, of course, most numerous in the industrial sections. It is rather surprising that during the past two years only one system in the Mountain and Pacific States has entered the 100,000,000-kw.-hr. class as against thirteen Eastern companies. Also the intensely industrial New England section reports no company with an output in excess of 500,000,000 kw.-hr.

# Unusually High Operations During January

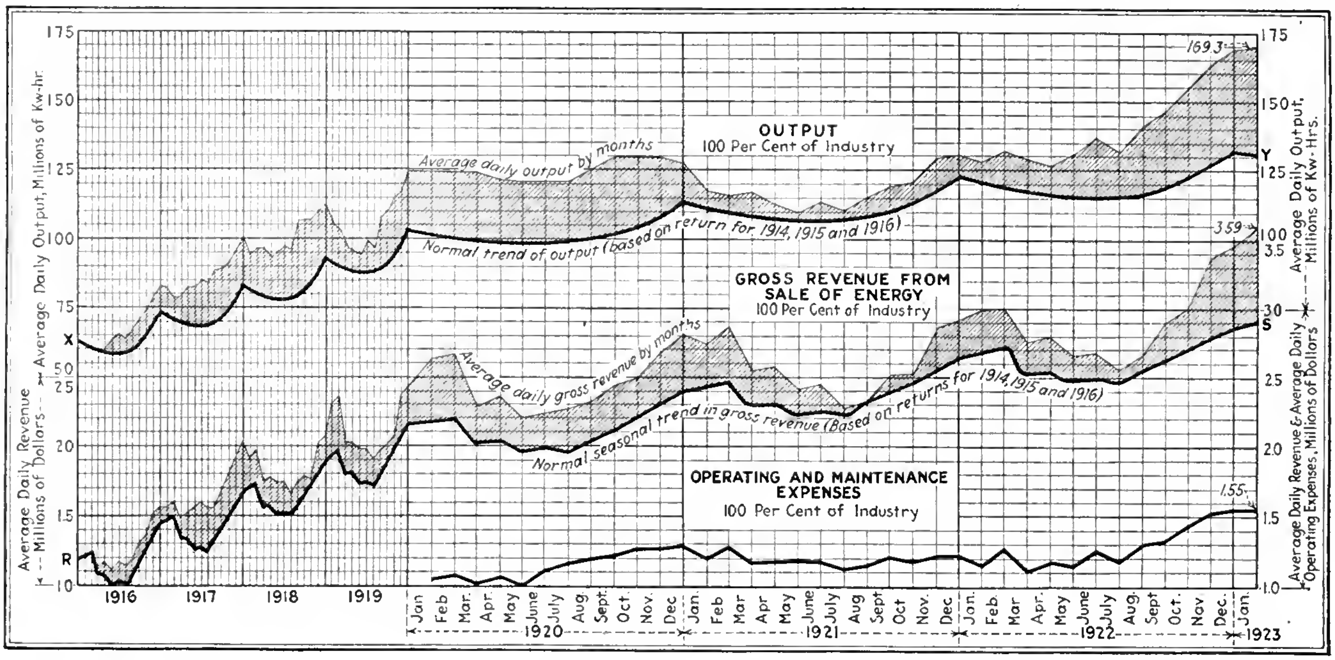
### Output for the First Month of the Year Totaled 5,245,000,000 Kw.-Hr., an Increase of 28.5 per Cent for the Twelve-Month Period

FOUR new records were hung up by the electric light and power industry during January. Reports for the month received by the ELECTRICAL WORLD from electric generating and distributing companies representing 78 per cent of the installed generator rating of the country indicate that the average daily output was 169,290,000 kw.-hr. This exceeded the previous record, made during December, by 1,232,000 kw.-hr. In addition, the total output for the month of January was 5,245,000,000 kw.-hr., which exceeded the former high monthly figure, set during December,

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

| Mos. | Percentage of Installed Ratings Represented | Kw.-Hr. Output (Companies Reporting): 1922 Thousands | 1921 Thousands | Per Cent Increase | Percentage of Installed Ratings Represented | Revenue from the Sale of Energy (Companies Reporting): 1922 Thousands | 1921 Thousands | Per Cent Increase |
|---|---|---|---|---|---|---|---|---|
| Nov... | 81 | 3,964,299 | 3,208,870 | 23.6 | 75 | $75,909 | $65,203 | 16.4 |
| Dec... | 77 | 4,011,609 | 3,200,661 | 25.2 | 71 | 76,360 | 65,613 | 16.4 |
| | | 1923 | 1922 | | | 1923 | 1922 | |
| Jan... | 78 | 4,093,452 | 3,185,282 | 28.5 | 72 | 80,193 | 67,592 | 18.7 |

| Mos. | Percentage of Installed Ratings Represented | Operating and Maintenance Expenses (Companies reporting): 1922 Thousands of Dollars | 1921 Thousands of Dollars | Per Cent Increase | OPERATING RATIO: Steam Plants 1922 | Steam Plants 1921 | Hydro Plants 1922 | Hydro Plants 1921 | Combined Systems of Steam and Hydro 1922 | Combined 1921 |
|---|---|---|---|---|---|---|---|---|---|---|
| Nov... | 62 | 28,308 | 26,071 | 8.6 | 50.4 | 50.2 | 24.3 | 25.0 | 46.0 | 45.3 |
| Dec... | 59 | 28,784 | 23,687 | 21.5 | 49.3 | 48.3 | 29.7 | 27.7 | 48.8 | 46.2 |
| | | 1923 | 1922 | | 1923 | 1922 | 1923 | 1922 | 1923 | 1922 |
| Jan... | 59 | 28,486 | 23,050 | 23.6 | 47.3 | 45.3 | 23.8 | 23.4 | 45.3 | 43.1 |




by 45,000,000 kw.-hr. and the output reported for January, 1922, by 28.5 per cent. The second set of record figures reported by the central stations for the month of January is to be found in the revenue received from the sale of energy. The average daily revenue from the sale of energy during January was $3,590,000, which exceeded the previous record, made during December, by $123,000. In addition, the total gross revenue for the month of January totaled $111,300,000, which exceeded the previous record, made during December, by $3,800,000.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to the gross revenue from the sale of energy, shows that the industry is not in quite so good a position financially as it was this time last year. The operating ratio reported for January by companies having steam plants only, taken in the aggregate, was 47.3 per cent against 45.3 per cent for January of last year. It is encouraging to notice that the operating ratio has decreased from 56.6 per cent in August, or by about 9.3 per cent. Such a decrease in the operating ratio between winter and summer months is to be expected, however, on account of the relatively higher percentage of low-revenue industrial energy sold during the summer months. If the normal trend of past years is followed, the operating ratio should commence to increase with February on account of the decreasing high-revenue lighting load, but if the price of coal decreases during the spring months, it may be that the operating ratio will decrease to a lower point than that reached during January, nothwithstanding the decreased lighting requirements.

## Study of Street-Lighting Practice

THE study of street-lighting service undertaken by the Bureau of Standards several years ago but suspended in war time has been actively resumed. This study will cover street lighting in all its phases—gas, electric and other special types. The problems of design of street-lighting systems from the illuminating standpoint, the distribution of gas and electricity for street lighting, methods of operation and maintenance and the technical and engineering features of contracts for street-lighting service will be included. The results of this and other studies on the subject will be presented, if possible, in the form of a publication.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

| Month | Percentage of Installed Ratings Represented | New England States | | | Percentage of Installed Ratings Represented | Atlantic States | | | Percentage of Installed Ratings Represented | North Central States | | | Percentage of Installed Ratings Represented | South Central States | | | Percentage of Installed Ratings Represented | Pacific and Mountain -States | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1922 Thousands | 1921 Thousands | Per Cent Increase | | 1922 Thousands | 1921 Thousands | Per Cent Increase | | 1922 Thousands | 1921 Thousands | Per Cent Increase | | 1922 Thousands | 1921 Thousands | Per Cent Increase | | 1922 Thousands | 1921 Thousands | Per Cent Increase |
| KW.-HR. OUTPUT: | | | | | | | | | | | | | | | | | | | | |
| Nov. | 80 | 312,949 | 248,370 | 25.8 | 78 | 1,438,270 | 1,160,878 | 23.9 | 81 | 1,318,588 | 1,073,114 | 23.6 | 64 | 212,739 | 159,917 | 33.1 | 97 | 681,753 | 566,591 | 20.3 |
| Dec. | 82 | 338,419 | 255,657 | 32.4 | 76 | 1,507,025 | 1,213,409 | 24.2 | 74 | 1,251,239 | 997,922 | 25.4 | 62 | 210,897 | 165,922 | 27.2 | 93 | 704,029 | 567,751 | 24.0 |
| 1923 | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | |
| Jan. | 86 | 327,292 | 252,245 | 29.8 | 76 | 1,549,604 | 1,196,898 | 29.4 | 73 | 1,304,444 | 1,008,032 | 29.6 | 63 | 206,408 | 155,148 | 33.0 | 94 | 705,204 | 572,959 | 23.2 |
| REVENUE: | | | | | | | | | | | | | | | | | | | | |
| Nov. | 80 | $7,244 | $6,875 | 12.6 | 23 | $28,579 | $24,363 | 12.3 | 69 | $23,659 | $20,037 | 18.2 | 62 | $5,022 | $4,330 | 16.0 | 96 | $10,905 | $9,598 | 13.6 |
| Dec. | 82 | 8,481 | 7,104 | 19.4 | 71 | 29,436 | 25,763 | 14.3 | 62 | 22,163 | 18,518 | 19.6 | 61 | 5,129 | 4,378 | 17.2 | 93 | 11,151 | 9,850 | 13.2 |
| 1923 | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | |
| Jan. | 86 | 8,624 | 7,275 | 18.5 | 71 | 31,637 | 26,285 | 18.1 | 62 | 23,453 | 18,835 | 24.5 | 62 | 5,173 | 4,478 | 15.5 | 94 | 11,306 | 10,219 | 10.6 |
| OPERATING EXPENSES: | | | | | | | | | | | | | | | | | | | | |
| Nov. | 52 | $2,545 | $2,161 | 17.7 | 54 | $8,942 | $7,806 | 14.6 | 57 | $10,540 | $8,468 | 24.4 | 62 | $2,597 | $2,178 | 19.3 | 94 | $3,684 | $3,537 | 4.1 |
| Dec. | 51 | 2,796 | 2,016 | 36.8 | 53 | 9,431 | 8,141 | 15.8 | 51 | 9,559 | 7,368 | 29.7 | 61 | 2,624 | 2,216 | 18.5 | 92 | 4,324 | 3,946 | 10.8 |
| 1923 | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | |
| Jan. | 52 | 2,432 | 2,033 | 19.7 | 55 | 9,525 | 8,013 | 18.9 | 51 | 9,737 | 7,359 | 32.3 | 62 | 2,550 | 2,052 | 24.2 | 93 | 4,242 | 3,593 | 18.0 |

# Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

## Rating of Electrical Apparatus

*To the Editors of the* ELECTRICAL WORLD:

In answer to your request for a commentary on the new British standard specifications, referred to in your issue of March 24, I would say that, in my opinion, they are a step forward in giving proper recognition to the requirements of the user. These requirements I shall attempt to cover in their essentials in the following notes.

The fundamental reason that eventually will make the double rating of electrical apparatus the accepted engineering and commercial standard is one which in the ultimate analysis directly affects only the user.*

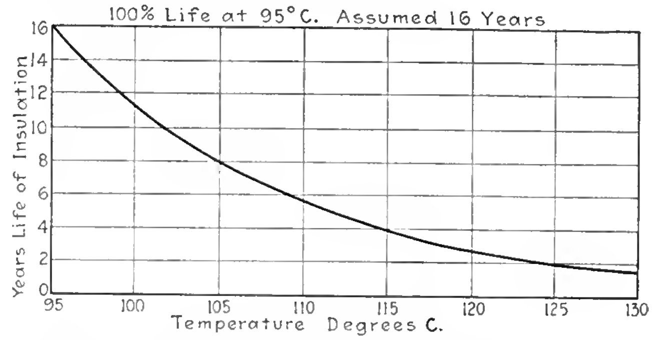
The maximum power capacity of an electrical machine is not a definite quantity representable by a single value, such as is the cubic-feet flow of water per second in a water-power plant. As a matter of fact, the power of most electrical apparatus may vary widely. It is therefore obvious that to make an intelligent application of the apparatus the user must know the limits of power which he may expect to obtain from a machine when unusual or unforeseen conditions are encountered. To illustrate with a few simple cases, the power engineer who is equipping a machine for sawing 2-in. planks will inform his client that if in an emergency he must saw a 3-in. plank the motor will have sufficient power to do his work safely. A distribution engineer planning a customer's service connection will provide not only transformers and cable connections capable of carrying continuously the estimated maximum load of the building, but also a liberal margin to meet unexpected larger demands, or even to carry the customer's load with a portion of the transformers and cable connections temporarily disconnected on account of failures of apparatus or other emergencies affecting the distributing system. The designer of a substation will similarly have to reckon that if he loses one of the transforming sets those remaining must have the capacity needed to carry the maximum load even if they should, for the time being, operate in excess of their normal load. These conditions are not the exception; they are the general rule for the great majority of power applications, since there are relatively very few applications where the maximum possible demand of power is strictly limited to a definite amount, as would be the case with a water-pumping set where the load was limited by both the speed and the head of water. If there should be no elasticity whatever beyond the rated capacity of the electrical apparatus in a substation, let us say, to meet emergencies or limited demands of short duration, it would in regular operation be equivalent to actually reducing the substation's capacity. It is evident that the operators would refrain from approaching the loading of the apparatus to the full rated capacity, as they would then have no safety margin left at all, and to provide for such margin on which they might be compelled to fall back at any time, they would actually reduce the maximum load which they would allow the station to carry to a certain amount below the rated capacity, thus providing at a sacrifice of operating capacity the necessary flexibility. There is, therefore, no question that the user must recognize those conditions of service which occasionally demand an increase in power over that nominally required. On this vital point rests the difficulty of the single rating.

If we choose to give a piece of apparatus only one rating, we are confronted with two alternatives:

(1) The rating may be conservative, but we then fail to inform the user of the extra capacity available for the occasional heavier load demands that are mentioned above.

(2) The rating we choose may approach the maximum capacity of which the apparatus is capable, but then the user, to provide the margin for the occasional heavier loads, must "derate" the apparatus; that is, he must select equipment of larger size in order to secure the margin of capacity required for his occasional heavier load demands.

Many will perhaps say that all apparatus will carry considerable overloads without breaking down, and that engineers of course figure in the back of their heads on such margins of capacity in motors, cables, transformers, etc. On the other hand, it seems that such haphazard procedure in figuring a margin of capacity to meet unavoidable temporary overloads is apt to be uneconomical and to lead to unsatisfactory or wasteful results.




CHARACTERISTIC LIFE OF ELECTRICAL INSULATION AS AFFECTED BY OPERATING TEMPERATURE

This curve indicates graphically that, other things being equal, a machine operating at 105 deg. C. will have a life only 50 per cent of that of a similar machine operating at 95 deg. C. From the curve we can calculate that if we operate a machine 90 per cent of the time at 95 deg. C. and the remaining 10 per cent of the time at 115 deg. C., the life of the machine will be 77 per cent of the virtual life at 95 deg. C. for 100 per cent of the time, and similarly that this 77 per cent of the virtual life would be more than 50 per cent longer than the life of machines operating 105 deg. C. for 100 per cent of the time.

The double rating undoubtedly gives the user a more satisfactory means of selecting his electrical apparatus to meet most economically both the normal and abnormal conditions of service.

The double rating was used the world over up to a few years ago. In this country it was largely abandoned during the period of the war, perhaps without any bestowal of the careful consideration which the importance of the change would have justified. Abroad somewhat similar steps were taken, but at least one large country—Great Britain—has recently arrived at the conclusion that the single rating is commercially impracticable, the users having definitely refused to adopt it.

*The present discussion specifically excludes steam and hydro turbo-alternators of large sizes, for which single rating was generally adopted long before the A. I. E. E. or the International Electrotechnical Commission adopted the single rating for any machines. The special reasons which led to that practice for turbo-alternators are still valid and the practice should be continued.

The original proponents of the single rating had in mind establishing a simple method of rating which would avoid the complications of measurements of temperature rise for two loads, i.e., normal load continuous and two-hour overload. They compromised by selecting the single rating at a point slightly lower than the overload limit of the double rating.

In selecting this compromise value they in effect boosted the old normal rating 15 per cent to 20 per cent and entirely dropped the overload rating. This naturally raised a strong protest from many consulting engineers, users and manufacturers who were dissatisfied with the lack of conservatism shown in the innovation.

The principal objection to the "normal and overload rating" arose from the fact that the percentage of overload and the period of its duration had never been standardized. In practice 25 per cent and sometimes 50 per cent overload was specified for periods of one, two or three hours, without stating the time intervals between overloads, so that it was very difficult to make comparisons between machines of different makes or from different countries. Hence it followed that the single rating as an international standard based on a uniform rise of temperature, which avoided all these complications, suddenly met with the favor of many, except for the criticism that the rise allowed for the single rating was too great and therefore not sufficiently conservative.

Returning now to the time when the double rating was universally practiced and having in mind the objections which made it unpopular, it is desirable to review afresh the whole problem and attempt to arrive at a new solution that may combine the advantages of both systems of rating.

This desirable solution can be reached readily if in our double rating we will omit the period in which the given overload will produce a specific temperature rise, but will prescribe that the overload rating shall refer to the ultimate temperature to be reached by the machine, regardless of whether it shall require one hour, or two or more, with the overload kept constant.

By this expedient the determination of temperature rise for overloads becomes exactly the same as for the normal load or, as a matter of fact, for the single-rating machine. To simplify the matter, the standard rules might specify for acceptance tests that only the overload tests should be required. This plan would overcome the original objections of the double rating. The plan is practicable and feasible for all classes of machines like motors, transformers, etc., and it is obviously proper to say that a motor having an overload rating of 25 hp. with an ultimate temperature rise of 55 deg. C. will not have to be of radically different design from a 20-hp., 40-deg. C. motor with two-hour overload at 25 hp. with 55 deg. C. There will be practically no differences for any rotating machine of any size where the time overload is two hours or more, for experience shows that within that period rotating machines in general reach within two or three degrees of the ultimate temperature, even in the case of the largest size units. For oil-cooled apparatus the time required to reach ultimate temperatures is more than two hours, but this fact will not handicap the plan suggested.

The suggestion of substituting the ultimate temperature rise for the overload rating is also justifiable from the advanced knowledge we have now of the relation between temperature and life of fibrous insulation. We know that treated fibrous insulation can withstand safely for short periods of time temperatures as high as 150 deg. and 160 deg. C., and that it can sustain continuously temperatures of 120 deg. C. for over two years without being destroyed. The characteristic life of a machine as affected by operating temperature of its insulation is represented by the curve reproduced. (See *A. I. E. E. Journal*, June, 1922, at page 446.)

This new knowledge of the properties of insulation gives us a new guide for the interpretation of the double rating of electrical machinery. It gives us the basis to rate the machines for normal load with a rise of temperature that will produce the longest and most economical life and for overloads with a rise that will not endanger the safe operation of the machine when carrying the occasional heavier load demands of the service as the demands arise. The meanings of the two ratings of normal load and overload are logically correlated to the practical requirements of the great majority of services of power application. With this clear understanding that in practice there exists a marked distinction between average or normal load of a service and the occasional maximum or overload requirements of power, the designer will direct his efforts to obtain the highest efficiency and highest power factor possible for the conditions of normal load and will tolerate relatively reduced efficiency for overloads, for which reduction in efficiency he will be allowed, without increased cost, to put into the machine more capacity for overloads than he would be able to obtain from the same amount of materials if used to produce a single-rating machine having the highest efficiency at that rating.

I think that the suggested plan will eliminate the enormous misunderstanding that has arisen from the hopeless attempt to consolidate in one compromise rating two things which are economically inconsistent with each other; that is, the capacity for normal load and the capacity for maximum load, each of which has a definite practical significance in application and service and which cannot both be economically and commercially covered by a single value. This is what has been attempted by the single rating. Without heat or prejudice let us now attempt to see whether the suggestion herein offered may not bring us all back to full mutual understanding.

PHILIP TORCHIO,
Chief Electrical Engineer.
New York Edison Company,
New York, N. Y.

## A Misleading Patent Note

*To the Editors of the* ELECTRICAL WORLD:

I read in the record of electrical patents in the ELECTRICAL WORLD for Feb. 24 the following entry: "1,444,620. Air-Motor-Driven Generator; E. Lunn, Chicago, Ill. App. filed Sept. 12, 1921. Wind-driven generator for charging airplane batteries."

I appreciate the fact that only the briefest kind of information relative to a patent can be given in such a short note, but in this case the entry is misleading in that the patent does not refer in any way to charging airplane batteries. It covers a combination of an air motor, an electrical generator and gearing between the motor and generator, the idea being to make a more efficient combination of these three elements than has heretofore been assembled. No reference is made as to how the current generated should be used.

Pullman, Ill. ERNEST LUNN.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Where the Money Goes in the Building of Transmission Lines

THE diagram shown on this page illustrates how each dollar was expended in securing and preparing transmission rights-of-way and in erecting the towers and stringing the conductors for an 80-mile section of double-circuit, 100,000-volt steel-tower line requiring six No. 2/0 conductors and one ⅜-in. steel ground wire. It is based on very careful records kept by an electric service company in the Southeast. The cost of the materials used is not included. While the cost per mile of line erected is not available for publication, it can be said that it is very low and agrees well with the average cost obtained on this system in erecting about 200 miles of similar circuits this year.

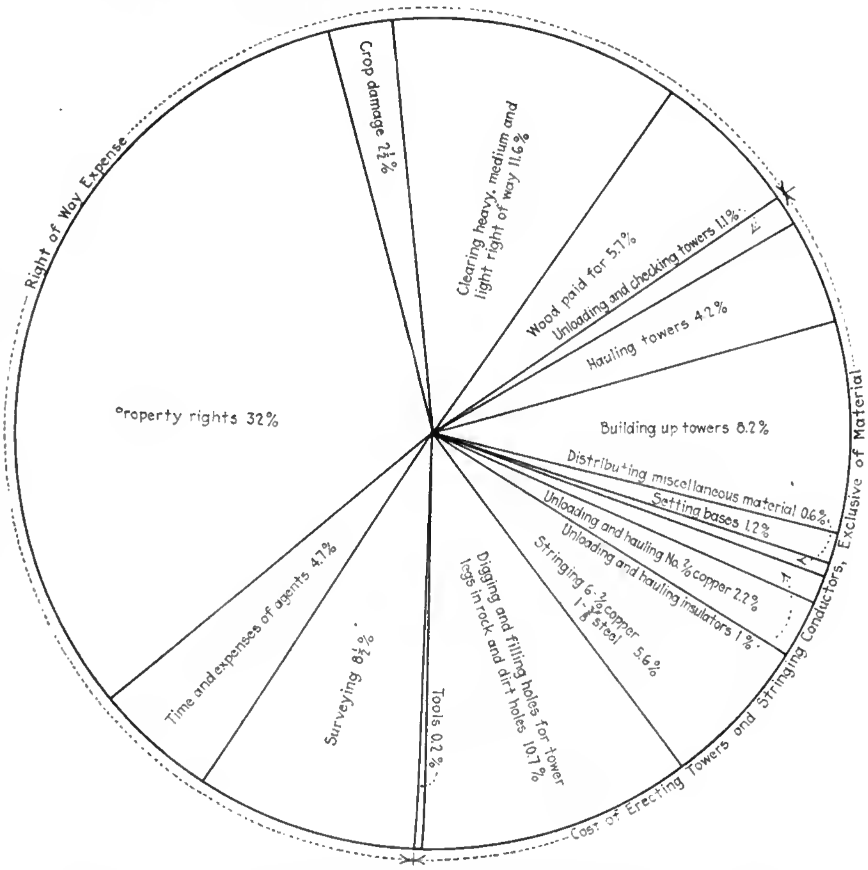
The figures for the right-of-way are a little unusual in that there was considerable difficulty in locating this particular line and therefore the item of surveying is almost double what it ordinarily is. The line also passes through rather heavily wooded country, and the item of clearing is considerably larger than usual. The expenses of the agents on this line were also high because of this heavy clearing.

The data on which this diagram is based were collected each day during the construction of the line and took into careful consideration the cost of labor for each item represented. Instead of lumping the camp expense, as is usually done, this expense was apportioned over the various phases of the work according to the amount of labor required for each phase.

It should be observed that the cost of no material is included; hence in determining what proportion each item of the expense bears to the total expense of constructing the transmission line it would be necessary to keep this in view. However, considering the items represented, it may be observed that property rights constitute 32 per cent of the total, clearing right-of-way 11.6 per cent, digging and filling holes for tower legs 10.7 per cent, surveying 8½ per cent, and building up towers 8.2 per cent. In regard to digging holes 22 per cent of the total number of poles were in solid granite, making it necessary to drill and shoot. All the remaining expenses are of less proportion, ranking in about the following order: Wood paid for, stringing conductors and ground wires, time and expenses of agents, hauling towers, crop damage, unloading and hauling copper conductors, setting bases, unloading and checking towers, unloading and hauling insulators, distributing miscellaneous material and tools.

The foregoing analysis indicates very closely where the greatest attention must be directed if the expenses of transmission and line construction are to be reduced.

The low cost of erecting the towers is attributed to the method employed. It is known as the unit method. Each gang for constructing these towers consisted of a foreman, two erecting crews of eight men each, one anchor setting crew of three men and sufficient men to dig and fill the holes with the anchors, the number depending upon the character of the soil encountered. One skilled and two unskilled laborers place the anchor. Templates were furnished, made up mostly of




RELATIVE COSTS OF SECURING AND PREPARING RIGHT-OF-WAY AND ERECTING TWO-CIRCUIT TOWERS (EXCLUSIVE OF MATERIALS)

Based on 80-mile section of double-circuit, 100,000-volt steel-tower line carrying six No. 2/0 conductors and one ⅜-in. steel ground wire.

tower members, but it was found that the anchors could be placed without the use of templates, and they were therefore seldom used. The surveying party placed one stake at the center location for each tower and one at each side in the direction of the line.

Instead of assembling each tower on the ground in the usual manner and then hoisting it, the towers were built up entirely from the ground. This was made possible by making the splices and connections so simple and at such places that they could be easily connected while working upon the tower. Each erecting crew had four ground men and four men who could work above ground. After the bottom section of the tower was completely erected the erection crew was augmented to eight men, one man working on each corner of the tower and four remaining on the ground. One ground man serves as a dead man for a guide line attachment to the top of the tower and another serves on a tag line attached to the piece to be raised. The two remaining ground men attach and hoist the various members by means of a single block and line connected to the top of the pole.

### CREW OF EIGHT MEN ERECTS THREE TOWERS A DAY

When the tower is completely assembled and the insulators are hung the four men who worked on the tower above ground start at the top and work down, tightening every bolt. The four ground men proceed to erect the first-story section of the next tower. After some experience one crew of eight men has erected as many as three towers per day.

On the particular line to which the diagram refers there were ten towers per mile on the average. The towers were specially designed and fabricated for this system of erection by the Riter-Conley Company.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

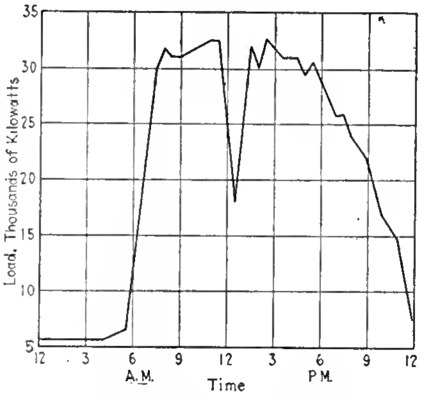
## Setting Poles with Earth-Boring Machines

THE Detroit Edison Company has had splendid success with earth-boring machines and finds that two such machines care for the extension needs of the whole system. Poles are assembled with arms and hardware in place, and recently four men, one machine and six back fillers placed 133 35-ft. poles in one day. In January about 1,800 poles were set, and the remodeled International earth-boring machines have given good service for several years.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Fuel Cost 72 per Cent of Production Expense

DESPITE the increase in output which features central-station development and the improvement in even peak-load curves apparent in many plants, fuel cost remains the chief burden of production expense.




INDUSTRIAL LOAD OVERCOMES HOLIDAY PEAK AND AIDS PLANT ECONOMY

The accompanying production costs of the Worcester (Mass.) Electric Light Company for the year 1922 are typical. The plant is about 50 miles inland with no tidewater facilities for fuel handling and has a present rating of 55,600 kva. Six Stirling, two Edge Moor and six Bigelow-Hornsby boilers are in service, the steam pressure being 200 lb. and the superheat 100 deg. F. Eight-retort and fourteen-retort Riley stokers are used on the later boilers, Taylors on older units and Cox stokers on equipment burning anthracite.

During the year the company burned 66,956 tons of bituminous coal at a cost of $7.752 per ton and 13,613 tons of anthracite at $4.52. Two 7,800-kva. and two 20,000-kva. turbine units are installed, and the station output for the year was 73,256,100 kw.-hr. Itemized production costs at the station are given in the accompanying table.

The maximum load on the plant was 32,600 kw. and the year's load factor 25.6 per cent. The production cost was 1.097 cents per kilowatt-hour, of which 7.93 mills represented fuel expense. The accompanying load curve, taken Dec. 22, 1922, emphasizes the importance of power business to this plant, which sold during the year more than 39,000,000 kw.-hr. for power as against slightly under 18,000,000 kw.-hr. for commercial lighting. About 9,000,000 kw.-hr. was purchased from other companies.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Frozen Water in Generator Loosens Laminations

THE article on "Generator Breakdown from Loose Laminations" in the Feb. 24 issue of the ELECTRICAL WORLD, page 461, recalls an expensive experience with same results but from a different cause. While replacing an obsolete and unsatisfactory horizontal turbine with another in one of the Malone Light & Power Company's stations it became necessary to move the generator from its foundation to one side of the building. This was done in the winter. The power house being built into the side of a rock bank the wheels had to be lowered through the roof. During this time bad weather was encountered, and in some way water was allowed to get into the generator, which froze to such an extent that, as was afterward determined, the laminations were forced apart, loosening them so that when the machine was put into operation trouble was experienced with grounded coils.

PRODUCTION EXPENSES FOR 1922 FOR A 55,600-KVA. STATION

| | Total Expense | Expense per Kw.-Hr., Cents | Per Cent of Total |
|---|---|---|---|
| Superintendence | $17,058 | 0.0233 | 2.13 |
| Boiler labor | 35,599 | 0.0486 | 4.44 |
| Turbine labor | 18,905 | 0.0258 | 2.37 |
| Electrical labor | 6,824 | 0.00933 | 0.86 |
| Miscellaneous labor | 7,109 | 0.0097 | 0.88 |
| Boiler fuel | 580,583 | 0.793 | 72.40 |
| Water for steam | 322 | 0.00044 | 0.04 |
| Lubricants | 3,653 | 0.00499 | 0.47 |
| Station supplies, etc. | 29,770 | 0.0406 | 3.75 |
| Maintenance: | | | |
| Station structures | 21,237 | 0.029 | 2.65 |
| Boiler-plant equipment | 31,059 | 0.0424 | 3.79 |
| Turbine units | 21,217 | 0.02895 | 2.65 |
| Generating equipment | 8,755 | 0.01185 | 1.09 |
| Accessory electrical equipment | 1,475 | 0.002015 | 0.02 |
| Miscellaneous equipment | 19,717 | 0.0269 | 2.46 |
| Total plant only, not including overhead | $803,288 | 1.097 | 100.00 |

During the twelve years this generator has been in operation we have never been able to stop the vibrating of the laminations, although it has been overhauled several times and once was completely rewound.

In reference to the articles appearing in the ELECTRICAL WORLD under the title "Extracts from an Operating Code," the writer feels that they are of great benefit to central-station men and have added a value to the paper which cannot be estimated.

S. G. HUNTER,
Operating Manager.
Malone Light & Power Company,
Malone, N. Y.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Wound-Rotor Induction Motor Generators

WHEN starting wound-rotor induction motor generators from the alternating-current side with starting resistance the secondary current is limited by connecting the starting resistance in series with the secondary winding. By transformer action this limiting of the secondary current limits the primary current to a safe value even with full voltage impressed on the primary. Moreover, as the speed increases the current decreases because of the effect of counter-electromotive force; therefore the resistance is cut out, step by step, until full speed is reached with all resistance cut out. In some cases after the starting resistance has been completely cut out the collector rings are short-circuited and the brushes raised.

For starting and shutting down this type of machine, the Philadelphia Electric Company has issued the following rules to be followed by its employees:

### STARTING

1. Make sure that the controller is in the starting position, and that the brushes are down on the rings.
2. Choose the alternating-current bus switch. The motor should then turn over.
3. As the speed of the motor increases cut out successively the steps of the starting resistance with the controller.
4. When running speed has been reached lift the brushes from the collector rings. This operation also short-circuits the rings by means of a short-circuiting bar.
5. After lifting the brushes, place the controller back in the starting position.
6. Close the generator field switch.
7. If the generator is compound-wound, close the equalizer switch.
8. Adjust the direct-current voltage to that of the bus and close the circuit breakers and the negative and positive machine switches.

### SHUTTING DOWN

1. Reduce the load on the machine to be taken off to as low a value as possible.
2. Trip the direct-current circuit breakers and the machine and equalizer switches.
3. Open the alternating-current bus switch.
4. Lower the brushes to the collector rings.

## Instructions for Taking a Boiler Off the Line

ACCORDING to the operating code of the Philadelphia Electric Company, points to be watched in taking a boiler out of service are (1) that the water does not get low after steaming has stopped and the fire is still burning; (2) that the boiler and setting are not cooled too rapidly, and (3) that all precautions are taken to block off outside sources of pressure, such as steam, feed water, blowdown and soot blowers, for the sake of personal safety and protection when the boiler is opened up. Following are the instructions for taking the boiler off the line:

1. Cut off the coal feed pipe.
2. Set the change-over valve on the waterback line for raw water.
3. Run the coal-feed pipes and hopper empty.
4. Cut off the stokers.
5. Shut off feed-water valves, keeping the water in sight above the nut on the gage glass.
6. After the coal in the furance is burned out, cut off all forced draft.
7. Shut off the spray line in clinker-crusher pit.
8. Stop both the induced and forced draft fans.
9. As the steam pressure drops shut the main stop valve.
10. Close the trap-line valve above the automatic non-return valve.
11. Lock the automatic non-return valve.
12. Open the vent valves on the superheater and open the drain valves between the main stop and automatic non-return valves.
13. Close the stack damper.
14. Shut off the waterback feed and discharge valves after the waterback soot chamber has been cleaned.
15. Empty the boiler through the blow-off valves when the setting has cooled. The superheater drain valves on the other boilers must be closed while this is being done.
16. When the boiler is empty, see that the safety stop valve in the blow-off line is closed and close all blow-off valves and cocks.
17. Hang danger signs on the main stop, main feed, blow-off valves and control board.

## Stimulating Initiative and Placing Responsibility

ASKED as to what he considered the best method of making men develop within a company, one department head of a central-station company, who is a very able organizer and supervisor of men, said: "It is getting them to think." This is not always as simple as it sounds, but he suggests one method which has extensive application.

Every company has its mishaps and interruptions to service in varying degrees. Instead of himself anticipating what may happen and how the trouble shall be handled, the department head referred to puts the responsibility up to the men or man who may have to handle the problem—sometimes the boiler-room foreman, sometimes the switchboard operator, etc. He asks each one to imagine what might happen and how he would handle the trouble if it developed. Even if the man to whom the responsibility is given does not use good judgment the first time, it has been found that the mental process may stimulate his imagination and that this plus experience will bring good judgment. The department head makes it a point to go over these suggestions with the originator personally to ascertain why certain conclusions were reached and, where judgment is erroneous, to draw out a better suggestion.

This method has been found not only to make the men think more clearly about their jobs and plan for future contingencies, which is always a benefit when emergencies arise, but it lessens the monotony of certain jobs and makes the men who fill them feel that, after all, they are more than automatons.

To force men to think along these lines this department head always takes up with the man in charge any serious interruption or trouble after it has been cleared and reviews the situation to make certain that any lessons to be learned are absorbed. He also impresses it upon the men that avoidable interruptions are charged against them and that these interruptions can be minimized by constantly thinking over what may happen and how it shall be handled.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Park Cable Used Throughout St. Louis Parks

BY MEANS of buried or "park" cable the city of St. Louis has recently completed the work of supplying electricity to more than 3,400 ornamental lighting posts along the highways of its park system. These cables are single-conductor, insulated with 30 per cent rubber compound for 1,500 volts, and are protected against moisture by lead sheathing and against mechanical injury by spirally wound steel-tape armor. The trench in which the cables are buried is 2 ft. deep.

An unusual feature of this extensive installation is the fact that the trenches were dug with caterpillar trenching machines. The conditions in the parks are almost ideal for the efficient operation of such machines, and as almost 800,000 ft. of trench was dug, the economy was very substantial. Another interesting feature was the method of mounting six reels on a motor truck and paying out the cable as the truck slowly progressed along the line of the trench. The manner in which this was accomplished is shown in the composite picture on the front cover. The other photographs show the caterpillar trenching machine in operation and a view of a completed post.

It may be wondered why it should take nearly 800,000 ft. of trench and cable for 3,400 posts. This is because a separate cable has been provided for each side of the road, forming two independent series circuits, so that if anything happens to one circuit there will still be lights on the other side. Where the roads curve the lights are all placed on the outside of the bend and connected to the two cables in such a manner that only alternate lights will be extinguished if either of the circuits fails. It is evident that the city engineer is a progressive advocate of safe highways and means to guard against accidents due to insufficient lighting.

COST OF INSTALLING STREET-LIGHTING SYSTEM WITH 3,423 POSTS

| | Cost per Post |
|---|---|
| Labor cost of trenching, laying in cable, filling in, digging post holes, setting and equipping posts, splicing, boring under streets where necessary, repairing road surfaces and curbs, fitting up substations, etc. | $35.44 |
| Posts (made by city) | 15.23 |
| General warehouse expense, including electrical work on poles and switchboards, painting, loading and unloading, etc. | 3.23 |
| Cost of cable | 40.00 |
| Total cost per post (average of 3,423) | $93.90 |

That this method of lighting is not excessively expensive for a permanent installation where safety and appearance are of prime importance is shown by the costs in the accompanying table. The figure—$93.90 per post—includes everything except the cost of transformers and transformer houses.

The reasonableness of this figure is largely due to the low cost of trenching and laying the cable in the trench and the careful study of details. For instance, it was found that a saving of $2 per post could be effected by stripping the armor off the park cable and running it directly to the top of each post instead of using special wire in the posts. This not only eliminated two splices at the bottom of each post but also did away with the necessity of making an excavation at the base of each post large enough for a splicer to work in.

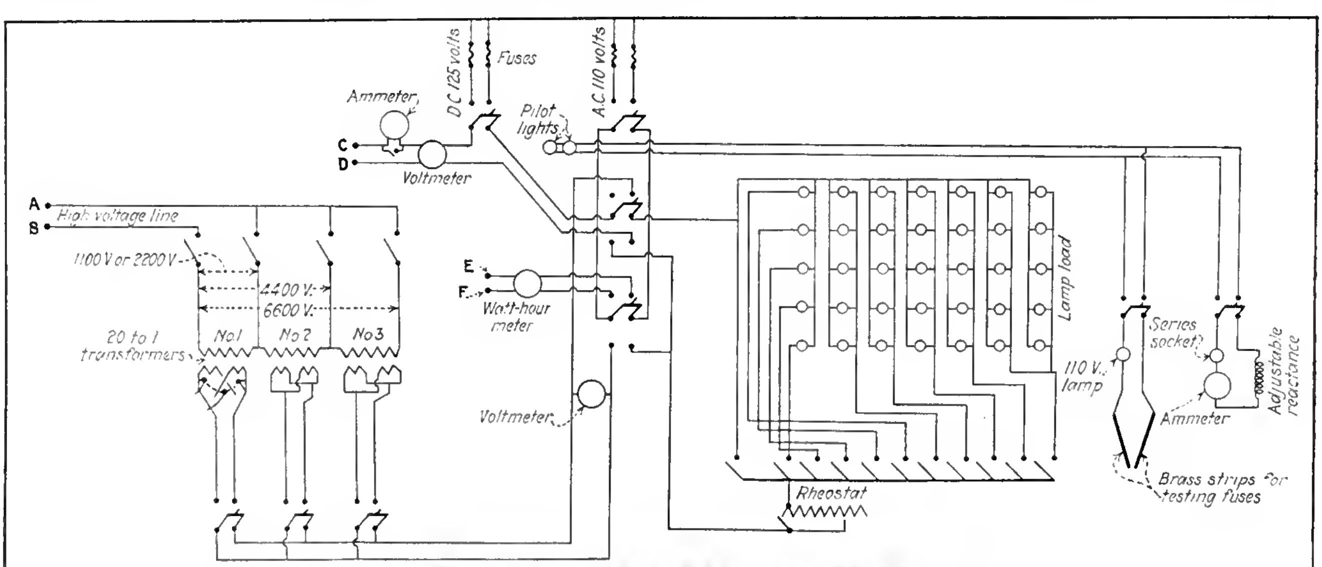
F. A. WESTBROOK,
Field Engineer.
Habirshaw Electric Cable Company,
Yonkers, N. Y.

## Transformer Testing Apparatus

### Panel Developed by Stamford Gas & Electric Company Utilized to Test Equipment in Minimum Time Has Worked Out Very Successfully

A TEST board for transformers, arc lights, etc., that has been in use by the Stamford (Conn.) Gas & Electric Company for several years and has proved very satisfactory is shown in the accompanying illustrations. The equipment is made up of standard wiring parts (sockets, snap and knife switches, etc.), three small line transformers and a home-made adjustable reactance coil for incandescent-street-lamp work. At the left of the diagram is shown the arrangement of the three 10 to 1 or 20 to 1 transformers, which, being energized from the 110-volt alternating-current source, can give 1,100, 2,200, 4,400 or 6,600 volts pressures for transformers or other insulation testing at the terminals *AB*.

At the right of the diagram and having the terminals *EF* is an in-




PANEL LAYOUT FOR TESTING TRANSFORMERS, STREET LIGHTS AND FUSES

tegrating kilowatt-hour meter which is used for obtaining the transformer no-load losses. There are two sources of energy supply, one service being at 125 volts direct current and the other at 110 volts alternating current. The former is used primarily for the testing and adjustment of magnetite-arc lamps and can be supplied at the terminals *CD* either at 125 volts or at a voltage controlled by the lamp load. This lamp load can also be inserted in the line feeding the testing transformers to limit the current on the breaking-down test for insulation. At the bottom of the lamp-load diagram is shown a small adjustable rheostat used for accurate voltage adjustment in setting the shunt-coil lift on direct-current arc lamps. At the right of the lamp bank is a device for testing cartridge fuses, and at the extreme right is an adjustable reactor for testing series alternating-current lamps and street-lighting transformers.

### All Transformers Passing Through Storeroom Tested

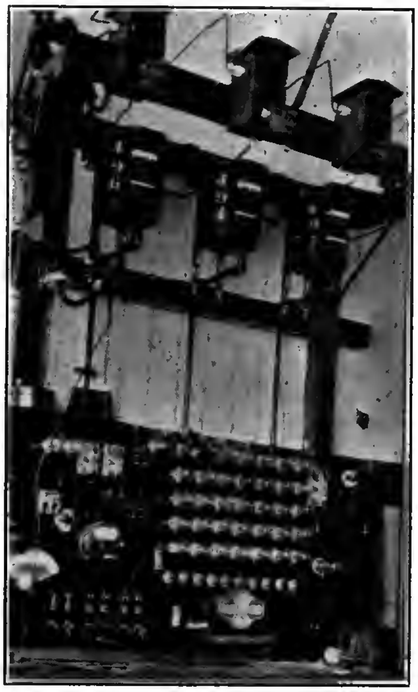
The routine use of the board for transformer testing is the same for new transformers as for those that have been on the lines and are brought in for load changes or on account of breakdown. All transformers passing through the storeroom, whether new, changed or apparently burned out, are tested and overhauled. Our system has two primary distribution voltages, the greater part operating at 2,200 volts delta and some at 4,400 volts delta-connected, three-phase. All transformers used on the latter have double primary coils and a terminal board for series or multiple operation.

The first operation in testing consists of putting 2,200 volts on the primary of the transformer under test and examining the secondary voltage. This is quite important, especially on transformers that have been hit by lightning and are liable to have part of their primary coils cut out.

If this voltage proves satisfactory, the insulation is tested between the high-tension coils and the case, the low-tension coils and case, and between the high-tension and the low-tension coils. In every case all terminals of each coil are connected together, the test being made with 4,400 volts (6,600 volts for transformers with double primaries).

The transformer is now repaired if necessary, the core pulled out and the coils scraped if badly covered with carbonized oil. The terminal boards in transformers that are relics of 1,100-volt primary days and any paper tags that may have been glued to the cover are removed, the latter especially being a fertile source of trouble on the older types of transformers.

After testing, cleaning and painting the case, the transformer is



COMPACTNESS A GOOD FEATURE OF THIS TESTING EQUIPMENT

again tested for insulation and is then tested for no-load loss. This consists of applying 110 volts to the secondary of the transformer through a kilowatt-hour meter and reading the input by timing the disk rotation with a stop-watch. The watts lost are recorded on a transformer history card, no attempt being made to separate these data into component parts or to correct for the actual value of magnetic flux the transformer would require. This must be done before the no-load loss of various transformers may be even approximately compared, as part of our line transformers (power) are of 9 or 18 to 1 ratio and part (lighting transformers) 10 or 20 to 1 ratio, and the no-load losses may be roughly compared by proportioning the square of the secondary voltages.

No tests for heating or regulation are made in routine. The writer does not believe it worth the time it would take on transformers of standard manufacturers, whose designs are well determined, and which have stood the insulation test.

The test board is located on the second floor of a building served by a power elevator so that line transformers of practically any size can be handled easily.

### Portable Test Outfit

In case handling facilities are not available, a testing apparatus which the writer devised a few years ago and used at the Hackensack office of the Public Service Electric Company of New Jersey is very satisfactory and convenient.

Two 1-kva. transformers were mounted on a wooden platform about 8 ft. square and fitted with casters. On one side of the platform was a vertical wooden switchboard about 2 ft. high and 3 ft. wide, which held a fused 30-amp., 110-volt switch, a small adjustable 110-volt circuit breaker and three plug switches, such as are used on series street-lighting panels. The low-tension sides of the transformers were permanently connected in multiple through the switch and circuit breaker and the high-tension sides were connected in series, leads being brought to the plug switches and from them to terminals. By this arrangement test voltages of 2,200 volts or 4,400 volts were obtained, and either transformer was large enough to supply exciting current to any line transformer for testing its ratio. This set could be carried quite easily from place to place and used wherever 110-volt service was available.

Chester S. Wendell,
General Foreman Line Department,
Stamford Gas & Electric Company,
Stamford, Conn.

## Rubber-Covered Wire for Underground Service

About five years ago the Buffalo General Electric Company installed rubber-covered wire for the underground street-lighting service. The cost ratio was about three to one in favor of the rubber-covered wire. No. 8 wire, rated at 5,000 volts with $\frac{7}{32}$-in. rubber insulation (30 per cent para rubber), was used in a $2\frac{1}{2}$-in. fiber duct laid between the lamp pedestals.

Each length of wire was pulled from one lamp to the next. Some of these conductors have frequently lain in water or in ice, yet the service has been completely satisfactory and the practice has been continued for later installations.

Field Editor Electrical World,
New York, N. Y.

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## Grading Utilities on Service Rules*

**Means Adopted by the Railroad Commission of Wisconsin for Maintaining Service Standards and Determining Relative Performance of Lighting Companies**

By Charles B. Hayden
Service Engineer Wisconsin Railroad Commission

THE first order issued by the Railroad Commission of Wisconsin prescribing certain requirements for gas and electric service was made effective in 1908. The second order, which is now in effect, was issued in 1913. Very soon after the last order came out, early in 1914, the service department began grading the gas and electric utilities, and about a year or so later, in 1915 or 1916, standings were given to the telephone utilities. Up to this time we have not attempted to grade the water utilities, although service rules have been in effect for about four years. There does not appear to be any great advantage, as far as our department is concerned, in applying grades to the service of water utilities, since the quality of service with different municipal and private utilities does not vary much.

When this system of grading was started it was not with the thought of applying to the regulation of utilities the time-tried plan of grading as used in our school system, where it is absolutely necessary in order to keep the pupils placed according to the achievement and growth which each one makes; nor was it our idea that each utility would be expected to run the gamut of conditions, passing and honor marks through the various years of the course, with the possibility of failure up to the final graduation. It was done because it afforded a means of keeping track of the utilities according to the service standards which had been established, and if possible to determine whether there was any increase or decrease in the degree of compliance from year to year, of the utilities throughout the state or of any one utility in particular.

*Abstract of paper presented at conference of railway and utility engineers at Washington, D. C., March 2, 1923.

After use in this way for some time it was determined to try out the scheme on the unsuspecting utilities, and it was found that the results were decidedly good. The utilities which received high rank were very much pleased and in almost every case put forth efforts to improve their position or at any event maintain it. To be sure, some jealousy developed, but for the most part the best of feeling existed and a friendly rivalry sprang up for the high-rank positions.

The rules do not have equal relation to the quality of the service; for instance, the meter-history record has no particular bearing on service, while the pressure conditions and meter-testing practice will determine greatly the degree of satisfaction felt by the consumer.

The rules are also subject to quite wide interpretation and the inspector must make this decision. To be sure that this will be worked out uniformly by the engineer inspectors —all of our inspectors are engineering college graduates—conferences have been held about twice a year, when sample inspection reports receive a mark; i.e., each rule received a percentage from each inspector according to the report. These marks are then compared and the differences argued out by the several inspectors, until it is possible to have a close approximation to uniformity.

RULES REGARDING ELECTRIC SERVICE

| Number of Rule | Subject | Per Cent Credit | Rank |
|---|---|---|---|
| 14. | Creeping meters | 4 | 6 |
| 15. | Accuracy of meters | 7 | 3 |
| 16. | Installation tests | 5 | 5 |
| 17. | Periodic tests | 14 | 2 |
| 18. | Meter-testing records | 5 | 5 |
| 19. | Meter-testing equipment | 5 | 5 |
| 20. | Request tests | 4 | 6 |
| 21. | Referee tests | .. | .. |
| 22. | Meter readings on bills | 4 | 6 |
| 23. | Interruptions | 18 | 1 |
| 24. | Station records | 6 | 4 |
| 25. | Pressure and voltage variation | 18 | 1 |
| 26. | Pressure and voltage surveys | 6 | 4 |
| 27. | Information | 4 | 6 |

In order to avoid too great variation, the different rules are divided, where this is possible, into their elements and a portion of the percentage is allowed for each subdivision. In the detailed explanation of the markings this will be followed out. The weighing of the various rules for gas and electric service was decided after a number of conferences of all the inspectors, and we believe that the result is reasonably proper.

For electric service, interruption and voltage variation hold first place, periodic tests second, accuracy of meters third, and the rest of the rules are of about equal value. The table gives an idea of the plan.

It is obvious that the instance would be rare of a utility which could give perfect voltage or pressure conditions over its entire system all of the time, but it is possible that such a condition could exist. Naturally the full allowance of 18 per cent is seldom if ever given. An analysis of the company's records and of the inspector's tests will give a good idea of the extent of poor pressure conditions, and penalties are imposed in proportion to the extent and to the importance of the business affected. With most of the rules, however, it is quite possible for the utility fully to meet the requirements and receive full credit.

Some of the rules applying to electric companies, with explanation of the reasons for the grades given, follow:

*Interruptions, 18 per Cent (Rule 23).* —Each electric utility shall make all reasonable efforts to eliminate interruptions in service and when such interruptions occur shall endeavor to re-establish service with the shortest possible delay. Whenever the service is interrupted for the purpose of working on lines or equipment this shall be done at a time which will cause the least inconvenience to consumers, and those most seriously affected by such interruption shall, if possible, be notified in advance.

Compliance with this rule is based

upon the number of interruptions to service, the length of interruptions, and on whether they are reasonably avoidable or not. Some weight is also given to the class of consumers served and whether or not the interruptions affect the whole, a major portion or only a small part of the system. Interruptions of the whole service are classed as follows in per cent credit: No interruptions, 18; few short, unavoidable interruptions, 18; few long unavoidable interruptions, 16-17; few short, avoidable interruptions, 15; few long avoidable interruptions, 12; many short, unavoidable interruptions, 12; many long, unavoidable interruptions, 10; many short, avoidable interruptions, 5; many long, avoidable interruptions, 0.

*Station Records, 6 per Cent (Rule 24).* — Each utility furnishing electric service shall keep a record of the time of starting and shutting down power-station equipment and feeders, together with the indication of the principal switchboard instruments, at sufficiently frequent intervals to show the characteristics of the load, and shall maintain a record of all interruptions of service upon the entire system or major divisions of its system, and include in such record time, duration and cause of each interruption.

A complete station log will constitute full compliance, but if it lack a record of interruptions, showing cause, duration, etc., only half to two-thirds credit will be given.

*Pressure and Voltage Variation, 18 per Cent (Rule 25).*—Each electric utility operating in a city having a population of 1,500 or more shall adopt a standard voltage for the entire constant-potential system and shall maintain the voltage within 3 per cent of such standard on all lighting circuits during lighting hours; on power circuits and during other than lighting hours the voltage shall be maintained within 10 per cent of the standard. All other electric utilities shall maintain their voltage regulation on constant-potential circuits during lighting hours so that the maximum voltage furnished any consumer shall not be more than 6 per cent above the minimum voltage at that consumer's cut-out.

A large percentage, about 15, is given if the pressure requirements are met during lighting hours and 3 per cent for the remainder of the twenty-four hours. With utilities not giving service except during lighting hours compliance is figured on the whole 18 per cent. Deductions are made depending on the amount of variation from the standard voltage and for variations below the standard on parts of the system.

*Pressure and Voltage Surveys, 6 per Cent (Rule 26).*—Each utility furnishing electric service shall provide itself with one or more portable indicating voltmeters, and each utility serving more than 250 consumers shall have one or more portable graphic recording voltmeters, these instruments to be of a type and capacity suited to the voltage supplied. Each of the utilities shall make a sufficient number of voltage surveys to indicate the service furnished from each transformer and feeder and to satisfy the commission of its compliance with the voltage requirements, and those having graphic recording voltmeters shall keep at least one of these voltmeters in continuous service at the plant, office or some consumer's premises. All voltage records are to be kept open for public inspection.

The compliance with this rule depends on whether or not the utility is fully equipped with recording gages and the judgment used in making the surveys as to the proper time and the location of the gages, etc., and whether or not a complete and available record is kept for inspection. Deductions will be made depending on the degree to which the inspector feels that the surveys are incomplete.

*Information, 4 per Cent (Rule 27).*—Each utility supplying electric service shall specifically inform each of its consumers as to the conditions under which efficient service may be secured from its system and render its consumers reasonable assistance in securing incandescent lamps and other appliances best adapted to the service furnished.

A utility is required by this rule to advise the consumers properly regarding the best lamps and motors to use, etc., and, in general, to show a proper attitude to the public. The public policy of the utility is another factor which is considered in connection with this rule. The degree of compliance must be determined from observation by the inspector.

## Alabama Power Displays Broadcasting Results

THE window shown here was decorated by the Alabama Power Company to show the people of Birmingham the scope of WSY, the new broadcasting station which the company recently installed in a department store in that city. Every place from which letters have come is marked on a map of the Western Hemisphere with a red ribbon which extends down to the floor pointing to the letter itself, which is opened so that it may be read with ease. There are several hundred of these letters from all sections of the country, as far west as the Pacific Coast, northeast to Maine and south to Cuba. One ribbon indicated a point in Mexico 1,500 miles from Birmingham, and another a point in Canada 2,000 miles away. The display attracted much interested attention during the time it remained in the window.

WINDOW DISPLAY SHOWS SCOPE OF RADIO SERVICE

## Weekly Meter Readings Prevent Disputes

THE Ohio Gas & Electric Company, Middletown, Ohio, L. E. Marshall, general manager, has adopted a practice of reading the meters of large consumers weekly. When a consumer uses so much power that the monthly bills are well up into the hundreds of dollars, no company can afford to have debates as to the accuracy of his bills. By the weekly reading of meters it is

possible to check any unusual use of power, real or apparent, and to make note of it or make adjustment in case it is a meter error, before any large sum is involved. This practice has been followed for three years, and during that time there has not been a disputed bill, whereas before there were occasional disputes with large customers.

Bills are rendered on the usual monthly basis. The weekly reading is merely an insurance measure, and it has proved well worth the expense and trouble involved by anticipating complaints on high bills.

# Inspections Build Business and Good Will

## Ten Years Experience by a Michigan Utility Indicates Value of Cordial Relationships—Inspector Sells Lamps and Appliances from an Electric Truck

By H. A. Fee
President Citizens' Light & Power Company, Adrian, Mich.

MAINTAINING customer good will and keeping energy-consuming devices on the line is a problem of no less importance to a small public utility than it is to a utility serving several hundred thousand customers. Often the personal relationships between a small utility and its customers can be, if properly handled, much more intimate and cordial than is possible with a larger utility. The extent to which a small utility will benefit by these relationships will depend upon its service to its customers "above and beyond its actual call of duty."

One of the most effective methods of having consumers view their local company in a favorable light is a free inspection service. Such a service has now been in use in Adrian, a city of twelve thousand inhabitants in lower Michigan, since 1912. During 1922 our inspector made twelve thousand visits among our three thousand consumers. This inspector follows the regular meter route with an electric truck carrying lamps and appliances, which he demonstrates and sells. He works the territory on schedule so that four complete inspections are made yearly. This work has continued ever since it was started, with the exception of the war period. At that time our inspector entered the nation's service, but the inspection trips were resumed in the year 1919 after customers had urged that they be restored.

Although in the beginning the inspector reported frequent trouble in gaining entrance because of housewives' suspicion of the company's object, the service is now so popular that oftentimes a customer will call up to determine just when the inspector will be around again. With such intimate contact with customers no introduction card is presented, although the inspector always carries credentials explaining the purpose of the investigating service.

### Note Book Lists Appliances

A loose-leaf notebook is carried by the inspector which gives the name and address of each customer. It also has room for four additional names in case any new tenants move in. White sheets are used for residential customers, while for commercial users buff colored sheets are used. Space has been provided to enter the number and the wattage of lamps and to list the appliances in use. However, as a result of protests from some residential customers against the visiting of all rooms in search of outlets or to determine the lamp wattages, the inspector now merely asks the number of outlets and figures the residence load on the basis of a 50-watt equivalent per socket. On the reverse side of this sheet columns are provided for the date of inspection, demonstrations and remarks regarding the quality of service. Careful note is made of all comments. If the complaints are not remedied by the inspector on the spot, he refers the subject to the repair department, which issues a regular work order

NO ST. F.

| | NAMES | FROM | TO |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

| ITEMS | STYLE | WATTS | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| Lamps | | | | | | | |
| " | | | | | | | |
| " | | | | | | | |
| " | | | | | | | |
| " | | | | | | | |
| Cleaners | | | | | | | |
| Fans | | | | | | | |
| Flatirons | | | | | | | |
| Motors | | | | | | | |
| " S. Mch. | | | | | | | |
| Percolators | | | | | | | |
| Radiators | | | | | | | |
| Stoves | | | | | | | |
| Toasters | | | | | | | |
| Warming Pads | | | | | | | |
| Washing Mch. | | | | | | | |

INSPECTION BLANK USED IN CHECKING WATTAGE OF LAMPS AND APPLIANCES USED

11-16-22 1M Gempel

THE CITIZENS LIGHT AND POWER COMPANY

Inspection Service Report 192

Section No ... to ... Number of Inspections made

Demonstrated —Cleaners .. Heaters .... Irons .... Percolators Stoves Toasters

Sales— Cleaners.. Heaters ... Irons . Percolators Stoves Toasters

Lamp sales

Time—Inspecting . Hours Demonstrating . Hours On car . . Hours Miscellaneous . . . Hours

Remarks

Approved Signed

No. St Sect No.

RESIDENCE Card No.

| No. | NAMES | Connected From | Connected To |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

| | ADDITIONS AND DIMINUTIONS Dates of Changes | | | | | | | WATTAGE BALANCE Light | Power | Heat |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |

LEFT—INSPECTOR'S DAILY REPORT BLANK, GIVING APPLIANCES SOLD AND REPAIRED. RIGHT—PERMANENT FILE CARD, SHOWING DATA OBTAINED FROM INSPECTOR'S NOTEBOOK

for repairs. It is also his duty to explain any interruptions to service and to bring about adjustment on real or fancied grievances.

The inspector makes an investigation of the service, looking for low-hanging wires, loose brackets or switches and examines service entrance switches. He also inspects appliances. Minor repairs on appliances, sockets or wiring are made free of charge, but when further repair work is required the device is taken to the store with the customer's permission and repaired, this work being charged for according to the material and labor required. Labor in repairing appliances is generally furnished free, however, provided that the time consumed does not exceed fifteen minutes.

After doing his best in repairing appliances and bringing service to the 100 per-cent mark, the inspector tactfully suggests the use of some other appliance the housewife needs. If she appears interested, he steps out to his truck and brings it in. By effectively demonstrating its use he is often able to overcome reluctance to purchase. The sight of an appliance in actual use in the home often is the main selling point in closing a sale.

The part of the service most appreciated by the customer is the sale of lamps. Customers are prone to forget to buy lamps to replace those burned out and as a result of this forgetfulness get along with a lower consumption of energy than normal, without any desire to practice rigid economy. The fact that most of our sales from the truck are of lamps shows that the service helps to keep the sockets full and in use.

After the day's work the inspector makes out a report showing the number of appliances demonstrated, the number of sales made and the number of hours devoted to inspection. These reports are checked daily by the secretary of the company, who supervises the service. No itemized lists of various types of appliances inspected has been kept, since this would involve extra time for an office clerk in filing and making out reports. The inspector's route books are turned over to a listing clerk who posts upon permanent cards the load data contained therein. From these cards figures are taken when calculating the distribution capacity required by the residential consumers.

From the results of this service in keeping appliances in good working condition, together with the spirit of good will fostered by maintaining an effective contact with the company, we have found that the improved customer relationship more than offsets the expense of the service itself, which last year cost us only $1,692. When the customer is made to feel that the company is directly interested in seeing that he gets good service he soon comes to realize that it is made up of human beings like himself and that its officers and men alike are interested in giving him personal as well as mechanical service. With this attitude bills are cheerfully paid. From our early experience we came to believe that the average customer appreciated the convenience of being able to get new tungsten lamps from the inspector far more than he did the saving he made in the cost per candlepower of his lighting service. It was the personal element of the service that appealed to him, and so beneficial have been the results from our free inspection that we would not think of doing without it. We believe there is no better way of building up good will.

## Telephone Courtesy Shows Results

As PART of a "courtesy" campaign the Scranton (Pa.) Electric Company has placed the card reproduced here on the transmitters of all the telephones in its general and departmental offices. This action is an outgrowth of the theory that "the voice with the smile wins," and almost immediate results were real-


CARD PROMOTES TELEPHONE COURTESY

ized by the company in the form of commendatory letters from customers who had noticed the cards and were moved to compliment the company on the general courtesy of its employees.

## What Other Companies Are Doing

**Chicago, Ill.** — A booklet, "Electrify Your Savings," has been prepared by the Commonwealth Edison Company for increasing the sale of stock by the company's investment department, the Utility Securities Company. The fourteen pages are given over to an interesting conversational narrative in which a suburbanite discusses the advantages and value of holding the company's stock, which has been sold to 29,000 persons.

**Birmingham, Ala.**—The Alabama Power Company is exhibiting in every state in the country a series of three industrial moving pictures showing the industrial and manufacturing plants of Alabama. These pictures are being sent out by the publicity department of the company to every national industrial exposition held in the country as a part of its program to attract new industries to the state.

**Augusta, Me.**—The Central Maine Power Company will rebuild its offices and stockroom at Waterville, recently destroyed by fire. A number of new electric stores have recently been opened on the system and the outlook is excellent for the year's appliance business.

**Philadelphia, Pa.** — During its annual spring washing machine campaign, which closed on March 31, the Philadelphia Electric Company sold 900 washing machines. Other types of washers sold brought the total to 1,000 for the six weeks. On the closing day 101 machines were sold, the day's total sales amounting to $19,000. Sales for March totaled $175,000, the largest month's business in the history of the company's electric shop. Merchandise sales for the first three months this year show an increase of 80 per cent over the same period in 1922.

**Franklin, Mass.**—Active cultivation of electric range business by the Union Light & Power Company has resulted in the installation of 145 ranges on its system, the total number of customers being about 4,000. E. S. Hamblen, local manager, states that the range "bogey" this year is 100 and that an installment proposition of $99 per range wired in place is about to be launched. The company is under the general management of C. D. Parker & Company, Boston.

# Digest of Electrical Literature

**Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World**

## Hydro-Electric Development and Steam Equipment

*Electric Steam Generators.*—W. P. MUIR.—The author describes what is asserted to be the largest and most successful installation of the water-resistance electrode type of electric generator. This type has been used in Europe for a number of years and was recently introduced into Canada and further developed by the Shawinigan Water & Power Company, Shawinigan Falls, Quebec. Excess hydro-electric power is sold to the Laurentide Company, where two units, each consisting of three sections connected on a 6,600-volt, three-phase circuit, produce steam. Each generator has a normal capacity of 25,000 kw. and 35,000 kw. during overload. The generators are capable of producing 50 tons of steam per hour. —*Power*, Feb. 6, 1923.

*Trent River Development Yields 10,000 Hp. to Central Ontario.*—A new hydro-electric generating station of 10,000-hp. capacity was recently put into operation at Ranney's Falls on the Trent River in Ontario. This station is the most recent addition to a chain of seven developments that supply energy to the Central Ontario system of the Hydro-Electric Power Commission of Ontario. A head of 48 ft. is utilized in two turbines of the vertical single-runner type, directly connected to 4,500-kva. generators. Details of the turbine and generator installations, relay operation and switchboard accommodations are given.—*Electrical News*, March 1, 1923.

## Generation, Control and Switching

*Static Condensers.*—C. MARMY.—The design of the usual type of static condensers, wherein layers of metal are placed mechanically upon dielectrics of paper, mica or glass, has resulted very frequently in failures due to either inclosed air pockets or the so-called "border effect," both causing a slow brush discharge which leads sooner or later to a puncture. The paper under notice describes a type of condenser which, it is claimed, avoids these two shortcomings. Upon both sides of a narrow and very long ribbon of "cellon," a substance similar to celluloid but non-inflammable, a chemical metallic deposit is made somewhat narrower than the width of the ribbon. Judging from the illustrations, this ribbon has about the dimensions of a standard motion-picture film. This ribbon is wound upon small bobbins, several of which are stacked up, connected in series and placed within an insulating tube, representing a condenser unit. For outdoor service these units are capped with a rain-shedding porcelain petticoat. By a special method, the nature of which is withheld, the edges of the metallic deposit are made of a very high ohmic resistance, so that the potential near the edges of the condenser ribbon is much smaller than in its middle portion, thereby avoiding the dangerous "border effect."—*Bulletin Association Suisse des Electriciens*, January, 1923.

*Automatic Control of Synchronous Industrial Motor-Generator Sets.* — An article describing a full automatic-control equipment for a 2,300-volt synchronous motor driving a direct-current generator, which is also automatically controlled by standard apparatus. A complete wiring diagram of both the motor and generator is given.—*Power*, Feb. 13, 1923.

*Frequency Doubling Devices.* — Y. WATANA. — Wave distortion of two highly saturated transformers and current-rectifying apparatus are two methods for obtaining double frequency. Both are based on the fact that when the magnetic flux through a coil undergoes the change of a half wave of a sinusoidal curve, lasting only for that half period, a complete wave of current of nearly double frequency may flow through the coil circuit. The writer shows that the latter method can be greatly improved by means of direct-current magnetization applied in the opposite direction to the magnetization of the rectified current. He also treats experimentally the direct method of deriving alternating currents of higher harmonics from a sinusoidal current source. — *Journal of the Institute of Electrical Engineers of Japan*, February, 1923.

## Transmission, Substations and Distribution

*Possibilities of Transmission by Underground Cables at* 100,000 *Volts to* 150,000 *Volts.*—A. M. TAYLOR.—This paper is primarily a plea for the use of single-phase cables. The effect of separating the cores is considered, both in its relation to easing the potential gradient and in relation to eddy currents induced in the lead sheathing. The gain effected by employing "intersheaths" is pointed out, and the author's proposals for obviating the disadvantages of intersheaths by combining their employment with a six-phase transmission are considered. An actual transmission of 50,000 kw. at 100,000 volts over a distance of 30 miles is worked out in detail and compared with a similar transmission at 30,000 volts. The principal conclusions arrived at are: (1) Reliability under the six-phase three-phase system very greatly increased, as compared with plain single-core cables (as at Gennevilliers) or with three-phase cables for equal voltage. (2) The author's arrangements will permit loads of poor power factor to be taken up, with positive gain in efficiency and regulation. (3) The maximum voltage gradient being no greater with 100,000 volts than with 30,000 volts, such transmissions can be undertaken immediately the cable makers are in a position to guarantee the cables. (4) The investment in capital outlay proceeds, in the six-phase three-phase scheme, in proportion to the development of the load. (5) The reduction in line-charging current and the improvement in regulation are very considerable, as compared with those for any other proposals.—*Journal of the Institution of (British) Electrical Engineers*, February, 1923.

*Steel Aluminum Cables for Overhead Lines.* — H. KRAUTT. — An elaborate theoretical treatise on the properties of bimetallic cables, primarily dealing with the mechanical relations between the two metals. In spite of the large amount of scientific research work which has been carried on to study the physical properties of steel-aluminum cables, much has yet to be investigated to establish fully the feasibility of the use of these combination conductors. It has been definitely established that results found by calculations or from using short cable lengths in laboratories differ considerably from actual results with long transmission lines of the same material. The main difficulties are found in inability to measure accurately the existing stresses in the two metals and in the lack of exactness in measuring the cable temperature during artificial heating of the conductor. — *Elektrotechnik und Maschinenbau*, Feb. 18, 1923.

## Units, Measurements and Instruments

*Electric Test Brakes.* — C. REINDL. —To determine the mechanical output of prime movers of electric motors and to test the characteristics of generators the author advocates electric braking methods, describing the equipment. A universal testing apparatus and switchboard which will take care of virtually all routine testing in repair shops is described in full detail. Particular attention is paid to the use of brake dynamos both rotor and stator of which are free to rotate. A lever attached to the stator carries a sliding weight or may be connected to a dynamometer. Providing a lever 710 mm. in length, the mechanical output of the tested motor in horsepower is simply the speed times the weight in kilograms over 1,000. A further simplification may be obtained by having the lever actuate a hydraulic measuring cylinder which is connected to a registering pressure gage. It is suggested that advantage be taken of regenerative braking, which will give a saving of 30 per cent to 40 per cent of the electrical energy otherwise required. A diagram is shown of a testing equip-

ment for automobiles, where the rear wheels of the car stand on large wooden drums, which drive two braking dynamos.—*Elektrische Betrieb*, Jan. 24, 1923.

*Direct-Current Cable-Testing Car.*—W. Pfannkuch. — Testing of underground cables with high-voltage direct current, which eliminates all wattless currents met with when using alternating current, has the advantage of permitting more severe test of the cable and joints. By using direct current the charging energy of the cable has to be supplied only once, so that a very small amount of energy will be sufficient for any length of cable, the time required for the charging being of no importance. A portable plant of this type is described which consists of a 10-kva. single-phase, 220/33,000-volt transformer, one three-phase synchronous motor connected to a Delon type rotating mechanical rectifier, two condensers of 0.01 mf. capacity each and a sphere-gap voltmeter. A maximum of 150,000 volts direct current is obtainable. A voltage regulation from zero to the highest value is achieved by a special design of the synchronous motor, the stator of which can be so turned relative to the rotor that the rectifier will pick up any value of the alternating-current sine wave.—*A. E. G. Mitteilungen*, January, 1923.

## Illumination

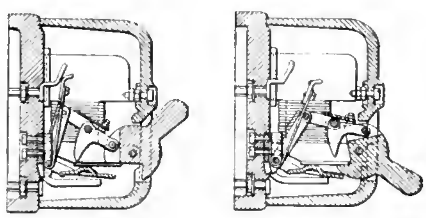
*Illuminating Engineering Society Notes.*—This issue of the *Transactions* includes three papers that were presented at the Swampscott convention last fall, with the complete discussion following their presentation. They are: "A Distribution Photometer of New Design," by C. C. Colby, Jr., and C. M. Doolittle; "The Regular Icosahedron as a Substitute for the Ulbricht Sphere," by K. S. Weaver and B. E. Shackelford, and "Lighthouses and Light Vessels," by S. G. Hibben. Abstracts of these papers may be found in the Electrical World for Oct. 7, 1922, page 783; Oct. 28, 1922, page 948, and Nov. 11, 1922, page 1060, respectively.—*Transactions of the I. E. S.*, March, 1923.

## Motors and Control

*Steel-Mill Cranes and Mill Motors.*—A symposium of six papers dealing with steel-mill crane and motor problems, crane-wiring diagrams, a 120-in. motor-driven plate mill, motor-driven accumulator pumps and foot-operated control for steel mills.—*Proceedings of Association of Iron and Steel Electrical Engineers*, February, 1923.

*Operation of Induction Motors in Cascade.* — H. Cotton. — In a highly mathematical paper the author draws the circle diagram of two induction motors in cascade by elaborating the diagram of one machine functioning under normal conditions. In order to simplify the diagram the case considered is that of ideal motors in which the copper losses are so small that they can be neglected. This means that the generated electromotive force in the main rotor and the back electromotive force in the auxiliary rotor will be equal and opposite. But the directions of rotation of the two rotors are the same, the shafts being mechanically coupled; hence the fluxes which produce these electromotive forces must be in phase with one another when drawn on the same diagram. Moreover, assuming identical windings on the two rotors, the two fluxes must be equal in magnitude.—*Journal of the Institution of (British) Electrical Engineers*, February, 1923.

*Miniature Automatic Breaker.*—As a substitute for fuses in house installations, a small, single-pole automatic switch not much larger than an ordinary wall switch is described. This is shown in the accompanying illustration. The rating of the switch is for 6 amp. and for 10 amp., up to 250 volts. A double-toggle joint brush contact is con-



Instantaneous Automatic Breaker Adaptable for Protecting House Circuits

trolled by the adjustable armature of a small solenoid. The coil acts at the same time as a magnetic blow-out for the arc. On tests the breaker opened on 250-volt short-circuit currents of as high as 1,500 amp. without trouble. It was further demonstrated that the switch will open short-circuit currents of up to 400 amp. from 110 volts to 220 volts quicker than the 25-amp. plug fuse customary in light circuits.—*Elektrotechnische Zeitschrift*, Feb. 15, 1923.

## Traction

*Control of Alternating-Current Locomotives.*—I. Döry.—Electric control of large locomotives with motor capacities of 3,000 hp. or more requiring the handling of currents of 10,000 amp. or more is a difficult problem, and most constructions use contactors which are themselves energized from a master controller. While such a system operates satisfactorily, it lacks the highly desirable positiveness of a direct operation. That is to say, the engineer has no assurance that the contactors will always obey the impulses given from the master controller. It may also happen that one of the usually great number of contactors will stick, upsetting the entire control. It was found during tests that doubling and even trebling of each contactor reduced the current per finger but could not give the required positiveness. Moreover, it introduced a maze of additional connections. Further attempts were made with straight-row contacts and a traveling double brush, and later an auxiliary transformer connected in series with the main transformer came into use. Both designs failed to give the desired results, partly owing to arcing or on account of too heavy weight. Poege developed finally a system which, it is claimed, is both reliable and positive. He connects to the main transformer a regulator with stationary windings and a commutator upon which are arranged a set of brushes which can be shifted upon the circumference of the commutator.—*Elektrotechnik und Maschinenbau*, Jan. 28, 1923.

*Points of Interest About the Capital Traction Company.*—R. H. Dalgleish.—A general idea of the physical characteristics of this property in Washington, D. C., is given, together with information on some of the company's construction and maintenance practices.—*Electric Railway Journal*, Feb. 10, 1923.

## Heat Applications and Material Handling

*Controllers for Ore Unloaders and Ore Bridges.*—L. M. Mortensen.—The author discusses the different motor and controller connections used in conjunction with ore unloaders and ore bridges. The construction and principal characteristics of these machines as they vitally affect the equipment are briefly described.—*Proceedings of the Association of Iron and Steel Electrical Engineers*, February, 1923.

*Arc Welding of Steel Structures.*—F. P. McKibben.—Structural engineers are now giving careful attention to the application of electrical welding to steel structures with the view of guiding the art along safe lines. Up to the present time most electrically welded structures have not been carefully proportioned with proper regard for the stresses to be carried and the strength of parts necessary to carry them. The author gives also a short history of the erection of steel structures by this method, following it with examples of the problems encountered and the method by which these may be overcome.—*Journal of the American Welding Society*, February, 1923.

## Telegraphy, Telephony, Radio and Signals

*Oscillation Engineering Design of Submarine Acoustic Signaling Apparatus.*—W. Hahnemann.—The acoustic systems corresponding to closed oscillatory electric circuits, to radiating electric systems and to coupled circuits are described. The design of submarine signaling transmitters and receivers on an engineering basis is also described and actual installations are discussed. The resemblance of submarine signaling engineering and radio engineering and the relation between these fields are considered. — *Proceedings of the Institute of Radio Engineers*, February, 1923.

*Inverse Duplex System of Amplification.*—B. Phelps.—One of the best-known so-called reflex circuits is a hookup whereby three amplifying tubes are used for three stages of radio and two of audio at the same time, employing a crystal for detection. The diagram for this circuit is given, accompanied with detailed data as to size of condensers and inductances to use.—*Q. S. T.*, March, 1923.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Colorado Ratifies Treaty

**Six of the Seven States Watered by River Are Now in Line—Arizona May Reconsider**

THE Colorado River treaty has been ratified by the Legislature of Colorado and was signed on Monday last by Governor Sweet. Only Arizona of the seven states concerned is now withholding its consent to the agreement. According to statements made by Colorado legislators, Arizona is to reconsider the decision made by her Legislature on March 10, when the bill for ratification was defeated by a tie vote. The treaty, however, could not become effective until its ratification by the new United States Congress, which, unless called in special session, will not meet until Dec. 4.

## De Forest Demonstrates His "Phonofilm"

Before the New York Electrical Society on Wednesday evening of this week Dr. Lee de Forest gave a demonstration of his new "phonofilm," an invention to make voice reproduction with motion pictures practicable by inducing perfect synchronism. The process involves the photographing of sound vibrations on a standard motion-picture film and translation back to sound by electrical means. It was briefly described in the ELECTRICAL WORLD for Aug. 26, 1922, page 442.

"I claim," said Dr. de Forest, "that an entirely new form of screen drama can be worked out, taking advantage of the possibilities of introducing music and voice and appropriate acoustic effects, not necessarily throughout the entire action, but here and there where the effects can be much more startling, or theatrical, if you will, or significant, than is possible by pantomime alone, no matter how cleverly such can be worked out."

## Connecticut Power Finances New Transmission Lines

The directors of the Connecticut Power Company last Monday authorized the floating of 7,500 shares of unissued common stock, with a par value of $100 a share. They will be offered to common-stock holders of record in the ratio of one share of new to two of old, stock not taken to be sold at par at the option of the directors.

The stock is to be sold to finance the projected transmission line to the north and a transmission circuit to New Britain. The former, as already told in the ELECTRICAL WORLD, is to extend from the South Meadow up the east bank of the Connecticut River to Springfield and then to Turners Falls, Mass. Right-of-way was obtained some time ago.

## Public Utility Information Bureau for Pennsylvania

Representatives of all branches of the public utility companies of Pennsylvania met at the Bellevue-Stratford, Philadelphia, on Wednesday last, with Philip H. Gadsden, vice-president of the United Gas Improvement Company, as chairman, and virtually decided to establish a State Committee on Public Utility Information along the lines of those existing in many states. A committee composed of four members each from electric light and power, electric railway, telephone and gas companies was appointed to arrange for financing the new body and attend to the other preliminaries. Headquarters will probably be in Philadelphia.

## Alabama Now Has Public Utility Bureau

A number of the leading public utility companies in Alabama last week established a joint information bureau in Birmingham in order to disseminate information regarding the utilities of the state. Leon C. Bradley, formerly city editor of the Birmingham *Age-Herald*, has been made director. Offices will be in the Jefferson County Bank building. The object of the bureau is to keep the people of the state informed at all times on fundamental questions affecting the utilities, according to J. S. Pevear, chairman.

In establishing the bureau, Mr. Pevear said, the utilities realize that the public utility industry has been more or less clouded with mystery and it is in an effort to correct this situation that the bureau has been formed. "It is our purpose," he said, "to conduct a bureau in which complete confidence can be placed, which will collect authoritative data on the industry and disseminate it impartially both to the public and to the utilities themselves. The object of the bureau is to acquaint the people of Alabama as thoroughly as possible with the facts, economic and otherwise, regarding the organizations which furnish them with electric light, power, gas, street-railway and other essential services."

## Oppose Smith Power Bill

**William Barclay Parsons and Others Point Out Its Weaknesses at Committee Hearing**

ADVOCATES and opponents of Governor Smith's water-power bill clashed at a hearing on Wednesday, April 4, before the New York State Senate committee on conservation, and the usual countercharges of socialism and monopolistic greed were made.

George E. Van Kennen, Special Deputy Attorney-General, who drafted the measure, said it would affect only the St. Lawrence and Niagara Rivers and was intended to prevent a private monopoly of electricity in New York State such as the coal monopoly in Pennsylvania. He said that the bill was drawn in the best interests of the people of the state and that it would protect them from the companies which were now charging "exorbitant rates" for electricity.

William Barclay Parsons of New York City contended that such a law would be the means of killing private enterprise and that the bill really defeated itself, because no provision was made whereby power could be sold to electric railways.

Claims made by supporters of the measure that government development of hydro-electricity in Canada had resulted in cheaper rates for consumers were disputed by Frederick D. Corey, president of the Niagara, Lockport & Ontario Power Company.

Former Mayor Burns of Troy, representing the New York State Conference of Mayors, asserted that the bill was the result of the arrogance of water-power interests. If it became law, it could be used as a weapon to compel them to provide cheaper rates and better treatment to the consumers. The State Federation of Labor went on record in favor of the bill.

Senator Rabenold urged the power interests to help the state work out a plan for the economical development and distribution of hydro-electricity.

### PUBLIC SERVICE COMMISSION BILL PASSES STATE SENATE

The bill to reorganize the New York Public Service Commission by substituting a commission of three members, removable by the Governor, for the present five commissioners, who can be removed only by a two-thirds vote of the Legislature, was passed by the New York State Senate on Wednesday and sent to the lower house. The Democrats control the Senate and the Republicans the Assembly.

## Revision of Standards

**A. I. E. E. Committee Making Good Progress—Twenty-seven Sections Under Tentative Preparation**

THE standards committee of the American Institute of Electrical Engineers has undertaken a thorough revision of the A. I. E. E. standards. The work of revision is being carried out on the basis of certain principles as follows:

1. The standards will be subdivided into separate sections, each adequate to the needs of the machinery with which it deals.

2. There will be sections relating to general principles, technic of measurements and so forth.

3. Whenever practicable, the same general order of arrangement of the contents will be followed in each of the sections. This order of arrangement is as follows: Scope, service conditions, definitions, rating, heating limits, other limits to rating, efficiency, dielectric strength and insulation, resistance, regulation, variations in voltage, speed and frequency, construction details, etc.

The committee is preparing twenty-seven sections with the following titles:

1. General Principles Upon Which Heating Limits Are Based.
2. Standard Definitions and Symbols.
3. Standards for the Measurement of Test Voltages in Dielectric Strength Tests.
4. Standards for Direct-Current Generators and Motors and Direct-Current Commutator Machines in General.
5. Standards for Alternating-Current Synchronous Generators and Motors and Synchronous Machines in General.
6. Standards for Synchronous Converters.
7. Standards for Induction Motors and Asynchronous Machines in General.
8. Standards for Alternating-Current and Direct-Current Fractional-Horsepower Motors.
9. Standards for Railway Motors.
10. Standards for Prime Movers and Generator Units.
11. Standards for Power and Distributing Transformers.
12. Standards for Induction Regulators.
13. Standards for Instrument Transformers.
14. Standards for Control Apparatus.
15. Standards for Oil Circuit Breakers.
16. Standards for Air Circuit Breakers, Lever Switches, Inclosed Lever Switches and Disconnecting Switches.
17. Standards for Busbar Supports, Ammeter Jacks, Potential Plugs, Test Plugs, Power Fuses and Potential Transformer Fuses.
18. Standards for Switchboard Panels.
19. Standards for Lightning Arresters.
20. Standards for Electric Railways.
21. Standards for Wires and Cables.
22. Standards for Transmission Lines and Distribution Lines.
23. Standards for Meters and Instruments.
24. Standards for Telegraphy and Telephony.
25. Standards for Radio Communication.
26. Standards for Storage Batteries.
27. Standards for Illumination.

This division and the titles are not necessarily final and may be subject to modifications. It is the intention of the committee to concentrate on a few sections which, when completed, will serve as models for the others. These are:

3. Standards for the Measurement of Test Voltages in Dielectric Strength Tests.
4. Standards for Direct-Current Generators and Motors.
6. Standards for Synchronous Converters.
8. Standards for Alternating-Current and Direct-Current Fractional-Horsepower Motors.
11. Standards for Power and Distributing Transformers.
14. Standards for Control Apparatus.

The work is being carried on informally and suggestions are welcome from all who are interested. Each section will be approved by a representative working committee before being approved by the standards committee.

It is proposed that before final adoption each section shall be printed or otherwise duplicated, and appropriate notice will appear in the *Journal of the A. I. E. E.* so that any one interested may obtain copies and contribute criticisms and suggestions.

### Preliminary Draft of Standards for Control Apparatus

It is expected that enough progress will have been made on the section of the proposed revision covering standards for control apparatus to permit its submission to the standards committee of the A. I. E. E. for approval at the meeting of the committee to be held about May 11. It is also expected that copies of the proposed standards will be available for distribution by April 16, and the standards committee requests that all interested engineers obtain copies by applying to the secretary of the Institute and give the committee the benefit of their criticisms and suggestions.

## For Standardization in the Electrical Industry

For some time past there has been a growing feeling in the electrical field that the several electrical associations engaged in standardization work should co-operate in presenting a single set of electrical standards to the American Engineering Standards Committee for approval as American standards. The lack of universally accepted American standards has been a considerable handicap to this country in connection with international standardization and has undoubtedly increased the difficulty of selling electrical products in foreign countries.

During the summer of 1922 a movement was started to revise the A. I. E. E. standards, subdividing them into a number of separate pamphlets or sections, each covering completely the standards for one kind of apparatus. An outline of this work is printed on this page.

These two movements—one to revise the A. I. E. E. standards and the other to arrive at a single set of American standards through co-operative effort—were joined in a resolution adopted by the A. I. E. E. standards committee and approved by the A. I. E. E. board of directors last year.

Thus far standards for certain electrical machinery and apparatus only have reached a stage where the co-operative effort can take tangible form, and to deal with these the National Electric Light Association, the Electric Power Club, the Associated Manufacturers of Electrical Supplies and the American Institute of Electrical Engineers have appointed such official representatives. This joint committee has begun work and has had under consideration a section of standards for control apparatus. The first section, which is now in the hands of a representative working committee, will, as stated in the preceding article, be ready for circulation to all those interested within a brief period of time.

## Electrical Men Welcome Sir J. J. Thomson

THE visit of Sir Joseph J. Thomson, master Trinity College, Cambridge, England, and a distinguished electro-physicist, has aroused great interest among the electrical men of America. The group picture shows a gathering at the works of the Metropolitan Engineering Company in Brooklyn, where Thomas E. Murray's method of welding glass to metal was inspected. Left to right, the men in the group are: J. B. Murray, vice-president Metropolitan Engineering Company; Thomas E. Murray, vice-president New York Edison Company; Sir J. J. Thomson; W. C. L. Eglin, vice-president Philadelphia Electric Company; Robert B. Owens, secretary Franklin Institute; John W. Lieb, vice-president New York Edison Company; John F. Murray, secretary Metropolitan Engineering Company; Thomas E. Murray, Jr., president Metropolitan Engineering Company, and Mr. Fields, a representative of the American Telephone & Telegraph Company.

## Pacific Coast Technical Committees Meet

A final assembly of the sub-committees of the Technical Section of the Pacific Coast Electrical Association was held at Fresno, Cal., on March 20-22. Plans for the annual convention of the association, to be held in San Francisco on June 19-22, were the principal topic of discussion. It was decided to present two or three short papers on correlated subjects at the convention instead of submitting a printed report of the year's activity as in the past.

The chief interest of the three-day session just held centered in questions concerning three-phase versus single-phase distribution, 4,000-volt distribution, radio communication and automatic generating plants, and on all four of these topics informative discussions were held.

The hydraulic power committee reported that it had made a study of penstocks during the past year and had published its findings in a comprehensive report which will be presented by the national committee at the New York convention in June.

It has been decided to continue the work of the safety rules committee and the inductive co-ordination committee.

A meeting of the overhead-systems committee was held coincident with the meeting of the national committee in Chicago. The meeting was devoted largely to a discussion of the size and scope of the new handbook to be compiled by the committee. A resolution was passed favoring the adoption of 8½-in. x 11-in. sheets with standard loose-leaf punching so that the sheets may be filed in a loose-leaf binder of whatever description suits the individual.

# Contractors Appoint a High Commissioner

### Charles L. Eidlitz Chosen to Be the Judge Landis of the Electrical Contractors of New York City—He Will Seek to Reform Their Business Methods

EVER since 1914 the electrical contracting business of New York City has been on an unstable basis. The war brought with it more work than could be comfortably handled by existing firms, and in consequence inexperienced and irresponsible wiremen were attracted to the business and began to compete for contracts, to the demoralization of the entire electrical trade.

Conditions became worse instead of better after the war. Competition was bitter and keen; overhead expense was ignored, and jobs were taken for less than the cost of material and labor, complete reliance for profit being placed on changes and extras. Such a condition of affairs meant that the contractors were losing not only money but good will as well. Matters were finally brought to a head at a recent meeting of the electrical contractors' associations of Manhattan, Brooklyn and Queens Boroughs, when the following resolution was adopted:

"Whereas the business of electrical contracting has developed a speculative character to such an extent as to convert it from a profitable to an unprofitable business, partly owing to economic conditions and partly to the increase of the speculative hazards normally inherent in the business; and

"Whereas it is desirable to take such remedial measures as may suggest themselves by a careful survey of the situation,

"Therefore, be it resolved that Charles L. Eidlitz be and he hereby is appointed a commissioner of this association to make such studies in whatever manner deemed best by him in consultation with the executive committee and to develop therefrom for this association ways and means of transforming the business of electrical contracting from its present highly speculative character to a regular and profitable business, free from undue speculation."

CHARLES L. EIDLITZ

The aggregate business done by the electrical contractors in the metropolitan district ranges from $40,000,000 to $60,000,000 yearly. There are three hundred members in the associations. Mr. Eidlitz began his work of reorganizing contracting methods and eradicating bad trade practices among them on April 1. The first organization meeting was held in New York on Thursday.

#### EIDLITZ A CONTRACTOR AND ORGANIZER

The contractors of New York were moved to choose Mr. Eidlitz as their commissioner because of his long experience and standing in the industry. Mr. Eidlitz was born in New York on Sept. 3, 1866. As a boy he was one of the numerous youthful apprentices in the Edison Machine Works on Goerck Street, New York City. About two years after graduation from Columbia University in the class of 1888 Mr. Eidlitz organized the Charles L. Eidlitz Company, electrical contractors. The firm's affairs progressed successfully for more than twenty years, or until Mr. Eidlitz retired as president in 1913, bringing its operations to a close.

Though nominally in retirement, Mr. Eidlitz is a very busy man. He is president of the Metropolitan Electric Manufacturing Company, which he organized in 1902; president of the Atlantic Electric Goods Company and is interested less directly in several other enterprises. His influence has been strongly felt in the councils of his associates and of the electrical contracting profession at large, to which he has brought marked organizing and executive ability. He was one of the founders of the National Electrical Contractors' Association, serving as its first president from 1901 to 1903. He also established the Building Trades Employers' Association of New York City in 1903, of which he was president until 1905. Mr. Eidlitz is a member of the New York Electrical Society and the Building Trades Club and a founder member of the Edison Pioneers.

#### OBJECTS TO BE ACCOMPLISHED

When Mr. Eidlitz was seen in his office at 1170 Broadway by a representative of the ELECTRICAL WORLD this week, he told of the conditions in the electrical contracting business in New York City and its environs, the chaotic state of which caused him to be chosen to his new office. Mr. Eidlitz said that the job was not of his seeking, but because of his long connection with the electrical contracting business and his keen interest in its welfare he had accepted the position thrust upon him. The movement, he said, was instigated by the largest contracting firms in the business, all of which have pledged him their earnest co-operation and support.

Mr. Eidlitz will have authority to reorganize local contracting methods from top to bottom but without touching labor. The books and accounts of the various contracting firms will be open to him at all reasonable times. He is privileged to inspect them much as a bank examiner inspects the books of national and state banks. As indicative of the dearth of knowledge among even large firms on the cost of doing business, Mr. Eidlitz showed a tabulation of bids for a large building in the city. Although the specifications furnished bidders were the same, the estimates for labor alone ran $8,100, $11,000, $12,000, $13,500, $14,600, $16,800, $17,000 and $20,000, and the estimates for the conduit and other material were also at variance to almost the same degree. Mr. Eidlitz said this case was typical of bids for other installations and that it showed the necessity for education. To his amazement he had found that the painstaking work of the Association of Electragists International in its "Manual of Estimating" was either unknown or ignored in spite of the fact that it represented

the practice and experience of companies all through the country and was applicable to work anywhere, the unit basis being man-hours.

"The electrical contracting business in New York," he said, "has become completely demoralized. Some men are in it without real knowledge of the work, business training or financial responsibility. No real organization or reputation can stand up against competition of this kind. I have seen bids which when the cost of labor plus the cost of material was deducted would not even pay expenses, to say nothing of profit. So many changes and additions are made in electrical equipment during the course of constructing a building that contractors are tempted to put in figures for the original work at less than cost in the hope that the extra work will enable them to pull out with a profit. This makes a gambling game out of a legitimate business. There is no apparent reason why bids should vary from 20 to 140 per cent. Certainly the cost of labor should not vary on efficiency or supervision more than 10 per cent. If when bidding on contracts electrical contractors were informed that the contract carried with it no changes or extras, all such work being let to some other contractor, the bids would be entirely different.

"What I hope to do," Mr. Eidlitz went on, "is to educate the trade to a knowledge of how much of a certain kind of work a man can do. In this work I shall seek the active co-operation of the Association of Electragists International as well as the experience of the non-association contractors. Out of this work should evolve a manual for the electrical wireman which will be of immense value to him in his work and will educate him in proper business methods. The task which is before me has nothing whatsoever to do with price fixing, nor will it savor in the least of collusion. Whenever I am in doubt as to whether it is legal for me to go ahead on a certain line, I will ask the Attorney-General for a ruling."

Mr. Eidlitz's appointment and acceptance of the post of commissioner has been received very favorably by the electrical contractors of the city.

# Substantial Increase in Utility Financing During March

During the month of March issues of stocks and bonds made by electric light and power companies totaled **$95,172,750**, the highest figure reached this year, exceeding the banner month of 1922 (October) by more than three million dollars. Only one offering exceeded **ten** million dollars, the fifteen-million-dollar-issue of the Duquesne Light Company, but thirty-two utilities took part in the month's financing. Although the refunding activity continued, a large number of issues were offered for the purpose of obtaining new capital to provide for additions and extensions. The rate of return yielded the investor advanced to 6.31 from 6.25 in February. Long-term issues prevailed.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN MARCH

| Name of Company | Amount of Issue | Period, Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Consolidated Power & Light Co., (W. Va.) | $7,000,000 | 20 | First mortgage and refunding lien sinking-fund gold bonds, series A | General corporate purposes | 6½ | 99½ | 6.50 |
| Southern California Edison Co. | 10,000,000 | 21 | General and refunding mortgage gold bonds | Construction | 5½ | 97½ | 5.70 |
| Pennsylvania Water & Power Co. | 450,000 | 17 | First mortgage sinking-fund bonds | Additions | 5 | 98½ | 5.12 |
| Portland Railway, Light & Power Co | 1,000,000 | .. | Cumulative prior preferred stock, series A | To reimburse for construction | 7 | 98 | 7.13 |
| Puget Sound Power & Light Co. | 2,000,000 | .. | Cumulative prior preference stock | Additions | 7 | 103 | 6.80 |
| Wisconsin Railway, Light & Power Co. | 825,000 | 10 | First mortgage and refunding gold bonds of 1913 | | 5 | 89 | 6.50 |
| American Power & Light Co. | 5,000,000 | 93 | Gold debenture bonds, American series | To retire floating debt and for working capital | 6 | 95½ | 6.25 |
| Duquesne Light Co. | 15,000,000 | .. | First preferred stock, cumulative, series A | Refunding and for additions and extensions | 7 | 103 | 6.80 |
| Missouri Utilities Co. | 600,000 | 29 | First mortgage gold bonds, series A | Refunding and to reimburse for construction | 6 | 96½ | 6.25 |
| Penn Public Service Corp. | 1,500,000 | 15 | Convertible gold debentures | Acquisition of common stock of companies to be merged and for working capital | 6½ | 98 | 6.70 |
| Public Service Co. of Northern Ill. | 5,000,000 | 39 | First lien and refunding mortgage gold bonds, series A | Capital expenditures and to reimburse for retirement of maturing obligations and expenditures | 5½ | 94½ | 5.88 |
| Federal Light & Traction Co. | 2,500,000 | 30 | Convertible debenture gold bonds, series A | Refunding and to reimburse for expenditures | 7 | 100 | 7 |
| Georgia Railway & Power Co. | 3,000,000 | 25 | General mortgage gold bonds, series F | | 6 | 97 | 6.25 |
| West Penn Power Co. | 6,000,000 | 40 | First mortgage gold bonds, series E | Additions and extensions | 5 | 90 | 5.62 |
| Hawkesbury Electric Light & Power Co., Ltd. (Ont.) | 300,000 | 20 | First mortgage bonds | Refunding and for additional working capital | 6½ | 100 | 6.50 |
| Interstate Electric Corp. | 550,000 | 10 | Sinking-fund gold debenture bonds | Refunding, additions and other purposes | 7 | 98½ | 7.20 |
| Los Angeles Gas & Electric Corp. | 4,000,000 | 20 | General and refunding mortgage gold bonds, series F | Additions and extensions | 5½ | 97¾ | 5.70 |
| Metropolitan Edison Co. | 1,000,000 | 30 | First and refunding mortgage gold bonds, series C | To reimburse for capital expenditures | 5 | 89 | 5.77 |
| | 1,176,000 | .. | Cumulative participating preferred stock | Acquisition of new stock and other purposes | 7 | 98 | 7.14 |
| Ohio Public Service Co. | 2,675,000 | 30 | First mortgage and refunding gold bonds, series C | Additions, refunding and other purposes | 6 | 97.29 | 6.20 |
| United Light & Railways | 1,000,000 | 30 | First lien and consolidated mortgage gold bonds, series A | To reimburse for additions and improvements | 6 | 97 | 6.20 |
| Arizona Power Co. | 800,000 | 24 | First lien and unifying mortgage gold bonds, series A | Refunding, to reimburse for additions and other purposes | 6 | 97 | 6.20 |
| General Gas & Electric Corp. | 1,000,000 | | Cumulative preferred stock, class A | Additions and for other purposes | 8 | 100 | 8 |
| Illinois Electric Power Co. | 3,500,000 | 20 | First mortgage sinking-fund gold bonds, series A | Construction | 6 | 97 | 6.25 |
| Electrical Securities Corp. (N. Y.) | 1,000,000 | 30 | Collateral trust sinking-fund gold bonds, sixteenth series | New capital | 5 | 94 | 5.40 |
| Salina Light, Power & Gas Co. | 950,000 | 20 | First mortgage sinking-fund gold bonds, series A | Refunding and for additions and extensions | 6 | 96.63 | 6.30 |
| Wisconsin-Minnesota Light & Power Co. | 323,750 | .. | Cumulative preferred stock | Additions and extensions | 7 | 92½ | 7.57 |
| American Water Works & Electric Co. | 2,000,000 | .. | Cumulative first preferred stock (voting-trust certificates) | Corporate purposes | 7 | 91 (flat) | 7.75 |
| Eastern Connecticut Power Co. | 3,000,000 | 25 | First mortgage sinking-fund gold bonds, series A | Extensions, purchase of securities and refunding | 5 | 91 | 5.70 |
| | | | | To provide for future requirements | 5 | 89½ | 5.80 |
| Idaho Power Co. | 3,200,000 | 24 | First mortgage gold bonds of 1917 | Refunding | 6 | 96 | 6.30 |
| Nevada-California Electric Corp. | 1,500,000 | 27 | First lien gold bonds, series B of 1920 | Refunding and for cash working capital | 6½ | 98 | 6.75 |
| Standard Gas & Electric Co. | 6,000,000 | 10 | Convertible gold debenture bonds | Refunding and to reimburse for capital expenditures | | | |
| Western United Gas & Electric Co. | 1,323,000 | 27 | General mortgage gold bonds | | 6 | 100 | 6 |
| Total | $95,172,750 | | | | | | |

## A. E. S. C. Year Book Out

**Steady Progress Toward Standardization in Electrical Industries Is Indicated**

GREAT progress the last year in standardization projects affecting electrical industries is shown by the 1923 Year Book of the American Engineering Standards Committee, which has just been issued. Of thirty-five standards thus far approved by the committee, eleven are of special interest to the electrical industries. Of these the National Electrical Code and Electrical Safety Code of course rank first, the others being the "Code for Electricity Meters," "Automobile Headlighting Specifications," "Code of Lighting Factories, Mills and Other Workplaces," "Safety Code for the Protection of the Heads and Eyes of Industrial Workers," "Illuminating Engineering Nomenclature and Photometric Standards," "Methods for Battery Assay of Copper," "Specifications for Electrolytic Copper Wire Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars," "Specifications for Lake Copper Wire Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars," and "Specifications for Soft or Annealed Copper Wire."

Of 121 projects which have reached an official status, fifteen have to do with electrical engineering. Two hundred and seventy-five national bodies—technical, industrial and governmental—are now co-operating in the work of the A. E. S. C. through officially accredited representatives, and more than nine hundred individuals are serving on the sectional committees which carry on the actual standardization work, the A. E. S. C. acting only as an administrative body.

### Electrical Representatives

The electrical industry is represented on the committee by the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies, the National Electric Light Association, the American Electric Railway Association, the Electrical Manufacturers' Council, the Associated Manufacturers of Electrical Supplies, the Electrical Manufacturers' Club and the Electric Power Club.

One of the most important accomplishments of the year was the development of a plan of co-operation between the Federal Specifications Board—the body which develops the specifications for all government purchases—and the A. E. S. C. by which the specifications of the board are submitted informally to the A. E. S. C. before definite adoption. Through this plan the government receives the criticisms of industry through the organizations which speak for those branches of industry that are concerned with any particular standard. Among the specifications which have already been submitted to the A. E. S. C. under this new co-operative arrangement are those for dry cells, snap switches, rigid conduits and rubber-insulated wires and cables. Dr. A. S. McAllister, who has been serving as a special liaison officer of the Bureau of Standards, has been designated by the chairman of the Federal Specifications Board as liaison representative in the co-operative work with the A. E. S. C.

Other electrical projects which have an official status before the committee are those for an electrical fire and safety code, a safety code for electrical power control, a safety code for lightning protection, terminal markings for electrical apparatus, rating of electrical machinery, insulated wires and cables (other than telephone and telegraph), symbols for electrical equipment of buildings and ships, electrical properties of aluminum, electrical installations on shipboard, a specification for 600-volt direct-current overhead-trolley construction, and electrical safety rules for bituminous coal mines.

## Rural Power Districts Authorized in Michigan Bill

A bill now before the Michigan Legislature will, if passed, allow any township having a resident population of not less than 500 to establish rural power districts and by purchase or construction acquire facilities to transform, transmit and distribute electrical energy. Before such a district is established the township board must declare the expediency of the formation of such a district and obtain an estimate on the cost from some competent person, and the question of raising the necessary money shall be submitted to the electors at a regular or special election. It will take two-thirds of the electors voting at the election to pass the proposal. The township will then be authorized to borrow not to exceed 5 per cent of the assessed value of the property in the township for the purpose of establishing the power district. Bonds may be issued but shall not be sold below par, the interest shall not exceed 6 per cent, and the total amount expended must not exceed the estimate.

Authorization for maintenance is given to the board, which will have the right to contract with any public or private corporation for its energy supply. Construction of lines is to be in accord with the specifications prescribed by the Michigan Public Utilities Commission.

## Delaware River Development Bill a Law in New York

The bill providing for the appointment by the Governor of New York of three commissioners to confer with commissioners named in New Jersey and Pennsylvania for the purpose of making a treaty between the three states and the federal government for the conservation, use and development of the water resources of the Delaware River is now a law in New York State. The sum of $10,000 is to be appropriated to pay the necessary expenses of the commissioners, who are to serve without compensation.

## Rate Cut for Philadelphia

**Consumers Will Save a Million a Year by Reductions in Residential and Other Charges**

THE rate reduction made by the Philadelphia Electric Company a year ago, which the officials of the company say resulted in a saving to consumers of $1,200,000 in twelve months, has just been followed by another reduction which the officials say will bring a further saving to consumers in a similar period of $1,000,000.

The new rates will go into effect on May 1. Residence service will be charged for at the rate of 8 cents a kilowatt-hour for the first 36 kw.-hr. or less used during a three-month period, 7 cents for the next 144 kw.-hr. or less (a reduction from 225 kw.-hr.), and 5 cents for energy in excess of 180 kw.-hr. (a reduction from 261 kw.-hr.). Retail lighting service will be on an 8-cent, 6-cent and 4-cent basis as before, but the number of hours' use in the three classes will be reduced respectively from 75 to 60, from 75 to 60, and from 150 to 120. For retail power service the same reductions in hours' use will be made, the rates remaining at 7½ cents, 5½ cents and 3½ cents. There will also be reductions in "standby" and "current" charges for wholesale light and power service (maximum demand) and "Rate E" power service, as well as kilowatt-hour reductions for auto-charging and for theater service.

Reductions in municipal lighting rates throughout the territory served by the company will bring about an annual saving of more than $80,000.

### Company Explains Reductions

W. H. Johnson, senior vice-president of the Philadelphia Electric Company, discussed the reductions as follows:

"The reduction in rates, expressed on a percentage basis, will vary in the different schedules from 2½ to 5 per cent, depending upon the class of service, and will amount, over all, to nearly $1,000,000. Customers who are obtaining service under schedules of our tariff in which a coal clause is incorporated will also receive the benefit of whatever lower coal costs we may obtain.

"When the reduction was made a year ago it was our expectation that business generally would take an upward turn and that the reduction in rates made by us at that time would act as a stimulus to such business expansion, which would be reflected in increase in our revenue. It is most gratifying to the management to have our predictions verified. It is pleasing that we are able this year to make a reduction in rates for street lighting to the cities and boroughs in our territory, even though our contracts with them at higher rates are valid for from one to five years. The reductions in rates during the last two years have only been made possible because of largely increased output in connection with increased efficiencies and the exercise of rigid economies in our operation."

## Massachusetts Adopts Industrial Lighting Code

Effective Jan. 1, 1924, the Massachusetts Department of Labor and Industries has voted to establish a lighting code for industrial and mercantile establishments following the general lines of the New York code. As an initial set of regulations the code appears to be potentially effective in relation to flagrant abuses of illumination and furnishes a point of departure for later advances. Well-informed opinion, however, inclines to the view that the code leaves much to be desired in relation to the specification of intensities for textile mills and for machinery devoted to coarse operations. The code does not follow that of the American Engineering Standards Committee.

## Indianapolis Contest Over Competition Comes Up

The Merchants' Heat & Light Company's injunction suit to restrain the Indiana Public Service Commission from issuing a certificate of necessity and convenience to the Terre Haute, Indianapolis & Eastern Traction Company was assailed March 28 in a demurrer filed by the commission. The commission recently demurred to a similar suit filed by the Indianapolis Light & Heat Company. A joint hearing on April 9 in the Superior Court has been ordered. Officials predict that the hearing on the demurrers will result in the cases being quashed. In answer to the charge that the local commercial electric field is congested, the demurrer declares that the Merchants' company is not operating under an exclusive franchise and is powerless to exclude competition. It further contends that the company's complaint fails to show that the Public Service Commission's order to the traction company is for rate-making purposes.

City officials of Richmond, Ind., have voiced disapproval of a contract submitted by the Terre Haute, Indianapolis & Eastern Traction Company asking for permission to run a high-power transmission line through the city to connect with the Dayton Light & Power Company east of Richmond. The company agrees not to compete with the municipal light plant in Richmond, but has refused, it is said by city officials there, to agree not to compete with the city light plant outside the corporation limits. Some of the big industrial consumers are outside the city limits, and the city officials fear the traction company will try to get this patronage if permitted to run its wires through the city.

## Missouri Commission Gets Large Appropriation

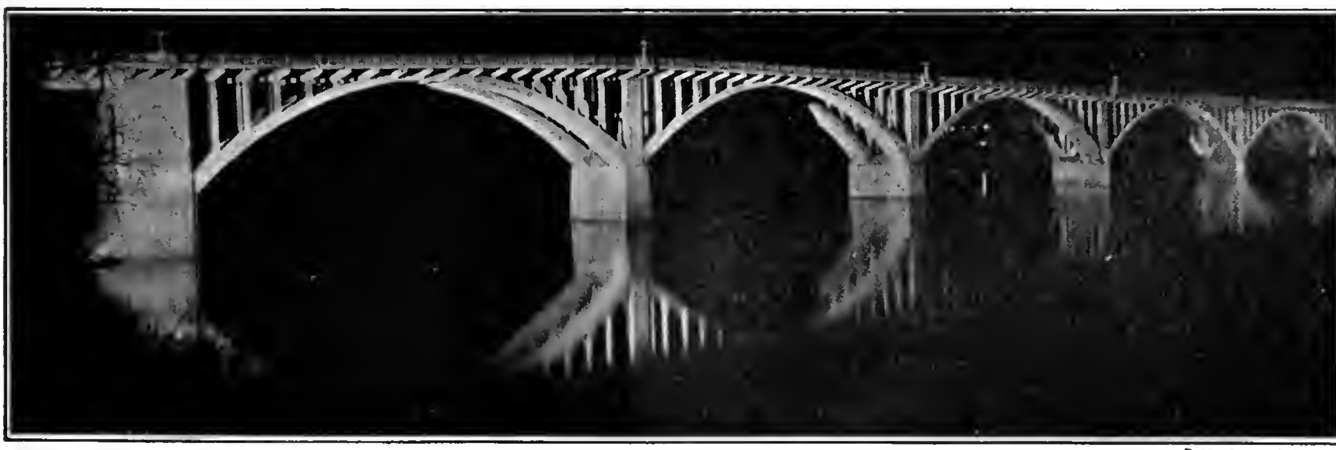
The Missouri State Public Service Commission, which was the center of an eighteen-hour deadlock in the closing hours of the Legislature, came out of the fight with a larger appropriation than it had asked for and with more than it received for the last biennium. As finally passed this bill carried an appropriation from the revenue fund for the Public Service Commission of $125,000 and a like sum from the earnings of the commission if they run so high. This $250,000 with the $71,000 for the commission incorporated in the civil salaries bill gives the commission $321,000, though it had asked only for $318,000.

## Illinois Power & Light Bond Issue of $30,000,000

Plans already reported (Electrical World, March 10, page 591) for the consolidation and reorganization of the North American Light & Power Company and the Illinois Traction Company, whose combined interests include about ninety-five public utilities valued at $200,000,000, were approved at a meeting of the stockholders of the Illinois Traction Company on March 24th. A new company, to be called the Illinois Power & Light Corporation, was formed to absorb the light and power companies owned by the North American Light & Power Company, which served about forty towns in southern Illinois, as well as those owned by the Illinois Traction Company, which served about fifty-five towns in Illinois, Missouri, Kansas and Iowa. W. B. McKinley will be head of the merged corporations.

An issue of $30,000,000 first and refunding mortgage thirty-year 6 per cent bonds of the new company was offered on Monday at 98½, to yield 6.10 per cent. Proceeds from the sale and also from the sale of $10,000,000 of debenture bonds will be used toward the retirement of more than $50,000,000 securities of the companies formerly constituting the Illinois Traction Company system and also to acquire the properties formerly owned by the Southern Illinois Light & Power Company.

## Floodlighting Little Rock's New Broadway Bridge



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The floodlighting of the Broadway Bridge at Little Rock, Ark., thrown open on March 12, was the result of co-operation between the various branches of the electrical industry in Little Rock. The chairman of the Board of Commerce committee appointed a committee from the utilities of the city, which in turn invited the Electric Club, composed of the electrical contractors in the city as well as the utilities, to assist. The very effective result of the co-operation of these bodies is shown in the photo.

The length of the bridge, including approaches, is 2,873 ft. The floodlighting was financed by the utility companies of Little Rock and designed by the Little Rock Electric Club. Four batteries of floodlamps were used to illuminate the bridge during the celebration and four individual floodlamp units were spaced apart from the batteries. Each battery consisted of two 1,000-cp. and three 500-cp. floodlighting units. These batteries were placed about 100 ft. from the bridge on both sides of the river and on each side of the bridge. In order to bring out the center span, an additional floodlamp was installed about 250 ft. from the bridge on each side and on both sides of the river.

# Brief News Notes

**Wausau to Have Electrical Exposition.**—Wausau, Wis., is to have an Electrical Exposition and Food Products Show on April 9-14 which its promoters claim will be one of the best ever held in a city of 20,000 people. Electrical interests operating in all parts of Wisconsin are to be represented.

**Marshall, Okla., to Abandon Municipal Plant.**—When the new transmission line of the Oklahoma Gas & Electric Company is completed the town of Marshall, Okla., will abandon its municipal electric light plant and receive service through the Enid division of that company.

**Jim Falls Power Plant Completed.**—The Chippewa Power Company announces the completion of the hydro-electric plant at Jim Falls, Wis., started last summer. It has a capacity of approximately 16,000 hp. and has been leased to the Wisconsin-Minnesota Light & Power Company, with whose Wissota hydro-electric plant near Eau Claire it is connected.

**Another College in Line for a Metermen's Course.**—The Kansas State Agricultural College will hold a metermen's short course from April 16 to April 21. Metermen of Kansas and surrounding states are being invited, and many of the larger cities with well-developed meter departments and expert metermen in charge will co-operate by sending their men to assist.

**Electrical Progress at Memphis.**—It will cost the Memphis Power & Light Company more than $3,000,000 to complete its new plant at Broadway, Fourth and Iowa Streets, President H. C. Abell announces. The amount will include the installing of boilers, turbines and other electrical apparatus. Construction is under way, and the company hopes to have the plant ready for operation by next fall.

**Express Company Uses 1,500 Electric Trucks in Twenty-Seven Cities.**—Twenty-five electric trucks for use in San Antonio, Tex., have been ordered by the American Railway Express Company, and all horse-drawn trucks will be discontinued. San Antonio is the twenty-seventh city in the country in which electric trucks of the American Railway Express Company are being used, bringing the total in use by this company to approximately 1,500.

**Fishing for Sardines with Electricity.**—Sardine canneries along the Norwegian coast, recently threatened with a complete lack of raw material owing to the fish remaining so deep as to render fishing impossible, have, it is said, solved the problem of bringing them to the surface by flashing electric searchlights over the water. According to a report received by the Department of Commerce from Consul George N. Ifft, Bergen, many shoals of the little fish previously safe from capture are being lured to the surface and into the cans.

**Geary Goes on Oklahoma Gas & Electric's Lines.**—The town of Geary, Okla., was cut in on the Oklahoma Gas & Electric Company's transmission line a week or two ago and the local municipal electric light and power plant was shut down, the seventh to close within recent months. The Geary line runs south from Watonga, 15 miles, and will be operated as a part of the Enid division.

**Interconnection in North Central States.**—Interconnection between the 40,000-volt lines of the Otter Tail Power Company, Fergus Falls, Minn., and the Union Light, Heat & Power Company, Fargo, N. D., has been completed and interchange of energy begun. This leaves a gap of only 12 miles between the generating stations on the Mississippi River in Minnesota and the largest city of North Dakota.

**Meter School at Purdue.**—The electric metermen of Indiana will meet at Purdue University for a five-day conference and school on April 9 to 13, under the auspices of the engineering extension service. A room has been set aside in the electrical engineering building where apparatus will be placed and cataloged so that the particular machine sought may be found at once. Experiments will be conducted on polyphase meter connections and the determination of instrument transmission errors.

**Michigan Utility Increases Capacity.**—By the addition of a 2,000-kw. General Electric turbo-generator and a 780-hp. Stirling boiler the capacity of the Citizens' Light & Power Company, Adrian, Mich., has been increased to 3,500 kw. This increased capacity was due, according to H. A. Fee, president, to the growing demand for both residential and industrial power. In 1919 the total kilowatt-hour sales were 2,298,913, while in 1922 they had risen to 3,001,389, with a value of $180,905.

**Utility Education in Missouri High Schools.**—Four thousand pupils in 228 of the 636 high schools in Missouri are studying public utility subjects. This has come about through the activities of the Missouri Committee on Public Utility Information, which, in noting the success of the work, suggests that since the bulletins supplied the schools deal largely with technical subjects, it would be wise for central-station operators to invite classes to visit their plants for personally conducted tours.

**Map of Iowa's High-Tension Lines.**—A map is being prepared by the Iowa Committee on Public Utility Information which will show the network of transmission lines now covering the state. Besides the high-tension transmission lines connecting the smaller towns, thousands of miles of lower-voltage rural lines will also be shown. Reports received by the committee indicate that a great number of rural lines will be built in Iowa this year. Ten years ago such a map would have shown only a few short scattering lines.

**Middle West Utilities Increases Stock.**—At the annual stockholders' meeting in Wilmington, Del., on March 27, both the prior-lien and the preferred stock of the Middle West Utilities Company were by charter amendment increased to $30,000,000 and the common stock to 300,000 shares of no par value.

**Electric Vehicles for Post Office Service.**—In the report of the joint congressional commission on postal service the enormous cost of repairs to motor vehicles is dwelt upon and doubt is cast on the economy of the government's maintaining its own equipment. The contract system, the commission asserts, should be tried out in representative cities. It adds: "It is, further, the opinion of the commission that electric vehicles should be experimented with in a typical city or group of cities to determine if economy would not be secured by their adoption in preference to the gas-propelled machine."

**Leviathan to Have Biggest Radio.**—The radio installation aboard the Leviathan, which will re-enter the transatlantic service in June flying the United States Lines flag, will, it is said by the Radio Corporation of America, which is making the installation, be the most powerful and elaborate steamship radio equipment in the world. In addition to telegraph service, a radio-telephone installation which will provide voice contact with other vessels and shore stations is to be installed. A special emergency set will also be put in. Furthermore, two of the lifeboats are to be fitted with emergency radio apparatus. The principal transmitter consists of a high-power vacuum-tube outfit which will deliver to main antonnas about six times as much power as the apparatus now used on the average steamship.

**Electrical Control of Sperry Gyroscope.**—A 350-hp. electric motor will drive the steel top weighing 100 tons and 13 ft. in diameter which Elmer A. Sperry has designed for the steamer Hawkeye State to prevent rolling and the consequent discomfort of the passengers. This gigantic top will run at 800 revolutions a minute in a huge metal case set in the hold of the vessel and so built that both case and top can incline to meet the motion of the ship. The top is electrically connected with a small gyroscope, which responds to the least roll and communicates its motion or swing to the 100-ton top. Answering the motion communicated electrically from the small gyroscope, the top swings first one way and then the other, and thus stops the roll of the vessel before it is well started, by acting as a counterbalance to the successive waves.

**Northern States Power Reduces Coal 15 per Cent.**—Improved operating economy at the fifteen steam-power plants of the Northern States Power Company in 1922 reduced the coal consumption per kilowatt-hour 15 per cent as compared with that consumed in 1921. This saving of 67,000 tons, valued at $400-000, was directly reflected in the earnings of the company. Steam-power

plants for the year generated 293,737,000 kw.-hr., or 35 per cent more than in 1921. The ten water-power plants totaled 139,878,000 kw.-hr., making a grand total of 433,615,000 kw.-hr. generated by the company's power plants. In addition, 54,330,000 kw.-hr. was purchased from other companies, making a total of 487,945,000 kw.-hr. placed at the disposal of the public in Minneapolis, St. Paul and nearly four hundred other cities, towns and villages in the Northwest in 1922.

**Yale Scholarship for Mexican Engineering Students.**—A Mexican scholarship in engineering at Yale has been endowed by John Hays Hammond. The award, which is for four years, will go to the student making the highest grade at examinations in Mexico City.

**North American Company Buys Light & Development Company.**—The North American Company has purchased the Light & Development Company of St. Louis. The North American Company owns the Union Electric Light & Power Company, and the Light & Development Company was a holding company operating several public utilities in and adjacent to St. Louis as well as numerous utilities in more distant points. This purchase foreshadows the probable amalgamation with the lines of the Union Electric Light & Power Company of properties in and around St. Louis which include the Cupples Station Light, Heat & Power Company in that city, the Western Power & Light Company in St. Louis County, an electric company in St. Charles, Mo., and one in Bonne Terre, Mo. The Light & Development Company owned and operated at points some distance from St. Louis the electric companies in Monmouth, Ill., Cape Girardeau, Poplar Bluffs and Carthage, Mo., and at points in other states.

**Large Self-Cooled Transformers Ordered by Northern States Power Company.**—In order to take care of increasing demand for power from industrial concerns and lighting requirements in and around Minneapolis, the Northern States Power Company has ordered from the Westinghouse Electric & Manufacturing Company three 15,000-kva. oil-immersed, self-colled single-phase transformers which, it is announced, are 50 per cent larger than the largest transformers of this type previously built. The three units used together in a bank will have a continuous capacity of 56,250 kva., or 75,000 hp. Each transformer will weigh approximately 150,000 lb., and the height to the tips of the high-voltage terminals will be nearly 25 ft. Approximately 7,000 gal. of highly refined oil is required for each unit. The high-tension winding of these transformers will be connected in star for 118,800 volts, the neutral of this star connection being solidly grounded, and the low-tension winding will be connected in delta for 15,405 volts. Inasmuch as the transformers are rated at 15,000 kva. with a temperature rise not to exceed 40 deg., they are equivalent to 18,750-kva., 55 deg.-rise transformers.

# Associations and Societies

**New York Section, A. I. E. E.**—At the New York Section meeting next Wednesday, April 11, Dr. Robert A. Millikan of the California Institute of Technology, Pasadena, will speak on "Some of the Developments of Modern Physics."

**Associated Engineering Societies Visit Wagner Plant.**—On March 28 the Associated Engineering Societies of St. Louis were entertained by the Wagner Electric Corporation. A buffet supper was served and a motion picture showing the details of the design and construction of Wagner motors and transformers was taken. More than 400 engineers participated.

**Society for the Promotion of Engineering Education.**—The annual meeting of this society will be held at Ithaca, N. Y., on June 20, 21 and 22. Today (Saturday, April 7) the New England branch of the society is holding, in conjunction with the Associated Industries of Massachusetts, a meeting at Wentworth Institute, Boston, at which Prof. D. C. Jackson, Prof. C. F. Scott, Dr. Charles W. Eliot and other well-known men are to speak.

**Innovation in Time of Section Meetings.**—The New York Section, Illuminating Engineering Society, will try out the plan of holding meetings at 5:30 p.m. instead of later in the evening. This innovation will begin on Thursday, April 19, when "Hospital Lighting" will be the topic. A buffet luncheon will be served, and the idea is to "tie in" the meeting with the business day, permitting members and guests to be free by 8 o'clock. The new plan is reported to have been adopted in England with much success.

**Middle Western Division, N. E. L. A.**—The first annual convention of the Middle West Geographic Division of the National Electric Light Association, to be held at the Statler Hotel, St. Louis, next Wednesday and Thursday, will on the first day listen to addresses on public utility finances by Festus J. Wade, president of the Mercantile Trust Company of St. Louis, and on customer ownership of public utilities and securities by Louis H. Egan, president of the Union Electric Light & Power Company, and Dwight N. Lewis, president of the National Association of Railway and Utilities Commissioners. On Thursday E. W. Lloyd, chairman of the Joint Committee on Business Development, will talk on better business development; Martin J. Insull, vice-president Middle West Utilities Company, on public relations, and J. C. Martin, Western editor ELECTRICAL WORLD, on rural-line development. There will be a conference of public utility information directors on Tuesday. Among others who will address the convention are H. E. Weeks, treasurer People's Light Company, Davenport, Iowa, and H. C. Blackwell, vice-president and general manager Kansas City Power & Light Company. President Smith, Vice-president Davidson and Executive Manager Aylesworth of the National Electric Light Association will address the delegates at the banquet to be given at the Statler Hotel Wednesday evening.

**Section Meetings, A. I. and S. E. E.**—Coming section meetings of the Association of Iron and Steel Electrical Engineers are announced as follows: Chicago, April 11, "Electric Heating of Sheet-Mill Rolls," by Gordon Fox; Philadelphia, April 20, inspection of Bethlehem Steel Company's Lehigh and Saucon plants; Cleveland, April 9, "Teletype Communication in the Steel Mill," by J. O. Carr; Birmingham, April 21, "Interconnection of Industrial Power Plants with a Central System," by G. H. Finks; Pittsburgh, April 12, "Transient Phenomena and Their Elimination," by C. P. Steinmetz, and April 28, "Factors in the Selection of Mine-Hoist Motors," by F. W. Cramer and A. A. MacDonald.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Middle West Division, N. E. L. A.—St. Louis, April 11-12 H. M. Davis, Bankers' Life Bldg., Lincoln.

American Society of Mechanical Engineers—Pacific Coast meeting, Los Angeles, April 16-18; general convention, Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society — New York, April 24-27.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex,

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. Dean F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

## Commission Rulings

**Improper Capitalization.**—In rate proceedings concerning the Sault Ste. Marie Gas & Electric Company the Michigan Public Utilities Commission refused to permit the issue of stock to capitalize a deficit resulting from the failure to earn a 7 per cent return on the rate base, or to capitalize reorganization expenses incurred several years before the application was made and prior to commission regulation, or to capitalize the expenses of a rate proceeding.

**Evaluating Plant to Be Acquired by Municipality.**—In placing a value on the McGowan Water, Light & Power Company prior to its sale to the town of Milton, the Wisconsin Railroad Commission held that consideration should be given to an investment in power-plant equipment discarded after connection with a transmission line, to past deficits, to land acquired after valuation proceedings were begun and to a well situated on private property and used as a water-supply source, provided that title was transferred to the municipality.

**Exclusion of Record of Rate Fixing in One Borough Approved in Case Affecting Another Served by Same Utility.**—In a rate hearing affecting the borough of Conneautville the Pennsylvania Public Service Commission excluded records of a similar hearing affecting the borough of Albion which were offered by the United Lighting Company, serving both boroughs, on the plea of the former borough that it had not been a party to the previous proceeding. The commission found that the allocation of property between the two boroughs was not vital or material.

**Street-Lighting Rates — Interstate Business—Uniform Accounts.**—Establishing new rates for the Pembina Light & Power Company, the North Dakota Board of Railroad Commissioners asserted that a municipality should bear its proportionate share of the expense of maintaining an electric utility by paying adequate rates for street lighting, although as a large consumer it may be entitled to slightly reduced rates, the expense of billing and meter reading being less. Street-lighting rates should be put on a meter basis (Pembina and other towns had been paying a flat rate less than the cost of service). The Pembina company serves St. Vincent, Minn., and exports energy to two towns in Manitoba, Canada, and the commission fixed rates upon the assumption that towns served outside the state will be required to meet their portion of a necessary increase in revenue to meet operating expenses, depreciation and return. The bookkeeping system of the Pembina company was disapproved, and it was ordered to use the uniform system of accounting prescribed by the commission.

**Interest During Construction.**—The Maine Public Utilities Commission refused to allow the Central Maine Power Company to issue stock for the capitalization of interest accruing on the cost of dam sites purchased for future development. The commission contended that the company might later sell some or all of these properties, in which case it would have capitalized as "interest during construction" an item properly chargeable to investment account. When actual construction begins a change in the classification of the item might be sanctioned.

**Jurisdiction Over Mortgages.**—Asserting its jurisdiction (*in re* Wisconsin Utilities Company) over the giving of a mortgage on public utility property within the state, the Wisconsin Railroad Commission refused an application for permission to issue a mortgage covering the property of a Wisconsin utility in order to secure bonds of a foreign holding corporation on the ground that this would establish a precedent against public policy contrary to the clear intent of the stock and bond law and might create a condition under which the commission would be deprived of its entire jurisdiction over the regulation of the issuance of securities by a Wisconsin corporation.

**Should Pole Treatment Be Charged to Capital or Maintenance?**—The Public Utilities Commission of Idaho in a case affecting the Kootenai Power Company held that the cost of treating poles might be properly charged to capital rather than to maintenance. "If a pole has been put through a process which lengthens its service life to nearly double what it would have been without such process, it would appear," the commission observed, "that the cost of the application of the process should be added to the cost of the natural poles as an element to be considered in determining the value of the pole. The service life of the pole is a determining factor in estimating the percentage rate for depreciation allowance."

**Accuracy of Meter Service Accepted.**—One A. D. Sharp complained to the Massachusetts Department of Public Utilities that he had been charged $84 for electric service covering a period during which, as compared with similar periods, he should not have been charged more than $23. The complainant produced evidence in support of his contention, but the department, while holding that as a matter of business judgment the company might have been justified in making a rebate, maintained its belief in the accuracy of the meter records of the electrical energy delivered to the premises and took the view that either there must have been a leak in the interior installation, for which the company was not responsible, or that the amount consumed must for some reason have been far greater than the petitioner's calculations indicated. The petition was therefore dismissed.

**Original and Reproduction Cost.**—The New York Public Service Commission, according with the practice of other bodies, does not accept original cost as the sole criterion of the value of a utility. In appraising the property of the Adirondack Power & Light Corporation the commission made this observation: "Fairness to the property, to its owners and to its consumers does seem to require recognition of pre-war cost of the present properties increased so far as to regard what seem to be reasonably permanent present-day prices of such properties constructed under existing conditions, and including overhead costs which are reasonable and necessary to be incurred, together with a provision for organization covering what may be said to be preliminary to putting up the plant."

## Recent Court Decisions

**Insulation by Isolation.**—The trial judge having instructed the jury in Godfrey vs. Kansas City Light & Power Company that an electric wire by contact with which a boy was killed could have been isolated, the Kansas City Court of Appeals held the charge not to have been an error, despite evidence that there was no covering that could have been put on the wires, because a witness for the defendant included isolation within the term "insulation" and said that insulation by space is one of the best insulators known to the electrical world. "This evidence is not contradicted," the Court of Appeals said. "The record is undisputed that this wire could have been insulated by isolation, and in view of this testimony we do not think that the assumption in the instruction that the wire could have been insulated was improper." (247 S. W. 451.)*

**Temporary Injunction Granted Against Increase of Contract Rates.**—The Supreme Court of South Dakota held, upon a demurrer by the Mitchell Power Company against a motion by the city of Mitchell for a temporary injunction to restrain the company from charging rates in excess of those specified in its franchise and from discontinuing its service, that while the city and the company were powerless to make an irrevocable contract as to rates, yet the rate specified in the franchise, in the absence of negative allegations, will be presumed to be a reasonable rate for the purpose of considering the sufficiency of a complaint on demurrer, and on a hearing of a motion for a temporary injunction a like force will be given to such specified rate, in the absence of affidavits tending to show that it is unreasonable. (190 N. W. 1013.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## H. L. Geisse President Wisconsin Association

Harold L. Geisse, who was elected president of the Wisconsin Utilities Association at its recent convention in Milwaukee, is the secretary and general manager of the Wisconsin Valley Electric Company at Wausau, Wis. After his graduation from the University of Wisconsin in 1907 he served as statistician with the Railroad Commission of Wisconsin for one year and then joined the San Antonio Gas, Electric & Traction Company in Texas. But upon returning to Wisconsin in 1913 Mr. Geisse re-entered the employ of the Railroad Commission as statistician and subsequently was promoted to be assistant secretary and finally secretary. In the spring of 1919 he became associated with the Northwest Utilities Company, an Insull property, and later operated the Janesville Electric Company. Mr. Geisse remained with this organization until August, 1921, when he took charge of the Wisconsin Valley Electric Company.

H. L. Geisse

Bruno Rahn of the Milwaukee Gas Light Company was elected vice-president of the Wisconsin Utilities Association and John N. Cadby of Madison was re-elected executive secretary. George A. Mills, general superintendent of the Wisconsin-Minnesota Light & Power Company at Eau Claire, Wis., in charge of construction and operation, is the new chairman of the Electric Section of the association.

**T. C. Martin**, past-president of the American Institute of Electrical Engineers and executive secretary of the National Electric Light Association for a number of years, has just returned from Europe after a short sojourn abroad.

## F. M. Feiker to Direct Surveys at Washington

F. M. Feiker, assistant to the president of the McGraw-Hill Company, Inc., has, at the request of Secretary Hoover of the Department of Commerce, again received leave of absence to undertake the organization and general direction of the world surveys of raw-material supplies, rubber, sisal, hemp and nitrates, for which Congress made an emergency appropriation of $500,000.

Mr. Feiker served as assistant to the Secretary of Commerce during the first year of Mr. Hoover's administration, acting as general assistant in organizing the personnel and industrial trade contact committees in relation to the Bureau of Census, the Bureau of Standards and the Bureau of Foreign and Domestic Commerce. Out of his nine months' work came the monthly statistical survey of the Bureau of Census, the Division of Simplified Practice of the Bureau of Standards, *Commerce Reports* in new form and fifteen so-called commodity divisions of the Bureau of Foreign and Domestic Commerce. Of this latter work the annual report of Dr. Julius Klein, director of the Bureau of Foreign and Domestic Commerce, said: "The important task of carrying on this liaison work with the industries was under the general supervision of F. M. Feiker, assistant to the Secretary of Commerce. Mr. Feiker's extensive experience and wide contact with industrial organization and individual manufacturers are largely responsible for the striking success which has accompanied this innovation in the organization of a government department."

## Elihu Thomson Honored on His Seventieth Birthday

Congratulations by wire, mail and spoken word poured in upon Dr. Elihu Thomson, consulting engineer General Electric Company, on Thursday of last week, when that beloved leader of electrical development attained the age of seventy. A celebration dinner was held at the Boston City Club, which was attended by about seventy-five friends and associates. W. C. Fish, former manager of the Lynn works of the company, was toastmaster. Vice-president G. E. Emmons, Schenectady, presented the guest of honor with a loving cup, and congratulations by letter were received from Thomas A. Edison, Dr. Charles P. Steinmetz, President Gerard Swope of the General Electric Company, O. D. Young, chairman board of directors, and President S. W. Stratton of the Massachusetts Institute of Technology. E. W. Rice, Jr., and W. R. Whitney cabled good wishes from Europe, and among the speakers who lauded Professor Thomson's achievements in the field of invention and research were Dr. A. E. Kennelly of Harvard University, Prof. D. C. Jackson of the Massachusetts Institute of Technology, Prof. C. A. Adams of Harvard University, J. R. Lovejoy, vice-president General Electric Company; G. Faccioli, electrical engineer at the Pittsfield works, and M. de Marjorie of the French Academy.

## C. O'B. Murphy General Manager of Indiana Company

Charles O'Brien Murphy has recently been elected vice-president and general manager of the Central Indiana Power Company. Before engaging in the public utility business Mr. Murphy spent twelve years in Wall Street with W. H. Granbery & Company, Street & Norton and E. Clarence Jones & Company, all members of the New York Stock Exchange. During that time he became familiar with corporation securities and financing, leaving Wall Street as office manager for E. Clarence Jones & Company, specialists in bonds. Subsequently Mr. Murphy went West, where he became interested in public utility work. As vice-president and general manager of the United Light & Power Company and its subsidiaries, supplying electric light and power in and around San Francisco Bay, he helped to install central-station steam heating in San Francisco. When the Great Western Power Company of California took over the United in 1916 Mr. Murphy was retained in an executive capacity. In 1917 he became affiliated with the American Public Utilities Company of Grand Rapids, Mich., as assistant general manager, and one year later he joined the Merchants' Heat & Light Company, one of the properties forming the Central Indiana Power Company, as vice-president and general manager.

C. O'B. Murphy

### Sir J. J. Thomson Arrives

Sir Joseph J. Thomson, British physicist, who arrived in New York Monday, March 26, on board the Majestic, delivered the principal address at the meeting of the American Chemical Society in New Haven Wednesday night, April 4, selecting for his subject "The Unity of Physics and Chemistry." Sir Joseph will give a course of lectures before the Franklin Institute, Philadelphia, on April 9 to 14. Shortly after his arrival he was the guest of the Western Electric Company at a luncheon at its Bell System laboratories attended by F. B. Jewett, vice-president, in charge of the telephone department of the Western Electric Company; E. B. Craft, chief engineer; E. H. Colpitts, assistant chief engineer, and other company executives. After luncheon the party was escorted through the research plant.

Sir Joseph J. Thomson received the Nobel prize for physics in 1906. He was Cavendish professor in experimental physics in the University of Cambridge from 1884 until his resignation in 1918. During this time he developed a great research laboratory which attracted workers from all parts of the world. In 1918 he was elevated to the mastership of Trinity College, Cambridge, and in 1919 was elected to a newly established professorship of physics in the Cavendish Laboratory. He has been the recipient of many British and foreign awards and honors, is the author of treatises and textbooks on physics and is popularly known as the discoverer of the electron.

### Col. Charles Keller Resigns

Col. Charles Keller, a widely known officer of the Corps of Engineers, U. S. A., who has served for the past two years as engineer commissioner of the District of Columbia, has resigned as a district commissioner to undertake important duties in connection with hydro-electric development on the Pacific Coast. Colonel Keller was not communicative regarding his new duties, but it is understood that he has been employed by the Eldorado Power Company, a subsidiary of the Western States Gas & Electric Company, to undertake the direction of the engineering work on the South Fork of the American River. The development planned at that point is confronted with engineering difficulties of unusual magnitude. Throughout his engineering career, which began with his graduation from West Point in 1890, Colonel Keller has taken great interest in water-power development. As the representative of the War Department he supervised most of the important installations at Niagara Falls, and he was the representative of the department who assisted in drafting the federal water-power act.

**Fred H. Smith** has been elected vice-president of the Worcester (Mass.) Electric Light Company. Mr. Smith is one of the best known central-station men in New England, having been assistant general manager of the Worcester company for about ten years and prior to that its electrical engineer. He is a past-chairman of the Commercial Section of the New England Division, N. E. L. A. He will continue the work of assistant general manager in his new post.

### D. W. Snyder Heads Illinois Electric Association

D. W. Snyder, the new president of the Illinois State Electric Association, has been general manager of the Bloomington & Normal Railway & Light Company since 1917. After his graduation from Lafayette College in 1907 with an E.E. degree he entered the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company. The year 1909 was spent in construction work, and one year later he joined the Northampton Traction Company, Easton, Pa., as superintendent. From 1911 to 1914 he served as manager of the Clinton Gas & Electric Company, Clinton, Ill., and in 1915 he became connected as general superintendent with the Jefferson City Light & Power Company. Subsequently he was appointed to the position he now holds in Bloomington, Ill. Mr. Snyder has been an active member in the association's work, having for the past three years served as chairman of the rural-lines committee and as vice-president in 1922. He is also a member of the N. E. L. A. rural-lines committee.

D. W. SNYDER

## Obituary

**Charles F. Cuno**, president of the Cuno Engineering Corporation, manufacturer of electric starting devices for automobiles, Meriden, Conn., died at Miami, Fla., March 14, at the age of sixty years.

**George H. Guy**, for the last forty years secretary of the New York Electrical Society, died of pneumonia on April 1 at the Long Island College Hospital. Mr. Guy was one of the leading spirits among those who obtained from Andrew Carnegie the gift of $1,500,000 from which sprang Engineering Societies Building and the Engineers' Club in New York City. He conducted a scientific press bureau for many years and was a contributor to the columns of the *Evening Post* and the *Globe*. Mr. Guy was a member of the A. I. E. E. and the Engineers' Club. He was seventy-six years old.

**Major Abram J. Gifford**, formerly in charge of the transportation department of the General Electric Company for many years, died March 20 at his home in Schenectady after an operation. He was seventy-four years old. In 1891 Major Gifford became associated with the Northeast Thomson-Houston Company at St. Paul, whence he was transferred in 1894 to the transportation department of the General Electric Company at Chicago. In 1899 he was put in charge of the transportation interests of the company and moved to Schenectady, where he resided until the time of his death. On March 1, 1920, he gave up his active duties, but continued on in an advisory capacity.

**Philip I. Robinson**, who was appointed manager of the Baton Rouge (La.) Electric Company recently, died on March 22 after a short illness. Mr. Robinson entered the statistics department of Stone & Webster, Inc., Boston, in 1908 and was soon transferred to Houghton, Mich., where he advanced to the post of superintendent of lighting for the Houghton County Electric Light Company in 1917. For about five years he was manager of the Fort Madison (Iowa) Electric Company and Dallas City (Tex.) Electric Company. Mr. Robinson was born in 1886, his home being at Waterville, Me., and was graduated in electrical engineering from the University of Maine in 1906.

**Dr. Walter Gill Wylie**, for many years intimately associated with water-power development in the South, died at his home in New York City on March 13 at the age of seventy-five years. Dr. Wylie was born in Chester, S. C., and besides being a surgeon of note was the first president of the Southern Power Company of Charlotte, N. C. He helped to organize the Anderson (S.C.) Water, Light & Power Company and later the Catawba Power Company. Early in 1900 he interested J. B. Duke, the tobacco magnate, in the water-power possibilities of the Carolinas, and shortly afterward the Southern Power Company, which has since grown to be the dominant power company of the South, was formed with Dr. Wylie as its head. Professional work in New York caused him later to relinquish the presidency to J. B. Duke, but his interest in industrial and power development continued unabated. Dr. Wylie was consulting surgeon of Bellevue Hospital and professor emeritus of the New York Polytechnic school of medicine for post-graduates. Besides being a member of numerous professional bodies he was a member of the Engineers' Club of New York, next door to which he lived.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Logical Outlet and Profit

**Urges Careful Analysis of Market—If Jobber Is to Sell 9 per Cent of Output, Is He to Receive 9 per Cent of Support?**

By W. A. Kennedy

Sales Manager Sibley-Pitman Electric Corporation, New York City

NATIONAL manufacturers have asked me to give them a recipe for success in electrical merchandising. I am quite willing to give it to them. There ought not to be anything confidential about it. It is a very old recipe — "character and knowledge." Getting business "any old way" is not an evidence of either character or knowledge. Business taken on the wrong basis today—even at a profit of $1,000—may seriously retard a manufacturer's progress for a year, with a failure to gain a possible profit of $30,000 tomorrow.

A manufacturer must have knowledge of his market—not casual knowledge, but a student's analytical knowledge. In applying his knowledge in the establishment of his policy he must have character — character enough to resist temptation, character enough to keep his head and push on, character enough to keep swimming up stream with a bone in his mouth, holding to the substance and ignoring the shadow.

The electrical industry is spending a considerable part of its time discussing the relative merits of electrical contractor-dealers, factory stores or department stores and where the jobber fits in with the ethics and profit—or loss—of canvassing for sales. In the electrical industry we are simply selling appliances on a pure basis of hit or miss. The manufacturer, the jobber and the retailer in virtually every city are working entirely in the dark so far as definite knowledge of the local market is concerned and knowledge as to how much they ought to spend and what they ought to do to develop. They do not know what the market really is. They do not analyze it from the standpoint of potential sales.

Suppose a manufacturer should decide to enter the New York City market with a campaign on vacuum cleaners. Here is a city of nearly six million inhabitants and a suburban territory within 50 miles having a total population of slightly under five million. The usual way is to break loose with advertising, send out salesmen, set up jobbers or dealers, and then see how much business can be obtained, without determining in advance any single fact but that the people are there and therefore the market must be there.

W. A. Kennedy

It would be easily possible, however, to develop the facts from existing and accurate tables on wired homes, central-station customers, location of population, etc. From such accurate analysis the manufacturer would find that there are, for illustration, 750,000 wired homes within the metropolitan and suburban area that may be considered "prospects" to which the vacuum cleaner may be sold in advertising. If this manufacturer were to come to me in a spirit of analytical and intelligent co-operation, we could determine that there are 450,000 possible purchasers, and the manufacturer, considering all elements of sales resistance as well as sales potentialities, could definitely determine the number of machines which he could apportion to his territory. If his total output is to be 100,000 cleaners and he feels that he can assign 9,000 to the New York territory, then that means that I am called upon to do a 2 per cent job. I must sell 2 per cent of the apparent "prospects." That is all, but how many times has any manufacturer ever looked upon such an equation?

Since I am to sell 9 per cent of the manufacturer's output, it is not unreasonable for me to expect 9 per cent of his advertising and sales appropriations to be spent in furthering the New York campaign. If his appropriation for promotion is, for illustration, $100,000, then I am entitled to $9,000 less that proportion of the cost of national publicity represented by its circulation and value within my territory.

### Importance of Advertising

No sensible jobber is apt to minimize the importance and value of national advertising. Such jobbers are aware that national reputations are made this way. An intelligent manufacturer could clearly show to any jobber how much of the national advertising is going into any particular local territory. The figures are always available. The proportion that the local jobber is receiving from a national campaign therefore can be figured out for him, but the allowance for local advertising should be in proportion to the job which the manufacturer expects him to do.

Such an arrangement cannot be one-sided. If the manufacturer is devoting 9 per cent of his sales promotion appropriation to a local campaign in which the jobber is expected to do a 2 per cent selling job, he should be willing to add to the manufacturer's appropriation an amount of money represented by the difference between the gross profit and operating expense up to a figure equal to the manufacturer's expenditure. Figuring this difference to be $3 per machine upon vacuum clean-

ers, the jobber should contribute $9,000, or net profit on the first 3,000 machines, the remaining 6,000 producing a net profit of $18,000. Whenever such fundamental principles are followed, we shall be able to do not merely a 2 per cent selling job, but a real job. On such a basis the jobber and the manufacturer combine their publicity and selling effort, and both enjoy the profit.

A campaign of this kind, predicated on accurate knowledge of the opportunity, a definite purpose in the undertaking and a clear understanding of the obligation on both sides, will put the selling of electrical merchandise on a plane that will be both profitable and constructive. The usual methods are tremendously wasteful. The manufacturer thinks in generalities, and his salesmen talk in generalities. The sales policy, if they have one, is framed at the factory with little or no regard for local market conditions. They don't know how many homes are wired in a town. They don't know how many people own their own homes. They don't know what they should or must spend to get the business. They don't know the source of the business when it comes. The scope of central-station companies serving the community is seldom if ever known. The average salesman is content to merely ask "Why don't you place an order? So-and-so has already done so."

Little headway will be made by any manufacturer in trying to determine on a purely theoretical basis how electrical appliances can best be sold—whether by establishing stores of his own, or through department stores, or through central stations, or through still some other channel. Every now and then you hear some manufacturer say that the electrical contractor-dealer is not a good merchant.

But let us consider for a moment whether or not there is a logical outlet, and, admitting that there is, my opinion is that it is within the electrical industry, and that it is based upon electrical contractor-dealers working in harmony and co-operation with the central-station companies

There has been a tendency on the part of some central stations to minimize the value of jobber to contractor-dealer distribution, and were the forces of the central stations and the contractor-dealers harnessed together properly, the question of logical outlet would be solved.

Central stations through their display rooms can select and direct the consumer in the use of appliances of approved merit, and with their facilities for making collections they can perform both sound and economical functions for the industry and by so doing obtain the support and interest of jobbers in the distribution of approved appliances, because in the final outcome the consumer looks to the central station for satisfactory service during the life of the appliance.

### Taking the Jobbers' Profits

Such a result, however, is retarded when any central-station company, in consideration of the volume of its purchases, obtains the jobbers' cost from the manufacturer and, because it is not performing any wholesale functions, passes along the compensation to the consumer. It would seem fundamental to me that when central stations recognize wholesale consumers of energy, who in turn distribute the energy to retail consumers, they should recognize without argument that the jobber is rightfully entitled to a wholesale profit, which is necessary to compensate for the labor and expense of service given retail dealers.

While the channel of distribution is important—and I believe it exists within the electrical trade—it is not nearly so important as the analysis of the market, the making of a definite policy and then sticking to it. Sound sales volume is not built overnight. What we want in electrical merchandising campaigns is more advance knowledge, more planning and more purpose—in other words, "character and knowledge."

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

FEAR of inflation following the unusually heavy purchasing during these last few weeks is causing considerable comment among the leaders of the larger manufacturers of the industry, and methods of curbing "dangerous buying" have already been adopted in different sections of the country where credit risks are being carefully scrutinized. In addition, a few bulletins warning against overloading the markets have been issued, but it is felt that this practice will not be widely followed by any sensible manufacturers who have already been through any one or two periods of inflation and who must well realize now that it is better to scrutinize accounts than to disregard and discourage them. Prices in the raw-material markets continue to go higher, and while copper has recovered about 45 per cent from the low levels of August, 1921, it is believed that still higher prices will come before the present boom has ended. Authorities in copper circles believe that the peak levels will not be reached for some time and that quotations will react sooner than will other commodities, as the red metal fluctuates most easily. Other advances in the porcelain, wire and iron-pipe markets are laid to general business conditions and up to the present time have been accepted by the larger manufacturers quite readily.

### British Competition and Her Effort to Keep Skilled Labor

ALARMED by the loss of skilled workmen in the United States, Great Britain is taking determined steps to stem that type of emigration. This is thought to account for the recent very low prices which British manufacturers of electrical and other machinery have quoted on export bids. British manufacturers recently were able to underbid their American competitors for large orders in Canada and Brazil, at figures which indicate that little margin was left above the bare cost of labor and materials. At the same time, steps are being taken to increase the volume of domestic business in the hope that the earnings of skilled workmen will be sufficiently attractive to keep them at home. British manufacturers apparently are having some difficulties in their relation with the public at home. There seems to be a widespread feeling that the domestic market has been exploited so as to make possible sales at much lower prices in order to extend foreign trade. Domestic prices on electrical equipment have been such as to permit material inroads into the home market by German manufacturers. Now that they are faced with the departure for America of many of their skilled operatives, they are having difficulty in placating a rather hostile public.

### Americans Do Not Expect to Get Europe's Larger Equipment Orders

THE extension of railway electrification now being undertaken in several of the European countries is not expected to bring orders to this country for the larger equipment needed, according to manufacturers in this country, but it is certain that some of the high-voltage equipment and supplies will be bought here. Also there will be purchases of American specialties, such as signal devices, switches and train-dispatching telephones.

The rising standards of living in China, Japan and India offer an improving market for American electrical specialties. The Oriental is particularly inclined to purchase anything novel. At present the United States is not getting the proportion of this business that it might expect owing to the fact that it has such poor selling facilities in those countries.

The drought during the past season has made it clear to the new hydro-electric companies in Japan that they must install steam auxiliaries. It is believed that the Japanese will soon be in the market extensively for much steam-plant equipment. The demand for power in that country is increasing by leaps and bounds to a point where there is a much greater demand for heavy loads throughout the entire year. The Japanese rivers are short and the opportunities for storage are few. As a result, the opportunity for equalizing the flow of their power streams is much less than in most other countries.

### Occupation of Ruhr Affecting Demand for American Supplies

OCCUPATION of the Ruhr by the French and the cutting off of coal supplies from certain of the German plants engaged in manufacture of electrical goods is having a noticeable effect on the demand for American electrical goods abroad. The average order now reaching the American electrical manufacturers and jobbers is much larger than it was even three months ago. This is taken to indicate that the unsettling influence of low German bids has now been removed.

### Meter Sales Are in Large Volume with Improved Deliveries

DELIVERY conditions in the meter market are highly satisfactory at present as regards the more common sizes and types of watt-hour instruments, looking at the current large demand from the angle of factory production and shipments. A few weeks ag · it was reported that central-station buyers of meters would be wise to look farther ahead in placing orders. At that time rail embargoes and blockaded highways in the North were hampering transportation of both raw and finished materials so badly that there was at least a possibility of inconvenience in the supply of meters if the development of the building industry continued apace. Conditions have now improved materially on the road, and the larger manufacturers of meters have accumulated reasonable stocks of materials and are able to make prompt deliveries of standard lines either from the factory direct or out of district office stocks. The demand is very active, although perhaps a little below the 1920 peak. Overseas trade is poor and is handicapped by Continental competition. There is some tendency toward the more general use of 10-amp. meters in residential service as the number of appliances in use in the home multiplies, but the well-known overload capacity of the 5-amp. meter stands in the way of any very rapid change here. Industries and utilities are using more graphic equipment. Labor is in fair supply in meter factories, and women are extensively employed in this field. Prices are steady, with little tendency toward fluctuation.

### Farm-Lighting Sets About to Enjoy More Active Market

RESTRICTIONS upon travel in rural districts in the northern sections have impaired the growth of farm-lighting business in some quarters, although the total volume of trade is probably somewhat ahead of last year's. A slow opening up of this field is anticipated, followed by a good year's business, reaching its peak in the summer or fall. Little trouble is expected from low stocks in the larger distribution depots, for it has been the practice in the more progressive of these organization branches to carry stocks capable of meeting a demand considerably in excess of the present volume. Some manufacturers have stiffened their prices to at least a moderate degree as a result of increased production costs, but not all have done this as yet. The outlook is for a general falling into line on price movement before long if present labor and material costs do not come to a halt or decrease. One large manufacturer is still selling on a 1917 price basis and has made no change of importance in five months. Confidence as to the outlook is widespread.

### Irregular Demand for Tools Due to Accumulated Stocks

OWING to the previous accumulation of considerable stocks by distributors, the demand for electric tools as felt by representative manufacturing interests is at present somewhat uneven from week to week, although the general trend of sales is upward. Factories are busy, however, and the increasing shortage of labor in industry is stimulating interest in the economic utilization of electrically operated drills, industrial irons and many other appliances designed to expedite shopwork. Current stocks are sufficiently lowered now to require more attention to purchasing, and there are still intermittent embargoes on the railroad lines between factory and distribution points. As in other lines, raw material and labor costs are stiffening, and price trends are correspondingly firm.

### Prime-Mover Prices Hardening with Rises in Labor and Material

INCREASING demands for central-station service throughout the country continue to cause orders for steam turbo-generator sets to accumulate at the manufacturing plants. Broadly speaking, the 1923 output has been sold out for many weeks if not for several months, and it is unsafe to figure on less than a year in estimating deliveries of large units. In the field of large plant development the 30,000-kw. unit continues popular as the normal upper limit of routine heavy practice. Probably upward of a million kilowatts of such units are now on order in this country. Turbine development along the line of increasing reliability of operation continues to absorb the efforts of designing engineers, and the approaching commercial application of the mercury boiler and turbine has aroused wide interest in commercial as well as in engineering circles. Higher boiler pressures are readily coming into service, superheat is being pushed upward, and something like a race in size development is under way between steam and hydraulic turbo units. The whole prime-mover market is alive with new developments; proposition work is fraught with unprecedented interest, and existing long deliveries have little effect upon competitive activities. Raw materials, long anticipated as to requirements, are in good stock at the factories, but the upward trend in costs of material, labor and overhead tends to harden prices at this time.

### Signal Apparatus Strong with Orders from New Schools

ELECTRICAL signaling equipment is in excellent demand at present, school construction in many localities requiring liberal purchases of this line of material. Factory stocks are reported in good shape, and the making up of systems for interior telephone, annunciator and call-signal work is readily effected from existing parts in current storage. Many jobbers appear to leave the sale of these systems to the manufacturers, although some parts are carried for replacement service and a small installation work. Prices are firm and so far little complaint has been heard regarding the ability of manufacturers to obtain raw material in plants where the purchasing department is sensitive to pending delivery conditions.

### English Electrical Exports Fell £56,296 in February

THE following are official values of electrical machinery, apparatus and material exported from England (a) during February, 1923, and (b) from Jan. 1 to Feb. 28, with increase or decrease compared with the corresponding periods of 1922. The total of electrical machinery, material and apparatus, other than insulated wire, was £936,482 for February, which was a decrease of £56,296 from those exports during the month of February, 1922.

Electrical machinery, (a) £284,290 (decrease £99,725), (b) £719,192 (decrease £232,087); including railway and tramway motors, (a) £28,170 (increase £12,992), (b) £44,991 (increase £13,-935); other generators and motors, (a) £131,968 (decrease £45,272), (b) £386,-027 (decrease £135,712), and other electrical machinery, (a) £124,152 (decrease £67,445), (b) £288,174 (decrease £110,310); telegraph and telephone cables, submarine, (a) £27,274 (decrease £33,811), (b) £102,395 (increase £37,917); other than submarine, (a) £67,000 (increase £32,766), (b) £121,-909 (increase £6,012); telegraph and telephone apparatus, (a) £170,932 (in-

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.0322 | $0.0312 | $0.0229 |
| Cold finished shafting, per lb. | 0.0406 | 0.0402 | 0.0317 |
| Brass rods, per lb. | 0.1904 | 0.1804 | 0.15 |
| Solder (half and half), per lb. | 0.314 | 0.2617 | 0.20 |
| Cotton waste, per lb. | 0.1231 | 0.1181 | 0.109 |
| Washers, cast iron (½-in.), per 100 lb. | 4.50 | 4.33 | 3.83 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.11 |
| Machine oil, per gal. | 0.349 | 0.349 | 0.40 |
| Belting, leather, medium, off list | 42% | 49% | 46¾% |
| Machine bolts, up to 1-in. x 30-in., off list | 48⅓% | 51⅓% | 64½% |

crease £31,200), (b) £345,656 (decrease £15,147); other electrical wires and cables, rubber-insulated (a) £95,301 (increase £54,375), (b) £213,562 (increase £116,516); with other insulations, (a) £90,433 (decrease £24,550), (b) £176,788 (decrease £62,161); carbons, (a) £3,489 (increase £1,126), (b) £10,159 (increase £1,053); glow lamps, (a) £26,206 (decrease £3,377), (b) £55,238 (decrease £3,355); arc lamps and searchlights, (a) £300 (increase £159), (b) £746 (decrease £346); parts of arc lamps and searchlights (other than carbons), (a) nil (decrease £244), (b) £84 (decrease £697); batteries, (a) £47,168 (increase £23,169), (b) £94,523 (increase £36,130); electrical instruments (commercial and scientific), electricity meters, (a) £31,359 (decrease £4,369), (b) £56,993 (decrease £15,201); switchboards, (a) £7,538 (decrease £16,851, (b) £23,046 (decrease £87,318); other electrical goods and apparatus, (a) £85,192 (decrease £15,164), (b) £212,281 (decrease £10,995).

## The Metal Market

**Demand Is Less Active — London Prices Fluctuate Widely—Customers Are Scrutinizing Quotations**

The week in the metal market has been a quiet one with only small price changes. Prices in London have fluctuated widely, however, and the unrest in that country has without doubt had an adverse effect on business here. Consumption in most lines continues excellent. Copper continues at 17.37½ cents delivered. Producers are well sold up, and it is unlikely that they will force their copper on an unwilling market for some weeks, so that no important price recession is likely. It is a fact, however, that the demand for manufactured copper products has weakened since the price went above 17 cents. The customers of the wire and brass mills seem to be watching the price of raw copper more than they formerly did and to restrict their buying if they think the price has risen too fast.

Heavy exports are going to Germany; of the total of 2,793 tons exported last Wednesday, 1,837 went to Germany.

NEW YORK METAL MARKET PRICES

| Copper | Mar. 28, 1923 Cents per Pound | April 4, 1923 Cents per Pound |
|---|---|---|
| Electrolytic | 17.37½ | 17.37½ |
| Lead, Am. S. & R. price | 8.25 | 8 25 |
| Antimony | 8.75 | 8.75 |
| Nickel, ingot | 30.00 | 30 00 |
| Zinc, spot | 7.65 | 7.65 |
| Tin, Straits | 48.00 | 48.00 |
| Aluminum, 98 to 99 per cent | 26.00 | 26.00 |

### Copper and Brass Products

Copper, brass and bronze mills quote the following prices on brass and copper products:

Copper wire, 19.87½ cents, mill; brass wire, 22.50 to 24.00 cents; copper sheets, 25.50 cents; copper rods, 20.37½ cents; brass rods, 20 to 24.50 cents; sheet brass, 21.75 to 23.50 cents.

**Electric Elevator Manufacture.**—According to figures issued by the Department of Commerce there were 117 establishments making electric elevators in the United States during 1921. Value of their products was $29,414,000. In 1919 there were ninety-four establishments, whose output amounted to $29,607,000.

# The Week in Trade

**Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

BUYING in most sections of the United States continues in heavy volume with slight advances in prices of wire, conduit, wiring devices and some high-tension equipment following the rising quotations in the raw-material markets. Business in second-hand motors is gaining in the East owing to increased activities in the textile and metal-working fields. Warmer weather is bringing more outdoor construction, with the result that poles, wire and meters are moving rapidly. Spring lamp replacements are making up a fair amount of orders. Aluminum wire is said to be receiving added interest.

**Boston** Little recession can be seen in buying, which is still conservative and well adjusted to demands in sight. Prices have increased again on sockets and switch plates, and connectors for flexible armored conductor also are quoted higher. Deliveries are quoted at longer periods. Motor stocks are decreasing materially. Some types of radio tubes are unobtainable. Outdoor construction is opening up gradually. A compromise wage increase is expected in the building field. Banking conditions are in good shape and retail trade is excellent. Unemployment is causing little concern and railroad conditions are better.

**New York** Buying is in heavy volume with prices generally firm for the last ten days, although slight increases are noted for wiring devices. Business in new and second-hand motors is slightly stronger than a few weeks ago, with depletion of stocks here and there throughout the Eastern territory. High-tension-equipment business is picking up favorably with increased buying by utilities. Construction business has given the wire market another strengthening turn. Large orders of meters are reported with lamps selling in large lots for spring replacements.

**Atlanta** Business in jobbing circles continues fair with little change from last week. The higher prices for lumber have caused advances in poles and cross-arms, and while sales are good, deliveries are becoming slower. Heavy construction is taking large quantities of conduit, and although shipments have improved, it is impossible to accumulate satisfactory stocks.

**Pittsburgh** No price changes of any importance occurred during the week. Dealers report good sales of washing machines following large advertising campaigns supported by manufacturers. Other appliance business is rather slow. Radio demand is holding up fairly well.

**Cleveland** Great increase in orders is reported. Retail sales are increasing rapidly in seasonal articles and business from the utilities is favorable. Added residences have brought about a heavier demand for meters. Fixtures likewise are moving well. Aluminum wire is attracting a great deal of attention because of higher quotations in the copper market. Conduit deliveries are more prompt. The general price trend is firm with the exception of radio, where some cutting is evident. Lamps are stronger. Collections are reported at sixty days.

**Chicago** Brisk trade is reported by dealers in this territory. Considerable quantities of conduit are being placed despite its shifting prices. Demand for motors remains active. High-tension equipment and pole-line hardware buying is stronger. Pole stocks are normal. Advances are expected in wire.

**St. Paul-Minneapolis** Colder weather has halted spring campaigns by jobbers and contractors. Falling off in demand for poles and other construction material is noted.

# Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Washers and Cleaners; Irons and Storage Batteries

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High-Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Radio | Farm-Lighting Plants | Signal Apparatus | Electric Tools |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boston** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Act. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Low | Nml | Nml | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml | Low |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Dec. | Firm | Firm | Firm |
| **New York** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act | Sdy. | Act. | Act. | Slow | Act. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Low | Nml | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Inc. | Firm | Dec. | Firm | Firm | Firm |
| **Baltimore** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. | Slow | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Act. | Act. | Act | Sdy. | Act. | Sdy. | Act. | Act | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **St. Paul-Minneap.** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Sdy. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Slow | Sdy. | Slow | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Slow | Act |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | | |
| Demand | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Slow | Sdy. | Slow |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow | Act. | Slow | Sdy. | Act. | Act. | Act. | Slow | Act. | Slow | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Low | Nml, | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | High | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Slow | Slow | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | High | Low | Low |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Inc | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Inc. | Firm | Dec. | Firm | Firm | Firm | Firm | Firm |

High-tension insulators have advanced 10 per cent, with stocks depleted and factories two months behind with orders. The conduit situation is slightly relieved. Radio orders from rural districts show slight improvement.

**St. Louis** Appliance sales for March showed a very appreciable increase over the same month of 1922. Motor and transformer manufacturers are operating to capacity and are considerably behind with their orders. Farm-lighting plant sales in this district during last month were greater than for any month since 1917. Demand for radio equipment continues active. Strong demand for wire, wiring devices and fixtures is reported as the result of a large house-wiring campaign now being carried on by a public utility. Calls for second-hand motors are increasing.

**San Francisco** A fine fan year is predicted. Perhaps it will be even better than 1922 because of improved business conditions. Drastic steamer rate increases are expected. The six weeks' dry spell has been broken by a well-distributed rainfall. Contractor and dealer business is increasing. San Francisco building permits for March totaled $3,229,572.

**Portland-Seattle** Business is reported good, and building in this district continues to exceed last year's records. Prices generally are stronger. Conduit stocks are improving and incoming shipments are increasing. Deliveries in lead-covered cable are poor, shipments on paper-insulated being at thirty weeks and cambric at twenty weeks. Lamp demand is following seasonal requirements.

**Denver** Volume of sales for most lines is larger. Increased wage scales effective last week apparently have not affected the present heavy building program, and there is a marked absence of labor difficulties. Railroads report another increase in tonnage and car loadings, and incoming shipments are more prompt. Washing machine, range and vacuum-cleaner campaigns are being carried out in this territory with satisfactory results.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Vye-Smith Company, Inc., Opens New Boston Jobbing House

Murvyn W. Vye and Ray H. Smith have organized a new electrical supply jobbing house under the name of Vye-Smith Company, Inc., and will open for business at 199 Purchase Street, Boston, April 2. Mr. Vye is widely known in New England electrical circles, having recently been vice-president of the McKenney & Waterbury Company, Inc., of Boston, and for some years previous sales manager of the Wetmore-Savage Company, Boston. Mr. Smith was formerly on the sales staff of the latter organization.

## Betts & Betts Open Branch Office in Philadelphia

The Betts & Betts Corporation, 645 West Forty-third Street, New York City, has recently opened a branch office in Philadelphia in charge of Vernon H. Walker as district manager at 1536 Cherry Street, where space has been provided for a complete line of stock. Frank Wolk, who has been actively engaged in the radio market in New York City, is now connected with Betts & Betts in charge of the metropolitan district sales staff.

## Organizes Transmission and Street Lighting Department

The Capital Electric Company, Salt Lake City, has inaugurated a policy whereby its technical sales problems will be handled by a competent engineer. The company has organized a transmission and street-lighting department which is in a position to go into the engineering features of customers' problems. This department has been placed in charge of K. V. Laird. Mr. Laird is an experienced electrical engineer and a graduate of the University of California. He was formerly employed by the Anaconda Copper Mining Company in Montana and was also associated with the Gellert Engineering Company in Philadelphia.

## Standard Turbine Makes Sales Appointments

The Standard Turbine Corporation, Wellsville, N. Y., announces the following appointments of representatives in connection with the sale of their steam turbines: Fred H. Dorner, 548 Milwaukee Street, Milwaukee; Craun-Liebing Company, 30 Euclid Arcade Annex, Cleveland; L. S. Vallely and Company, Whitney-Central Building, New Orleans; Leonard G. Payne, 806 Otis Building, Philadelphia; Castle & Wilson, 1601 Arrot Building, Pittsburgh.

The Standard Turbine Corporation, is manufacturing steam turbines in capacities up to 500 hp.

## Am-plus Storage Battery Makes Rapid Recovery After Fire

The Am-plus Storage Battery Company, Chicago, in less than two months after a fire which on Jan. 24 nearly destroyed its plant at 741 Van Buren Street, has established an entirely new plant at 429 West Superior Street, where the manufacture of its products has been resumed under improved conditions. The new plant, besides having double the floor space of the old one, is newly equipped with entirely new machinery and is so laid out as to greatly facilitate manufacture, assembly and shipping. Provisions have been made for expansion on a large scale.

## Philadelphia Firms to Exhibit at Civic Industrial Exposition

The Troupe Electric Company, Ambrose Diehl Electric Company, F. J. Saylor Company, Voight Company, Emery & Son, Abso Clean Sales Corporation, the Better Home and the Vital Sales Company, all of Philadelphia, have arranged for displays in the Philadelphia Palace of Progress, a civic-industrial exposition to be held in the Commercial Museum May 14-26.

The exposition will celebrate the two hundred and fortieth anniversary of the founding of Philadelphia and will represent the civic and industrial advancement of the city. All of the firms here mentioned will exhibit electrical appliances.

## Electric Machinery Changes

The Electric Machinery Manufacturing Company, Minneapolis, manufacturer of synchronous motors and alternators, announces that F. F. Espenschied has been appointed in charge of its Pittsburgh office in the Union Arcade Building. The company also announces the establishment of its Cincinnati office in charge of C. G. Tarkington in the Mercantile Library Building.

## Radio Corporation of America Report Shows Rapid Growth

The stupendous strides made last year in the development of its system of world-wide wireless and outlines of a comprehensive program of expansion in all parts of the world are reviewed in the annual report for 1922 of the Radio Corporation of America, issued to stockholders last week.

The extent to which business expanded in 1922 is shown by the fact that gross sales amounted to $11,286,489, compared with only $1,468,919 for 1921, and gross income totaled $14,830,856, against $4,160,844 for the year preceding. After all deductions, including reserves for amortization of patents, federal taxes and organization expenses were written off, there was a surplus of $2,974,579, an increase of $2,547,780.

Current assets of the company at the end of the year were $8,686,907, contrasted with current liabilities of $2,688,941. Of the assets $946,888 was cash, $2,445,925 accounts and notes receivable and $5,041,213 inventories. Current assets exceed the current liabilities by $5,997,966.

## General Electric 1922 Sales Were $200,194,294

The General Electric Company reports net sales of $200,194,294 for last year, against $221,007,992 in the previous year. Despite the drop of approximately $21,000,000 in the volume of business, the net profits were larger than those reported in the previous year.

| | †1922 | †1921 |
|---|---|---|
| Net sales | $200,194,294 | $221,007,992 |
| Costs, expenses, etc. | *177,458,012 | *199,331,309 |
| Balance | $22,736,282 | $21,676,683 |
| Other income | 8,058,684 | 6,478,984 |
| Total income | $30,794,966 | $28,155,667 |
| Inventory reserve | ........ | 3,700,000 |
| Interest | 4,563,947 | 2,802,855 |
| Surplus | $26,231,019 | $21,652,812 |
| Cash dividends | 14,073,628 | 13,409,522 |
| Stock dividends | 8,717,265 | 6,746,114 |
| Surplus | $3,440,126 | $1,497,176 |
| Appropriations | 400,000 | 1,418,864 |
| Previous surplus | 70,126,921 | 70,048,611 |
| Profit and loss surplus | $73,167,047 | $70,126,921 |

*Includes depreciation, federal taxes, &c.
†Excludes accounts of International General Electric.

After payment of all expenses, charges and taxes and allowances for depreciation, net profits for the year were $26,231,019, which after dividends on the special $10 a share par value stock was equal to $14.86 a share earned on the $175,624,746 common stock of $100 a share par value outstanding at the end of 1922. The net profits for the previous year amounted to $12.57 a share on the $172,194,300 capital stock then issued.

The consolidated balance sheet showed total assets of $355,445,492. Cash holdings were carried at $49,482,770 at the close of 1922 against $39,888,683 at the close of 1921; investments were valued at $63,892,232 against $75,326,382; government securities, $35,858,768 against $23,862,912; notes and accounts receivable $35,154,419 against $52,514,902, and inventories at $75,334,562 against $64,848,189. A total of $13,874,385 cash is carried in sinking-fund reserve. Accounts payable totaled $13,415,954 against $9,495,261.

## Westinghouse Authorizes Sale of $14,962,530 Common Stock

Directors of the Westinghouse Electric & Manufacturing Company at a meeting last Wednesday authorized the sale of $14,962,530 additional common stock, which will be offered to stockholders at a subscription price of $53 a share, to the extent of one share of new stock for each five shares now held. The offer will be made to stockholders of record April 16. Payment for the stock must be made in full by May 31. In connection with the offering of new stock, Guy E. Tripp, chairman of the board of directors, sent the following letter to stockholders:

"Your company has a large amount of unfilled orders on hand, and is taking additional orders in large volume. In addition, the directors believe that there will be a still further enlargement in the demand for your company's products, due to the public attention which is now being directed toward hydro-electric developments, steam railroad electrification, industrial electric manufacturing processes, further development of activities in the radio field and a widening use of electricity for other purposes, all of which would stimulate still greater activity in your various manufacturing lines.

"After applying the proceeds of the sale of the new issue of common stock, the net quick assets of the company, as of March 31, 1923, will amount to $105,000,000.

"The net profits of your company available for dividends for the fiscal year ended March 31, 1923 (March estimated), will amount to about $12,000,000, while the dividend on the shares of your company, including the new issue of stock, at the rate now being paid, viz., 8 per cent per annum, will be $7,182,000."

## Shakstad Moves to Larger Quarters

The Shakstad Electric Company, formerly at 213 West Ninth Street, Sioux Falls, S. D., has moved to larger and better quarters at 214 South Main Avenue, the same city, where it will be better prepared to give prompt attention to calls for new apparatus or immediate repairs to all makes of machines.

## Ohio Brass Earnings $1,398,863 in 1922; $722,440 in 1921

Net earnings of the Ohio Brass Company, Mansfield, Ohio, manufacturer of insulators and other equipment, during the year 1922 were $1,398,863, as compared with those for the year 1921 of $722,440. The company during the past seven years has shown total net profits of $5,229,295, or a yearly average of $35.56 a share on the outstanding preferred stock and $6.49 on the outstanding common stock.

During the depression period the company's business showed only comparatively small decline and the period resulted in no losses to the company.

Balance sheet as of Dec. 31, 1922, shows the following items: Assets: Cash, $700,038; notes and accounts receivable, $1,570,986; United States and other securities, $496,412; inventories, $1,443,138; total current, $4,210,574; plant and equipment, $2,781,056, making total of $6,991,630.

Liabilities: Accounts payable, $448,622; reserve for taxes, $250,000; total current, $698,622; preferred stock, $2,100,000; common stock, no par, $1,922,580; surplus, $2,270,428.

The company recently completed and placed in production a new plant at Niagara Falls, Ont., to gain a better foothold in the Dominion and other British territory and is also contemplating a large addition to its Barberton subsidiary, the Ohio Insulator Company.

**The New England Insulator Company**, New Freedom, Pa., a subsidiary of the American Insulator Company, manufacturer of electrical insulating products and other electrical equipment, has leased property from the Danbury Industrial Corporation, Danbury, Conn., for the establishment of a new plant. It is thought that the New Freedom works may be removed later to the new location.

**C. G. Everson & Company**, manufacturer of electric light fixtures, 70 West Lake Street, Chicago, has leased the five-story-and-basement building at the northeast corner of Erie and Green Streets, where it will move its manufacturing equipment.

**The Electric Storage Battery Company**, Philadelphia, has adopted a night shift in a number of departments, in addition to a maximum day working force, officials of that company announce.

**The Bell Lighting Company**, 385 Broadway, New York City, has been incorporated with a capital stock of $100,000 and will manufacture electric and gas fixtures. It is taking over the property and assets of the Campbell Lighting Company, New York City, which has been in this business for some time. At present parts are being manufactured under contract, the company's activities consisting principally of assembing. It plans to do a part of its own manufacturing some time in the near future. The incorporators are C. A. Campbell, W. Weigand and A. C. Worgren.

**The Home Specialties Manufacturing Company**, recently organized, has entered into a manufacturing agreement with the S. S. Wenzell Machine Company, Philadelphia, to manufacture electrical household appliances. The new company is represented by Joseph C. Haines, 301 Market Street, Camden, N. J.

**The Modern Sign Company**, 5750 Woodward Avenue, Detroit, has been incorporated with capital stock of $75,000 to manufacture electric signs and displays, also to do general commercial work in electric sign rental. The company has a well-equipped plant, since it took over a company which has b[illegible] manufacturing for about two years. I[illegible] is estimated that this year's sales w[illegible]l amount to about $200,000. C. L. Beswicke is general manager of the company.

**The Cliff Electric Corporation**, 59 Pearl Street, New York City, has been organized to manufacture and distribute electric phonograph motors. It is already on an operating basis, having a factory at Lebanon, N. H. S. A. Jacobs is president and I. M. Davis is secretary.

**The Quality Electric Company**, Los Angeles, manufacturer of electrical specialties, has plans in progress for the construction of a new one-story plant, 40 ft. x 175 ft., on San Pedro Street, and will call for bids at an early date.

**The Hoosic Engineering Company**, Hoosic Falls, N. Y., has been incorporated with capital stock of $20,000 to manufacture electrical products. Future plans of the company are undetermined, but no building will be undertaken at present. The chief incorporator of the company is E. Tiffiny.

**The B. & H. Electric Company**, Woburn, Mass., is taking bids until April 15 for the construction of a local plant 120 ft. x 175 ft. and 60 ft. x 150 ft. estimated to cost approximately $100,000, with equipment.

**The Rubber Insulated Metals Corporation** has moved its general offices from 50 Church Street, New York City to 18 Oliver Street, Newark, N. J. The new location will give the company larger accommodations and afford every facility for handling a steadily increasing business.

**The Superheater Company**, 17 East Forty-second Street, New York City, announces the appointment of J. S. Cothran, Charlotte, N. C., as its representative in North and South Carolina.

**The Cutler-Hammer Manufacturing Company**.—The Pittsburgh office of the central district of the Cutler-Hammer Manufacturing Company, Milwaukee will move on May 1 from the Farmers Bank Building to rooms 950 to 95[illegible] Century Building, on Seventh Street between Penn Avenue and Duquesne Way. A. G. Pierce is manager of this district.

**The Bullock Manufacturing Company**, 356 West Fortieth Street, New York City, manufacturer of lighting fixtures, has purchased two four-story buildings, 33 ft. x 102 ft., at 352-54 West Fortieth Street, for plant extensions.

**The Electric Porcelain Manufacturing Company**, Trenton, N. J., has filed plans for the construction of a new one-story building at its plant on New York Avenue, in order to increase production.

**The Detroit Electrical Appliance Company**, 9124 Linwood Avenue, Detroit, which was recently incorporated to manufacture electrical equipment, will do its work under contract. Its own activities will consist in assembling the parts in its shop. D. H. Ladd is president of the company.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in South Africa (No. 5,890) for a small modern plant for the manufacture of paper bags for grocers, to be driven by electricity, and to include a suitable printing press and type for printing the bags.

Purchase is desired in China (No. 5,893) of clay mills capable of pulverizing clay into fine flourlike paste for pottery purposes, capacity to be about 2 tons of clay per forty-eight hours, to be operated by electricity.

Purchase is desired in Mexico of tire-inflation equipment, including a 200-lb. pressure air tank, 1-hp. electric motor and a two-cylinder pump.

An agency is desired in Punjab, India (No. 5,912), for electrical goods, motor accessories, etc.

Purchase or agency is desired in Mexico (No. 5,917) of electric flatirons, 110 volts, 6 lb., costing about $3; electric stoves with two or three hot plates, carrying about 1,000 watts, and similiar electrical apparatus of a cheap grade.

An agency is desired in China (No. 5,918) for motors and accessories to generate electricity for lighting ten towns in that country, capacity ranging from 11 kw. to 110 kw. Price lists, descriptive catalogs, etc., are requested.

The following inquiries have been received by the Philadelphia Commercial Museum, which will furnish names and addresses of the inquirers to any one desiring them and mentioning the number given: Parties in Paramaribo, Dutch Guiana (No. 40,579), would like to get in touch with manufacturers of electrical apparatus, electrical engines, automobiles and supplies, batteries, etc. Parties in Trinidad, British West Indies (No. 40,590), would like to correspond with manufacturers of optical supplies and also violet-ray and other high-frequency machines. A party in Stockholm, Sweden (No. 40,588), would like to communicate with manufacturers of advertising articles and electric or non-electric moving signs and apparatus for show windows.

HYDRO-ELECTRIC POWER FOR SAO SEBASTIAO, BRAZIL.—Under a contract recently made with a local company, according to *Commerce Reports*, hydro-electric power will be supplied for lighting and power purposes in the city of São Sebastião, State of São Paulo. Electricity for the neighboring port of Caraguatatuba is included in the agreement.

CALL FOR BIDS FOR A MUNICIPAL LIGHT AND POWER CONCESSION.—A municipality in the State of Rio Grande, Brazil, *Commerce Reports* states, is calling for bids on the franchise for supplying electricity for lamps and motors. The concession will be granted for thirty years, the municipality having the right to purchase the concessionaire's property at the end of fifteen years. Bidders must agree to the use of specific water power and to the supplying of service at 120 volts. They must also state the power and light rates, both to the municipality and to individuals, for the first ten years.

## New Apparatus and Publications

AUTOMATIC ELECTRIC LIGHT PLANT. —R. A. Lister & Company, Inc., 101 Park Avenue, New York City, has placed on the market an electric lighting plant that will start and shut itself off automatically.

INDICATOR LIGHT.—The H. T. S. Indicator Company, Chester, Pa., has brought out a device, known as "Lite-A-Meter," to protect the motor car from danger of overheating when the radiator indicator is not readily visible to the driver.

ETCHING OUTFIT.—The Union Electric Company, 933 Liberty Avenue, Pittsburgh, has placed on the market an outfit for etching ownership marks on lamps and other glass articles.

TOASTER AND GRILL.—The Chicago Flexible Shaft Company, 5560 Roosevelt Road, Chicago, has placed on the market the "Sunbeam" combined electric toaster and grill.

ELECTRIC CLOTHES DRIER.—An electric clothes drier has been developed by the Airo Electric Appliance Company, Columbia Bank Building, Pittsburgh, Pa.

POWER PLANT. — A light and power plant for portable and stationary work has been brought out by the Charles J. Bogue Electric Company, 513 West Twenty-ninth Street, New York City. The set can be operated in conjunction with storage battery if desired.

ELECTRIC RANGE.—A side-wall electric range has recently been placed on the market by the Standard Electric Stove Company, Toledo, Ohio.

WINDSHIELD CLEANER.—An electric windshield cleaner has been brought out by the Apco Manufacturing Company, Providence, R. I.

BELL STRIKER.—An electric bell striker for fire and danger signals has been placed on the market by the Electrical Automatic Appliance Company, 1749 Arapahoe Street, Denver, Col.

ELECTRIC STEAM VULCANIZER.—An electric steam vulcanizer which will repair two tubes at one time has been brought out by the Cross Vulcanizer Company, 1655 Blake Street, Denver, Col.

MULTI-SPEED MOTOR.—The Louis Allis Company, Milwaukee, has published a bulletin covering the "Watson" multi-speed motor. This motor is made in three types, two-speed, three-speed and four-speed, and is particularly adaptable to machine-shop requirements.

SOCKET.—The Tri Novelty Company, Wilson, Pa., is distributing a leaflet describing the "Neidig" drop socket.

## New Incorporations

THE ALMOND LIGHT & POWER COMPANY, Albemarle, N. C., has been chartered with a capital stock of $100,000 by Jethro Almond, J. T. and David P. Dellinger.

THE BLOWING ROCK (N. C.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $125,000 by T. H. Coffee, D. A. Burkhart and W. L. Alexander.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

MACHIAS, ME.—The Eastern Development Company, a subsidiary of the Bangor Railway & Electric Company, contemplates building an addition to its local power plant.

MEREDITH, N. H.—The Meredith Electric Light Company expects to extend its transmission lines to Tuftonboro and Winona and to purchase energy from the hydro-electric plant of the Utilities Power Company. C. M. Turner is secretary and treasurer.

PORTSMOUTH, N. H.—The Rockingham County Light & Power Company contemplates increasing the output of its plant. F. W. Randall is assistant general manager.

WINDSOR, VT.—The Windsor Electric Light Company expects to install an additional 50-hp., 2,200-volt, three-phase motor, directly connected to a centrifugal pump for the municipal water supply. Richard P. Osgood is superintendent.

HUNTINGTON, MASS.—The Huntington Electric Light Company contemplates establishing a twenty-four-hour service. E. A. Stanton is treasurer.

NORWICH, CONN.—The Eastern Connecticut Power Company has issued $3,000,000 in bonds, part of the proceeds to be used for extensions.

## Middle Atlantic States

BROOKLYN, N. Y.—The Rubel Coal & Ice Corporation, 197 Glenmore Avenue, will install electric power equipment at its ice-manufacturing plant on Fulton Street, Hollis, to cost about $500,000. Edward Adelsohn, 1778 Pitkin Avenue, is architect.

COPENHAGEN, N. Y.—The Deer River Power Company contemplates building a new reservoir this year. V. C. Wood is manager.

FORT TOTTEN, N. Y.—Bids will be received by the Quartermaster Department, Torpedo Depot, until April 16, for 56,000 ft. submarine cable, nineteen-conductor, rubber-insulated, and fourteen cable reels.

LEICESTER, N. Y.—The Mount Morris Illuminating Company plans to extend its transmission line to Leicester and install a local light and power system.

MIDDLETOWN, N. Y. — The Orange County Public Service Corporation is building a new hydro-electric plant on Monagaup Falls of 5,000 hp., which will be placed in operation about May 1. The new 33,000-volt transmission line which will be connected with the line of the Honk Falls Power Company, Ellenville, will be completed about April 1. H. A. Farst is superintendent of electric stations.

MONROE, N. Y.—The erection of an interconnecting line with the Rockland Light & Power Company at Hillburn is under consideration by the Orange & Rockland Electric Company. R. W. Smith is president and manager.

WATERTOWN, N. Y.—The Power Corporation of New York contemplates building a hydro-electric plant on the Oswegatchie River, near South Edwards, to develop 10,000 hp. The cost is estimated at about $500,000. W. P. Creager, Northern New York Trust Company Building, is chief engineer.

WATERTOWN, N. Y.—Bids are being received by J. W. Ackerman, city manager, and P. B. Sutton, city engineer, for three 2,250-kw. generators, switchboard and transformer equipment for the new power plant at Delano Island. The cost is estimated at $75,000 to $100,000.

YONKERS, N. Y.—Electric power equipment will be installed by the Alexander Smith & Sons Carpet Company in connection with mill additions to cost about $1,000,000.

HIGHTSTOWN, N. J.—The Electric Light & Power Company of Hightstown plans to extend its rural line about 2 miles. Thomas J. Duncan is treasurer and superintendent.

NEWARK, N. J.—The Public Service Electric Company is planning to construct a power plant in the meadow section, to cost about $12,500,000. The station will be designed for an ultimate capacity of 160,000 kw. and will cost $25,000,000. Additional transmission lines for power service will be erected.

ALLENTOWN, PA. — Officials of the Pennsylvania Power & Light Company are organizing a number of subsidiary companies for the purpose of erecting transmission lines to various townships, with substations and distributing systems. Application for state charters will be made early in April. The companies will be known as the Dreher, Buck, Bear Creek, Lehigh, Salem, Denison, Paupack, Sterling and Palmyra Power & Light companies.

DOYLESTOWN, PA.—The Philadelphia Suburban Gas & Electric Company, Philadelphia, has acquired the property of the Bucks County Electric Company. A transmission line will be erected and the local power plant will be remodeled for a substation.

EAGLES MERE, PA.—The Eagles Mere Light Company will install two new waterwheels and governors within the next two months, to replace the present equipment, at a cost of about $11,000. R. D. Kehrer is general manager.

KANE, PA.—The American Water Works & Electric Company, New York, has issued $2,000,000 in capital stock, part of the proceeds to be used in connection with the acquisition of the Keystone Power Corporation, the Edison Electric Illuminating Company and the Cumberland Electric Railway Company and for proposed extensions and improvements.

MARCUS HOOK, PA.—The Viscose Company is planning to build a power house in connection with its proposed artificial silk mill, to be erected at Holmesburg Junction, to cost about $2,500,000.

MODENA, PA.—The Margargee Paper Company will build a power house in connection with a new mill at Edgeley, to cost about $500,000.

PHILADELPHIA, PA. — Electric power equipment will be installed in the proposed candy factory to be erected by the Brandle & Smith Company at Fifth and Bristol Streets, to cost about $360,000. The William Steele & Sons Company, Sixteenth and Arch Streets, is engineer.

YORK, PA.—The Pennsylvania Water & Power Company plans to erect a double-

circuit transmission line from Holtwood to supply energy to the Edison Light & Power Company. A substation will be erected at the city limits.

NEW CASTLE, DEL.—The Wilmington Fibre Specialty Company plans to install additional equipment in its power plant in connection with extension to its works, to cost about $250,000.

MIDDLEBOURNE, W. VA. — The West Virginia Light, Heat & Power Company plans to erect a transmission line from Sisterville to Middlebourne, and to install a local distributing system.

FORT EUSTIS, VA.—Bids will be received by the Quartermaster, United States Army, until April 10, for one electric watt-hour meter, 100 amp., and fifty electric watt-hour meters, 15 amp. (Circular 23-24).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until April 11, for ten mercury-arc rectifiers, 10 amp., for an eleven-cell storage battery (Proposal 14123-14 CP).

## North Central States

GRAND MARAIS, MICH.—The installation of new boilers in the Grand Marais light and water plant is under consideration. A. Newberg is chief engineer.

WAYLAND, MICH.—The M. & W. Light & Power Company is erecting a transmission line to the village of Hopkins, a distance of 4 miles, to furnish electrical service. A distribution system is also being built in the latter place. Clarence L. Miller is secretary and manager.

AKRON, OHIO. — The Northern Ohio Traction & Light Company contemplates the erection of a 132,000-volt steel-tower transmission line from Cleveland for the purchase of 25,000 kw. of energy, the construction of a downtown transformer and distribution substation, and the erection of a 22,000-volt transmission line to Wadsworth and Rittman. M. W. Arthur is commercial manager.

FULTONHAM, OHIO. — The Pittsburgh (Pa.) Plate Glass Company will build a power house in connection with its proposed local cement plant for the Columbia Chemical Division, to cost about $1,500,000.

CALHOUN, KY. — The Public Service Company contemplates installing a 75-hp. oil-engine-driven generating unit. C. G. Gilmore is proprietor.

HARDINSBURG, KY.—The Hardinsburg Electric Light Company is planning to erect about 20 miles of transmission lines to five towns and will install a street-lamp regulator of about 5 kw. or 6 kw. capacity and also twenty-five street lamps. R. R. Compton is secretary and manager.

KUTTAWA, KY. — The Public Service Company, Inc., contemplates installing another generating unit of the same capacity as the present unit. William Eades is manager.

MIDDLESBORO, KY. — The Kentucky Utilities Company plans to install electric power equipment in connection with extensions to the former plant of the Middlesboro Ice & Storage Company, recently acquired.

WALTON, KY.—The Dixie Light & Power Company contemplates the erection of 3½ miles of 2,300-volt transmission line. Royal A. Pickup is manager.

INDIANAPOLIS, IND.—Bids will be received by the Board of Trustees, Indiana University, Bloomington, until April 12 for equipment for the proposed power plant at the James Whitcomb Riley Memorial Hospital, including electric generators and engines, water-tube boilers, mechanical stokers, electric elevators and auxiliary machinery. Charles R. Ammerman, Occidental Building, Indianapolis, is consulting engineer.

LAFAYETTE, IND.—The Board of Trustees, Purdue University, plans to build a power plant, to cost about $250,000.

MARTINSVILLE, IND. — The Central Indiana Power Company has purchased the Martinsville Gas & Electric Company and will merge it with the Spencer (Ind.) Light, Power, Heat & Water Company and the Morgan County Light & Power Company, Gosport, recently acquired. Extensions and improvements will be made in the systems.

TIPTON, IND. — The Tipton Electric Light Company, recently organized to operate the municipal electric plant, contemplates purchasing electricity from the Northern Indiana Power Company within the next three months to operate the local system. Robert E. Staats is manager.

AUGUSTA, ILL. — The Central Illinois Public Service Company has secured a ten-year street-lighting contract and will make extensions and improvements in the system. A commercial system will be installed at Wenona, where a fifty-year franchise has been secured.

BELVIDERE, ILL.—The Illinois Northern Utilities Company has been awarded a ten-year street-lighting contract. Extensions will be made in the system, including the installation of new incandescent lamps to replace present arc lamps.

EAST ST. LOUIS, ILL.—The Murphysboro (Ill.) Brick Company plans to build a power house in connection with its proposed local plant, to cost about $200,000.

ASHLAND, WIS. — The Lake Superior District Power Company plans extensions to its system including the installation of additional equipment, to cost about $700,000.

EAGLE RIVER, WIS. — The Electric Light and Water Commission is planning to extend the transmission line to Three Lakes, Clearwater Lake and nearby resorts to furnish electrical service in those towns.

MADISON, WIS.—The Wisconsin Power, Light & Heat Company has appropriated $925,000, for extensions to its system.

MARSHFIELD, WIS.—The installation of new street lamps on about 2 miles of newly paved streets is contemplated this year.

MILWAUKEE, WIS. — Work will soon start on the erection of various buildings, etc., in Castalia Gardens, Milwaukee. The cost of this amusement resort is estimated at about $1,000,000, a large portion of which will be used for the installation of electrical equipment. Electricity for light and power purposes will be supplied by the Milwaukee Electric Railway & Light Company.

PORT WING, WIS.—Work, it is understood, will begin on the power dam at Orienta Falls for the North Wisconsin Hydro-Electric Power Company as soon as the weather will permit. The plans provide for a development of 500 hp. and the erection of a transmission line to Port Wing and to Herbster, Cornucopia and Bayfield. The erection of a transmission line to Iron River and later to Washburn is also under consideration. T. N. Okerstrom, Port Wing, is president.

RHINELANDER, WIS.—Plans are being prepared by Mead & Seastone, engineers, Journal Building, Madison, for an addition to the power house of the Rhinelander Light & Power Company, to cost about $40,000.

TOMAHAWK, WIS. — The Tomahawk Kraft Paper Company will soon being work on the erection of a new high-tension line from here to the site of the proposed hydro-electric plant at Grandmother Falls, 5 miles from here, to furnish energy for construction work. After the completion of the plant it will be used to transmit power from the hydro-electric station to the paper and pulp mill in Tomahawk.

BLUE EARTH, MINN.—The construction of a new boiler room and the installation of a new boiler of about 350 hp. at the municipal electric light and water plant is under consideration. A new well is now under way and a pump will be purchased. Don Fitch is superintendent.

CANBY, MINN.—The Union Public Service Company is planning to install two new steam-driven units of 900 hp. capacity, to run condensing with boilers, condensera, spraying pond, etc.; also the erection of 25 miles of new line for 38,000 volts, and rebuilding a 13,000-volt line for 38,000 volts for a distance of 40 miles. A. H. Savage is secretary and treasurer.

LITCHFIELD, MINN.—Improvements are contemplated to the municipal electric light plant, including the installation of a 500-kw. generating unit, a 300-hp. water-tube boiler, stokers, etc. J. C. Bang is superintendent.

GRUNDY CENTER, IOWA.—The Grundy Center Electric Company is installing a 225-hp. Diesel oil engine directly connected to a 200-kva. Western Electric generator. J. B. Calderwood is owner and manager.

KNOXVILLE, IOWA. — The Marion County Electric Company contemplates the erection of 11 miles of 22,000-volt transmission line. Herbert Bellamy is secretary and manager.

ODEBOLT, IOWA.—The Odebolt Electric Service Company is planning to change its system to four-wire, three-phase, 2,300 volts to neutral and 4,000 volts between phase conductors, and to serve all farm lines at 4,000 volts, single-phase. H. E. Russell is manager.

SIBLEY, IOWA.—Improvements are contemplated to the municipal electric light plant, including the installation of a 250-hp. Stirling boiler, with hand-operated stoker, coal and ash-handling equipment. The cost of the work is estimated at about $17,000. Joseph J. Shoemaker is superintendent.

PARK RIVER, N. D. — The Light and Water Department is considering rebuilding part of the electric distributing system and the installation of a 50-hp. engine. J. L. McGurre is superintendent.

KILGORE, NEB. — Arrangements are being made for the construction of a transmission line for local service.

LYONS, NEB.—The Electric Light Department is planning extensions of the electric lines (2 miles) to outlying districts, with transformers. A. W. Cass is superintendent.

DODGE CITY, KAN.—The installation of a 350-hp. boiler and accessories is under consideration by the Electric Service Company. Otto Theis is vice-president and manager.

LURAY, KAN.—The municipal distribution lines are being built and a power circuit added. H. M. Olson is city clerk.

McCRACKEN, KAN.—Plans are under consideration for rebuilding part of the municipal electrical distribution system for heavier duty. L. L. Ryan is city manager.

McCUNE, KAN.—An election will soon be held to submit the proposal to grant the Kansas Gas & Electric Company, Wichita, a thirty-five-year franchise. Under the terms of the proposed franchise the company will take over the municipal electric distributing system. C. F. Liebig is superintendent of the municipal light and water plant.

## Southern States

CONCORD, N. C.—The Hobarton Manufacturing Company contemplates the construction of a power house in connection with a local cotton mill, to cost about $400,000.

LAKEVIEW, N. C.—The Sandhill Power Company contemplates the construction of a hydro-electric plant, to supplement its present steam-operated station.

MARSHVILLE, N. C. — The Marshville Manufacturing Company will build a power plant in connection with its proposed local cotton mill, to cost about $115,000.

WHITAKERS, N. C.—Bids are being received by W. T. Hearne, superintendent of the municipal plant, for the erection of 5⅜ miles of electric transmission line.

DUNCAN, S. C.—Bids are being received by Lockwood, Greene & Company, Piedmont Building, Charlotte, N. C., for four-story cotton mill, 135 ft. x 300 ft., a five-story storehouse, 75 ft. x 100 ft., bleachery, power house, etc., and 300 houses for employees, for the Pacific Mills.

BIRMINGHAM, ALA.—Complete rehabilitation of the municipal electric light and water plants at North Birmingham, to cost about $60,000, has been decided upon by the City Commission. Meters will be installed throughout both the lighting and water systems.

BROCKWAYVILLE, ALA.—The Brockwayville Light, Heat & Power Company is planning to extend its transmission lines about 5½ miles to serve electricity in the rural districts. B. J. Morrison is treasurer and manager.

CRUGER, MISS.—Bids will be received by the city of Cruger for construction of an electric lighting plant, including equipment. The Kramer Engineering Company, Magnolia, is engineer.

PLAQUEMINE, LA.—Bids will be received by the Mayor and Board of Selectmen of Plaquemine until April 17 for improvements to the light and water plant as follows: For three crude-oil engines, directly connected to alternators, motor-driven centrifugal fire pumps, motor-driven domestic service pumps, motor-driven air compressors, switchboard, etc. Swanson-McGraw, Inc., United Fruit Building, New Orleans, is engineer.

PONCA CITY, OKLA.—A special election has been called to vote on the proposal to issue $80,000 in bonds for extensions to the municipal power plant. A. M. Stalnaker is city engineer.

BROWNWOOD, TEX. — The Helious Gasoline Company, Dallas, contemplates the construction of a power plant at its proposed gasoline works, to cost about $250,000.

HOUSTON, TEX.—Work will begin at once on the first unit of the new electric generating plant on the Ship Channel for the Houston Lighting & Power Company, to cost about $4,000,000. The equipment for the initial installation will include two turbo-generators of each 20,000 kw. capacity. The plans provide for an ultimate capacity of 160,000 kw.

LONGVIEW, TEX.—The Lacy Oak Flooring Company plans to build a power house in connection with its proposed hardwood mill, to cost about $150,000.

## Pacific and Mountain States

CHEHALIS, WASH.—The city of Chehalis has applied to the Supervisor of Hydraulics for permission to appropriate water from the Cowlitz River for power purposes. The cost of the proposed hydro-electric development is estimated at about $650,000.

LEAVENWORTH, WASH. — The construction of a power plant on Royal Mountain is under consideration by J. Naughton of the Royal Development Company.

TENINO, WASH. — The Puget Sound Light & Power Company will erect a transmission line from Olympia to connect with its Vancouver system.

PENDLETON, ORE.—Surveys are being made by the Pacific Power & Light Company for its proposed 66,000-volt transmission line from Pasco to Pendleton, via Umatilla. The cost is estimated at $300,000.

ROSEBURG, ORE.—Plans are under consideration by the Douglas County Light & Water Company to double the capacity of its electric plant at Winchester. The cost is estimated at about $200,000.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company is planning extensions to its electric plant, including the installation of a 17,500 kw. turbo-generator and auxiliary equipment; 12,000 electric meters will be installed on consumers' premises, and transmission lines will be extended.

SAN JOSE, CAL.—The Guadalupe Lime & Cement Company, San Francisco, plans to install a power plant at its proposed local cement mill, the cost of which is estimated at $275,000.

SAN RAFAEL, CAL.—Steps are being taken for the installation of an ornamental lighting system on sixteen blocks in the business section.

SANTA ANA, CAL.—Bids will soon be asked for the installation of an ornamental lighting system on Fourth and Fifth Streets, consisting of eighty metal standards, to cost about $30,000. W. G. Knox is city engineer.

TAFT, CAL.—Bids will soon be called for the installation of an ornamental lighting system on Fourth and Fifth Streets, comprising fifty-four standards. Edward M. Lynch is city engineer.

VENICE, CAL.—The Southern California Edison Company will make extensions to its system in this district, to cost $400,000, including new transmission lines.

VISALIA, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in the business section.

YREKA, CAL. — The California-Oregon Power Company will rebuild its transmission line from Fall Creek to Yreka. The voltage of the line from Fall Creek to Montague will be increased from 34,000 to 60,000 volts.

CALHAN, COL.—At an election to be held May 3 the proposal to install a municipal lighting system will be submitted to the voters.

DENVER, COL.—A proposal to install a new fire-alarm system, to cost about $200,000 will be submitted to the voters at the coming election.

CARLSBAD, N. M.—The Public Utilities Company will install a new 300-hp. vertical water turbine and a 210-kva., three-phase, 2,300-volt alternator this summer. A new 170-kva., directly connected alternator will be put on oil engine. A new telephone switchboard, new lines, etc., are contemplated for telephone system, and some improvements will be made to the water system. E. A. Roberts is manager.

## Canada

ROSSLAND, B. C.—The West Kootenay Power & Light Company, Ltd., has petitioned the Provincial Department of Lands for permission to double the output of its main power plant at Bonnington Falls on the Kootenay River.

TORONTO, ONT. — The Bell Telephone Company contemplates improvements in the Hudson exchange district, including wire, cable and underground conduit work, to cost about $255,000.

RIMOUSKI, QUE.—Plans are being prepared by the Lower St. Lawrence Power for a water-power development on the Metic River. The generating station will be built at Princeville and a transmission line erected from Matane to Princeville, a distance of 80 miles. Bids, it is understood, will be asked in May.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued March 13, 1923)

1,448,381. CONTROL SYSTEM; E. M. Bouton, East Pittsburgh. App. filed May 12, 1919. Control apparatus for reversing motors.

1,448,382. MOTOR-CONTROL SYSTEM; E. M. Bouton, East Pittsburgh, Pa. App. filed Dec. 14, 1920. Thermal control system for starting motors.

1,448,388. ELECTRIC FURNACE RESISTOR; O. A. Colby, Irwin, Pa. App. filed June 3, 1921. Combined granular and solid resistor.

1,448,389. ELECTRIC PERCOLATOR; O. A. Colby, Irwin, Pa. App. filed April 18, 1922. Two-shell receptacle.

1,448,398. RESISTOR FOR LIGHTNING ARRESTERS; L. R. Golladay, Wilkinsburg, Pa. App. filed May 10, 1922. Several discharge gaps with liquid resistance connected between gaps and ground.

1,448,402. MEASURING SYSTEM; S. Q. Hayes, Pittsburgh, Pa. App. filed June 5, 1916. Totalizing wattmeter.

1,448,403. COIL SUPPORT; S. C. Hoey, Wilkinsburg, Pa. App. filed Sept. 19, 1919. Supporting structures for field-magnet coils.

1,448,405. ELECTRICAL SYSTEM; G. W. Huey, Wilkinsburg, Pa. App. filed March 9, 1917. Phase-reversal protection for three-phase motors.

1,448,408. DUPLEX CARRIER-WAVE SYSTEM; J. S. Jammer, New York, N. Y. App. filed Jan. 21, 1920. Applied to carrier-current telephone systems.

1,448,409. FREQUENCY REGULATOR SYSTEM; C. H. Kidl, Pittsburgh, Pa. App. filed March 31, 1920. For governing the speeds of prime movers.

1,448,410. REGENERATION OF SINGLE-PHASE MOTORS; J. M. Labberton, Wilkinsburg, Pa. App. filed Sept. 13, 1919. Regulation of alternating-current commutator motors during regenerative periods.

1,448,413. ELECTRODE; F. J. Metzger, New York, N. Y. App. filed July 29, 1920. For luminescent lamp bulbs.

1,448,419. FLASH GUARD FOR DYNAMO-ELECTRIC MACHINES; M. W. Smith, Wilkinsburg, Pa. App. filed May 14, 1920.

1,448,420. TELEPHONE-EXCHANGE SYSTEM; P. C. Smith, Worcester, Mass. App. filed Sept. 30, 1919. Automatic or mechanically controlled switching devices.

1,448,437. TROLLEY-WIRE HOLDER; M. L. Dunlap, Philipsburg, Pa. App. filed Oct. 14, 1922. U piece around wire clamps onto ear.

1,448,474. TROLLEY HARP; L. Vollmuth, Chicago, Ill. App. filed Nov. 25, 1921. Device to prevent pole from leaving wire.

1,448,484. GENERATOR AND BATTERY CONTROL; G. Fornaca, Turin, Italy. App. filed Jan. 12, 1920. Automatic battery-charging system.

1,448,510. APPARATUS FOR ELECTRICAL HEATING OF FLUIDS; P. A. E. Armstrong, Loudonville, N. Y. App. filed April 16, 1921. Non-rusting element immersed in fluid.

1,448,511. BRUSH FOR ELECTRICAL MACHINERY AND METHOD OF MAKING SAME; O. E. Becker, Oak Park, Ill. App. filed June 4, 1919. Gage brush.

1,448,523. TELEPHONE-EXCHANGE SYSTEM; R. D. Conway, Chatham, N. J. App. filed Oct. 23, 1918. Signaling means for telephone switchboards with co-operating circuits for extending incoming circuits.

1,448,540. APPARATUS FOR MEASURING GAS PRESSURES; W. G. Housekeeper, Philadelphia, Pa. App. filed July 14, 1917. For evacuated tubes or lamps.

1,448,542. PROCESS OF MANUFACTURING LOADING COILS; B. H. Jackson, New York, N. Y. App. filed March 20, 1920. Method of manufacturing cores for inductance coils for telephone lines.

1,448,550. THERMIONIC AMPLIFIER CIRCUITS; H. D. Arnold, Maplewood, N. J. App. filed Feb. 3, 1919. Vacuum discharge repeater for telephone lines.

1,448,553. TELEPHONE-PLUG SHELF; F. F. Lucas, East Orange, N. J. App. filed April 24, 1920. For telephone manual switchboards.

1,448,559. ELECTRICAL PROTECTIVE DEVICE; D. T. May, New York, N. Y. App. filed Dec. 6, 1920. Communication-wire lightning arrester utilizing carbon gap.

1,448,563. MOTOR CONTROL; N. L. Mortensen, Milwaukee, Wis. App. filed June 12, 1920. Provides for uniform lowering speed of cranes.

1,448,566. WIRE FABRIC MANUFACTURE; O. Muller, Jr., Brooklyn, N. Y. App. filed Sept. 20, 1919. Manufacture of wire-mesh grids for vacuum tubes.

1,448,572. TELEPHONE SYSTEM; L. Polinkowsky, Antwerp, Belgium. App. filed April 29, 1920. Machine-switching apparatus utilized for setting up connections.

1,448,575. WAVE METER AND SIMILAR ELECTRICAL DEVICE; G. H. Stevenson, Rye, N. Y. App. filed Dec. 21, 1920. Frequency calibration of meter not affected by opening or closing circuit.

1,448,576. TELEPHONE-EXCHANGE SYSTEM; W. B. Strickler, East Orange, N. J. App. filed March 19, 1921. Establishing connections between extension lines of private branch exchange.

1,448,578. RESISTANCE ELEMENT; A. R. Swoboda, Newark, N. J. App. filed March 10, 1922. Coreless winding of insulated wire formed into an elongated unit.

1,448,583; DIRECT-CURRENT TRANSFORMER; H. J. Van der Bijl, New York, N. Y. App. filed May 8, 1916. By means of thermionic tubes and induction coil.

1,448,586. PROCESS OF MANUFACTURING ALUMINOUS ABRASIVES; T. B. Allen, Hamilton, Ont., Canada. App. filed April 22, 1922. By smelting with powdered coke and a metal.

1,448,604. COLUMN STRAIN INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Dec. 6, 1918. Guy-wire insulators.

1,448,621. PIPE-OPERATING DEVICE; G. A. Fletcher, Brazil, Ind. App. filed July 26, 1920. Service pipes laid in ground by drilling hole.

1,448,676. RECEIVER; E. Reisz, Zehlendorf-Mitte, Germany. App filed May 25, 1921. Adaptable to loud-speaking telephones.

1,448,681. ELECTRICAL RESISTANCE; E. R. Stoekle, Milwaukee, Wis. App. filed Sept. 11, 1922. Grid leak for the vacuum tubes.

1,448,700. LIQUID-COOLED ELECTRIC MACHINE; M. Seidner, Budapest, Hungary. App. filed March 18, 1919. Liquid-tight channels in both stator and rotor.

1,448,702. TRANSLATING CIRCUITS; J. R. Carson, Montclair, N. J. App. filed July 10, 1920. Modulator arrangement to vacuum-tube sending or receiving apparatus.

(Issued March 20, 1923)

1,448,749. ELECTRICAL SYSTEM FOR AUTOMOBILES; C. F. Kettering, Dayton, Ohio. App. filed April 6, 1918. "Delco" system with 110-volt generator.

1,448,750. TELEGRAPH PRINTER; E. E. Kleinschmidt, Brooklyn, N. Y. App. filed April 14, 1916. Direct method of selecting and operating type bars of the printer.

1,448,773. TRANSMISSION-LINE INSULATOR; F. W. Springer, Minneapolis, Minn. App. filed March 7, 1919. Protecting insulation from abnormal voltages by arcing gaps.

1,448,792. METHOD OF MAKING MASTER PHONOGRAPH RECORDS; W. H. Cole, Newark, N. J. App. filed Aug. 10, 1921. Metal deposited by precipitation from solution distributed upon the wax record.

1,448,815. SELF-WINDING CLOCK; F. J. Reilly, New York, N. Y. App. filed Feb. 27, 1920. Electrically operated primary movement.

1,448,816. SECONDARY CLOCK; F. J. Reilly, New York, N. Y. App. filed Feb. 27, 1920. Secondary clock wherein hands are gravity operated.

1,448,824. TELEGRAPH REPEATER; R. C. Blakeslee, Milwaukee, Wis. App. filed Dec. 20, 1920.

1,448,902. MEANS FOR REGULATING THE SPEED OF ELECTRIC MOTORS; W. Schäffer, Berlin, Germany. App. filed May 3, 1922. Motors for radio sending apparatus.

1,448,923. ELECTROLYTIC PROCESS; F. N. Flynn, East Orange, N. J. App. filed Oct. 29, 1919. Reduction of lead sulphate to lead.

1,448,949. ELECTRIC LAMP STAND; R. J. Travers, San Diego, Cal. App. filed May 13, 1921. Table lamp made from telephone stand.

1,449,004. JEWELER'S PLATING MACHINE; F. A. Howe and S. W. Howe, Spencer, Iowa. App. filed Sept. 11, 1922.

1,449,008. ELECTRODE FOR ELECTROLIZING FUSED MATERIALS; T. Kolkin, Vadheim, Sogn, Norway. App. filed June 27, 1921. Support for diaphragm between electrodes.

1,449,022. BRAIN TELEPHONE; W. B. Vanderlip and C. H. Viggars, Los Angeles, Calif. App. filed Dec. 21, 1921. Translation of sound vibrations to the brain without intervention of ear.

1,449,070. SIGNALING DEVICE FOR VEHICLES; W. E. Spangler, Arlington, Va. App. filed Jan. 25, 1918. Direction signal.

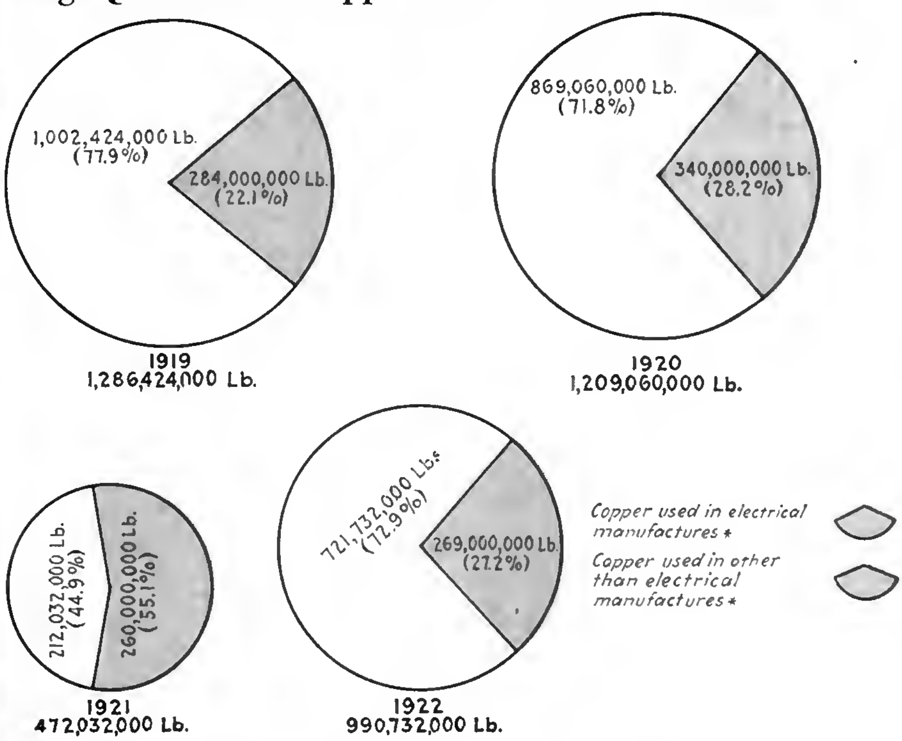
1,449,094. ELECTRIC IRON PROCESS; Albert E. Greene, Seattle, Wash. App. filed May 3, 1916. Deoxidizing process carried on in electric furnace.

1,449,148. DETECTOR FOR WIRELESS-TELEPHONE OUTFITS; W. F. Gehrig, Newark, N. J. App. filed March 9, 1922. Crystal detector holder and contact.

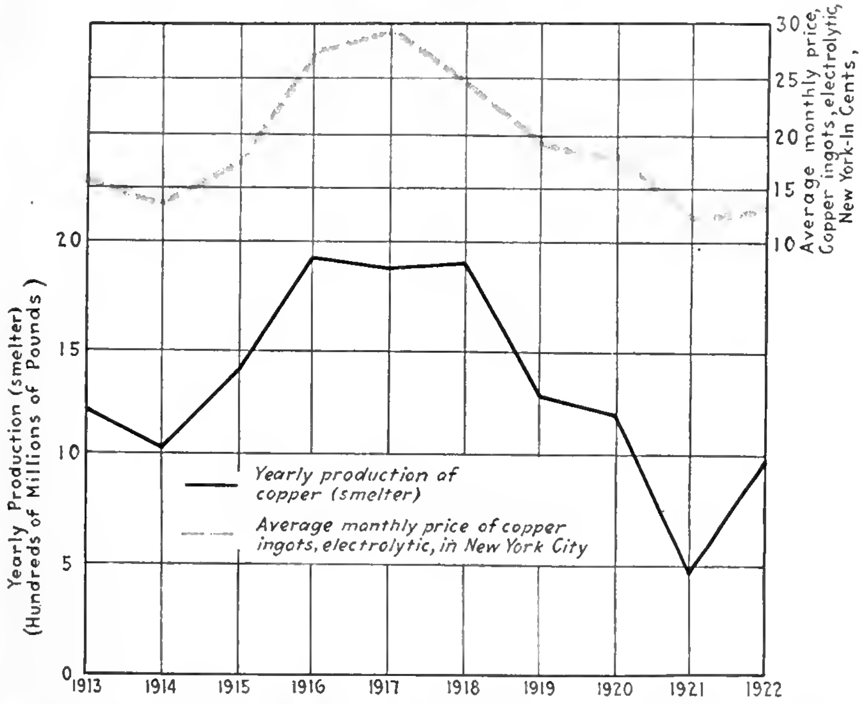
# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## Large Quantities of Copper Used in Electrical Manufactures




## Production and Prices of Copper Follow Same General Trend




*"Electrical manufactures" includes electrical machinery, apparatus, accessories, etc, but not conductors.

## The Place of Copper in the Electrical Industry

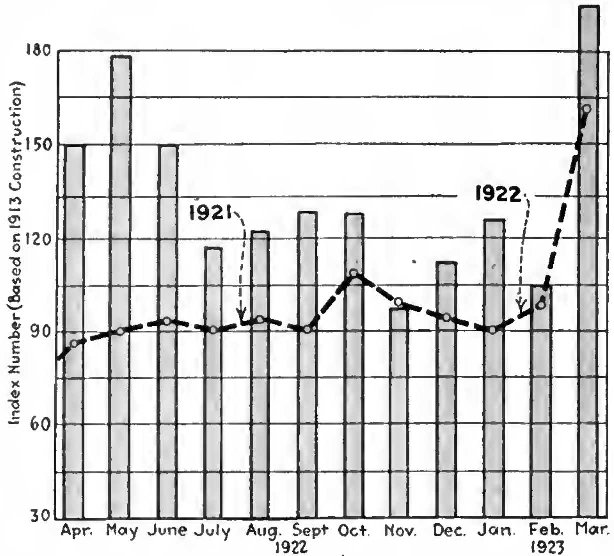
IN A LARGE way the story of copper during the past century and a quarter is the story of the development of the electrical industry. At the beginning of the nineteenth century Volta, Watt, Maxwell, Faraday, Siemens and many other scientists were engaged upon a series of researches on electrical phenomena that was only of academic importance. Their practical application was soon perceived by such men as Morse, Bell, Edison, Brush, and in the latter half of the nineteenth century the telegraph, telephone, generator, motor, the incandescent lamp, and the installation of transmission and distribution systems had opened up a vast field in the usefulness of copper. At present copper holds undisputed sway in the electrical field.

The accompanying diagrams which are based on data furnished by the American Bureau of Metal Statistics indicate the large percentage of copper production which ultimately finds its way into the manufacture of electrical machinery, apparatus, accessories, etc., but these data do not include conductors. If wire is included and also the brass used in electrical manufacturing it is probable that beween 60 and 70 per cent of the total copper produced is at present used by the electrical industry, and in a much higher percentage during the industrial depression of 1921.

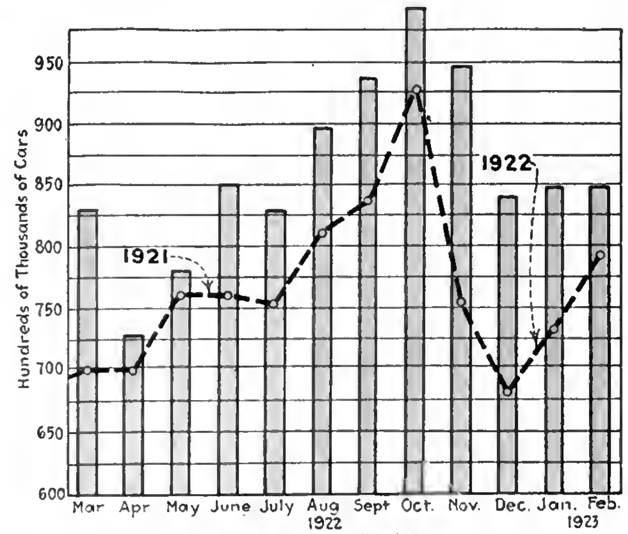
The price of copper has followed closely the general trend in copper production. During the war period the use of copper was tremendously increased due largely to its use in the manufacture of war materials, and the price rose with this increased market, the peak being reached in 1917. After this peak had been reached the average monthly price gradually returned to pre-war levels, reaching the low point in August, 1921. The present price is about 45 per cent above the low mark, and it is believed that still higher prices will come before the present boom is ended.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those using these statistics would credit the ELECTRICAL WORLD.

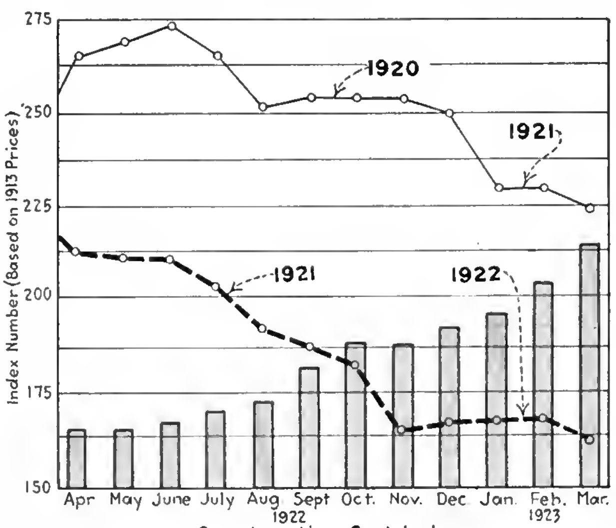
## How the Primary Industries Are Trending



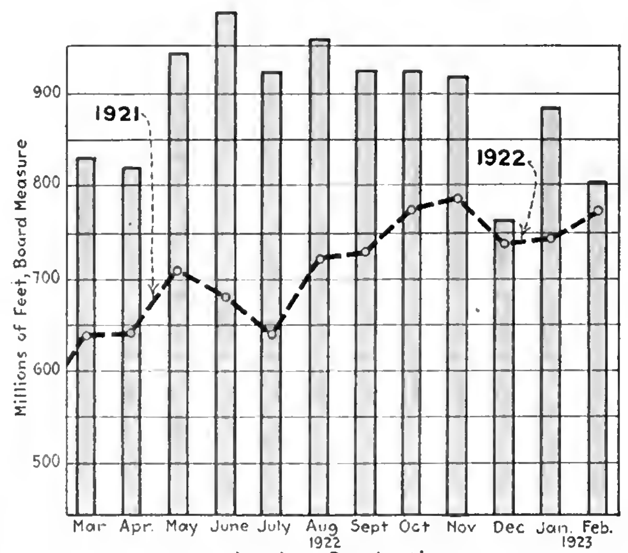

Construction Volume Index
(Engineering-News Record)



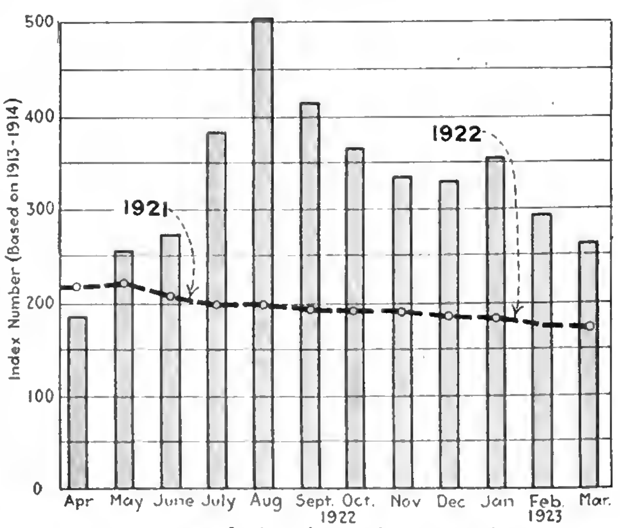

Total Average Weekly Freight-car Loadings




Construction Cost Index
(Engineering-News Record)




Lumber Production
(Yellow Pine and Douglas Fir)




Price of Bituminous Coal at Mines
(Coal Age)

## Record Projected New Construction During March

MARCH witnessed the largest volume of projected new construction ever reported in the United States for any single month. The *Engineering News-Record* figures indicate that the new construction projected during March was almost 9 per cent over that of March last year. And this in the face of an increase in construction cost of almost 32 per cent during the 12-month period. It would appear, therefore, that the often expressed fear that a large portion of the projected construction would be held up on account of high prices is unfounded. New construction is so imperative this year that it is being undertaken in spite of costs which under ordinary conditions would serve to materially retard such activities. All of which has an optimistic bearing on the electrical industry, both in the future sale of electrical energy and the installation of electric apparatus and supplies. It begins to look as if the generating, manufacturing and merchandising activities of the electrical industry will exceed even the most optimistic prophecies made at the opening of the year.

Electrical World

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# Loyalty Must Be Mutual

IN A CERTAIN city is a central-station operating organization headed by an executive whose vision extends far beyond the balance sheet and into the hearts and feelings of his fellow-workers. The activities of the "family" are led by an employees' club in which all employees meet on a common ground. It is managed solely by employees. Except for the times when he is called on to introduce a speaker in the periodical meetings or take some part that reveals his position, a casual stranger would find it impossible to pick "the boss" out of the happy, jolly crowd that gathers several hundred strong. Down through the entire force is a feeling of loyalty, a sense that "we are doing the job" developed to an unusual degree, which is clearly reflected in company relations with the community. The club work is simply a sign of the spirit that prevails from "the boss" down.

In another organization is a temporary utility construction crew, gathered together, as such organizations are, from casual labor available in the territory. With a record of 2 per cent a month in labor turnover, the entire working crew is found pulling enthusiastically to get the job done at the least cost, the various camp crews vying with each other in doing their best. A crew that meets with misfortune and falls behind is the subject of good-natured "ragging" that leads it to redouble its efforts to regain the lost ground. Every man knows how the job is progressing, knows what it is costing, and is taking a keen interest. Despite the higher wages, work is being done at a unit labor cost that is far under pre-war costs and in some cases almost unbelievably low.

WHY such results? Because in each case a man with real vision and the keenest of human sympathy is in charge. His forces are working with and not for him. Regardless of the disagreeable things that must be faced, the organizations know that "the boss" is looking out for their interests just as much as for those of the stockholders, and they also realize that he knows the value of the investment in the human material that makes up the organization and is as loyal to the men as he expects them to be to him.

The results in dollars and cents on the balance sheet in each case are results that no hard-boiled dollar-chasing policy can possibly achieve. The secret lies in the sturdy honesty, character, good sense and the broad human sympathy of the man at the top. His courage in acting in accord with these qualities is one of the fundamental reasons for a success that needs emulation in far too many organizations.

# Frank William Peek, Jr.

*A brilliant research engineer and formulator of the basic laws of corona.*

THE electrical industry has been singularly fortunate in solving the technical problems that it has encountered in its progress and development. When progress is blocked by a technical obstacle there always come to the rescue the technical and research engineers who have been active in developing the industry along sound scientific lines. No industry in history has so closely followed a theoretical and technical program of development.

Frank William Peek, Jr., is a fine example of the modern technical engineer. His enthusiastic and rigid researches in the field of transmission and dielectric phenomena are typical of those of a band of engineers who devote their lives to research and invention. In 1910 Mr. Peek was engaged in the study of the problems of 250-kv. transmission. More than ten years in advance of commercial 220-kv. transmission, Mr. Peek built a high-voltage line, established and put in form for practical application the laws of corona, pointed out the necessity for grading line insulators and made other researches covering the control, protection and regulation of high-tension lines.

In the field of transients and dielectric phenomena Mr. Peek has created a position for himself second to none. His research papers on oil and air dielectric phenomena, transients, corona, insulation and lightning protection are studied and admired by all engineers and have been translated into foreign languages. His book on "Dielectric Phenomena in High-Voltage Engineering" is a standard reference and text book in technical schools.

Mr. Peek is a native of California and was born in Mokelumne Hill, Aug. 20, 1884. He is a graduate of Leland Stanford, Jr., University of the year 1905 and received his master's degree from Union in 1911. He became connected with the General Electric Company in 1905 and took the test course and then spent two years in the power and mining department. In 1909, upon its formation, he joined the staff of the consulting engineering department.

The A. I. E. E. has always been cordially supported by Mr. Peek, who has been chairman of its electrophysics committee for several years and is besides a member of other committees. He is also a member of the American Physical Society and other bodies. His calm judgment and winning personality have resulted in a host of friends who predict for him a still more brilliant future in his researches for developing the art of transmission.

# Editorial Comment

Electrical World, April 14, 1923

Volume 81 Number 15

### A Pregnant Source of Public Good Will

NEW sources or methods of contact with the public are always attractive to the industry, but good ideas are unfortunately somewhat rare. One such idea is embodied in a book issued last fall by the Smithsonian Institution—a work of art which possesses large possibilities in the education of the rising generation to an appreciation of the tasks and problems of the electric light and power industry. Much of the misunderstanding between the public and industry in general is due to ignorance of the functionings of industry, and not to any inherent enmity between the two. One cure lies in the proper instruction of grammar-school and high-school students in the operations of the various industries of the country, and this is exactly what this Smithsonian Institution publication aims to do.

The book is an unusually elaborate diagrammatic and pictorial study of the natural resources of Pennsylvania, based on the latest government data and designed for use in the public schools of the Keystone State. Each industry of the state is thoroughly covered both in text and illustration. The generation, transmission and distribution of electrical energy are explained in a clear and concise manner, the text being augmented by maps and a pictorial diagram of a complete generating and distributing system. Every advanced student in the State of Pennsylvania will study this book, and none can help being impressed by the intricate functionings of the electric light and power industry. Such instruction should make the pupil a better citizen as well as more sympathetic with the problems of the local distributing company. "Where there is no vision the people perish."

Pennsylvania is to be congratulated on this decided advance in public school instruction, and the central stations of that state will profit materially because of it. The Smithsonian Institution is desirous of doing the same work for the other states of the Union, and the state electrical associations would do well to help make this wish an actuality.

### The Farmer Not a Radical

THAT the Middle Western farmer has turned from radical ideas acquired temporarily as a result of his severe post-war deflation troubles is the conclusion of competent observers. This has a direct meaning for utility men. Under the stress of deflation conditions the farmer as a political force struck blindly at a great many things that were apparently causes of his troubles. The elections last fall, especially in the Middle West, put into office many irresponsibles who may be expected to espouse all sorts of radical regulation or municipal ownership proposals. But the swing of the farmer back to his normal conservative mental state is already being made evident in the withdrawal of support of radical proposals made by these men who were put into office by the agricultural vote.

Utility interests faced by radical movements while legislatures were in session in the Middle West found it good policy to steer a clear course that would keep the conservative elements of the agricultural group with them. For the sake of their public relations, utility men need to avoid being stampeded by some unbalanced radical who breaks loose with wild proposals. It is worth while to keep close to the sober thinking people of the community and retain their confidence.

### Equipment Betterments and the Executive

EXECUTIVE approval is necessary in such a large proportion of engineering betterment undertakings that it behooves operating men to make a special study of how to present such propositions to their superiors. Many a desirable improvement in plant has been flatly refused because of inadequate data, insufficient explanation or too confident an assumption that once the estimated economic justification was shown to the men "higher up" a favorable decision would follow as a matter of course.

Industrial-plant motive-power superintendents, electrical engineers and other technical staff members may be satisfied in their own minds that it will pay rich returns to install new equipment in particular cases, but such convictions are often inadequate to carry the appropriation to victory. Thus the proposal may arise to equip thirty industrial electric trucks with ampere-hour meters or to install watt-hour meters in factory departments and sub-departments. The busy executive listens to the proposal and multiplies the cost per truck or per meter by the total number involved—result, a sum perhaps not large in itself, but one that looks to the hard-headed executive like a target worth demolishing. He advances the opinion that the money had better be saved or expended in some other way, and the cause is lost for the time being unless the technical staff can summon reserves enough to break the line of opposition.

These reserves include specific information upon equipment performance under present conditions, reduced when possible to unit figures; a willingness to take a slice of bread when even half a loaf cannot be had, via the route of making piecemeal installations of economical devices; concise knowledge of results of using similar equipment elsewhere, adequate service record provisions, and an intimate understanding of the viewpoint and mental habits of the court of appeal.

Nothing can take the place of detailed knowledge on the part of the electrical engineer or motive-power man of the reasons why this or that piece of apparatus accumulated a good or bad reputation for service in the plant cost-accounting system. Maintenance costs on a particular truck, for instance, may be extraordinarily low during a certain period and catch the

executive eye. Incorrect deductions may result unless the reason be made clear; for example, that the equipment was held for painting and was out of service during a certain time. The present lack in many industrial plants of anything like adequate record systems of equipment performance badly hampers the engineer who attempts to convince his constitutionally and professionally skeptical superior that savings will be effected by the introduction of betterments. The older the plant, the more fertile should be the field for economic achievements by these means, and even in new plants it is sound policy to keep the door ajar when improvements come a-knocking.

## Facts Concerning Electric Trucks Too Long Ignored

In a recent address before the New York Electrical League R. C. Boyer pointed to some interesting figures of the New York Port Authority. According to these, 25 per cent of the trucks in New York are gasoline-driven, 2 per cent are electric and 73 per cent are still horse-drawn! The gasoline trucks are for the most part probably well fitted to the longer hauls—the wise man will not knowingly spend 6 cents per minute for a gasoline truck to stand or crawl in New York's slow-moving traffic on short-haul work. But in replacement of the 73 per cent of horse-drawn vehicles the electric truck should find an opportunity. Similar, though probably not so striking, conditions exist in other cities.

That the truck manufacturers are commencing to appreciate the situation is shown by the noticeable intensifying of their advertising (and, by the way, their factories have been much busier in the past two months). They have employed much newspaper space to point out that of every dollar received from sales of merchandise from 18 to 25 cents is spent for delivery by gasoline or horse; for laundry deliveries, 20 to 30 cents; for bakery goods, 18 to 25 cents; for ice cream, 20 to 30 cents, and for milk, 25 cents. Electric trucks, they say, can handle city deliveries faster than the gasoline car in city traffic, with the inherently easier starting, and they operate at a cost 20 to 35 per cent less and last longer.

These facts are worth pondering over a bit. Apparently too few central-station executives have ever really stopped to study them and picture what they might mean in dollars saved in the delivery of goods in their own cities. An opportunity to cut delivery costs 20 to 35 per cent where at present the expense runs 18 to 30 cents on every dollar taken in is something on which no man who has goods to deliver will turn his back. The trouble has been that he has not known that the electric truck could do so much for him. The central-station man has not known it either. They have both been told, but neither has paid attention and realized what the figures mean.

But here are facts that demand recognition. The electric truck is shown to offer a fundamental economy in a large field of urban distribution. There is a demand, if not a clamor, for reduced distribution costs in cities, and conditions could hardly be more favorable than they are right now for instilling the idea of electric trucks for city deliveries. The first step everywhere is for the central-station man to learn and believe these facts. Then let him go to work with the truck manufacturer to demonstrate them to every man in his town who uses trucks and to see that servicing facilities are established. From this will some day grow the substantial vehicle load that all men know will ultimately come, to the real profit of the electrical industry.

## Handling Service Applications Promptly

Recent observation of the time lag between a number of applications for central-station service and the introduction of energy into the new customers' establishments raises the query whether utilities of this class are doing all that they can do to expedite such procedure. The larger the company, the more of a problem it becomes to avoid delays in furnishing service, and frequently these delays are due to conditions outside company control. None the less when complaints that there is a gap between promise and performance become frequent it is time to look sharply into the cause.

What the Syracuse Lighting Company has accomplished in reducing the elapsed time between the signing of the application for service and the execution of the order to less than three hours is a fine example of what can be done to cut red tape and eliminate lost motion. At no increase in cost over the former method, the company is rendering a high grade of service that has produced the most tangible of results in making friends of its customers. The methods employed by the Syracuse company merit serious consideration by every central-station man who is interested in winning the good will of the public.

The whole subject of furnishing service and its routine is a large one. It is out of the question to suggest in a few paragraphs detailed solutions of a problem which has interested central-station managers for decades, and yet the need of applying efficiency engineering to this branch of company business is far from imaginary. Viewing the matter broadly, the public policy of providing service to applicants is the most important phase of the question. There have lately been some very discouraging reports on service delays after approved applications have been set in motion departmentally. Promises to give service by particular dates have not been kept; agreements as to installation costs of reaching residences from street mains have been too informal, sometimes on mere scraps of paper, and in some cases the calling of official attention to unwarranted delays in putting service into operation has had scant result. In other cases certain standardized average costs of reaching the consumer have been applied, with the result that the consumer has gone ahead and done the work himself at lower outlay and with a correspondingly poor opinion of the utility's regulations and charges.

In countless thousands of cases central-station companies are doing all that is possible to render prompt service to applicants, and in many other instances good reasons can be adduced for apparent failure to furnish service on expected dates. To call attention to the fact that too many cases have come to the front of late where popular good will has been jeopardized through delays in the installation of service is but to urge that utility executives check up their practices in this respect and ascertain whether departmental red tape is not here and there strangling accomplishment and hampering the development of friendship with new customers. A

policy of indifference in this matter is a dangerous game to play, for the public is going to have the service it demands, and if company managements do not meet the need, this branch of public relations will be taken out of their hands.

## Boiler-Room Practice of Tomorrow

WHEN the development and perfection of a type of equipment or system of operation becomes complete, the electrical industry is particularly addicted to finding another type of equipment or system of operation that promises better performance or is better adapted to its needs. When the steam engine reached a remarkable state of perfection the turbine came into being; when the direct-current system became satisfactory the alternating-current system was developed into a commercial possibility. In each case the replacement of the old by the new worked out to the ultimate advantage of the industry.

Are we now witnessing the same kind of revolutionary changes in boiler-room practice? Recurrent news of pulverized-fuel stations, thousand-pound boiler pressures, separately fired superheaters, preheaters, new designs of feed-water systems and operation at temperatures over 700 degrees cannot fail to impress central-station engineers and executives. Such changes are radical and yet they seem to develop overnight from theoretical dreams into practical installations. The light and power industry is especially daring in its engineering work because the prize to be obtained through increased efficiency in operation is so great. On the larger systems a gain of even 1 per cent in efficiency can be capitalized for a substantial sum, and every inducement is offered for trying out new equipment and practices which promise better and more economical service. Yet the widespread adoption of pulverized fuel, high pressures and high temperatures for the new power stations, although based broadly on sound engineering, affords food for thought and presents opportunity for many complications.

No question exists as to the splendid efficiency and better adaptability of boilers fired by pulverized fuel, but some pretty weighty problems are still to be solved before standard or satisfactory practice is to be attained. In the very large boilers contemplated the stack effect of the long flame, the effect of the high temperature on refractories and tubes, the proper baffling to insure most efficient heat absorption and many details of fuel handling, crushing and firing are difficult to determine by paper design. Yet the development of the practice has proceeded to such an extent that courageous engineers do not falter in the face of these comparatively minor details but render their decision on the basis of the big possibilities for more economical and convenient operation. There is no reason to doubt that the minor troubles which occur will be solved by the engineers.

Operation at high temperature is accompanied inherently by more difficult problems. It reduces to a question of materials and in its theoretical aspects invades the realm of metallurgy. Valves, valve stems, pipe and pipe fittings to operate at 800 degrees or even higher have yet to be developed, and indications point to an extensive use of alloys or very high-grade steel. Much experimenting and research must be done on materials and much better design will be necessary to secure successful operation. Even the turbine must be redesigned and perhaps rebuilt to operate under the contemplated pressures and temperatures.

Yet these radical changes in boiler-room practice have advanced to a stage where nearly 750,000 kva. in new station capacity is being installed along lines embodying the new features. The next two years will see station after station starting operations using powdered fuel, high pressures and high temperatures. Never was there a greater degree of combination and readjustment in boiler-room practice or more opportunity for initiative and sound engineering. Such moves make the light and power industry advance still more rapidly on its conquering career.

## Opportunity to Increase Switch Ratings by Minor Modifications

THOUGH no very definite information has been released by electrical manufacturers who have co-operated with operating companies in the testing of old and standard-type circuit breakers during the last few years, the statement is generally gaining credence that the rupturing capacity of some of the old circuit breakers can be increased considerably by relatively simple modifications and without great expense. This does not mean that any operating company can expect to handle greatly increased short-circuit currents merely by modifying old circuit breakers. It does mean that if the rupturing duties have not increased very much, the switches can possibly be strengthened by consulting the manufacturer and purchasing replacement parts. In cases where even the modified breakers will not be adequate for increased short-circuit duty in their existing positions they may be moved to positions of less severe duty and can be expected to perform better than the unmodified breakers.

In general the changes involve one or several of the following modifications: Increasing head of oil over the contacts; provision of explosion chambers; installation of combined gas vents and oil-separating chambers; stronger tank covers and tie rods, and improved contacts. No one switch is likely to require all of the foregoing modifications. In some cases round tanks are preferred to other shapes, static shields must be removed from terminals, contact terminals must be braced, or stuffing boxes must be provided around the operating rod.

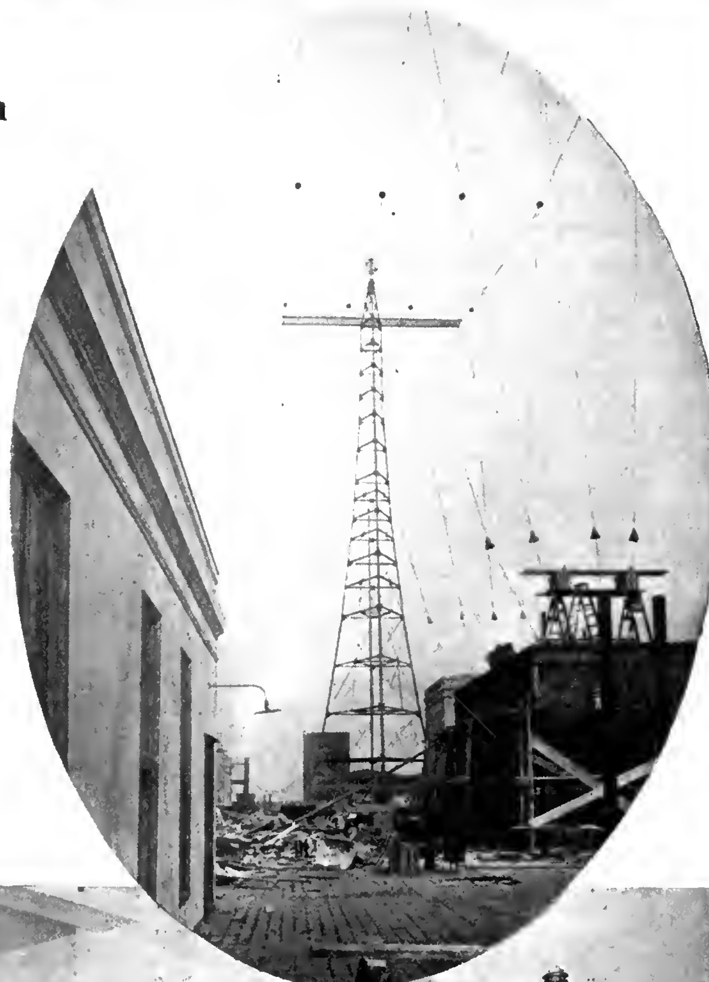
Some companies are going ahead with modifications of the character outlined, utilizing the old equipment almost entirely but adapting it to the replacement parts. Where greater oil heads are required, an extension is being welded on the top of the tank and new insulating linings are being inserted.

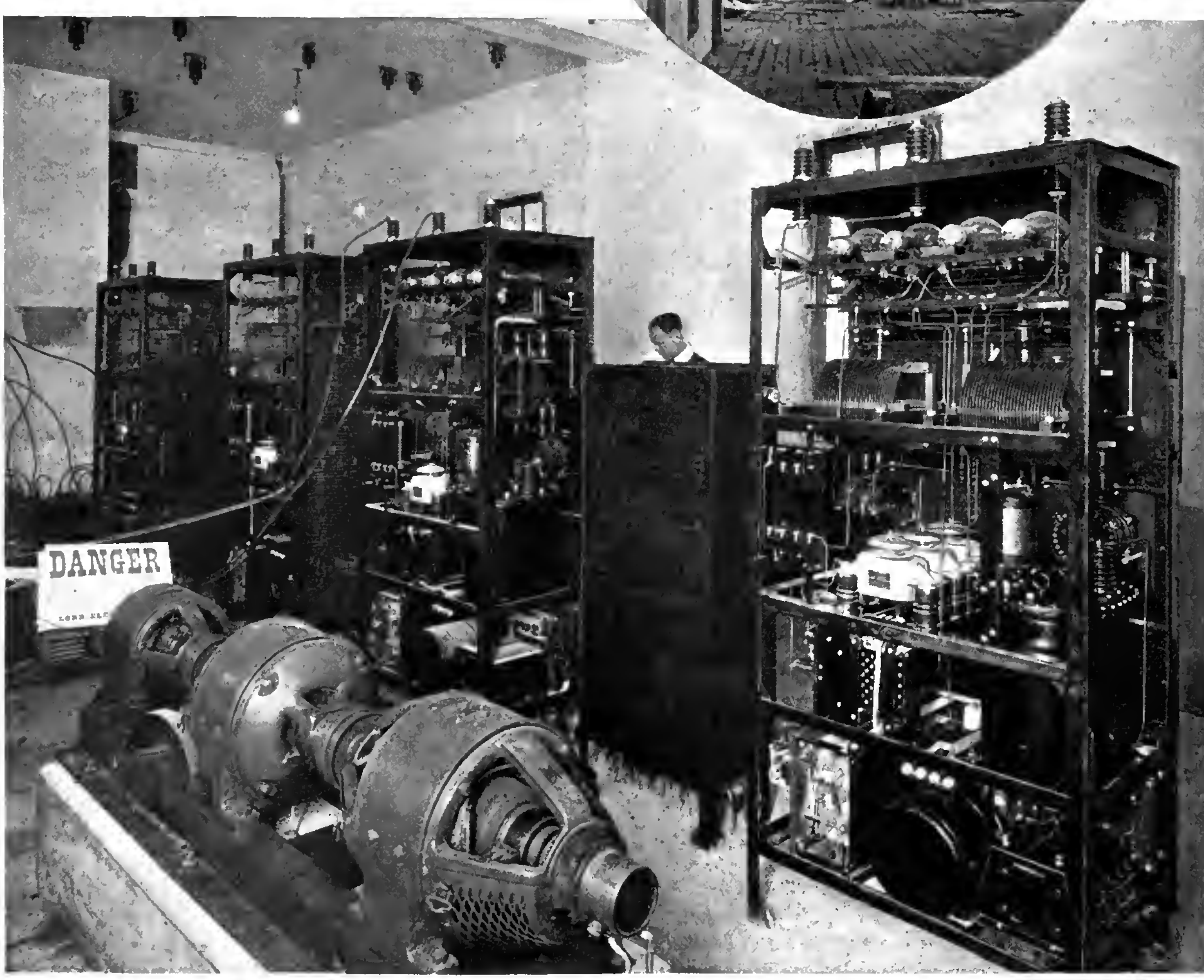
According to the co-operative tests conducted on the modified breakers the expense of making the changes is fully justified by the improved performance of the breakers and the resulting increase in service reliability.

To a limited extent manufacturers are now carrying on this modification for customers where a situation is really pressing. But most manufacturers are heavily loaded with orders for equipment sorely needed for extensions and it would not be to the general interest to add to their burdens unnecessarily. Where immediate relief is urgently needed with existing equipment, users are advised to consult the manufacturers who made the particular switches in question for details as to what to do.

# New Broadcasting System to Transmit Two Programs Simultaneously

ANTENNAS and broadcasting equipment capable of transmitting two different programs simultaneously are being installed on the Aeolian Building, New York City, by the Radio Corporation of America. The antenna consists of two separate groups of wires which are connected to two independent transmitting sets operating at different wave lengths. The station will probably be in operation early in June.





# Complete Million-Volt Laboratory—Part II

## Auxiliary Equipment Consists of a Sphere Gap, Crest Voltmeter and Control Transformers and Resistors—An Adequate Oil System Is Necessary—Specially Designed Rectifier Is Used

By J. F. PETERS and D. F. MINER
*Engineering Department, Westinghouse Electric & Manufacturing Company*

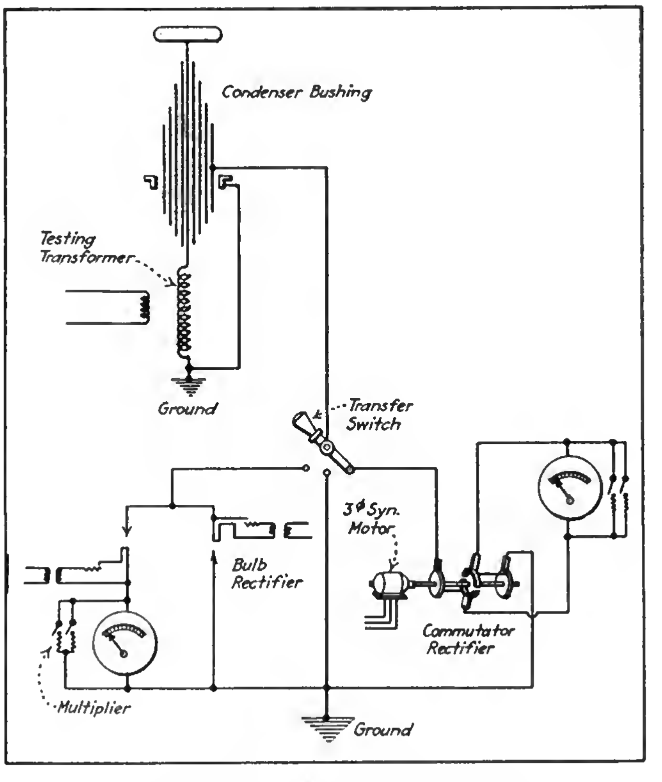
IN ADDITION to the transformer equipment for supplying high voltage, a complete laboratory must have auxiliary apparatus for control and measurement purposes. This equipment is usually specially designed and must be very reliable and accurate as its functioning is absolutely essential to securing correct data. One of the most important high-voltage devices is the sphere gap, and the 100-cm. gap is one of the assets of the laboratory.

Following the pioneer investigations of Fortescue and Farnsworth of the Westinghouse company in 1913, the sphere spark gap was adopted by the American Institute of Electrical Engineers as a secondary standard of high-voltage measurement. An air gap between two metal spheres breaks down and allows a spark to pass at a surprisingly uniform voltage. A definite relation, only slightly affected by atmosphere changes, exists between the size of spheres, separation and voltage necessary to start an arc. No other form of spark gap can be relied upon to such a degree of accuracy. Meters used for indicating high voltages must be standardized by comparison to a sphere gap. In order to insure greatest reliability the sphere gap should not be used at separations greater than the sphere diameter. This limits the accurate range of any diameter of spheres and necessitates the use of several sizes of sphere gaps, each suitable for a limited voltage range. When the million-volt transformer equipment was designed no existing sphere gap was suitable for measurement of such potentials. Consequently a 100-cm. sphere gap was included in the plans.

Each ball was cast of special bronze and carefully turned to 100 cm. diameter (39.37 in.). After turning, micrometer measurements of several diameters were made daily for a long period and slight changes were found to occur, due to release of internal strains. When these movements had ceased the spheres were trimmed in the machine to insure perfect spherical shape. When finished each ball weighed 400 lb., with a wall ⅜ in. thick.

In mounting this gap one sphere was placed on the end of a micarta tube attached to the top of the condenser-bushing static shield. The other was suspended vertically over it on an insulating shaft terminating in a metal rack. A motor operated from the switch room is geared to this rack and raises or lowers the upper sphere at the will of the operator. A counter weight is provided to balance the sphere, so that the motor can control the movement sensitively. The separation of the spheres is read on a vertical scale with a pointer attached, through multiplying pulleys, to the upper end of the sphere shaft. Zero setting is accomplished electrically. When the upper sphere is run down until it touches the lower sphere enough to change the downward pull on the shaft, an automatic device operates a limit switch, stopping and braking the motor instantly.

A resistance rack is installed to limit the gap discharge to full-load current (1 amp.). This consists of a group of carbon rods mounted on an insulating frame hung from the roof truss and connected at one end to the upper sphere and at the other to ground. The spark then jumps the gap, travels to the resistances, thence to ground. Above the upper sphere a grounded metal surface was built to preserve a uniform field.

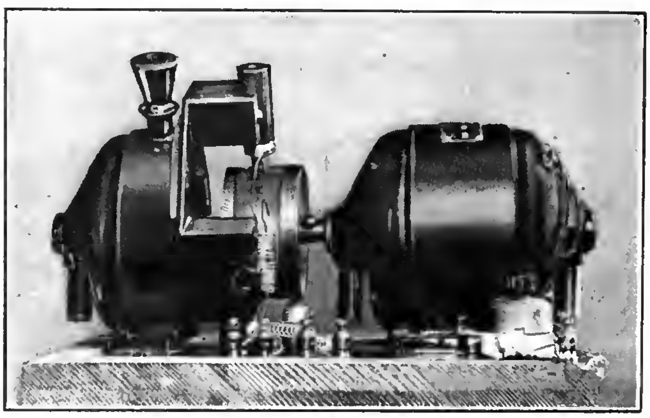



CONNECTIONS FOR CREST VOLTMETER

Starting with the incoming lines at 22,000 volts, power is controlled by an electrically operated automatic circuit breaker in the substation and connected to a 1,000-kva. tapped supply transformer. From this point there are two systems by which the voltage supply to the million-volt transformer may be controlled. With good conditions on the power line a 35-kva. step-induction regulator is used, directly connected by a remote-control circuit breaker between the taps of the supply transformer and the primary of the testing transformer. This regulator consists of a motor-operated induction regulator provided with a drum above with connections to the transformer taps. The regulator raises or lowers voltage between taps, and when the limit is reached connections are automatically switched to the next set of tap connections. By this arrangement a very uniform and consistent rise of primary voltage from zero to 5,000 volts is obtained.

For accurate testing, or when circuit disturbances are present in the main supply, a motor-generator set is used. This is connected through circuit breakers to the supply transformer secondary, using this winding as an auto-transformer to supply the induction regulator, with the primary (22,000-volt side) disconnected. Generator field control, motor-operated, may also be used if desired. The generator is a special 600-kva. unit, 5,000 volts, single-phase, 60 cycles, designed for good wave form at low power factor. It is directly connected to an 800-hp., 2,200-volt, three-phase, 900-r.p.m. synchronous motor, driven from the central-station supply. A 23-kw., 250-volt exciter is also provided.

A grid resistance insulated for 5,000 volts is arranged to be shunted across the circuit breaker which connects the regulator to the supply transformer. This is used for sustained flashovers. After breakdown has occurred this circuit breaker is opened automatically and the resistance inserted, cutting down the primary voltage and limiting the current. The circuit is finally cleared when desired by tripping the substation breaker.



VIEW OF COMMUTATOR RECTIFIER

Control of the various auxiliary apparatus is installed in the operating booth, which is so placed that the test floor is in view. Within easy reach of the operator are the substation breaker control, the regulator control, spark-gap control, generator circuit-breaker control and generator field control. In addition to the manual switches and buttons, a foot switch was installed upon which the operator stands. Release of pressure on this button disconnects the power at the substation.

### Crest Voltmeter Used to Measure Voltages

It is essential that the greatest possible accuracy be obtained in indications of voltage on testing transformers. Experimental data are frequently relied upon to furnish information for design of a complete line of equipment. If the test results are in error, disastrous failures may occur and expensive changes become necessary. As the test voltages employed have risen in advance of commercial practice in the last few years, the importance of reliable high-potential measurements has brought improvements of interest.

As a measuring instrument the sphere gap has some disadvantages. It is not an indicating instrument but a limit measure. Measuring voltage by a spark gap is like measuring steam pressure with a nicely adjusted safety valve. Whenever a reading of changing voltages is desired, or if it is required that a certain test voltage be applied to some apparatus, another form of instrument calibrated by comparison with the sphere gap must be used.

For relatively low voltages (up to 50,000) a voltmeter reading the primary voltage of the transformer may be relied upon to indicate the secondary or high voltage, using a multiplying factor of the ratio of secondary to primary turns. If the transformer is well designed, with closely coupled windings and low leakage reactance, this method is sufficiently accurate for all testing purposes.

Above 50,000 volts two factors enter to destroy the accuracy of the turns-ratio method. First, insulation requirements involve greater spacing between primary and secondary coils and thus greater distance of secondary from the core. The entire magnetic flux then does not link all coils, and the primary voltage necessary to establish the leakage flux in addition to the useful flux does not bear a true ratio to secondary voltage. Furthermore, the error is not constant but increases with voltage. The second factor is that of capacity reactance. In transformers built for the higher test voltages (300,000 and upward) the construction is often such that there is considerable capacitance between coils and between coils and case. In the million-volt transformer and several 500,000-volt units recently constructed by the Westinghouse Electric & Manufacturing Company a new design was used, employing nested concentric tubes with single-layer coils wound on them. The construction resembles the form of a condenser bushing. This gives a very high capacitance, which is of value in distributing internal stresses between windings. However, it also produces a secondary voltage higher than the turns ratio would warrant. In other words, it has a positive regulation which increases up to about 25 per cent at full voltage. The million-volt transformer primary is designed for 5,000 volts, or a 200 to 1 ratio, but application of slightly more than 4,000 volts will produce a million volts on the secondary, a ratio of 250 to 1.

Two methods of indicating voltage in the case of extremely high-voltage testing transformers are in use. One is by what is called a voltmeter coil. A specially designed and placed small coil is built into the transformer and corrected for errors by compensation. The voltmeter then reads the secondary voltage quite well under proper conditions. It will read effective value, however, no matter what the wave shape. Distorted wave shape may be present owing to source of supply or to character of the load.

In most testing work we are interested not in the effective value of the wave but in the peak. The highest voltage reached during the cycle is the value to which the apparatus is subjected and which will cause failure. For this reason the sphere spark gap is an excellent standard. It is, in effect, a standard piece of insulation (an air path in a uniform electrostatic field) which will fail in a manner similar to the apparatus to be tested, and its breakdown is determined by the crest value. Usually the calibration curve of a sphere gap is, however, marked in values of the equivalent sine wave effective voltage ($E_{max.}/1.41$).

The other method is the crest voltmeter, developed by L. W. Chubb of the Westinghouse company. It can be demonstrated mathematically and experimentally that the average value of the charging current to an electrostatic condenser is proportional to the peak of the applied voltage wave. An average-value reading instrument and a condenser connected to the voltage to be

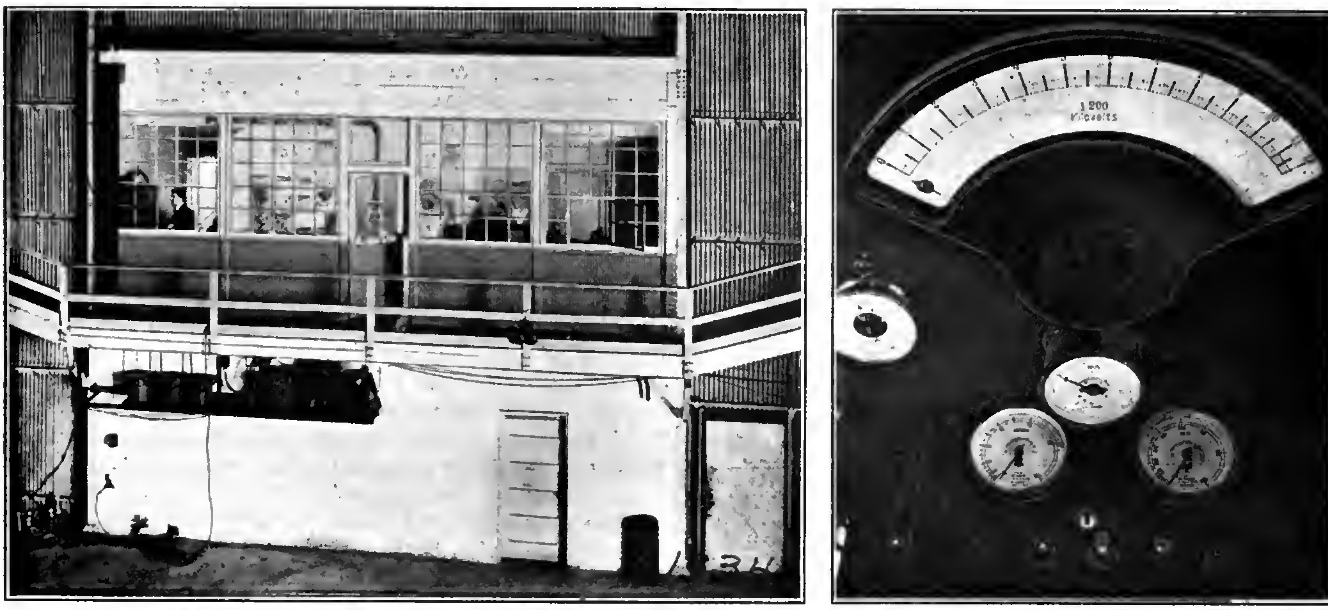
measured are therefore needed. The charging current to the condenser bushing of the transformer is rectified and passed through a D'Arsonval type of direct-current meter, connected at the ground potential end. The meter can be calibrated directly with uniform scale in secondary volts or kilovolts.

For several years the rectifiers used in crest voltmeters have been of the bulb type, using a hot cathode in a mercury vapor. With such distortions of wave shape that the bushing charging current (differential of voltage wave) crosses zero more than twice per cycle, the bulb rectifiers are inaccurate, for they entirely suppress the negative loops instead of adding them algebraically. While harmonics do not usually occur in such values as to cause this excessive distortion, certain combinations of testing conditions have been experienced where this does occur, especially at the extremely high voltages in use.

To provide for such conditions an additional system of double mechanical rectification with separate meters After this adjustment is once made it rarely needs to be touched.

The indicating meters are made sensitive enough so that they are normally shunted when used for highest voltages. This permits the use of switches increasing by steps the resistance of the shunt for various ranges or cutting out the shunt altogether for low readings. This means of making a multi-range instrument is very flexible and may be modified to suit conditions. Usually two or three fixed ranges are sufficient. The scale of the larger of the two meters (used with mechanical rectification) is divided into twelve major divisions and 120 minor divisions. The best arrangement of shunts found for this million-volt set was full-scale reading of 1,200,000 volts and 600,000 volts, giving the easily used multiplying factors of 100,000 and 50,000. The smaller meter, used with the bulbs, contains 100 minor divisions and similar factors may be used.

The operator in his booth is usually occupied with several duties—control of the various switches and gen-



VIEW OF CONTROL ROOM, AUXILIARY EQUIPMENT AND CONTROL PANEL

was installed. The duplicate system has the added advantage of a spare in case of damage to either set of instruments or circuits. A ratio voltmeter is also available and can be calibrated against the crest voltmeter for approximate indications in case of failure of both other instruments. On the panel a convenient transfer switch is used to connect in the bulb rectifier system, the mechanical rectifier, or to short-circuit and ground all meters.

The mechanical rectifier was built by mounting a special commutator on an extension of the shaft of a three-phase, four-pole, ¾-hp. synchronous motor connected to the same supply as the transformer. The commutator consists of a brass cylinder mounted on an insulating core. Four brushes bear on this ring—two for the alternating current coming from the condenser bushing and two carrying the rectified current to the meter. The cylinder is so slotted that each meter brush is alternately connected to the two alternate-current brush segments, the reversal taking place at the zero point of the wave. A lever on the brush rigging allows the brushes to be shifted relative to the motor frame so that the point of maximum rectification can be found.

eral observation of events out on the test floor. Consequently it is desirable to have the meter scales as long as possible and clearly marked so that readings may be accurately taken without loss of time or distraction of attention from other events. The meter elements must also be dead-beat, yet not overdamped, a requirement hard to meet when the needle is long and travels over quite a distance.

This crest-voltmeter installation has proved to be entirely satisfactory as to accuracy and convenience, and the principle, devised long before the present high voltages were available, solves problems of more exacting requirements than were originally anticipated.

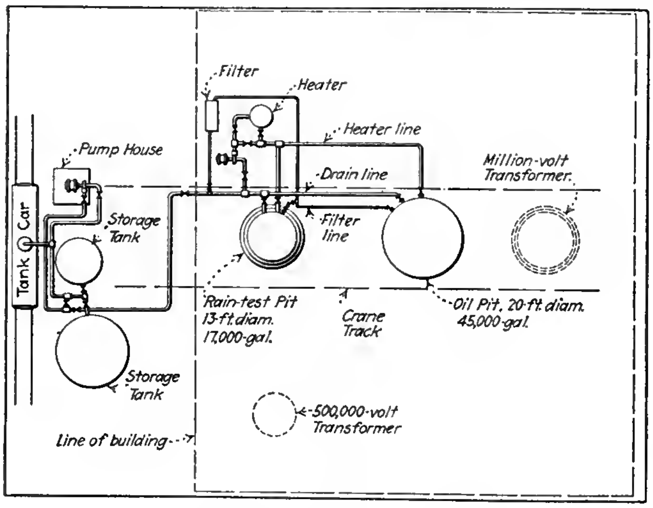
The second testing transformer is similar in construction and is equipped with auxiliaries similar to those of the million-volt transformer. The tank, provided with an internal barrier, is 9 ft. in diameter by 10½ ft. high. A similar cover with a projecting lip for shielding was used and nothing projects above the surface except the bushing. On top of the condenser bushing, which is 12½ ft. long and 21½ in. in diameter at the flange, rests the upper static shield 5 ft. in diameter and 10 in. thick. A reactance coil for protec-

tion is wound on a micarta tube attached to the top of this "hat" and terminates in a connector.

The capacities of the supply transformer (500 kva.), the generator equipment (300 kva.) and the testing transformer (500 kva.) are just one-half those of the corresponding equipment for the million-volt set. For uniformity in installation and repair the circuit breakers and regulator, however, were made identical with the larger outfit.

In the control room an operating booth for the 500,000-volt transformer was installed with similar switching control and metering arrangements, except that no spark-gap control was needed. In place of the stationary 100-cm. sphere gap a portable 50-cm. gap is used with this transformer. For lower-voltage tests a 25-cm. gap is available.

The two testing transformers may be used simultaneously for different work without interference if desired. With the two transformers on the same supply phase,




LAYOUT OF OIL PIPING SYSTEM

1,500,000 volts difference of potential is obtained between the two transformer terminals with ground potential one-third of the total from one side. Another connection useful with three-phase transmission-line work may be used. The transformers may be switched to different phases to obtain a phase angle of 120 deg. between the high potential windings.

Most of our stationary types of electrical apparatus—transformers, circuit breakers and electrolytic lightning arresters—use a petroleum-base oil for insulating purposes and as a medium for conducting internal heat from the electrical parts to the outside. In order to utilize these two valuable characteristics of transformer oil to best advantage, careful design studies must be conducted. The combination of solid insulating members with oil involves consideration of the relative specific inductive capacities, the internal losses and other factors. Furthermore, corona under oil may present serious problems, and research must be undertaken to determine the best forms of conducting members adjacent to insulation. The characteristics of solid insulation change with temperature, so that engineers must have data at oil temperatures similar to those reached under heavy load on apparatus. For these reasons extensive facilities have been provided for oil tests.

A steel tank, 20 ft. in diameter and 20 ft. deep, holding over 45,000 gal. of oil, was installed. Placed in this tank is a large wooden frame, 14 ft. x 14 ft. x 16 ft., with adjustable cross-members for supporting any apparatus or model under test. If desired, the frame may be raised from the tank and changes or adjustments made at a convenient location.

Another tank, 13 ft. in diameter and 18 ft. high, in a concrete pit, is used for bushing tests. The cover of this tank is fitted with flanged plates to accommodate various sizes. The lower end of the bushing is immersed in the oil, and the upper may be kept in dry air during test or a heavy spray may be directed against outdoor types. The water runs off the cover and is drained out of the concrete pit.

An extensive piping system is required to handle the large volume of oil (60,000 gal.) in these test tanks. When hot oil is desired in either or both, a centrifugal pump of 500 gal. per minute rating is started to circulate the oil through a heater. Cold oil is drawn from the bottom, passed through the heater and delivered to the top of the tank. The discharge pipe is built in sections, so that the hot oil may be delivered just below any desired oil level to prevent foaming. The heater tank, 5 ft. in diameter by 8 ft. in height, contains grids arranged for several connections and capable of dissipating a maximum of 500 kw. A separate substation circuit breaker and supply transformer are installed for this equipment. Even with this rate of heat supply to the oil, approximately ten hours is necessary to heat the oil in the larger tank from 10 deg. C. to 70 deg. C.

After continued use, especially at high temperatures, the oil deteriorates, but filtering will remove the impurities and moisture, making the oil good again. A large filter press of 30 gal. per minute capacity is used for this purpose and may be connected to either tank by opening proper valves.

An adequate storage system becomes necessary with these test tanks by means of which oil may be drained from the tanks for inspection, repair or changes. A reserve oil supply and means of segregating special oil or bad oil is also desirable at times. For these purposes two storage tanks were constructed outside the laboratory. They are so located, with necessary pump and piping, that new oil may be easily taken from a tank car on the railroad side. An unusually flexible piping arrangement in connection with the storage tanks allows the following operations: (a) Pumping oil from tank car to either or both test pits; (b) pumping oil from tank car to either storage tank; (c) pumping oil from either or both storage tanks to either or both test pits; (d) draining oil from either or both test pits to either or both storage tanks.

Both test tanks are provided with piping attached to a 500-gal. "Foamite" chemical engine. In case of fire the opening of a valve permits mixing of the chemicals and a blanketing of the oil surface with a foam which smothers the flame.

### Layout of Substation and Grounds

Power from the transmission system of the Duquesne Light Company is delivered to the laboratory at 22,000 volts, three-phase, 60 cycles. This power, through disconnecting switches and automatic circuit breakers, is supplied to the separate transformers installed for the larger power-consuming equipment. Each test transformer and the oil heater have separate supply units. The low voltage of the testing transformer supply units is arranged with several taps, with a maximum of 5,000

volts. The heater circuit is 2,200 volts. In addition, a three-phase, 1,000-kva. bank, 22,000 volts to 2,200 volts, is provided for auxiliaries, such as crane, lighting, motors, etc. The total connected load of the substation is 3,000 kva.

Adjacent to the laboratory, which is on a hill, there is over an acre of level ground intended for outdoor testing. Life tests and weathering studies are set up here and leads connected to the testing transformers through the 60-ft. x 45-ft. doors. There is unusual opportunity for transmission-line investigation in this location along a right of way through relatively unimproved property leading from the laboratory for over a mile. Beyond this another long stretch is available with only slight contact with civilization.

In high-voltage research photographic instruments for recording phenomena both visible and invisible to the eye are of great aid. The high-voltage laboratory has a complete portable oscillograph with accessories with which valuable data have already been obtained on testing-transformer transient characteristics. Recently great importance has been attached to high-speed photography for studying the progressive changes in insulator flashovers under various conditions. For this purpose a special high-speed camera, designed by the designer of the portable oscillograph,* J. W. Legg, has been provided.† This camera is capable of taking exposures at a rate up to 3,000 per second. Besides these instruments, a camera for ordinary photographic work is used. Dark-room facilities are provided in the control building.

*A. I. E. E. *Transactions*, July, 1920.
†*Electric Journal*, December, 1919.

# The Home Office Visits the Local Plant

## A Bit of Satire Pointing Out the Hurt and Harm that This Can Do, Whereas the Situation Offers a Great Opportunity

By WARREN R. VOORHIS
*Vice-President American Water Works & Electric Company, New York City*

IN THIS day of holding companies of large business interests and utilities, a semi-oversight and management of the various branches is usually maintained at what is known as "the Home Office." This necessitates the visit of officers, auditors and inspectors from time to time to the branch offices, and it is to these "visitations" that the following article applies.

### HE SEES THE PLANT

The doorway of the "local plant office" is darkened.

It is the representative of the home office.

He is about to visit the local plant.

The flustered cashier rejoices in the safety of his cage; the girl at the adding machine misses her decimal point; the typists pound furiously on the keys; the plant manager scrambles into his coat and puts his monthly report to the home office on his desk where it can be seen of all men; the dog of the repair man crawls under the service truck and regards the universe with a gloomy and an apprehensive eye.

The representative and the manager shake hands, and there are a few minutes of that most acute of all the forms of social torture—polite conversation; late trains, poor hotels, mean weather, warm and pleasant in New York, and so on.

Together they climb into the company car and drive out to see the plant.

The representative expects to find something wrong at the plant.

It was built by human hands; it has since been run by human intelligence; there always is something wrong at the plant.

Really the place looks clean, trim and well kept. It is in a good state of operating efficiency. But the manager is paid for this service; obviously there is no occasion for approving comment.

The manager points out, with a gleam of enthusiasm, one or two little recent improvements which he thinks will make for economy.

The representative regards them and inquires whether the manager first submitted these innovations to the home office.

If the manager says he did, the representative gives his benediction.

If the manager says he did not, the representative permits his silence to register grieved reproof.

The representative finds something wrong. He explains how it got wrong, what will happen if it is not fixed, and he gives the most minute and explicit orders about it. The manager murmurs his understanding and assent.

It is difficult to regard the timely visit of the representative at this crisis of the plant's life other than as providential.

The representative and the manager lunch together at the hotel.

This is apt to be a dull business.

The representative, with the broad outlook of the suburban commuter—his wide world vision gained in Pullman smokers and second-class hotel lobbies, naturally enough finds it difficult to adjust himself to the conversational plane of the manager, who gets his viewpoint from newspapers and books and Chamber of Commerce luncheons and loafing at odd times with the local editors, bankers and lawyers.

So there is more polite conversation at this luncheon.

### HE SEES THE BOOKS

In the afternoon the representative goes into the office and looks into the books—any book will do to look at.

The cashier wonders how long the bond company will give him to fix it if anything is wrong.

Every little girl remembers every error she has made since she went to work for the company.

Probably the books are all right; still more probably the representative would not know if they were wrong.

But this is not the point.

He has scared the everlasting daylights out of the whole office, which is the one impressive feature of this kind of a visitation.

There is more polite conversation with the manager.

The representative explains that the home office is getting out a new set of forms—they will be twice as long and so arranged as to provide a permanent tomb for twice the present amount of useless information.

The clouds break. The representative asks for a timetable showing the next train and one hundred dollars expense money. Willing hands assist him.

The manager drives the representative to the station and tries to find where he is going in order to send a wire of warning.

Back at the office the cashier greets the patrons with a smile and looks forward to a few more years of association with his family, the little girls salvage their gum from under their desks, the manager hangs his coat on its nail and goes to work, and the dog of the repair man resumes his benevolent watch over the yard and bites his fleas in the sun.

The visitation is over.

The voice of authority has been heard. Discipline has been maintained.

### He Sees the Help

To all young gentlemen who regard this general type of visitation with approbation I should like to suggest certain refinements of technic, the effect of which can reasonably be expected to improve this form of visitation.

For example, when the representative finds something wrong at the plant, instead of confining his criticism and giving his orders to the ear of the manager alone, let him call in the chief engineer and two or three workmen and then give his views and orders in the form of a lecture or discourse. The effect of this should be to emphasize the fact that, while the manager is in nominal charge, the real brains of the business is, of course, in the home office.

My suggestion upon this point should be especially helpful to the manager.

And as soon as the representative gets back to the office he should dictate to the manager's stenographer a letter to the home office.

He should report the crisis which he found at the plant.

He should inform the home office, however, that there is no cause for alarm: "Explicit orders have been given by *me* for its correction."

A copy, of course, to the manager.

### He Sees the Public

Another suggestion: It should be desirable and useful for the representative of the home office to know the men of standing and consequence in the community where the plant operates.

He should call upon them, and of course he should go alone, leaving the manager at the office. In his conversations with these gentlemen, being a man of tact, as are all representatives of the home office, he will say no word in any way derogatory of the manager.

The representative should merely create the impression that while the manager is really a very honest, worthy person, well able to operate the physical property, naturally in the higher realm of public relations and affairs the home office expects its representatives to establish and maintain that contact.

Upon his return to the office the representative should write a second report to the home office—this time in longhand; and since the matter is outside the scope of the manager's duties, there is no occasion to give him a copy of this letter or tell him about the various conversations.

Another good way to impress the manager with the co-operative spirit of the home office is in the matter of the adjustment of grievances.

If some consumer has a quarrel over the service of the company, let the representative go alone to the aggrieved consumer and patch up the quarrel. It does not matter how it is settled—probably best by letting the consumer have his way. The important object is to let the consumer know that he can always get justice by going over the head of the manager to the wise, strong, able home office.

Upon returning to the office the representative should say to the manager that the matter is adjusted and that he will receive a letter from the home office stating the terms of settlement, under File 16-21208.

And so on.

### The Opportunity

The man who goes out from the home office to visit the local plant has a fine opportunity.

He can make his visit so helpful, so friendly, sc sympathetic and so useful that the local manager and all his force will welcome his coming and will want him to stay as long as he can.

He can be a source of inspiration; if he is an inspiring kind of a man.

In a play that captured our hearts a generation ago the genial but worthless husband pointed out to his wife his great value as a bad example which the children should not follow.

That is the spirit of this article.

## Measuring the Sag and Pull in an Overhead Line

FOR measuring the height of an overhead line above ground at a number of equidistant points between two towers, A. Vaupel, in a recent issue of *Elektrotechnische Zeitschrift*, suggests the use of a tall collapsible stick, made of an insulating material similar to bamboo, with a scale painted on it. One man carries the pole and a second man sights through a telescope from a selected point on a tower near the ground to a point on the same height above ground on the next tower. He reads the elevation of this second line above ground on the calibrated stick. Such measurements, made at a few points between two towers, may be drawn to scale on a cross-section sheet and will give the exact sag of the wire. A grounding wire is attached to the stick, to safeguard the man holding it in direct contact with the live transmission wire. From the sag, the known weight of the wire per unit length and the distance between the towers and the temperature during measurement the author gives a formula for calculating the pull on the wire. The use of this method and formula is explained by an example.

# Demand-Meter Maintenance*

## Importance of Suitable Location for Installation of Meters—Organization of Inspection and Maintenance Service—Desirable Records—Attention Required by Different Types of Instruments

By E. A. LE FEVER
*Superintendent of Meters, Buffalo General Electric Company*

MEASUREMENT of demand has come into general use in America only during recent years because of the fact that high-grade devices were not previously obtainable and because there was not the general attention given to the accuracy of metering that exists today. In most companies demand is measured on all large customers. The revenue derived from the demand-meter customers may run as high as 30 per cent to 50 per cent of the total gross measured revenue, though the number of such customers may be as low as 1 per cent to 2 per cent of the total number of metered customers. Because of the magnitude of the revenue dependent upon correct registration of these meters, it is exceedingly important that they be carefully installed, inspected and maintained.

### Proper Location an Important Factor

Fortunately the demand for good meter locations became general before the advent of many metered-demand contracts. If it was important to have a good location for a watt-hour meter, which was visited for test purposes only once in one, two or three years and once a month for reading, it is much more important to have demand meters installed in accessible positions, as they are visited from two times a month up to one or two times a week. In the choice of watt-hour-meter locations accessibility was not the only factor. Rightful insistence has been placed on locations for watt-hour meters which are not only accessible but free from vibration and extreme changes in temperature, reasonably light and clean. Demand meters in general are much more delicate pieces of apparatus than watt-hour meters and will not maintain their accuracy when subjected to abuse. Hence the even greater importance of selecting good locations for their installation.

It pays to have meters of all kinds installed in such a manner that the meterman has a chance to perform the duties assigned to him in a safe and accurate manner without taking unnecessary chances and with reasonable physical ease. A meter with demand attachment may be installed in a box on a pole and maintenance insisted on. But if weather conditions are not favorable, and it is raining or bitterly cold at the time of inspection, it stands to reason that this device will not receive the care it would get if it were installed in a building. Installations in unfavorable places should be avoided, and even if a slight increase in expense were necessary, avoidance of one error would often much more than pay for many such minor expenses.

Special care should be taken to give the demand maintenance inspector ample space for his work. The demand-meter auxiliary circuits should be fused to proper capacity and in such a way that the company employees may easily remove the fuses. Such auxiliary circuits should be independent of the main circuit so that the maintenance man may perform his duties without interference with the customer's service. If such precautions are not taken, there is always the possibility of short circuits, or the demand maintenance inspector may "take a chance" and say a device is "O.K." in cases where he might have done otherwise had he been provided with better means of performing his work.

One man should be in charge of all demand work. If one man cannot handle it alone, others should report directly to him. This places all the responsibility on one person and permits the shifting of work from one man to another if required because of transportation conditions, failure of devices, or difficulties which arise when one man gets behind the schedule.

WATT METER No. 1810964 — DEMAND DEVICE TYPE M-4 — ADDRESS 994-998 Broadway TK 20
AMP 300 VOLTS 100 — No. 76639 OK — CUSTOMER J. Sattler

| Date | KW Hr. Reading | KW Hr. Difference | Demand Reading | Speed of Demand Before | Speed of Demand After | Remarks | Inspector |
|---|---|---|---|---|---|---|---|
| 1-2-23 | 5620 | 772 | 30.5 | 60-59 | | OK Demand 20 RPM = 24.0 KW Checked 23.4 KW | AS |
| 12-1-22 | 4848 | 670 | 26.0 | 60-59 | | | AS |
| 10-30-22 | 4178 | 516 | 24.1 | 60-59 | | 16 RPM = 19.2 KW Checked 19.0 KW OK | AS |
| 10-2-22 | 3662 | 422 | 23.0 | 60-59 | | | AS |
| 9-7-22 | 3240 | 484 | 21.8 | 60-59 | | OK | AS |
| 7-31-22 | 2756 | 374 | 21.8 | 60-59 | | OK | AS |
| 6-30-22 | 2382 | 399 | 18.0 | 60-60 | | OK | AS |
| 6-1-22 | 1983 | 357 | 18.0 | 60-60 | | OK | AS |
| 5-5-22 | 1626 | 411 | 20.0 | 60-60 | | OK | AS |
| 4-7-22 | 1215 | 447 | 20.0 | 60-60 | | OK | AS |
| 3-7-22 | 0768 | 574 | 20.0 | 60-60 | | OK 40 KW Scale 20 Point Com. 74 Contacts to full load scale at 30 KW OK | AS |
| 1-27-22 | 0194 | | 21.5 | 60-[illegible] | 60-60 | 12 RPM = 14.4 KW, 13 RPM = 15.6 KW Av. = 15 KW M Showed 15 KW OK | AS |

TYPICAL DEMAND-METER RECORD

The responsible head should have enough time to permit his dropping in here and there to check up the other men. Demand maintenance, like meter reading, presents a chance for abuse in that it is a routine operation and suggests the so-called "curbstone" inspection all too often encountered in meter reading. This kind of inspection is far more serious in demand work because of the revenue involved and the fact that the device is set back each month. The honest man welcomes a check on his work. This chief demand inspector should have time to go on jobs where unusual conditions exist or where doubt has been raised. A new man will often see things which others have overlooked. If there is more than one kind of device on the system, one man may well follow each kind.

It is a good policy to give a certain number of demand customers to each man and have him care for these customers continuously. He will become acquainted with the general requirements of the plant and with the personnel of at least that part of the plant which has to

*Abstract of a paper presented before the Empire State Gas & Electric Association.

do with the operation of the electrical equipment. His familiarity with both the plant and the personnel will aid materially in accounting for low or high demands and will be of considerable value on any complaint adjustment in so far as the complaint work concerns the meter department. In our organization we make it a point to have the demand maintenance inspectors keep inventory of customers' connected load and also keep in personal touch with those responsible for the electrical equipment. In the case of small demand installations which do not fall in the factory class, it is felt that this personal touch assists greatly in ascertaining that demands are correct and satisfies the customer that such is the case. The impression that knowledge of plant operation should determine the accuracy of any measurement must not be gained, but nevertheless it has a bearing which is well worth considering.

The subject of transportation should not be overlooked, especially if there is an appreciable number of devices. The demand maintenance inspector should be able to go to any device concerning the performance of which he has any doubt without a serious inconvenience or difficulty due to the time that is required to reach the location and the resulting delay of other routine inspections.

### Frequency of Inspection

Frequency of inspection will depend on the types of devices. It has always been found advisable to base practice in this regard on experience and on the inherent characteristics and the dependability of the devices. When we start using a new type of device, the chief inspector handles it until he is personally familiar with it and then turns the device over to other inspectors who handle the work in the territory in which it is installed. The chief inspector retains enough of these jobs himself to familiarize himself thoroughly with the strong and weak points of the devices. New types receive at least a weekly inspection and are repeatedly checked. After the limitations of new devices are known the inspection interval is extended. It is believed the foregoing method is especially desirable in determining the reliability of devices and in the development of the demand inspectors themselves.

### Inspection Records

Regular record forms should be used in inspection work. The form should carry the date, demand reading, watt-hour reading, check of time interval on certain types, and other check tests and the tester's signature. All failures should be noted on these reports and the reason for failure given if possible. Failure records should show whether the trouble was cared for or not. Unusual high or low demands should be commented upon if a reason can be assigned. It is often useful to figure the consumption in kilowatt-hours per month and compare the pro rata kilowatt-hours and demand with previous records as a means of determining the reasonableness of unusual demands.

The inspection report slips should be small in size to be easily carried and be so arranged as to give the inspector several inspection records. As these sheets are filled they should be filed so that they will be readily accessible. Definite routes should be arranged and definite schedules followed. If this be not done, lax inspection may result and a device may fail and not be detected promptly.

The "Factograph" camera has been successfully used to take photographs of all demands where the record is destroyed when the meter is read. All meters where customers are on a demand basis are read by demand maintenance inspectors. This serves as a combined inspection and reading for billing. The meter superintendent should keep a classified record of all failures under each type of device. He may class these as failures beyond the control of the demand inspector, those which are purely within the inspector's control and those which are doubtful. This classification gives an excellent check on the type of device and on the work in general, because the record can be compared from month to month and from year to year.

### Demand Attachments on Kilowatt-Hour Meters

When using demand devices which are attachments to the kilowatt-hour meter, it is obvious that accuracy depends directly on the kilowatt-hour meter, and if it be a high-tension measurement, accuracy also depends on the accuracy of the instrument transformers. Instrument transformer defects are considered of great importance, and demand inspectors are required to be continually on the watch for defects. Defects will occasionally occur due to lightning or to plant disturbances caused by short circuits or other serious temporary overloads. The importance of this cannot be overestimated. They are often not as apparent as one would expect.

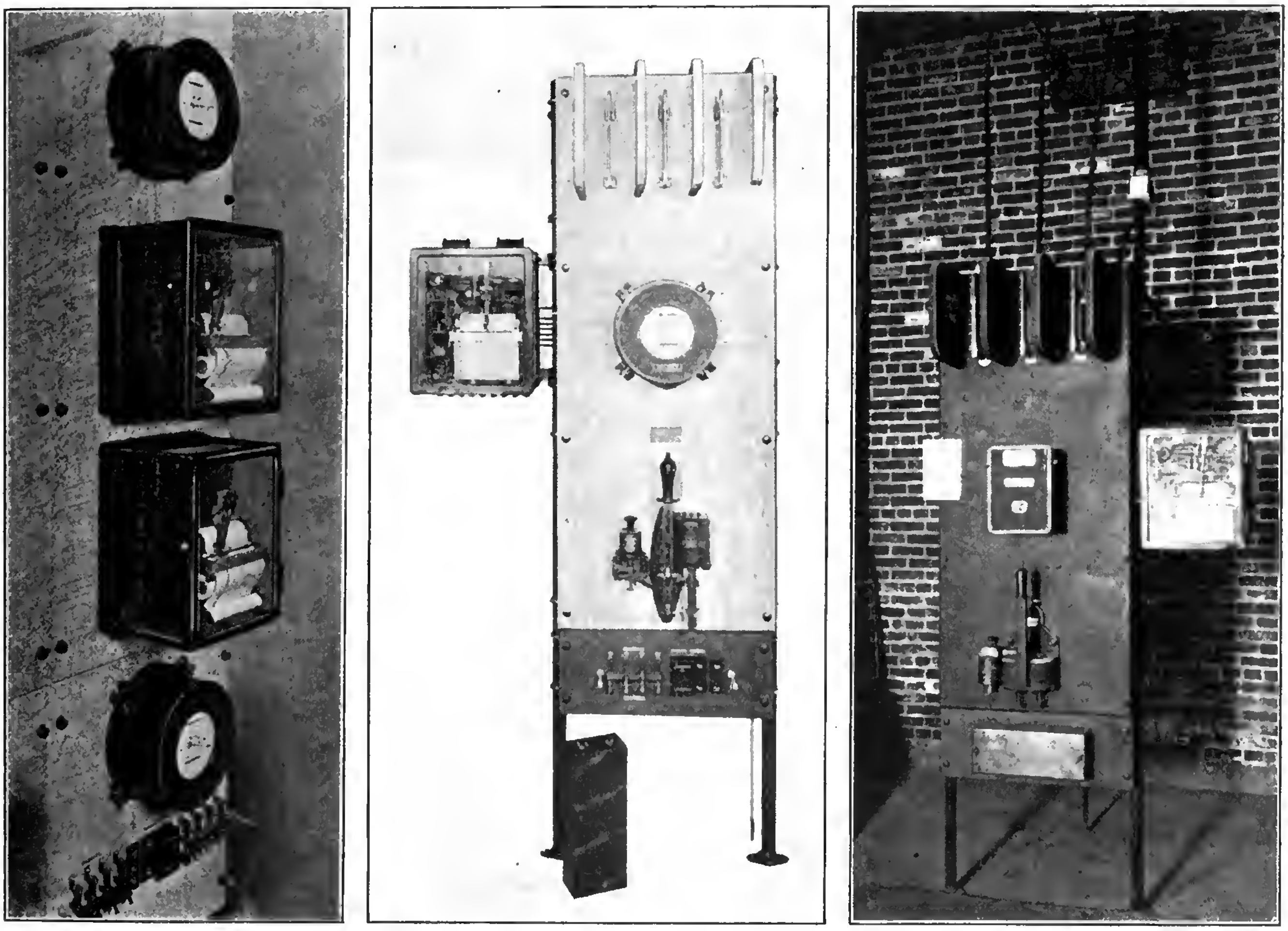
Where a contact mechanism is used on such meters it places additional friction load on the meter which is bound to have some effect on the light-load adjustment. Such combinations should be checked as a unit for watt-hour-meter accuracy. Demand inspectors should bear this in mind when handling such contact adjustments. The watt-hour-meter tester must also be careful about this. When necessary to change such contacts it is a good plan to retest. In the case of General Electric type M-4 devices a mid-month inspection is made, with a brief inspection at reading time. Should anything occur to throw doubt on the device at the time of the mid-month inspection, enough inspections are made before the monthly reading for billing to assure the inspector that proper demand has been obtained. Delay of billing may also be warranted by errors detected or suspected at the time of reading inspection. Contacts on such devices should be watched carefully to be sure they are clean and operate properly. The revolutions of the watt-hour meter should be compared with the impulses registered on the demand scale to obtain a complete check on the device. It is not necessary to do this for the entire interval. The speed of the timing element should be taken at each mid-month inspection. Meshing of teeth between the demand register and the timing shaft should be carefully noted each time a demand register is removed, since serious errors may occur, especially in the older types. If not watched off-scale reading may result from poor meshing or complete disengagement of the gears, and a high demand may result in the case of serious friction due to excessive meshing.

Occasionally a glass cover may bear down on the demand scale, causing improper registration which cannot be found when the cover is removed. The reset mechanism should be watched to see that it returns to zero. Occasionally, too, a contact coil or other wiring device within the meter may open circuit or, worse still, may develop a loose connection. These things should be watched.

In the case of direct-current measurements the General Electric type M-5 and M-6 devices are widely used. Previous comments apply to these except as regards the timing device. The M-5 timing device is an eight-day clock, and, though it is a good clock, it is subject to all the troubles found in any high-grade clock. Any clock mechanism must be kept clean. It cannot be installed and expected to run indefinitely without cleaning. Clock mechanisms should be cleaned at least once a year. It is a good plan to care for a portion of these each month. When cleaning, the clock should be taken entirely apart and all parts washed in gasoline. Damaged balance wheels and roughened jewels should be replaced by new parts. A small pocket magnifying glass will be found useful for examining shafts; a needle is best for examining the jewels. After thoroughly drying, all bearings should be cleaned with orangewood sticks, and any gum or other foreign matter which may adhere to the shaft ends should be removed. After being reassembled the clock should be thoroughly oiled with high-grade oil.

The General Electric Company recommends a high-grade mineral oil known as "Finol" for this service. This company discourages the use of fish oil especially on the M-6 meter. A twenty-four-hour run after cleaning and before installing is an excellent plan. Attempts to clean a demand clock by immersing it in gasoline (without disassembling), allowing it to dry and then oiling should be avoided. The instrument may run after such treatment and it may not. Do not blame the clock if it does not run with such treatment. Care should be taken to see that the mainspring is run down before attempting to disassemble these clocks. This is especially true in the M-5 type. Clock cleaning should always be done in the meter shop. The best results will probably be obtained if the regular maintenance inspector cares for this work unless the department is fortunate enough to have a real clock man on its staff. Good clock men are born and not trained. However, with careful training good results can be obtained. The average jeweler is of little value.

The M-6 device has an advantage over the M-5 in that it does not have to be wound once each week. If the M-5 is not wound on a very definite schedule each week, there is naturally a chance of losing the demand. A clean and smooth commutator is essential to good operation of the M-6 device.



SOME TYPICAL DEMAND-METER INSTALLATIONS WITH FACILITIES AT BOTTOM FOR TESTING

Eight-day key clocks have the same disadvantage in connection with graphic demand meters that they have when used in other devices, in that they require visits at a definite time. The electric clock on the Westinghouse M graphic meter has a reserve of thirty minutes minimum to sixty minutes maximum, which cares for ordinary power interruptions. The control potential transformer should be connected ahead of the main-line oil switch except in cases where the customer never opens the main-line oil switch.

The General Electric type M-7 and the Westinghouse type OA demand attachments are similar in many respects to the M-4 devices. The timing element is in the meter itself. These devices present very much the same problems described above. Contacts are, of course,

absent. The meter cover must be removed for any extended inspection. Care must be taken to see that dirt does not get into the meter. These devices are not recommended for use on installations requiring much over 50 kw.

The General Electric type G device has many elements in common with those previously described. It operates from contacts on the watt-hour meter and has an eight-day clock mechanism if it is not operated by a Warren motor. Care must be exercised in the handling of the waxed charts. The stylus must be handled carefully as a blunt point will result in indistinct charts. Tension on the stylus spring has a very material effect on clearness of the chart. The General Electric Company recommends the use of a definite weight applied in a definite manner to test this spring tension. Low temperatures may cause trouble securing proper operation of the stylus. The temperature should not be allowed to go below freezing; this can be prevented by the use of a special heating element with thermostatic control which can be obtained from the manufacturer. Zero adjustments and clock maintenance are as important here as in other similar types.

### Graphic Meters Which Are Independent of Watt-Hour Meters

With the various graphic types which are independent of the watt-hour meter, there is an excellent opportunity to check the demand device against the watt-hour meter by means of a stop watch since they should both give the same results independent of each other. The comments already made on the subject of instrument transformers apply equally here. A very definite schedule of placing the paper chart should be observed in connection with graphic meters or there will be either a loss of record or a waste of paper. It is not advisable to attempt to splice the paper because this may often result in failure of the record. Each time a new roll of paper is placed in a graphic meter its zero mark should be checked and adjusted if necessary. At the same time Westinghouse graphic meters should be checked for center scale by means of the calibration weight provided by the manufacturer.

The motor-control graphic meter of the Westinghouse company has a few features which are not common to the solenoid-control type. With these care should be taken not to set the contacts too close or the moving contact arm may bridge the two stationary contacts and burn out the motor. Fuses are provided for this motor. However, owing to the fine wire in motor winding, special care should be taken not only that the proper size of fuses is used but that the fuses will blow at their rated current. The cam or helix curve is an important consideration in this meter. In the event of wear it may be necessary to replace it.

Many graphics which are subjected to widely fluctuating loads will require special adjustment of the solenoid dashpots to prevent drawing too wide a curve. Individual graphic meters should be so adjusted after they are in position and operating. Solenoid dashpots ought to be cleaned out once a year. In removing them care should be taken not to dent them or serious errors will result. The glycerine level in the small dashpot connected to the balance arm should be carefully noted when installed and maintained at this point as the accuracy of the device will be affected thereby. Excessive vibration may change the level and produce serious errors.

Paper collection should be made about once a week, although with the motor reroll used by this company three times a month will suffice. If allowed to go too long, the reroll will carry so much paper that it is liable to catch under the drum. Paper should be dated, and if any record is lost, the fact should be noted. Each graphic meter inspector should go over each roll and see if there are any troubles indicated on the paper. If so, he should correct them.

Catching of paper under the driving drum is an old difficulty which is due to several causes, but which may be lessened to some extent, depending on the ingenuity of the maintenance inspector. For example, widely fluctuating loads cause considerable ink to be deposited on the chart. If the ink comes in contact with the glass door, the paper will stick and the reroll paper will not pick it up. This may be avoided to a great extent by placing a seal wire on the surface of the glass so that the paper will not strike it; or an extra idler roller may be inserted to prevent used paper from following the drum around under the roll.

Ink used in demand-meter registering devices should be free from any sediment or clogging of the pen will result. Ink should be strained through chemical filter paper. After trying many ink combinations, we are now using the General Electric No. 6 formula ink, to which we add pure glycerine, using about two parts ink and one part glycerine to thicken it. Many industrial customers' meters would not run through a week on standard inks. Pens are filled from once a month to three times a month, always using fresh ink.

### Tools and Meter Tests

Many special tools will suggest themselves for use on graphic instruments such as a grinding device for truing the armature commutators. A special tool for pulling out sticky dashpots, punches for pressing out armature shaft pins and other such useful and time-saving tools can be used to advantage.

Since graphic meters used to measure demand are usually confined to the larger installations, they should be run through their entire scale by use of phantom load and indicating instruments from once a month to once every six months, depending on their importance. The test should include ascending and descending readings on both the "as found" and "as left tests," these being recorded on the actual chart paper and turned in as the record of test. Before the "as left" test is made the graphic clock and other mechanism should be thoroughly cleaned mechanically and electrically. We do this on the job, using the small motor device previously referred to for truing the commutators on the graphic-instrument motors. Such tests should be strictly the duty of the demand maintenance inspector who is in charge of the graphic meters. Installation tests are also advisable.

It should be remembered that the graphic meter of almost any manufacture is one of the most delicate pieces of mechanism that is used in billing. Hence it must receive scrupulous care. If it is properly maintained on customers' premises, it will produce excellent results.

Too much emphasis cannot be placed on the fact that because some weakness may seem to be apparent in the above comments we should be very slow to condemn any device. The measurement of demand is a very different problem from that of a measurement of kilowatt-hours, necessitating far more complicated and delicate devices.

# Trend of Electrical Construction Costs

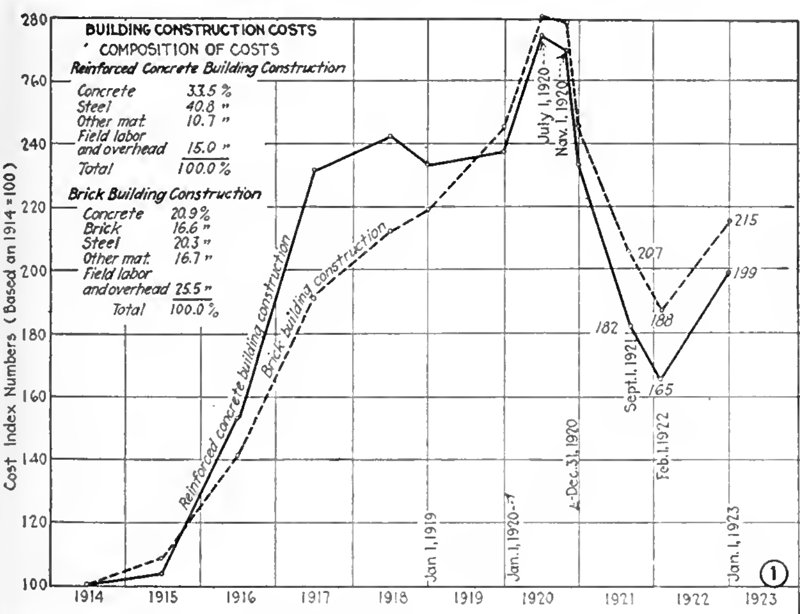
## Price Fluctuations of Major Items Composing Electric Light and Power Construction Work During Past Twelve Years—Index Curves Facilitate Estimates of Past and Future Construction

By WILLIAM W. HANDY
*Consulting Engineer, Baltimore, Md.*

IN CONNECTION with a valuation made by the author of this paper in the last three years, covering the property of a large gas and electric light and power public utility company in the Middle Atlantic States, there was occasion for the preparation of a rather unusually elaborate set of cost analyses of construction work, involving the determination of the relative costs of the several major elements making up the totals of various capital accounts, together with the unit costs of all of these elements and the percentage fluctuations in these costs over a period of years from 1911 to 1922 inclusive. During this period, as is well known, prices rose from the pre-war normal level to the war and post-war peaks, and subsequently fell to the minimum post-war level in 1921, from which in turn they have been on the average increasing to a greater or less extent during the year 1922, with the exception of equipment generally, the price trend of which has been downward.

As these cost analyses were prepared on an unusually comprehensive scale and covered such an extended period, it appeared that they afforded an excellent opportunity for the preparation of cost-index numbers and cost-index charts which would be of value to the industry and which would make it possible to tell at a glance the price trend of all major labor and material factors entering into the construction of a property and the price trend of each different kind of construction work, together with the price trend of the property as a whole, including buildings, power-plant and substation equipment, distribution system and all other items, including customers' installations. Furthermore, by the periodic posting of these index numbers and charts it appeared that the trend of construction costs could be continued and a record made which would be of permanent value through future years. While information similar to this is available in the form of the well-known cost indexes published by the United States Department of Labor and by the Bradstreet and Dun organizations and others, and while certain manufacturing and construction companies also maintain such records for the apparatus which they manufacture and for the work which they do, it appears that there is no similar service in effect especially applicable to public utility properties such as those of electric light and power companies. With this end in view the cost analyses made of the electric division of the public utility property in question have been used to prepare the cost-index charts presented in this paper, a brief explanation being herewith presented to set forth as clearly as possible the method used in the making of the analyses and in the preparation of the charts.

*Buildings.*—Costs of buildings, divided into reinforced concrete and brick types of construction as erected by the company,



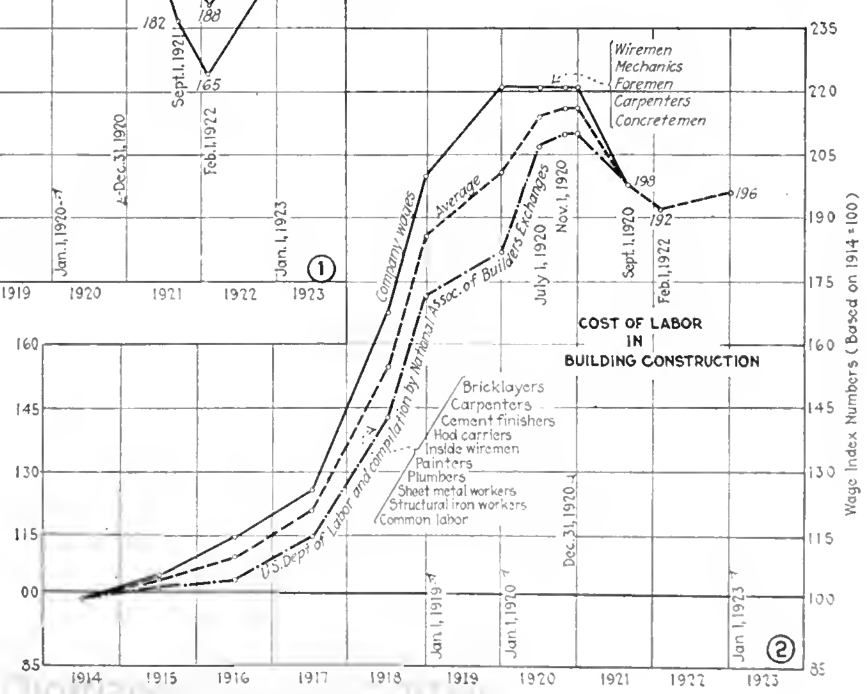




FIG. 1—BRICK AND CONCRETE CONSTRUCTION NOW 65 TO 81 POINTS BELOW PEAK PRICE AND RISING

FIG. 2—LABOR COSTS HIGHER THAN IN FEBRUARY, 1922, BUT RISING

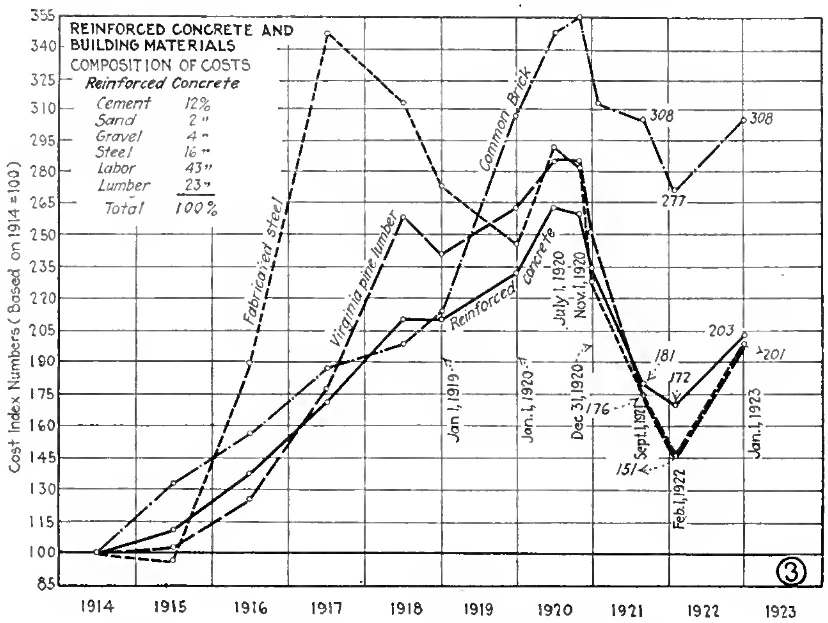



FIG. 3—OF ALL BUILDING MATERIALS BRICK HAS REDUCED LEAST

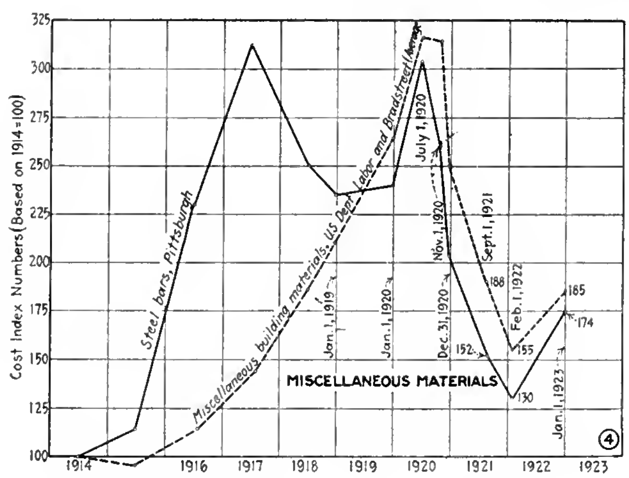



FIG. 4—MISCELLANEOUS BUILDING MATERIALS

were separated into the elements making up the cost, comprising cost of concrete in place, brick delivered, steel delivered, other materials and field labor and overhead costs. The percentage of each of these elements to the total costs was determined, together with the percentage of fluctuations in unit costs of each of these elements over the period from 1911 to 1922 inclusive. Weighted percentage fluctuations in the costs of these elements were then figured, the total of the weighted percentages plus a base figure of 100 giving the cost-index numbers of the two types of construction over the period, and from these the index curves as shown on Chart 1 were prepared.

Supporting the analyses from which Chart 1 was made, detailed analyses of the unit costs of reinforced concrete and the various elements entering into it were compiled and the percentage fluctuations in the unit costs of these elements from 1911 to 1922 inclusive determined, the same analyses being made of the costs of brick, structural steel, miscellaneous building material and the various kinds of field labor entering into building construction. The cost-index curves prepared from these analyses are shown on Charts 2, 3 and 4.

*Mechanical Equipment.*—An analysis of mechanical equipment as a whole entering into the total cost of power stations was prepared in a manner similar to the analysis made of building costs, the relative cost of each element, such as boilers, turbo-generators (mechanical end), piping, coal and ash handling, stokers and auxiliaries, condensers and tubes and pumps, and the percentage of each of these to the total cost, determined, together with the actual and weighted percentage fluctuations in the unit costs of these same elements from 1911 to 1922 inclusive, the total of the weighted percentages giving the fluctuations in the costs of mechanical equipment as a whole over the period, from which the

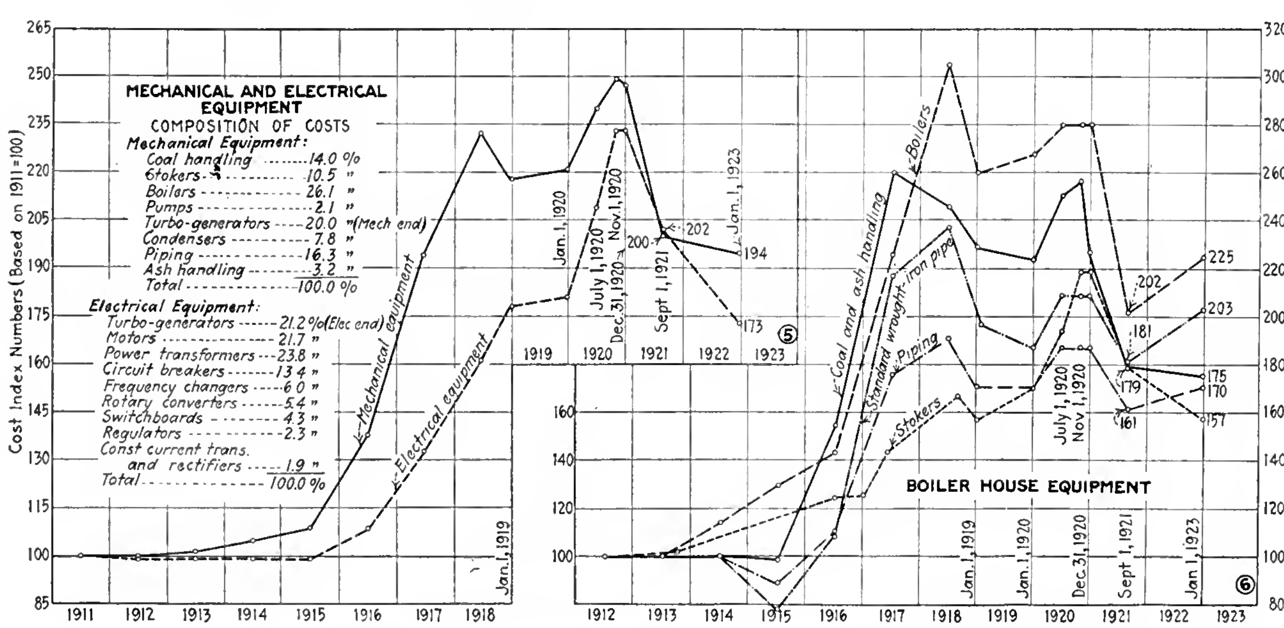



FIG. 5—ELECTRICAL EQUIPMENT ONLY 73 PER CENT ABOVE PRE-WAR LEVEL. FIG. 6—STOKER PRICES MORE REDUCED THAN BOILER

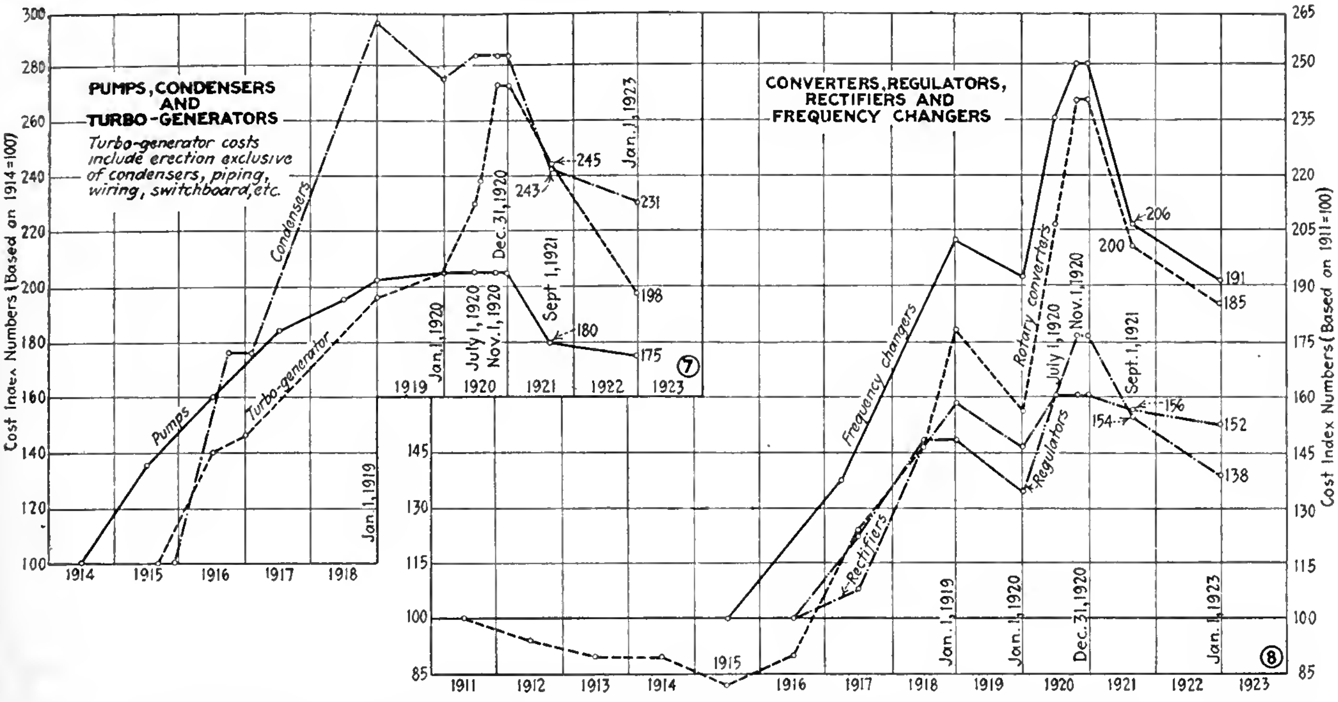
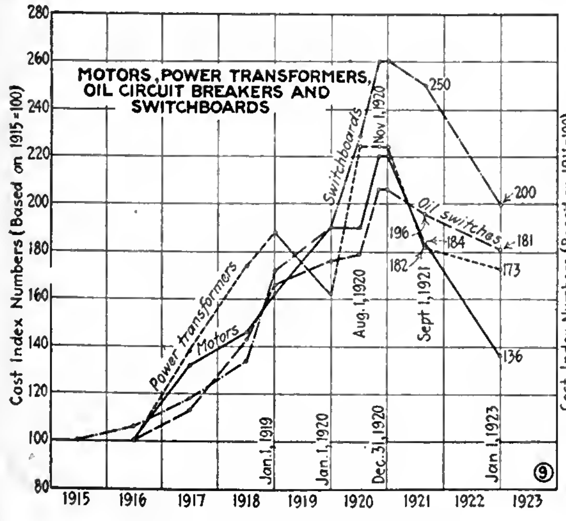



FIG. 7—TURBO-GENERATORS 72 POINTS BELOW PEAK PRICE; CONDENSERS 131 POINTS ABOVE 1914 PRICES. FIG. 8—FREQUENCY CHANGERS STILL 91 PER CENT ABOVE PRE-WAR LEVEL; RECTIFIERS ONLY 38 PER CENT ABOVE

index-cost curve shown on Chart 5 was prepared, the cost index curves for boilers and the other elements of mechanical equipment being illustrated in the curves of Charts 6 and 7.

*Electrical Equipment.*—A similar analysis to that made for mechanical equipment was made for electrical equipment entering into the total cost of generating stations and substations, relative cost determined of each element such as turbo-generators (electrical end), motors, power transformers, oil switches, frequency changers, rotary converters, switchboards, induction regulators and constant-current transformers and rectifiers, and the percentage of each of these to the total cost, together with the actual and weighted percentage fluctuations in these same elements from 1911 to 1922 inclusive, the total of the weighted percentages giving the fluctuations in the cost of electrical equipment as a whole over the period, from which the index cost curve shown on Chart 5 was prepared, the cost-index curves for frequency changers, and the other elements of electrical equipment being shown in the curves plotted in Charts 8 and 9.

*Poles and Fixtures.*—Cost analyses of poles and fixtures were made similarly to the analyses of buildings and mechanical and electrical equipment. The relative costs of chestnut poles, cross-arms, braces and racks, guys, miscellaneous material, labor, hauling and overhead costs, and the percentage of these to the total cost, were determined, together with the actual and weighted percentage fluctuations in the costs of these same elements from 1911 to 1922 inclusive, the total of the weighted percentages giving the fluctuations in the cost of poles and fixtures as a whole over the period in question, from which the cost-index curve shown on Chart 10 was prepared, the index curves for poles, cross-arms and other elements entering into the cost of poles and fixtures being shown in the curves composing Charts 11 and 16.



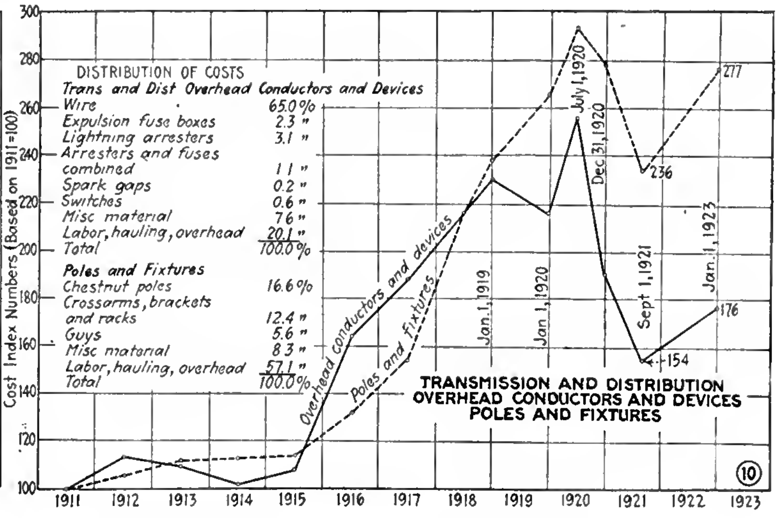




FIG. 9—OIL SWITCHES STILL 100 PER CENT UP, BUT MOTORS SHOW GREATER REDUCTION. FIG. 10—POLES AND FIXTURES NEAR PEAK PRICES; CONDUCTORS LOW BUT RISING

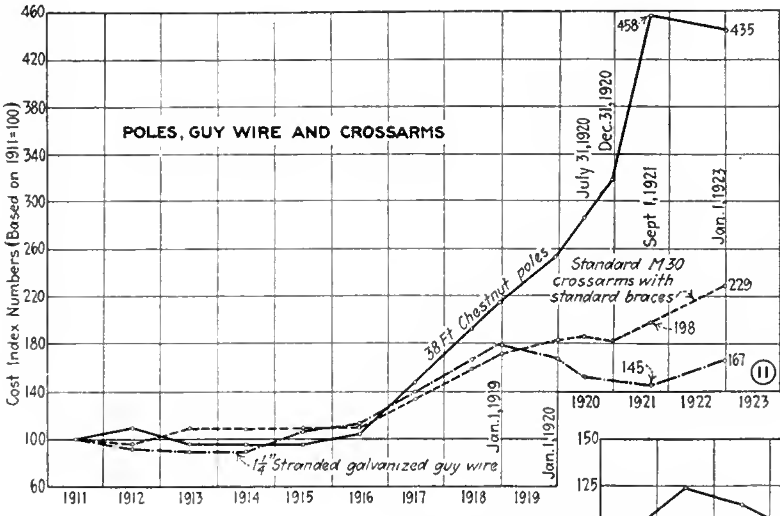



FIG. 11—CHESTNUT POLES ARE 360 PER CENT ABOVE PRE-WAR NORMAL

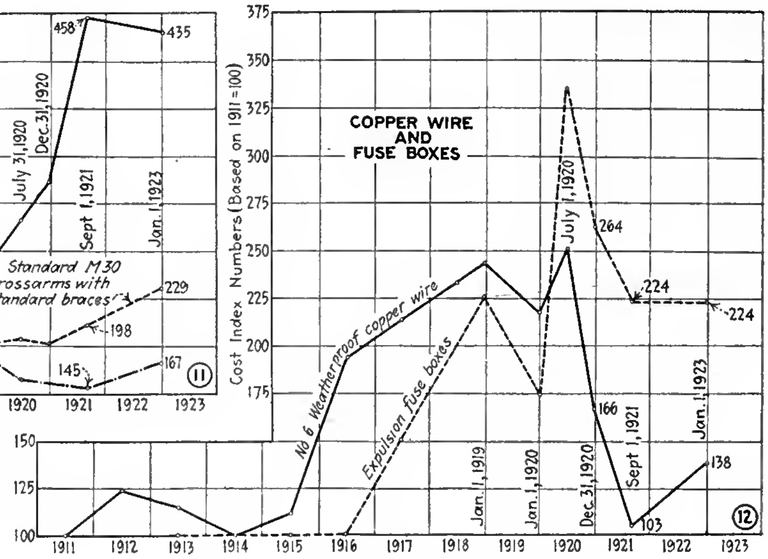



FIG. 12—COPPER WIRE LOW BUT RISING

*Other Capital Accounts or Kinds of Construction.*—Similar analyses to that made of poles and fixtures were also made of overhead conductors and devices, underground conductors, municipal street lighting, customers' services, electric house meters, distribution or line transformers, arc and glower lamps and customers' electric installation, the cost-index curves for these being shown on Charts 10, 13, 14 and 15 and the cost-index curves for copper wire, underground cable and the other elements entering into the costs of the above several kinds of construction being shown on Charts 12, 13 and 16.

*Total Construction and Equipment.*—Finally a cost analysis was made of the property as a whole, including all construction and equipment, but exclusive of land, unfinished plant investment, working capital and intangibles, such as organization and development, cost of obtaining capital, etc., and the relative cost was determined of each element entering into the total, including buildings and structures, mechanical equipment, electrical equipment, poles and fixtures, overhead conductors and devices, underground conductors, line transformers, arc lamps, municipal street lighting, customers' services, customers' meters and customers' installation, the actual percentage fluctuations in each of these elements for the

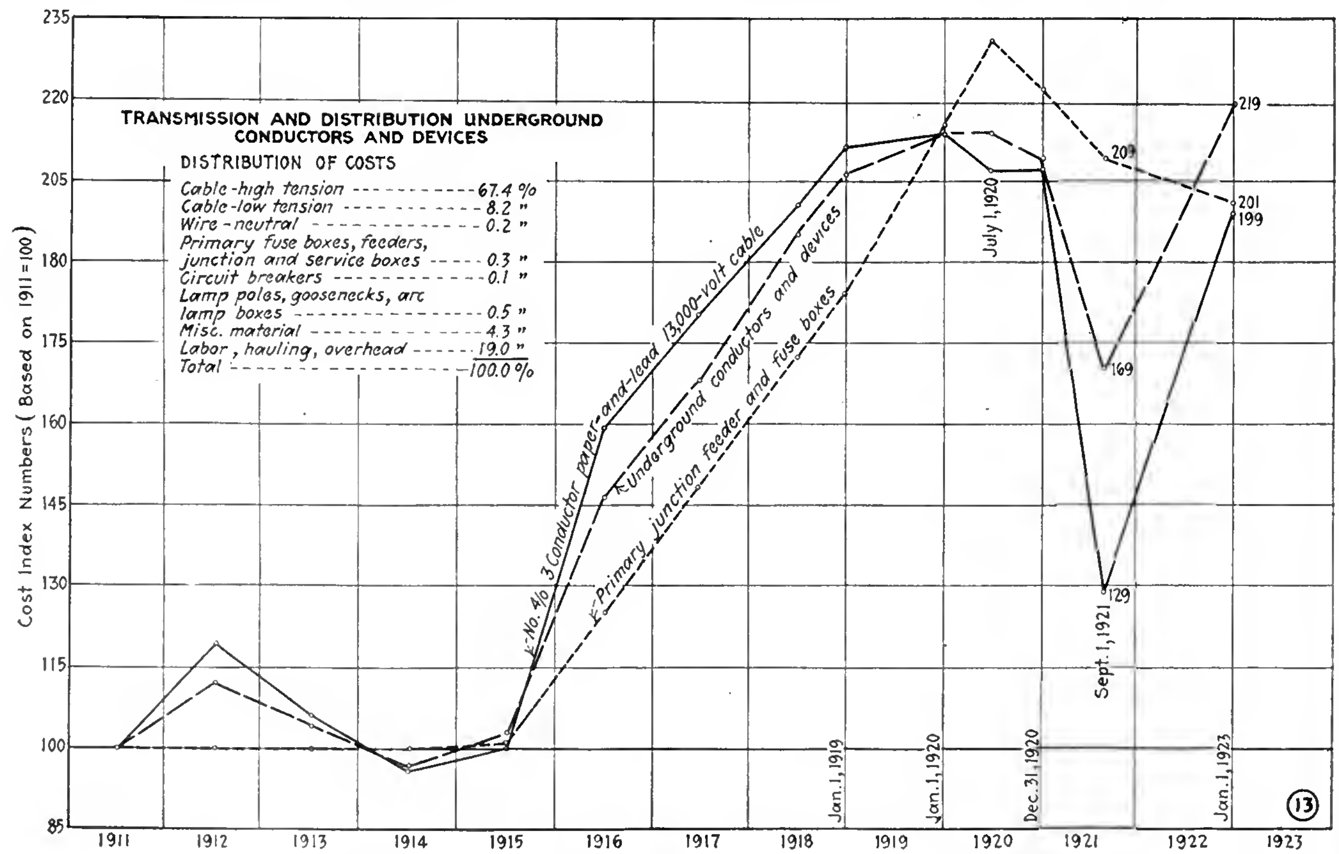



FIG. 13—UNDERGROUND EQUIPMENT NEAR PEAK PRICES AND RISING

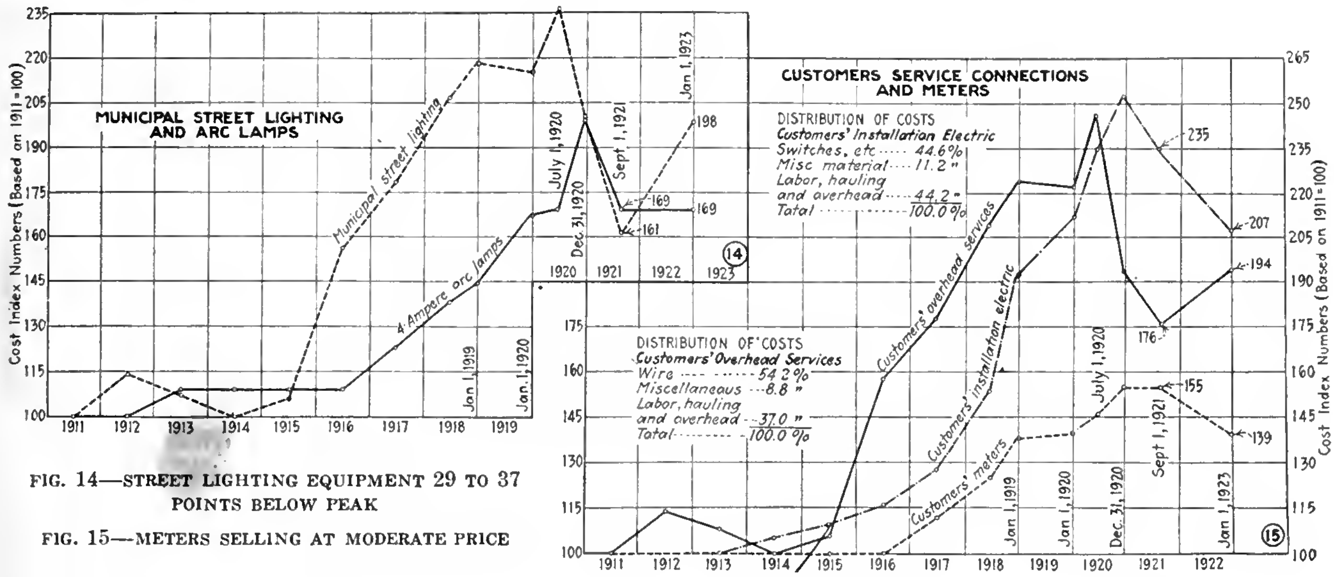



FIG. 14—STREET LIGHTING EQUIPMENT 29 TO 37 POINTS BELOW PEAK

FIG. 15—METERS SELLING AT MODERATE PRICE

period being taken from the analyses already made and the weighted percentage fluctuations being calculated therefrom, the total of the weighted percentages giving the fluctuations in the cost of construction and equipment as a whole from 1911 to 1922 inclusive, from which the cost-index curve for the entire property shown on Chart 17 was prepared. From this chart it will be noted that the cost index for a large electric light and power utility such as the one in question rose from the pre-war level in 1911 to a maximum in July, 1920, decreased from this date through the latter part of 1920 and through 1921 up to September, and from that date has been slowly rising through the past year to Jan. 1, 1923, as of which date the analyses were completed and at which time the cost index was 194, showing an increase over the pre-war period of 94 per cent.

## Derivation of Index Figures

For the purpose of illustrating still more effectively the method used and its application in deriving the cost-index figures from which the charts presented in this paper were derived, the table on page 864 gives the derivation of the indexes for total construction and equipment. By reference to this tabulation it will be noted that the upper part of it gives the actual costs under each capital account covering its particular kind of construction, including buildings and structures, mechanical equipment, electrical equipment, poles and fixtures, overhead conductors and devices, underground conductors, and so on down to customers' installation, together with the percentage each of these sub-totals bears to the total of all construction and equipment.

The lower part of the tabulation gives for each capital account the percentage fluctuation in cost for its particular kind of construction from 1911 to 1922 inclusive, together with the weighted percentage fluctuations in cost for each by years, the latter being derived by multiplying its percentage of the total cost of all construction and equipment by the actual percentage fluctuations, the actual percentages having been first derived from similar tabulations giving the cost analyses of each kind of construction—such, for example, as buildings and structures, which was made up from an analysis of the unit costs and percentage fluctuations in costs for each construction element (sand, gravel, cement, brick, structural steel, lumber, etc.) and the various kinds of building labor.

Again referring to the tabulation, the sums of the weighted percentages of buildings and structures, mechanical equipment, electrical equipment, etc., for each year were taken, giving the percentage fluctuations in cost for construction and equipment as a whole over the period, from

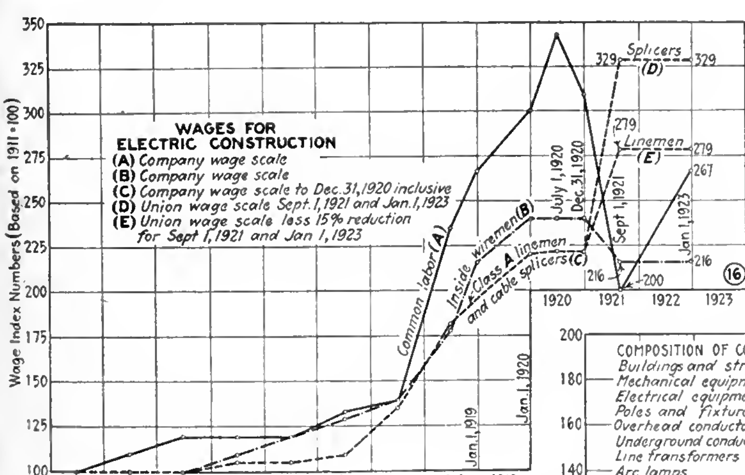
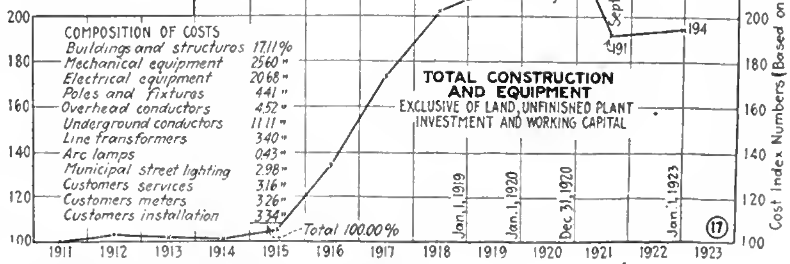



FIG. 16—WAGES OF CABLE SPLICERS AND LINEMEN 179 TO 229 POINTS ABOVE PRE-WAR AVERAGE

FIG. 17—TOTAL CONSTRUCTION COST 94 PER CENT ABOVE PRE-WAR BASIS, BUT RISING SLOWLY



CONDENSED SUMMARY OF ANALYSES OF ACTUAL COSTS OF TOTAL CONSTRUCTION AND EQUIPMENT (ELECTRIC DIVISION)*
(Costs and Percentages of Total)

| Buildings Cost | Buildings Per Cent | Mechanical Equipment Cost | Mechanical Equipment Per Cent | Electrical Equipment Cost | Electrical Equipment Per Cent | Poles and Fixtures Cost | Poles and Fixtures Per Cent | Overhead Conductors Cost | Overhead Conductors Per Cent | Underground Conductors Cost | Underground Conductors Per Cent | Line Transformers Cost | Line Transformers Per Cent | Arc Lamps Cost | Arc Lamps Per Cent | Municipal Street Lighting Cost | Municipal Street Lighting Per Cent | Customers' Services Cost | Customers' Services Per Cent | Customers' Meters Cost | Customers' Meters Per Cent | Customers' Installation Cost | Customers' Installation Per Cent | Totals Cost | Totals Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $4,029,412 | 17.11 | $6,029,672 | 25.60 | $4,870,037 | 20.68 | $1,039,137 | 4.41 | $1,061,303 | 4.52 | $2,625,865 | 11.11 | $800,318 | 3.40 | $101,939 | 0.43 | $702,890 | 2.98 | $744,332 | 3.16 | $767,251 | 3.26 | $786,516 | 3.34 | $23,558,671 | 100.00 |

PERCENTAGE OF COST FLUCTUATION BASED ON STUDY OF PRICE FLUCTUATIONS IN MATERIAL AND LABOR

| Date of Construction | Buildings Actual | Buildings Weighted | Mechanical Equipment Actual | Mechanical Equipment Weighted | Electrical Equipment Actual | Electrical Equipment Weighted | Poles and Fixtures Actual | Poles and Fixtures Weighted | Overhead Conductors Actual | Overhead Conductors Weighted | Underground Conductors Actual | Underground Conductors Weighted | Line Trans-formers Actual | Line Trans-formers Weighted | Arc Lamps Actual | Arc Lamps Weighted | Municipal Street Lighting Actual | Municipal Street Lighting Weighted | Customers' Services Actual | Customers' Services Weighted | Customers' Meters Actual | Customers' Meters Weighted | Customers' Installation Actual | Customers' Installation Weighted | Totals Actual | Totals Weighted | Cost Numbers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1911 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100 |
| 1912 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.0 | 0.3 | 16.0 | 0.7 | 14.0 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 15.0 | 0.4 | 13.0 | 0.4 | 0 0 | 0.0 | 0.0 | 0.0 | 3.4 | 3.4 | 103 |
| 1913 | 0.0 | 0.0 | 0.0 | 0.0 | —1.0 | —0.2 | 12.0 | 0.5 | 10.0 | 0.5 | 5.0 | 0.6 | 0.0 | 0.0 | 9.0 | 0.0 | 8.0 | 0.2 | 8.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 1.9 | 102 |
| 1914 | 0.0 | 0.0 | 4.0 | 1.0 | —1.0 | —0.2 | 12.0 | 0.5 | 1.0 | 0.0 | —1.0 | —0.1 | 0.0 | 0.0 | 9.0 | 0.0 | 0.0 | 0.0 | 2.0 | 0.1 | 0.0 | 0.0 | 4.0 | 0.1 | 1.4 | 1.4 | 101 |
| 1915 | 5.0 | 0.9 | 8.0 | 2.0 | —1.0 | —0.2 | 14.0 | 0.6 | 8.0 | 0.4 | 3.0 | 0.3 | 0.0 | 0.0 | 9.0 | 0.0 | 6.0 | 0.2 | 8.0 | 0.3 | 0.0 | 0.0 | 9.0 | 0.3 | 4.8 | 4.8 | 105 |
| 1916 | 50.0 | 8.6 | 38.0 | 9.7 | 10.0 | 2.1 | 32.0 | 1.4 | 64.0 | 2.9 | 47.0 | 5.2 | 0.0 | 0.0 | 9.0 | 0.0 | 55.0 | 1.6 | 56.0 | 1.8 | 0.0 | 0.0 | 17.0 | 0.6 | 33.9 | 33.9 | 134 |
| 1917 | 122.0 | 20.9 | 94.0 | 24.1 | 33.0 | 6.8 | 55.0 | 2.4 | 88.0 | 4.0 | 69.0 | 7.7 | 8.0 | 0.3 | 23.0 | 0.1 | 79.0 | 2.4 | 79.0 | 2.5 | 12.0 | 0.4 | 28.0 | 0.9 | 72.5 | 72.5 | 173 |
| 1918 | 134.0 | 22.9 | 132.0 | 33.8 | 62.0 | 12.8 | 116.0 | 5.1 | 117.0 | 5.3 | 95.0 | 10.6 | 46.0 | 1.6 | 37.0 | 0.2 | 106.0 | 3.2 | 110.0 | 3.5 | 27.0 | 0.9 | 54.0 | 1.8 | 101.7 | 101.7 | 202 |
| Jan. 1, 1919 | 129.0 | 22.1 | 118.0 | 30.2 | 79.0 | 16.3 | 139.0 | 6.1 | 131.0 | 5.9 | 108.0 | 12.0 | 58.0 | 2.0 | 44.0 | 0.2 | 119.0 | 3.5 | 124.0 | 3.9 | 39.0 | 1.3 | 92.0 | 3.1 | 106.6 | 106.6 | 207 |
| Jan. 1, 1920 | 140.0 | 24.0 | 121.0 | 31.0 | 81.0 | 16.8 | 165.0 | 7.3 | 119.0 | 5.4 | 115.0 | 12.8 | 46.0 | 1.6 | 67.0 | 0.3 | 117.0 | 3.5 | 123.0 | 3.9 | 40.0 | 1.3 | 112.0 | 3.7 | 111.6 | 111.6 | 212 |
| July 1, 1920 | 175.0 | 29.9 | 140.0 | 35.8 | 109.0 | 22.5 | 194.0 | 8.6 | 157.0 | 7.1 | 116.0 | 12.9 | 60.0 | 2.0 | 69.0 | 0.3 | 137.0 | 4.1 | 147.0 | 4.6 | 46.0 | 1.5 | 133.0 | 4.4 | 133.7 | 133.7 | 234 |
| Dec. 31, 1920 | 136.0 | 23.3 | 147.0 | 37.6 | 133.0 | 27.5 | 178.0 | 7.8 | 91.0 | 4.1 | 110.0 | 12.2 | 76.0 | 2.6 | 99.0 | 0.4 | 100.0 | 3.0 | 94.0 | 3.0 | 55.0 | 1.8 | 151.0 | 5.0 | 128.3 | 128.3 | 228 |
| Sept. 1, 1921 | 88.0 | 15.1 | 100.0 | 25.6 | 102.0 | 21.1 | 136.0 | 6.0 | 54.0 | 2.4 | 69.0 | 7.7 | 54.0 | 1.8 | 69.0 | 0.3 | 61.0 | 1.8 | 76.0 | 2.4 | 55.0 | 1.8 | 135.0 | 4.5 | 90.5 | 90.5 | 191 |
| Jan. 1, 1923 | 103.0 | 17.6 | 94.0 | 24.1 | 73.0 | 15.1 | 177.0 | 7.8 | 76.0 | 3.4 | 120.0 | 13.3 | 38.0 | 1.3 | 69.0 | 0.3 | 98.0 | 2.9 | 94.0 | 3.0 | 39.0 | 1.3 | 107.0 | 3.6 | 93.7 | 93.7 | 194 |

* Exclusive of costs of land, unfinished plant investment and working capital.

which figures, after the addition to each of 100 as a base and as representing the 1911 normal cost, we derive the cost-index figures in the last column, ranging from 100 in the year 1911 to 194 as of Jan. 1, 1923, with a peak of 234 as of July 1, 1920, and a minimum since that date of 191, occurring on or about Sept. 1, 1921.

# Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

## The 1923 National Electrical Code

*To the Editors of the* ELECTRICAL WORLD:

In your issue of March 24 you published an account of proposed revisions of the National Electrical Code. Numerous inquiries which are being received by me and by inspection departments suggest that it is well to describe the present status of these rules. It should not be assumed that these new rules are now in force. The new edition of the code embodying the revisions is now being prepared and will be printed and made ready for distribution as soon as possible. We cannot say exactly when it will be issued.

Meanwhile we believe it will be the practice of most, if not all, inspection departments to be guided by the 1920 rules. Each inspection department, whether of underwriters or of municipalities, will after the 1923 edition is issued decide for itself on what date it will begin to operate under the new code. The electrical committee of the National Fire Protection Association, which prepares the code, assumes no responsibility for determining when the new rules shall be actually made effective by inspection authorities. We believe that confusion and misunderstandings will be avoided if all who are interested in this subject will proceed on the basis that the 1920 code is still in effect and will continue so to do until the 1923 edition is issued.

DANA PIERCE,
Chairman Electrical Committee.
National Board of Fire Underwriters,
New York, N. Y.

## Importance of Underground-Distribution Engineering

*To the Editors of the* ELECTRICAL WORLD:

The concluding lines of your editorial in the March 17 issue headed "Engineers Must Have Time for Forethought and Retrospection," were of great interest to me. Many engineers seem to look upon underground distribution as a necessary evil and not as the vital nerve of a system. This attitude may be due in large measure to the lack of proper training and incentive. In far too many cases a young graduate on joining a company with underground distribution is satisfied to accept an office job in that department and is content to lay out the work from that angle, hardly realizing or caring for the difficulties which beset the "outside staff." This attitude is all wrong, and only through actual outside experience, attention to detail and real interest in the work will "distribution engineering" become recognized and so come into the place that should be its own.

In my opinion distribution engineers should be se-

lected from men with a liking for outdoor work. On graduation they should be placed on the field staff, starting in to supervise under skilled engineers small matters such as the laying out of manholes, ducts, racking, splicing, etc. The importance of supervision of splicing and the correct radius and manner of bending the cables must be firmly impressed upon them, as it is in this actual field work that the maintenance costs either rise or fall. Too often there seems to be a tendency to fit the job to the cable, not the cable to the job, with ultimately disastrous effects.

Too many young distribution engineers cannot seem to realize that a badly made joint may when it subsequently fails necessitate pulling out and scrapping two lengths of cable, nearly always difficult to use elsewhere. Properly engineered work, even though it entails high construction costs, ultimately pays by its immunity from breakdowns and loss of service. I should not advise any young engineer to take up distribution work unless he is heart and soul in his work; for it is in the detail of the actual field work that the success or failure of his system lies, and to gain the training he needs necessitates long hours, patience and a real love of his duties. Distribution engineering is not a "job"; it is a lifelong study, every day bringing up new problems with hardly two alike. W. E. BOYLE,

Engineer Transmission and Distribution Department.
United Electric Light & Power Company,
New York, N. Y.

### Gasoline Trucks Heavier than "Electrics"

*To the Editors of the* ELECTRICAL WORLD:

When your excellent editorial entitled "Penalizing the Electric Truck," which appeared on page 377 of the Feb. 17 issue, was reprinted in the *Literary Digest* of March 24, my particular attention was drawn to this sentence: "Therefore, in spite of its greater gross weight per net ton carried, due, of course, to the weight of the storage battery, the 'electric' is far easier on roads than any other type of truck."

Unfortunately this statement conveys an erroneous impression, since it it not in accord with the facts in the case. I give the exact data:

| | 1-Ton | 2-Ton | 3½-Ton | 5-Ton |
|---|---|---|---|---|
| C-T chassis only | 2,400 | 4,000 | 5,000 | 6,500 |
| C-T chassis with battery | 3,248 | 5,740 | 7,172 | 9,134 |
| C-T chassis with average-weight battery | 3,867 | 6,000 | 7,525 | 9,445 |

The weights of a number of standard-make chassis as given in the annual statistical number of *Automotive Industries* for Feb. 22, 1923, are:

| | 1-Ton | 2-Ton | 3½-Ton | 5-Ton |
|---|---|---|---|---|
| Kelley-Springfield | 4,670 | ..... | 7,730 | 8,400 |
| Mack | ..... | 5,400 | 7,970 | 8,550 |
| G.M.C. | 3,250 | 5,300 | 7,945 | 8,645 |
| Diamond T | ..... | ..... | 7,250 | 8,790 |
| Brockway | 3,250 | ..... | 7,075 | 9,215 |
| Pierce-Arrow | ..... | 6,000 | 8,300 | 9,300 |
| Garford | 3,500 | ..... | ..... | 9,350 |
| Sterling | ..... | 5,950 | 8,350 | 9,750 |

A comparison of the above figures shows clearly that there is not "greater gross weight per net ton carried," but in many instances the gross weight is lower than for gas trucks of the same capacity.

A feature that seems to be entirely overlooked in most motor-truck legislation is the fact that electric trucks are used almost exclusively for city transportation. With very few exceptions none of them go outside urban limits. Since none of these trucks are used on state highways, some special consideration should be shown the users in taxation, as motor registration fees are applied to the upkeep of roads on which electric trucks seldom if ever operate.

Speed is another factor that has a great effect on wear of roads. The speed of the electric truck is inherently controlled. It is not subject to the whim of the operator. As a result the wear and tear on streets and roads from the operation of electric trucks is very much less than from gasoline-propelled vehicles of equal gross weight. Moreover, as the weight increases the speed automatically decreases, this feature being due to the characteristics of the motor itself, which acts automatically to adapt the speed to local conditions. We thoroughly understand that there was not the slightest intention to be unfair to the electric truck, but that, on the other hand, your desire is to further its use and protect its interests. Therefore the above facts are brought to your attention. H. S. MEESE,

Commercial Truck Company, Transportation Consultant.
Philadelphia, Pa.

### Calibrating Five Meters Simultaneously

*To the Editors of the* ELECTRICAL WORLD:

I note with considerable interest the article by R. S. Hinman in the Feb. 24 issue of the ELECTRICAL WORLD (page 458) describing a method for calibrating five meters simultaneously, with particular reference to the number of meters tested per day. There is no question that the method described is both an accurate and a rapid one. At the same time I do not believe it is possible to test and stock from one hundred to two hundred meters per day, as is there stated.

Testing a watt-hour meter consists not only in determining whether the number of revolutions of the meter is correct in a given interval of time for the energy passing through the meter, but also that the test constant, register gearing and dial constant bear the correct relation to each other to translate correctly those revolutions into kilowatt-hours as registered by the dial. Furthermore, the mechanical condition of the bearings and the register gearing and the clearance of the disk between the jaws of the magnet should be inspected carefully and readjusted if found necessary.

Even new meters from the manufacturer are sometimes received with a wrong register ratio or constant, resulting in incorrect billing. The bearings may become damaged in transit or some of the parts get out of alignment. The point I wish to emphasize, therefore, is that it is not sufficient simply to test the accuracy of the meter without taking its mechanical condition into consideration. This cannot be properly done at the rate mentioned by Mr. Hinman.

C. H. INGALLS,

Edison Electric Illuminating Company, Meter Engineer.
Boston, Mass.

*To the Editors of the* ELECTRICAL WORLD:

In regard to the letter from C. H. Ingalls of which you sent me a copy I may say that we have been able to average 120 meters a day with new meters. This includes cleaning with compressed air, cleaning between disk and magnets, checking dial and disk constants, and test. We have tried also the method of checking one meter at a time. I am very much in favor of the present method. R. S. HINMAN.

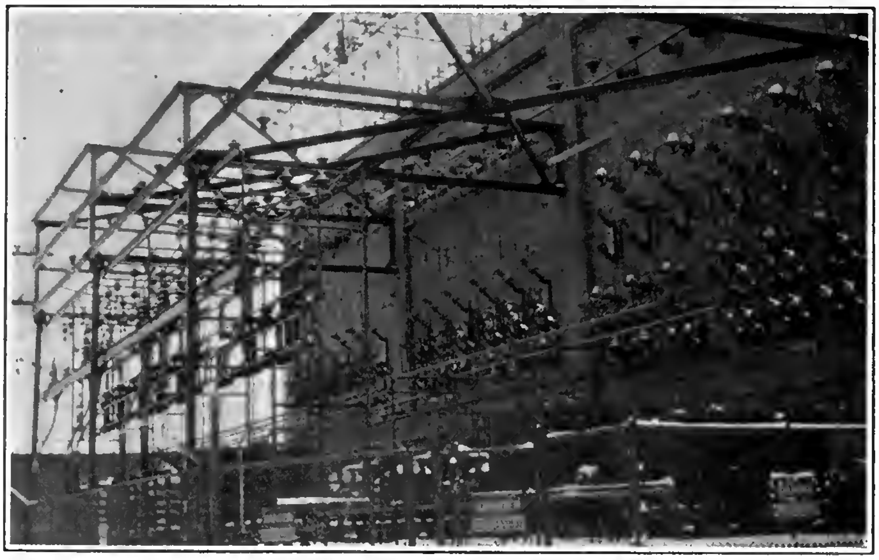
United Illuminating Company, Meter Department.
New Haven, Conn.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

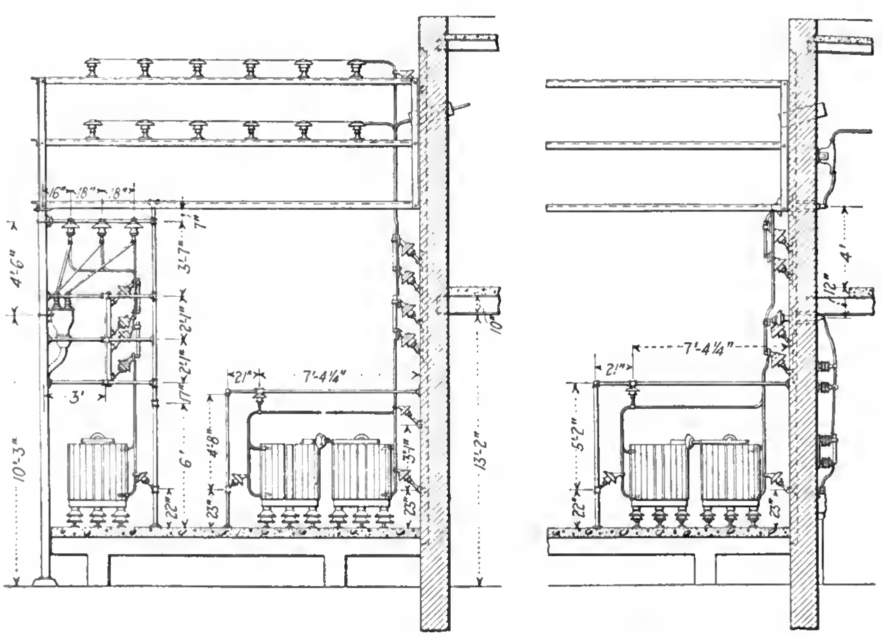
## Installing Twenty-seven Reactors for $20,177

THE continued increase in generating capacity of the Central Illinois Light Company's main station at Peoria, Ill., required a corresponding additional increase in protective devices. The choice in giving this protection lay between installing higher-capacity circuit breakers and installing current-limiting reactors. Since the space required for breakers of the larger rupturing capacity was not available, nine three-phase sets of outdoor reactors were installed. Eight of these sets, with a rating of 200 amp. at 13,200 volts, were placed in circuits feeding various mine and mill loads. These reactors have a reactance of 2.76 per cent at 4,600 kva. load. The other set, standing 62 in. high, has a higher rating of 300 amp. at 13,200 volts and supplies service to the Keystone Steel & Wire Company of South Bartonville, a suburb south of Peoria. This unit has a reactance of 4.32 per cent at 7,200 kva. The total cost of the entire installation was $20,177.88.



OUTDOOR REACTORS MOUNTED ADJACENT TO SWITCHES WITH FACILITIES FOR SHUNTING OUT OF SERVICE

Not having space within either the generating station or the substation to install these reactors, it was necessary to place them outdoors between these two buildings, as shown in the photograph. Since this space also served as a driveway, it was not feasible to use any more of the space than necessary without restricting the entrance to the rear of the plant. Therefore a concrete platform, 56 ft. x 17½ ft., was erected 2½ ft. above the ground directly next to the substation wall. On this wall were placed the air-break switches in direct line with the reactors themselves. The steel superstructure afforded supporting means for the bus work on the outer row of reactors, besides allowing the top of the structure to serve as an insulator base for the distribution circuits. The circuits to the left of the reactors in the diagram come direct from the Liberty Street generating station through underground ducts. After passing through the reactors, these circuits continue through 3½-in. conduit embedded in the ground beneath the platform to the substations served by these feeders. Switching controls are so arranged that these reactors can be shunted out of the circuit without service interruption, thereby giving continuity should trouble arise on these reactors.




REACTORS PREVENT VOLTAGE FROM DROPPING BELOW 70 PER CENT OF NORMAL DURING SHORT CIRCUIT IN SYSTEM

Before these reactors were installed the main bus voltage would sometimes drop to zero when a short circuit occurred on one of these 13,200-volt feeders. This would also cause a general disturbance all over

the system and at times create a complete shut-down due to generators falling out of step. Since installing these reactors several short circuits have occurred, but at no time has the main bus voltage fallen more than 30 per cent below normal. The percentage reactance is calculated to maintain 50 per cent of normal bus voltage when a short-circuit occurs just beyond the reactors or right at the main station without any line in the circuit.

C. R. BUSH,
Electrical Engineer.
Central Illinois Light Company,
Peoria, Ill.

## Divided Opinion on Value of Flexible Couplings

THE application and operation of flexible couplings were discussed at a recent section meeting of the Association of Iron and Steel Electrical Engineers held in Pittsburgh. Both operating men and representatives of manufacturers told of the strong and weak points in various coupling designs. Perhaps the most important facts brought out were that the couplings should be properly installed with as little misalignment as possible, that they should be checked at intervals to make sure that misalignment has not become excessive, and that the couplings should be kept thoroughly lubricated. The difference between the elastic type of coupling and the coupling which only transmits power from one shaft to another without any elasticity was dwelt upon. There was some difference of opinion as to the need for elasticity to prevent transmitting shocks from the driven machinery to the driving equipment and vice versa. Two representatives of motor manufacturers claimed that an elastic connection was necessary. On the other hand, two operators and one coupling manufacturer said that they had found no shock absorber necessary.

It was stated by some of the operating men that end thrust, sometimes of an excessive amount, was present with practically all types of couplings. Ample lubrication, they held, is the only means of reducing this to reasonable limits.

The effect of synchronous vibrations in producing very wide oscillations was discussed. It was shown that if ordinary steel springs are used in the couplings oscillations of a certain frequency may start mechanical surges which may eventually do much damage. These oscillations may be damped out by friction or by the use of elastic materials like rubber and leather in place of steel springs. It was also pointed out that if necessary the springs could be made with a varying modulus of elasticity so that they would not have any definite oscillating period. One speaker asserted that if the vibration periods of the machinery were studied a spring might be chosen with another period and this would eliminate surges.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Starting Motor-Generators from the D. C. Side

THE most important point in starting an induction motor-generator from the direct-current side is to have the field of the generator properly excited at the start. Should the field current be open or should too much resistance be cut in the field circuit, the machine may not turn over, or, should it start, its speed would increase to a dangerous value. Full field strength gives maximum starting torque and minimum running speed. During starting the generator has its field connected to the bus, but when running it should be connected across the brushes to insure safety of operation, as a loss of field might occur under separate excitation and cause the machine to race. The following rules for starting synchronous or induction motor-generators from the direct-current side have been abstracted from the operating code of the Philadelphia Electric Company:

STARTING

1. Where an oil pump is provided, start it. Adjust the valves on the pipes feeding the bearings so that the one farthest from the pump will be open widest. If this does not lift the shaft from the bearing, open one valve wide at a time until the shaft does lift. Then adjust the valves as stated above It is necessary on some machines which are hard to start to assist the starting by hand with a ratchet and bar.
2. Make sure that the generator field rheostat is all out.
3. Test the generator field switch for voltage, and if there is no evidence of any, throw the switch to the bus side.
4. Close the direct-current circuit breakers.
5. Close the machine selector and starting resistance selector switches; then place the starting switch on the first point.
6. If the starting resistance is connected to the positive bus, close the positive machine switch.
7. Cut out the starting resistance, pausing between steps to allow the armature current to decrease to a low value, and when the last point is reached close the negative (or positive) switch. (Note.—In some cases it may be found that the acceleration is too violent and the current excessive in passing from one resistance step to the next. In these cases increase the speed on each starting point to approximately that of the next point by weakening the field. Then, simultaneously, bring the field up to full strength and pass to the next starting point.)
8. Test the field switch and, if no difference in potential between the two contacts is noted, throw the field switch to the machine side. Restore the machine selector and starting selector switches to normal positions.
9. Bring the machine up to speed by cutting the field rheostat in, synchonize and close the machine oil switch. (Note.—If the motor is a synchronous motor, close the motor field switch, adjust its voltage to that of the bus and synchronize.
10. Load the generator.

SHUTTING DOWN

1. Reduce the load on the machine to be taken off as much as possible.
2. Trip the circuit breaker and open the machine and equalizer switches.
3. Open the alternating-current bus switch.
4. In the case of a synchronous motor, cut all resistance in the field and open the field switch.

## Instructions for Banking Boilers

IN GENERAL. boilers should not be banked until the load on every boiler in service falls below normal rating. As all coal burned during the banking is a loss, every effort should be made to reduce the draft through the fire bed and setting to a minimum. During the banking period stokers should be turned over occasionally to prevent the fire bed from becoming too porous or honeycombed. These rules form part of the operating code of the Philadelphia Electric Company, from which the following instructions for banking boilers are abstracted:

1. Cut off the forced draft.
2. Stop both the induced and forced draft fans.
3. Cut off the stokers. In case of light fire at the time of banking, let the stoker turn about three revolutions to give a bed of green coal and repeat this operation approximately every hour during the banking period.
4. Close the damper of the stack draft until the opening is just sufficient to clear the furnace of gases.
5. Close the main feed-water valve to the boiler.

# Most Economical Power Factor

## Must Be Considered from Standpoint of Investment in Apparatus—Use of Synchronous Condensers and Unity-Power-Factor Motors Analyzed

That 100 per cent may not be the most efficient power factor for a commercial installation was shown in a recent paper presented before the Power Sales Bureau of the New England Division, N. E. L. A., by A. R. Stevenson, Jr., of the power and mining engineering department, General Electric Company. The speaker analyzed a system where the power company installed a synchronous condenser near the load center. The question arose as to what power factor is the most economical. The answer was a compromise between the determination of the most efficient power factor and the best power factor from the standpoint of investment in apparatus.

Considering the addition of synchronous condensers to a power system for the purpose of raising the power factor, the most efficient power factor, said the speaker, will be given by the formula:

Power factor $= 1/\sqrt{1 + (c/a)^2}$, (1)

where $c$ represents the losses of the synchronous condensers, excluding the excitation loss expressed as a fraction of the kva. rating of the synchronous condenser (do not include the excitation loss of the synchronous condenser because the ampere-turns excitation furnished in the synchronous condenser balances other ampere-turns which would have been necessary in the generators and it simplifies the problem to assume that these balance exactly), and $a$ is the total resistance loss at unity power factor and given load in the alternators, transformers and distribution system expressed as a fraction of the load in kw.

The losses of a 300-kva. synchronous condenser are 21 kw., but 5.5 kw. of this is the excitation. Therefore $c = 15.5/300$, or approximately 0.05.

The losses in the alternators, transformers and transmission lines are between 10 per cent and 15 per cent. By substitution in equation (1), the most efficient power factor for these two losses will be 89 per cent and 95 per cent respectively.

From the standpoint of lowest first cost the best power factor is given by the formula:

Power factor $= 1/(1 + b^2)$, (2)

where $b = m/(n + p)$, (3)

$m$ = the price per kva. of the synchronous condenser,

$n$ = the price per kva. of the generating plant,

$p$ = the price per kva. of the distribution system.

A 2,500-kva. turbo-driven generator costs about \$5.20 per kva. If the turbine is included, the price is about \$14. It is likely that if a customer buys a larger generator he will also buy a larger turbine. Consequently let $n$ = \$14. It is also likely, the speaker said, that the distribution system would cost at least \$20* per kva. Therefore let $p$ = \$20. Substituting these values in equation (3), $b = 0.325$. The best power factor from the standpoint of the first cost can be obtained by substituting this value of $b$ in equation (2). The power factor will be 91 per cent.

It is therefore advisable to raise

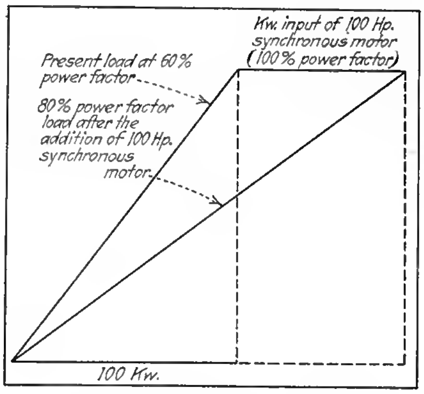



FIG. 2—POWER FACTOR OF SYSTEM IMPROVED BY ADDING UNITY-POWER-FACTOR SYNCHRONOUS MOTOR TO SYSTEM

the power factor to approximately 90 per cent from the standpoint of most efficient operation and that from the standpoint of lowest first cost the power factor should be somewhere in the neighborhood of 91 per cent.

While the losses of a 300-kva. synchronous condenser are about 21 kw., the losses of a 300-kva. static condenser are only about 1½ kw., but a static condenser of this size costs about 60 per cent more than the synchronous condenser. Static condensers need maintenance and should be installed and kept up by the power company.

When the synchronous condenser belongs to a customer the question cannot be solved in this way. The advantage derived by the customer in installing the synchronous condenser depends entirely on the bonus for power-factor correction given by the power company. This bonus must be compared with the fixed charges on the investment and the energy loss in the condenser which the customer has to pay for in his monthly power bill. The speaker knew of only about seventeen power com-

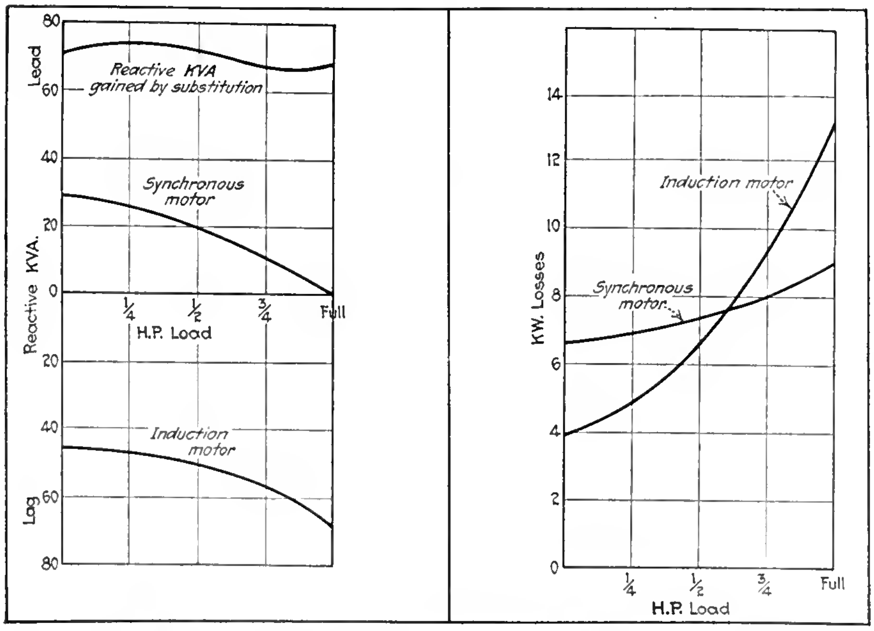



FIG. 1—COMPARATIVE CHARACTERISTICS OF UNITY-POWER-FACTOR SYNCHRONOUS MOTOR AND SQUIRREL-CAGE INDUCTION MOTOR

*The \$20 per kva. is not taken here as the total cost per kva. of the distribution system. It is the cost per kva. of increasing the capacity of the system and merely represents the cost of the copper required for a medium-sized system. The cost of increasing the capacity of the transformer banks should be included in any particular cost.

panies in the country which give bonuses for power-factor correction.

Unity-power-factor synchronous motors can be built for very little more than the cost of a slip-ring induction motor and have as good or better efficiencies. At low speeds the comparison is all in favor of the unity-power-factor synchronous motor as against an induction motor.

At the same time, a unity-factor synchronous motor will improve the customer's power factor, such a type of motor having been recently developed. The expense of installing these motors has been reduced to a minimum by simplifying the control. The exciters are adjusted for unity power factor at full load, and no field rheostats are necessary. The only control apparatus needed consists of a standard starting compensator and a standard field switch. The motors themselves being designed for unity power factor, they have good efficiency, and their prices are only slightly more than those of slip-ring induction motors.

The power factor can be improved considerably by adding a unity-power-factor synchronous motor as shown in Fig. 2. This figure represents a load of 100 kw. at 60 per cent power factor, to which is added a 100-hp. unity-power-factor synchronous motor. The result is approximately 180 kw. at 80 per cent power factor.

But if the alternative of installing an induction motor is considered, the improvement in power factor obtained by putting in a unity-power-factor synchronous motor is even more apparent because of the lagging kva. of the induction-motor alternative. Fig. 1 shows the comparative characteristics of a 150-hp. unity-power-factor, 720-r.p.m., 2,200-volt synchronous motor and a 150-hp. 720-r.p.m., 2,200-volt squarrel-cage induction motor. It will be noticed that with the field set at its full-load value the synchronous motor draws some leading kva. at part loads. The removal of the induction motor reduces the reactive lagging kva. The total improvement of the system obtained by replacing the induction motor with a unity-power-factor synchronous motor is the sum of the reactive kva. lagging of the induction motor and the reactive kva. leading of the synchronous motor. The change is therefore equivalent to adding a 70-kva. condenser. At full load the efficiency of the synchronous motor is better than that of the induction motor, but with full-load field setting the no-load losses are greater. However, even at no load these losses are only 2½ kw. more.

By this substitute there is gained the equivalent of a 70-kva. condenser with less than 2½ kw. losses. A 70-kva. synchronous condenser would have about 6½ kw. loss.

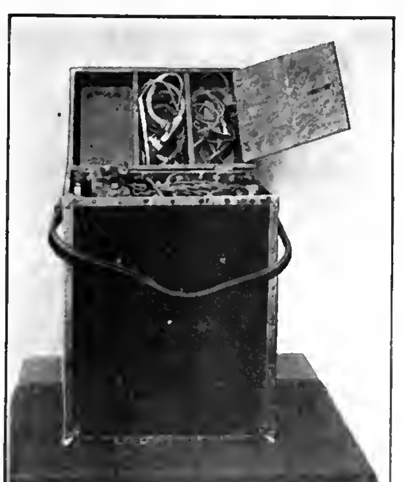
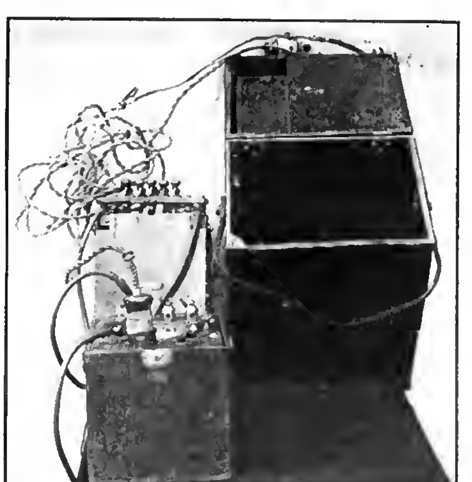
It is thus seen that when a customer wants to improve power factor it is sometimes more advantageous to replace an induction motor by a unity-power-factor synchronous motor than to purchase a synchronous condenser.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Rugged Meter Case May Be Used as a Stool

THE combination meter tester's instrument and tool case shown in the accompanying illustrations was designed and built with the object of having everything in place so that tools, leads, etc., could be got at quickly and a meter tested in the minimum time. The case is strong enough to stand on when the meter cannot be reached from the floor, and in many cases this saves the time of hunting up a box or chair. The outside dimensions of the case are: Height, 17½ in.; length, 12½ in.; width, 9½ in. The testing apparatus carried consists of a test rheostat with a capacity of 0.5 amp to 15 amp. and a rotating standard meter with a rating of 1 amp. to 20 amp. Two compartments with a cover in the lid of the case are used for leads, jumpers, lamp socket and cord. Inside the case on the left side are pockets for meter seals, dust brush, slide rule and meter-test kit. In the bottom is a box 7 in. x 9 in. x 2 in. deep, with cover, which is used for extra fuse plugs, jewels and meter repair parts. The case with instruments and tools weighs 40 lb.

HALLETT B. GRAEFF.
Los Angeles Gas & Electric Corporation,
Los Angeles, Cal.

WHEN LID IS CLOSED CASE MAY BE USED TO STAND ON TO REACH HIGH METERS

## Handling Ice Troubles in Hydro Plants*

THE most important trouble to guard against in the design and operation of hydro plants is caused by ice. The ice is of three kinds—"local" ice (that is, cake ice that has been formed in the forebay or in the canals leading to the plant), up-river ice, which moves down from the creeks and tributaries into the main river and eventually will pass by the plant, and frazil and anchor ice. The first kind can be released through ice chutes or by removing the most troublesome pieces with the hoisting facilities of the gatehouse; very little of the second kind enters the forebay of a modern plant, and it may be regarded as harmless so far as interruptions to service are concerned. The third kind, however—frazil or anchor ice—although it creeps along stealthily and without spectacular accompaniments, is most dangerous. Some remedies can be provided in the design of the plant and equipment, but the most reliable protection lies in a systematic procedure for detecting the approaching danger well in advance and mitigating its disturbing effect by a well-organized system of protection.

There are many possible ways to diagnose impending frazil-ice runs,

*Abstract from address before a joint meeting of the A. I. E. E., A. S. M. E., A. S. C. E. and A. I. M. M. E. at New York, March 21, 1923.

beginning with the study of climatological conditions, accurate readings of water temperatures, inspection of submerged test chains or other metal objects, observation of the behavior of small waterwheel-driven auxiliaries that operate acoustic or optic signaling devices, etc. The remedial steps consist in the raising of the screens, maintaining of highest possible temperature in gatehouse and power house, continuous movement of guide-vane mechanism, steam or electric heating of those submerged metal parts where the ice is inclined to stick, etc. Electric heating may be used directly on the screens, or it may be applied indirectly by circulating air through heating chambers containing electric heaters.

The most simple and effective heating method consists in the use of a boiler that supplies a small header with steam which taps into each wheel casing. The steam is turned on alternately from one pit to the other, taking one unit out of service at a time. The steam does not actually melt the ice, but after a few minutes' application the ice coating loses its adhesive force, and when the water is turned on again the ice drops off and is washed out into the tailrace.

F. A. ALLNER,
General Superintendent.
Pennsylvania Water & Power Company,
Baltimore, Md.

# "Wired Wireless" for Communication with Line Crews

EXPERIMENTS indicating the practicability of using high-frequency current for communicating with trouble wagons and line crews were conducted on March 26 by the Third Avenue Railway, New York, in conjunction with the General Electric Company. Although these particular experiments were conducted for application to electric railways, similar circuits may possibly be applied to central-station companies for communication between generating stations, substations, line crews and patrol wagons.

A laboratory set-up of a radio transmitting and radio receiving set was installed on a street car, with corresponding apparatus in a substation which supplied energy to the line over which this car was operated. Perfectly audible communication was conducted between the car and the substation from various points on the line, with the car either standing or moving.

The particular feature of this demonstration was the use of a duplex current whereby conversation could be carried on in either direction, just as it is done over the telephone. This was accomplished by utilizing two different frequencies. The transmitting set at one end and the receiving set at the opposite end were tuned for a frequency of 73,000, while the other pair of sets were tuned for 49,000 cycles. Currents of the two frequencies were thus conducted over the same wires, the trolley and feeder, without interference. By putting on the head telephones of the receiving set and talking into a transmitter connected with the transmitting set, it was possible to receive and transmit without the use of any changeover switch.

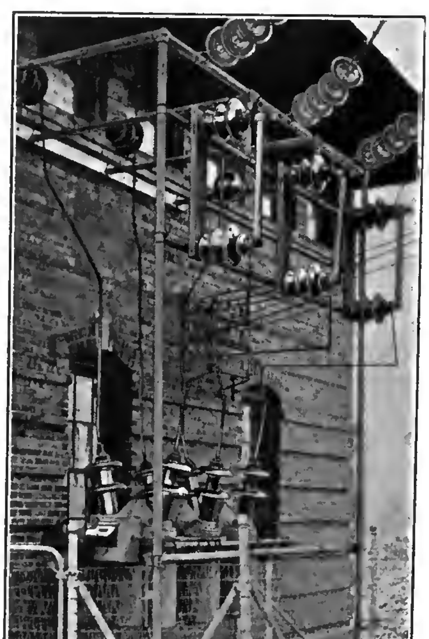
The set-up in the street car consisted of an ordinary simple radio receiving set with one three-electrode vacuum tube connected as a detector and another as an amplifier. The transmitting set made use of three type UV 203 tubes of 50 watts capacity. These three tubes were used as an audio-frequency amplifier, an oscillator and a modulator. The power for the sending set was supplied by a 1,000-volt motor-generator set with the energy to operate it supplied by twelve cells of storage battery supplying approximately 24 volts. A similar set-up was used in the substation, except that in the receiving set only a single tube was used as detector and amplifier. In the substation the sets were connected to the outgoing feeder through a condenser of low voltage drop. A condenser was, of course, also inserted in the circuit between the set on the car and the main power-feed wire from the trolley.

The General Electric Company had been engaged in experimental work on the Third Avenue Railway for several weeks to determine the constants of such a system, looking toward the development of suitable apparatus for utilizing high-frequency carrier current for communication work. While it is possible to establish communication between any point on the system and any car suitably equipped with apparatus, the idea will be primarily to devise plans for communication between some central emergency office and line and trouble crews, construction and repair gangs, and, perhaps, such transportation men as starters and inspectors out on the system. The principal advantage of the wired wireless as compared with radio communication is that it requires much less input of power, and that, while the current probably spreads over the entire overhead and feeder system, the radiation into the ether is very small so that it introduces practically no interference with any radio communication. It would therefore not be necessary for a railway company to have a government permit for a radio sending station in order to use its own system for wired-wireless communication.

The demonstration on the Third Avenue Railway was conducted in the presence of an invited group, including representatives of the General Electric Company, the American Telephone & Telegraph Company, the Radio Corporation of America, the Electric Storage Battery Company, the ELECTRICAL WORLD, local newspaper men and officials of the Third Avenue Railway. The test was in charge of Walter J. Quinn, electrical engineer of the railway company, and Edward Austin of the General Electric Company.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

# Compact Circuit-Breaker Installation



THE above illustration shows a 44,000-volt circuit breaker mounted on pipe frame in an inclosure protected by wire fencing. Entering and exit leads are protected from direct downpour of rain by the extended roof shown.

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## Connecting Service in 2 Hours 48 Minutes

**How the Syracuse Lighting Company Takes Applications, Passes Credits and Gives Service in Less than Three Hours' Average Time**

NOTHING a central-station company can do will earn greater appreciation from a customer than quick action in connecting up his service after the application has been made. With the object of reducing to a minimum the elapsed time between the signing of the application and the cutting in of the service, the Syracuse (N. Y.) Lighting Company has adopted a method of dispatching and executing "connect-up" orders which has virtually eliminated all lost motion. It has brought the average elapsed time per order down to two hours and forty-eight minutes and has made many solid friends for the company. Such a record is particularly noteworthy when it is considered that in many well-operated utilities at least a half a day is required for the necessary office routine of approving credit, making out the order and sending it to the meter department for execution. This particular part of the operation is accomplished by the Syracuse company in just two minutes.

The service has grown out and is a part of Manager G. I. Vincent's conception of his company as a personality represented to the customer by the individual employee. In the practical application of the idea he has been assisted by Ernest Johnston, auditor, and the hearty co-operation of the entire personnel of the company. To get the proper background for the method by which these results are accomplished it is necessary first to know how Mr. Vincent visualizes his company and then hear Mr. Johnston's story of carrying out the plan. The whole idea is based upon a "Bill Jones" service which Mr. Vincent describes as follows:

### Foundation of the Service

"Once upon a time there was a little gas and electric company in a tiny village. The manager's name was unimportant, so we will call it 'Bill Jones.' Bill had two or three assistants, all told, and was the alternate for all of them. He knew everybody in town by his first name and everybody knew Bill. They were all good friends. Bill never had any trouble that he could not readily adjust and the flannel-mouthed demagogue would never have made a good start. If he tried to run down Bill or his little company, he would have been run out of town, because the folks knew Bill personally and knew he was a regular fellow besides knowing his business.

"Now, imagine the lapse of many years and that the tiny town has grown to a metropolis. With it grew its public utilities, and apparently their efficiency in operation improved, because the management was progressive, kept pace with the times, and developed high-grade men and women, trained to do their particular task in a highly efficient way. Bill Jones has long since passed on and who has taken his place? Nobody. The utility has changed from a personality to a thing. The high specialization carried with it essentially a cold-blooded adherence to routine. The customers found their

FIG. 1
WHERE THE CUSTOMER ORDERS SERVICE

Showing an interpreter at the office taking application for service from a foreign-born resident who cannot speak English and transmitting it on the telautograph to the credit and shop departments. These instruments are shown mounted upon a temporary counter while moving the company's office to a new location.

FIG. 2
CREDIT DEPARTMENT LOOKS UP RATING

Employees examining records to clear credits on applications taken as shown in Fig. 1, which records on instruments at main office and shop.

FIG. 3
METER SHOP MAKES OUT "TURN-ON" ORDER

The operator at the shop makes up orders, which are transmitted by telautograph after credit has been passed. There is also shown on the right the telephone order table at which applications for gas and electric service and for complaints and notices of a leak are taken and are given direct to "Bill Jones."

requests attended to at length by a hopeless succession of workmen in their homes. True, each task might have been well done and each request in the office courteously answered, but the customer was dazed by the multiplicity of contacts, and there was confirmed in his mind the soap-box utterances that he had heard so often—that the utility was a cold-blooded, heartless corporation. The personal element was gone.

"The 'Bill Jones' idea of the Syracuse company is a sincere attempt to do in the large utility what 'Bill Jones' did in the tiny one.

"Essentially, the order-taking and order-executing departments had to be reorganized in a most revolutionary way, but that is not by any means the whole story. The idea is that each employee in coming into contact with our customers should imagine himself the 'Bill Jones' whose effort was to give the perfect and complete service and leave the customer a friend."

Such is the principle upon which the Syracuse Lighting Company is rendering a superservice and is cashing therefrom large dividends in customer friendship and good will. How it is done, from taking the customer's application to turning on the service, Mr. Johnston tells in an equally entertaining and logical manner.

### How the Plan Operates

"'Maka lights burn my house, please,' says a swarthy-looking woman to the clerk at the order counter. A crude and simple sentence, yet one which is capable of setting in motion the machinery which executes the order of furnishing gas and electric service to about 200,000 inhabitants of the city of Syracuse.

"Miss Smith, an efficient clerk, trained and advised by men who have studied carefully the situation and evolved through experience and judgment a system most satisfying to the customer, picks up her pen and commences the execution of the order.

"There are three divisions on the pad of orange-colored paper on which the application is written. The first division is the original application known as a 'turn on' and contains the date, name, address and kind of service desired, as well as the customer's signature. This may be accepted over the telephone in cases where the credit is satisfactory as readily as though the customer called at the office. When this application for service is accepted, the customer is informed that some one must be at home when the service is turned on. This is necessary in order to have the formal application signed if the request for service has been made by telephone. In case of a new customer where a deposit is required arrangements must be made through the collection department.

"The second division contains the name, address, occupation, kind of service desired and the address from which the customer is moving. This part of the application is filed according to the street and is used to follow up the completion of the work. The third division is familiarly known as a 'shut-off' notice and contains the name, address, floor, date notice is taken and date of discontinuance. The address to which the applicant is moving is also necessary so that the final bill may be forwarded to him. The 'shut-off' notice is also signed except in cases where it is accepted over the telephone.

"When these blanks are properly filled in, the order is ready to be conveyed to the various departments concerned. The vehicle of transportation is the telautograph, which makes an instantaneous record of communication between the order department, the credit and collection department and the gas-meter shop. In cases of special electric service this information is conveyed from the gas-meter shop to the electric shop by a separate instrument.

"Let us put ourselves in three places at once. The clerk in the order department writes the application on the telautograph in the manner shown in Fig. 1. This produces a visible record in three places, namely, the order department, the credit and collection department and the gas-meter shop. The credit and

RECORD OF SHOP ORDERS

Transmitted by the telautograph Jan. 8, 1923, to show time between actual receipt of order and execution of same. This does not include notices of leak and miscellaneous orders received by telephone at shop. The record of only one machine is given. The total for the day is shown in the summary.

| | | TIME | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Telautograph Nos. | Nature of Order | Application Made by Consumer | Credit Passed | Further Credit Investigation | Order Given to "Bill Jones" | "Bill Jones" Arrived at Premises | Elapsed Between Hr. | Min. | Remarks |
| "A" Machine | | | | | | | | | |
| 1 | Special test | 8.49 | .... | .... | ..... | ..... | .. | .. | To be done 1-9-23 |
| 2 | G. | 9.20 | 9.21 | .... | ..... | ..... | .. | .. | Bookkeeper only |
| 3 | G. | 9.47 | 9.48 | 9.57 | 11.08 | 11.15 | 1 | 28 | |
| 4 | Canceled | | | | | | | | |
| 5 | Sales | 10.00 | 10.39 | .... | 12.00 | 1.35 | 3 | 35 | Welsbach heater |
| 6 | E. | 10.14 | 10.15 | .... | 12.00 | 1.00 | 2 | 46 | |
| 7 | P.S. | 10.17 | ..... | .... | 11.21 | 1.35 | 3 | 18 | C.G.I. |
| 8 | Set G. & E. | 10.18 | 10.19 | .... | 12.00 | 5.05 | 6 | 47 | |
| 9 | S. G. & E. | 10.19 | ..... | .... | 12.00 | ..... | .. | .. | To be done 1-15-23 |
| 10 | Void | | | | | | | | |
| 11 | G. & E. | 10.25 | 10.26 | .... | ..... | ..... | .. | .. | To be done 1-20-23 |
| 12 | S. T. | 10.30 | ..... | .... | ..... | ..... | .. | .. | To be done 1-9-23 |
| 13 | C. & E. | 11.00 | 11.01 | .... | 12.00 | 1.30 | 2 | 30 | |
| 14 | Special Electric | | | | | | | | |
| 15 | E. | 11.15 | 11.16 | .... | ..... | ..... | .. | .. | To be done 2-20-23 |
| 16 | P. S. | 11.18 | ..... | .... | 12.00 | 1.50 | 2 | 32 | |
| 17 | Complaint | 11.20 | ..... | .... | 12.00 | 4.00 | 4 | 40 | |
| 18 | P. S. | 11.20 | ..... | .... | 12.00 | 5.20 | 6 | 00 | |
| 19 | S. T. | 11.21 | ..... | .... | ..... | ..... | .. | .. | To be done 1-9-23 |
| 20 | S. T. | 11.38 | ..... | .... | ..... | ..... | .. | .. | To be done 1-9-23 |
| 21 | G. & E. | 11.37 | ..... | .... | 11.40 | ..... | .. | .. | To be done 1-10-23 |
| 22 | G. & E. | 11.40 | 11.41 | .... | 12.00 | 1.45 | 2 | 05 | |
| 23 | S. G. & E. | 11.42 | ..... | .... | ..... | ..... | .. | .. | To be done 1-10-23 |
| 24 | S. G. & E. | 11.45 | ..... | .... | 12.00 | 3.00 | 3 | 15 | |
| 25 | G. & E. | 12.02 | 12.03 | .... | 12.10 | 2.05 | 2 | 03 | |
| 26 | Special Electric | | | | | | | | |
| 27 | Set G. | 12.19 | 12.20 | .... | 2.42 | 4.00 | 3 | 41 | |
| 28 | Set G. | 12.30 | 12.31 | .... | 12.40 | 4.20 | 4 | 00 | C. G. I. |
| 29 | G. & E. | 12.34 | 12.35 | .... | 2.42 | 2.50 | 2 | 16 | |
| 30 | P. S. | 12.40 | ..... | .... | 6.15 | 8.15 | 7 | 35 | Wrong address |
| 31 | P. S. | 12.40 | ..... | .... | 3.00 | 3.40 | 3 | 00 | |
| 32 | A. R. | 12.45 | ..... | .... | ..... | ..... | .. | .. | To be done 1-9-23 |
| 33 | A. R. | 12.47 | ..... | .... | 12.50 | 3.20 | 2 | 33 | |
| 34 | P. S. | 12.48 | ..... | .... | ..... | ..... | .. | .. | To be done 1-9-23 |
| 35 | S. G. | 12.50 | ..... | .... | 2.42 | ..... | .. | .. | To be done 1-15-23 |
| 36 | G. & E. | 12.56 | 12.56 | .... | ..... | ..... | .. | .. | To be done 1-10-23 |
| 37 | S. T. | 1.00 | ..... | .... | ..... | ..... | .. | .. | To be done 1-9-23 |
| 38 | Leak | 1.40 | ..... | .... | 1.50 | 2.30 | .. | 50 | |
| 39 | A. R. | 1.46 | ..... | .... | ..... | ..... | .. | .. | To be done 1-9-23 |
| 40 | G. & E. | 1.53 | 1.54 | 2.06 | ..... | ..... | .. | .. | Bookkeeper only |
| 41 | G. & E. | 2.06 | 2.07 | .... | 3.27 | 4.15 | 2 | 09 | |
| 42 | Special Electric | | | | | | | | |
| 43 | G. | 2.46 | 2.47 | .... | 4.14 | 5.00 | 2 | 14 | |
| 44 | R. S. | 2.50 | ..... | .... | 3.48 | 5.20 | 2 | 30 | |
| 45 | S. T. | 5.10 | ..... | .... | ..... | ..... | .. | .. | To be done 1-9-23 |
| 46 | S. T. | 5.11 | ..... | .... | ..... | ..... | .. | .. | To be done 1-9-23 |

Code:—S. T. Special test.
G. Turn on gas.
E. Turn on electricity.
G. & E. Turn on gas and electricity.
P. S. Poor supply.
S. G. & E. Shut off gas and electricity
A. R. Adjust range.
C. G. I. Can't get in.

SUMMARY

| | |
|---|---|
| Total number of orders | 141 |
| Orders completed 1-8-23 | 68 |
| Total time | 190 hr. 48 min. |
| Average time per order | 2 hr. 48 min. |
| C. G. I's | 17 |

collection department reads this record and immediately looks up the credit rating (Fig. 2). At the same time the operator at the shop is making a copy of the order (Fig. 3). It is now the collection department's move, and it shows by means of a code symbol written on its machine whether the credit is O. K. or if a deposit is required.

"At this point, in order to speed up the passing of credits, it was necessary to revise the method of keeping these records as the company has on its books approximately 80,000 gas and electric accounts. Accordingly, a card index was made of all accounts on which a deposit would be required or the credit was doubtful. This file of dubious accounts numbers about 5,000, so that the credit department in looking up the rating of an applicant simply consults these cards and if the customer's name is *not* found the credit is approved at once. From this it should not be assumed that the company has 5,000 bad accounts, for the index includes the names of many people who have moved out of the city or whose accounts for some reason have become inactive.

"Any information that any one of the three places concerned desires can, of course, be obtained by writing on the machines, which will reproduce a record in the same manner as above described. A typical telautographed order is shown in Fig. 4.

"When the credit has been properly established, the order is given to 'Bill Jones' to execute. We usually associate the name of 'Bill Jones' as that belonging to the eighteen men whose duty it is to fill these orders of 'turn on' and 'shut off,' as well as those dealing with complaints, etc. However, all employees coming in contact with the public consider themselves individually as 'Bill Jones.' That is, they are to feel personally interested in each case coming to their attention and do all they can to see that the customer is properly satisfied. The speed with which the orders are carried out can best be illustrated by a story which these men tell.

"Mrs. J—— of Tompkins Street came into the office of the Syracuse Lighting Company on Tuesday morning at 10:15 o'clock and made application for gas and electric service at her home. The clerk took her application and completed all arrangements with the parties concerned. At 10:17 Mrs. J—— left the office. She boarded a street car and upon arriving at her home at 10:40 met a man just leaving her house to enter a Ford roadster standing at the curb. She looked inquiringly at him, and he asked if she were Mrs. J——. When she answered in the affirmative, he said:

" 'I'm from the Syracuse Lighting Company and am here to turn on your gas and electric meters.'

" 'What!' said Mrs. J——. 'Why, I just signed for it.'

" 'Bill Jones' grinned: 'I'll say that's service.'

"Most gas and electric companies agree that if an order is executed in from one to three days after its receipt it is good work. We are doing it in less than three hours.

"Statistics are always convincing, and we therefore use this method to back up the statement that we found it possible by means of the telautograph instrument and the 'Bill Jones' organization to reduce the time from days to hours. A record was kept by placing the time of receipt on each application written on the telautograph and having 'Bill Jones' note on his order the time it was completed.

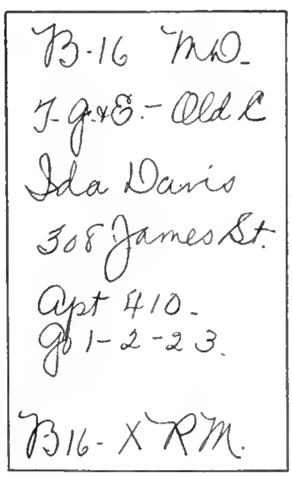



FIG. 4—TELAUTOGRAPHED SHOP ORDER

"What was the result? The average time required to secure gas and electric service was not two or three days, but two hours and forty-eight minutes. In order that it may be understood just how this test was made, there is shown also a detailed analysis of some of the orders taken during the test.

"Cases are constantly coming up which show how well this system works. Take the case of Mr. B——, for instance. Mr. B——, a resident of another city, came into our office at 9:50 in the morning and wanted his gas and electricity turned on at 308 James Street.

" 'Say, have it done as soon as you can, will you?' Mr. B—— said. 'I've got to take the wife and babies down to dinner today, and it's an awful nuisance getting them all dressed and lugging them back and forth on the street car.'

" 'Will noon be all right, Mr. B——?' the clerk asked.

" 'Noon? Sure! When?'

" 'Why, today.'

"Mr. B—— smiled. 'Well, that's good news, if it's true,' he said and walked out of the office.

"At 11:15 Mrs. B—— called up the office to tell us that her service had been turned on and to thank us for the prompt and considerate treatment she had received. She even brought the baby to the telephone and let him say, 'Thank you.'

"This is an actual case taken from our records, but it is in no sense a test case. It is only one of thousands which the company handles each year in its effort to perform its work efficiently and in the shortest possible time."

## Estimated Income from Appliance Sales at Providence

LAST year's sales of appliances in the electric shops of the Narragansett Electric Lighting Company, Providence, R. I., will add an estimated annual income from the use of electricity totaling $109,465. Through the courtesy of Arthur B. Lisle, general manager of the Narragansett company, the accompanying schedule of appliances sold, together

REVENUE FROM ENERGY CONSUMPTION OF APPLIANCES SOLD IN 1922

| Appliances | No. Sold | Income per Appliance | Estimated Yearly Income |
|---|---|---|---|
| Fireless cookers | 17 | $6.00 | $102.00 |
| Chafing dishes | 24 | 2.00 | 48.00 |
| Hair dryers | 28 | 3.00 | 84.00 |
| Drills | 10 | 6.00 | 60.00 |
| Fans | 332 | 2.00 | 664.00 |
| Radiant stoves | 55 | 3.60 | 198.00 |
| Grills | 360 | 6.00 | 216.00 |
| Immersion heaters | 144 | 3.00 | 432.00 |
| Auto heaters | 34 | 4.00 | 136.00 |
| Water heaters (large) | 18 | 96.00 | 1,728.00 |
| Curling irons | 386 | 3.00 | 115.80 |
| Waffle irons | 89 | 3.00 | 267.00 |
| Ironers (electric) | 7 | 36.00 | 252.00 |
| Ironers (gas) | 7 | 6.00 | 42.00 |
| Flatirons | 4,248 | 6.00 | 25,488.00 |
| Tailors' irons | 36 | 12.00 | 432.00 |
| Sewing machines | 31 | 2.40 | 74.40 |
| Sew motors | 162 | 3.60 | 583.20 |
| Heat pads | 342 | 3.00 | 1,026.00 |
| Percolators | 482 | 3.60 | 1,735.20 |
| Radiators | 1,117 | 6.00 | 6,702.00 |
| Ranges | 52 | 84.00 | 4,368.00 |
| Pumps | 191 | 6.00 | 1,146.00 |
| Disk stoves | 317 | 3.60 | 1,041.20 |
| Toasters | 1,280 | 3.60 | 4,608.00 |
| Thermolites | 24 | 3.00 | 72.00 |
| Vacuum cleaners | 2,214 | 3.60 | 7,970.40 |
| Vibrators | 227 | 3.00 | 681.00 |
| Clothes washers | 474 | 3.60 | 1,706.40 |
| Dish washers | 13 | 6.00 | 78.00 |
| Portable lamps | 4,768 | 6.00 | 28,608.00 |
| Rectifiers | 72 | 12.00 | 864.00 |
| Total income | | | $109,465.80 |

with the estimated yearly income, is published.

A. H. Allcott is manager of electric shops, of which there are seven in the company's territory. While the company's merchandising operations are conducted to show a profit on sales sufficient to cover all expenses including overhead, the primary object is to increase the use of energy by residential customers. From the tabulation it will be noted that portable lamps and flatirons exceed all other single items, while vacuum cleaners are third.

## Electric Range Demonstrated to Rotary Club

THE accompanying cut shows the members of the Rotary Club of Boulder, Col., as guests of C. A. Semrad, general manager of the Western Light & Power Company, at an electrical luncheon served in the turbine room of the company's Lafayette plant, 12 miles from Boulder. The luncheon was prepared entirely on electric ranges as a practical demonstration of their commercial application.

Three electric ranges were installed at the plant especially for the occasion by E. B. Ball, commercial manager, and M. E. Lanning, of the Westinghouse company in Denver. The latter did the cooking, starting the night before in order that oven space might be available immediately prior to serving the meal. The seventy-five Rotarians pronounced the luncheon one of the best ever attended by their club.

Mr. Lanning, having thus established his culinary qualifications at Boulder, is preparing to feature a similar demonstration at Pueblo in conjunction with the Southern Colorado Power Company.

## Three Arguments for Better Window Lighting

There are three outstanding conditions which are influencing merchants to adopt higher standards and intensities of illumination in their display windows, declared J. R. Colville of the National Lamp Works of the General Electric Company, before a meeting of the Philadelphia Section of the Illuminating Engineering Society recently. First, the high investment cost of window space, the high pay of window trimmers and the increase in the habit of "window shopping" by passers-by have caused storekeepers to do everything possible to attract attention to their displays. Second, the increase in intensity of street illumination has forced merchants to raise that of window lighting. Third, the drawing power of window lighting in the daytime is becoming better appreciated and the use of artificial illumination in daylight hours is growing.

Another development in the store-window lighting, Mr. Colville pointed out, is the elimination of street reflections by the use of very high intensity illumination. Typical instances have been the use of flood and spot lights where the value of the light on the floor or object displayed is between 3,000 and 4,000 foot-candles.

ROTARY CLUB LUNCHEON AT WESTERN LIGHT & POWER COMPANY'S PLANT

## What Other Companies Are Doing

**Pueblo, Col.**—Although of short duration, the display of a model electrical home here attracted 6,000 visitors. It was open from March 14 to 18, and on the last day of the exhibition nearly 2,000 people were turned away. Because of its success plans are now being made to feature another electrical home during the summer months, with the aid of the Electrical Co-operative League in Denver.

**California.**—Members of the Edison Road Show Company, a good-will producing unit of the Southern California Edison Company, recently entertained the residents of Redlands with the show, which deals with the development of hydro-electric power in California. Experiments with high-voltage current were also performed for the guests of the company.

**Springfield, Ill.** — Merchandise sales of the Central Illinois Public Service Company for the third week in March totaled $15,048, which is next to the largest weekly sales the company has made, the high record this year being in January. The January sales exceeded those for the same period in 1922 by 31.4 per cent. The February sales over the same period were greater by 128.1 per cent. The combined sales for the first two months of this year were 73 per cent greater than for the same period in 1922.

**Roswell, N. M.** — An electrical apartment will shortly be exhibited to the residents of this city as the result of an arrangement between the Roswell Public Service Company and the electrical contactor-dealers. The apartment to be used is that of Carl M. Einhart, general manager of the central-station company. Although no electrical homes have been shown thus far in New Mexico, the movement is under way and other displays will be made in the late spring following the Roswell exhibition.

**Hartford, Conn.**—To meet the convenience of three thousand local customers, the Hartford Electric Light Company will shortly establish its first branch office in East Hartford, under the resident managership of John Garrett. All business formerly handled at the main office in Hartford can be covered at the new location.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Power Direct from Sunlight.*—TITO ROMAGNOLI.—The theories of all present-day projects for getting power direct from sunlight are treated and illustrated in this article.—*Elettrotecnica*, Jan. 5, 1923.

*Loss of Head in Valves and Pipes.*—C. I. CORP and R. O. RUBLE.—The results of 2,200 tests on forty-eight different gate and globe valves are presented in this bulletin. Results of 425 tests to determine pipe friction are also included. The loss of head due to gate valves ½ in. to 12 in. in diameter was measured for various openings, namely, one-eighth, one-quarter, three-eighths, one-half, three-fourths and fully open. The loss of head due to globe valves ½ in. to 2 in. in diameter was determined under fully open conditions. As a part of the valve experiments the loss of head in pipes of ½-in. to 12-in. diameter was determined, and these results are included in this bulletin. The article is 143 pages long and includes a description of all of the tests, apparatus, methods of experimentation, results and numerous tables of data. There are twenty-two tables giving the loss of head in pipes, gate valves and globe valves.—*Bulletin of the University of Wisconsin, Engineering Series*, 9-1.

## Generation, Control, Switching and Protection

*Experiences with Lightning Arresters in South Africa.*—H. BOHLE.—Very little protection against lightning disturbances was obtained on overhead lines with but one grounding cable above the wires. Three of such cables fastened to a top cross-arm gave fair protection to a three-phase double line, but only in the case of high-frequency discharges. Grounding of the neutral Y-point over large water resistances (water boxes) was effective only if the three phases carried a balanced load. An unbalanced load of as much as 5,000 kva. was found occasionally. In this case the grounding of the Y-point may be a voltage grounding, but not a current neutral grounding, and it is therefore useless. Arcing horns proved to be of no value in South Africa on account of their time lag, during which transformer puncture occurred. The resistance in series with such horns limits the ground current usually to about 15 amp., but as high as 1,000 amp. induction currents will occur frequently. It was observed that buses with well-rounded corners flashed over, while nearby horn gaps set much closer did not function. The sphere gap of the General Electric Company showed in actual service a much smaller time lag and gave results superior to the horn gap. Aluminum arresters give a better performance than other arresters, but necessitate daily charging and have, together with lead-peroxide arresters, the common disadvantage of all spark gaps. Neither of these arresters represents, therefore, a definitive method of protection from lightning.—*Zeitschrift des Vereines Deutscher Ingenieure*, March 3, 1923.

*Studying the Motion of Relays.*—H. E. IVES and T. L. DOWEY.—In the study of the electrical phenomena accompanying the making and breaking of contacts for relays it is of considerable importance to know definitely how the contact points move relatively to each other. Apparatus is described for photographing the motion of relay points, the shadowgrams of which give information on the performance of the relays, while accurate measurement of the films opens the way for quantitative analysis of the motion.—*Bulletin B-10-1 of the Western Electric Company.*

## Transmission, Substations and Distribution

*Problems of Parallel Operation of Transformers.*—E. WIRZ.—In the theoretical part of this article the author proves that for a perfect parallel operation of transformers not only the same reactance of the two machines is required, but that they also should have the same no-load characteristics. In the second part, which deals with test results to verify the theoretical conclusions, it is shown that transformers with disk coils lend themselves better to a perfect parallel operation than those with barrel or cylindrical windings, and that in the case of operating two transformers in parallel, where the one is built with disk coils and the other with barrel coils, the disk-coil machine should have a smaller reactance. Vectorial analysis is used throughout the theoretical part of the paper. The tests were made on 150-kva., three-phase transformers.—*Bulletin Association Suisse des Electriciens*, January, 1923.

*Lightning Disturbances on Distribution Circuits.*—M. MACLAREN.—A general survey is presented of the nature and distribution of failures and interruptions due to lightning upon the circuits of the Philadelphia Electric Company. Recommendations are given for improving conditions without specifying any particular make of arresters, in recognition of the fact that a considerable number of different types are proving adequate to meet the conditions imposed upon them on the moderate-voltage systems under consideration. The subject is treated under three principal divisions—115-230-volt distribution circuits, 2,300-volt circuits and 13,200-volt circuits. The number and the nature of the failures on each of these three systems are discussed.—*Journal of the A. I. E. E.*, March, 1923.

*An Integral Equation for Skin Effect in Parallel Conductors.*—CHARLES MANNEBACK.—The author has obtained the general set of integral equations giving the theoretical solution of the current distribution in parallel conductors by the method of successive approximations. This method is particularly advantageous in giving the approximate solution of skin-effect problems at low frequency for parallel conductors of any shape and number. A physical interpretation of the successive approximations is made. The integral equations as developed may also be used as a check on solutions obtained by other processes. — *Publications of the Massachusetts Institute of Technology, Serial No.* 30.

*Economy of Cooling Methods for Large Transformers.* — H. SCHULZE.—Only two methods of cooling large power transformers are being considered today in Europe. In one of these methods the hot oil from the transformer is pumped through an oil-pipe system, over which a shower of water is directed. Being arranged within a cooling tower, the same water is used over and over again. The method requires one oil pump and one water pump. The second method dispenses with water entirely and directs a powerful blast of air across the oil-pipe system, requiring one oil pump and one air blower. Experiences obtained on the 100,000-volt transmission systems of Germany have shown that the second method, in spite of its higher initial cost, is more economic and reliable in operation, particularly where the water conditions are not fully perfect as when only impure or carbonated water is available. The heated air, after leaving the oil-pipe system, can be and is being used advantageously to heat the operating rooms of the station or substation, whereas with the first-mentioned method a special steam-heating plant has to be provided. The author gives a detailed cost comparison of these two methods for a station with two 7,500-kva. transformers. The installation costs compare in the ratio of 100 to 117 respectively, but the operating expenses are as 100 to 90, resulting in a saving of approximately 10 per cent.—*Elektrische Betrieb*, Feb. 24, 1923.

## Units, Measurements and Instruments

*A Direct-Reading Thermionic Voltmeter and Its Applications.* — E. B. MOULLIN.—The conditions suitable for constructing a sensitive direct-reading voltmeter from a triode rectifier are discussed and two distinct forms of completed thermionic voltmeters are described. The power absorbed by a rectifier is discussed theoretically, and a description is given of the experimental

methods of measuring the effective resistance of a thermionic voltmeter. Possible causes of frequency errors in the calibration of the voltmeter are considered and the results of experiments are quoted, showing that a calibration made at low frequencies is reliable up to at least one million periods per second. Several typical illustrations are given of the uses of a thermionic voltmeter in measurements at both high and low frequencies.—*Journal of the Institution of (British) Electrical Engineers*, February, 1923.

*History of Electric Meters.* — W. STUMPNER.—The article deals in a general descriptive manner with the development of the direct-current amperehour and kilowatt-hour meters, embracing the chemical, electromechanical and motor principles. Except for a description of a few thrust-bearing constructions, only a few technical details are given in the paper, the main interest of which lies in its many illustrations.—*Siemens Zeitschrift*, February, 1923.

*Maintaining Small Objects at a Constant Temperature.*—P. P. CIOFFI and L. S. TAYLOR.—An apparatus for maintaining small objects at any temperature between —180 deg. C. and +20 deg. C. is described. The method consists in surrounding the object to be cooled by a stream of cold, dry air, while keeping any surfaces exposed to the free atmosphere above 0 deg. C. The cold, dry air is obtained by evaporating liquid air in a Dewar flash by an electric heater immersed therein.—*Bulletin B-18-1 of the Western Electric Company.*

## Motors and Control

*Electric Drive in Steel Mills.* — A. RUSCHOWY.—A general description of a great variety of modern electric installations in steel mills, comprising gas-driven central stations, rolling-mill motors, coal-conveying plants, Ilgner flywheel sets, Leonard motor-generators and a 13-ton induction furnace installation of the Frick type. The paper is well illustrated with machines built by three of the largest European manufacturers.—*Elektrotechnik und Maschinenbau*, Feb. 18, 1923.

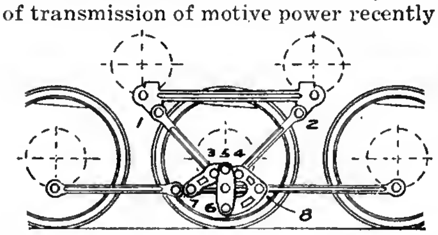
*Electric Heating for a "Shrink Fit."* —A. GANDENZI. — To fasten securely the shaft of a 4,000-kw. rolling motor into its large rotor casting a "shrink fit" was decided upon. The necessary shrinkage was calculated to from 0.5 mm. to 0.6 mm., requiring the heating of the bulky casting to about 200 deg. C. to 220 deg. C. To accomplish this without undue loss of time and with greatest accuracy, electric heating was resorted to, using alternating current in a few turns of cable around the rotor hub as a short-circuited secondary. A number of calibrated thermocouples, placed at different points on the hub, measured the rising temperature during the process. The job was successfully finished in sixteen hours, consuming 50 kw., of which 3½ kw. were the copper losses in the cable.—*Brown-Boveri Mitteilungen*, March, 1923.

## Electrophysics, Electrochemistry and Batteries

*Production of Nitric Oxides and Ozone by High-Voltage Electric Discharges.*—K. B. MCEACHRON and R. H. GEORGE.—A bulletin of 189 pages presenting the results attained in investigating various types of tubes to which electrical discharges are confined. The material presented is grouped under four general heads, corresponding to the type of tube employed and classified as the Siemens tube, the rod-type tubes, the single dielectric tube and tubes using spark discharges. All these tubes are described in detail in connection with the tests made with them. As a rule several tubes of the same type were tested, and the results serve to show the effect of changing the size of the parts or of constructing the tube of the same dimensions but of different pieces of the same material. Except in the case of the Siemens type, the effect of varying air-flow rate, pressure and voltage and current were studied. A special study of high-voltage alternating-current discharges has been made in working on the fixation problem. Some conclusions are given which may aid in the formulation of a theory of the reactions of the corona discharge.—*Bulletin No. 9 of the Purdue University Engineering Experiment Station.*

## Traction

*Articulated Connecting Rods for Electrical Locomotives.*—G. BIANCHI.—The author describes the new system of transmission of motive power recently



ARTICULATED CONNECTING RODS APPLIED TO HIGH-SPEED ELECTRIC LOCOMOTIVES

applied to a high-speed electric locomotive built for the Italian State railways. This system has the advantages of being much lighter than the old arrangement and of transmitting to the drivers the horizontal components only of the efforts at the cranks of the motors. Points 1 to 8 of the accompanying illustration show where the articulations have been made. The design of the system is briefly treated and general considerations are given.—*Elettrotecnica*, Vol. 9, No. 33.

*Development of Mercury-Arc Rectifiers*—A. ODERMATT.—The writer compares the rectifier with a stationary commutator around which the arcs circle as brushes, without mechanical inertia or friction and with the speed of the frequency. The originally somewhat wavy character of the resulting direct current can be easily smoothed out with properly dimensioned iron-core choke coils. The latest Brown-Boveri constructions of rectifiers are described in the paper with several photographs of recent installations. A rectifier shows an efficiency of its cylinders of 96 per cent operating on 500 volts, 98 per cent operating on 1,000 volts and 99 per cent operating on 2,000 volts. For a substation of, for example, 200 kw. output with an average load of 80 kw. the following over-all efficiencies may be obtained: Motor generator, 70 per cent; rotary converter, 83 per cent; mercury-arc rectifier, 94 per cent. Good comparisons were obtained from actual meter readings in a substation for an 850-volt direct-current suburban railway, operating once with rotaries and once with rectifiers. At 1,042 kw.-hr. delivered to the road the rectifier consumed 1,110 kw.-hr., while the rotary consumed 1,203 kw.-hr., or a saving of 93 kw.-hr. per day. Assuming a cost of 10 centimes per kilowatt-hour, a yearly saving of 3,390 francs, or 10 per cent of the cost of the rectifier, was realized. A rotating rectifier plant may therefore be replaced by a mercury rectifying plant practically without cost, the latter paying for itself by its much more economic operation.—*Elektrotechnik und Maschinenbau*, March 4, 1923.

## Telegraphy, Telephony, Radio and Signals

*Acoustic Efficiency of Thermophones of the Heated Foil or Wire Type.*—E. C. WENTE.—Theoretical formulas are derived for the maximum value of the alternating pressure produced within the inclosure of any thermophone when a given alternating current, superposed on a direct current, is passed through the central foil or wire. The effect of certain simplifying assumptions which are made is shown to be small in practical cases. As an experimental verification of the formula, an electrostatic transmitter was calibrated for a wide range of frequencies with four thermophones which differed greatly in their physical constants, the formulas being used to compute the pressures produced. The four calibrations thus obtained agree with each other closely and also with an independent calibration made with a pistonphone.—*Bulletin B-6-1 of the Western Electric Company.*

*Signaling Increases Capacity of Three Tracks.* — Automatic signaling and interlocking plants will play an important part in handling the traffic on the 21-mile stretch of third track now nearing completion on the Illinois Central between Monee, Ill., and Kankakee. The outstanding feature of this installation is the fact that the routing of trains on the three tracks is left to the towermen, conflicting moves on the middle track, which is signaled for both directions of traffic, being prevented by electrically interlocked circuits between the towers. The two outside tracks are signaled for the normal direction of traffic, while the middle track is signaled with one-mile blocks for both directions of traffic. The track layouts and crossovers are so arranged that a towerman can divert a train from either outside track to the center track or the reverse.—*Railway Age*, March 3, 1923.

# New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

## The Induction Voltage Regulator

By E. F. Gehrkens. Schenectady, N. Y.: General Electric Company. 516 pages, illustrated.

The induction regulator is a valuable and essential device on large systems, and the author has presented the theoretical and practical aspects of regulator design and application in a splendid manner. The general operating and design principles are discussed, and yet the major portion of the book treats of the applications of the various types of regulators. The auxiliary equipment used is also discussed and explained. This volume should prove very helpful to operators who use the regulator, to students and to those who desire to study the device in all of its detail.

## Electricity and Its Application to Automotive Vehicles

By P. M. Stone. New York: D. Van Nostrand Company. 844 pages, illustrated.

The electrical features of the automobile have become necessary and valuable adjuncts to the mechanical equipment. But the confined space in which the electrical apparatus is contained, its own character and the rapid developments in the art usually make it difficult for the owner or mechanic to master the workings of the equipment. In this book a teacher in an automobile school has written down in text form the fundamental principles of electricity and then applied them to the operation and installation of automotive electrical equipment. A judicious exercise of theory and practice has resulted in a valuable book for car owner, mechanic or student. Among its commendable features are the chapters devoted to "Trouble Shooting," "Testing" and "Splicing and Soldering."

The book is well illustrated and contains drawings and descriptions of representative installations. It is an excellent addition to the automotive text series.

## Relativity and Space

By C. P. Steinmetz. New York: McGraw-Hill Book Company, Inc. 126 pages, illustrated.

The versatility and deep knowledge of Dr. Steinmetz are well proved by the four lectures contained in this volume. He has made a very successful explanation of the meaning of relativity for the lay mind by using analogies and the synthetic method of attack. Even though the relativity theory cannot be grasped completely without the use of mathematics of higher degree, Dr. Steinmetz has brought out the philosophy, the science and a great deal of the physical meaning of the theory. The book contains some mathematics of a simple type to illustrate more accurately certain of the conceptions involved in relativity. The last lecture is devoted to the conception of mathematical space and exemplifies the power of thought, the lucid expression and the logical analysis for which Dr. Steinmetz is noted. This is a worthwhile book for all engineers interested in a fascinating subject.

## Ultra-Violet Radiation

By M. Luckiesh. New York: D. Van Nostrand Company. 258 pages, 12 plates.

It is a remarkable fact that, despite the great amount of research which has been spent on ultra-violet radiation and its importance both theoretically and practically, no book dealing with the subject has appeared since the little volume of Prof. S. P. Thompson a good many years ago, when knowledge of the subject was scarce. Mr. Luckiesh has done a real favor to the engineer and the investigator by gathering together with no little patience and much discriminating judgment many data on the ultra-violet and its properties. He first acquaints the reader with the nature and history of the subject and then takes up in turn solar radiation, the transparency of gases, liquids, solids and glasses, the reflection of the ultra-violet by various substances, its occurrence in common illuminants, the experimental sources for such radiation, its detection and measurement, and its physiological and photo-chemical effects. The treatise thus forms an extremely useful summary of the present state of knowledge of fundamental facts regarding short-wave radiation, the more valuable in that it is provided with very full bibliographical notes. Mr. Luckiesh makes no attempt to deal *ex-cathedra* with moot problems, but sets out in his usual effective and interesting way the things which are known, leaving disputed questions to be dealt with by reference to the original papers.

The data on transmission and reflection of the ultra-violet, which are given somewhat fully, will be found most convenient for the investigator, who will discover assembled here data which would take him long to dig out of the somewhat scattered literature of the subject. One may, in fact, say without exaggeration that here is a book that should be at the elbow of any one who is working or expecting to work on the ultra-violet region of the spectrum. Science certainly owes Mr. Luckiesh a debt of gratitude for having gone to the pains to put so effectively a great mass of facts ready to its hand.

Louis Bell.

## Schaltungen von Gleich und Wechselstrom Anlagan

By E. Kosack. Berlin: Julius Springer. 155 pages, 226 illustrations.

Books of this character are usually a collection of more or less monotonous wiring diagrams with the necessary text, all reference to auxiliary apparatus being omitted. The author has carefully avoided this fault by using as examples the diagrams of plants in actual operation and omitting calculations wherever possible in order to reduce the mass of material to the dimensions of a much condensed volume. Very plain diagrams, conforming to the latest rules of the Vereines Deutscher Ingenieure, are used throughout the book. Its ten main sections are devoted to connections for switches and protective apparatus, lamp wiring, measuring instruments, direct-current plants, direct-current motors, alternating-current plants, transformer stations, alternating-current motors, connections of substations with rotating apparatus like motor-generators, rotaries, cascade groups, etc., and, finally, starting and regulating devices. The progress made in late years in Europe through the mercury-arc rectifiers, which have become in many instances serious competitors of rotaries or motor-generators, is not made manifest in the scant two-page treatment of their connections.

A. Palme.

# Books Received

**Electric Toy Making.** By T. O'Conor Sloane. New York: The Norman W. Henley Publishing Company. 254 pages, illustrated.

**Jahrbuch der Elektrotechnik. 1920.** By Dr. Karl Strecker. Munich and Berlin: R. Oldenbourg. 232 pages.

**Tait's Electrical Directory of Australia and New Zealand.** Sydney: Tait's Publishing Company. 224 pages.

**Electrical Engineering Laboratory Experiments.** By C. W. Ricker and Carlton E. Tucker. New York: McGraw-Hill Book Company. 310 pages, illustrated.

**Interior Wiring and Systems for Electric Light and Power Service.** By Arthur L. Cook. New York: John Wiley & Sons, Inc. 458 pages, illustrated.

**Metals and Their Alloys.** By Charles Vickers. New York: Henry Carey Baird & Company, Inc. 767 pages, illustrated.

**American Society for Testing Materials—Index to Proceedings.** Volumes XIII-XX (1913-1920). Philadelphia: American Society for Testing Materials.

**Printing Telegraph Systems and Mechanisms.** By H. H. Harrison. London: Longmans, Green & Company. 435 pages, illustrated.

**Elektrotechnische Messinstrumente.** By Konrad Gruhn. Berlin: Julius Springer. 223 pages, illustrated.

**English and Engineering.** Second Edition. By Frank Aydelotte. New York: McGraw-Hill Book Company, Inc. 415 pages.

# News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

## Promote Superpower Plan

**Superpower Advisory Board and the F. A. E. S. to Act in Concert on Atlantic Coast Project**

A LEGAL committee headed by Edward G. Buckland, general counsel of the New York, New Haven & Hartford Railroad and a member of the Superpower Advisory Board, will ascertain in the near future what state laws interfere with the building up of a superpower system on the North Atlantic Coast and what legislation is necessary to bridge over these laws. The Federated American Engineering Societies will co-operate with the Superpower Advisory Board in an effort to revive activity looking to the practical application of the plan. It is believed that the time is particularly opportune since the earnings of railroads and utilities now are such as to justify improvements of an electrical character which, because of reduced earning power, could not have been undertaken at the time the superpower report was made. It is believed that earnings during this peak of business activity had better go into improvements requiring large capital but making for ultimate economies rather than allow rate reductions to be made on the basis of present earnings.

### Letter to Governor Smith

As one of the uncertainties in the superpower situation at this time is the attitude of the Governor of New York toward the plan, L. W. Wallace, the executive secretary of the Federated American Engineering Societies, has addressed the following letter to Governor Smith:

"The engineering profession is very much interested in seeing secured for the public the economies and benefits which would follow the building up of a superpower system in the Boston-Washington area. I am wondering if the superpower plan proposed for this area would conflict with your policy. The advantages to New York, I believe, would be many were resort had to greater interconnection. So far as New York is concerned, it probably would be largely a matter of importing power. Exports of energy would be confined largely to offpeak loads, which would make possible uniform operation of plants in New York.

"I am not attempting to present the advantages and disadvantages of the superpower system. I am not willing to conclude before learning your opinion that you would oppose such a system or would object to New York's consideration of a compact between the states concerned which would make uniform the regulation of such a utility. I shall be grateful to you indeed if I may have your thought on the foregoing points."

## For Adams-Albany Line

**Harriman Outlines Value of This Interstate Tie—Pittsfield Company Withdraws Opposition**

MARKED benefits in the utilization of streams with diverse flowage characteristics, coupled with more effective operation of steam plants, will result from the interconnection of the New England Power Company's system with that of the Adirondack Power & Light Company, declared H. I. Harriman, president of the former company, at a recent hearing before the Massachusetts Department of Public Utilities upon a petition for authority to issue securities to finance this and other improvements. It is proposed to build a transmission line across western Massachusetts from Adams to Albany, N. Y., permitting flexible operation of the hydro-electric and steam stations on each system. Mr. Harriman pointed out that while the great seasonal variations in flow are synchronous on the watersheds of the two systems, the intermediate variations are asynchronous and susceptible to more efficient utilization through tie-line operation. Coal costs from $1.50 to $2 per ton less at the Amsterdam (N. Y.) steam plant of the Adirondack company than on the New England system, and the former has recently contracted with the International Paper Company for 40,000 kw. more water power. Completion of this interconnection will effect electrical solidarity from Boston to Utica.

### Pittsfield Company Withdraws Opposition

During the hearing the Pittsfield (Mass.) Electric Company withdrew opposition that it had exerted against the New England company's petition in view of the latter's withdrawal of its projected Lanesboro substation in the Pittsfield district, and upon the understanding that the construction of the Adams-Albany tie line would be for trunk-line interconnection purposes and not for the supply of local loads within the Pittsfield company's area of service. The early interconnection of the latter with the Turners Falls Power & Electric Company's system, it was set forth, will insure ample power supply to the Pittsfield district as future business develops.

## Superpower in Northwest

**Survey Committee for Upper Pacific Coast Finds No Present Need for Ambitious Plan**

A CAREFUL study of power conditions in the Pacific Northwest has just been completed by the Superpower Survey Committee organized two years ago, as reported in the ELECTRICAL WORLD for April 30, 1921, page 1008. D. C. Henny of Portland, Ore., was the chairman of this committee, and it included representatives of electric light and power, railroad and commercial companies in Oregon, Washington and Idaho. The committee reports that the situation in regard to developed water power as well as feasible undeveloped sites is so favorable throughout the Northwest that there is no need at present of a superpower line. Present inter-tie lines of medium capacity, it holds, make ample provision for the comparatively small interchange of power necessary from one district to another and for reasonable insurance against service interruption.

## Final Plans for Pittsburgh Meeting of A. I. E. E.

An important group of papers covering the vital phases of the grounding of transmission systems will, as already announced in the ELECTRICAL WORLD (March 31, page 767), be presented and discussed at the spring convention of the American Institute of Electrical Engineers, which will be held in the William Penn Hotel, Pittsburgh, on April 24 to 26 inclusive. The report of the sub-committee on grounding of systems will analyze the practices used for transmission of more than 6,000,000 kva. of energy over 30,000 miles of transmission lines at voltages up to 150,000. This report will show very wide divergence in practice, for, while grounding the neutral prevails, a number of important systems are still operating ungrounded. Although the use of resistance in the grounding circuit is becoming increasingly common, the value of such resistance shows no uniformity, according to the report, which will also show that the Peterson coil used on one system has a very creditable record. A deviation has been made from the program as printed on March 31 in that W. W. Woodruff, Philadelphia Electric Company, will handle the report on "Systems Transmitting at Generated Voltage" and E. C. Stone, Duquesne Light Company, the report on "Systems Transmitting at Higher than Generated Voltage."

The banquet to be held on Wednesday evening will be of unusual importance as a meeting. President Jewett will preside, and the speakers will be Philip P. Wells, who will represent Governor Pinchot of Pennsylvania, and Paul T. Brady of the Westinghouse Electric & Manufacturing Company. They will discuss "Superpower—a National Resource."

E. C. Stone, Duquesne Light Company, chairman of the Pittsburgh Section, American Institute of Electrical Engineers, is chairman of the general committee in charge of arrangements for the convention. Engineers expecting to attend the convention are requested to communicate with W. C Goodwin, chairman committee on registration, in care of the control engineering department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., at the earliest possible moment in order that convenient hotel accommodations may be secured.

## Ten-Million-Dollar Plant for Houston

It is announced by Edwin B. Parker of Houston, Tex., president of the Houston Lighting & Power Company, that that company will immediately construct the first unit of an electrical generating plant. This unit will cost $4,000,000. The plant will ultimately be the largest in Texas and will entail an expenditure of $10,000,000. Excavation for the building has already been started. It will be built on a 98-acre tract of land, fronting 1,200 ft. on the Ship Channel, owned by the company. The equipment of the first unit will be two turbo-generators, each of 20,000 kw. rating. The construction of three additional units of 40,000 kw. rating each is planned, bringing the total ultimate production of the new plant to 160,000 kw.

"The idea in the minds of the executives of the Houston Light & Power Company," said Mr. Parker, "is to build ahead of the probable needs of the city. Then, as the needs increase, the facilities of the Ship Channel plant will be added to from time to time until the four units are completed. The new plant will be maintained independently of the present plant, which will be used as an emergency plant. At present there is a demand for 5,000 kw. in the immediate vicinity of the proposed plant on the Ship Channel. The remainder of the energy will be transmitted to the present plant over two cables, one on the north and one on the south side of the channel. Each transmission line will be capable of carrying the entire load.

"The present capacity of the company's plant is 32,500 kw. This will be increased by the power from the channel plant by 35,000 kw. upon the completion of the first unit. The turbines are being built by the General Electric Company and will be ready for installation as soon as the building is completed, which will be in about twelve months."

## Explosion in Indianapolis

### Turbo-Generator in Mill Street Power House Is Blown to Pieces and Building Damaged

A LOSS estimated at $1,000,000 in damage to machinery and interruption of service was caused, two men were hurt and light and power service over most of the city was paralyzed about 5 a. m., Monday, April 2, when a 12,500-kw. steam-electric turbine in the Mill Street plant of the Indianapolis Light & Heat Company exploded. Pieces of the giant turbine were thrown in all directions, and the interior of the engine room at the plant was wrecked. Two other turbines were temporarily put out of commission. Fire started and an alarm was sent in, but at no time did it assume serious proportions.

The turbine was on a slightly raised platform in the north end of the engine room at the plant, which is a three-story brick structure. One piece of the unit wrecked traveled the length of the plant and crashed through a window at the south end, a few feet beneath the eaved roof. Other pieces crashed through windows nearer the wrecked turbine. Holes were torn in the roof.

#### PROMPT RESTORATION OF SERVICE

Officials expect soon to have a 19,000-kw. steam turbine in service at the plant to supplement the 5,000-kw. and 19,000-kw. turbines which have been restored to service and now bear the load there. While all demands on the plant are being supplied, the explosion created a situation in which it has had to operate the two turbines now in use beyond their rating. Addition of the extra turbine will relieve the strain. Experts say repair of the turbine that exploded is virtually impossible.

Despite the extensive damage done by the explosion, officials of the Indianapolis Light & Heat Company, are going ahead with plans for the year's development work, according to a statement made by President C. C. Perry. The only change in the program, Mr. Perry said, was to include greater generating equipment for the two large central power stations owned by the company, so that in event of another accident the ordinary light and power load can be taken up and served by the remaining station. This change in development plans calls not only for the installation at the Mill Street plant of the 19,000-kw. turbine just mentioned to take the place of the generator destroyed, but also of another turbine of the same capacity for the Kentucky Avenue plant. When all the equipment ordered has been installed the company will gain an increase in generating capacity of about 35 per cent.

## Public Service Electric to Build Superplant

Plans have been completed by the Public Service Corporation of New Jersey for the erection near Newark of a superpower steam-electric generating station with an initial installed capacity of 200,000 hp. and an ultimate capacity of 400,000 hp. Construction will begin soon. The new station will be interconnected with the Public Service Electric Company's system, and power will be distributed through the densely populated industrial sections of New Jersey, where the demand for energy exceeds the supply. Electricity is now supplied to 337,500 customers in 202 communities. The new installation when completed will bring the Public Service Electric Company's total generating capacity up to 720,000 hp.

HAVOC WROUGHT THROUGH BURSTING OF TURBO-GENERATOR IN INDIANAPOLIS POWER HOUSE

## Rural-Service Charges

### Discussion Before Indiana Commission on Rate Including Percentage of Equipment Cost

AT A RECENT hearing by the Public Service Commission of Indiana on proposed rules for the extension of electric utility service into rural territory, much attention was given to a proposed additional rate to be paid for energy for rural service as compared with the rate in the city from which extensions are made, this additional charge to equal 10 per cent of the total cost of the general and local equipment included in each separate extension. E. J. Condon of Angola said that in view of the fact that the farmers are to pay for the cost of the extension, including general and local equipment, it would be difficult to explain to them why an additional rate of 10 per cent of the cost of such equipment should be added to their bills every year. Roy Thurman of the Indiana General Service Company, which had submitted the proposed rules, answered that the 10 per cent was to take care of depreciation, taxes and excess maintenance cost of rural over city lines.

H. A. Nichols of the Union Traction Company submitted that the 10 per cent addition to the rate, on the basis proposed, would make complicated bookkeeping. He thought it would be better to establish a minimum monthly charge of about $2.50 a month and add about 25 per cent to the bill to cover the extra costs of rural service. A farmer or a group of farmers would pay for the general and local equipment, and title would rest in the utility company.

The utility men present took the position that it would be of no advantage to them to have title to property that had been paid for by the farmers, and that such title would be a liability rather than an asset, because the utilities would have to pay taxes and maintain the property. Commissioner Ratts, who presided, said that placing title in the utilities would result in better maintenance.

In the rules as first proposed for adoption 10 per cent to cover contingent expenses, cost of accounting and other items and 10 per cent to cover engineering supervision and the use of tools were added to the actual cost of equipment for an extension. It was said by some of those present that farmers would object to these charges, and Earl Carter, chief engineer of the commission, suggested that the actual engineering and supervision costs in dollars be included in the cost of equipment and only one 10 per cent be added, this to cover contingent expenses and cost of accounting.

## Civil Engineers Vote Not to Join F. A. E. S.

By a vote of approximately 3,600 to 2,100, the American Society of Civil Engineers has again decided not to join the Federated American Engineering Societies. This vote proceeded during the month of March, closing on April 1, and was canvassed April 6. This question has been a very live one with the civil engineers and briefs pro and con have been widely circulated. The feeling among other engineers is one of regret, with the belief that the civil engineers have not fully comprehended the opportunity for service by means of the F. A. E. S. organization.

## Italy Turns Back Telephones to Private Hands

A decree whereby the telephone systems of Italy, heretofore a government monopoly, are to be turned over to private industry and completely reorganized has been issued, in accordance with previous announcement, by the Italian government. Under this decree, the government, by virtue of its grant of full powers in administrative matters from Parliament, may grant to public or private companies or individuals right to operate the state telephone systems, with eventual ownership. It will oblige the concessionaires to improve the systems according to a program established by the state administration, giving preference in the purchase of materials to the national industries.

The duration of these concessions is unlimited, with a minimum in each case of twenty-five years. Right of repurchase by the state is reserved. The cession of the systems may be either by payment of value or by the admission of the state as a stockholder in the company. The concessionaires will pay to the state an annual amount not less than 5 per cent of the gross receipts of their respective companies, as shown in the annual budget, and a share in progressive degree of the net returns on capital when these exceed 7 per cent.

# First Convention of Middle West Division

### Commercial Section Discusses Increase of Residential Business and Importance of Sales Department—Social Aspects of Electric Service—Selling Bonds to Customers

THAT residence customers can be educated to the use of from forty to fifty kilowatt-hours as an average monthly consumption was asserted by N. T. Wilcox in presenting his report as the chairman of the Commercial Section of the Middle West Geographic Division of the National Electric Light Association at the first annual convention of the division, which began on Wednesday, April 11, at St. Louis. Mr. Wilcox said that the average monthly residential consumption in most sections of the country now is under 20 kw.-hr., a figure at which the expense of establishing and maintaining the service is not returned to the utilities. The larger figure that ought to be reached, he said, is exclusive of the use of ranges, refrigerators or like household equipment. Mr. Wilcox characterized residential business as one of the most important fields for the development of energy sales.

#### Importance of Commercial Men

E. W. Lloyd of the Commonwealth Edison Company, Chicago, thought that the central-station commercial man in many organizations does not occupy the position to which the importance of his work entitles him because central-station executives often do not themselves appreciate that his position ranks with the most important in the organization. Executives must realize that the commercial department is in the same position in the central station as in any other business which must depend on the ability of its sales forces to market its products. He criticised the attitude of the commercial man who looks on his position merely as a stepping stone to something else, thus defeating the very objects for which he should be working.

R. F. Schuchardt, Commonwealth Edison Company, asserted that the time has gone by when central-station men can ignore the National Electric Light Association and the opportunities it gives for development of men and methods through the broad contacts it affords. He said that executives who refuse to allow their men to participate are sinners against their stockholders by depriving them of potential increased returns as well as against their employees.

#### Social Aspects of Electric Service

The social aspects of the distribution of electricity were presented by Paul Winthrop Brown, who said that electricity has so multiplied the power of men to accomplish tasks that, in spite of the increase of wealth and population in the United States, the servant classes have decreased, although in the past history of the world an increase in wealth has always brought an increase in their number.

Louis H. Egan, president Union Electric Light & Power Company, St. Louis, discussing customer ownership, called attention to the fact that the supply of preferred stock will not permit an indefinite continuance of the present methods of selling securities to customers and predicted that in time bonds and other securities would be sold in the same way.

The annual banquet was held Wednesday evening. President Smith, Vice-president Davidson and Executive Manager Aylesworth of the N. E. L. A. were the speakers.

Better business development, public relations and rural lines were discussed at the Thursday sessions.

## Pennsylvania Men Confer

**Relays and Automatic Stations Are Discussed at N. E. L. A. Meeting at Wilkes-Barre**

A MEETING of the Pennsylvania Electric Association, which forms part of the Eastern Geographic Division of the National Electric Light Association, was held in Wilkes-Barre, Pa., on April 6 at which several good papers were presented and discussed by the members. The meeting was preceded by a luncheon, A. J. Llewellyn, general manager of the Luzerne County Gas & Electric Company, acting as toastmaster. The eighty visiting members were addressed by R. R. Van Horn and Mayor Daniel L. Hart of Wilkes-Barre. Following the luncheon E. A. Lewis and Paul Sporn discussed relay protection on interconnected systems. Mr. Sporn pointed out that relays should be installed to satisfy any operating condition and should clear trouble and also maintain service. He said that differential protection had worked out satisfactorially in safeguarding equipment and that the use of overload and directional relays had become standardized on ring systems. On outgoing parallel transmission lines he recommended the mechanically balanced relay and for the incoming ends of such lines the electrically balanced relay.

Standardization of wood-pole line construction was taken up by R. R. Curtis, who said that the practices of the Luzerne County Gas & Electric Company were largely based on the National Safety Code. A standardized construction code book has been developed which works very well on the system, and standardization is gradually being obtained that will permit any service man or lineman to work intelligently on any part of the system. Fir cross-arms with six pins have been adopted, as have standard conductor sizes. No. 0 hard-drawn copper is used on all transmission lines, No. 0 insulated wire on primary mains and No. 4 on branches. In three-wire service the neutral is made one-third the size of the outer wires. Standardized makes and sizes of insulators are used on the different circuits in the system. In discussing the paper the opinion was expressed that great improvement had been made in the quality of insulators and construction materials, but in many cases difficulty had been found in obtaining insulators for guy wires on crossings with factors of safety equal to the specification set by the Public Service Commission. Further discussion brought out the fact that three-wire service had been used to good advantage on 2,300, 4,000, 6,600 and 11,000-volt circuits.

### Automatic Substations

An illustrated lecture on automatic substations was given by Chester Lichtenburg in which the author indicated the rapid strides made in the art as applied to motor-generator, rotary converter and transformer substations. The wide adoption of the reclosing circuit breaker for substation use was advocated and numerous slides were shown of actual automatic installations. A lively pro and con discussion of the paper was followed by a short talk on education by J. G. Osterhaut and a talk on accident prevention by Paul Kuhn.

Delegations were present from points as widely separated as Baltimore and Pittsburgh and widespread interest was shown in plans for future section activities. The next meeting of the association will be in Johnstown on May 8.

## Millikan on the Big and Little in the Universe

Gulliver in his travels never saw wonders to compare with those now known to exist in the universe. So declared Dr. R. A. Millikan, director of the Norman Brooks Laboratory of the California Institute of Technology, Pasadena, in an address made on Wednesday evening, April 11, to the New York Section of the A. I. E. E. He first discussed the big things of creation, dwelling on the indications from late researches that the universe has finite dimensions and picturing it to the audience by visualizing distances in terms of pin points, oranges and miles. The past decade, in the opinion of Dr. Millikan, has witnessed more progress in scientific knowledge and accomplishments than any other period of history and has made possible a comparatively exact knowledge of matter, energy and space.

Turning from the big things to the small things of creation, Dr. Millikan then discussed atomic structure and electrons. Radio activity, he said, is now considered a general property of matter and all matter is apparently made up of atoms containing a nucleus of positive and negative electrons which restrain other electrons having orbital movements about the nucleus. The quantum idea of sudden changes in energy, matter and space conditions has been pretty well established by late experiments, the lecturer thought, and in the consideration of how energy from the ether is obtained by the electrons the hypothesis that the quantum is part of the electron, and not the corpuscular hypothesis, is, he held, the correct one.

Dr. Millikan discussed recent experiments at high altitudes which gave indications that hard ray emanations exist in space and furnish the energy required to expel electrons, both positive and negative, from the atom. He also said that, although present experiments permitted only a breaking down of atoms with resulting changes in matter, no reason existed to doubt that atoms could be built up to produce equally startling changes in matter.

At the business meeting of the section Calvert Townley, the retiring chairman, announced the election of these officers for the ensuing year: Chairman, L. F. Morehouse; secretary, E. B. Meyer. F. M. Feiker and Prof. J. H. Morecroft were made members of the executive committee.

## Remands Potomac Case

**United States Supreme Court Disclaims Jurisdiction at This Stage of Proceedings**

THE dismissal by the United States Supreme Court of the appeal of the Public Utilities Commission of the District of Columbia from a decision of the District Court of Appeals which had directed the District Supreme Court to proceed further in the injunction proceedings instituted by the Potomac Electric Power Company in resisting a rate reduction means virtually that there must be a revaluation of the company's properties for the purposes of rate making by the District Supreme Court or, under its order, by the Public Utilities Commission.

Chief Justice Taft, speaking for the unanimous court, declared invalid that section of the act creating the District of Columbia Public Utilities Commission which sought to convey the right of appeal to the United States Supreme Court in cases in the condition of that at issue. The Chief Justice held that this section attempted to confer legislative authority upon the court. The unconstitutionality of the section did not, however, affect the validity of the remaining sections of the act. Appeal will be permissible in cases which have been completed in the lower courts.

### History of the Case

The original lawsuit, now referred to the lower courts, involves a question of principle in fixing the valuation of public utilities for rate-making purposes. When the commission began valuation of the properties of the Potomac company in 1915 it took reproduction values as of July 1, 1914. In deciding the case in 1917, the commission added the actual cost of replacements between July 1, 1914, and July 1, 1916. The commission fixed the value as $11,231,000 and ordered a reduction in rates of 20 per cent. The company asserted that reproduction values should have been as of Dec. 31, 1916, and sought an injunction declaring the new rates unlawful, unreasonable and inadequate. The company alleged a fair value of the property to be $15,642,000 and that other property worth $5,000,000 had been illegally excluded from the valuation by the commission. The District Supreme Court dismissed the bill, but the District Court of Appeals reversed this decision. The commission appealed to the United States Supreme Court.

While the litigation has been pending the old rates—which were 10 cents per kilowatt-hour for domestic consumers—have been in operation in the District of Columbia, the difference between these rates and those ordered by the commission being impounded until final disposition of the case. This impounded fund is now nearly $4,000,000 and is increasing by $100,000 a month.

Pronouncements of the Public Utilities Commission of the District made since the case went to the United States Supreme Court will be found under this week's "Commission Rulings."

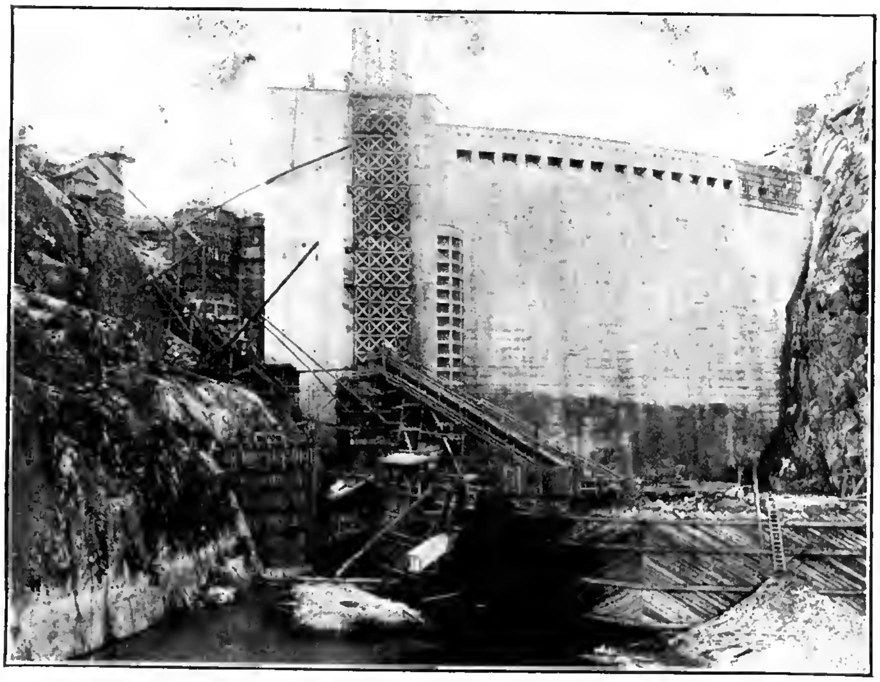
## Hetch Hetchy Nearly Ready

**San Francisco's Big Water and Power Plant Will Have an Initial Rating of 80,000 Kva.**

CONSTRUCTION work on the Hetch Hetchy domestic water supply and power project of the city of San Francisco is progressing rapidly, and city officials estimate that the Moccasin Creek power plant will be ready for operation before the middle of 1924. An 18-mile tunnel will convey the water for domestic supply and power from a diversion dam several miles below the main Hetch Hetchy dam to the forebay near the Moccasin Creek power house. Sixteen miles of this tunnel has been bored, and the work will be completed within four months. One-third of the 5,000-ft tunnel from the forebay to the penstocks has been driven; excavation for the four penstocks has been completed; excavation for the power house is under way; contract has been awarded for the structural-steel frame of the power house, and both electrical and hydraulic equipment has been under contract for some time. Delivery is to be made on all power-house equipment before Aug. 31 of this year, and the plant is expected to be in operation within eighteen months.

Four 20,000-kva., 257-r.p.m., three-phase, 11,000-volt generators will be installed under the present contract. These will be driven by 25,000-hp. double overhung impulse waterwheels operating under an effective head of 1,250 ft. Eight 36-in. hydraulically operated gate valves will control the flow of water at the point where the penstocks enter the power house. An overhead crane with a span of 50 ft. and a capacity of 135 tons will be included in the power-house equipment.

Surveying crews are now in the field locating the 135-mile double-circuit steel-tower transmission line from the Moccasin Creek power house to San Francisco. This line will be completed and ready for service before the power plant is finished. For the mountain and valley section of the transmission line a total of 525 miles of steel-core aluminum cable has been ordered. This will be 250,000-circ.mil copper equivalent, having a cross-sectional area of 389,000 circ.mil. Order has been placed for 177 miles of hemp-core copper wire with an area of 345,000 circ. mil for the San Francisco Bay division of the transmission line. Outdoor transformers and switching equipment will be used at the power house. The generator voltage of 11,000 will be stepped up by thirteen 6,667-kw. single-phase transformers to 115,000 volts delta or 154,000 volts star. Both oil and air-break switches will be used and all transmission and other equipment will be insulated for 154,000-volt operation.



UPSTREAM VIEW OF HETCH HETCHY DAM

This dam, which will store San Francisco's domestic water supply and develop 60,000 hp., is 226 ft. above the former stream bed and is now almost completed.

## Report of Engineers' Committee on High Dam

As reported in the ELECTRICAL WORLD for March 10, page 591, the Federal Power Commission has awarded a preliminary permit for developing power at High Dam, in the Mississippi between St. Paul and Minneapolis, to Henry Ford, subject to certain stringent conditions which he must accept before receiving a license. While awaiting final disposition of the matter a joint committee of the Engineers' Club of Minneapolis and the Engineers' Society of St. Paul has made a report in which it says that "the one logical agency for the development and proper utilization of the power developed at the High Dam is the Northern States Power Company." At another point in its report the joint committee says:

"If the coming of the Ford interests to the Twin Cities is contingent upon their having the initial use of the High Dam power, this is another method of immediate utilization of this power, and your committee would favor an award to the Ford Motor Company by the Federal Power Commission, provided that an arrangement for disposing of any excess power not required by the Ford Motor Company is made with a distributing agency. The committee further feels that the public's interests are entirely guarded whether the permit for the High Dam power is awarded to the Northern States Power Company or to the Ford interests because of the fact that the United States government through its Federal Power Commission has full and complete authority as to construction, operation and rates to be charged, no matter who develops and operates a water-power project under a federal grant."

In regard to the development and operation of the High Dam by the city of Minneapolis, the committee is unanimous in its opinion that "the hazard of an investment such as is contemplated is far too great and entirely unwarranted for so small an anticipated saving." The committee also expresses the opinion that "the development of the High Dam by the municipalities will have no effect whatsoever on the stabilization of public utility rates for lighting or power purposes, for the cost of producing electrical energy at the switchboard is only a small factor of the total cost of furnishing this energy to users."

## Eleven States Ratify Reciprocal Registration

For the purpose of making operative the reciprocal registration of professional engineers in the various states, several state boards of engineering examiners, which are members of the Council of State Boards of Engineering Examiners, have agreed to adopt and put in practice provisions to that end. So far, according to P. H. Daggett, secretary-treasurer of the council, eleven states have ratified reciprocal registration, namely, Arizona, Colorado, Florida, Indiana, Iowa, Louisiana, Michigan, Minnesota, North Carolina, Oregon and West Virginia. Wyoming and South Carolina are expected to take similar action this month.

The "Articles of Agreement on Reciprocal Registration of Engineers" contain the following provisions:

"Reciprocal registration shall be granted only to an applicant who is already licensed in a state which is a member of this council. A detailed professional record, properly attested, and accompanied by references as to character and qualifications from three registered practicing engineers, shall be filed with the board of registration of

the state in which the applicant is originally licensed.

"Professional experience shall be considered as beginning when the applicant shall have entered upon a position in professional engineering work which requires original thought and responsibility.

"As evidence of qualification for reciprocal registration, the applicant shall have had ten years of experience in professional engineering and in addition shall show that he is qualified to design as well as to direct engineering operations, and his experience record shall show progressive advancement in the character of the work performed.

"Graduation from an engineering school of recognized standing shall be accepted as equivalent to four years of practice.

"Reciprocal registration between states shall be made operative by means of certification of the applicant's qualification from one state to another. This certification shall be by means of a card or form bearing the date, serial number, signature of the officers and seal of the board of the state issuing same. These cards shall be printed and distributed by the Council of State Boards of Engineering Examiners."

# Colorado River Projects and Others

**Despite Delay of Treaty, Power Commission May Act on Diamond Creek and Glen Canyon—Cumberland River Rights Sought—White River Development**

WHETHER or not the Federal Power Commission will be content to allow the failure to ratify the Colorado River compact to delay indefinitely all development on the Colorado River probably will be determined at a meeting of the commission to be held April 18. The commission has advised the Governor of Colorado, according to a previous promise, that consideration is to be given the application of James B. Girand for a license to develop the project at Diamond Creek on the Colorado. It was stated in the letter to the Colorado Governor that any license issued to Mr. Girand would carry with it a condition that the use of the water for power purposes would have to be subordinated to its use for irrigation.

This carries with it the intimation that the commission may act on the Girand application at its forthcoming meeting. It is understood that Mr. Girand will accept the condition mentioned. The controversy over the project at Diamond Creek has been long drawn out. Mr. Girand received a permit covering this project in 1915 and has been trying ever since to obtain the necessary rights to begin construction.

It is fully expected, however, that the discussion will include the whole Colorado River question. Any discussion of the Diamond Creek project carries with it the necessity of considering the Glen Canyon application of the Southern California Edison Company. It also is believed that the Flaming Gorge project of the Utah Power & Light Company will be brought up, since that company is very anxious to utilize the coming field season to do the necessary drilling to establish foundation conditions. The Kremmling project of the Denver Gas & Electric Light Company is also to be considered.

### SODA POINT DAM

Permission has been given the Utah Power & Light Company to alter again the exact site of its Soda Point dam. Permission was granted previously to change the site from the original location to a point 1,200 ft. up stream. Further foundation investigations revealed that better conditions exist at a point 700 ft. above that point.

The Michigan Hydro-Electric Power Company of Three Rivers, Mich., affiliated with the Midwest Power Company, has applied for a preliminary permit covering a project on the St. Joseph River near Three Rivers. It is planned to develop 2,500 hp. The company is prepared to begin its development immediately.

The Midwest company also is planning a development on the Grand River, northeastern Oklahoma. The company operates public utilities in several towns in that region. The new power is to be fed into those systems.

### FALLS OF THE OHIO AND WHITE RIVER PROJECTS

The Cumberland Hydro-Electric Power Company, recently organized in Indianapolis, which holds options on valuable Cumberland River rights in southeastern Kentucky, has applied to the commission for preliminary permits covering three projects on that stream. The Cumberland company has entered into a contract with the Middle West Utilities Company of Chicago with the idea of carrying out the Kentucky development, which is an important adjunct to the utilization of the power to be developed by the new government dam at the Falls of the Ohio. The Middle West company has properties in Kentucky and in Indiana which are in a position to absorb the power thus to be made available.

Full development of the Cotter site on the White River, in Arkansas, is to be undertaken by a company being organized by Hugh L. Cooper. The interests of the Dixie Power Company in this project already have been taken over by Colonel Cooper. The project contemplates the erection of a dam 215 ft. high. An extensive pool will be created which will reach up the river as far as Forsyth, Mo. In addition, sites are to be developed on the North Fork and the Buffalo Fork of the White River. The total development will create 125,000 hp. The possibilities of this site long have been recognized. For ten years prior to the passage of the water-power act determined efforts were made to secure authorization from Congress for the development. It was one of those projects which were caught in the long period of uncertainty which preceded the final enactment of the water-power act.

## Water Power in Maine

**Conservation Program Is Defeated by the Governor's Attitude and the Disagreement of Legislators**

PLANS for the development of a storage reservoir for hydro-electric and other water-power conservation in the Dead River and Kennebec River valleys of Maine failed to materialize at the session of the Legislature which closed April 7 and which was marked by sharp divergences of opinion between Governor Baxter, the members of the two houses and the public utility and manufacturing interests interested in furthering the cause of conservation. During the session the controversy over this issue overshadowed practically all other matters at the Capitol. General agreement exists as to the necessity for storage-reservoir construction on the Dead River, and the well-known opposition of the Governor to private ownership of water-power facilities under public regulation appears to have been the chief factor in the failure of a constructive measure to become law.

Early in the session a bill was introduced authorizing the incorporation of the Kennebec River Reservoir Company for the construction of a dam on the Dead River on land owned by the state. It was provided that the amount to be paid for the land should be determined by arbitration. Governor Baxter vetoed the bill, and the veto was overridden by a two-thirds vote. The Governor then appealed to the people to defeat it by a referendum, the vote to be taken at the regular election in September, 1924. The public utility and manufacturing interests which were asking for the charter met this issue by circulating petitions demanding a special election so that the question might be settled this year. The Governor followed by a message to the Legislature stating that a compromise had been reached by which a new developing corporation (the Dead River Reservoir Company) would pay the state $1,000,000 rental for the right to use the land and resources involved, in forty annual payments of $25,000 each.

The compromise bill was never introduced, but so much confusion and cross-purpose action ensued that the Legislature finally repealed the original act, thus annihilating the hope of conservation in the Kennebec and Dead River valleys at this time. As the Maine constitution would have to be amended to enable state development of water powers to be attempted, there appears no present danger of progress toward public ownership; but in the meantime power users will be obliged to suffer a continuance of handicaps through

water shortages in competition with other conservation developments in Maine and elsewhere, and a deplorable waste of power will go on as a result of the fiasco with which the session closed.

## Indianapolis Companies Show Rapid Growth

An increase of between 28 and 30 per cent in the production and sale of electrical energy used for lighting and power purposes in 1922 over the preceding year is indicated in the annual statements for the year ended Dec. 31 made by the two light and power utilities of Indianapolis and filed with the Indiana Public Service Commission. The financial statements of the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company both reveal a comfortable margin of gross income as a result of the year's business, due in the main to the increase in electric power used by the industrial companies of the city. The rate of increase in energy generated and sold for the first two months of this year is even greater than that for the corresponding period of 1922, being estimated at 40 to 50 per cent.

According to the financial statement of the Indianapolis Light & Heat Company, total operating revenues from all sources for the year 1922 were $3,910,120 and operating expenses were $3,051,364. The gross income came to $887,251. After deducting interest charges on the funded debt and taxes, there was total net income for the year of $678,138. The total amount of electrical energy generated during the year, the report shows, was 138,356,280 kw.-hr.

The total kilowatt-hour production of energy by the Merchants' Heat & Light Company for 1922 was 80,094,318. Total earnings of the company from the sale of energy were $2,064,833 and operating expenses were $1,425,810. There was a gross income from lighting and power of $660,811. Total commercial lighting revenues were $642,356, representing the sale of 11,977,988 kw.-hr.; municipal contract lighting revenues were $305,482, and commercial power earnings were $892,982. Revenues from sale of energy to other utilities totaled $224,014. Total merchandise sales were $41,283, showing net profits of $7,599.

## Iowa May Tax Water-Power Plants 10 Cents per Hp.

A committee of the Iowa lower house has had under consideration a bill which provides for the issuance of permits for the construction and operation of dams and the imposition of a $100 original permit fee and an annual privilege tax of 10 cents per theoretical horsepower. The permit fee would be required for dams now constructed as well as those to be constructed in the future, and the occupational tax would be levied on all dams and water-power plants built after the enactment of the law. Permits would be required for all except municipal dams. Sections to prohibit unlawful combinations and price fixing of the output of any dam under heavy penalties are contained in the bill, which has been drawn up along lines recommended by Governor Kendall in a message to the Legislature.

## Brief News Notes

**A. S. M. E. Seeks Postponement of Law for Registration of Engineers.**—The American Society of Mechanical Engineers is attempting to obtain a postponement of the law in New York State requiring the registration of all engineers in the state by May 5, 1923, and the New York membership of the society is being circularized to learn the opinion of mechanical engineers on the various phases of the law.

**Wireless-Telephone Record.**—What is said to be a new distance record for wireless telephony over a high-voltage transmission line was established when the Lake Superior District Power Company talked 42 miles from its branch at Ashland, Wis., to its Ironwood (Mich.) branch. The company expects to use the system extensively for communication between its plants in the northern parts of the two states.

**Marshfield Sticks to Municipal Plant.**—Following the example of Manitowoc, Wis., the city of Marshfield, in the same state, has resolved to increase the equipment of its municipal plant and has discontinued negotiations looking to the connection of the city with the high-power lines of either the Wisconsin Valley Electric Company of Wausau or the Wisconsin-Minnesota Light & Power Company of Eau Claire. New equipment will be purchased from the Allis-Chalmers and Westinghouse companies.

**Daylight Saving as a Crime.**—Amid news of the usual legislative struggles in early spring between advocates and opponents of daylight saving stands out the passage of a bill by the lower house of the Connecticut Legislature imposing a fine of $100 or a sentence of ten days in jail for the "willful public display of any time-measuring instrument or device intentionally set so as to indicate any time other than standard time." Fortunately the Draconian spirit in which a predominantly bucolic House approached the problem was emulated in the Senate, which has left daylight saving as it found it.

**Utica Company to Extend Use of Carrier Current.**—The Utica Gas & Electric Company plans to extend the carrier-current wireless-telephone system it has now in use between its Trenton Falls plant and Utica so as to include the Rome and Watertown plants. The installation by the General Electric Company has been particularly successful, the company reports, and since Dec. 7, when the system was first put in use, only one suspension of communication has been forced. The Utica company was a pioneer in the use of carrier current for interplant communication.

**First Electrically Driven Passenger Boat for Great Lakes.**—The Goodrich Transit Company announces that plans have been completed for the construction by the Manitowoc (Wis.) Shipbuilding Company of the first electrically driven passenger boat on the Great Lakes. It will go into service next season between west short ports of Lake Michigan. The vessel will be from 345 ft. to 360 ft. long, will contain 300 rooms above decks with 600 berths, and the cost is estimated in the neighborhood of $1,000,000. No decision as yet has been made as to the exact type of equipment to be installed.

**Forty-two Thousand Persons Go Through Tunnel.**—Upward of forty-two thousand persons went through the power tunnel of the Niagara Falls Power Company during the week that it was open for public inspection prior to admitting the water. The average was 500 persons each hour that the tunnel was open. Many engineers and scientific men came from a distance to examine the project. Among the visitors were the entire senior class of the University of Kentucky's school of engineering. The new tunnel is one mile in length and 32 ft. by 32 ft. in diameter.

**Johns Hopkins Engineering Lectures.**—The first of the open lectures on engineering practice given each year at Johns Hopkins University, Baltimore, was delivered on Wednesday of this week on a civil engineering topic. Two others will follow—the first on Wednesday, April 18, when N. W. Storer, general engineer with the Westinghouse Electric & Manufacturing Company, will consider the "Possibilities for Steam Railroad Electrification," and the second on Monday, April 30, when George A. Orrok, consulting engineer, New York City, will discuss "Power Development, Past and Future."

**Wisconsin Utilities to Spend $25,000,000 This Year.**—Basing his estimate on the returns of a questionnaire sent out by the Wisconsin Public Utilities Bureau, J. P. Pulliam, the retiring president of the Wisconsin Utilities Association, said in his address at the recent meeting of that body that the utilities of Wisconsin would spend between $25,000,000 and $30,000,000 during 1923 for additions, extensions and improvements to their plants and outside equipment. Among the larger expenditures he listed were $6,860,000 by the Milwaukee Electric Railway & Light Company and the Wisconsin Gas & Electric Company, $1,500,000 by the Wisconsin Public Service Corporation, $925,000 by the Wisconsin Power, Light & Heat Company and $700,000 by the Lake Superior District Power Company.

**Hydro-Electric Project to Serve Petrograd.**—An 80,000-hp. hydro-electric plant, situated east of Petrograd on the Volchov or Wolko River, is under construction, according to Max

Kadinsky, a Russian engineer who is a graduate of the University of Illinois. Eight vertical turbines with a capacity of 10,000 hp. each under a head of 40 ft. will make up the installation. The average yearly output, estimated at 40,000 hp., will be transmitted to Petrograd, a distance of about 80 miles, at 110,000 volts. The power house will be a reinforced-concrete building and the dam of masonry type. Work already done includes about one-third of the excavation for a canal connected with the project, a part of the caissons which must be sunk for the power house and an ice-diversion wall.

**Growth of Load Will Force Rapid Expansion of Cahokia Plant.**—A probability that when the Union Electric Light & Power Company of St. Louis completes the first unit of its new Cahokia power plant on the east bank of the Mississippi River next autumn it will within a few weeks begin construction of the second of the four ultimate units was forecast by Louis H. Egan, president of the company, in a recent address. It had been thought that the second unit would not be undertaken before two years, but the rapid increase in consumption in the St. Louis district will force the company to accelerate its plans, and the entire construction, which it was intended to spread over ten years, may be accomplished in five or six.

**May Generate Electricity from Sewage-Disposal Plant.**—A possibility that Milwaukee will generate the energy for its street-lighting system in the sewage-disposal plant under construction for the city on Jones Island, instead of obtaining the power from the Milwaukee Electric Railway & Light Company, as it does now, exists, if the report of T. C. Hatton, chief engineer of the sewage-disposal commission, may be taken at its face value. The sewage-disposal plant is to be finished next year, and Mr. Hatton says: "The maximum capacity of the boiler plant is 6,200 hp., but when two boilers are operating at a 20 per cent rating they can produce all the power required up to 1930 for the street-lighting needs of this city unless the city decides to install generators for producing current for street-lighting purposes." This is interpreted to mean that only two boilers will be needed to dispose of the sewage and that the other two which are to be installed will await only the installation of generators by the city to furnish energy for the street-lighting system.

**Oversea Telephony.**—As an outcome of the recent successful demonstration of wireless telephony between New York and London, the British Postmaster General has appointed a committee "to consider in the light of recent progress in the wireless science the possibilities from a technical standpoint of transatlantic wireless telephony of sufficient reliability for commercial use and to advise what practical steps, if any, can at present be taken to develop this means of communication." A beginning of commercial service is, however, according to American authorities, at least twelve months and probably twice that time away. Ignorance of the precise nature of atmospheric changes, which make talking easier by day than by night and harder in summer than in winter, is a hampering factor. The prospect is that much more powerful broadcasting apparatus will have to be used in the summer than that which so far has been used in successful experimental demonstrations. Another great difficulty, and one which makes official activity by Great Britain particularly desirable, is that the present English telephone circuits are not adaptable to relaying wireless messages to or from the coast, so that improvement of the present apparatus in use on land lines in England is essential to commercial communication.

# Associations and Societies

**Nebraska Section, N. E. L. A.**—The annual convention of this section, which forms part of the Middle West Geographic Division of the association, will be held on Thursday and Friday, May 10 and 11, at Omaha.

**Engineering Council of Utah to Give Banquet.**—The annual banquet of the Engineering Council of Utah has been set tentatively for April 23 at the Hotel Utah, Salt Lake City. Calvin W. Rice and other prominent engineers are expected to speak.

**Associated Manufacturers of Electrical Supplies.**—The summer section meetings of the Associated Manufacturers of Electrical Supplies will be held at the Hotel Griswold, Eastern Point, New London, Conn., beginning Tuesday, June 26, and extending through the week. On June 28 the annual meeting of the association will be held.

**American Welding Society.**—The annual meeting of this society will be held at the Engineering Societies Building, New York, from April 24 to April 27. The committees on training of operators, resistance welding, electric arc welding and welding of storage tanks will report on the first day. New developments in the welding field will be discussed on the second day, W. L. Warner reporting on electric welding.

**Coming Section Meetings of A. I. E. E.**—Section meetings of the Institute to be held next week are announced as follows: Baltimore, April 20, "Insulator Design and Manufacture," K. A. Hawley; Boston, April 16, "The Panama Canal," Brig.-Gen. Chester Harding, U. S. A.; Cleveland, April 19, "Manufacture of Copper Wire and Cable," C. F. Hood; Seattle, April 18, "The Columbia Basin Project," W. T. Batcheller.

**Tri-State Water and Light Association.**—Birmingham technical men are getting ready for the annual convention of the Tri-State Water and Light Association, which will be held in that city on April 17, 18 and 19. On the first day Glen H. Corlette of the engineering department of Fairbanks, Morse & Company, Atlanta, will speak on "The Oil Engine as a Prime Mover and Its Application to the Electric Plant"; A. A. Passolt, manager of the water and light plant at Newnan, Ga., will talk on "How Experience Guides Us in Looking Ahead," and there will also be short talks on Birmingham industries and the Alabama Power Company. Speakers selected for the second day include C. N. Grantham, city manager, Goldsboro, N. C., who will talk on "Service-Satisfying the Consumer," and E. T. Austin, General Electric Company, Atlanta, whose subject will be "Development of Street Lighting." Another speaker will be L. V. Gaffney, superintendent of the municipal plant of Gaffney, S. C., whose topic will be "Management in Easing the Day Load."

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

American Society of Mechanical Engineers—Pacific Coast meeting, Los Angeles, April 16-18; general convention, Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society — New York, April 24-27.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Nebraska Section, N. E. L. A.—Omaha, May 10-11. Horace M. Davis, secretary-treasurer.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Empire State Gas and Electric Association, Electric Section—Utica, N. Y., May 17-18. C. H. B. Chapin, Grand Central Terminal, New York.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. Dean F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

## Recent Court Decisions

**Company Cannot Be Sued Under Employers' Liability Act for Death of a Non-Employee.**—In Saylor vs. Enterprise Electric Company, the Supreme Court of Oregon has sustained the lower court in holding that an electric service company cannot be sued under the employers' liability act of the state because of the death of a man, not an employee, through contact with a high-tension line of the company brought about when he moved a hay derrick from one field to another. Only employees can prosecute under this act, and decedent's widow, if entitled to redress, must seek it otherwise and defendant will be entitled to plead contributory negligence as a defense. (212 Pac. 477.)*

**United States Supreme Court Upsets Minimum-Wage Law.**—By a divided court, five to three, the United States Supreme Court on April 9 declared the minimum-wage law passed by Congress for the District of Columbia unconstitutional as abridging the right of contract guaranteed by the Fifth Amendment to the Constitution. The decision was by Justice Sutherland, with whom concurred Justices McKenna, Van Devanter, McReynolds and Butler. Chief Justice Taft and Justice Sanford joined in one dissenting opinion, while Justice Holmes read a more sweeping dissenting opinion. Justice Brandeis, whose daughter is secretary of the District of Columbia Minimum Wage Board, did not participate in the case or in the opinion. The decision has national significance, establishing a precedent for tests of minimum-wage laws of thirteen states. The Attorneys-General of New York, California, Kansas, Oregon, Wisconsin and Washington intervened in the case, presenting briefs in support of the constitutionality of the act. The District of Columbia minimum wage law applied to women and to minors. The District Supreme Court declared the law valid. The Court of Appeals first upheld this decision, but on rehearing reversed it.

**What Is Ordinary Care in Case of Accident Arising Through Tree Climbing?**—In Godfrey vs. Kansas City Light & Power Company damages were awarded for serious injury to a boy who climbed a walnut tree on a vacant lot and came into contact with an electric power wire. Although the boy was a trespasser as to the owner of the land, he was not a trespasser as to the company, the Kansas City Court of Appeals declared in affirming the verdict, and the company was not relieved by his trespass of the duty to use ordinary care and anticipate reasonably likely occurrences. An instruction denying recovery if the boy knew or could have discovered by any means that there was a dangerous wire in the vicinity of the tree climbed was properly refused, the court held, since it wholly ignored the question of ordinary care; nor was an instruction directing a verdict for the plaintiff if the wire was uninsulated and could have been insulated and made harmless erroneous as imposing a greater burden than that of exercising reasonable care. These and similar instructions did not give the jury a "roving commission" to find the defendant guilty of negligence, nor was any question of law thereby submitted to it. (247 S. W. 451.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

## Commission Rulings

**District Commission Maintains Income Tax Ruling and Champions Historical Valuation.**—The Public Utilities Commission of the District of Columbia has ordered a reduction in the rates of the Potomac Electric Power Company. This reduction is in addition to the one ordered a year ago and designed to provide at least a 7 per cent return. As a matter of fact, the commission finds, the rate of return for 1922 was 8.9 per cent. The hearing was held on the initiative of the commission. The company asked that no change be made in its existing rates pending the final decision in the valuation case then before the United States Supreme Court. The Federation of Citizens' Associations of the District of Columbia urged the commission to state "clearly and definitely its treatment of the depreciation fund account and the federal income tax item of said company" and protested against "the practice of the commission of the allowance in full and their addition to the valuation base established in 1916, at book value, of all property additions made by the company since the commission's valuation of the year named." As to the federal income tax, the commission adhered to its position in previous cases that such taxes should be borne by the corporations and not passed on to the public—"should not be included as an operating expense, but should be paid from the net income of the company." The commission made an analysis of the depreciation account, saying that the reserve was growing rapidly to such a size that it would be necessary to give careful consideration at an early date to the manner in which it should be treated. The commission took exception to the statement of the federation that the property to the value of $7,000,000 added since its valuation order of 1916 had "never been appraised, valued or passed upon in review by the commission." "There is no better method of valuation known," it said, "than the ascertainment of the actual cost of property where such cost represents the investment honestly and prudently made. The commission believes this to be the most exact possible kind of valuation and in accordance with the provisions of the public utilities act. This position of the commission was clearly stated at the public hearing on the rates of the Potomac Electric Power Company held July 18, 1921, at which time the representative of the Federation of Citizens' Associations advanced the same argument on this question. To the commission it appears difficult to believe that the argument is intended to be taken seriously."

**Rates Should Be Large Enough to Insure Good Service.**—In fixing new rates for the Potomac Electric Power Company the District of Columbia commission said: "The rates now in effect in the District of Columbia are reasonable and compare favorably with those in effect in other large cities where power plants operated by steam are in use. What is desired by all is good service and this implies dependability as well as reasonable rates. To insure dependability, and for the business man particularly this is the first consideration, it is necessary that the company shall always be in a position to keep the capacity of its plant well in advance of the demand upon it. To insure economy in generating energy, it is necessary that the company shall keep well abreast of progress in the mechanical and electrical arts, installing new and improved appliances promptly when their worth has been demonstrated. To do these things the company must be able to raise funds in comparatively large amounts. To enable this money to be secured at reasonable rates, if at all, requires that the company shall have good credit. It is therefore in the interest of the entire public that rates be not reduced so low as to prevent that healthy growth of the company's facilities without which the entire community might suffer serious losses and inconvenience of various kinds. The commission does not therefore believe a return of 7.99 per cent more or less to be excessive, but it is nevertheless of the opinion that the circumstances of this case warrant a reduction in the present rates of the Potomac Electric Power Company and that this reduction will not impair the company's credit or its ability to serve the public."

**Construction Costs and Overhead Expense Under Pioneering Conditions.**—In its valuation of the property of the Idaho Power Company, the Idaho Public Utilities Commission held that the use of average prices over the period from 1913 to 1916 for the study of property placed in service prior to 1917 and the actual cost of property installed after that time was fair to both the utility and the public. An allowance of 10½ per cent was made for general overhead expenses, exclusive of interest during construction, in valuing this utility, which was constructed under pioneer conditions.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## W. B. McKinley and C. Studebaker Head New Company

William B. McKinley, who has been president of the Illinois Traction Company, will be chairman of the board of the Illinois Power & Light Corporation, which is acquiring an extensive group of long-established utility properties and which will control the Illinois Traction, Inc., through ownership of the entire capital stock of that company. The president of the Illinois Power & Light Corporation will be Clement Studebaker, Jr., who with his associates, through the medium of the North American Light & Power Company, is acquiring a controlling interest in the company. Mr. Studebaker is chairman of the board of the North American Light & Power Company. Among the directors of the Illinois Power & Light Corporation in addition to Mr. McKinley and Mr. Studebaker will be William A. Baehr, H. E. Chubbuck, George Mattis and G. W. Niedringhaus.

## Dr. Hollis to Leave Worcester "Tech"

Dr. Ira N. Hollis, for the past ten years president of the Worcester (Mass.) Polytechnic Institute, distinguished for his service in the navy and as an educator at Harvard University, has presented his resignation to the board of trustees, to take effect upon the appointment of a successor. Dr. Hollis was born at Mooresville, Ind., in 1856 and was graduated from the United States Naval Academy in 1878. For twenty years previous to his association with the Worcester Polytechnic Institute he had been professor of engineering at Harvard. He is widely known in educational and engineering circles and his philosophical views of the trend of science and economics command a wide audience. Upon retirement from the Worcester institution Dr. Hollis plans to engage in literary work.

**William Lamont Abbott**, the chief operating engineer of the Commonwealth Edison Company, Chicago, has been selected to head the special committee of the Federated American Engineering Societies which will make a study of coal storage. Mr. Abbott has long been a student of coal storage.

**Charles E. Wiggin**, manager of the electrical department of the Dunham, Carrigan & Hayden Company since 1910, has resigned to join the sales force of the Pacific States Electric Company. Mr. Wiggin is well known in electrical jobbing circles of the West.

P. O. CRAWFORD

## P. O. Crawford and W. M. Shepard Made Vice-presidents

At a recent meeting of the board of directors of the California-Oregon Power Company Perry O. Crawford, chief engineer of the company, was made vice-president and chief engineer and W. M. Shepard, general agent, was made vice-president and general agent.

Mr. Crawford received his technical training at Stanford University and took an A.B. in electrical engineering from that institution in 1908. During the next three years he was construction engineer for the Northern California Power Company and built several power plants. In 1912 he went to Afghanistan as assistant engineer on government hydro-electric work and for three years was in charge of the construction of the Jabl-us-siraj power plant. After returning to the United States he spent six months at Stanford University in research work under Prof. Harris J. Ryan. He became identified with the California-Oregon Power Company in 1916 and since that time has had charge of all engineering activities of that company, including the building of Copco dam and power house and several important transmission lines.

W. M. SHEPARD

Mr. Shepard was graduated from the Alabama Polytechnic Institute in 1904, and then spent about a year with the Knoxville & Northern Railroad. In 1905 he took the General Electric test course and in 1906 was transferred to the Atlanta office of the company and later to the San Francisco office. While with the General Electric Company in San Francisco he worked successively as supply salesman, apparatus salesman and special agent and was active in applying electricity to gold dredging and other typically Western industries. He joined the California-Oregon Power Company in 1916 as commercial agent and became general agent in 1918. He has had charge of all commercial activities of this company since his affiliation with it, including the negotiation of interconnection agreements with other power companies, and in addition has been in charge of valuation work and rate matters of the company.

**E. S. Roberts**, assistant commercial manager Blackstone Valley Gas & Electric Company, Pawtucket, R. I., has resigned to enter private business. Mr. Roberts has been active in the Commercial Section of the New England Division, N. E. L. A., and has done excellent work in the field of public relations.

**E. J. Seaborn**, formerly assistant treasurer of the Truckee River Power Company, has been transferred to Houston, Tex., as assistant treasurer of the Houston Electric Company and the Galveston-Houston Electric Railway. Mr. Seaborn has been with Stone & Webster for sixteen years and was with the Truckee River Power Company for five years. He is taking the place vacated by the transfer of H. L. Harding to Boston, where he will be in the treasurer's department of Stone & Webster.

**G. C. Neff**, Madison, Wis., was elected vice-president in charge of operation of the Wisconsin Power, Light & Heat Company, the Wisconsin River Power Company, the Southern Wisconsin Power Company, the Eastern Wisconsin Electric Company and the Mineral Point Public Service Company, all subsidiaries of the Middle West Utilities Company, at a recent meeting of the boards of directors of the above-named companies. These companies operate the large hydro-electric plants on the Wisconsin River at Kilbourn and Prairie du Sac. Mr. Neff is also treasurer of the Wisconsin Utilities Association and chairman of the rural-lines committee of the National Electric Light Association.

### R. E. Smith Electric Club's President

Richard E. Smith, advertising manager of the Southern California Edison Company, has recently been elected president of the Electric Club of Los Angeles. Mr. Smith has been engaged in the electrical industry in California for the past seventeen years. Starting as a wireman's helper in San Diego, he has held successively the positions of Pacific Coast representative of the National X-Ray Reflector Company, illuminating engineer of the Pacific Light & Power Company, sales manager of the Mount Whitney Power & Electric Company, district manager of the Tulare office, Southern California Edison Company, and, for the past two years, advertising manager of the Southern California Edison Company. He has been one of the oustanding figures in the club during the two years of its existence. His contributions to *Sparks*, the club's weekly bulletin, early earned for him a large and loyal following, and this, together with committee work and the directing of programs, has culminated in his election to the highest office in the club.

**William Dubilier**, president of the Dubilier Condenser & Radio Corporation, New York City, has just returned from Europe after spending a month visiting England, France, Germany and Belgium.

**C. B. Merrick**, who recently spent several months with the Valley Electric Supply Company of Fresno, Cal., is now back with the San Joaquin Light & Power Corporation as assistant to the new-business manager.

**Rudyard Goodland**, who has been assistant superintendent of the Oliver mine at Ironwood, Mich., for several years, has recently been made superintendent of distribution of the Wisconsin Gas & Electric Company.

**W. T. Leander** replaces W. H. P. Weston as secretary and treasurer of the Ironwood & Bessemer Railway & Light Company, and W. J. Hodgkins, formerly purchasing agent, is now general manager and has been succeeded in the position of purchasing agent by L. G. Gothe. J. B. O'Neil, formerly line superintendent, has become district manager, supplanting E. L. Hinchliff; E. O. Sinrud replaces W. A. Campbell as assistant district manager, and R. S. Wilhelm, formerly engineer of power station, has become chief engineer.

**Frank D. Schwartz** has resigned as Western salesman of the Indiana Rubber & Insulated Wire Company. Mr. Schwartz was formerly sales manager of the Electric Appliance Company, Chicago, and has long been a prominent figure in the rubber-covered-wire industry. For the last nine years he has had sales direction for the Indiana Rubber & Insulated Wire Company over the State of Ohio and all territories south and west. Mr. Schwartz has announced no definite plans for the future, but will remain in Chicago as his home is in Oak Park. F. R. Dolan has been appointed Chicago representative for the Indiana Rubber & Insulated Wire Company.

### O. H. Simonds Leaves Dubuque

O. H. Simonds, vice-president and general manager of the Dubuque (Iowa) Electric Company, has resigned to ally himself with the Electric Bond & Share Company of New York City. Mr. Simonds has been identified with the electrical industry since 1908, when, after being graduated from Cornell University, he joined the forces of the General Electric Company. For seven years thereafter he was employed in various capacities with that company, spending the last four in the lighting and railway department of its Chicago office. He then resigned to enter the engineering department of Elston, Clifford & Company, Chicago, and later became general manager of the Vicksburg (Miss.) Light & Traction Company. Since his advent in Dubuque as general manager more than five years ago, Mr. Simonds has been able to advance materially the interests of the properties intrusted to his management. The Electric Bond & Share Company of New York watched with interest the results of his efforts and has been desirous of obtaining his services for about two years. Recently the inducements were made so attractive that his satisfaction with his Dubuque position had in the exercise of sound business judgment to be subordinated. He will be stationed in New York.

O. H. SIMONDS

Mr. Simonds has been active in state association work and also in committee work of the N. E. L. A. and in addition has found time to devote to movements tending to civic improvement and advancement. His successor will be Thomas Parker, who comes from the Emporia (Kan.) division of the Kansas Power Company, owned and controlled by the Albert Emanuel Company.

**R. C. Hodges**, formerly chief electrical engineer with the Newburgh (N. Y.) Shipyards, Inc., has opened offices in Newburgh, specializing on power installation.

**C. L. Marshall** of the Tacoma office of the Puget Sound Power & Light Company has been transferred to the Wenatchee office of the Washington Coast Utilities. Z. E. Merrill, electrical superintendent at Wenatchee, who resigned, has been succeeded by Frank Walsh of Everson.

**William W. Merrill**, who has been associated with the Chicago Fuse Manufacturing Company since 1894, was recently elected president of the organization, succeeding Arthur D. Dana, retiring to become chairman of the board. Mr. Merrill has served successively as bookkeeper, cashier, secretary, assistant treasurer, treasurer, and since April, 1910, as vice-president and general manager.

**Thomas W. Peters**, who has been general superintendent of the Potomac Public Service Company, with headquarters in Frederick, Md., for nearly a year, has resigned. Mr. Peters resigns to join the American Water Works & Electric Company and will become the general superintendent of the Cumberland Edison Company, a property recently acquired by the American company. William C. Humm will succeed Mr. Peters at Frederick.

**E. A. Bradner**, newly elected president of the New Mexico Public Utilities Association, has been identified with public service corporations for more than thirty years. Starting as an arc-light trimmer, he has held all intermediate positions up to that of manager, which office he now occupies with the Las Vegas Light & Power Company and the Las Vegas Transit Company. For a number of years Mr. Bradner was chief engineer and superintendent of the Grays Harbor (Wash.) Railway & Light Company and later became manager of the central station at Hobart, Okla., holding this position until 1919.

**John W. Carpenter**, vice-president and general manager of the Texas Power & Light Company, with head offices in Dallas, was elected president of the Southwestern Geographical Division of the National Electric Light Association at the convention held recently at Oklahoma City. Mr. Carpenter has been identified with the electrical industry in the Southwest for the last twenty-five years. He entered the business in Corsicana and his rise has been steady and rapid. To Mr. Carpenter is given credit for having launched the recent campaign in Texas looking to the establishment of cotton mills, and it was due to his efforts that nationally known textile engineers visited Texas and made investigations which have already resulted in the organization of a half-dozen companies for building cotton mills. Mr. Carpenter has also been deeply interested in industrial education in Texas, and Governor Neff recently appointed him as one of the members of the first board of trustees of the new Texas Technological College to be founded in west Texas.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## A Quota Plan for Jobbers' Salesmen

**Report on Some Recent Experience in Setting a Sales Bogey in Each Community and by Commodities**

By H. F. Thomas
President Northwestern Electric Equipment Corporation, St. Paul

FOR a long time we have felt that we were considerably handicapped by the fact that our salesmen—like other jobbers' salesmen—have been working in the dark. That is, they have been going on from day to day and from town to town, taking orders for what commodities they could sell, but with no accurate or even approximate knowledge of the possibilities for business in any town or in any commodity. The average salesman works with no record of what he has done in past years in that town, or of what commodities he has sold there, except as he may remember certain large or otherwise conspicuous orders secured from individual customers. Therefore he has no practical guide as to what he should sell there, or how much he should sell, save his judgment at the time and his interest at the time in his various commodities and customers. He has no bogey that will tell how much he should sell, or where, or what.

### Rough Figures Set Up

We recently decided, therefore, to establish a quota system for our men the aim of which would be to set down the amount of business that they should be able to develop in each commodity they sell and ultimately to make that a quota for each community. We discussed this plan with our salesmen and they all asserted that it would be absolutely impracticable. All towns were different, they felt, and it would be impossible to forecast how much of any commodity could be sold. However, we went ahead and made an analysis of each man's sales for the last two years by commodities, and then we sat down with the salesman and studied these statements and tried to determine with him how much business we should be able to get in each town, dividing our totals according to the business which might be expected during the four quarters of the year. This of course was purely approximate and arbitrary and not scientific in any way for there is no reason for believing that the last two years' sales or any two years' sales can be taken as a basis for business possibilities. Yet we had to start somewhere.

### Two Forms Used

So we went ahead and on the sheets reproduced here drew up a quota for each salesman under convenient groups of commodities, setting down the total sales expected for each in each quarter of the year. We began on the first of the year to keep a record each month of the sales

SALESMANS QUOTA AND ACTUAL SALES.

SALESMAN John Doe MONTH OF February 1923.

| Group Com. | | QUOTA For 1st Quarter | QUOTA For February | MONTH Actual Sales | MONTH Over | MONTH Short | ACCUMULATED Over | ACCUMULATED Short | Necessary Sales in March to Meet Quota |
|---|---|---|---|---|---|---|---|---|---|
| 10 | Wiring Devices, including fuses | 6000 | 2000 | 1480 | | 520 | 460 | | 1540 |
| 20 | Rubber Covered Wire and Lamp Cord | | | | | | | | |
| 30 | Weatherproof and Bare Copper Wire | | | | | | | | |
| 40 | Rigid Conduit, Fittings, Condulets, Outlet Boxes, Etc | | | | | | | | |
| 50 | Loom | 300 | 100 | 25 | | 75 | 75 | | 25 |
| 60 | Porcelain Knobs, Tubes and Cleats | | | | | | | | |
| 70 | Meters | | | | | | | | |
| 80 | Fans | | | | | | | | |
| 90 | Pole Line Construction Material | | | | | | | | |
| 100 | Dry Cell Batteries | 999 | 333 | 330 | | 3 | | 18 | 351 |
| 110 | Telephone Material | | | | | | | | |
| 120 | Miscellaneous Supply Material | | | | | | | | |
| 130 | Lamp Department | | | | | | | | |
| 140 | Fixture Department, Includes Street Lighting Equipment | | | | | | | | |
| 150 | Batteries, Rectifiers and Auto Accessories | | | | | | | | |
| 160 | Radio | | | | | | | | |
| 170 | Washers, Ironers and Vacuum Cleaners | | | | | | | | |
| 180 | Heating Devices and Other Socket Appliances | | | | | | | | |
| 190 | Electric Ranges and Ovens | | | | | | | | |
| 200 | Transformers | | | | | | | | |
| 210 | Motors, Switchboards, Engines, Etc | | | | | | | | |
| 220 | Shop Labor and Material | | | | | | | | |
| 230 | Outside Construction Labor | | | | | | | | |
| | | | | | | | | | |
| | TOTAL | | | | | | | | |

SALESMAN

SALES YEAR 192

| Group No. | MATERIAL | FIRST QUARTER Gross Sales | FIRST QUARTER Credits | FIRST QUARTER Net Sales | FIRST QUARTER Quota | SECOND QUARTER Gross Sales | SECOND QUARTER Credits | SECOND QUARTER Net Sales | SECOND QUARTER Quota | THIRD QUARTER Gross Sales | THIRD QUARTER Credits | THIRD QUARTER Net Sales | THIRD QUARTER Quota | Gross Sales |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | Wiring Devices | | | | | | | | | | | | | |
| 20 | Rubber Covered Wire and Lamp Cord | | | | | | | | | | | | | |
| 30 | Weatherproof and Bare Copper Wire | | | | | | | | | | | | | |
| 40 | Conduit, Fittings, Outlet Boxes, Condulets, Etc. | | | | | | | | | | | | | |
| 50 | Loom | | | | | | | | | | | | | |
| 60 | Porcelain Knobs, Tubes and Cleats | | | | | | | | | | | | | |

FORMS ON WHICH QUOTAS AND SALES OF JOBBERS' SALESMEN ARE RECORDED AND COMPARED BY COMMODITIES AND TOWNS

to each community classified in this way. On each sheet the name of the town, the salesman and his code number are filled in. Within the city of St. Paul a sheet is carried for each important customer, and casual customers are grouped so that our city salesmen may work to a quota also. On the back of the sheet we keep a record of the number of calls made on each customer, taken from the daily reports.

Then at the end of each month we draw up the sheet, also shown here, giving a report on the salesman's quota and actual sales. This form is printed and filled out in "ditto ink," so that copies may be made on blank paper, and each salesman receives one each month for each town. He knows, therefore, as he approaches a town just how he stands—over or under his quota—and how his sales there have compared with sales in other towns. He can look for the reason why.

### Effect on Salesmen

As a result of this we are now beginning to get actual figures on the sales of each salesman in each town by commodities, and a study of these figures is developing some interesting facts that are surprising to the salesman. For instance, in one town of 8,000 population one man during six months sold $350 worth of heating devices, but in another town of 24,000, only a short distance away, he sold only $200 worth. Before he saw the figure he was certain that he had got all the business that was possible out of the larger town, but when the actual sales were compared he could not reconcile the descrepancy. He knew that the bigger town should yield more business than the smaller.

In the beginning the men treated the whole thing as a joke—they laughed at it. But in the few months that the system has been in use they have discovered its worth to them and become enthusiastic. One of them recently said: "This is the first time that I have had a guide to what I am or am not doing and can see my weak spots." They are all watching the returns, studying and comparing them. They check up each case when some return of goods results in a smaller total sales than they expected. If they are disappointed in their sales in some town, they write and give us facts on the situation.

In short, the plan has given every man a new intensity of interest in his work and his responsibility for sales. We do not find fault when the total falls behind the quota. We do not use the quota to hound the men. The purpose is to give the men a means of checking up themselves—by towns and by commodities.

Next year, with a set of figures carrying twelve months' sales to every town and showing the totals on each commodity, we shall be in a position to make a real study and set a specific quota in advance for each town, for each salesman and for each commodity. We believe that this quota should not only recognize the total sales of 1921 and 1922 and the detailed reports on the sales of this year, but take into consideration also the population living in wired houses, the electrical conditions in the town—that is, the aggressiveness of the central-station company and dealers—the number of our customers, and also the strength of our salesman in the territory. From this we should be able to set a quota that will really reflect possibilities and not just our own selling history.

Already, however, the use of a practical quota on sales is proving of great value to our salesmen and therefore to the house, and we have no hesitation in recommending the plan to other jobbers and to manufacturers whose men must sell a varied line. Results are justifying the starting of the system on the most loosely approximate of figures, for even these are of real guiding value to the salesmen in their daily work.

# Need the Dealer Lose His Line?

## Facts from Hardware-Store Experience and Some Evidence from Electrical History—An Industry Problem that Needs Action

By A. W. Fischer
Director of Sales Magnetic Housecleaner Division, Birtman Electric Company, Chicago

Theoretically the dealer selects the kind of goods that he wants to sell out of his store, or the customers select the lines that the dealer carries by the expression of their preference in purchasing. In other words, the dealer sells what his customers want to buy. But as a matter of fact and experience it often happens that there is another thing that has a lot of influence in determining what a dealer sells. Other merchants take lines away from him by their superior skill in selling and sometimes force him practically to give up a profitable specialty or staple because the public is taught to buy these goods from some other kind of a store and they refuse to come to his store any more for them.

### Lost Lines of Hardware

Consider the hardware store, for example. The function of most hardware stores is merely to render a neighborhood service to the households of a community by providing a place where they may buy all kinds of metalware. When one wants nails or buckets or wire netting, or a stove or some tools to use in the home or garden, or a lawn mower or a poultry food hopper, the hardware store has them for sale. The carpenter also naturally goes there for his tools and nails and screws, and the plumber buys stuff there, and the farmer depends upon the hardware man for his spades and forks and in rural communities for plows and mowers and other agricultural machinery as well. And with this line of hardware are naturally grouped other associated materials, like window glass and weather strips and paint and brooms and cement and chickenfeed. All that and many other miscellaneous things make up the stock which we expect to find in a hardware store.

But wait a minute! Razors are hardware. They ought all to be sold out of the hardware store, yet they are not. We buy our safety razors from the drug store usually. Why? Because the man who sells soap decided one day that he could logically associate this article of specialty hardware with his staple and make some money at it, so he went after the safety-razor business and by better merchandising he has stolen the line away from the hardware man. Many men therefore go today to the druggist for their razors.

Cutlery is hardware also and used to be sold out of the hardware store. But today we buy much of it from the department store. And the department store has won away from the hardware dealer a great portion of the kitchen utensil business, just

as the department store has made itself headquarters for a lot of other popular merchandise that ten years ago used to be sold almost exclusively out of some other kind of a shop—and it is all right. Nothing can be said against the druggist for going out and rounding up the safety-razor business to sell with soap. We have no grievance, any of us, against the department-store man for selling our wives their baking dishes. The only criticism that can be expressed is against the hardware man himself for letting this easy-selling specialty of universal demand get away from him. For if he had been on his toes and made his store the chief source of information and supply on safety razors, we would all be purchasing our blades right there today.

### Lost Electrical Lines

All of this, of course, is set down by way of background for the electrical dealer, for he is apparently allowing himself to follow the lead of the hardware man and lose some of the best lines of merchandise that his store can sell. The electrical dealer failed to do a job with dry batteries. In the beginning he sold them, but as the demand grew he failed to keep pace with his supply, and service and selling and other stores took them up until today the hardware man has won a tremendous volume of this business on which the electrical man might have been making the profit.

Likewise the hardware man is selling an enormous number of incandescent lamps that the dealer could be handling if he had sensed the change when the people began to become "lamp conscious" a few years ago and select for themselves, and had increased his advertising, his display and his lamp service. Moreover, the electric flashlight has become a steady seller in the hardware store. The hardware man took it up just as soon as the housewife grew convinced that this device was dependable, and it became a staple not just sold into the homes but bought by the people without asking the advice of some expert.

The hardware man also saw the change in the popular attitude toward the electric flatiron so he put it in his stock. He will be just as ready to stock all the other electric heating appliances and the motor-driven appliances if the way is left wide open for him to walk into the business. And the drug store will be selling most of the heat pads, vibrators, immersion heaters and devices of that kind, if we let him.

The question is, will the electrical dealer be willing to let the hardware man and the department-store man appropriate this exceedingly important function of merchandising in the electrical industry? And will the electrical manufacturer and jobber stand by and see it happen without taking some part in this affair which concerns them so vitally? The entire electrical industry should and naturally does want to see the electrical dealer prosper and grow in strength and influence. It is worth a great deal to it to have, as a skirmish line for distribution, a class of local retail dealers who are electrical men and both sympathetic with the ideals and purposes of the industry and intelligent in interpreting them.

If the electrical dealer can be as good a merchant as the hardware man, all electrical manufacturers and jobbers would rather have him sell their goods. But if the electrical dealer does not build himself up and make his store as appealing and helpful to the householder as the hardware store, when it comes to the sale of electrical appliances, then the hardware man and the drug-store man and the department-store man will go right on invading his market as certain lines one after another become staples. If this goes on, then the electrical dealer will have left only the specialties that are harder to sell and naturally bring him less prosperity during the period of building up than later when they are established in the market and in popular demand.

There is plenty of opportunity for the electrical dealer—a big job and a fine chance to prosper. But it is not just his problem. It is the problem as well of the man who makes and the man who distributes these goods that his store should sell, and they individually must undertake the responsibility for keeping their lines in the electric store by guiding, stimulating and assisting the electrical dealer to hold his lines. And the only way that any dealer can hold his line is by doing a better job of selling than some other merchant in some other store. It is time that we men behind the electrical dealer made ourselves responsible for seeing that he does this very thing. These facts are proof that we have not done enough so far.

## Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

TRANSFORMER orders placed with American manufacturers since the first of the year have exceeded anticipations, and at present factory facilities are working very close to capacity. It is safe to say that in the last twelve years transformer sales in this country have been growing at the rate of 10 per cent compounded per annum, and there is much interest in manufacturing circles at this time to see whether this rate will be exceeded in the near future. All signs point to continued productive activity in this field for certainly the rest of this year.

### Immersed Self-Cooled Types Are Taking the Field

IN TELLING of the activities in the transformer field, Westinghouse has received so far this year orders for large power transformers aggregating 750,000 kva. The business closed in January alone would have been a good six months' business a few years ago. A striking fact in connection with this great activity in transformers is the relatively large amount which are of the oil-immersed self-cooled type.

### Shortage of Labor Affecting Transformer Production

BY LOOKING far ahead with respect to the supply of raw materials, leading transformer manufacturers have thus far been able to maintain full production. It is becoming increasingly difficult to obtain labor for the more skilled operations, and in some quarters toolmakers are particularly hard to obtain. Distribution transformers are still obtainable in reasonable quantities from factory stocks. Power transformers, however, are being quoted on long deliveries, sometimes running into eight or nine months and rarely falling below seven months on comprehensive orders. There has been little recent change in prices, but the rising costs of steel, insulation and labor, combined with the burdens of taxation and other overhead expenses, make it not improbable that some further adjustment may take place. In typical cases distribution transformers are selling at about one-third above pre-war figures, power transformers running below the distribution type in percentage advance. In

discussing the situation the point is effectively made that only a moderate advance was registered during the war in comparison with many other lines of electrical apparatus, and attention is drawn to the low ratio of transformer cost to the total cost of modern hydro-electric transmission development, frequently of the order of 1.5 to 3 per cent.

### Ameliorating Depression Evils When Business Is Booming

CONCLUSIONS by the committee appointed by Secretary of Commerce Hoover as chairman of the President's conference on unemployment have been made public after more than a year's study. Recommendations are under ten headings:

Collection of fundamental data.
Larger statistical service.
Research.
Control of credit expansion by banks.
Possible control of inflation by the Federal Reserve System.
Control by business men of the expansion of their own industries.
Control of private and public construction at the peak.
Public utilities.
Unemployment reserve funds.
Employment bureaus.

Most of the report is devoted to the importance of the collection of fundamental data. It says: "What is evidently needed is an increase in the resources of the Department of Commerce and a larger degree of co-operation with the department in co-ordinating and extending business information, so that business men and bankers may know promptly the facts about the rate of production measured in physical units, the stock on hand and in transit, the trend of prices, the volume of sales and the trend in money rates."

Of equal importance to the electrical industry is the sixth recommendation, which emphasizes the point that "Planning production in advance and with reference to the business cycle, laying out extensions of plant and equipment ahead of immediate requirements with the object of carrying them out in periods of depression and carrying through such construction plans during periods of low prices in conformity with the long-time trend, the accumulation of financial reserves in prosperity in order to mark down inventories at the peak, and the maintenance of a long view of business problems rather than a short view, will enable firms to make headway toward stabilization."

### Highly Competitive Tape Market Has Many Turnovers

VIGOROUS activity accompanied by acute competition for business is the feature of the friction-tape market, which is responding to the stimulus of increased wiring construction throughout the country. The use of black tape has become practically universal, probably not more than 1 per cent of sales being white specifications. Many hundreds of thousands of pounds of friction tape are being produced monthly in the United States, and jobbers are making a fairly rapid turnover of this product as it reaches their shelves. Foreign demand is reported to be improving in quarters where this class of trade is assiduously cultivated. Raw materials are in good supply, but their costs have stiffened sharply within the past year. Cotton at double last year's price now costs the tape manufacturer in the vicinity of 30 cents per pound (sheeting quotes 15 cents per yard and about one yard is required per pound of tape), and rubber sells around 35 cents per pound against 18 to 20 cents a year ago. Labor is not so difficult to secure, at least in representative plants where working conditions are thoroughly satisfactory, but the wage level is maintained at a high index figure. Automatic machinery is being utilized more and more in tape manufacture.

### Inexperienced Producers and Rising Costs Causing Unsteady Prices

SOME unsteadiness of prices in the tape market exists. This condition is due in part to the entrance of relatively inexperienced producers into the field, coupled with the rising cost of materials. In few lines of electrical manufacture has there been less appreciation of the meaning of quality products than in tape. In the past too much buying has been conducted on the theory that "tape is tape," and the difference between initial appearance and lasting quality has been overlooked by many purchasers. Hasty purchases based on the lowest obtainable quotation have been made without suitable study of the material offered and its record of durability in service.

### Steady Demand for Washers and Cleaners

WASHERS and cleaners appear to be doing a staple business, although the usual spring acceleration of demand is due. Competition is so widespread in this field and factories are so scattered that little complaint is being heard as to inability to supply local trade. Where particular makes are insisted upon at points far from the jobber's stock or producing plant, delay in filling orders is, of course, necessary in some cases; but, by and large, requirements have been well anticipated. New developments continue to interest the trade in the line of improved designs of apparatus, and the bearing of servicing is being considered more and more by dealers as a factor in securing satisfied customers. Reports have been received of some house-to-house motor-truck sales at cut prices, but these appear to be devoid of service features which are demanded and appreciated by intelligent buyers. On the whole, trade is in a healthy condition unless one deprecates the widespread manufacturing competition which characterizes current business in these outfits.

### Iron Manufacturers Keeping Well in Line on Raw Material Side

A STEADY and sustained demand for electric flatirons characterizes the current market, with little spectacular news. The manufacturers are very busy and by careful attention to buying for a well-studied demand are keeping well in line on the raw-material side. Prices remain firm; deliveries are on the whole in good shape, and the growth of new and old house wiring in many localities is stimulating sales. Normal replacement business and some duplication orders for reserve in the household equipment are adding to the total.

### Storage Battery Buying Quickened During Last Few Weeks

SUSTAINED interest in radio and increasing requests for proposals in connection with industrial and road truck service have quickened the buying of storage batteries during the past few weeks. Local stocks are being maintained only with difficulty, but manufacturing facilities were so increased during the past year or two that the situation has not given much trouble. Prices stiffened slightly on some types early this month. The expansion of central-station plants is resulting in some control-battery sales, and there is an active trade in starting and lighting batteries for motor-vehicle use as the season "goes into high" in automobile purchasing.

### Depending on the Government's Foreign Trade Pointers

INCREASING use of help and advice by the government's bureaus is seen in the recent report by the directors of the Bureau of Foreign and Domestic Commerce which stated that 135,000 personal calls were made in the interest of manufacturers during the year 1922. This is nearly double the number in any previous year. The Department of Commerce is encouraging co-operation with about seventy trade associations in the promotion of foreign trade through committees representing in all a membership of 150,000. The prospective users of the foreign bureau's service may have their names and interest in export trade recorded in the department's "Exporters' Index." At present this comprises fifteen thousand American merchants and manufacturers entitled to information on foreign trade opportunities and receiving confidential news bulletins.

### Study of Trade Necessary in Australia's Electrical Market

ASKED how the American manufacturer can increase his trade with Australia in electrical supplies and equipment, W. G. Watson, chairman and managing director of W. G. Watson & Company, Ltd., electrical engineers of Sydney, who is in San Francisco on business, stated to a correspondent of the ELECTRICAL WORLD:

"If you reduce your prices, you can

sell more goods. The present upward trend of prices of electrical goods in America is going to make it still more difficult to sell goods in Australia. If American manufacturers, exporters and shippers studied more fully the Australian requirements, it would be of considerable assistance to them.

"Appliance sales in Australia move about in the same proportion to population as in the United States. The electric ranges manufactured in the United States are too costly to allow for any large sales due to the high cost of getting the goods into the Australian markets. There exists an acute shortage of power, and plants almost everywhere are being increased in capacity. The completion of the Morwell scheme in Victoria will supply current at a pressure of 150,000 volts to Melbourne and other large cities. Steel core aluminum conductors and suspension insulators are being used."

### Germans Report Their Large Equipment Market Suffering

THE report of the Prussian Chambers of Commerce on German trade and industry during February states that in the electrical industry the inland purchasing power is weak. Neither official nor private customers dare place orders for large plant and machinery. Further, the partial fall of prices is causing some customers to hold back in the hope of further reductions. Foreign countries, for the most part, are showing reserve, in so far as the German prices, which have partly reached the world's market level and partly already exceeded it, admit of any competition. Accordingly a general falling off in orders is noticeable in high-pressure current articles, machinery, apparatus, installation materials and cables. The outlook for railway safety appliances is poor, and the sale of electric lamps in Germany and abroad shows no improvement.

### Germany's Electrical Exports via New York Double England's

SPECIAL preliminary figures showing imports of electrical goods through the port of New York during March showed that Germany sent \$32,905 and England \$17,123 worth. France sent \$14,643 and all other countries \$6,659. The highest value of an imported commodity from Germany was for sockets to the amount of \$7,731. No sockets were imported from England. Electric iron imports from Germany were valued at \$512. Other figures are as follows:

| | Germany | England |
|---|---|---|
| Batteries | \$512 | ... |
| Lighting fixtures | 4,170 | \$675 |
| Heaters | 804 | 108 |
| Plugs | 122 | 146 |
| Sockets | 7,731 | ... |
| Flashlights | 1,666 | ... |
| Vacuum cleaners | 30 | ... |
| Wireless apparatus | 963 | 370 |
| Bells | 2,533 | ... |
| Hair driers | 3,981 | ... |
| Carbons | 6,917 | 5,824 |
| Telegraph and cable apparatus | ... | 10,000 |

## The Metal Market

Most producers continue to quote copper at 17.37½ cents delivered, but report only occasional orders for small tonnages at that level. Copper is obtainable at 17.25 cents in two or three directions, but at that price also the volume of business has been small. Some forward copper has been sold at a considerable discount from this price, and consumers near New York where the freight rate is low have also been able to do better than 17.25 cents delivered. There is as yet no evidence of a buying movement, but it is thought that this cannot be postponed much longer, and few breaks in the ranks of producers holding for 17.37½ cents are expected. The export demand has also been weak.

The railway and electric subsidiary companies of the Public Service Corporation of New Jersey have placed orders for 4,000,000 lb. of copper to meet their operating necessities for the current year. All but a small part will be in the form of wire and cables. It is estimated that the electric company will consume about three-fourths of the total order to supply requirements for extensions.

NEW YORK METAL MARKET PRICES

| Copper | April 4, 1923 Cents per Pouod | April 11, 1923 Cents per Pound |
|---|---|---|
| Electrolytic | 17.37½ | 17.37½ |
| Lead, Am. S. & R. price | 8.25 | 8.25 |
| Antimony | 8.75 | 8.75 |
| Nickel, ingot | 30.00 | 30.00 |
| Zinc, spot | 7.65 | 7.55 |
| Tin, Straits | 48.00 | 48.00 |
| Aluminum, 98 to 99 per cent | 26.00 | 24.00 |

# The Week in Trade

**Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

INCREASED building construction and spring replacements are having a favorable effect on the industry in all parts of the United States. Motors and controlling devices are going to the industries in greater volume. Insulator manufacturers report unusually good business, some saying that the last month has been far above any month in three years. Shipments no longer hold stocks of commodities, but shortages are mostly due to lack of raw materials in the factories. Prices are stiffening in lamp cord, switches, tape, galvanized conduit and weatherproof wire.

**Boston** Business continues very active, with prices stiffening in lampcord, switch boxes, tape, galvanized conduit and weatherproof wire. Few shortages are reported by jobbers except in radio tubes. Road conditions still hamper the movement of heavy supplies by truck in the interior. Money is easy and no marked evidence of inflation was in sight Monday. Building operations gained 8 per cent over the first quarter of 1922 in the corresponding period this year, but a reaction in building is expected as a result of price changes in materials and labor shortage. Central-station expansion continues steady, and the construction of important interconnections is a factor in business.

**New York** Purchases in the retail trade are somewhat better, while buying from the jobbers is only fair. Manufacturers are buying raw materials in larger quantities and making many plant changes in view of increased production. Lamp sales during the week were in greater volume. Wire and wiring-device stocks are said to be lower owing to a heavy drain to new buildings. All supplies entering into central-station expansions are moving faster.

**Baltimore** Conditions are unusually bright, and prospects are for heavy business in every line with the opening of the spring season. There is a special drive on at the present time for the sale of cleaners and washers with a steady demand for this commodity. Storage batteries are very active with the supply normal. Radio equipment has fallen off to a certain extent owing to seasonal conditions. Wire is still very active.

**Atlanta** The general situation shows a continued gain in strength in practically every line, with a tendency toward price increases in the majority of electrical products. This is particularly true of all materials into which steel largely enters, and there are some expressions of opinion that slight increases will be noted in appliance lines before fall. One jobber reports that he has more unfilled orders on his books than at any time since 1920.

**Cleveland** Stability is reflected in the week's orders. Manufacturers have advanced prices slightly on copper products, but stocks are in good shape. New construction is keeping meters and fixtures in active demand.

**Chicago** Business continues very active, with jobbers and dealers reporting good demand for most commodities. Several advances were announced this week. Wire advanced approximately 5 per cent, porcelain 5 per cent and 10 per cent on certain types of insulators, wiring devices 10 per cent and transformers 5 per cent. Conduit prices remain the same, with an anticipated increase in prices of lock nuts and bushings.

# Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Conduit Boxes; Dry Batteries and Tape

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High-Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Radio | Washers and Cleaners | Irons | Storage Batteries |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boston** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Nml. | Nml. | Low | Low | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml | Low |
| Price trend | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Inc. |
| **New York** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act | Sdy. | Act. | Act. | Sdy. | Act. | Act.. |
| Supply | Nml. | Nml. | Nml. | Nml. | Low | Nml | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml | Nml |
| Price trend | Inc. | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Inc. |
| **Baltimore** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Slow | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Slow | Act. | Act. |
| Supply | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Chicago** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Act. | Act. | Act | Sdy. | Act. | Sdy. | Act. | Act | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Inc. | Firm | Firm | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Paul-Minneap.** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Firm | Firm | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Act. | Sdy. | Sdy. | Sdy | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Act |
| Supply | Low | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. |
| Price trend | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Sdy. | Sdy. | Slow | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow | Act. | Slow | Sdy. | Act. | Act. | Act. | Slow | Act. | Slow | Sdy. | Nml. |
| Supply | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Firm |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Sdy. |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | High | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Inc | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Inc. | Firm | Dec. | Firm | Firm | Firm | Firm | Firm |

**St. Louis** Sales of electrical supplies for the past month were approximately 20 per cent greater than for the same period in 1922. There is a splendid demand for radio sets, installation material for new buildings, automotive equipment and household appliances. The trend of prices is upward, especially on anything containing copper and steel. Some improvement is reported in the demand for pole hardware and all other materials used by public utilities.

**St. Paul-Minneapolis** Washers and cleaners are moving fairly well, but winter weather is holding this business as well as all others back. Prices seem more steady with a slight incline all along the line. The conduit situation is better. Radio is slowing up.

**San Francisco** Dealers' business is good with better sales on larger household appliances. Conduit boxes are in active demand with stocks low and prices firm. Tape stocks are normal. Recent packing changes have considerably stimulated quantity buying.

**Denver** Increasing prosperity in this region indicates a healthy demand for appliances of all types. Radio is holding up well, and as a consequence batteries and rectifiers when obtainable are moving also. Shortage in materials now appears to be due to manufacturers' inability to supply demand rather than to delayed transportation facilities. Uncertain prices are preventing placement of surplus stock orders. Collections have not shown the desired improvement.

**Portland-Seattle** Price levels remained about the same for the past week, but all building materials show a strong upward tendency due to very heavy demand. Wage scales have advanced in some of the building trades crafts. The increasing trend in prices of both material and labor is having a deterrent effect upon new building projects in some sections. Electrical jobbers report active industrial and central station demands, with a decrease in country business. Conduit stocks have materially improved in the past few weeks.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Pelton Water Wheel Awarded Large Pacific Coast Order

The Pelton Water Wheel Company, San Francisco, has been awarded a contract by the Portland Railway, Light & Power Company for furnishing a 72-in. butterfly valve for the lower end of the penstock and a 72-in. Johnson valve for the upper end of the penstock on its Oak Grove project. The turbine for this job which is now under construction at the Pelton shops is a vertical unit and will develop 35,000 hp. under a head of 850 ft. It will be the highest-head reaction turbine in the world.

## Approves Fixture Appeal

Assistant Secretary of the Treasury Moss approved last week the action of the Assistant Attorney-General at New York in appealing to the Court of Customs Appeals from the decision of the Board of General Appraisers in connection with the proper duty on electric light fixtures.

The appraisers' decision held that certain electric light fixtures classified as metal articles plated with gold or silver dutiable at 50 per cent ad valorem under paragraph 167 of the tariff act of 1913 were properly dutiable at the rate of 20 per cent ad valorem under the same paragraph of that act.

## Black & Decker Resume Payments on Common Stock

The Black & Decker Manufacturing Company, Towson, Md., manufacturer of portable electric tools, announces that the regular quarterly dividend has been declared on preferred stock, and that the payment of dividends on common stock has been resumed, these having been discontinued for about a year, following the recent depression.

## Wagner Electric 1922 Earnings Were $265,934

The annual report of the Wagner Electric Corporation for 1922 to its stockholders shows net operating earnings of $265,934 for the year 1922, after deducting physical depreciation and interest charges. After the payment of preferred-stock dividends of $52,500, earnings applicable to the common stock were $213,484, or at the rate of $2.73 per share on the outstanding common stock of the corporation.

All bank obligations were paid Aug. 11, 1922, and no bank borrowings were necessary to operations during the rest of 1922. The current liabilities shown reflect in general the normal obligations of the corporation incident to current business. Inventories of raw materials, work in process and finished products are priced at cost or the current market, whichever was lower. A very substantial improvement of the general business of the company was reflected in the last quarter of the year, and incoming sales for the first quarter of 1923 show a substantial increase over the same period in 1922.

## Combustion Engineering Handle Uehling Instruments in Canada

The Combustion Engineering Corporation, Ltd., and the Uehling Instrument Company have recently entered into an agreement whereby Uehling interests in the Dominion of Canada and Newfoundland will be handled exclusively by the Combustion Engineering Corporation, Ltd., with principal offices in Toronto, Montreal, Winnipeg and Vancouver.

## Inspiration Copper Sales Totaled $10,236,894

The Inspiration Consolidated Copper Company, in its annual report issued to stockholders last week, showed that its sales of copper in 1922 totaled $10,236,894, compared with $8,636,498 the preceding year. After expenses, depreciation and interest, there was an operating profit of $255,246, but an expenditure of $229,081 on account of suspension of operations left a net income of only $26,165, against a deficit in 1921 of $1,790,421.

Current assets at the end of the year, according to the Dec. 31 balance sheet, were $6,688,837, contrasted with current liabilities of $1,165,180. Of the current assets $2,518,745 consisted of cash and cash assets.

## De Forest Radio Sold

A controlling interest in the De Forest Radio Telephone & Telegraph Company, Franklin Street, Jersey City, N. J., has been secured by Edward T. Jewett, head of the Paige-Detroit Motor Car Company, Fort Street, Detroit, and associated local interests. Plans are under way for enlargements in the Jersey City works to double approximately the present capacity. Dr. Lee de Forest will act as consulting engineer for the new organization in the development of radio equipment.

## Ideal Electric Office Change

The Ideal Electric & Manufacturing Company, Mansfield, Ohio, has announced the consolidation of its Chicago office, formerly at 701 Fisher Building, with the Gebhardt Company & Associates, at 1419 Fisher Building, Chicago.

## Dwight P. Robinson Opens Philadelphia Office

The opening of a Philadelphia office is announced by Dwight P. Robinson & Company, engineers and constructors, New York City. The new office will be under the direction of Carl A. Baer, recently with the firm of Baer, Cook & Company, engineers, and a consulting engineer in the design of industrial, textile and power plants.

## Westinghouse Gets Philadelphia Order for 20,000 Meters

The Philadelphia Electric Company, which supplies the city of Philadelphia with electric light and power, has ordered from the Westinghouse Electric & Manufacturing Company 20,000 type OA watt-hour meters of various sizes. The value of the order was approximately $160,000.

The order, which is intended to satisfy the requirements of the Philadelphia company for several months, is one of the largest ever placed for such meters and is an indication of the very great increase in the demand for domestic lighting circuits. Although the size of the order is only in line with the general rapid improvement in the electrical industry throughout the country and is simply another evidence of the improvement in business conditions, specifically it is an indication of the large increase in home building activities in Philadelphia and other cities.

**The Ohio Brass Company, Mansfield, Ohio**, manufacturer of brass goods for electrical service, is planning for extensions at its local plant as well as at its branch works at Toronto, Ont. It is also purposed to make enlargements at the plant of the Ohio Insulator Company, Barberton, Ohio, a subsidiary organization, to increase the capacity approximately 50 per cent. Additional equipment will be installed at the latter works.

**The O. K. Battery Company, Dallas, Tex.**, has acquired property at 934-36 North Lancaster Avenue for a new plant for the manufacture of electric storage batteries and kindred electrical products. The structure is two-story and will be equipped for an output of about five hundred batteries daily.

**The Betts & Betts Corporation**, 645 West Forty-third Street, New York City, has made arrangements with Marshall & Company, Union League Building, Los Angeles, to handle its line of radio apparatus in the Pacific Coast territory.

**The Condensite Company of America**, Bloomfield, N. J., a division of the Bakelite Corporation, manufacturer of insulation products, will soon commence the construction of a new addition to its plant on Grove Street, to cost $32,000.

**The Bryant Electric Company**, Hancock Avenue, Bridgeport, Conn., will soon build a new addition 32 ft. x 56 ft., contract for which has been awarded.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in England (No. 5,960) for the best quality of copper rods for the manufacture of electric cables in quantity of about 60 tons per month.

An agency is desired in Denmark (No. 5,999) for machine tools, small tools, electrical material, etc.

The following inquiries have been received by the Philadelphia Commercial Museum, which will furnish names and addresses of the inquirers to any one desiring them and mentioning the number given: Parties in Bombay, India (No. 40,507), desire agencies for electrical goods, engineering supplies, etc. Addresses of concerns selling wireless telephone apparatus are desired by a party in Vera Cruz, Mexico (No. 40,568). A party in Stockholm, Sweden (No. 40,572), would like to communicate with manufacturers of forced-draft furnaces to be used with electric motor and blower.

THE AMERICAN MANUFACTURERS' FOREIGN CREDIT UNDERWRITERS, Inc., 110 William Street, New York City, have received an inquiry from a company at Tabasco, Mexico, which would like to get in touch with American manufacturers of batteries, flashlights and kindred electrical products.

INCREASING DEMAND FOR ELECTRICAL APPARATUS IN MEXICO.—Improvements to the electric service in the cities of Aguascalientes and Zacatecas, Mexico, and the extension of the electric lighting system to nearby towns, *Commerce Reports* states, has created an increasing demand for the cheaper electric household devices, such as electric flatirons, hot plates, toasters, etc.

LEONARD WORK, MANUFACTURERS' REPRESENTATIVE, 40 Rue Laffitte, Paris, France, desires to communicate with manufacturers of insulated wire and would like to receive prices and samples of the following; Annunciator wire, assorted colors; annunciator wire, twisted pairs, assorted colors; telephone twisted pair, inside wire; radio antenna wire, enameled wire for radio reactance coils, braided wire, rubber-covered sizes 16 to 12 (for lighting), braided rubber-covered fixture wire, and thin sheet copper such as is used for condensers in radio telephony.

PUBLIC UTILITIES OF VICTORIA, BRAZIL, LEASED TO AN AMERICAN-CONTROLLED COMPANY.—The public utilities of Victoria, Espirito Santo, Brazil, according to *Commerce Reports*, have been leased to the Servicos Reunidos de Victoria, S. A., which is controlled by George A. Hodge, who is an American. The lease covers the operation of a hydro-electric station, furnishing electricity for lighting and power, operation of tramways, telephone system, water supply and sewage system.

## New Apparatus and Publications

MOTOR STARTERS AND INDUSTRIAL SWITCHES.—The Square D Company, Detroit, has issued bulletins No. 20, No. 21 and No. 30, entitled "Motor Control Switches," "Wiring Data for Motors" and "Industrial Switches with Positive Quick Make and Quick Break and Cover Control Fused and Unfused" respectively.

PORCELAIN COVER FOR LINE TERMINALS.—A new porcelain cover for line terminals has been developed by the Square D Company, Detroit.

PUMP VALVE.—A new pump valve known as the "Seal" has been brought out by the Worthington Company, Inc., 115 Broadway, New York City.

PUMPING EQUIPMENT.—A leaflet distributed by the De Laval Steam Turbine Company, Trenton, N. J., describes and illustrates the "De Laval" pumping equipment in the new Baltimore refinery of the American Sugar Refining Company.

PANELBOARD.—The Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, is distributing a circular covering its dead-front panelboard.

BENCH DRILL.—The Wisconsin Electric Company, Racine, Wis., has placed on the market a new sensitive drill known as the "Dumore" type "A" drill.

ELECTRIC INCUBATOR.—The Petaluma (Cal.) Electric Incubator Company has brought out an improved model of its electric incubator.

IRONING MACHINE.—The Modern Home Appliance Company, Kansas City, Mo., has added an electric ironing machine to its "Sieben" line of electrical laundry equipment.

WINDOW-DISPLAY DEVICE.—An animated window-display device, "Sellsem," has been brought out by the Animated Advertising Service, 130 West Forty-second Street, New York City.

BELL-RINGING TRANSFORMER.—A bell-ringing transformer "No. 77," designed for doorbells, buzzers, etc., has been developed by the Jefferson Electric Manufacturing Company, 426 South Green Street, Chicago.

OUTLET BOX.—A new collar-clamp outlet box, "Merrico," has been brought out by the Merrill Company, Ipswich, Mass.

## New Incorporations

THE GREEN & TAYLOR ELECTRIC COMPANY, Hazard, Ky., has been chartered with a capital stock of $10,000 by J. G. Green, H. T. and A. T. Taylor.

THE FARMINGTON (N. C.) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of $15,000 by E. C. James, W. E. Kennen and C. A. Hartman.

THE WELCOME (N. C.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $50,000 by J. A. Johnson, Winston-Salem; W. O. Burgin, Lexington, and L. C. Ripple, Welcome.

THE LEAGUE CITY (TEX.) LIGHT & POWER COMPANY has been organized by W. M. Truxaw, E. T. Arnett and C. Trifon.

THE EVANS LIGHT & POWER COMPANY, Woodville, Tex., has been incorporated with a capital stock of $12,000 by T. E. and J. H. Evans and J. P. Lindsey.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

BOSTON, MASS.—The Edison Electric Illuminating Company will build an addition to its substation at East Boston, to cost $65,000.

BROCKTON, MASS.—The Edison Electric Illuminating Company contemplates extensions to its system.

EAST WALPOLE, MASS.—Electric power equipment will be installed in the proposed additions to the plant of Bird & Sons, Inc., to cost about $300,000. Monks & Johnson, 89 Chauncey Street, Boston, are architects.

WORCESTER, MASS.—The New England Power Company has been granted authority to issue $3,000,000 in capital stock, the proceeds to be used for a hydro-electric plant at Whitingham, Vt., erection of transmission lines, new substation at Lanesboro, etc.

HARTFORD, CONN.—The directors of the Connecticut Power Company have authorized an issue of $750,000 in capital stock to finance the erection of a 110,000-volt transmission line from the Agawam (Mass.) substation of the Turners Falls Power Company to the South Meadow plant of the Connecticut Power Company and a line from Hartford to New Britain.

NEW LONDON, CONN.—The Eastern Connecticut Power Company, it is reported, contemplates building an addition to its power plant at Uncasville, to cost about $400,000.

## Middle Atlantic States

CARMEL, N. Y.—The Carmel Light & Power Company contemplates extensions to its distributing lines. S. C. Dunning is treasurer and general manager.

COHOES, N. Y.—The installation of a 10,000-hp. generating unit is under consideration by the Cohoes Power & Light Corporation.

JAMESTOWN, N. Y.—The installation of two 500-hp. water-tube boilers with stokers and accessories in the municipal electric light plant and the erection of a 200-ft. radial brick chimney are under consideration by the Department of Water and Lighting. Melvin O. Swanson is general superintendent.

NEW YORK, N. Y.—Electric power equipment will be installed in the proposed ice-manufacturing and refrigerating plant of the Lion Brewery of New York at Ludlow and Whitlock Avenues, to cost about $400,000. Adolph G. Koenig, 405 Lexington Avenue, is architect.

UTICA, N. Y.—Plans for the proposed addition to the plant of the Munson Mill Machinery Company include a power house. The cost is estimated at $400,000. Charles Kiehm, Gardner Building, is architect.

WATERTOWN, N. Y.—Bids will be received by the Power Corporation of New York, Northern New York Trust Company Building, until April 10 for additional hydro-electric development at the Northern Utilities plant at Effley Falls. The work will include extensions to the present power station to house a 2,000-hp. generating unit, etc. Bids will also be received at the same time for a hydro-electric development at Flat Rock site on the Oswegatchie River, to develop 4,000 hp. W. P. Creager is chief engineer of the company.

YORKSHIRE, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, plans to erect a transmission line to Yorkshire and to install a substation here for light and power service in this district.

BAYONNE, N. J.—The Standard Oil Company of New Jersey, it is reported, will build a power plant at its local oil refinery, to cost about $500,000.

HAMMONTON, N. J.—The installation of a new substation, connecting with the Atlantic County Electric Company by means of a 22,000-volt transmission line and extensions and repairs to its distribution lines are under consideration by the Hammonton Electric Light Company. Charles A. Berry is manager.

NEWARK, N. J.—The Public Service Corporation plans to build a substation at 1223 Broad Street, to cost about $100,000.

ALTOONA, PA.—The Pennsylvania Railroad Company will install electric power equipment in the proposed machine and locomotive repair shop, to be erected at its local yards, to cost about $1,000,000.

ERIE, PA.—The Erie County Electric Company contemplates the extension of its 13,800-volt system for tie-line service and power customers and the erection of a substation at Twelfth Street and Pennsylvania Avenue. Contract has been awarded for the construction of a switch house at Twelfth and French Streets. P. G. Sturtevant is general superintendent.

HARRISBURG, PA.—An electric power plant for emergency service will be installed in the proposed operating building to be erected by the Bell Telephone Company at Pine and Court Streets, to cost about $2,000,000.

MEADVILLE, PA.—The installation of an ornamental lighting system on the main streets, to cost about $25,000, is under consideration.

PHILADELPHIA, PA.—The La France Textile Company, 4423 Frankford Avenue, plans to build a one-story power house.

PHILADELPHIA, PA.—The Philadelphia Electric Company has acquired a site on the Delaware River, near Ontario Street, as a site for a power plant.

PHILADELPHIA, PA.—Electric power equipment will be installed in the proposed addition to be erected by the W. H. McCahan Sugar Refining Company, Tasker Street, to cost about $400,000.

TOWANDA, PA.—The Towanda Gas & Electric Company will install a 375-kva. unit and a switchboard this summer. D. R. Smith is vice-president and superintendent.

WILKES-BARRE, PA.—The Wilkes-Barre & Hazelton Railway Company will build a transmission line to connect with the system of the Pennsylvania Power & Light Company, from which electricity will be secured.

WILLIAMSTOWN, PA.—The East Penn Electric Company has applied for permission to purchase the property of the Lykens Valley Light & Power Company and the Pine Grove Electric Light, Heat & Power Company. Extensions and improvements to the systems are contemplated.

CHARLESTON, W. VA.—The Dewey Furniture Manufacturing Company plans to install a power house in connection with

the rebuilding of its plant, recently damaged by fire, causing a loss of about $100,000.

KEYSER, W. VA.—The Keyser Electric Company contemplates increasing its output either by the installation of a new plant or the purchase of power. E. W. Lothrop is president.

MARTINSBURG, W. VA.—The Potomac Light & Power Company will erect a new 33,000-volt transmission line from Martinsburg to connect with the new steam plant of the Potomac Public Service Company at Williamsport, Md., this spring. W. M. Krise is general superintendent.

PIEDMONT, W. VA.—Renewal of its transmission lines and extending its lines to coal mines for motor service is under consideration by the Piedmont Electric Light & Power Company. Norris Bruce is secretary.

STUART, W. VA.—W. H. Clark, owner of the local electric plant, expects to replace the 50-kw. generator with a 75-kw. to 80-kw. machine, waterwheel type preferred. He may also add another waterwheel.

WASHINGTON, D. C.—Plans are being prepared by Stone & Webster, Inc., 147 Milk Street, Boston, for extensions to the Bennings Road Power Station of the Potomac Electric Power Company, to cost about $1,500,000. The equipment will include 20,000-kw., 60-cycle, 13,200-volt turbine generators, three 1,400-hp. boilers, etc.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until April 24 for 250 storage batteries for use at the Philadelphia and Pensacola (Fla.) navy yards. (Schedule 742.)

## North Central States

DETROIT, MICH.—Bonds to the amount of $12,000,000 have been approved by the voters for the construction of a new municipal electric light and power plant and $5,000,000 for street-railway extensions.

SEBEWAING, MICH.—Arrangements are being made for installing new equipment in the municipal electric light plant, for which contract has already been placed. The system will be changed from direct to alternating current. H. J. Davis is superintendent.

CLEVELAND, OHIO. — The Cleveland Electric Illuminating Company is planning to install one additional 25,000-kw., one 30,000-kw. Curtis turbine and four additional boiler units of 3,060 b.hp. each, together with necessary transmission and distribution lines. Robert Lindsay is president and general manager.

MOUNT GILEAD, OHIO. — The Mount Gilead Water, Light, Heat & Power Company will connect with the transmission line of the Morrow Public Service Company and purchase energy for local service. The present steam plant will be held for emergency service. L. C. Dye is secretary.

SABINA, OHIO.—The three-phase high-tension lines of the municipal electric system may be extended and transformers installed for power service. J. C. Phelps is superintendent.

AURORA, ILL. — The Western United Gas & Electric Company has issued $1,323,000 in bonds, part of the proceeds to be used for extensions and improvements.

ALMA, WIS.—New transformer installations and changes in the local light and power distribution system are under consideration by the Wisconsin-Minnesota Light & Power Company.

BUTTERNUT, WIS. — The Butternut Electric Light & Power Company will install an additional engine and generator and will rebuild some lines. W. J. Schulz is president and manager.

LA CROSSE, WIS. — The Wisconsin-Minnesota Light & Power Company has issued $323,750 in capital stock, part of the proceeds to be used for extensions and improvements.

OCONTO, WIS.—The Northeastern Power Company is considering improvements to its Peshtigo water-power station, to cost about $25,000, and also improvements to the local distribution system, to cost about $50,000. Both properties were recently acquired by the company.

PRAIRIE FARM, WIS. — The Prairie Farm Electric Company is planning to change its plant from direct current to alternating current, 2,200 volts, three-phase, 60 cycle. J. A. Helland is president and manager.

RIVER FALLS, WIS.—The installation of a 200-hp. oil engine to operate a 175-kva. alternator in the municipal electric power house is under consideration. F. V. Williams is city clerk.

ELKADER, IOWA.—The People's Electric Service Company contemplates a new hydro-electric development, the erection of about 20 miles of transmission lines and the installation of distribution systems for rural service. W. C. Reimer is secretary and treasurer.

HARTLEY, IOWA.—The Municipal Electric Light Department contemplates erecting a number of rural lines this summer. Fred A. Raasch is superintendent.

OSKALOOSA, IOWA. — Bonds to the amount of $370,000 have been voted for the installation of a municipal electric light plant.

HIGGINSVILLE, MO. — The Board of Water and Light Commissioners is considering buying power from the Kansas City Power & Light Company or purchasing additional equipment for the municipal electric plant during the coming year. O. L. Hebbler is superintendent.

KANSAS CITY, MO. — The American Paper Manufacturing Company contemplates the construction of a power house in connection with a new mill at North Kansas City, to cost about $100,000.

MONETT, MO.—The St. Louis-San Francisco Railroad Company will install electric power equipment in connection with the rebuilding of its local shops, recently destroyed by fire, with loss of $350,000.

ORAN, MO.—Plans are being prepared for a municipal power plant and waterworks, to cost about $40,000. W. A. Fuller, Railway Exchange Building, St. Louis, is engineer.

CROSBY, N. D.—The erection of a high-tension transmission line from Noonan to Crosby is under consideration by the Crosby Light & Power Service. K. S. Huso is manager.

STANLEY, N. D. — The Public Utility Company contemplates erecting a new pole line and distributing system. R. F. Wherland is manager.

ASHTON, NEB. — Extensions to the street-lighting system are under consideration by the Council.

CODY, NEB.—Plans are being prepared for the erection of a transmission line for local service. The municipal lighting plant will be closed down.

FAIRBURY, NEB.—The installation of one 1,500-ft. or 2,000-ft. surface condenser in the municipal electric light plant is under consideration. G. D. Myers is manager.

HARRISON, NEB.—Extensions and improvements are contemplated to the municipal electric light plant, including the installation of a 75-hp. Fairbanks engine and a 60-kva. generator, and changing the system from single-phase to three-phase. T. L. Iversen is superintendent.

ORLEANS, NEB.—The Light and Power Department contemplates extending the municipal transmission lines to Stamford, a distance of 8 miles. N. E. Lideen is manager.

ANTHONY, KAN. — The Anthony Salt Works, Inc., plans to rebuild its power house and mill, recently destroyed by fire, causing a loss of about $250,000.

HUMBOLDT, KAN. — The Humboldt Light & Power Company contemplates the erection of 21 miles of transmission line to take in the towns of Lone Elm, Kincaid and Blue Mound. Work is under way on the construction of a dam and power plant at Neosha Falls, to develop 300 hp. Dwight C. Diver is secretary and treasurer.

INDEPENDENCE, KAN.—Bids will be received by Hugh W. Crawford, city engineer, until May 1 for three motor-driven centrifugal pumps, one of 1,550 gal. per minute and two of 775 gal. per minute, with necessary electric equipment, etc.

WICHITA, KAN.—Plans are under way for the construction of a co-operative power plant, to cost about $150,000. D. S. Jackman, 715 East Thirteenth Street, is interested.

## Southern States

ALBEMARLE, N. C.—The Almond Light & Power Company contemplates extensions at its local power plant. Substations will be built at New London and Richfield, and transmission lines will be erected.

CHAPEL HILL, N. C.—The installation of an engine-driven generating unit of 300 kva. or 500 kva. capacity in the university power plant is under consideration. J. S. Bennett is general superintendent.

COOLEEMEE, N. C.—The Cooleemee Ice & Laundry Company plans to construct a power house in connection with a new ice-manufacturing plant.

WALLACE, N. C.—The Tidewater Power Company plans to erect a transmission line to Wallace and a line from Warsaw to Clinton, about 70 miles.

CLINTON, S. C.—The Lydia Cotton Mills contemplates the construction of a power house in connection with a new mill, to cost $750,000.

MACON, GA.—The Massee & Felton Lumber Company contemplates the construction of a power house in connection with the rebuilding of its mill, recently destroyed by fire.

CLEARWATER, FLA.—The Clearwater Lighting Company has arranged for a merger with the St. Petersburg (Fla.) Light Company. Extensions and improvements will be made in the systems.

MIAMI, FLA.—The Tropical Radio Company plans to erect a wireless terminal plant at Hialeah, near Miami, to cost about $250,000, including power plant and equipment.

CHATTANOOGA, TENN.—The directors of the Tennessee Electric Power Company have authorized an expenditure of $1,800,000 for further development of the hydro-electric plant at Great Falls.

CLEVELAND, MISS.—The Home Light & Ice Company contemplates the erection of a transmission line to Boyle to supply electricity to the Boyle Electric Light Company. F. G. Proutt is treasurer.

GLENMORA, LA.—The Glenmora Power Company, Inc., contemplates installing another generating unit this year, consisting of a 100-hp. oil engine and generator. T. L. McNicoll is treasurer and manager.

WELSH, LA. — Improvements are contemplated to the municipal electric plant during this year, including the installation of an 180-hp. engine (Busch Sulzer Brothers) and probably an ice plant of from 10 to 15 tons capacity. John F. Smith is superintendent.

CUSHING, OKLA.—The Illinois Refining Company plans to install electrically operated pumping plants in connection with a 60-mile pipe line to the Tonkawa oilfields, to cost about $200,000.

FORGAN, OKLA.—Plans are being considered for the installation of a 100-hp. Fairbanks-Morse oil engine directly connected to a 60-kw. alternator, also to erect 1 mile of new pole line and about 16,000 ft. of new copper wire. E. E. Crites is superintendent.

SULPHUR, OKLA.—The Oklahoma Light & Power Company has acquired the local power plant. It will be remodeled for a substation. A transmission line will be erected from Pauls Valley.

TULSA, OKLA.—The Prest-O-Lite Company, Indianapolis, Ind., contemplates the construction of a power house at its proposed local plant for acetylene gas production, to cost about $250,000.

TULSA, OKLA.—The Texas Company, New York, contemplates extensions to its power plants in connection with proposed additions to its oil refineries at West Tulsa, Port Arthur and Port Neches, Tex.; Lockport, Ill., and Casper, Wyo. An appropriation of $10,000,000 has been made.

FENTRESS, TEX.—The Fentress Gin Company contemplates changing its electric system from direct to alternating current. J. C. Dauchy is manager.

FORT WORTH, TEX. — The National Lumber & Creosoting Company, Houston, plans to build a power plant in connection with its proposal local wood treatment works, to cost about $100,000.

FORT WORTH, TEX.—Electric power equipment will be installed in the printing plant to be erected on Jones Avenue near Second Street by the World Company, Inc., to cost about $500,000.

MIDLAND, TEX.—The Midland Light & Power Company plans to build an addition to its power plant, to cost about $25,000. Transmission lines will be erected to Odessa and vicinity.

NOCONA, TEX. — The Nocona Ice & Light Company contemplates installing a 150-hp. engine and generator and to erect transmission lines to towns off the line to Terrall and Ringgold. J. W. Lehman is president and manager.

RISING STAR, TEX.—The Rising Star Light & Power Company plans to install additional 80-hp. gas engine directly connected to generator and to extend its service mains. Wright L. Felt is president.

## Pacific and Mountain States

LONGVIEW, WASH. — The Long Bell Lumber Company, Kansas City, Mo., contemplates the construction of a power plant in connection with its proposed mills, to cost about $1,500,000.

WASHOUGAL, WASH. — The Western Light & Power Company contemplates the erection of 6 miles of transmission line, using No. 2 bare copper wire. C. W. Cottrell is president.

DAYVILLE, ORE.—Application has been filed at the office of the State Engineer by H. H. and R. B. Cummings to appropriate 15 second-feet of water from the south fork of the John Day River for irrigation and power purposes. The project includes a dam, 4.4 miles of ditch, a Hunt turbine and a 200-kw., 60-cycle alternator. The cost is estimated at $25,000.

EUGENE, ORE.—The installation of an 1,800-hp. generating unit in the municipal electric plant is under consideration. C. A. McClain is secretary and superintendent.

ALHAMBRA, CAL.—E. K. Davis and associates plan to build a hydro-electric plant on Deer Lake.

ARROYO GRANDE, CAL.—Steps have been taken for the installation of an ornamental lighting system.

CORNING, CAL. — The Pacific Gas & Electric Company will make extensions and improvements to its local system, including the installation of new lamp standards, to cost about $53,600.

FRESNO, CAL.—Bids will soon be asked for the installation of an ornamental lighting system, consisting of ninety-nine single-lamp standards, to cost about $25,000.

FRESNO, CAL.—The San Joaquin Light & Power Corporation will build a mechanical plant at Orange and California Streets, including a meter-testing and repair shop, transformer-testing station, transformer warehouse, pole-treating plant, cross-arm mill and machine shop, to cost about $300,000.

LOS ANGELES, CAL. — The Southern California Edison Company contemplates an expenditure of $26,000,000 for extensions and improvements during the present year as follows: $11,851,000 for hydro-electric power development, $4,149,000 for substations and transmission lines, $265,000 for steam and water-power plants, $6,800,000 for distributing lines and stations, $1,400,000 for miscellaneous equipment, and $1,535,000 for low-voltage transmission lines.

SAN FRANCISCO, CAL.—F. B. Cross, care of Rudolph W. Van Norden, Mills Building, engineer, has been granted permission to construct a hydro-electric plant on Deer Creek, Tehama County, to develop 18,600 hp., to cost about $1,700,000.

SAN FRANCISCO, CAL. — The Utica Mining Company, 575 Mills Building, plans to install a hydro-electric plant on Highland Creek, Tuolumne County, to develop 3,300 hp., at a cost of about $150,000.

ST. GEORGE, UTAH.—The Dixie Power Company has applied to the State Engineer for permission to divert 30 cu.ft. of water from the Santa Clara River in Washington County for power purposes. The plans call for a development of 800 hp. and will include a channel 30,450 ft. to divert the water and a 5-ft. Pelton waterwheel.

LIBBY, MONT.—The Libby Water & Electric Company contemplates building a dam, 50 ft. high and also the installation of a second-hand 250-kw., three-phase, 2,300-volt generator and Pelton waterwheel and may possibly purchase about 2,000 ft. of 24-in. conduit or pipe to carry 250 ft. static head. Judson Bibb is manager.

STOCKTON, CAL.—The Western Gas & Electric Company is building a new hydro-electric plant on the South Fork of the American River, to have an ultimate capacity of 100,000 hp. The initial unit of 27,000 hp. will be completed by the latter part of this year. B. F. Wellington, Jr., is secretary and treasurer.

WORLAND, WYO.—The Big Horn Light & Power Company contemplates installing two 100-kw. generators, directly connected to generators, and the erection of transmission lines from the hydro-electric plant to Worland; also to install two 50-kw. natural-gas units this summer. M. W. Thompson is secretary and manager.

KEMMERER, WYO.—The Frontier Supply Company contemplates the installation of a 2,000 kw. Curtis turbo-generator unit. P. J. Quealy is president and manager.

SANTA FE, N. M.—The Santa Fé Water & Light Company is installing a 500-kw. Curtis steam turbine. A. J. Griffin is manager.

## Canada

EDMONTON, ALTA. — The Department of Railways and Telephone contemplates 1,500 miles in telephone extensions, to cost about $800,000.

BARRIE, ONT. — The installation of about 6,000 ft. of underground work is under consideration by the municipal electric light department. J. A. Hare is superintendent.

CAMPBELLFORD, ONT. — The Hydro-Electric Power Commission of Ontario contemplates a 10,000-hp. development at Dam 8 on Trent River, near here, to cost about $1,066,000. F. A. Gaby is the chief engineer.

FORD, ONT.—The Town Council is considering an issue of $26,000 in debentures for extensions to the local Hydro-Electric system.

PARIS, ONT.—The Hydro-Electric and Water Commission contemplates increasing the transformer capacity of substation. Fred Bishop is secretary and treasurer.

TORONTO, ONT. — The Hydro-Electric Power Commission of Ontario is planning to erect a 100-mile steel-tower transmission line from Niagara Falls to St. Thomas, to cost about $1,000,000. F. A. Gaby is chief engineer.

TORONTO, ONT.—Extensions and improvements to lighting and power systems, to cost about $2,000,000, are under consideration by the Toronto Hydro-Electric System, to include transformers, wire, cables, concrete poles, etc.

WALKERVILLE, ONT.—The City Council has granted the petition of the local Hydro-Electric Commission for an appropriation of $50,000 for extensions to the Hydro-Electric system this year.

YORKTON, SASK. — Extensions to the municipal electric system, to cost about $100,000 are under consideration.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued March 20, 1923)

1,449,167. DISCHARGE TUBE FOR ELECTRICAL APPARATUS; G. Collins, Chicago, Ill. App. filed Sept. 30, 1920. For medical applications.

1,449,201. ELECTRIC FLATIRON; A. H. Smith, New York, N. Y. App. filed April 14, 1921. Control switch operated by handle.

1,449,202. STREET-CAR BARN; W. F. Snohr, Chicago, Ill. App. filed Feb. 10, 1922. Providing means for quickly moving cars in case of fire.

1,449,206. METHOD OF AND APPARATUS FOR HEAVY SPOT WELDING; J. M. Weed, Schenectady, N. Y. App. filed Nov. 29, 1920. For spot welding heavy plates and structural parts.

1,449,239. CONTROLLER FOR ELECTRIC MOTORS; N. L. Mortensen, Milwaukee, Wis. App. filed May 31, 1921. Controller adapted for series-parallel commutation of plurality of motors.

1,449,248. COMINATION LOCKING MECHANISM; G. D. Rathbun, Kansas City, Mo. App. filed Sept. 14, 1921. Electromagnetic combination locking mechanism for doors.

1,449,249. RHEOSTAT; J. T. Rhamstine, Detroit, Mich. App. filed Aug. 8, 1922. Filament rheostat for radio sets.

1,449,251. ELECTRIC FURNACE REGULATOR; J. A. Seede, Schenectady, N. Y. App. filed Feb. 4, 1920. Automatic control of electrodes.

1,449,253. UNIDIRECTIONAL RECEIVING SYSTEM; M. S. Strock, Washington, D. C. App. filed Sept. 23, 1921. Circuit employs two tubes.

1,449,278. ELECTRIC IRON; A. Fleming, Alexandria, Va. App. filed Feb. 10, 1921. Automatically controls current.

1,449,305. APPARATUS FOR TEACHING TELEGRAPHY; E. H. Snyder, Baltimore, Md. App. filed July 15, 1921.

1,449,307. ELECTRIC FURNACE; L. Tagliaferri, Genoa, Italy. App. filed March 25, 1920. Arrangement of electrodes for supplying and distributing current.

1,449,319. PROCESS OF MELTING AND DEOXIDIZING STEEL; A. E. Greene, Seattle, Wash. App. filed May 3, 1916. Treating with special slag in electric furnace.

1,449,357. FILTER INDICATOR FOR X-RAY SYSTEMS; H. F. Waite, New York, N. Y. App. filed Sept. 28, 1921. Indicates whether undesired waves are passing through screen.

(Issued March 27, 1923)

1,449,370. CURRENT-CONTROLLING DEVICE; V. G. Apple, Dayton, Ohio. App. filed Jan. 17, 1919. Combined starting switch, automatic current regulator and overload and underload cut-out for automobile generators.

1,449,371. METHOD OF CONSTRUCTING ARMATURES FOR DYNAMO-ELECTRIC MACHINES; V. G. Apple, Dayton, Ohio. App. filed Sept. 15, 1919. Windings of armature inclosed in refractory insulating armor.

1,449,372. SYSTEM OF TELEPHONY; H. D. Arnold, East Orange, N. J. App. filed Dec. 1, 1915. Wireless signaling by means of modulated high-frequency waves or currents.

1,449,382. METHOD AND MEANS FOR SIGNALING WITH HIGH-FREQUENCY WAVES; J. R. Carson, New York, N. Y. App. filed Dec. 1, 1915. Similar to Squier high-frequency telephone system.

1,449,391. COMBINATION FLASHLIGHT AND TOILET ARTICLE; L. Franklin, New York, N. Y. App. filed March 9, 1922. Electrically lighted vanity case.

1,449,406. ELECTRIC HEATER; M. E. Householder, Pittsburgh, Pa. App. filed Oct. 29, 1921. Resistance-wire water heater.

1,449,425. HEATING SYSTEM FOR TYPESETTING MACHINE CRUCIBLES AND THE LIKE; E. N. Lightfoot, New York, N. Y. App. filed Oct. 10, 1916. Automatically governs electric heaters for linotype pots.

1,449,437. FLOW METER; J. A. Obermaier, Chicago, Ill. App. filed Jan. 2, 1918. Totalizing meter operated by pilot tubes in pipes and variable resistance.

1,449,460. CLAMP FOR BINDING SCREWS AND THE LIKE; B. G. Thomas, Bridgeport, Conn. App. filed Dec. 20, 1918. For lamp sockets, switches, cut-outs, etc.

1,449,462. METHOD AND APPARATUS FOR THE ELECTROLYTIC RECOVERY OF COPPER; G. D. Van Arsdale, New York, N. Y. App. filed Sept. 24, 1920. Precipitation of copper from mine waters.

1,449,487. TELEPHONE SYSTEM; E. M. Ashworth, Toronto, Ontario, Can. App. filed April 7, 1920. Automatic-exchange.

1,449,500. CONTROLLING MECHANISM FOR ELECTRIC MOTORS; W. Davis, Chicago, Ill. App. filed June 12, 1922. Speed governor for automobile motors.

1,449,501. TELEGRAPH INSTRUMENT; O. R. Dorris, Harney, Minn. App. filed Aug. 1, 1921. Telegraph sounder operated directly by current from main circuit.

1,449,511. TELEPHONE SYSTEM; H. H. Ide, La Grange, Ill. App. filed Feb. 14, 1919. Two-wire type where directively controlled switches are operated by subscribers' circuits.

1,449,517. HEATING IRON FOR MELTING PLASTIC SUBSTANCES; H. F. Lame, Jersey City, N. J. App. filed March 28, 1922. Wax, glue, etc., electrically heated and melted in tube from which it is applied to object.

1,449,539. DYNAMO-ELECTRIC MACHINE; A. H. Neuland, Jersey City, N. J. App. filed Aug. 21, 1920. Electric transmission for automobiles.

1,449,557. RHEOSTAT; L. A. Seiss, Toledo, Ohio. App. filed May 6, 1922. Vacuum-tube-filament rheostat.

1,449,573. CONTROLLING SYSTEM; W. P. Albert, Newark, N. J. App. filed May 1, 1920. Control of step-by-step telephone equipment.

1,449,577. DYNAMO-ELECTRIC MACHINE; C. O. Bergstrom and P. de Clamecy, Boston, Mass. App. filed Aug. 18, 1919. Construction of fractional-horsepower motors that reduces their weight.

1,449,578. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed June 25, 1919. Control of electrodes.

1,449,579. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Nov. 6, 1919. For governing movable electrodes of electric furnaces.

1,449,593. FURNACE REGULATOR SYSTEM; R. D. Evans, Wilkinsburg, Pa. App. filed Oct. 30, 1918. Movable electrodes automatically raised and lowered.

1,449,627. ELECTRIC INCANDESCENT LAMP; E. Rohner, Rheineck, Switzerland. App. filed Dec. 14, 1921. Two-filament lamp.

1,449,632. ELECTRIC WAVING IRON; E. R. Talbot, Chicago, Ill. App. filed March 6, 1922.

1,449,644. TELEPHONE SYSTEM; C. White, East Orange, N. J. App. filed Dec. 30, 1919. Signaling circuit wherein simplexed physical lines are utilized.

1,449,658. ELECTRIC LAMP FIXTURE; M. F. Deach, Oakland, Cal. App. filed Oct. 27, 1920. Extension-arm lamp.

1,449,694. PROTECTIVE DEVICE; F. W. Peek, Jr., Pittsfield, Mass. App. filed Sept. 18, 1919. Resistance between transmission line and insulator for protection against surges.

1,449,722. HIGH-FREQUENCY SIGNALING SYSTEM; W. R. G. Baker, Schenectady, N. Y. App. filed Sept. 17, 1921.

1,449,725. ELECTRICAL APPARATUS; F. R. Beckert, Schenectady, N. Y. App. filed Oct. 18, 1921. Potentiometer for electron tubes.

1,449,746. ELECTRIC BATTERY OR ACCUMULATOR; W. H. Exley, Woking, and G. H. Handasyde, West Byfleet, England. App. filed Jan. 6, 1923. Arrangement of electrodes in minimum space.

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# Thinking Ahead

GOOD fortune has played a large part in the prosperous development of the electrical industry. Steam and electric railways and gas companies have all seen slumps come in the market for the services they render. But there has been no setback in the demand for electric light, heat and power. There may not be for many years. The convenience, the flexibility, the adaptability and the cheapness of electrical service are the reasons.

But the electrical industry cannot be content to await expansion and progress through the influence of accident or fortunate environment. The great majority of men attain their position and prosperity through sheer merit, the constructive application of their brains and imagination. And so it is with an industry. It must plan and promote its evolution as well as concern itself with the activities of the day.

There are tremendous possibilities for service and achievement in the electrical industry. Problems and opportunities of the past are overshadowed by the problems and opportunities of the future. But, just as truly, the possibilities for disaster are equally tremendous if the fabrication of the great structure which the future will reveal is left too much to chance or unsound thinking.

Today's problems of engineering, operating and financing electric power systems are absorbing. And there are questions of public relations, of selling equipment to present customers, of wiring buildings, now at hand. But these activities are actually preparatory. The great conceptions of complete water-power development, of fuel utilization at the mines for conversion into electric power, and of great interconnected superpower systems that will serve the entire land at maximum efficiency—these are all preparatory.

History will some day write the record of this industry in terms of the service which electricity has rendered to mankind, its contribution to civilization. It will list the complete electrical equipment of industry, of the home and of the farm and the establishment of universal communication as its great achievements. These are the objectives—toward them there should be the best constructive study and thinking. Whether it is in power generation, transmission or distribution, in finance or in merchandising, there are many large problems which should be clearly formulated, the proper solution to which will have an all important bearing on the future realization of today's hopes. Even though in the midst of present pressing problems, specific and co-ordinated study of the problems connected with the future's structure should be energetically pursued. Definite planning ahead even ten years would be a great advance. No more important work can be done by the industry's organizations if the work of today is to build adequately and soundly for the future.

# Charles Leo Eidlitz

*A successful and prosperous electrical business man who has devoted himself for years to the betterment of the electrical contractor.*

THE progress of the electrical industry has been achieved locally. Great central power stations may serve broad areas and scattered populations, but it is in the homes and business places of the communities that new and more applications of electricity are effected and that actual industry growth is realized. The electrical contractor—the man who wires buildings for the introduction and the use of electric service—is therefore an important element to all the industry. All are greatly concerned that he should prosper and expand. No man in the country has done more or is doing more today, however, to mold this contractor into the better instrument needed for the advancement of electrical progress than Charles L. Eidlitz, recently appointed a special commissioner to act as the Judge Landis of the electrical contractors of New York.

Mr. Eidlitz has had an interesting and useful career. Born in 1866 in New York City, he came to manhood just at the time when the first popular wonders of electricity were unfolding. While a student at Columbia he decided to become an electrician and joined the old Bergman Electric Works. From there he shifted to the Edison Machine Works when Edison and Sprague were carrying on their experiments there. Then he became inspector of installations for the Edison United Manufacturing Company and then joined the Edison Wiring Company.

With two others he later organized an independent contracting company which he acquired in 1889 and renamed the Charles L. Eidlitz Company. This company he developed into an exceedingly prosperous business. In 1913 he turned it over to his employees. Meanwhile he had also become interested in manufacturing and general sales through the purchase and expansion of the Metropolitan Electric Manufacturing Company and the Charles E. Corey Company, of which he is now head.

Mr. Eidlitz has devoted a large amount of time and effort to trying to make a better business man of the electrical contractor. In 1892 he organized the first local association of electrical contractors in America. Shortly afterward he helped organize the first state association of contractors and in 1901 was the first president of the National Association of Electrical Contractors.

# Editorial Comment

Electrical World, April 21, 1923

Volume 81 Number 16

### Right to a Reasonable Return Again Upheld

THE decision of the United States Supreme Court in the case of the Public Service Commission of New York vs. New York Telephone Company serves again to remove from ambiguity and doubt the right of a public utility to appeal to the federal courts for relief from rates deemed by it to be confiscatory. It was the contention of the Public Service Commission of New York that the utility, instead of applying to the federal courts for an injunction, should first have asked the commission to reopen the hearings and in case of a refusal an appeal should have been taken to the state courts. That it was not necessary under the law as it exists for the utility to apply to the commission for a rehearing before resorting to the federal courts was very clearly set forth by the Supreme Court. The decision of the court, which was unanimous and reaffirmative of the right of a utility to a fair and reasonable return on its investment, should once more set at ease the minds of commissions, utilities and the public on a point which cumulative decisions have definitely removed from the realm of peradventure.

### America Not Alone in Rural-Service Problem

THE facilitation of the use of electrical energy in agriculture is not exclusively an American problem. The technical press of other countries contains editorial and contributed articles that, with a few changes in phraseology to conceal the locality in which they were written, could be published in the United States without a suspicion that they were not written to describe our own conditions.

The English technical press is discussing the problem of how to finance farm lines when the rural use of energy as compared with its urban use is so small. Fear to put the rates at a point which will make the service stand on its own merits is exhibited, and the lack of equipment and methods which will allow the farmer to use a large volume of energy is apparent. The French government is reported to have provided one-third of a huge subsidy, the other two-thirds of which is to be provided by agricultural organizations. With this sum the necessary distribution lines to afford service to French farmers will be built. Germany and the Scandinavian countries are also wrestling with the rural-service problem.

All this indicates that agriculture in the civilized world is looking to the electrical industry for some of the help that electricity has already given industry in general. No one as yet knows just how that help is to be given; but every one who has given the movement careful thought knows that if the help shall be forthcoming, it will mean a real revolution in agricultural production methods. American agricultural engineers of standing take the position that a proper development of the use of electrical energy on the farm will be the biggest step forward that agriculture has ever taken, because it means bringing home to the farmer the importance of the entire farm-power problem as a factor in more economical production. These men point out that, with human labor costs constantly rising and with living conditions on an ascending plane, the problem of the farmer, like that of the manufacturer, is to increase the productive ability of the human worker by taking from him the tasks that mechanical equipment can accomplish much more economically so that he can devote his time to keeping machines at work.

It is the old industrial question of labor-saving machinery in a new guise, and the electrical industry is being urged to solve the problem because of the part it has played in solving the same problem for other industries.

### New Two-Rate System Brings Desirable Results

THAT a form of rate for residential service containing a fixed charge for which the customer receives no energy cannot be made successful is a pet hobby which many central-station men have ridden for years. Attempts to hide the fixed costs by spreading them over the first units of energy consumption have been made, and, to protect the utility from loss due to the consumer who refuses to use enough energy to return to the company its fixed costs of service, some form of minimum charge is usually imposed. Most of these methods seem to have been unproductive in the way of the development of energy use on the part of the consumers, and on many systems, particularly the smaller central stations, they seem to have created a large body of consumers who are not carrying their fair share of the costs of service. In one way or another the deficit is made up at the expense of other classes of consumers.

That the problem can be successfully attacked in another way is rather strikingly indicated by the experience of the past year at Hartford, Conn. A rate consisting of a flat charge for which no energy is given, plus a low energy rate, was substituted for a straight-line meter rate that apparently did not encourage an increase in energy consumption among residential consumers. The new rate is of a form that has been used before in other communities; that is, nothing absolutely original in the way of rate structure is claimed. But that the new rate has been successfully "put over" to supersede an old 10-cent flat rate is indicated by the fact that after a year's trial less than two-tenths of 1 per cent of the residential customers asked to go back to the old form of rate, restitution of which was promised by the company if the consumers requested it at the end of the year. The manner in which this result was obtained was a triumph of

diplomacy. The curve of increased consumption shows a better shape than under the old rate.

The big lesson in the situation is the way in which it was handled. Nothing mysterious was attempted—just plain, straightforward laying of the cards on the table on the assumption that the people of the community were competent to judge the merits of the whole proposal. Judicious and continuous effort to show the consumers how to use the new rate form profitably to themselves is the other half of the story. No politics, no sleight-of-hand or back-room work—just plain, straightforward business.

The question of a proper residential rate is still, after all the years of experience and experiment, an unsettled one. Other things being equal, the simpler the rate, the better. While Hartford's new rate is not the simplest possible, yet the experiment is illuminating and the story is worth careful study on the part of central-station executives plagued with the problem of a large body of consumers who are not using the energy they can afford and who are deterred by rate forms that impose a penalty for increased use rather than encourage it.

## Refinements Worth While in Hydro-Electric Plant Design

THE more one studies hydro-electric plant design, the clearer it becomes that this is no work for the "catalog engineer." This conclusion is not based upon recent advances in prime-mover development, striking though they have been. What might be called the structural side of water-power installations is receiving increased attention from engineers as well as the problems connected with the selection and regulation of generating units, and it is a question whether utility executives in general appreciate the refinements which are now considered essential for analysis by competent technical minds charged with the task of conserving water for efficient use in electric systems.

Old as the development of water power by the use of dams and reservoirs is, there are many unsolved problems here. Off-hand judgments as to the type of dam best suited to particular cases have no place in the budget of a modern hydro-electric installation. The most skilled engineering opinion is essential upon such points as the allowance to be made for upward pressure, the design of waste gates, the provision for automatic, non-automatic or combination flashboards, and the desirable shape of intakes, scroll cases and rack sections. These may be the problems of the civil engineer, but electrical and mechanical men should also consider them in station development and be prepared to discuss them intelligently in striving for a well-balanced layout. There is a growing consensus of opinion that the sheet of waste water discharged over the crest should be closely conformed to the down-stream surface of a dam, for aside from the possibilities of increased erosion where there is a gap between the dam and the water, in some cases lately mechanical disturbances to neighboring windows and buildings have been noticed which should be eliminated. Operating difficulties arising from improper gate design may become very burdensome, and more attention should be paid to obtaining high-quality castings, anchor bolts of tested material, stop-log slots of fabricated shapes of adequate dimensions, duplex gate stems and sectionalized runways around headworks and forebays. In many instances the ordinary commercial sizes of channel irons are too thin for the best results in stop-log guides, a plate and angle design giving more reliable service. It is an expensive and difficult job, as a rule, to repair submerged structures.

From the intake at the dam to the tailrace, hydraulic experts are studying the shape of all water passages with intense interest. Even the cross-section of trash-rack bars is being analyzed, and in some jobs rounded corners and even special shapes to reduce friction losses are now specified. It may seem meticulous to put high-priced time upon such a question as the desirable angle between the axes of rack bars and the line of advance of the water stream in taking off, for instance, a lateral discharge from a canal to penstocks or wheel inlets; but in a large development with restricted storage facilities all reasonable means of obtaining more kilowatt-hours annually must be weighed. Hydraulic losses in general increase as the square of the water velocities, and there is some danger that engineers whose experience has been confined chiefly to waterworks practice will fail to realize the increased quantities and speeds involved in hydro-electric development work, if they do not get the power-plant viewpoint when undertaking such developments.

These and many other considerations bearing directly upon the convenience, safety, reliability and efficiency of operation emphasize the need of expert design in water-power developments of any real magnitude. It is unfortunate that the men who put their money into hydro-electric developments are seldom in a position to appreciate the difference between good and poor engineering. In a steam plant the fuel rate per kilowatt-hour and other running expenses are, to a considerable degree at least, indices of designing ability. In a water-power plant the designer often can "take it out on the river" if things fall far below expectations. The time is coming, however, when hydro-electric station operations will be more accurately compared than has been done in the past. From this time forward it should be more and more appreciated that hydro-electric design is no field for the amateur or faddist to enter.

## How Far Should Organization Work Be Carried?

ORGANIZATION is the keynote of the age, and present-day civilization could not continue without it. Our own industry is a wonderful illustration of what co-operative work can accomplish, but is it not time to define the limits of organization as an effective tool, taking central-station personnel as a case in point? Confining the inquiry to the formation of associations of electrical men in utility ranks, how far down the line is it expedient to encourage regional meetings of employees of different companies, either as branches of national societies or as groups of men trained along particular lines who gather from time to time to exchange views? The industry is thinking about this, at least in some quarters.

Perhaps it is too soon to do more than feel the way along toward conclusions which are adaptable to many situations, but which may not fit all. It seems obvious that real executives, department heads and leading assistants gain almost beyond measure from participation in national and local organizations honestly devoted to service and mutual improvement. So do specialists like power-sales engineers. Through regional organization operating employees classed as chief load dispatchers have become really acquainted as men; they have visited other systems and listened to and discussed

papers of marked educational value. Likewise the benefits of company sections of the National Electric Light Association to the rank and file of employees, men and women, are well established by experience. The point now under consideration, however, is whether corresponding regional organizations of boiler-room foremen, line and underground foremen, storekeepers and chief inspectors are likely to yield correspondingly good results. Opinions differ here, and perhaps no sharp line of demarcation exists between what is clearly worth while and what is doubtful in returns to individual utilities. One thing, however, is vitally important—control of programs within the zone of practical topics.

On some systems foremen of this or that department can rarely be spared to attend outside meetings. Their superiors can get away because construction and repair work go forward at normal speed during their absence. Here is a pretty critical test of prospective success. In some circles it is believed that the good things brought out at meetings and conventions can be brought home and put into use by the superintendents, engineers and other executives who can be spared, without the necessity of drawing upon the "top sergeants" of the industry and slowing down their important and pressing work. On the other hand, if a well-run meeting is attended by subordinates who stick close to business and do not turn the occasion into a base for the exploitation of labor issues, much good may result. Meetings of foremen inside a single company have been known to bring out admirable results in maintenance work, but less experience has been had with such gatherings involving companies under different managements. If there seems to be no categorical answer to the inquiry as to the desirable limit of such organizations at present, it at least serves some purpose to put the question. The crystallization of opinion upon it is much to be desired.

## Large-City Distribution an Increasingly Serious Problem

EVERY large generating station is a source of pride to its owners and operators. None the less, it is rapidly becoming recognized that it is impossible to care for the increased demands for electric service simply by building new stations and pouring their energy into the existing distribution systems. It has become necessary, particularly in the large cities, to rebuild and redesign the distribution systems both to care for the load and to gain greater economies in operation, because little real engineering or executive thought was devoted to a study of distribution practice during the rapid development of electrical service, and in most cases the distribution system that exists today is a hodgepodge of inadequate installations that have developed through the expediencies of the moment.

The enormous increase in the load density and the restrictions placed upon distribution by high costs, congested city streets and industrial and domestic demands for 100-per-cent-perfect service have made it necessary to study this problem with foresight in order to secure a system adequate for present and future needs. It has become necessary to look ahead ten to twenty years in laying out these new distribution systems. Any real study involves the growth in load, its location, the possibilities for overhead lines, the possibilities for underground lines and the possibilities for increasing the voltages. Each of the large cities has a distinctive environment and local load conditions such that no general solution can be applied. But some fundamental similarities exist in regard to general conditions as to type of city, general location of industrial districts and location of power stations with respect to loads, so that the constructive work of some utilities can be applied to the problem in other localities.

Many cities have grown uniformly about a central hub with industrial loads distributed almost uniformly around the periphery. Among these are Pittsburgh, Canton, Detroit and Buffalo. Still other cities have the industrial districts distributed radially along the railroads or watercourses—Cleveland, for example. Typical of the solutions applicable to the first type of city are those applied to the distribution problem in Pittsburgh and Detroit. In Pittsburgh a double-circuit overhead 66,000-volt steel-tower line has recently been installed as a ring about the outskirts. Upon this ring are transformer stations for feeding a unit group of loads. Inside the major ring a second ring of lower voltage is contemplated and secondary tie lines will be used to interconnect the several substations and to afford a two-point supply to each load. Detroit is completing the installation of a 120,000-volt overhead line in the form of a half circle about the city with a power supply from the Trenton Channel and Marysville stations. Transformer stations for radial group feeding will be erected on the transmission line, and secondary tie lines will be used to secure interconnection and a two-point supply to all large loads. In Cleveland, where the industrial districts are radially located, underground and overhead radial feeders with tandem substations will be used. Tie lines will be used to secure interconnection and a two-point supply to the larger loads.

In each of these solutions many vexatious problems are encountered. Using the overhead-ring system, difficulty is encountered in securing a right-of-way at a reasonable cost and, if the city grows, public sentiment may eventually force the removal of the line. Moreover, technical equipment for locating and isolating trouble, controlling voltage regulation, maintaining power-factor adjustments and automatically operating the transformer stations is not yet developed to a sufficient extent. In the radial system similar technical problems are encountered, and among these the high-voltage cable problem is of major importance. Underground systems are expensive and the carrying capacity of the streets is limited. Interconnection of substations is difficult and relays are not yet developed satisfactorily to secure the isolation of trouble under all circumstances. Operating engineers are not yet fully satisfied that oil breakers of ample rupturing capacity have been developed to work on any system with huge power stations behind it, and the development of control apparatus must proceed until it is satisfactorily sensitive.

The technical ability of the engineers in the industry undoubtedly will solve the detail problems and develop adequate equipment. But an organized and co-operative educational campaign is needed to obtain results along other lines which are equally important. The public must be convinced that high-voltage overhead lines are safe and reliable; the public must be educated to see that a steel-tower line, if artistic, can be viewed with pride instead of horror; it must learn that the right of eminent domain is essential if costs are to be reduced, and it must be made to appreciate that good service results from the use of expensive equipment and installations and that these are possible only if the operating company receives a reasonable return on the investment.

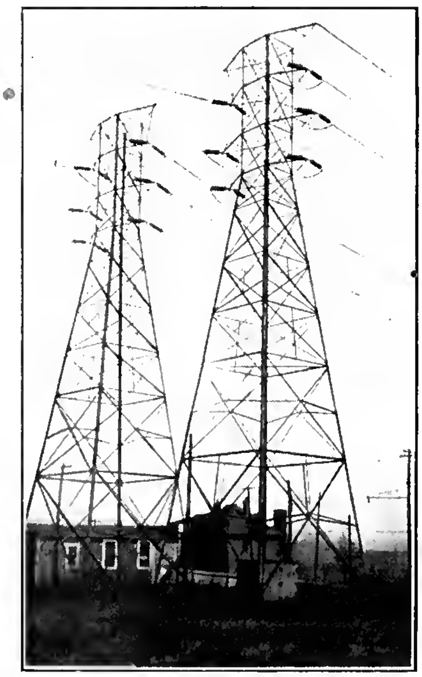
# Construction of the Pittsburgh Ring

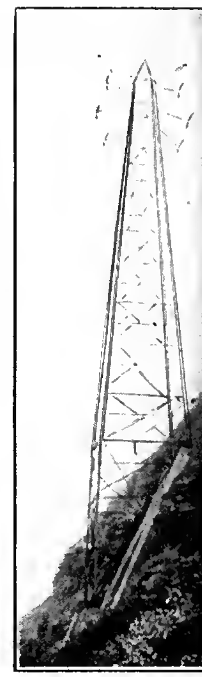
THE Duquesne Light Company has solved its distribution problem by building a 66-kv. overhead transmission line around the city of Pittsburgh. The hilly country, congested industrial districts and the rivers presented very difficult construction problems.

Upper view — A 2,300-ft. span across the Allegheny at Colfax has 600 ft. difference in the elevation of the supports.

Central views—Double-circuit steel towers 60 ft. high are spaced on an average 7.76 per mile. Many towers were located on steep hillsides.

Lower view—Automobiles, horses and men assembled preparatory to a day's work on the line. Power apparatus was used in stringing wire wherever possible.





# Construction, Operation and Repairing on 66,000-Volt System

## How the Duquesne Light Company Employs and Maintains Its 80-Mile Central-Station Bus Surrounding Pittsburgh and Fed from Its Brunot's Island and Colfax Power Houses

By IVAN BUYS
*Chief of Operation Duquesne Light Company, Pittsburgh*

WITHIN a radius of 20 miles of the confluence of the Monongahela and Allegheny Rivers, which form the Ohio, there lies the great industrial district whose heart is Pittsburgh. Power is in demand in large quantities, and the energy supplied by the Duquesne Light Company is playing a large part in making the widely quoted epithet "Smoky City" a misnomer.

The transfer of power from the power houses to the substations which step the voltage down for distribution to customers is accomplished by a 66,000-volt ring entirely surrounding Pittsburgh. Two principal stations, Brunot's Island and Colfax, feed this power ring, which has also been called an 80-mile central-station bus. Each 66,000-volt line can be sectionalized at any ring substation with oil circuit breakers controlled by the relays used for transmission-line protection.

The double-circuit steel towers average 60 ft. in height, although special locations have required the use of 200-ft. towers. The spacing of the towers averages 7.76 per mile; however, the more recently constructed sections tend toward fewer towers per mile and longer spans. The rugged topography of the territory covered has lent itself admirably to long spans with large sags and adequate clearance from ground.

The longest span on the ring is the crossing over the Monongahela River at Duquesne, which is 2,305 ft. The second longest span (2,230 ft.) is the crossing over the Allegheny River at Colfax, with a difference in elevation of supports of 600 ft. A number of other spans are above 1,700 ft.

Very few tangents of an appreciable length were possible because of the many right-of-way difficulties, which proved serious owing to the high value of property in the district. This condition, together with the long spans, has necessitated about 48 per cent of the towers being of dead-end or strain type.

The type of construction known as semi-tension is not used, although a number of combination strain and suspension towers are found. The combination tower is used on small angles. The pull on the inside of the angle gives the wire a tendency away from the tower, and a suspension string of insulators is used. The outside wires are held with strain strings to counteract the pull toward the tower.

### Both Copper and Aluminum Used

The distance of 81.4 miles around the ring is divided into 66.1 miles of No. 4/0 copper line and 15.3 miles of No. 4/0 equivalent steel-reinforced aluminum line. A spur of two-circuit line which feeds the Beaver Valley District through the Junction Park substation is copper. The aluminum wire is on the most recently

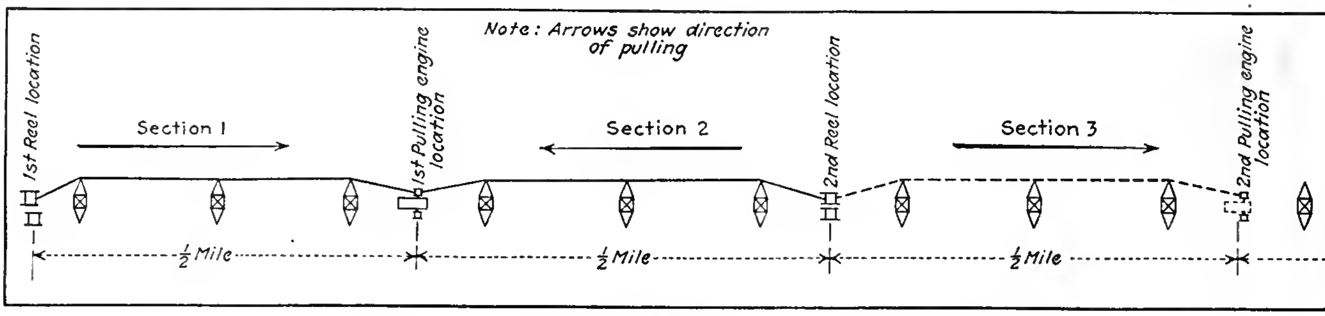
LINE TRUCKS ARE DESIGNED FOR QUICK TROUBLE SHOOTING

built section of the ring, and it has not been in service long enough to allow a comparison of the operating records of the two kinds of wire. The cost of installing the aluminum wire was higher than the copper, and special tools were required for its installation.

Ground wires of $\frac{3}{8}$-in. steel were used around the ring. The greater portion was copper-clad steel, although on the most recently built sections galvanized-steel strand was used. On the older portion of the ring five insulator units were used on suspension strings and six on strain strings. Because of trouble which developed from flashovers during lightning storms six units on suspension and seven on strain were used on the newer portions of the line.

Wide differences of opinion are held by operating engineers on the advantages of arcing horns for the protection of insulator strings. In an effort to obtain some comparable data on a large scale, arcing horns on some sections of the ring were placed on the insulator clamps only. On other sections horns were also placed on the towers to form a discharge gap shunting the insulator units, and on still other sections no horns were used. Operating records are not yet complete enough to allow a judgment of their effectiveness.

The towers were of the rigid type, weighing from 5 tons to 6 tons, and all standard towers were galvanized. A few special towers were painted. Towers at corners and at points of unusual strain, such as river crossings, were bolted to concrete bases. The majority of the towers were anchored to a grillage of steel about 4 ft. square and buried to a depth of about 8 ft.




SEQUENCE OF OPERATIONS IN STRINGING WIRE ON THE SYSTEM

On a considerable portion of the territory served by the Duquesne Light Company coal is found in veins which crop out on the surface or are but a few feet below the surface. On several proposed tower locations the coal rights were purchased to prevent possible weakening of the foundations by the removal of the coal. At one location old mine entries were under the only available tower site and forced the building of foundation piers through the workings.

The average 6-ton tower was erected by a five-man gang in one day. Several towers were built in the record time of seven and one-half hours each. The towers were erected piece by piece, with two men and a foreman on the ground and two men working on the tower.

The only special equipment consisted of a piece of 2½-in. double-strength gas pipe 22 ft. long which was used as a gin pole to raise the corner angles. Later the gin pole was used as a boom on the partly erected tower to aid in hoisting additional steel work.

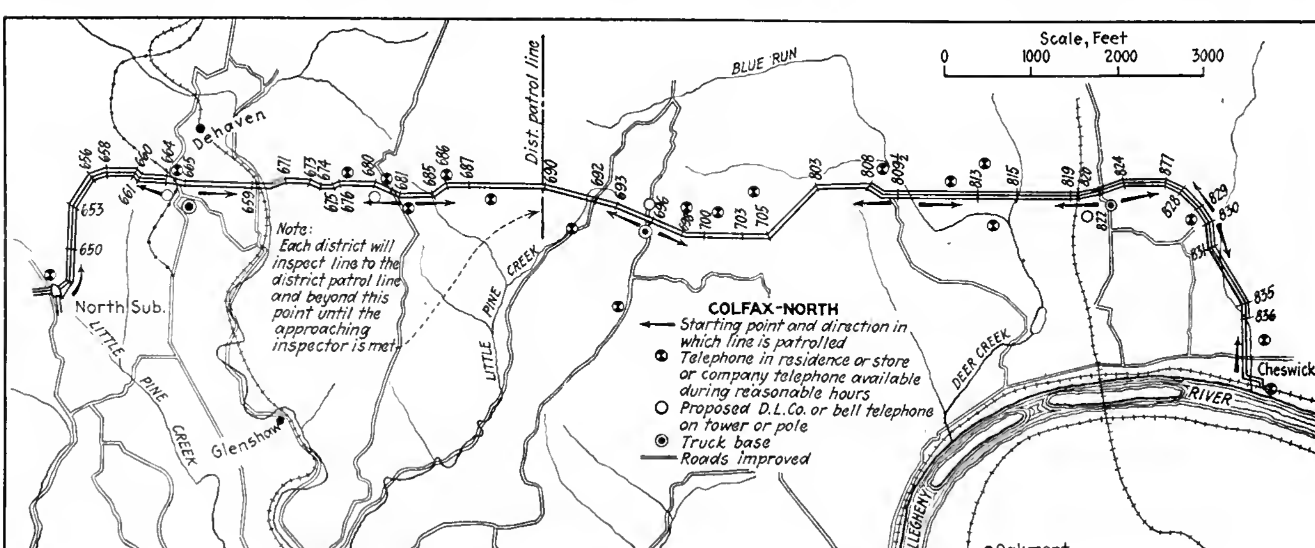
### Stringing of Wire

The many railroads and the excellent highway system in the vicinity of Pittsburgh were of advantage in placing the structural steel, wire and insulators at easily accessible points, but became a liability during the wire-stringing operation. The problem of stringing wire with safety and without interruption to public carriers, other wire lines or the orderly progress of the job required the exercise of much ingenuity. It was found that the best results were obtained by first threading ropes in one-half-mile lengths through snatch blocks on the towers. The wires were then attached to the rope and half-mile sections of wire were pulled in, making the ropes available for the next pull.

The ropes were strung by the aid of a team of horses and in exceptionally difficult places a gasoline tractor of the endless-tread type was used. The tractor also hauled material to points inaccessible to trucks and sagged the wire. The tractor's part in the sagging of wire will be discussed in detail in another part of this article.

A gasoline engine was used for pulling the wire. The engine, which was of 6 hp. capacity, was geared to two "niggerheads" which made pulling speeds of 500 ft. and 200 ft. per minute available. A skid mounting proved sufficiently portable, and the engine played a large part in the speedy stringing of the wires.

All of the motive equipment used in the stringing of the wire is shown grouped with a field headquarters on page 904. The completion of a half mile of two-circuit lines per day, which included the stringing of wire, the hanging of insulators and sagging and securing the wires, was achieved by the construction gang, which averaged thirty men. This record was made possible through the organization of the work. Constant communication by telephone was maintained at all times between the reels of wire, the pulling engine and the sagging gang, which were separated by distances varying from one-half mile to one mile. The telephone communication was established with a telephone twist laid on the ground and terminating in field test sets




MOBILIZATION POINTS FOR HANDLING TROUBLE

and signal bells or horns. The telephone line was installed before placing the pulling engine or wire reels at their locations.

A variation from this method of communication was required on a 30-mile portion of the line. One circuit was installed at the time of erection of the towers, and when about six years later the second circuit was being installed load conditions were such as to require the first circuit to carry load during short periods of emergency. Since, as a safety measure, no wire was strung when this circuit was alive the problem of constant communication between the system operator and the foreman of the construction crew was acute. It was solved by connecting the field-construction telephone circuit to the private lines of the company using the idle 66,000-volt wires as telephone conductors. Temporary connections at the nearest substation from the 66,000-volt wires to the telephone line were established and removed by the substation operator, acting under orders of the system operator.

Elaborate precautions and checking were necessary to insure against the line being energized before the temporary telephone connections were removed, but the results obtained justified the trouble. In one case the line was carrying load thirty minutes after the system operator, through the medium of this hybrid telephone line, ordered the construction foreman to stop work and clear up the line.

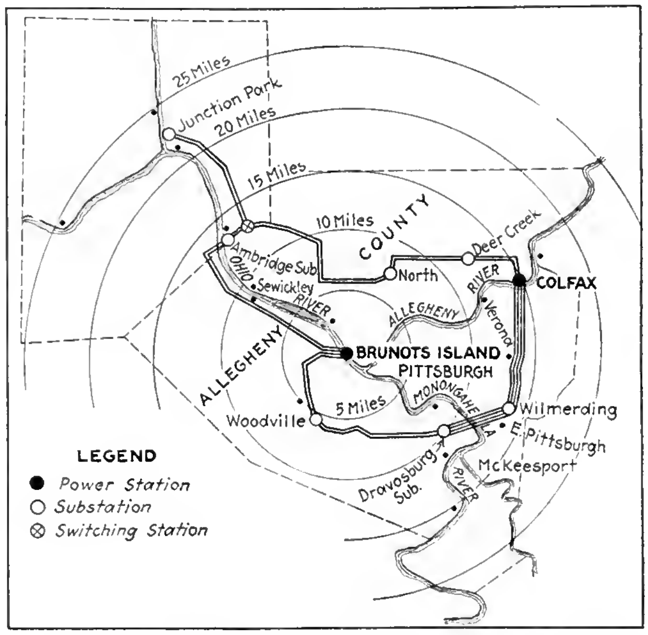
### Gasoline Engine Used to Pull Wire

Often a half-mile section of wire was pulled through the snatch blocks on the towers in eight minutes. This result was obtained by the constant communication maintained between the foreman and men at the reels and the engine. Linemen were stationed on each tower to insure the smooth and uninterrupted movement of the wire, and snagged wires and kinks were seldom encountered. After the wires were pulled through and the gas engine was disconnected, the tractor pulled the wires up to sag position with one operation without the use of intermediate rope blocks.

The time saved in sagging the wire in this manner as compared with using a team of horses and several successive hitches through one or more sets of blocks can readily be appreciated. The sag was determined from charts furnished to the construction foreman, and sag marks were painted on the towers by two men who worked ahead of the construction gang. A telescope clamped to the tower leg verified the sag, which was required to be accurate within 6 in.

A material man, aided as required by men from the stringing gang, hauled all material and tools to the best locations. He preceded the gang and located telephones, temporary storage houses for material and the best routes from point to point on the line. He interviewed property owners and secured permission for the necessary trespass on their property. Representatives of the real-estate department were called upon to settle claims which the material man was unable to satisfy. As the stringing gang moved forward the material man inspected the line, arranged for the collection of all scraps of material or tools left behind and the repairing of any damage to property caused by the gang. The construction foreman, who was relieved of these details, was enabled to devote his entire time to speeding the progress of the work.

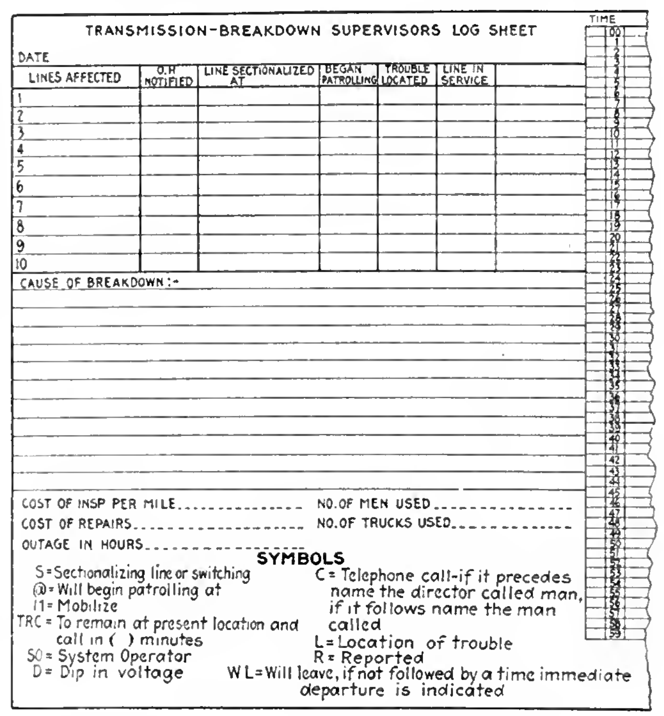
Inspectors or patrolmen who walk the entire transmission ring once each week are familiar with the




66,000-VOLT TRANSMISSION SYSTEM OF THE DUQUESNE LIGHT COMPANY FORMS AN 80-MILE RING

standards of operating condition to be maintained. They report things varying in importance from serious landslides, dangerous trees and broken insulators to the replacement of danger signs chipped by stones or rifle fire. Each inspector reports by telephone to the central office at intervals of about two hours during the day. Reports of a serious nature receive immediate attention. Reports which are not considered urgent are mailed by the inspector at the close of each day's work.

A weekly round-table meeting attended by all inspectors serves to keep alive the interest of the men. Competition among them is keen. Charts are prepared which show a comparison of the breakdowns on the


TRANSMISSION-BREAKDOWN SUPERVISORS LOG SHEET

DATE

| LINES AFFECTED | O.H NOTIFIED | LINE SECTIONALIZED AT | BEGAN PATROLLING | TROUBLE LOCATED | LINE IN SERVICE | |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |

CAUSE OF BREAKDOWN :-

COST OF INSP PER MILE.............. NO. OF MEN USED..............

COST OF REPAIRS.................. NO. OF TRUCKS USED..............

OUTAGE IN HOURS..................

TIME 00 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59

SYMBOLS

S = Sectionalizing line or switching
@ = Will begin patrolling at
M = Mobilize
TRC = To remain at present location and call in ( ) minutes
SO = System Operator
D = Dip in voltage
C = Telephone call-if it precedes name the director called man, if it follows name the man called
L = Location of trouble
R = Reported
W L = Will leave, if not followed by a time immediate departure is indicated

LOG SHEET FOR REPAIR FORCES SHOWS ORDERS AND MOVEMENTS

lines for which each inspector is responsible. Breakdowns which are due to the failure of the inspector to see or report hazardous conditions are emphasized by red circles on the chart. The result of a weekly discussion of this chart in open meeting has done much to reduce this kind of preventable failure to one or two per year.

Every effort is made to make the meetings interesting and of value. Each man is encouraged to talk, and in this way the inspection is being constantly improved as the experience of each man is shared by the others.

### Clearing Transmission Line Trouble

Next in importance to keeping tie lines in operation comes the restoring of the lines to service, following breakdowns, in the shortest possible time. Experience has shown that the major portion of the time required to restore the line to service following a 66,000-volt failure is often taken up in locating the fault.

The network of improved highways intersecting the power ring is a great asset in reducing the length of outage. In attempting to improve our records for speed in the restoring of service it was early found that the dispatcher or director in charge could not prepare his plan of attack after the trouble occurred. To remove the necessity for hasty and often ill-advised decisions, maps were developed on which detailed directions concerning the points at which patrolling should start and the location of truck and material bases were designated by symbols. In preparing the maps careful study as to the best roads for access to various points on the line and the location of telephones was made.

A GASOLINE ENGINE WAS USED TO PULL WIRE

Every section of the power ring is covered by such maps and the plan of attack is rigorously followed out. Immediately following notification to the overhead-lines division that a section of line is defective, the director of repair forces knows the exact points to which patrolmen must be dispatched (see arrows on map) and the most advantageous locations to which the repair trucks should be moved so as to be within striking distance of the trouble (see seals on map).

Since these maps have been used, the average outage following 66,000-volt line failures has been greatly reduced. Instructions to patrolmen are so simplified that there is little likelihood of a misunderstanding even by men not familiar with the particular line involved.

The director of repair forces maintains a log sheet on which his orders and the movements of the breakdown locations and repair forces are noted. (See page 907. From the time of failure to the time the line is repaired and returned to service each minute is accounted for. At some later time the log is subject to careful scrutiny to disclose any mistakes in dispatching or loss of time which could have been eliminated. The experience thus gained aids in reducing outages to a minimum. The cause of failure is summarized on the log, which is filed and becomes a permanent record of the breakdown.

Immediately following the dispatch of patrolmen on a faulty line, a number of repair trucks are equipped with emergency material and sent to the truck bases designated on the maps. A number of automobiles or light trucks which are used to distribute the patrolmen to needed points are held near telephones (see stars on map) and are available for transporting the patrolmen to the scene of trouble after it is located. The patrolmen then become repairmen.

Light, speedy trucks which ordinarily are used in light maintenance work or the testing of insulators are in almost hourly communication with the central office. These trucks have bodies designed especially for transmission maintenance and line repair. Following a breakdown, they usually have time to go to the nearest storeroom, load up with material and report at the truck bases before the trouble is located. Spotlights are operated from the storage batteries of the trucks, and portable, electric and carbide lamps are used by patrolmen and repairmen.

Breakdown material for use on lines remote from any storeroom is kept in concrete material houses built under towers at intervals on the line. These houses are about 6 ft. high and 6 ft. square and have steel doors. The contents of the houses are checked over each week by the patrolmen and an effort is made to replace any missing material immediately.

Breakdowns on the ring—i.e., physical damage to the line causing it to be out of service longer than the period required to reclose an oil circuit breaker—have been few. The causes of breakdowns, in the order of their destructiveness, have been lightning, trees or limbs of trees blown down by windstorms, and mechanical failure of insulators. Lightning is responsible for about 52 per cent of the failures, some of which were the result of direct strokes burning off the wires. The immediate cause of other failures was a power arc which followed a lightning spillover on a string of insulators.

Trees were formerly more of a menace than they now are. A systematic and persistent effort during the past two years to remove all trees which if they fell toward the line might cause trouble has brought results. During this period a solicitor has been constantly engaged in obtaining permission for the removal of trees. Experience has demonstrated that a tree-trimming crew consisting of a foreman and six men equipped with the necessary tools and a 2-ton truck can profitably spend all its time removing and trimming trees and clearing brush on the 66,000-volt ring.

The mechanical failure of insulators has been responsible for a few failures. Defective porcelain unable to stand the stresses caused by temperature changes apparently exists in only one lot of insulators. This cause of failure will be eliminated with the replacement of these insulators by others of tried and proved design made of better porcelain.

# Limitations of Carrier-Current Telephony

## Observations Based on Investigations on Duquesne Light Company's System—Duplex Operation Preferred—Spitting of Insulators, Charging of Arresters and Switching Troublesome

By C. A. BODDIE* and M. W. COOKE†

SUCH widespread interest has arisen among central-station men regarding the developments in "wired wireless" or "high-frequency" telephony as applied to high-voltage transmission lines that a brief analysis of this promising application of high-frequency currents from the viewpoint of central-station service seems desirable. In order to arrive at a fair conception of the value of a high-frequency circuit as compared with a physical telephone circuit which parallels a transmission line comparison of the advantages and disadvantages of each type of circuit will be of value.

A telephone circuit strung on the towers of a transmission line, in the absence of a better circuit, is very desirable, but is open to the grave objections that it is hazardous to use and is apt to be rendered inoperative by abnormal conditions in the power line, which is usually the time when it is needed most.

Under favorable operating conditions a fairly quiet telephone circuit is obtained over which clearly understood conversation may be carried on. However, this result is seldom obtained in practice because of the lack of attention to the details of protection, drainage and transpositions. The circuit can be used by line patrolmen from each tower in the line, the patrolman needing only an ordinary lineman's test set to establish communication with headquarters. The cost of construction is low.

Under abnormal operating conditions, on the other hand, the line will be so noisy as to be unusable. Surges in the power circuit will cause the protective devices in the telephone circuit to operate, and if some of these protective devices—particularly drainage coils—are installed outside of the stations, they cannot be switched out of the circuit and reserves switched in when the first set operates.

Failure of a power wire will frequently carry the telephone line down with it, and during high winds the lighter telephone wire may be whipped up into the power wire in the longer spans.

Where restrictions exist as to the ground clearance of the lowest wire on the towers, higher towers must be erected or poles set between the towers to support the telephone wires. It is not often practicable to set poles between the towers to raise the telephone wires, because the power wires may be so low that raising the telephone wires may bring them too close to the power line.

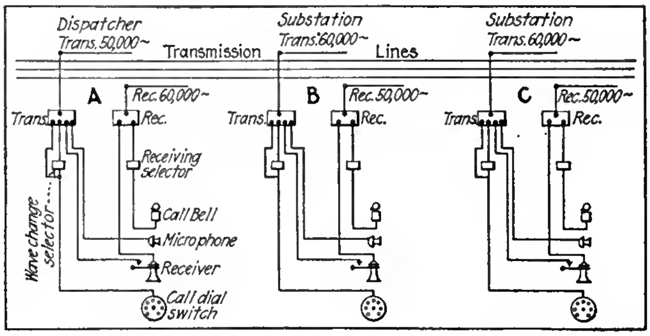
On the other hand, a separate telephone pole line built on the tower right-of-way is reasonably free of hazards so far as patrolmen and station operators are concerned. If the circuit consists of fairly large gage wire and is well insulated, carefully balanced and kept thoroughly trimmed out, it has all the advantages of a line on the towers. If provided with duplicate sets of arrester equipment at the terminals, it can usually be depended upon for service as soon as an abnormal condition in the power circuit is over.

CARRIER-CURRENT EQUIPMENT WAS PLACED IN THE SHANTY BELOW THE LINE, AND WIRES WERE LED TO STATION

The disadvantages of this type of line are that its first cost and maintenance cost are high. The telephone pole line being already on the ground, it is almost invariably used to support 11,000 or 22,000-volt, three-phase lines when new customers must be served along the high-voltage lines. These lower-voltage lines are as a rule provided with single-phase transformer taps which usually cause unbalanced load in the power circuit and destroy the telephone-line balance. Besides, such construction introduces a hazard due to the possibility of the power wires coming down on the telephone circuit.

As compared with either of the foregoing types of physical telephone circuits, the carrier-current circuit can usually be provided at a fraction of the first cost. The maintenance expense will be considerably less than that of a physical circuit on separate poles and probably no greater than a circuit on the towers. Furthermore,

*Radio department, Westinghouse Electric & Manufacturing Company.
†Superintendent of telephones, Duquesne Light Company, Pittsburgh.




METHOD OF CONNECTING STATIONS FOR DUPLEX COMMUNICATION

greater reliability can be expected because the tower line which serves to guide the carrier high-frequency current will remain in service under storm conditions, owing to its rugged construction, when the less rugged telephone line will fail.

Abnormal conditions in the high-tension line will only make the high-frequency circuit noisy during the duration of the disturbance, and even the failure of one or two phases will not render communication impossible, so that at first glance the superimposed circuit seems to fill most of the requirements for communication service over a tower line. However, it seems to the authors that in view of the rapid development now taking place it would at present be advisable to install high-frequency communication apparatus only under favorable conditions.

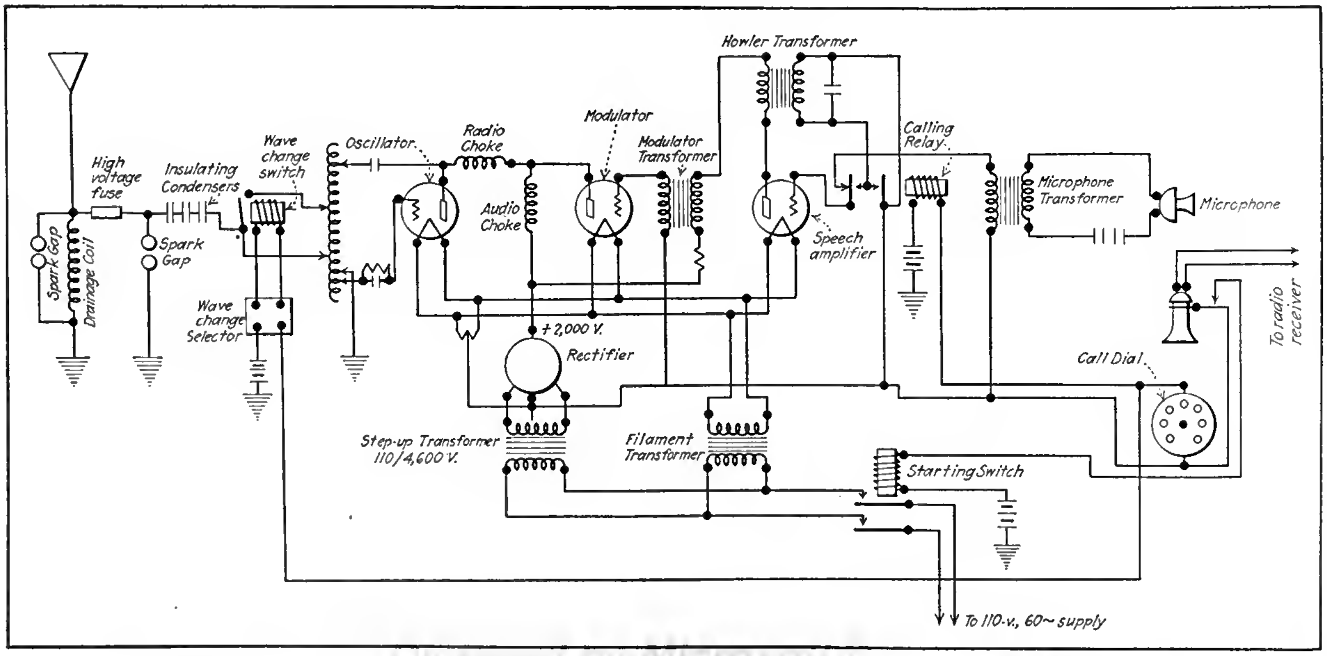
To bring out what the limiting conditions for carrier-current usage are, experiments have been made on the 66,000-volt lines of the Duquesne Light Company for the purpose of determining the feasibility of telephony and remote control of electrical apparatus by means of high-frequency currents superimposed on power lines. These experiments were conducted by the engineers of the Westinghouse Electric & Manufacturing Company, assisted by the communication department of the Duquesne Light Company.

Before the carrier-current experiments were conducted it was popular opinion that a transmission line affords a much more efficient medium for the propagation of high-frequency currents than direct space radio. This impression is probably due to the advertising nature of most of the current literature on the subject. There is also great confusion regarding the name to be applied to this method of communication. Such terms as carrier current, line radio, guided radio, wired wireless and even guided carrier current have been proposed and used. All of the above names are meaningless, and the authors propose to indentify the system by its one distinguishing characteristic, namely, "high frequency." We, therefore, will use the term "high-frequency telephony" in the following discussion to distinguish telephone systems using modulated high-frequency currents from the usual low-frequency telephone which operates on modulated direct current.

High-frequency currents may be introduced into the power line in two ways—either by means of antenna strung parallel to and usually above and below the power wires or by means of condenser-type bushings connected directly to the power wires. The experiments up to the present time indicate that most energy can be put into and taken out of the power line by using antennas.

From preliminary work which had been done on a 22,000-volt line, the Westinghouse engineers estimated that a 50-watt transmitting set would be powerful enough to transmit over the Duquesne Light Company's 66,000-volt line. It was found, however, that much more powerful transmitters were required, and the output was increased to 250 watts.

At the very outset of this work it was recognized that to be successful in load-dispatching service the system must be duplex. That is, it must be possible for a person to talk and listen at the same time as is the case with the usual wire-line telephone. A system which will not permit a person to talk and listen at the same time, but which only permits one person to talk while the party at the other end listens, and then requires both to operate throw-over switches, so that the one who was talking first can hear what the original listener says in reply, will rest under a serious handicap when




HIGH-FREQUENCY TELEPHONE TRANSMITTING AND SIGNALING APPARATUS USED BY DUQUESNE LIGHT COMPANY

compared with a duplex system which permits simultaneous listening and talking.

A further requirement is that the signaling shall be selective. Selective signaling means the ability to ring the bell of a particular station in the same way that the bell of a particular party is rung on a party-line telephone circuit. The necessity for this selective feature will be apparent when it is considered that between the two generating stations feeding into the Pittsburgh power ring there are eight large substations. Unless each one of these stations could be called selectively, the system would not be of practical use, since a signal sent into the line would call all stations when only one might be wanted, and the resulting confusion and delay might result in an improper switching operation being performed by one of the station operators.

The duplex and selective features have been successfully worked out.

One of the things which have been most annoying and for which no successful remedy has been found is the disturbance due to "spitting" insulators. It is generally recognized that an insulator may spit for years without apparently reducing its value as an insulator, and while as a matter of precaution continuous tests are carried on to locate and replace insulators which spit over, it is interesting to note that in large systems there is always more or less of this spitting going on. Conversations cannot be carried on successfully while this spitting is taking place. Furthermore, the spitting very often breaks up the trains of impulses used in selective signaling. This particular difficulty has been the most serious one encountered from the standpoint of talking continuity and reliability of signaling.

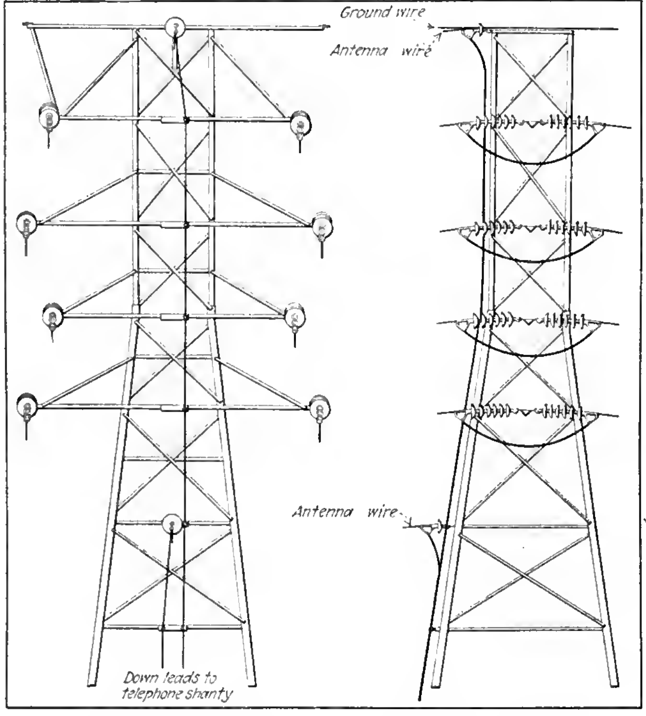
Disturbances introduced into the line through the charging of electrolytic lightning arresters also interfere in the same way that spitting insulators do. In a system in which there is a large number of arresters this is a matter of considerable importance.

### Certain Wave Lengths Best

In the installation between Brunot's Island and Colfax it was learned that the number of wave lengths which can be used satisfactorily is limited. During the progress of the experimental work frequencies ranging from 10,000 cycles to 500,000 cycles were explored with the idea of finding at which frequency the most energy was received at the other end. It was discovered that there are definite wave bands within which good transmission is possible. These bands range between 1,800-2,200, 4,500-7,000 and 14,000-23,000 m. With the apparatus set near the average values of these three bands—i.e., 2,000, 6,000 and 18,000 m.—good transmission is obtained. The surprising thing here is that at wave lengths outside of the bands mentioned virtually all of the energy sent out from one end of the line is absorbed before it arrives at the other end. It is assumed that the inductance and capacity values of the apparatus bridged across the power circuits at the intermediate substations are such that resonant circuits are formed which for all practical purposes are short circuits for those frequencies outside of the three bands named, or introduce impedances which seriously reduce the transmitted currents.

It is evident that owing to the complex system of reactances in a large power system a number of tests must be made to determine what frequencies will go through to a receiving station located at some point distant from the sending station. This is cited to indicate that the equipment cannot be installed with the same confidence that it will be ready to use when the installation is completed as one feels when ordering in an ordinary wire-line telephone.

The effect of switching operations in the tower-line circuits is greater than was anticipated, and it is not possible to predict with confidence the results which will follow the operation of any switch. The Duquesne Light Company tower line carries two 66,000-volt circuits, which until recently were usually in parallel at the two generating stations, but not in parallel at the intermediate substations. A striking illustration of the effect of switching occurred when during a conversation between the two high-frequency stations the amount of received energy at both ends suddenly




METHOD OF ATTACHING COUPLING WIRE TO TOWERS

dropped to about one-tenth of its previous value. In checking up with the system operator to see if any change had occurred in the transmission circuits at the time the change in amount of received energy had been observed, it was learned that the two power circuits had been paralleled at one of the intermediate substations. This substation was about 12 miles from the nearest high-frequency station.

Since the last observations were made, a system of relay protection for the power lines has been installed at each of the substations and generation stations, and the two circuits will ordinarily be paralleled at each of these stations in the future. From the results which were observed before the relays were installed it is to be expected that the high-frequency apparatus will no longer work on the original wave bands.

At most generating and substations it is difficult to string antenna wires on the power structures nearest the stations so that they can be led inside of the buildings, owing to the difficulty of getting them past the outdoor switching and protective apparatus. In practice this means the building of small houses out under the tower line, a span or two away from the main building.

This means that in order to be able to use the high-frequency set from within the station it must be extended by means of a wire-line circuit from the house in which the apparatus is placed to the telephone instrument in the station. A two-wire circuit has been perfected, using an ordinary dial-type automatic telephone, by the operation of which the high-frequency set is automatically started and the proper selective call sent out, substantially as is done in wire-line telephony.

### Nature of System Used

The nature of the communicating system as developed may be seen by a reference to the accompanying straight-line diagram, in which three stations are shown schematically. Each station is provided with two antenna wires, one for transmitting and one for receiving. This simple expedient of providing separate transmitting and receiving antennas is the most important single feature in the achievement of commercially stable and efficient duplex. By it a high capacitative reactance is interposed between the transmitting antenna and the delicate radio receiver, yet nothing is sacrificed in the way of transmitting and receiving efficiency. By the adoption of this means alone satisfactory duplex may be obtained with sets having a radio output of 50 watts or less. For higher powers additional features must be introduced.

As indicated in the diagram, the dispatcher may transmit 50,000 cycles in to the power line while his receiving set is tuned for 60,000 cycles. The various substations must then be set to receive the dispatcher's transmitting frequency of 50,000 cycles and they must transmit 60,000 cycles to the dispatcher. If the load dispatcher wishes to call station "B," the receiver is lifted from its hook. This act starts the dispatcher's transmitter, which sends out a steady high-frequency current of 50,000 cycles over the power line. The selectors at the substations do not respond to this kind of current. The dispatcher now dials the number assigned to substation "B." This operation sends out a series of modulated impulses over the power line; that is, the amplitude of the 50,000-cycle transmitting frequency is made to rise and fall at the rate of, say, 1,000 cycles per second. This modulated wave is rectified by the detector in the receiving sets in exactly the same manner in which the ordinary radio receiver functions. The output of the amplifier is fed into a second detector tube, in the plate circuit of which is a telegraph relay having a suitable high-resistance winding. The plate current of this tube is greatly reduced when a modultated signal is received. The relay closes its contacts each time a modulated impulse is received and hence repeats into the substation selector the impulses sent out by the dispatcher's dial switch. Each substation selector is a device which closes its contacts when it receives the proper number of impulses. Thus while all substation selectors advance during the dispatcher's dialing operation only station "B" selector closes its contacts. This closure picks up and locks in the bell relay. All selectors now return to zero. Station "B" call bell rings continuously until the operator lifts his receiver from its hook. This stops the bell and starts his transmitter, which now sends out 50,000 cycles, which is the frequency which the dispatcher is tuned to receive. Both parties may now talk and listen with the same freedom as in the case of the usual wire-line telephone. At the conclusion both parties hang up and the transmitters automatically shut off.

In the same way, any substation can call the dispatcher. This arrangement requires all communication to go through the dispatcher and does not permit communication between the substations since they are all tuned to transmit 60,000 cycles and all the receivers are set for 50,000 cycles. Hence no substation transmitter can communicate with another substation receiver. Communication between substations may be accomplished by throwing a wave-change switch in the calling substation, which automatically changes the substation transmitter and receiver frequencies to those normally assigned to the dispatcher. Suppose substation "C" wishes to call substation "B." After starting the transmitter by unhooking the receiver the substation operator dials 10. This sends out ten modulated impulses which are received only by the dispatcher's set, but does not ring his call bell because his call number is not 10. Hence nobody is disturbed. The dial switch is, however, directly connected to the wave-change selector which closes the transmitter-wave change switch and locks it in when ten impulses are received. This changes the antenna taps on the transmitter loading inductance and thereby changes the transmitter frequency to 50,000 cycles. Relays in the radio receiver transfer connections to duplicate primary and secondary tuned circuits adjusted to receive 60,000 cycles instead of the previous 50,000 cycles. The substation operator now dials the number assigned to station "B," which rings its call bell. Communication is now possible between "B" and "C," as was the case when "B" was called by the dispatcher. Thus the system as a whole is flexible in that any party on the system may freely communicate with any other party.

The oscillator and modulator tubes of the transmitter are of 250 watts capacity. The method of modulation is that now universally adopted in radio-telephone sets and known as the Heising or constant-current system. The principal feature of this system is the use of a large inductance coil frequently referred to as the audio choke, through which the oscillator modulator plates are supplied in parallel. Voice frequency is impressed on the modulator grid, which thereby varies the modulator plate current. This alternately robs and adds to the current flowing to the oscillator plate, which causes the amplitude of the high-frequency antenna current to rise and fall in accordance with voice frequency. A third tube of smaller capacity, known as a speech amplifier, is interposed between the microphone and the modulator grid, since the voice currents produced by the microphone have not sufficient energy to control directly the grid of a 250-watt tube. The speech-amplifier tube is also used to modulate the transmitter frequency during calls. The impulses from the dial switch act directly on the calling relay, which changes the grid connections of the speech amplifier so as to form a local oscillating circuit whose frequency is something lower than the transmitting frequency, which may be from 1,000 to 10,000 cycles as preferred.

The wave-change switch, as shown schematically, shifts the antenna tap on the antenna inductance coil, thereby changing the transmitter frequency. This is done through the wave-change selector, which acts only when it receives a series of ten consecutive impulses from the dial switch.

The 2,000-volt direct-current plate potential for the transmitter is supplied by a vacuum-tube type rectifier. The alternating-current pulses in the rectified current are completely damped out by a combination of con-

densers and inductances which are built in as part of the rectifier. A rectifier is to be preferred over a motor-generator set for this service because of the liability to failure of a 2,000-volt commutator and also because the 60-cycle alternating pulses in the rectifier are more easily elminated than commutator noises. The elimination of rectifier noises is permanent, whereas the commutator and brushes of a high-voltage direct-current generator require frequent attention.

The selectors used consist of a magnetically driven contact arm which moves over a series of contacts and a group of relays so arranged that unless the pause in the impulses from the dial switch occur on the right contact the arm automatically goes back to its initial position, without closing the bell circuit. This device is merely an adaptation of proved automatic telephone apparatus.

An illustration of what appears to be the proper attitude regarding this new communication development is said to have been taken by the Penn Central Light & Power Company, which is under the management of Day & Zimmermann, Inc. This company has a new power development in an inaccessible section of Pennsylvania. The problem of obtaining adequate communication service has had much study, with the result that the Bell Telephone Company was requested to advise what service should be provided and to quote rates therefor. The Bell company is said to have quoted a high construction cost and annual rental, due to the large amount of line which would have to be built through a rough country. As the private line would have been away from closely patrolled toll lines, its maintenance would have been difficult and repairs slow in case of failure, and the Bell company is said to have frankly advised against its construction and in favor of the installation of high-frequency equipment, for the reason that the high line would be more ruggedly constructed and would probably not fail under conditions which would probably cause the failure of the telephone line. As the result of this advice, the power company is reported to be planning to install five high-frequency sets, four in stations and one for portable use, with the intention of spending about $5,000 a year in the further development of the device.

# Distribution in Export Trade

## An All-Important Feature of the Foreign Policy of the Electrical Manufacturer Is the Organization Through Which His Sales Are Handled and Developed

By P. S. SMITH and W. L. URQUHART*

MANY manufacturers, inexperienced in selling to foreign lands, overlook entirely in considering the possibilities in export trade the fact that distribution is no less a factor in selling overseas than in domestic business. Once the decision is made that a certain product should be introduced to the distant market, there is no detail of preparation more vital than the determination of which will be the best method of distributing the goods to the purchasers. For the very fact that the market is far away and that the goods must be transported into countries and under conditions with which the manufacturer has little familiarity and over which he can have no control makes it all the more important that effective machinery be set up not only to carry forward the shipments themselves but to insure adequate representation for the manufacturer and provide a contact with the foreign buyer, attenuated though it may be.

### Six Plants for Exporting

No manufacturer should fail to fix upon a foreign selling policy. This policy should aim to cover a period of, say, ten years, during which time it will be creating permanent relations which will continue to yield a profitable trade indefinitely in the future. To do this requires some initial expense and much analytical investigation. The results will be a determination of the markets where one's goods cannot be sold and a knowledge of and connection with those where profits are to be had with proper developmental and follow-up procedure.

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The problem is different for each manufacturer as its correct solution rests upon many variables. These include particularly the type of goods involved—whether they are standard, enjoying large demand, or special, with restricted application; whether purely a merchandising or an engineering proposition, and whether there is great competition or not.

The best solution to these problems in a given case can be approximated, if not actually attained, by the selection of the right ways and means at the disposal of manufacturers to enter foreign markets. Different selections will be made for different problems, but they all will be based upon the several methods brought out in this article. For there are in fact six distinct plans under which a distribution system may be set up for export selling.

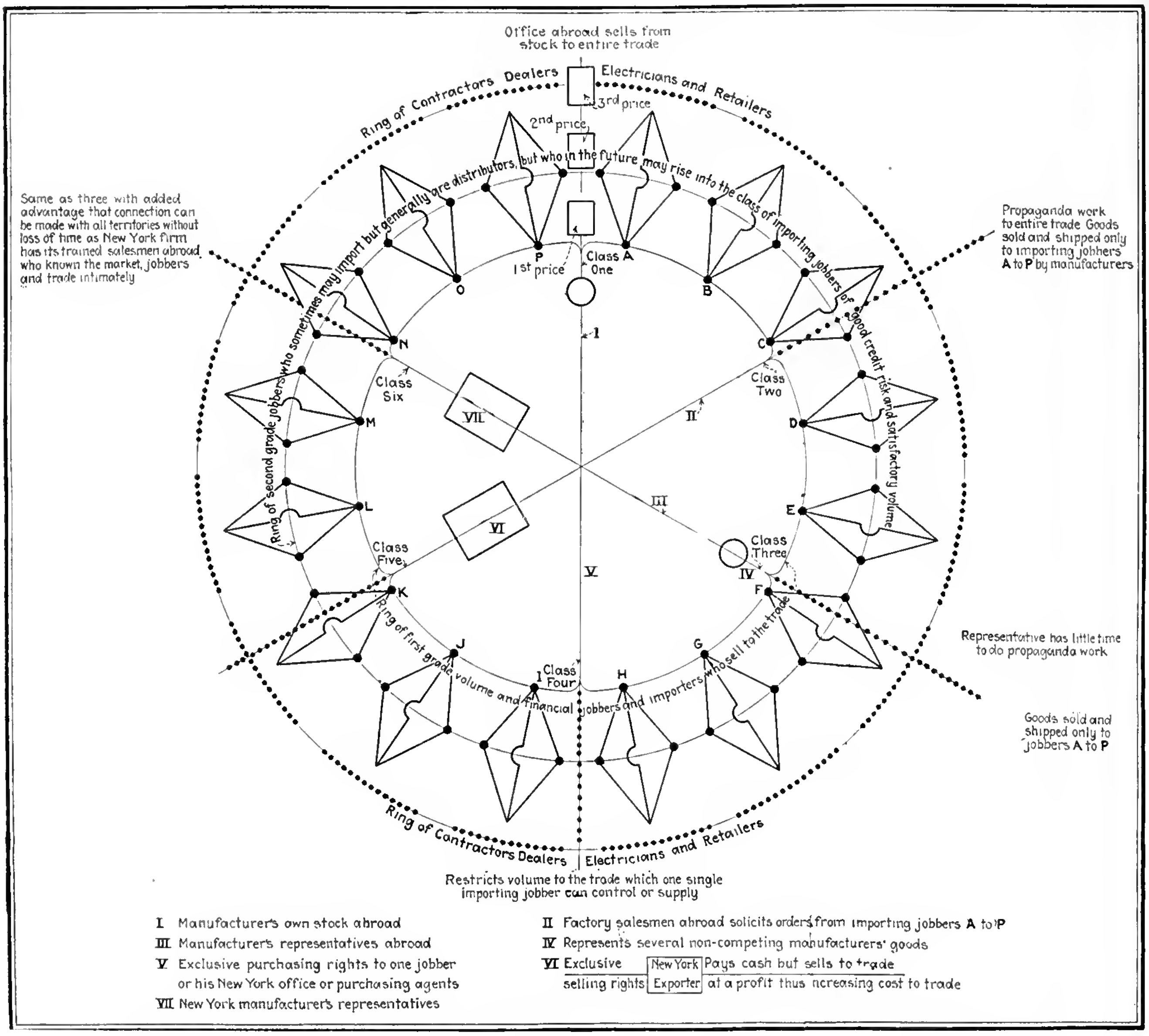
1. *Manufacturers' Branch Offices.*—A few manufacturers will be able to establish their own branches abroad. This usually can be done only in the case of a very large company controlling a complete line of apparatus and small materials so that the volume of combined sales will be large. If managed on correct merchandising principles, this method offers the advantage of controlling a large share of the market directly from the factory. Stocks will be carried locally to supply deficiencies in the shelves of customers while they are waiting for regular orders to come forward from the factory. Some of the tendencies to be guarded against are the erection of a local selling organization with too high an overhead for the volume of sales, the desire of the customer to depend largely upon the company stocks instead of upon his own invested capital, and the selling of goods to the retail or other small dealers who are the legitimate customers of the wholesaler and jobber.

Only if very strong can one afford to ignore the prerogatives of the latter houses.

*2. Own Salesmen Abroad.*—Where it is not possible or desirable to establish a branch office abroad a very satisfactory method may be to maintain one's own salesman in the center of large business possibilities. He would work on a salary or salary and commission basis and solicit orders from the trade to be shipped direct from the factory. He might work the field alone or be connected, at factory expense, with the office of the local exclusive agent. This is done particularly for handling machinery and technical lines requiring an expert to do justice to them. This method is expensive also and can be used only where there are prospects of large sales at a fairly high margin of profit. Under these conditions this is, perhaps, the best of all the systems, as the salesman is an active influence in maintaining the jobber's stocks; and, because he is trained in the line he sells, he can, if he has the incentive of being paid by the results he shows, greatly influence the retailer and even the customer to specify his principal's goods.

*3. Foreign Group Salesmen.*—General manufacturers' representatives, working on commission, handling various lines and soliciting orders to be shipped directly to the jobber, take the place of employee representation very efficiently at times. They are much less expensive than the resident salesman by reason of their expense being divided over a larger number of lines, hence not necessitating so large a commission. Care must be taken, however, to see that such a representative has not taken on too many lines to do justice to each. This and other measures are not always feasible, as the representative is independent of any single manufacturer and apt to be hard to control.

*4. Exclusive Right to Foreigner.*—Exclusive purchasing rights may be given to one selected jobber abroad, provided he is willing to guarantee a minimum annual amount of purchases. When this is done the outlet for at least that quantity of goods is assured, but this is very seldom a satisfactory basis. If the goods are new or unknown, the sales that any one can guarantee are not going to be attractive to a manufacturer thinking in terms of domestic sales. Even under the most favor-




A GRAPHIC PICTURE OF FOREIGN DISTRIBUTION AND THE SIX PLANS WHICH AMERICAN MANUFACTURERS MAY FOLLOW IN SELLING ELECTRICAL PRODUCTS TO THE EXPORT MARKET. RADII "CLASS 1-6" INDICATE METHODS OF APPROACH

able conditions, the jobber must be conservative in his guarantee for his own protection. A note of warning should be sounded, too, that the exporter may assure himself always that the jobber has not taken on the line merely to withhold competition with some other line in that territory.

5. *Exclusive Export Agent.*—In other cases the manufacturer grants exclusive rights to some organization such as the general export merchant, the commission house or the buying branch for a foreign house, all located in New York.

It will be understood that the difference between the export merchant and the commission house is that the export merchant buys in the open market for his own account and sells at a profit by increasing the invoice value, whereas the New York commission house, properly speaking, receives a commission from the importer abroad for purchasing material required.

The two principal defects with this plan are, first, that the manufacturer has no control over his ultimate market and so does not know who his customers really are nor whether he is getting his full share of the business, and, second, that these commercial units are very seldom in position to do any real constructive selling or propaganda. Their chief function is to buy upon receipt of an order from a foreign client, usually without stipulation as to maker. When they accept agencies it is also well to be assured that they have the proper personnel to handle a line of electrical goods and to push it actively on behalf of the manufacturer. The greatest advantage from dealing with them is that they generally pay cash in New York, thus eliminating from the transaction all question of credit or collection.

6. *Manufacturers' Export Group.*—There has been reserved until last the method which seems to have the best chances for success, especially for a group of manufacturers of wiring devices and other allied material. This method, which may be called the combination export department, consists of the exclusive rights given by manufacturers to a New York manufacturers' representative having jobbers or salesmen abroad soliciting trade from the wholesale importer-dealers. Just why this offers an exceptional opportunity—that is, the maximum of profit—for those to whom the direct personal representative in the field is not feasible will be shown.

Each manufacturer in considering these possible plans for distribution can decide for himself by the process of elimination just which ones are not applicable to him.

Distribution methods in foreign trade are not necessarily alike for different foreign markets, but in every

A SIDELIGHT ON DISTRIBUTION IN MEXICO—DRAGGING A TRANSFORMER THROUGH THE MOUNTAINS

case it should be the endeavor of the manufacturer to bring them as closely under his control as possible. This may be illustrated by citing the case of the several countries of the Orient which together now absorb approximately 20 per cent of our electrical exports. The general practice in past years seems to have been to sell almost exclusively through middlemen as indicated by method No. 4 instead of building up direct contacts. As a consequence, few manufacturers know the exact way in which their business is being or should be developed within those countries. Method No. 6 then might be the ideal arrangement under these circumstances.

But what is desired by the individual manufacturer

A LOCAL DISTRIBUTOR'S DELIVERY EQUIPMENT IN OSAKA, LOADED WITH AMERICAN ELECTRICAL GOODS

A DEALER'S STORE IN NEW ZEALAND AND HIS CART CARRYING AMERICAN METERS

perhaps more than anything else is the employment of men who know the specific requirements in each different country as it applies to his own line. Obviously there are a number of men in the electrical industry who have specific knowledge of this kind, and for this reason plan No. 6 will appeal as being the most attractive of all the other methods to the average manufacturer, and especially to the manufacturer who has not yet built up a large export organization.

### Electrical Export Lines

There are approximately fifteen hundred manufacturers in the United States producing electrical material, to most of whom this article on distribution applies. The main groupings are as follows:

Motor appliances.
Heating appliances.
Fans.
Interior-wiring devices.
Wire.
Small motors and motors up to 10 hp.
Insulated materials and devices, including tapes, etc.
Lamps.
Batteries, dry and wet.
Conduit and conduit fittings.
Pole-line material.
Motors.
Instruments.
Lighting fixtures and glassware.
Wireless supplies.
Bells and annunciators.
Radio-telephone sets and parts.
Special material.

Many, if not the majority, of these fifteen hundred manufacturers do sell to some extent for direct shipment abroad, but most of them have no definite knowledge as to the standing of the importer in the foreign territory, of his trade standing, of the way he distributes or the possibilities for extending his business by careful sales work.

### Methods Differ with Country

Sales methods, in spite of claims to the contrary, do vary considerably, depending upon the country. For instance, in the Argentine all the materials in these classifications could be sold direct to some fifteen or twenty merchants who are thoroughly dependable as regards credit and sales organization. However, there might be only five firms in Belgium, New Zealand or India; three in Egypt, or in the case of territories such as China and the Dutch East Indies, Norway or Italy, satisfactory direct distribution could be obtained only through one single firm. A question now arises immediately in the minds of the majority of these fifteen hundred manufacturers as to how they can learn the names and obtain the co-operation of these chosen firms through the world.

The answer should be and is a simple one, for it consists in the carrying out of the basic principles as outlined in the combination export department method. It is to be remembered, first of all, that all the materials in the column above are, properly speaking, jobbers' supplies, and it is obvious that the importing jobber who distributes to the smaller jobber, to the inland small-town contractors, dealers and hardware shops is the one to be looked to. And it is these importing jobbers in whose hands lies the future of the foreign sales of electrical material.

Returning now to the combination export department method already outlined as Method No. 6, manufacturers who do not yet possess direct contact with the class of importing jobber in the foreign country must obtain that contract if their sales are going to be a prominent and dependable factor. The object in mind should therefore be to build up an organization in each country, sometimes having that organization possess sub-agencies, as in the case perhaps of France, Chile and India, where there are more than one importing and distributing center.

As already mentioned, the entire electrical line which could be sold to jobbers can be classified under not more than twenty main sections, so that it would be easily feasible for twenty manufacturers to group together and form a centralized export department which would be composed of men thoroughly confident of the possibilities of export trade in the first place, and, secondly, well versed in the requirements of the majority, if not all, of the countries where market waits, and, thirdly, knowing by name and frequently from personal visits to foreign countries the character, caliber and trade standing of the main importing jobbers in each country. This centralized export department would most profitably be handled on a commission and fixed-contribution basis, receiving its remuneration by a commission on the sales made after they were fully paid for by the client, with a stipulated monthly allowance by each manufacturer paid for maintenance, through the first year at least, while the developmental work was being carried out.

### Organization of Group

The organization would employ trained electrical salesmen as manufacturers' representatives abroad, who would solicit business and take orders from the first-class importing jobbers and send these orders to the group export department in New York, which would distribute them to the various manufacturers concerned. The manufacturers would support the export department by supplying literature, sales information and manufacturing information, all of which would be passed on by the group export department to every country in the world where such manufacturers' products could be sold. The group export department would therefore be a true export sales department by informing customers throughout the world of salable material produced by each manufacturer it represented and referring the client to the resident salesmen for up-to-date information, terms of sales and delivery dates.

One of the main features of this organization would be that each manufacturer would retain his individuality as regards his product and the use by the export organization of the letterhead of the manufacturer whose products were being pushed in each foreign country; also, the control of the manufacturer's products would always remain in the manufacturer's hands. Drafts would be made out in his name, forwarded for collection and sent back to the manufacturer direct in his name. At all times the manufacturer could refuse to accept any specific order from any certain customer should he consider that the credit information supplied by the export department would not warrant the acceptance of such an order.

### How Group Agency Functions

Regarding the matter of financing, in the event that the credit information sent to the manufacturer was sufficient to obtain approval of the acceptance of a specific order, the manufacturer would make up the shipment in accordance with the specifications supplied by the export department and ship the goods to New York accompanied by the necessary documents—draft

on customer, export declaration, invoice and a bill of lading—and the export department would then take these documents and attach thereto the other necessary papers, such as ocean bill of lading and insurance certificate and would, in fact, attend to the dispatch of the shipment and add to the draft the expenses incurred for freight, insurance, cartage and so forth in accordance with the manufacturer's own terms of sale. The export department would in turn obtain reimbursement for the exact cost of clearing the shipment from New York, present the draft and attached documents to the bank for collection in the name of the manufacturer, and the bank would obtain payment from the customer and remit direct to the manufacturer.

Other points in favor of the group export department are the facts that, except in the preliminary or analytical stage, the cost of maintenance would be fixed by a commission depending solely upon the volume of foreign sales made; the information regarding clients would be complete; the information regarding possibilities of sale in each country would be complete as that organization's resident abroad would depend for his livelihood upon the group export department; instructions given by the department would be much more carefully attended to and carried out; each manufacturer would maintain his individuality from beginning to end of every transaction; skilled salesmen could be employed abroad who are fundamentally electrical men and who would not have to spend part of their time in visiting hardware importers and selling sanitary goods, foodstuffs and other imports as so many so-called manufacturer's representatives abroad do. By reason of the salesman in the foreign country representing as many as twenty different manufacturers, there would be sufficient income from the commissions to make it worth his while to do a thorough job not only by selling to the importing jobber but by helping that jobber sell the products, through bringing the new devices for which America is rightly famous to the attention of the local architects, builders, contractors and so forth.

# Hartford's Combination Residence Rate

## How It Was Introduced for Trial Period and Why—Four Objectives Sought—Results of a Year's Operation—Fewer Than Two-tenths of 1 per Cent of Residence Customers Desired Return of Old Rate

EXCLUDING cooking and refrigeration, the requirements of household appliance service are estimated at Hartford, Conn., as potentially from 30 kw.-hr. to 40 kw.-hr. per month per residence, with perhaps 20 kw.-hr. additional for lighting. The latter is low compared with the lavish use of illumination that customers would like to make under a more favorable rate than 10 cents per kilowatt-hour. Under the ordinary lighting rate this business simply does not come, and the resistance to the free use of appliances resulting from this straight meter rate is a stiff obstacle to the domestic utilization of electricity. In Hartford, as elsewhere, inducements were offered in the way of special rates to get appliances used. Failure resulted. Customers having power circuits got a 3-cent or a 4-cent rate and used the service liberally, but these were a mere bagatelle compared to the total number of customers. After fifteen years' effort a grand total of 500 out of 35,000 customers in Hartford had been persuaded to install special wiring. The proportion was too small to be justified.

### APPLIANCES "UNSOLD" ON LIGHTING RATE

From the Hartford company's standpoint, an appliance sold to operate on a lighting rate is not a "sold" appliance, at least for the rank and file of the customers. In order really to "sell" a flatiron, as Vice-President Samuel Ferguson put it before the New England Division, N. E. L. A., at a recent meeting in Worcester, the salesman must sell about $50 worth of wiring to insure its full use on a power circuit. In Hartford this means that a million and a half dollars' worth of wiring would have to be sold to customers before the full use of residential appliances could be insured. Such a task was seen to be too large a handicap, and the way out was via the two-part rate, the working out of which required an exhaustive study of all available rates of a residential character.

The rate in effect prior to the inauguration of the combination rate was a straight-line meter rate of 10 cents per kilowatt-hour. The new rate reduced the energy costs to the consumer, but included a flat charge of 5 cents per month for each 100 sq.ft. of floor area, outside measurements. In computing floor area the outside dimensions of the building multiplied by the number of floors were taken, less an allowance for walls, etc., of 4 per cent per 1,000 sq.ft. of over-all area up to 10,000 sq.ft., with a minimum allowance of 10 per cent. Bay windows, unfinished attics, cellars and porches, as well as incidental barns, garages and other outlying buildings unfitted for living quarters, were not included in the computations of floor area. A uniform energy rate of 6 cents per kilowatt-hour by meter is charged for all electricity used.

The new rate went into effect in January, 1922. Ten days before the new rate was announced to the public the directors of the company passed a rate which was published in the local press without announcing the details. The vote in substance said that the management was to file a new rate which would do the following four things:

1. Cause a reduction of approximately $100,000 in the yearly total of residential bills as a class; i.e., reduce the revenues from residential service approximately 10 per cent.

2. Distribute that reduction in proportion to the use made of the facilities required to furnish the service. This meant that a man with a bad load factor would get no reduction, while one with a good load factor would get the full benefit. The "facilities required to furnish the service" did not mean the meter. The company maintained that the meter charge is included in the energy component, but that its fixed charge is the interest and so forth on the station and lines to serve the house.

3. Make the distribution of reduction to residence

consumers without distinction between large and small customers; i.e., a small customer with a good load factor should get a reduction, a large customer with a bad load factor should not. No advantage was planned for the large customer because he was a large customer.

4. Provide a means whereby an average customer could obtain 30 per cent more electricity at an increased bill not to exceed 10 per cent.

The new rate was announced in December, 1921, in a display advertisement (Fig. 1). Here all the facts were laid upon the table and the various steps by which other rate schemes had been eliminated were set forth and the consumers shown exactly what the new rate meant to them. Most important of all, the consumer was shown that for relatively large uses of energy he would receive a material reduction in cost, but that for abnormally small use, either in individual months or continuously, the rate would be higher than the old one. The fact that the consumer has it in his power to "make his own rate" was stressed and illustrated by an example.

The new rate was not a service charge, but was an area charge, the area being a measure of the demand. One objection to a service charge was taken away by the fact that for a small customer it was based on a small house, for a large customer on a large house. The new 6-cent energy rate in place of 10 cents appealed to the public from the outset. For an ordinary lighting customer the area charge combined with the energy used for lighting made the company whole on a 9-cent lighting rate; that is, gave the same income as a 9-cent rate. Beyond an average use of lighting, the rate was 6 cents. This put a power rate into every room of the homes of 35,000 customers. The lighting bill was taken care of by the sum of the area charge plus the energy at 6 cents, and the additional use for appliances or extra light was taken care of by the 6-cent energy charge.

Announcements were also made that the company purposed to try the new rate for a year, but if at the end of that time it should for any reason prove unpopular and the customers desired a change, a return

H. E. L. 120A

**AGREEMENT FOR REFUND**

No. 4200

M.................................................. Address ..............................

having purchased during 1922 an electric ............................ on our Order No. ...................

for use at his home, we hereby agree that, after December 31st, 1922, up to the amount paid to us for the above stated appliance, we will repay to the above customer the amount by which his payments for electric current used at his home during 1922, on our prevailing residence meter schedules, exceed the amount which would have been paid to us for such current on the 1921 residence meter schedules.

Application for such repayment may be made after December 31, 1922, by presentation of this certificate or by person or letter with statement of article purchased and approximate date.

THE HARTFORD ELECTRIC LIGHT COMPANY

1921 Residential Light 10¢ K. W. Hr.
1922— " " Area charge plus 6¢ K. W. Hr.

By ..............................

FIG. 2—COUPON FOR REFUND ON APPLIANCE IN CASE LIGHT BILL INCREASED

# OUR RATE REVISION

**Our Revised Residential Lighting Rate, Effective January 1, 1922, is Announced as Follows**

## Combination Flat Rate and Meter

(1) FLAT RATE, 5 cents per month for each 100 square feet of floor area, outside measurements, with due allowance for walls, closets, etc.,

plus (2) 6 cents for each unit of electricity used by meter. Lamp renewals as at present.

THE FOLLOWING LETTER IS REPRINTED FROM TUESDAY'S "COURANT"

THE HARTFORD ELECTRIC LIGHT CO.
HARTFORD, CONN.

Dec. 20, 1921.

To the Hartford Courant,
Hartford, Connecticut.

Gentlemen:-

In to-day's issue of your paper is contained the announcement of our new combination rate for electric current for domestic use, superseding the existing 10¢ rate.

This rate is designed to make possible a more liberal use of our service, and to change uses which are now luxuries, on account of the 10¢ rate, into inexpensive necessities at a 6¢ rate.

The change involves a decrease in our revenue of approximately $100,000, and it is only our confidence that the new rate will correspondingly stimulate our sales, that justifies this reduction, as prices of coal and labor have not yet fallen sufficiently to materially affect our costs.

The new rate is fair to all, and will reduce the bills of all customers in the months where an average use or more is made of the facilities which we furnish. There will, of course, be an increase of rate in any case or in any month where the use made of our facilities is abnormally low, as in some cases would occur in the summer.

While we believe that the new rate is fair, logical and for the best interest of all, we realize that it is new in Hartford, and if for that reason it proves to be unpopular, it is valueless, as "good will" is our most valuable asset. We, therefore, make the following specific agreement, namely:-

"If after one year's fair trial of this Combination Rate, it should for any reason prove unpopular, and our customers desire us to change, we will return, either to the present 10¢ rate, or if conditions warrant, to such lower rate than 10¢ as our costs at that time justify."

We do not believe such change will be desired, but wish to assure our customers that in the future as in the past, we will endeavor to conduct our business as far as possible in conformity with their wishes.

Yours very truly,

THE HARTFORD ELECTRIC LIGHT COMPANY.

S. Ferguson Vice-President.

The above rate is in accordance with the vote of our Directors passed November 22, 1921, which stated that the revision must do all of the following things:

(1) Cause a reduction of approximately $100,000 in the total of house lighting bills as a class, based on the last 12 months' use.

(2) Distribute that reduction in proportion to the use made of the facilities required to furnish service.

(3) Make that distribution to residence customers without distinction between large and small customers.

(4) Provide a means whereby an average customer may obtain 30% more current at an increased cost of not more than 10% above his present bills.

Other Rates Which Were Considered and Rejected

9 CENTS FOR EACH KILOWATT HOUR

CUSTOMER CHARGE OF 50 CENTS, PLUS

BLOCK METER RATE

A

For the interest of those of our customers who wish to know why this rate was selected, we print herewith several rates used elsewhere which we have been figuring on. All of these would make the initial reduction desired in point (1) above, but each of them fails to meet one or more of the other requirements, or has some undesirable feature.

THE RATE WE HAVE SELECTED AS ANNOUNCED ABOVE IS A COMBINATION OF THE POPULAR HARTFORD FLAT-RATE, SLIGHTLY MODIFIED, WITH A LOWER METER RATE THAN WE HAVE EVER HAD.

Other Rates Which Were Considered and Rejected

COMBINATION FLAT RATE BASED ON SOCKETS, AND METER

COMBINATION FLAT RATE BASED ON ROOMS, AND METER

COMBINATION CUSTOMER CHARGE, FLAT RATE AND METER

B

### Effect of the New Rate

The effect of the rate on each customer depends upon his use of the facilities required to furnish service. If his use, for the size of his home, is larger than average then his reduction will be correspondingly greater. If his use, for the size of his home, is less than average, then his reduction will be correspondingly less. In a small number of cases, or in some months, if the use, for the size of the house, is abnormally small, then the rate will increase. In this way each customer makes his rate by his use.

The way the rate works out in the case of the average customer is shown in the example printed herewith.

THE AVERAGE CUSTOMER

C

**The Low 6-Cent Rate Makes Possible, for Large and Small Customers the Liberal Use of Our Service, for Better Lighting and for the Many Electric Labor-Saving Devices. The Cost of Operating Any Lamp or Appliance is Reduced 40%, or Nearly One-Half.**

**Increased Use of Our Service Will Make Possible Future Decreases in Rate Which Will Be Made as Soon as the Sales of Electricity Grow Sufficiently to Permit.**

## The Hartford Electric Light Company

266 PEARL STREET CHARTER 3330

### A Other Rates Which Were Considered and Rejected

**9 Cents for Each Kilowatt Hour**

This is a reduction of 1 cent per kilowatt hour from the present 10 cent rate. This meets point 1, but does not cover 2, 3 or 4, as this type of rate does not take any consideration of the use of the facilities required to furnish service; it is not low enough to meet point 4.

**Customer Charge of 50 Cents Plus**

7 cents for each unit of electricity. This meets point 1, but fails on points 2 and 3, as it is not based on the use of facilities required to furnish service; it is not low enough to meet point 4; also we do not believe a flat charge per customer, regardless of size, to be as fair.

**Block Meter Rate**

10 cents for first 15 kilowatt hours; 7 cents for excess. This meets point 1, but fails on points 2 and 3 as it is not based on the proportionate use made of the facilities required to furnish service; it is not low enough to meet point 4.

### B Other Rates Which Were Considered and Rejected

**Combination Flat Rate Based on Sockets and Meter**

Flat rate of 3.5 cents per socket, plus 6 cents for each kilowatt hour. This meets all the points, but causes annoyance to the customers on account of the frequent inspection trips to count the sockets, it is impractical with 40,000 customers.

**Combination Flat Rate Based on Rooms and Meter**

Flat rate of 20 cents for each room, plus 6 cents for each kilowatt hour. This meets all the points, but causes annoyance due to the necessity of our men going frequently through all the house; It is also somewhat unfair in charging the same for a small room as for a large room.

**Combination Customer Charge, Flat Rate and Meter**

A customer charge of 50 cents, plus a flat rate of 4 cents for each 100 square feet, plus 5 cents for each kilowatt hour. This meets all the points. It is in use elsewhere in Connecticut. It results in a lower energy rate than the one we have adopted. But we have been led to believe that our customers did not care for a uniform customer charge, and so have eliminated that element from our new rate.

### C The Average Customer

| | | |
|---|---|---|
| The present average customer uses 23 units a month, amounting on the old rate to... | | $2.30 |
| On the new rate, his bill would be: | | |
| (1) Flat rate, average area 1,400 square feet at 5 cents a hundred.......... | $ .70 | |
| (2) 23 units at 6 cents.............. | 1.38 | 2.08 |
| Saving | | .22 |

He can take this saving, or if he wishes he can use electricity more freely at lower cost. Assume that he uses 30% more, then his bill would be:

| | | |
|---|---|---|
| (1) Flat rate as above .................. | $ .70 | |
| (2) 30 units at 6 cents ............. | 1.80 | $2.50 |

**Note that if he had used this increased amount on the old rate, it would have cost $3.00, instead of $2.50.**

FIG. 1—FULL-PAGE ADVERTISEMENT ANNOUNCING NEW TWO-PART RATE IN HARTFORD AND SHOWING DETAILS OF RATE AND HOW IT AFFECTS DIFFERENT CUSTOMERS

THE HARTFORD ELECTRIC LIGHT CO.
266 PEARL STREET
HARTFORD, CONN.

ADDRESS YOUR REPLY TO THE COMPANY

IN YOUR REPLY REFER TO

January 10, 1923.

To Our Residence Lighting Customers:

A year ago we revised our residence rate from the previous 10¢ rate to a 6¢ energy rate plus a fixed charge based on area of customer's residence, a method of charge which was entirely new to most of our customers. From results elsewhere we were sure that it would prove advantageous to this community. We estimated that it would mean a reduction of approximately $100,000 from the old rate, and at the same time more electricity for less money. We asked our customers to give the new method a fair trial for one year. We also agreed that if after a year's trial the new method should prove unpopular we would abandon it.

The trial year has now passed and we thank you all for the fair tryout you have given the rate. We believe that the majority of you are pleased with the results because of the following facts, among others:

1. There are now only about one-quarter as many complaints on bills as there were with the old rate.

2. The public has paid $94,724 less for the total of its household electric bills in 1922 than it would have paid if billed under the old rate.

3. The reduction in cost of current at 6¢, as compared with 10¢, makes possible the use of labor-saving appliances in the home to an extent not otherwise possible or economical.

It is possible, however, that we have misjudged public sentiment. Therefore, as promised, we are giving our customers an opportunity to register their disapproval by the use of the attached coupon, which the Mayor has kindly permitted us to address to his office, in order that the count of same may be made by a third party.

Yours very truly,

THE HARTFORD ELECTRIC LIGHT COMPANY,

S. Ferguson
Vice-President

## *Instructions on Filling Out Coupon*

1. Coupon must be signed by the customer. See that the signature is the same as the name appearing on the face of your last bill.
2. Fill out the blank space on the coupon with the cost per day as obtained by dividing the area charge appearing on your bill by 30 days. This requirement is essential for two reasons:
   a. That you may surely know how small an amount you are paying in return for the benefit of a rate reduction from 10c. to 6c.
   b. That the genuineness of the signature may be checked, as this information is known only to the customer and to the Company.
3. Any other reasons, comments or criticisms which you think should be brought to the Company's attention may be written on a blank piece of paper and attached to the coupon. Constructive suggestions are always welcome.
4. After filling out and signing the coupon, same should be mailed to the Mayor not later than January 13, 1923.

Hon. Richard J. Kinsella,
Mayor of Hartford,
Municipal Building,
Hartford, Conn.

Dear Sir—

In order to obtain the reduced price of 6c. for electric current instead of the old 10c. price, I have to pay the Electric Light Company a flat charge of .... cents per DAY, and I understand that all others are billed a similar charge, varying in amount in accordance with the size of the house.

Because of my relatively small use of current in proportion to the size of my house, this flat rate overbalances the reduction in the cost of the current. My family and I do not see the need of enough additional electricity in our home for labor-saving appliances or for lighting at the 6c. price to make the new rate advantageous to me. Please record me as preferring the 10c. rate.

Yours truly,

..............................
Name of customer

..............................
Address

(For other reasons or comments use an attached sheet.)

FIG. 3—ADVERTISEMENT OF METHOD AND COUPON FOR REQUESTING FORMER RATE

City of Hartford.
CONNECTICUT.
OFFICE OF THE MAYOR.

RICHARD J. KINSELLA,
MAYOR

ABRAHAM S. BORDEN,
SECRETARY

January 15, 1923.

The Hartford Electric Light Company,

Hartford, Conn.

Gentlemen:--

With reference to your advertisements which have appeared in the local newspapers January 10th to 12th, inclusive, regarding your 6 cent residence lighting rate, this office has received a total of 67 coupons expressing preference for the old form of rate. We understand from certificate of Messrs. Brash & Blanchard, Certified Public Accountants, that you have a total of 34,599 customers on this residence lighting rate. Therefore, the coupons received showing a preference for the old rate amount to 2/10 of 1 % of the total customers concerned.

Very truly yours,

Richard J. Kinsella
MAYOR

We are pleased that the above letter from His Honor, the Mayor confirms our opinion that the great majority of our customers are satisfied that our new 6c. rate is now operating or will soon operate to their advantage, as we promised it would, and therefore it will be continued.

We have thereby succeeded in making a low power rate available in every room of each of our 34,000 customers' homes without an expenditure on their part of at least $50 each for the installation of a separate power circuit.

We are not, however, content that there should be even as many as 2-10 of 1% of our customers who are not pleased, as we aim to give 100% satisfactory service. We have, therefore, filed with The Public Utilities Commission two (2) options to our 6c. residential rate, as follows:

1—For any use:
**10c.** per k. w. hr.—No area charge.
Minimum bill **$1.00** per month.

2—For cooking (including light and other household uses):
2c. per k. w. hr.—Area charge 12c. per 100 sq. ft.
Range charge—50c. per k. w. installed.

With these three household lighting rates of **10c, 6c,** and **2c.** for our customers to choose between, every one can be satisfied, and we can accomplish our aim, which is to render good service to the public with 100% of good-will on both sides.

**THE HARTFORD ELECTRIC LIGHT COMPANY**
266 Pearl St. 2-0131

FIG. 4—ADVERTISEMENT OF RESULTS OF REQUESTS FOR FORMER RATE AND ANNOUNCEMENT OF TWO ALTERNATE RATES

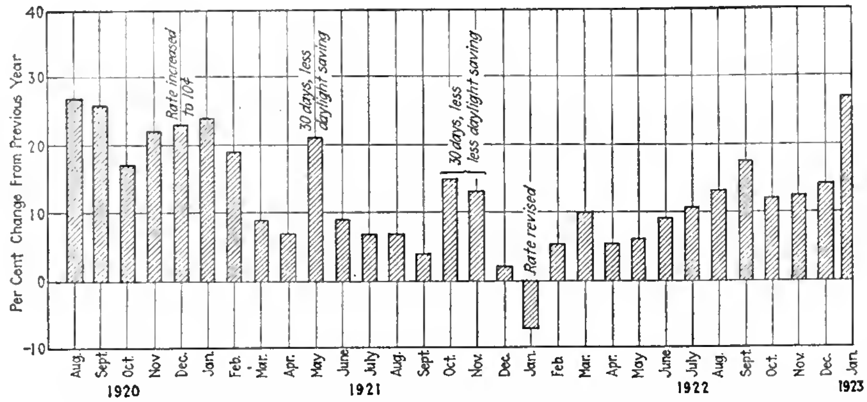



FIG. 5—PERCENTAGE INCREASE OR DECREASE OF RESIDENTIAL KILOWATT-HOURS CONSUMPTION OVER CORRESPONDING MONTH OF PREVIOUS YEAR

year. In these instances the increased consumption due to the use of appliances purchased had effected a lower rate in favor of the customer.

### THE FIRST MONTH'S RESULTS

The two-part rate was put into effect in January, the month of the greatest use. For that month, if the energy had been billed at the old 10-cent rate, the company would have billed about \$90,000; actually it billed \$73,000. The number of bills increased was 5,342 and the number decreased was 23,345. The total amount of the increases for the first month was \$1,007 and of the decreases \$17,938. The smallest bill decreased was 92 cents and the largest bill increased was \$16.68. The average rate received was 8.1 cents per kilowatt-hour. In a press statement discussing the first month's experience the company pointed out that it was sure that those who were not then making at least an average use of the benefits of electricity in the home were paying to others for coal, oil, gas or labor far more money than if they had hired the company at the new energy price of 6 cents to perform a greater amount of service far more conveniently for the user.

would be made either to the 10-cent rate or, if conditions warranted, to such lower rates than 10 cents as costs at that time would justify. It was also pointed out that the new rate meant immediate losses to the company, but that it was expected it would make possible wider uses of electricity which would recoup that loss. Window cards, bill inclosures each month, charts and appliance exhibits in the sales office, "cents-per-hour" meter equipment, notices regarding the greater use of lamps and other forms of advertising were used to impress the public with the possibilities of the new rate.

The promise to give the new rate a year's trial with the alternative of a restoration of the former or a diminished rate in case of dissatisfaction made an instant appeal to the Hartford press, and the company received very favorable editorial comment to the effect that the rate was a fair proposal. The very same papers which were hostile to a uniform service charge of the gas company, though they declared that this was another form of service charge, urged giving it a trial.

There were many customers who objected at the outset to the new rate and quite a number whose total bills were increased. These were of the opinion in some cases that the company was trying to "fake" an advance on the community in the guise of a reduction. They were answered by a coupon (Fig. 2) on every appliance sold during the year which stated that the company would refund them the total amount that their bills were increased during the year by the new rate on the purchase of any appliance made during the year. If their bills were increased \$3 and they bought a five-dollar flatiron, they would get a credit of \$3 on the iron at the end of the year. About 350 of these coupons were sent back for a refund, if any was due, and of these coupons the company paid out \$204 in refunds on about fifty of the coupons. The other 300 received a note stating that the company was glad to see that the rate had worked so much to their advantage during the

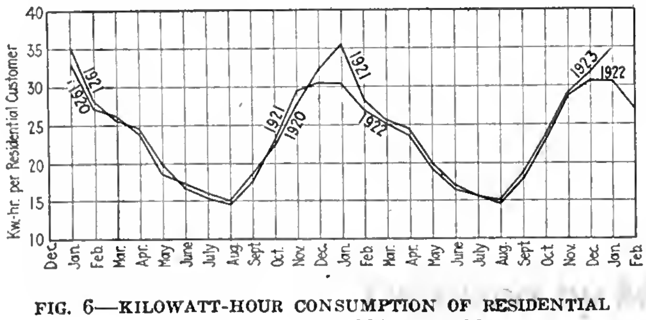



FIG. 6—KILOWATT-HOUR CONSUMPTION OF RESIDENTIAL CUSTOMERS, 1920, 1921 AND 1922

It was a great surprise to the company to find so much "dead wood" on its lines as the five thousand customers whose bills were increased represented. Those customers whose rates had been increased had been a drag on the costs of serving the community with electric light and power. The small customers *per se* are not "dead wood," the use of the service being the criterion, in conjunction with the load factor of each installation.

An analysis of these same customers' accounts in January, 1923, after a year's experience with the rate, showed that almost 60 per cent of them had so increased their use of energy that they had become gainers under the rate and could no longer be classed as "dead wood."

Measurements of areas were taken from the Sanborn insurance or assessors' maps, and after the first month's billing customers were invited to check up their areas with the company's computations for correction by the latter in case of inaccuracy. Resurveys resulted for about 10 per cent of the total residence customers.

### PUBLIC INVITED TO REGISTER DISSATISFACTION

The climax of the first year's use of the rate came in the insertion by the company of a letter form (Fig. 3) in the local newspapers addressed to the Mayor of Hartford, by the use of which customers dissatisfied with the combination rate might indicate their preference for the former 10-cent rate. With this letter form was published a statement signed by Mr. Ferguson, thanking the public for its fair trial of the new rate and pointing out that the public had paid \$97,724 less for the total of its household electric bills in 1922 than it would have paid if billed under the old rate. At the close of the year there were only about 25 per cent as many complaints on bills as under the old rate, and the reduction in the cost of electricity had made possible a greatly increased use of labor-saving appliances in the home. To keep its word about offering to restore the old 10-cent rate and to make sure that it had not misjudged public sentiment, the coupon letter to the Mayor was published. This advertisement was run

for nearly a week. The Mayor agreed to tell the company the number of complaints received, and in a letter (Fig. 4) he conveyed the extraordinary information to it that from 34,599 residence lighting customers only sixty-seven coupons expressing a preference for the old rate were received. This represented only about two-tenths of 1 per cent of the total customers concerned.

However, in order that even this small percentage of customers might be satisfied, the company announced in its advertisement (Fig. 4) two options to the 6-cent rate: First, for any use, 10 cents per kilowatt-hour, with no area charge but with a minimum bill of $1 per month; second, for cooking (including light and other household uses), 2 cents per kilowatt-hour plus an area charge of 12 cents per 100 sq.ft. per month plus a range charge of 50 cents per kilowatt installed. It is interesting to note that only twenty-seven customers availed themselves of the 10-cent option.

A diagrammatic story of the effect of the combination rate is told in Figs. 5 and 6.

This story extends back to August, 1920, and shows the condition existing under the old form of rate previous to and after its increase. The result of the earlier increase in rate to 10 cents, necessitated by high fuel costs, etc., was a marked decrease in the percentage of monthly consumption increases, after the first two months' use. May, October and November of 1921 show the effect of changes due to the daylight-saving shifts and to a shift in the latter two months of meter-reading dates that should be averaged over the months before and after to get a true picture.

The first month of the new rate, which covered the energy used in December before its announcement, shows a loss in residential consumption, but since this time the gain has been fairly uniform. At the expiration of the year the rate of gain of two years previous had been re-established and the per-customer use of current had increased 20 per cent up to March 1.

The consumers of Hartford have been convinced that the new form of rate is to their advantage, and the story of this rate and its introduction shows that the difficulties which many central-station men have feared as a result of an attempt to employ such a combination rate have not materialized. The use of this form of rate is being taken up and effectively applied in many other parts of Connecticut.

### THE SKY BRIGHTENS FOR RESIDENTIAL SERVICE

In closing, Mr. Ferguson's advice to central-station companies as presented at the Worcester meeting previously mentioned is of interest. Referring to the psychological aspects of rate modification, he said: "Take advantage of your present strategic position with the relatively high domestic rate to remove the resistance of wiring costs in the method outlined, and then see to it that your salesmen go at their work with enthusiasm and the feeling that the company is behind them in their efforts and that it expects them to make good. And when they have made good and we are serving a fully electrified customer for every four and a half of our population, we will supply for residential use not less than 150 kw.-hr. per capita per year instead of the present insignificant amount, which seldom exceeds 60 kw.-hr. per capita and in many places is as low as 20 kw.-hr. per inhabitant. And when we add to this the cooking and refrigeration possibilities, we cannot but feel that our industrial salesmen will have to look sharp or they will be completely outdistanced."

# Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

## High-Voltage Cables in Holland

*To the Editors of the* ELECTRICAL WORLD:

I noted with interest the letter of D. M. Simons in the issue of Dec. 2, 1922, page 1217, stating the difficulty of obtaining exact information about foreign high-voltage cables, and I am glad to be able to afford you some details about the cables used in Holland. The company of which I am chief engineer uses both single and three-core 50,000-volt cables. The former are Siemens cable, the latter manufactured by the Callender Works in England. Both kinds of cable are operated at 10,000 volts pending the arrival and installation of 50,000-volt substation apparatus.

The statement that the three-conductor cable developed considerable difficulties is not correct. Operation at 10,000 volts gave no difficulties at all. With 50,000 volts we have not yet had experience, but severe tests lately made have led us to expect that there will be no trouble with this voltage either. We intend to start the 50,000-volt service within three months, and the results will be made known in due time.

W. L. C. BRUNINGS,
Chief Engineer.

Prov. Electriciteitsbedrijf van Noord-Holland,
Haarlem, Holland.

## Sludge Formation in Transformer Oil and Solubility Thereof

*To the Editors of the* ELECTRICAL WORLD:

The experience of naphtho-chemists has shown that transformer oils in contact with air produce sludge very slowly at any operating temperature below 75 deg. C., provided that the oil is of good quality and no catalysts are present. At the operating temperatures above this point the sludge formation is materially increased. Laboratory practice has shown that an accelerated test can be carried on conveniently at 150 deg. C. (Scientific Paper No. 112-B reviews a number of such practical tests.) Consequently a series of tests upon a certain representative transformer oil were made to ascertain the effect of heat in producing a more sludgable oil. The greater the amount of unsaturated constituents present within the oil, the shorter the life becomes because of the greater tendency to form deposits.

Oil was heated at 144 deg. C. for three days. A small portion was taken, allowed to cool, diluted with an equal portion of petroleum ether and allowed to stand a day. The sludge was separated upon a Gooch filter and the filtrate treated by the Babcock absorption method for unsaturated constituents. Portions of the oil were sampled at intervals and tested in a similar manner. The results appear in the following table:

| Kind of Oil | Hours Heated | Temperature (Deg. C.) | Unsaturated Constituents (Per Cent) |
|---|---|---|---|
| Transformer oil | No | 25 | 6.9 |
| Flash, 141 deg. C. | 72 | 144 | 10.0 |
| Viscosity, 50 | 174 | 148 | 13.1 |
| | 384 | 148 | 15.0 |
| Saybolt seconds | 452 | 148 | 21.2 |
| | 650 | 148 | 23.6 |

After 650 hours' heating at 148 deg. C. the oil became thick and full of sludge. If the oil is filtered hot, without dilution, not all the sludge can be separated. If allowed to stand two weeks with no initial filtration, the sides of the containing vessel become heavily coated with sludge and some varnish.

It is a significant fact that parallel runs similar to those shown in the foregoing table were made with nitrogen and carbondioxide, and no sludge was formed. In parallel tests, but with a float arranged within the container, closely fitting along the sides thereof and floated upon the surface of the oil, only a slight coloration of the oil was noticeable.

Sludge-free oil dissolves only a very small amount of sludge. Very finely divided deposit which had been freed from oil by several naphtha extractions was shaken up with a high quality transformer oil ("Wemco A") at various temperatures and held there while shaking for one hour. The sludge was filtered off, washed, weighed, and the percentage of solubility calculated. Results of these tests are given below:

| Sample No. | Temperature (Deg. C.) | Solubility of Sludge in Oil (Per Cent) |
|---|---|---|
| 1 | 12 | 0.001 |
| 2 | 21 | 0.003 |
| 3 | 63 | 0.010 |
| 4 | 105 | 0.013 |
| 5 | 145 | 0.021 |

It is obvious from the above data that the oil-forming sludge tends to create a deposit upon the cooler parts of the transformer.

C. J. Rodman,
Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

## Electrical Energy on the Farm

*To the Editors of the* Electrical World:

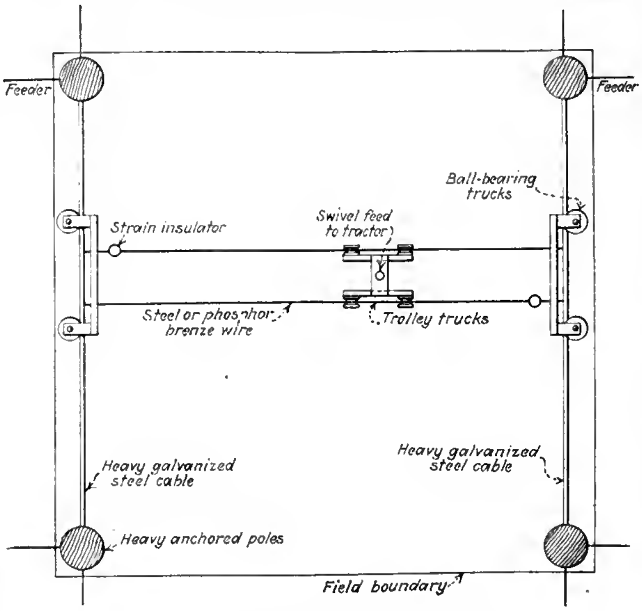
I read with considerable interest your article on the uses of electrical energy in agriculture and, having myself given the subject considerable attention, I should like to present my views.

The suggested equipment, I believe, is somewhat impracticable, considering that plowing constitutes probably only 20 per cent of the entire power work on a cultivated crop. With any cable-haulage system or with a trailing cable the damage done to the crops would prohibit use of the system.

I think a system such as I have outlined in the accompanying sketch would be superior inasmuch as the tractor can move anywhere in the field without changing any of the gear, as must be done with electric drive to compete with the present kerosene tractor. The cables carrying the trolleys can be made of ½-in. standard galvanized guy cable, which will have carrying capacity enough for the purpose. The motor in the tractor need not be of more than 15 hp., which with any kind of economical gearing will give a net pull at the drawbar of 8 hp. The trolley on the tractor is so built that it can make a complete swivel. The two trolley wires have a wide space to prevent short circuits, and the trolley trucks have four wheels, which should be ball-bearing the same as those of the trucks that carry the trolley wires.

I think it is possible to care for a field of 10 acres with the above system, and with proper planning the steel cable for one side of the field can be made to carry the trolley for the adjacent field.

A farmer, contrary to the seemingly popular opinion, has considerable discernment and must be shown that his initial investment is not going to be so high that he can run a kerosene tractor on the interest. An outfit which will satisfy the farmer, therefore, is one where, in the first place, the initial cost is low. In the second place, he must be able to run it all over his property and do all kinds of work with it. In the third place, he should be able to use the motor for stationary



THE TRACTOR CAN MOVE ANYWHERE IN THE FIELD WITHOUT CHANGE IN CONNECTIONS

work in a way which will compare favorably with results from the kerosene tractor.

The central-station company should be alert and use its influence to make electricity possible for the farmer, and this cannot be done till there is some equipment produced that the farmer can use. The central station should figure on not more than a dollar per day for every horse displaced during the active season, which would give \$8 a day for the outfit I have suggested, a fairly attractive figure for a 15-hp. motor.

Inspiration, Ariz. Richard Gibbs.

## The World's Second Largest Reservoir

*To the Editors of the* Electrical World:

In your issue of Jan. 20, 1923, page 179, there is in the statement of Ambassador Gelasio Caetani a little inaccuracy which I beg to correct. Under the heading "Electrical Development in Italy," the Ambassador states: "On the Tirso in Sardegna a reservoir with 416,000,000 cu.m. capacity is being constructed. It will be the second largest in the world, ranging immediately after Assuan Dam, and will develop 50,000,000 kw.-hr."

The Møsvand Reservoir in Telemarken, Norway, furnishing power for the two Rjukan plants belonging to the A/S Rjukanfos of the Norsk Hydro-Elektrisk Kvælstofaktieselskap (Norwegian Hydro-Electric Nitrogen Company) of Norway, has a dam height of 14.5 m., a capacity of about 768,000,000 cu.m., and gives water sufficient to generate from 1,700,000,000 kw.-hr. to 1,800,000,000 kw.-hr. from a total utilized head of 536 m. This reservoir, therefore, still ranges next to the Assuan Dam.

Wilhelm Fleischer,
Supervising Engineer.
Norsk Hydro-Elektrisk Kvælstofaktieselskap,
Christiania, Norway.

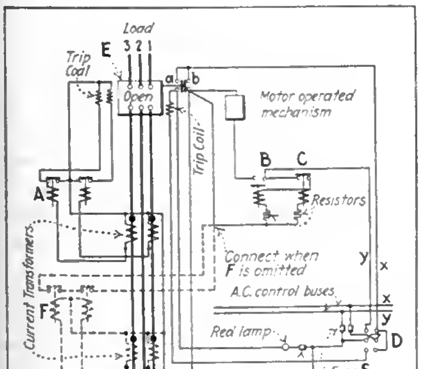
# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Auto Reclosing Switches at Remote Substations

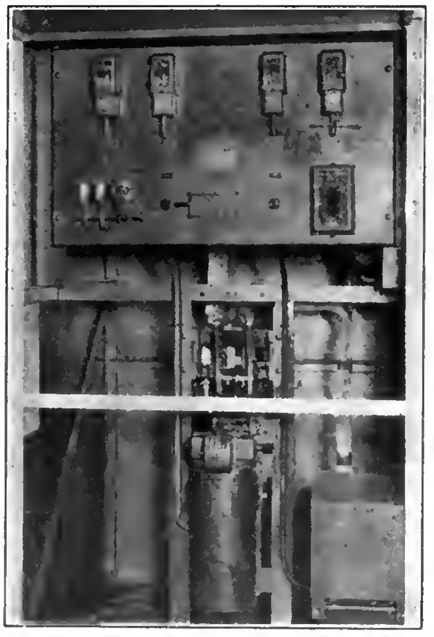
AT REMOTE substations, where the continuous attendance of an operator is not justified, the Tennessee Electric Power Company is installing automatic reclosing circuit breakers which operate on alternating current taken from the transmission lines. Hence no storage batteries are required. Such stations have already been installed at Athens, Sweetwater and Lenoir City. The control connections for the breakers, which are General Electric type, are shown in the accompanying diagram, while the simplicity of the Athens substation is shown by the photograph.

When a short circuit or overload beyond the setting of the overload relay *A* occurs, this relay operates with an inverse time characteristic and trips out the oil circuit breaker. The opening of the breaker closes auxiliary switch *b*, energizing the reclosing relay *B* and the notching relay *C*. After a definite time interval the former closes its contacts and starts the motor, which recloses the oil circuit breaker. At the same time the notching relay moves up a step and will begin resetting as soon as the breaker closes.




AFTER CLOSING SWITCH TWICE THIS EQUIPMENT BECOMES INOPERATIVE

A—Overload time-delay relay. B—Reclosing relay, time-delay closing, instantaneous opening. C—Notching relay. D—Control power switch. E—Oil circuit breaker and mechanism: (a) Auxiliary switch, open when main switch is open; (b) Auxiliary switch, closed when main switch is open.



SIMPLICITY OF CONTROL APPARATUS FEATURE OF AUTOMATIC RECLOSING EQUIPMENT

If the trouble has not cleared from the line by the time the breaker is closed, the overload relay will open it again and the same cycle will be repeated, the notching relay moving up another step. If the trouble still continues the breaker will open a third time, and further automatic operation of the equipment will be prevented by the notching relay, which opens its contacts on the third step and must be reset by hand before operations can be resumed.

The circuit shown by the dotted lines is a further protection which may be incorporated if desired and which locks the breaker open in case of severe short circuits that are beyond the interrupting capacity of the oil circuit breaker. By throwing the control switch *D* to the down position, the breaker is tripped, and it cannot be closed with the switch in that position. This feature assures the safety of anyone inspecting the breaker and equipment. Throwing the control switch to the upper position causes the automatic operation of the breaker to be resumed.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Adjustable-Speed Drive for Steel Mills

TWO adjustable-speed units aggregating 1,000 hp. for steel-mill drive, embodying some very recent developments, are described in the recent report of the iron and steel industry committee of the A. I. E. E. The main drive in these units consists of a mill-type induction motor with a direct-connected synchronous machine on the same base.

The auxiliary machine consists of a frequency converter driven by a synchronous motor. In the operation of the equipment no torque is developed by the frequency converter and the driving motor supplies the power for windage and friction of the auxiliary set. In the operation and during regulation the secondary of the main induction motor is connected to the commutator of the frequency converter and the slip rings of the frequency converter are connected to the synchronous machine connected to the mill. This machine has the property, when driven at synchronous speed, of taking the frequency impressed on the commutator and adding to or subtracting from the line frequency, which in this case is the secondary frequency of the induction motor. The voltage delivered at the commutator end of the frequency converter is the same voltage as that impressed on the slip-ring end and as supplied from the synchronous motor. The synchronous machine on the main set and the synchronous driving motor for the frequency converter are excited with direct current.

After starting the main motor in the regular way as an induction motor, the secondary circuit is transferred to the frequency converter. This is done with no field on the synchronous machine and with the frequency converter running at synchronous speed. If it is desired to use a speed other than the normal, the rheostat in the synchronous machine field is manipulated, putting a field on this machine.

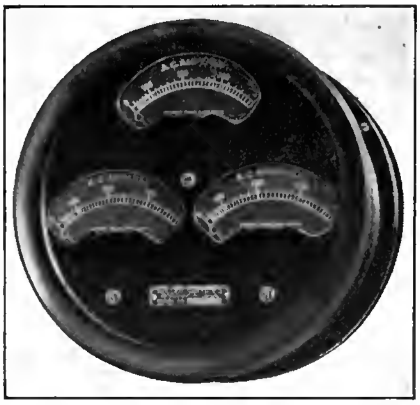
This causes the synchronous machine to generate a certain voltage which is transmitted through the frequency converter and impressed on the secondary of the main induction motor. This voltage, according to whether it opposes or helps the generated secondary voltage, causes the set to slow down or speed up. Any speed within the speed range can be obtained by simply adjusting the above-mentioned field rheostat, giving the desired practical range of speed above and below normal or induction motor speed.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Triplex Ammeter Used for Three-Phase Circuits

THE installation of ammeters on three-phase circuits is often governed by the available switchboard space and the expense involved. The use of an ammeter switch with only one ammeter is apt to cause interruptions to service when ground relay protection is installed. The West Penn Power Company has had developed in accordance with its specifications a triplex ammeter, such as is shown in the accompanying illustration, which has the following outstanding features:

1. It is possible to take readings in the three phases simultaneously as contrasted with the usual scheme of having one ammeter and throwing it from one transformer secondary to another by means of the conventional jack.
2. It occupies much less space than three individual ammeters.
3. It possesses all the advantages of three individual ammeters in that any one of the three mechanisms can be reversed if necessary.



COMBINING OF THREE AMMETERS SAVES SPACE ON THREE-PHASE SWITCHBOARD

4. Each element is thoroughly insulated from the others.
5. Each element has its own zero adjuster.
6. While developed particularly for high-tension metering circuits, the triplex ammeter is being used in low-tension three-phase circuits in connection with suitable current transformers.
7. It is possible to keep three-phase circuits more evenly balanced as a result of such an ammeter, thereby tending to prevent overload interruptions which often occur.
8. The use of three individual elements tends to keep secondary circuits more evenly balanced.
9. Continuity of secondary circuits is more reliable than with some types of ammeter jacks which are apt to cause interruptions, especially when using ground relay protection.
10. High overload capacity.
11. Accuracy well within any desired value for such service.
12. Any one of the three elements may be removed without interruption to the circuit.
13. When used in large quantities the replacing of the new element is about as economical as making repairs.

The details of this instrument are as follows: The elements are of the electromagnet type, in which an efficient air damping scheme is used. All three elements are mounted on one rigid bakelite base, thus insuring proper insulation and providing against misalignment of parts, and in addition there is a bakelite barrier between each two elements. The over-all diameter is 7½ in. and the depth (not including studs) is 3½ in. Connections are in the form of rear studs, of which there are six, so arranged that they cannot turn.

In mounting the instrument it is necessary to drill six holes for the studs. These studs also serve to hold the instrument in place. The whole structure is dust-proof, moisture-proof and practically waterproof. Each scale is about 2¾ in. long. The scales are readable from about 20 per cent to 100 per cent of full-scale value. The average net weight per instrument is 5½ lb.

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West Penn Power Company,
Pittsburgh, Pa.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Instructions for Operating Forced-Draft Fans

FORCED-DRAFT fans should be started under minimum load by having the damper closed when starting. This also prevents the furnace gases from being forced out of the side doors if the stack damper is not properly set. The main oil switch should be used only for the purpose of disconnecting electrical energy from fans, and if it automatically trips, then something unusual has happened which requires the attention of an electrical mechanic before starting the fans again. The following instructions for starting and shutting down forced-draft fans have been taken from the operating code of the Philadelphia Electric Company:

STARTING FORCED-DRAFT FANS

1. See that the forced-draft damper is closed.
2. Turn on the cooling water to the bearings.
3. Start the turbine or motor.
4. Inspect the oiling system and see that the gear case contains the proper quantity of oil and that oil rings, pumps, etc., are in operation.
5. Bring the unit up to speed.
6. Inspect the unit for excessive vibration, and if excessive vibration is discovered, report the trouble to the shift superintendent.
7. If the main oil switch (controlled at the boiler operating boards) should trip, have an inspection made by the electrical mechanic and any trouble corrected before closing again.

SHUTTING DOWN

1. Shut down the turbine or motor.
2. Turn off the cooling water.
3. Close the forced-draft damper.

## Testing Reverse-Current Trips

ACCORDING to the operating code of the Philadelphia Electric Company testing reverse-current trips on rotary converters and motor-generators should be done under the direct supervision of the substation supervisor or foreman. The only time that this test can be made is when the machine being tested is running in parallel with another source of direct current. The following instructions as abstracted from the above code should be followed for this test:

1. Cut in the field resistance slowly, observing the direct-current ammeter, until the reverse-current trip opens the circuit breaker. When the reverse-current relay is set at a high value, disconnect it mechanically from the circuit breaker, reverse the potential leads and load the machine until the relay operates. Reduce the load on the machine to zero. Trip the circuit breaker manually, using the reverse current tripping device.
2. Observe, if possible, the amount of reverse current which operates the trip.

## Test of Boiler Fired with Powdered Coal

A PRELIMINARY statement regarding the results of tests carried out at the Lakeside Station of the Milwaukee Electric Railway & Light Company by the fuel section of the United States Bureau of Mines, in co-operation with the research department of the Combustion Engineering Corporation of New York, has been issued by the Bureau of Mines. The main object of these tests was to determine the thermal efficiency, ease of operation and other particulars of a boiler equipped with specially designed furnace and burners for burning powdered coal. The boiler tested has 13,380 sq. ft. of heating surface and is one of eight boilers equipped with the Lopulco powdered coal system supplying steam to two 20,000-kw. turbines.

Twenty-six tests were run at rates of heat transference varying from 4,000 B.t.u. to 8,000 B.t.u. per square foot of boiler-heating surface, and the mean thermal efficiency attained was about 84 per cent, based on the gross calorific value of the fuel as fired. The efficiency varied little with the rate of steaming and its high value is accounted for by the small loss from incomplete combustion and the small amount of excess air, which varied from 5 per cent to 36 per cent.

The coal burned had a gross calorific value of from 11,500 B.t.u. to 12,800 B.t.u. per pound, containing 2 per cent to 5 per cent moisture, 33 per cent to 36 per cent volatile matter and 9 per cent to 13 per cent ash, and was so grounded that 89 per cent to 95 per cent would pass through a 100-mesh sieve. The ash had a softening point of 2,150 deg. to 2,450 deg. F., but did not fuse together at the bottom of the furnace because it was partly protected from the flame radiation by means of a series of water tubes connected to the boiler which were placed between the furnace bottom and the flame. A summary of the results of boiler tests is given in the accompanying table.

FIELD EDITOR ELECTRICAL WORLD.

Chicago, Ill.

RESULTS OF BOILER TESTS AT LAKESIDE POWER STATION, WHERE POWDERED COAL IS USED THROUGHOUT

| | | | Per Cent Efficiency Based on Gross Calorific Value | | Per Cent Efficiency Based on Net Calorific Value | | Temperature, Deg. F. | | | $CO_2$, Per Cent | | | Coal Size | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Test Number | Duration, Hours | Per Cent Rating Based on Heat Absorbed by Boiler and Superheater | Boiler and Superheater | Boiler, Superheater and Economizer | Boiler and Superheater | Boiler, Superheater and Economizer | Gases Leaving Boiler | Gases Leaving Economizer | Superheated Steam | Gases Leaving Boiler | Gases Leaving Economizer | Moisture, per Cent | Through Screen, 100 Mesh | Through Screen, 200 Mesh |
| 1 | 42.33 | 137 | 83.3 | 86.4 | 86.6 | 89.8 | 436 | 170 | 547 | 15.8 | 10.4 | 2.2 | 89 | 68 |
| 2 | 23.97 | 216 | 82.6 | 87.1 | 86.1 | 90.8 | 470 | 195 | 592 | 14.6 | 11.9 | 3.6 | 91 | 69 |
| 3 | 19.92 | 210 | 82.5 | 87.1 | 85.9 | 90.7 | 484 | 204 | 598 | 14.7 | 12.0 | 3.9 | 91 | 69 |
| 4 | 24.37 | 144 | 85.3 | 89.1 | 89.0 | 93.0 | 432 | 205 | 529 | 16.0 | 13.2 | 5.6 | 92 | 71 |
| 5 | 24.17 | 236 | 79.7 | 84.4 | 83.1 | 88.0 | 500 | 254 | 590 | 14.1 | 10.8 | 5.7 | 91 | 67 |
| 6 | 28.25 | 139 | 83.4 | 87.6 | 86.8 | 91.1 | 456 | 229 | 554 | 15.1 | 11.4 | 3.7 | 92 | 68 |
| 7 | 25.57 | 178 | 84.0 | 88.4 | 87.3 | 91.9 | 469 | 240 | 561 | 14.7 | 11.2 | 3.5 | 93 | 66 |
| 8 | 24.00 | 176 | 85.1 | 89.5 | 88.5 | 93.1 | 470 | 239 | 558 | 15.0 | 11.4 | 3.5 | 92 | 63 |
| 9 | 24.28 | 205 | 83.9 | 88.4 | 87.2 | 91.9 | 493 | 256 | 572 | 15.1 | 9.9 | 2.8 | 94 | 73 |
| 10 | 24.62 | 204 | 83.4 | 87.3 | 86.6 | 90.7 | 490 | 256 | 565 | 14.7 | 10.5 | 3.5 | 90 | 58 |
| 11 | 24.08 | 243 | 81.6 | 86.4 | 85.0 | 90.0 | 535 | 286 | 592 | 14.0 | 10.2 | 3.7 | 95 | 69 |
| 12 | 23.92 | 241 | 82.3 | 87.0 | 85.6 | 90.5 | 528 | 263 | 595 | 14.3 | 11.3 | 4.1 | 93 | 69 |
| 13 | 24.25 | 248 | 80.9 | 85.5 | 84.2 | 89.0 | 538 | 272 | 601 | 14.2 | 9.8 | 3.6 | 93 | 70 |
| 14 | 24.50 | 130 | 84.5 | 88.3 | 87.9 | 91.8 | 440 | 218 | 521 | 17.1 | 14.7 | 3.2 | 93 | 65 |
| 15 | 17.63 | 136 | 84.7 | 88.8 | 88.0 | 92.3 | 444 | 221 | 538 | 16.4 | 14.0 | 3.6 | 92 | 65 |
| 16 | 24.15 | 251 | 83.8 | 88.8 | 87.4 | 92.6 | 530 | 256 | 612 | 14.8 | 11.2 | 5.5 | 91 | 68 |
| 17 | 23.45 | 238 | 82.3 | 87.6 | 85.7 | 91.2 | 528 | 268 | 605 | 14.1 | 9.9 | 4.9 | 92 | 65 |
| 18 | 24.67 | 257 | 82.1 | 86.9 | 85.4 | 90.4 | 526 | 269 | 594 | 14.9 | 10.9 | 3.4 | 93 | 70 |
| 19 | 27.38 | 256 | 82.8 | 87.6 | 86.1 | 91.0 | 519 | 262 | 588 | 15.0 | 11.6 | 3.1 | 93 | 64 |
| 20 | 26.67 | 251 | 79.5 | 84.5 | 82.6 | 87.8 | 545 | 306 | 594 | 13.9 | 11.8 | 2.2 | 92 | 67 |
| 21 | 23.93 | 175 | 86.9 | 91.3 | 90.3 | 94.8 | 468 | 260 | 563 | 15.6 | 13.8 | 2.2 | 93 | 72 |
| 22 | 24.42 | 167 | 86.2 | 90.4 | 89.5 | 93.9 | 463 | 264 | 564 | 15.7 | 13.7 | 2.5 | 92 | 70 |
| 23 | 24.83 | 233 | 81.8 | 86.2 | 85.0 | 89.6 | 526 | 298 | 595 | 13.7 | 11.4 | 2.8 | 92 | 57 |
| 24 | 25.00 | 224 | 81.2 | 85.9 | 84.4 | 89.3 | 512 | 294 | 588 | 13.1 | 10.9 | 2.8 | 91 | 69 |
| 25 | 24.03 | 170 | 85.4 | 89.3 | 88.8 | 92.9 | 464 | 254 | 562 | 15.7 | 13.9 | 3.5 | 92 | 66 |
| 26 | 25.55 | 166 | 86.0 | 89.9 | 89.4 | 93.4 | 459 | 252 | 566 | 15.4 | 13.6 | 3.4 | 92 | 70 |

Note—No time elapsed between tests which are bracketed together.

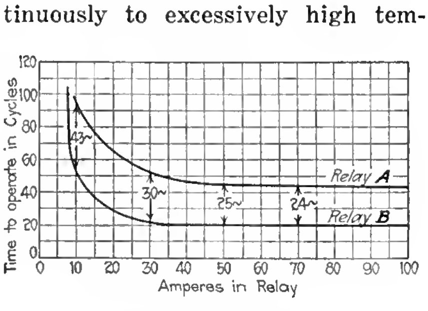
# Checking and Calibrating Relays in Place*

### Selecting Suitable Locations for Relays—Precautions to Be Considered Before the Actual Placing of Various Types of Protective Devices Into Service

IT IS important that relays be installed in a clean part of the station where there is plenty of light, minimum vibration and suitable temperature conditions. The relay equipments of the different lines or apparatus should be grouped on the panels at the proper height and clearly designated in order to facilitate thorough testing and inspection without accident of any sort such as operating a relay of equipment other than that being tested, from which serious consequences might come.

Generally speaking, there is not enough difference in temperatures of stations, except those of the outdoor type, throughout the year to be of serious consequence in affecting the operation of the relays. The temperature question should, however, receive consideration where relays are installed in unheated inclosures used with outdoor substations and required to function selectively with others in stations heated in the usual manner. It is possible that the error produced by a given change of temperature will affect different types of relays in different ways; that is, on one relay it may increase the time of operation and on another decrease the time. It would seem advisable not to install relays of the bellows type where they will be subjected more or less continuously to excessively high temperatures, on account of the likelihood of drying out the leather, with the consequent inaccuracies of operation.

Each relay equipment should be provided with facilities for opening the current circuits in such a man-




CHARACTERISTIC CURVES OF TYPICAL OVERCURRENT RELAYS

Relay A—8-amp. starting current; 50 amp. for opening within 45 cycles.

Relay B—6-amp. starting current; 50 amp. for opening within 20 cycles.

*This article, describing suitable locations for relays and outlining methods for checking and calibrating relay installations, is a continuation of the article printed in the Feb. 10 issue of ELECTRICAL WORLD, page 338.

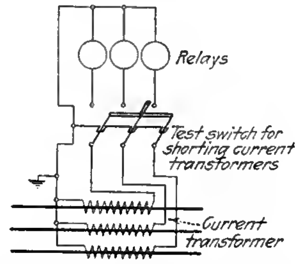
ner that the current transformers will be short-circuited and the relay terminals be available so that connections for calibration can easily be made. This device can be made up in the form of a knife switch with short-circuiting clips and test terminals placed in a small box, which can be locked if desired. When relays make use of potential, fuses can be used for protection and for the purpose of disconnecting the source of voltage. These current or potential cut-outs should, of course, be grouped with the relays or else clearly designated so that no mistake will be likely to be made in opening the circuits.

It will be found very convenient to have a source of alternating current of 110 volts or 220 volts available near the relay equipments to use for testing and calibrating purposes.

After the relay wiring on any given installation has all been completed, the correctness of connections can be checked by opening the circuits and talking over the various wires through the use of head telephones. It is generally not advisable to make tests of this sort by the use of a telephone receiver and battery depending upon a click in the receiver as an indication of completed circuit as the capacity between leads will often give a false indication. After all the wiring has been checked in this manner additional checks should be made on most types of installations to make sure that everything is correct.

In addition to the above, excess-current relays should be operated electrically, making use, if desired, of a small alternating-current test set such as was described in the previous article referred to in the footnote on page 925.

Directional (reverse-power) relay installations should be checked under load conditions to make sure that phase relations, etc., are correct and that the contacts are open with the normal direction of energy transfer. A device which may be used for this is described in the above-mentioned article.




MAKING RELAY TERMINALS AVAILABLE FOR TESTING PURPOSES

Double-winding differential relays such as are used for the protection of transformer banks may be checked for balance by removing the relay core and placing therein a test core provided with a winding which is connected to a voltmeter. If under load conditions an exact balance does not exist in the relay, a voltage will be induced in this winding and indicated on the voltmeter. This method of checking differential relays leaves nothing to be assumed and can be carried out without removing any electrical connections.

It should be kept in mind that the value of differential-relay protective systems lies to a great extent in their ability to isolate defective equipment quickly, and auxiliary relays or any factors which increase operating time appreciably are to be avoided.

TEST CORE USED WITH DIFFERENTIAL RELAYS MADE WITH 700 TURNS OF NO. 31 WIRE

After all tests have been made, care should be used to make sure that any circuits opened during the tests are properly closed and that the relays actually trip the circuit breakers as desired.

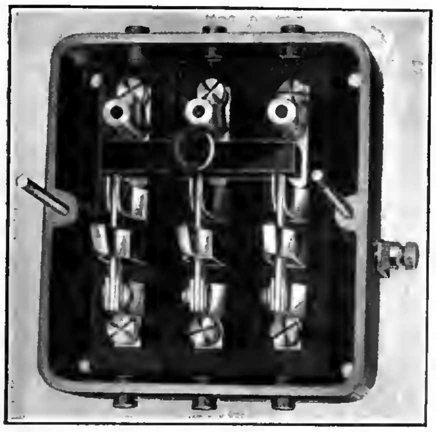
In developing methods for testing other types of relay installations than those described herein it should be kept in mind that it is inadvisable to use any method of test that requires extensive opening of circuits or changing of adjustments on account of the possible failure to restore them to their original condition at the end of the test. After it has definitely been determined that the relay protective system is in satisfactory operating condition, the relays should have their final setting.

In determining the exact time settings to be employed with excess-current time-limit relays it is generally considered that the relays with the minimum setting should have enough time delay so that they will not open the breaker under surges or troubles which do not require that that particular section of the system be isolated. This means that the relays which are set for minimum time will probably have an adjustment of 20 cycles (on the basis of 60 cycles per second and operation of the relay on the flat part of its characteristic curve). The relays with the next higher time setting, which must function selectively with these, should be set for about 45 cycles or 50 cycles. This time difference is made up as follows: After the first-mentioned relay has closed its contacts at the end of 20 cycles, the auxiliary relay will close its contact from 1 cycle to 5 cycles later, and an additional time of about 10 cycles or 12 cycles will be required from the instant voltage is impressed on the opening coil of the circuit breaker until the short-circuit current is actually opened.

The time for the breaker to open the short-circuit current must, of course, be included, as the relay with the higher time setting, which should not close its contact, keeps on moving closer to the point where its contacts close until the short-circuit current is actually interrupted. It is also advisable to include about 10 cycles additional time between the settings of the two relays to take care of any inaccuracies in the relays, errors in settings and sluggish opening of the circuit breaker.

It is advisable where relays of different types are used to function se-

lectively together that the characteristic curves be plotted according to the settings used so that the time difference under all conditions can be checked to make sure that selective action will really be obtained. The curves on page 925 show characteristic instances of typical relays plotted so as to show the time difference between the relay settings at various current values. This shows clearly the variation of time at the



SWITCH FOR SHORTING CURRENT TRANSFORMERS WHEN TESTING RELAYS

different points on the curve and the necessity for making sure that this time is sufficient at all points.

Every care should be used in making the final tests and inspections on relays to insure their functioning in the desired manner. It is almost impossible to overemphasize the need for exact work in connection with relay-protecting systems. If the person who inspects and adjusts relays is a keen observer, he may notice little things which are not quite as they should be that may lead to serious trouble if not corrected.

In a subsequent article it is planned to discuss routine tests and calibration of relays which should be made in order to insure that the relays will function properly.

RAYMOND BAILEY,
Assistant Chief Electrical Designer.
Philadelphia Electric Company,
Philadelphia, Pa.

## Blasting Post Holes Saves Hours

SOME interesting experiences in digging post holes in frozen ground for a light and power company are reported by Charles Van Zandbergen, Onalaska, Wis. Digging by hand, it required from eight to nine hours for one man to excavate a hole 6 ft. deep and 2 ft. in diameter. Mr. Van Zandbergen was able to accomplish the same work in a few minutes by the use of dynamite, using one stick of 40 per cent to break up the frozen ground and later three sticks to loosen it further down. A workman afterward trimmed the sides and cleaned the hole out, the entire operation with dynamite taking about one hour. Besides the great saving of time by the use of dynamite under these conditions, there was an appreciable saving of money.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Sidelights on Electric Furnace Maintenance

AN ELECTRIC furnace with intelligent handling should last at least eight years, and perhaps twelve, against a life of four to six years for an oil furnace, according to a recent discussion before the Boston Section of American Society for Steel Treating. It was pointed out that whereas ribbon-type heating units are designed for continuous life at normal service, if burn-outs occur repairs can easily be effected by lapping the strips over one another a few inches and welding the edges only. If cross-welding is undertaken, the uniformity of the material may be disturbed at critical areas. It was also stated that the cost of replacing hairpin-type resistors is excessive in comparison with replacing ribbon-type resistors.

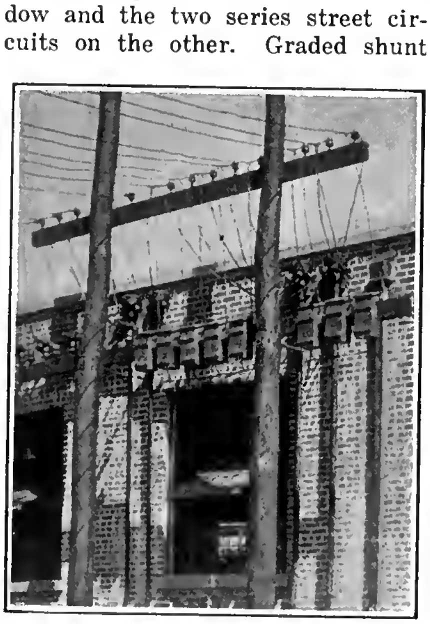
In the case of one rotary furnace with ribbon-type resistors mounted on the inside walls, the cost of repairs in three years' operation has not exceeded $25. No trouble was experienced from the scaling off and short-circuiting of coils unless very high temperatures considerably above 1,800 deg. F. were encountered. In some processes where about 2,000 deg. F. is required the furnace owner must be prepared at present to obtain a somewhat reduced life of ribbon-type resistors, this being about two months in one installation operated at 2,050 deg. F. Researches are now under way looking toward the development of resistor metal capable of operation at temperatures 300 deg. to 400 deg. above present conservative limits, and in due course there may be an advance of electric heating into the difficult fields of treating high-speed tool steel and even of forging. The advantages of electric heating in industry continue to spread. Gears formerly treated in fuel-fired furnaces in automobile manufacture had to be sand-blasted after heating. This frequently changed the shape of the teeth and always added to the manufacturing cost. Since the advent of the electric furnace it is necessary only to use the wire brush on such gears, with much better results.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Ample Space Provided for Outgoing Lines

IN A SMALL power plant where the outgoing feeders consist of two two-phase, four-wire, 2,300-volt commercial feeders and two series street-lighting circuits an arrangement of the circuits as shown in the accompanying illustration provides plenty of room for the lineman to work on the lines or poles and presents a neat appearance. All the lines are accessible either from the roof or from the poles. As the ground is very sandy and loose the poles were tubbed and in addition they were bolted to the building. This gave a very rigid and safe construction.

From the switchboard the feeders run underground and are lead-covered cable in conduit. The two commercial feeders come up outside the building on one side of the window and the two series street circuits on the other. Graded shunt



ARRANGEMENT OF FEEDERS PROVIDES PLENTY OF ROOM FOR LINEMEN

resistance multigap arresters are provided for the commercial circuits and single-pole horn arresters for the series circuits. Separate grounds are provided for the arresters on the series circuits and the arresters on the commercial circuits.

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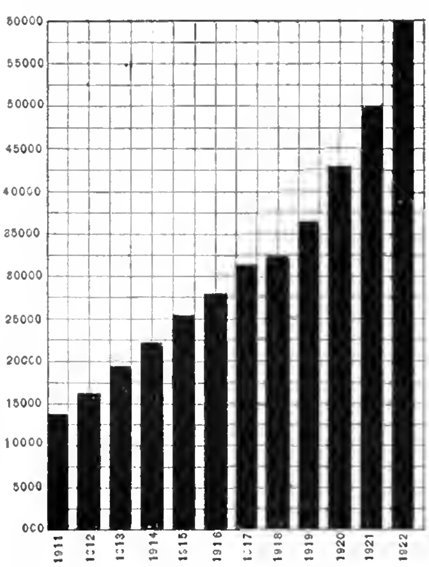
# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## Central-Station Development at Providence

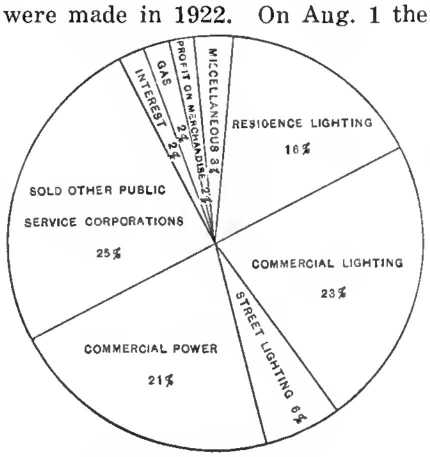
NOTEWORTHY expansion in the plant and service of the Narragansett Electric Lighting Company, Providence, is emphasized by President E. A. Barrows in his report to stockholders for 1922, and the excellent public relations of this, the second largest central-station company in New England, are also dwelt upon. During the year recently ended the total revenue was $5,574,825, a gain of over 10 per cent above 1921. The net income was $1,319,664, or more than 29 per cent above the preceding year and there was a gain of 20 per cent in station output, which reached a total of 277,993,260 kw.-hr. This output is nearly 300 per cent larger than it was six years ago. About $4 of capital is required for every dollar of new business obtained by this company.

The company has 59,985 customers, a gain of 10,176 during the year. This is the largest increase in customers in any year of the company's history. Old houses to the number of 2,462 were wired and stores to the number of ninety-nine in 1922, requiring the installation of 4,393 meters. The estimated gross revenue from this business alone is $110,000. It is the intention during 1923 to continue this work, as there are still fully 15,000 unwired houses in the territory. Gross sales of merchandise in the electric shops of the company totaled $569,400.




INCREASE IN CUSTOMERS DURING LAST TWELVE YEARS

Two important rate reductions were made in 1922. On Aug. 1 the clause in the schedule providing that no bills for house lighting should be less than 9 cents net per kilowatt-hour was eliminated, all electricity under this rate being sold for 7 cents per kilowatt-hour plus a monthly service charge of 50 cents. It is estimated that the elimination of this so-called "stop clause" will save the public about $140,000 during the first year. On Sept. 1 a further decrease from 7 to 6.9 cents per kilowatt-hour was made.




PROVIDENCE COMPANY'S SOURCES OF INCOME

The use of fuel oil was continued with marked economy during the year. Ninety-six per cent of the fuel used was oil and 4 per cent coal, the combined total being 188,506 tons. Of oil the company burned 942,244 barrels, and the company's customers were saved a large sum of money compared with the cost of service on a coal basis.

The company has begun gradually changing over its noted 250-volt lighting system to 104 volts. This change is planned in order that there may ultimately be a uniform voltage over the entire system, as is the case with the great majority of companies throughout the country.

## House Wiring on Trial Booms Business

AGREEMENTS to the number of 997 for house wiring were made in 1922 on the system of the Edison Electric Illuminating Company of Boston, a gain of 95.8 per cent over the previous year. During the year a thirty-day trial installation feature was adopted, the financing of which was done by the contractors on a ten-monthly payment basis. This trial feature, according to L. R. Wallis, superintendent of the sales department, has aided materially in securing this class of business, and up to the close of the year not a single instance had occurred where a customer failed to accept the installation at the end of the thirty-day trial.

The total number of houses wired during the year under these agreements represented an outlay for wiring of $170,604, or an average price per house of $171.12. The average number of sockets per house was twenty-five, compared with twenty-two in 1921, and in the latter year the average price per house was $178.33. The total connected load added by these wiring jobs was 1,257.6 kw., yielding an estimated annual income to the company of $41,224. In 1921 509 houses were wired. Boston and Somerville led the other municipalities served by the company with 309 and 266 house-wiring agreements respectively. The contractor making the largest number of agreements was E. C. Sanderson of Winchester, who handled 330 contracts.

## Advertising Security Sales on Company Letters

"CATCHY" sentences on the bottom of all outgoing letters form one of the methods of advertising the sale of its securities to customers recently used by the Central Indiana Power Company and its subsidiary companies in a customer-ownership campaign. Altogether

sixty-six of these sentences were used. A schedule was made up which started with No. 1 on a given day on all of the properties. The second day No. 2 was used, and so on for each succeeding day. Following are typical examples of the sentences. They were purposely made short enough to be read at a glance, aiming to hold the attention of the reader and make him ask for more information:

No. 1. Central Indiana Power Company owns electric companies operating in 103 communities in Indiana.

No. 2. Central Indiana Power Company's 7 per cent cumulative preferred stock nets better than 7.69 per cent on money invested.

No. 9. Central Indiana Power preferred stock can be purchased for cash or on partial-payment plan.

No. 16. Any employee of our company will be pleased to explain Central Indiana Power preferred stock.

No. 37. Central Indiana Power Company has paid forty-two consecutive dividends.

No. 43. Dividends on three shares of Central Indiana Power Company cumulative preferred stock will pay your light bill for a year.

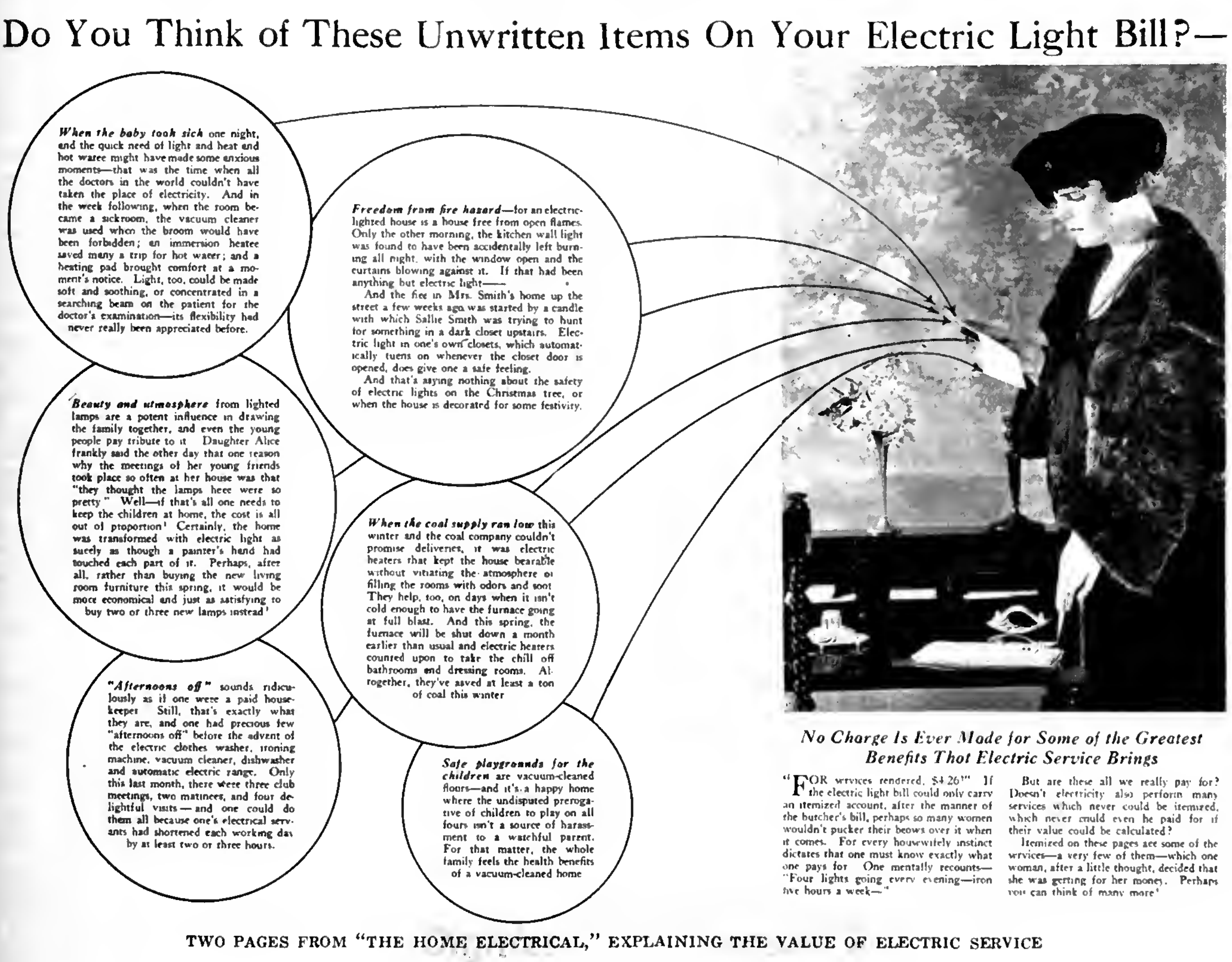
No. 53. As long as people need light Central Indiana Power Company cumulative preferred stock will pay dividends.

## Central Stations Using an Electrical Pictorial for the Home

THESE two pages are reproduced from a small publication entitled *The Home Electrical*, which has recently made its appearance. It is a distinct innovation in electrical publishing, for its purpose is to carry the message of electric service into the home in behalf of the central station.

For the purpose of drawing the line sharply between ordinary advertising and this type of educational reading several utility companies who have been for several months distributing *The Home Electrical* to their consumers are sending out this little pictorial in special envelopes marked "From the office of the President, United Light & Power Company." This secures attention, and the fact that the publication bears no name but that of the publisher is impressive. It is received as, and in fact is, an interesting independent picture-folder sent as a courteous gift. Therefore in addition to its educational influence it has a distinct public relations value. Each month the articles and pictures are devoted to some seasonable theme—housewiring, Christmas gifts, labor savers, electrical convenience and so on.

These central stations are taking advantage of the fact that people are *interested* in the household uses of electricity; that there is a popular appetite for information on this subject. They believe that men and women want to know more about it, and that there is an opportunity for the electrical industry to tell them many things, both in pictures and in facts, beyond the scope of the ordinary advertisements of light and power companies, manufacturers, jobbers, contractors and dealers whose messages usually have immediate selling as their chief objective. *The Home Electrical* has been developed as a medium for telling this more general story of electricity in our daily living and is designed to be distributed by central station companies to their residence customers. It is published by *Electrical Merchandising*, New York.



Do You Think of These Unwritten Items On Your Electric Light Bill?—

***When the baby took sick*** one night, end the quick need of light and heat end hot waree might have made some anxious moments—that was the time when all the doctors in the world couldn't have taken the place of electricity. And in the week following, when the room became a sickroom, the vacuum cleaner was used when the broom would have been forbidden; en immersion heatee saved many a trip for hot waeer; and a heating pad brought comfort at a moment's notice. Light, too, could be made soft and soothing, or concentrated in a searching beam on the patient for the doctor's examination—its flexibility had never really been appreciated before.

***Freedom from fire hazard***—for an electric-lighted house is a house free from open flames. Only the other morning, the kitchen wall light was found to have been accidentally left burning all night, with the window open and the curtains blowing against it. If that had been anything but electric light——

And the fiee in Mrs. Smith's home up the street a few weeks ago was started by a candle with which Sallie Smith was trying to hunt for something in a dark closet upstairs. Electric light in one's own closets, which automatically tuens on whenever the closet door is opened, does give one a safe feeling.

And that's saying nothing about the safety of electric lights on the Christmas tree, or when the house is decorated for some festivity.

***Beauty and atmosphere*** from lighted lamps are a potent influence in drawing the family together, and even the young people pay tribute to it. Daughter Alice frankly said the other day that one reason why the meetings of her young friends took place so often at her house was that "they thought the lamps heee were so pretty." Well—if that's all one needs to keep the children at home, the cost is all out of proportion! Certainly, the home was transformed with electric light as surely as though a painter's hend had touched each part of it. Perhaps, after all, rather than buying the new living room furniture this spring, it would be moce economical end just as satisfying to buy two or three new lamps instead!

***When the coal supply ran low*** this winter and the coal company couldn't promise deliveries, it was electric heaters that kept the house bearable without vitiating the atmosphere or filling the rooms with odors and soot. They help, too, on days when it isn't cold enough to have the furnace going at full blast. And this spring, the furnace will be shut down a month earlier than usual and electric heaters counted upon to take the chill off bathrooms end dressing rooms. Altogether, they've saved at least a ton of coal this winter.

***"Afternoons off"*** sounds ridiculously as if one were a paid housekeeper. Still, that's exactly what they are, and one had precious few "afternoons off" before the advent of the electric clothes washer, ironing machine, vacuum cleaner, dishwasher and automatic electric range. Only this last month, there weee three club meetings, two matinees, and four delightful visits — and one could do them all because one's electrical servants had shortened each working day by at least two or three hours.

***Safe playgrounds for the children*** are vacuum-cleaned floors—and it's a happy home where the undisputed prerogative of children to play on all fours isn't a source of harassment to a watchful parent. For that matter, the whole family feels the health benefits of a vacuum-cleaned home.

*No Charge Is Ever Made for Some of the Greatest Benefits Thot Electric Service Brings*

"FOR services rendered, $4.26!" If the electric light bill could only carry an itemized account, after the manner of the butcher's bill, perhaps so many women wouldn't pucker their beows over it when it comes. For every housewifely instinct dictates that one must know exactly what one pays for. One mentally recounts—"Four lights going every evening—iron five hours a week—"

But are these all we really pay for? Doesn't electricity also perform many services which never could be itemized, which never could even be paid for if their value could be calculated?

Itemized on these pages are some of the services—a very few of them—which one woman, after a little thought, decided that she was getting for her money. Perhaps you can think of many more!

TWO PAGES FROM "THE HOME ELECTRICAL," EXPLAINING THE VALUE OF ELECTRIC SERVICE

## Pacific Gas & Electric Increases Free Allowance on Extension

AS A RESULT of easier financing conditions, together with lower rates of interest and generally better business conditions, a new and consirerably more liberal line extension policy than the one which has been in effect was adopted by the Pacific Gas & Electric Company, effective March 1. Under the new arrangement the company will make extensions at its own expense where the cost does not exceed $125 per customer or where the cost of the extension does not exceed five times the estimated annual revenue. Under the former policy the free limit was $80 per customer, or the company would spend not in excess of three times the estimated annual revenue. Following is the complete text of the new rules:

(1) *Residential.*—The company will make extensions for bona-fide residential consumers at company expense where cost of such extension does not exceed $125 per consumer, or where the estimated annual gross revenue equals or exceeds 20 per cent of the total cost of said extension and facilities necessary to supply service.

(2) *General.*—(a) Where the estimated annual gross revenue equals or exceeds 20 per cent of the total cost of the extension and facilities necessary to supply service, the company will, at its own expense, make all extensions on public highways necessary to supply electric service to applicants (except service to mines, temporary service or service of doubtful permanency).

(b) When the estimated annual gross revenue to be secured from any electric extension is less than 20 per cent, the company will, when business is of a permanent nature, pay all costs in connection therewith up to an amount equal to five times the estimated annual revenue, and any excess of cost over said amount shall be advanced as extension deposit by the applicant, subject to refund as follows:

If the total revenue during any period of five consecutive years exceeds the cost of the said extension and facilities paid for by the company, then the company will refund to the consumer an amount equal to such excess, provided that no refunds will be made after the tenth year and that the revenue during the tenth year for the purpose of determining the refund shall not be taken as more than the average revenue of the three preceding years.

If and when other consumers are connected within a period of ten years to the extension so made, then the company will make such refunds as may be necessary to make said extension deposit equal to the difference between the total cost of the extensions and facilities involved and the combined five-year revenue of original and additional consumers.

When an additional extension, requiring an advance on the part of the consumer, is made in connection with an extension upon which advances have been made, a refund will be made to consumer making such additional extension as outlined above. When such consumer or consumers have been reimbursed to the full extent of his or their advances, then the revenue derived from such additional extension will be added to the revenue of the original applicant for the purpose of computing the original applicant's refunds.

(3) *Rice Irrigation.*—(a) Where the estimated annual gross revenue equals or exceeds 50 per cent of the total cost of the extension and facilities necessary to supply service, the company will, at its own expense, make all extensions on public highways necessary to supply electric service to applicants.

(b) When the annual gross revenue to be secured from any electric extension is less than 50 per cent of the total cost of the extension and facilities necessary to supply service, the company will pay all costs in connection therewith up to an amount equal to twice the estimated annual revenue, and any excess of cost over said amount shall be advanced by the applicant, subject to refund as follows:

If the total revenue during any period of two consecutive years exceeds the amount of the extension and facilities paid for by the company, then the company will refund to the consumer an amount equal to such excess, provided that no refunds will be made after the tenth year and that the revenue during the tenth year for the purpose of determining the refund shall not be taken as more than the average revenue for the three preceding years.

## Convention Paper Increases Window Lighting

THE connected load in window lighting of a large department store served by the Fitchburg (Mass.) Gas & Electric Light Company was increased nearly 200 per cent as a result of presenting the customer with a paper on show-window lighting which was read at the last convention of the Illuminating Engineering Society. After offering the paper to the customer for perusal, the central-station sales department and the department store's window decorator conducted a series of tests which proved to the user's satisfaction that it would pay to use a higher intensity in his windows than had formerly been employed.

## What Other Companies Are Doing

**Washington, D. C.**—The growth of residential customers in this city is showing a remarkable increase. The growth of dwelling-house installation business continues in Washington on an increasing scale. For the first three months of 1923 orders for new connections received by the Potomac Electric Company were double the volume for the same period in 1922, which was the heaviest year in the history of the company. With the addition to the steam-power plant at Benning, the company estimates it will have sufficient boiler capacity for the next three years. Despite the fact that beginning with October the company had to go into the open market for coal its records show that its per kilowatt cost of producing electricity in 1922 was lower than in any previous year. This was attributed to increased efficiency at the plant and to highly satisfactory results from West Virginia coal, which was delivered on contract until October.

**California.** — Dates for the display of electrical homes in California under the direction of the California Electrical Co-operative Campaign have recently been set. The four different exhibits now definitely decided upon cover a period of two months. The dates are as follows: Fresno, April 12-29; San Francisco, May 3-19; San Diego, May 17-June 3, and Sacramento, May 31-June 16.

**Springfield, Mass.** — Without direct solicitation of new business, the United Electric Light Company secured a net gain of 3,754 meters in 1922, compared with 2,725 in the best previous year. Natural development of business, the effect of general electrical advertising and the co-operation of contractor-dealers are believed to be major factors in this growth of service.

**Beaver Dam, Wis.** — Electrically operated pumps for the municipal waterworks of this city were installed about a year ago, replacing steam-driven equipment. Power is supplied from the lines of the Wisconsin Power, Light & Heat Company. A comparison shows that during the past year the amount of water pumped electrically exceeded by 2,000,000 gal. that pumped during the previous year by steam, and the cost of operation was $2,000 less than for the preceding year.

**Boston, Mass.**—A gain of 65 per cent in kilowatts contracted for by the sales department of the Edison Electric Illuminating Company was attained in 1922 as compared with 1921. The total new business contracted for was 79,287 kw. The added motor load totaled 45,558 hp., against 20,646 hp. in 1921. New business results last year were the largest in the history of the company.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Progress in Steam Research.*—As a result of a program sponsored by the A. S. M. E., three organizations have been carrying on researches to gather further information regarding the properties of steam. The Harvard Engineering School is investigating the Joule-Thomson cooling effect in superheated steam at pressures up to 600 lb. and at temperatures up to 600 deg. F. The Massachusetts Institute of Technology has been determining the pressure-temperature-volume relation of superheated steam at high pressures and over as wide a range of superheats as possible. The United States Bureau of Standards has been determining the specific heat of water for a more accurate determination of the mechanical equivalent of the mean heat unit. Reports and comments of progress are reviewed in this article.—*Mechanical Engineering*, March, 1923.

*Combustion Control for Steam Boilers.*—C. H. SMOOT.—The author has presented a clear picture of what happens when burning coal on a grate and the reasons for the difference in the thickness of the fuel bed required when burning different kinds of coal. —*Power*, March 6, 1923.

*Leicester Central Generating Station.* —L. C. KEMP.—A twenty-page article describing and illustrating the construction and arrangement of equipment in the central station being built at Leicester, England. The initial installation is for 10,000 kw. with provisions for an ultimate extension to a total capacity of 60,000 kw. to 100,000 kw. The author describes the buildings and foundations, the coal and ash handling plant, boiler house and engine room, switchgear and transformers.—*English Electric Journal*, Vol. 2, No. 3.

## Generation, Control, Switching and Protection

*Compression Chambers on Automatic Oil Circuit Breakers.* — O. L'EPLATTENIER.—The author regards the following as the essential facts for calculating compression chambers on oil circuit breakers of high interrupting capacity: The rupture of the arc must completely take place in the inside of the compression chamber, therefore it must be made big enough to allow room for the contacts when open. The chamber must be perfectly insulated, fireproof and able to stand high pressures. Studying the general equation of an arc and the gases evolved by the action of the arc on the oil during and after the opening of the contacts, the author explains how to determine with accuracy the conditions of maximum efficiency under which chambers of compression or explosion are to be built.—*Elettrotecnica*, Feb. 25, 1923.

*Parallel Operation of Direct-Current Generators.* — SCOTT HANCOCK.—There are three considerations of fundamental importance in paralleling compound generators: (1) They must have drooping voltage characteristics. Compound machines usually have rising characteristics at their terminals, and it is this consideration which requires the use of an equalizer. (2) They must have the same voltage at no load and at some other point, usually full load. This characteristic—obtained by shunting one or more series fields—seems to be generally understood. (3) The resistances of the series field circuits from the equalizer to the busbar must be inversely proportional to the current rating. This is the consideration which is usually neglected and hence causes most of the trouble. These general considerations, including the special case of generators too far apart to use an equalizer, as in railway substations, are analyzed in detail by the author.—*Electric Journal*, March, 1923.

*Rating of Cables for Intermittent or Fluctuating Loads.*—S. W. MELSOM and H. C. BOOTH.—The extent to which the rating of a cable is affected by an intermittent or fluctuating load as compared with continuous running conditions is investigated theoretically, and formulas are given by means of which the effect of any type of loading can be calculated. It is shown by experimental determinations on various sizes and types of cables that the thermal time constant can be calculated either from a heating or cooling curve of a particular cable or from the specific heat and mass of the various components of the cable. Tables are given showing the rating for the cables for which load tables are given in the I. E. E. Wiring Rules, on the same basis as for motors, i.e. half-hour and hour ratings.—*Journal of Institution of (British) Electrical Engineers*, March, 1923.

## Transmission, Substations and Distribution

*Wooden Poles of Very Long Life.*—A. VAUPEL.—A German firm produces a wooden pole for which a useful life of thirty-three years is claimed. The pole consists of a tar-oil-impregnated hardwood lower part to which is clamped, about a yard above the ground, a "kyanized" soft-wood pole. Three or four very heavy and rust-proofed steel clamps, each a yard long, connect the two pole pieces. A large number of small bolts instead of a few heavy ones are used in the clamps to avoid any splitting of the wood. A pole of this construction is claimed to be absolutely safe against breakage. If stressed beyond its elastic limit the pole will bend rather than break. The results of a number of comparative stability tests of ordinary poles and the new poles are given, showing decided mechanical superiority for the latter. A cost comparison between plain "kyanized" poles of sixteen and one-half years' average life and the new poles of thirty-three years' life gives a saving of more than 34 per cent in favor of the new poles.—*Elektrotechnische Zeitschrift*, March 1, 1923.

*Inductance on Transmission Lines.*—A. DE MARCHI.—The author presents a chart for determining the inductance on transmission lines. Inductance, length of conductors, distance between conductors and their radius are given independently, so that no calculations are required. This chart is simple, clear and easily constructed.—*Elettrotecnica*, March 5, 1923.

## Units, Measurements and Instruments

*Radial Voltage Coil in Induction Meters.*—E. EVANS.—To obtain an exact 90-deg. phase displacement between the current and the voltage coil in induction meters for alternating current many very ingenious but more or less complicated methods have been used and are still in use where the iron core of the voltage coil is in a tangential position with regard to the running disk. The author shows in this paper that practically all of these difficulties may be successfully overcome by swinging the voltage magnet 90 deg. around so that it will stand radially against the disk. Such a meter, with the current magnet under the disk and its two poles tangential with the disk, was first introduced by the Bergmann concern and was later adopted by several other European manufacturers. By proper dimensioning of iron and copper a torque of 5 gram.-cm. and more may be reached easily.—*Elektrotechnische Zeitschrift*, Feb. 22, 1923.

*Electron-Tube Tuning-Fork Drive.*—E. A. ECKHARDT, J. C. KARCHER and M. KEISER.—Several methods for maintaining tuning-fork vibrations electrically without circuit interruptions by means of electron-tube circuits have been in use. In this paper the authors describe apparatus and circuit arrangements which have been found advantageous. To date the electron-tube drive has been applied to a large number of forks with frequency range from 50 cycles to 2,000 cycles.—*Journal of the Optical Society of America and Review of Scientific Instruments*, Vol. VI, No. 9.

*Obtaining an Indication of Transformer Temperatures.*—J. B. GIBBS.—Measurements by thermometers placed in oil, the difference in temperature between the oil and the windings and the use of heating coils for determining

the winding temperature are the subjects discussed in this article.—*Power*, March 6, 1923.

### Motors and Control

*The Textile Industry.*—The Feb. 23 issue of the *Electrician* is given over almost entirely to the progress made in textile-mill drive. Among the more important articles are: "Electrical Operation and Control of Textile Machinery and Processes" by Frank Nasmith, "The Conversion of Spinning and Weaving Mills from Steam to Electric Drive" by V. Mallalieu, "The War and the Textile Industry," "A Description of an All-Electric Textile Mill," "Electricity and Its Effect on Textile Industry," "Group Drive in a Lancashire Mill" and "Textile Drives" and "Motor Design."—*Electrician*, Feb. 23, 1923.

*Application of Electricity to the Sugar Industry.*—The sugar industry within the past few years has been highly electrified. Steam turbines are used for power generation in some cases. In these cases non-condensing turbines are used, the low-pressure steam being used in the process work. In several of the recent refinery installations direct current has been used throughout. This enables the very accurate control of crushers and rolls. —*Electrical News*, March 1, 1923.

*Industrial-Plant Repair Shop.*—E. J. FORD.—A systematic schedule of inspection to detect motor and control trouble as soon as it develops and a well-equipped repair shop for handling the unavoidable breakdowns mean low operating costs and minimum loss of production through failure of power service. In this article details are given of the methods employed and the facilities available for the maintenance of electrical equipment in the twenty-nine departments of the Kewanee (Ill.) plant of the Walworth Manufacturing Company. Although ninety of the 238 motors are exposed to dust and steam and acid fumes, the care which they receive is so effective that not more than fifteen motors are rewound a year.—*Industrial Engineer*, March, 1923.

*Starting Direct-Current Motors.* — C. A. ARMSTRONG.—Two types of series-lockout contactors that are used on automatic motor starters are described and the operation of two controllers using these types of contactors is given in detail.—*Power*, March 13, 1923.

### Heat Application and Material Handling

*Graphite Welding Electrodes.*—S. L. WALWORTH.—The use of graphite electrodes for welding and cutting where the carbon arc was formerly employed is becoming increasingly popular. Owing to the slower vaporization of graphite by the arc much less carbon is carried into the weld when graphite electrodes are used. This produces a softer weld than is possible with amorphous carbon electrodes and one that more nearly approaches the composition and hardness of the parent metal. The accompanying table shows how the increased electrical conductivity allows much lighter current densities to be carried by the graphite electrodes without excessive heating. — *Journal of the American Welding Society*, March, 1923.

HIGH-CURRENT DENSITIES ALLOWABLE WITH GRAPHITE ELECTRODES

| Size Graphite Welding Electrode, In. | Current per Electrode, Amp. | Curent Density, Amp. per Sq.In |
|---|---|---|
| 1/4 | 130 to 250 | 2,650 to 5,000 |
| 3/8 | 185 to 270 | 1,870 to 2,700 |
| 1/2 | 260 to 440 | 1,320 to 2,200 |
| 5/8 | 340 to 560 | 1,100 to 1,800 |
| 3/4 | 410 to 660 | 930 to 1,500 |
| 7/8 | 500 to 850 | 830 to 1,400 |
| 1 | 600 to 1,000 | 760 to 1,250 |

### Electrochemistry, Electrophysics and Batteries

*Manufacture of Chemicals by Electrolysis.*—A. CLARKE.—The main types of cells used in the electrolysis of alkali chlorides are the fused electrolyte cell, the porous diaphragm cell, the bell cell and the mercury cell. High degree of purity, high efficiency, absence of complicated side reactions, etc., are the advantages claimed for electro-organic chemical manufacture. The author deals with the use of electro-organic methods for the elimination of the catalyzers, such as the expensive arc oxides of the heavy metals for oxidation and reduction. A description is given of the more important commercial cells that are on the market for the production of alkali chlorides by electrolysis.—*Beama*, March, 1923.

### Telegraphy, Telephony, Radio and Signals

*Power-Circuit Interference with Telephone and Telegraph Lines.* — S. G. BARTHOLOMEW.—The author points out that the very sensitive apparatus necessary to transmit and safely reproduce telegraphic signals or spoken words is easily deranged by extraneous influences. The losses due to leakage from power circuits cannot be afforded and the liability to these is considerable, especially when the lines are in proximity to traction circuits having an earth return. The effects of induction are still more serious, consisting principally of disturbing noises, which are sometimes so violent as to produce what is termed acoustic shock to an operator. Methods of eliminating these effects, the reduction of harmonics, transformer conditions and the resulting cost of interference are discussed.—*Electrician*, March 2, 1923.

*Stationary Waves on Open-Ended Solenoids.*—A. PRESS.—The problem of the coupling coil has received new importance physically because of its application to wireless signaling. The nodal-point distribution on an elongated Tesla coil was recently investigated and it was found that the nodal distances fell off in value as the ends of the coil were approached. This attenuation of distance had been attributed to end effects, but it is shown by the author that the cause is rather a body effect.—*Journal of Institution of (British) Electrical Engineers*, March, 1923.

*Signal Maintenance on an Oregon Railway.*—H. J. CHARTERS.—The signaling equipment on the lines of the Portland Railway, Light & Power Company at Porland, Ore., consists of ninety-one United States type "G-1" non-car-counting block signals, 142 automatic signals for protecting spring switch points, fourteen terminal signals for stub-end city car lines, seven train order boards, four crossing bells and two special light signals for indicating operation over bridges. Excellent results are being obtained by systematic inspection and repair work which cover all the devices of a warning character used to protect patrons and expedite operation.—*Electric Railway Journal*, March 17, 1923.

### Traction

*Diesel-Electric Rail Motor Car.*—Following the experiments with a direct-driven Diesel locomotive on the Prussian State Railways in 1913, orders were placed for five self-propelled rail cars to be driven by Diesel engines coupled to electric generators with electric motors geared to the driving axles. As the war interfered, the locomotives that had been built were taken back and new engines installed. A general description of the locomotives, including the engines, generators, motors and electrical equipment and control, is given. Brief operating results are described.—*Railway Electrical Engineer*, March, 1923.

*Equipment and Operation of Railway Workshops.* — G. A. GUTHRIE — The author gives a description of the steel foundry in the South African railway workshops at Pretoria. He points out how the equipment and operation of these shops increased the efficiency of the company. — *Journal of the South African Institution of Engineers*, February, 1923.

### Miscellaneous

*Vectorial Addition of Complex Quantities.* — VLADIMIR KARAPETOFF. — A kinematic device is described which permits the performance, graphically and without computations, of the following operations on complex quantities: Additions, obtaining of reciprocals and conversion from the polar into the orthogonal form, or vice versa. The device makes it possible to solve in a simple manner alternating-current problems involving impedances in series and in parallel. An illustration is given of the predetermination of the performance characteristics of an induction motor in accordance with the exact theory of this machine. It can also be used for the predetermination of performance characteristics of transformers, transmission lines, etc. The name that the author has given to the device is "CPS'er," after C. P. Steinmetz.—*Sibley Journal of Engineering*, March, 1923.

# Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

*Conducted by* PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[ PRINTED IN THE THIRD ISSUE OF EACH MONTH ]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

## Research Completed

### Fuses for Potential Transformers, Wire Resistors for

Tests have been made on wire resistances of about 60 ohms in series with 13,200-volt cartridge fuses for potential transformers. Such resistors limit the violence of a dead short-circuit on the high-tension side of the transformer and prevent the fuse from being blown to pieces or torn from its clips. Moreover, without such resistors the recovery voltage after a short circuit shows a very prominent high-frequency over-potential, while with the resistors the recovery is almost normal. The ratio error due to such resistors is negligible. Carborundum rods of about 200 ohms resistance broke under sustained short circuit and their use is not recommended.—*A. F. Bang, Pennsylvania Water & Power Company, Baltimore, Md.*

### Instruments, Graphic, for Recording Troubles

In co-operation with the engineers of one of the largest power companies in this country, recording instruments have been developed which operate at a low chart speed ordinarily, but in which the speed rises up to sixty times normal feed whenever a disturbance occurs. An electromagnet is controlled by an overload relay in the power circuit, so that the instant the current rises to an abnormal value, the wattmeter, the voltmeter, the ammeter and the power-factor meter begin to record at the increased chart speed.—*J. W. Esterline, Indianapolis, Ind.*

### Oscillograph Timer for Transient Phenomena

An attachment has been developed which permits the repetition of transient electrical phenomena a desired number of times per second, say ten. In this manner a steady image of the repeated phenomenon can be observed on the oscillograph screen. Then it can be recorded photographically on the film, if so desired. Thus it is possible to observe or to adjust a periodic transient phenomenon before actually photographing it. The device consists of a drum with suitable contacts, driven by a synchronous motor. The same arrangement can be also used with an indicating ammeter or voltmeter, thus making it possible to read directly the effective value of current or voltage of a repeated transient.—*H. M. Turner, Yale University, New Haven.* [This extension of the oscillograph field should prove to be of considerable interest in the study of transient phenomena, especially where they can be repeated at a rate sufficient to give a continuous impression.—EDITOR.]

### Paints for Concrete and Metal Surfaces

A series of tests on concrete paints has been completed during the year. Exposure panels of concrete were painted with samples of paints submitted by manufacturers, placed on the roof of the laboratory and examined periodically. It was found that very few of these paints were giving satisfactory protection at the end of the first six months. Those which were satisfactory at the end of six months are still satisfactory after a year and a half. A similar series of tests is now under way for paints on structural steel, and a series has just been started on paints for galvanized metallic surfaces.—*Hydro-Electric Power Commission of Ontario, Toronto.*

### Poles of "Centrifugated" Reinforced Concrete

Constructed by winding around a long, slightly coned temporary wooden core a spiral of iron, upon which is disposed the light steel skeleton around which again is wound a double steel spiral. After removal of the wooden core the skeleton is put into a divided wooden mold, which is then filled to about one-third with the concrete mixture. The mold is contained in a cage of angle irons and steel disks, which rotates at first at 600, rising to 1,000 r.p.m. for about ten minutes in a special machine. By centrifugal action the concrete mixture distributes itself into a cylindrical mass throughout the steel skeleton. In an actual test a 10.35-m. pole, rated for 350 kg. stress at top, broke with 2,000 kg. after deflecting 1.1 m.—*C. Zorzi (from Elettrotecnica).*

### Power Plants, Remote Control of

There are cases where it is desirable to open and close switches and to determine conditions of operation of a power plant or substation from a distance. This is now possible by means of remote supervisory control of a number of stations along a single pair of telephone lines, utilizing the principles of the automatic telephone. A load dispatcher, located at the most convenient point, may in this way supervise and control the operation of a considerable group of stations, starting and stopping generators, closing or opening circuit breakers and obtaining other desired indication by either audible or visual signals. The same pair of telephone lines can be used for conversations.—*J. L. McCoy, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.* [This is an arrangement intermediate between the full automatic and the manual control of power machinery. Incidentally, this is a new and useful application of the automatic telephone principle, probably not foreseen by the original inventors.—EDITOR.]

### Thermostatic Relay Switch

In order to use a low-voltage source of power in the thermostat itself and a 110-volt or 220-volt source in the solenoid of the main switch which controls the temperature, a selective relay has been devised on a new principle. The arrangement is suitable for automatic oil burners, electric refrigerating machinery, electric heating units and similar equipment where it is necessary to operate an electric switch in accordance with temperature changes.—*Minneapolis Heat Regulator Company, Minneapolis, Minn.*

## In Progress or Purposed

### Cables, Power, Tests with High-Tension Direct Current

Before the use of direct current for this purpose can be considered successful the proper ratio between direct-current volts and alternating-current volts, to obtain the same results, should be definitely known. Foreign investigations indicate that this ratio should be about 2.5, but the American manufacturers up to the present writing have not been willing to agree to a ratio higher than 1.5. If the ratio of 2.5 is correct, then a test made with the direct-current voltage limited by a ratio of 1.5 will be entirely without value, as it is not enough above the normal operating voltage to give results that are at all comparable with those heretofore obtained with alternating current. Two of the cable-manufacturing companies have undertaken to make tests of this character, and results should be available very shortly.—*A. I. E. E. Committee on Transmission and Distribution.*

### Cables, Soil Temperature Measurement for

To determine the basic temperature for the calculation of the current-carrying capacity of underground cables, soil temperatures are being taken 18, 27 and 36 in. below an asphalt-covered street in Washington, D. C. These measurements have been made every three hours since July 1, 1922, and will be continued until July 1, 1923, in order that they may embrace all seasonal changes.—*A. Smirnoff, Potomac Electric Power Company, Washington, D. C.*

### Circuit Breakers, Non-Oil-Throwing

These breakers are provided with explosion chambers and with separating chambers. The operating mechanism is underneath the cover of the breaker. When the breaker is opened under load the arc is interrupted in the lower part of the oil tank. The gas that is generated passes upward, mixed with some oil, through the center hole in the lower baffle, and the gas and oil are partially separate while passing through the upper baffles. They are finally carried to the separating chamber, where complete separation of the gas and oil and cooling of the gas take place. The oil then returns to the tank.—*General Electric Company, Schenectady, N. Y.*

### Lightning Arresters, Classification of

A classification of lightning arresters is being planned which will make a more complete comparison of the available types possible and will give operating engineers a better basis for choosing proper arresters for different lines. For the main subdivisions of such a classification see the *A. I. E. E. Journal*, November, 1922, Vol. 41, page 897.—*A. I. E. E. Sub-Committee on Lightning Arresters.*

### Transformer Temperature

It is proposed to make a study during the coming year of transformer temperature and possible allowance of overload, together with the duration of such overload for urban and rural service.—*Overhead Systems Committee of Great Lakes Division, N. E. L. A.*

## Suggestions for Research

### Cables, Determination of Faults in

There is apparently a demand among the central stations for an accurate and ready means of determining the character and extent of faults in cables, and after the fault has been determined by measurement, there is need of some apparatus, preferably portable, which will localize the fault.—*F. V. Magalhaes, New York City.*

### Heat Transmission

The division of engineering, with the co-operation of the division of physical sciences, is organizing a committee and developing a program for an investigation in heat transmission. Important fundamental and industrial problems exist in heating and ventilating of dwellings and workplaces, refrigeration, steam engineering, metallurgy, chemical processes, expansion and contraction of structures. At present there is need for information on the heat conductivity of many materials.—*National Research Council, Washington, D. C.*

### Photo-Electric Cells

Photo-electric cells are beginning to be used in some practical applications in place of the human eye, for example in photometry, in sorting objects according to their shade of color, in closing contacts, etc. The present cells are rather delicate and do not possess the required constancy of characteristics. It is desired to develop them into a practical piece of apparatus suitable for use in places where they do not get the same expert care as they would in a physical laboratory.

### Transmission Lines, No-Load Losses in

It would be of interest to operating engineers to know whether the no-load losses in a transmission line consist only of the $I^2R$ and corona loss, or whether there may not also be inductive earth losses of a magnitude that should not be neglected, since they probably increase at least with the square of the voltage. These losses would also occur with the line loaded, but might not be easily measured.—*R. J. C. Wood, Los Angeles, Cal.*

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## News from the Capital

**Reports on Susquehanna Projects and Other Matters Gleaned from Official Sources**

A PLAN to install 360,000 hp.—an installation greater than that on the American side at Niagara Falls—on the Susquehanna River is revealed by an application which has been filed with the Federal Power Commission by the Susquehanna Power Company of New York. The proposed development is to be at Conowingo, Md. It is the intention to construct a dam 100 ft. high, which will create slack water for 25 miles to McCall's Ferry at Holtwood, Pa. The Susquehanna Power Company already has acquired nearly all the flowage rights needed for the project and has made extended engineering studies. Further investigation, however, is planned. It is understood that Philadelphia interests are behind the undertaking. In proposing the installation of equipment sufficient to generate 360,000 hp. the company has in mind furnishing large blocks of power for use in Philadelphia and Baltimore.

It also is reported that the Pennsylvania Water & Power Company has in mind the development of the power immediately above its Holtwood plant. Such a plan would develop slack water in the Susquehanna from tidewater to the vicinity of Harrisburg and would pave the way for the utilization of these pools by a navigation project.

ALABAMA POWER'S GROWING LOAD

The Alabama Power Company has applied to the Federal Power Commission for a license covering the installation of a 5,000-hp. unit in Government Dam No. 17, on the Black Warrior River. Right to install a similar unit at Dam No. 16 will be asked in the near future. The growth of the Alabama Power Company's load has been so marked in recent months that these small developments are being seized upon in an effort to keep abreast with the demand for power. The company on April 7 put into service the first unit at its development at Duncan's Riffle on the Coosa River. Two additional units of that plant are to be installed with all possible expedition. In addition the company is pressing its investigations on the Tallapoosa River in the hope of developing at the earliest possible time the large power resources of that stream.

Since Congress has been unwilling to appropriate funds for the employment of an adequate personnel to attempt the determination of fair values covering actual investments on the part of licensees in water-power projects, a suggestion has been made that the investment in such works can be verified by inserting a provision in each license requiring the licensee to pay for the service of an inspector to check up items entering into the capital investment. This plan would provide funds in an indirect way for carrying out that part of the work. The proposal has not, however, been officially brought to the attention of the Federal Power Commission, and it is not known how that body would look upon such an expedient.

COLORADO DISCUSSION POSTPONED

Discussion of the Colorado River situation by the Federal Power Commission, which was to have taken place on April 18, was advanced until April 19.

## Highest Court Finds Against New York Commission

The United States District Court for Southern New York had full authority to grant an injunction to the New York Telephone Company against the Public Service Commission to enjoin temporary exchange rates ordered last year by the commission, and the temporary rates were too low to bring a reasonable return on the value of the company's property. This is the main purport of a decision of the United States Supreme Court rendered April 16. The court finds that under the New York commission law the telephone company was not obliged to ask the commission for a rehearing and then appeal to the state courts before taking the case to the federal tribunal, but had a right to immediate appeal on the ground that the temporary rates prescribed were confiscatory.

The New York Public Service Commission started an investigation of telephone rates on March 3, 1922, and before it was completed issued orders reducing rates temporarily, pending final determination, one schedule of maximum rates being fixed for New York City and other schedules for the remainder of the state. The company obtained an injunction in the district court, and the commission appealed to the United States Supreme Court. After the argument the commission fixed new and permanent rates, which, according to the company, will grant a higher return than the temporary rates would have done. These are left undisturbed.

## Deadlock Likely at Albany

**Small Prospect of Agreement Between Senate and House on Public Utility Legislation**

THE legislative session at Albany, N. Y., is drawing to a close with the Senate and Assembly at loggerheads over the passage of the public utility legislation introduced by the Democrats. While the Republican Assembly is willing to afford some measure of home rule to New York City in the matter of regulation of its transit facilities and to amend the Public Service Commission law by taking away the right of the commission to increase a fare, rate or charge regardless of the existence of a franchise agreement, contract or special or general law to the contrary, it will not adopt the radical measures proposed by the Democratic administration.

A bill introduced into the House by Assemblyman Jesse of New York, which is likely to pass that chamber, leaves the personnel and manner of appointment of the commission unchanged, but deprives it of the power to fix temporary rates while they await final determination or to increase rates over those specified in contracts, though it is permitted to lower them at will.

Governor Smith's water-power bill calling for state development and ownership passed the Senate on Tuesday by a vote of twenty-seven to twenty-two.

## Water-Power Situation in Pennsylvania

Uncertainty as to the water-power legislation which the Pennsylvania Legislature may adopt is delaying proposed developments in that state. Since Governor Pinchot brought forward his water-power bill not a single charter has been granted at Harrisburg covering a power project. It is the Governor's idea to bring intrastate water-power development under virtually the same restrictions as are imposed by the federal water-power act on the development of power on navigable waterways.

## Nebraska May Acquire Hydro-Electric Sites

A resolution has been introduced into the Legislature of Nebraska at the instance of Governor Bryan which provides for a general vote in November, 1924, upon an amendment to the state constitution permitting the state to "establish, maintain, acquire, convert and develop hydro-electric and other power

sites and plants, sand, cement, limestone beds for building material and other natural resources beneficial to the state." The resolution was sent to a committee by the House of Representatives on April 10.

The Nebraska House earlier in the session passed a resolution asking Henry Ford to survey the power sites of the state with the view of engaging in their development.

## Big Susquehanna Plant

**Metropolitan Power Company Organized to Build Station with Ultimate Rating of 200,000 Kw.**

THE Metropolitan Power Company is being incorporated under the laws of Pennsylvania to build and operate a large steam-electric power generating plant at Middletown, Pa., on the Susquehanna River. The initial capacity of the plant will be 30,000 kw., but it will be designed for extension to an ultimate capacity of 200,000 kw. The entire power generated in the plant will be sold to the Metropolitan Edison Company, which will then be in a strong position to meet the demand for electric power and lighting service in the extensive industrial district of Reading, Lebanon and sections in the vicinity of Middletown and Steelton. The Metropolitan Edison Company will be enabled to use this steam power in conjunction with the full capacity of the present hydro-electric power station of the York Haven Water & Power Company, which it controls.

Provision was made so that prior to the company being incorporated a well-adapted site could be acquired for the plant and borings for the foundations started. A contract for a 30,000-kw. turbine-generator, together with boilers and accessories, has already been made, and delivery will be during the early part of 1924. In the meanwhile the buildings, condensing facilities, coal storage, railway terminals, etc., will be completed, ready for the machinery, so that the station should be in operation not later than the middle of 1924.

The plant of the Metropolitan Power Company will be connected by 110,000-volt tower transmission lines with the present large generating plant of the Metropolitan Edison Company at Reading, which is now being connected by 110,000-volt tower transmission lines with the system of the Pennsylvania Edison Company, supplying the territory in Easton and adjacent territory. A large generating station at Holland now being erected by the New Jersey Power Corporation will be connected in to the Reading-Easton transmission line as well as to the system of the New Jersey Power & Light Company, which supplies territory in New Jersey from a point within 30 miles of New York City to the Delaware River and as far north as the New York State line. These transmission lines will form a system to which 90,000 kw. of new capacity will be connected in the near future.

## New Central Station for "Tri-Cities"

The erection of a new central station on the Mississippi to serve the "Tri-Cities" (Davenport, Iowa, and Rock Island and Moline, Ill.) and surrounding territory is now being planned by the United Light & Railways Company, Grand Rapids, Mich. The site has not yet been selected, but a 20,000-kw. turbine-generator has been ordered by the Moline-Rock Island Manufacturing Company, which supplies power to the other subsidiaries of the United Light & Railways Company in that territory. Delivery of the unit is to be made in March of next year. Powdered fuel may be used. The total cost of the projected station is put at $1,750,000.

The new turbine unit will be designed to operate on 350 lb. steam pressure, 250 deg. superheat and 29 in. vacuum referred to a 30-in. barometer. The generator will be designed for 20,000 kw., 80 per cent power factor, and will be wound for 13,200 volts, three-phase, 60 cycles. It will be equipped with a direct-connected exciter wound for 250 volts.

## Charleston, S. C., Seeks Development of Santee Power

An effort is on foot, backed by strong local public sentiment, looking to the development of a 37,500-hp. project in the vicinity of Charleston, S. C. The Columbia Railway & Navigation Company proposes to construct a canal from the Santee River at a point near Ferguson to the Cooper River at a point near Monck's Corner. In that way a head of 55 ft. can be developed. The project also involves the use for storage purposes of 20,000 acres of land which is not being used otherwise. It will provide a navigation channel direct from Charleston to Columbia via the Congaree River. Such a canal existed in the past. The feasibility of the project depends on the amount of water which the federal government will authorize the applicant to divert from the Santee River.

## St. Maurice Company Orders Propeller-Type Turbines

A contract for four propeller-type turbines of 30,000 hp. each for the new hydro-electric plant of the St. Maurice Power Company on the St. Maurice River, Quebec, has just been placed with the Dominion Engineering Works, Canadian licensees of the I. P. Morris Department of the William Cramp & Sons Ship & Engine Building Company of Philadelphia. These turbines, when completed, will be the highest-powered propeller-type turbines in the world, exceeding in unit capacity those built recently by the same firm for the Manitoba Power Company at Winnipeg. They will operate under a head of 60 ft. at 130 r.p.m. The Westinghouse Electric & Manufacturing Company is to furnish the electrical equipment.

The St. Maurice River Power Company is a subsidiary of the Shawinigan Water & Power Company, which already has two large developments on the river. The new station is at Gres Falls, 10 miles below the Shawinigan Falls station and about 20 miles below the Laurentide plant. When it is completed its rating of 120,000 hp. will raise the total amount of hydro-electricity developed on the St. Maurice to more than 500,000 hp.

## Thomson Visits General Electric Laboratories

BEFORE returning to England, Sir Joseph J. Thomson, the master of Trinity College, Cambridge University, who has world-wide fame as an electrophysicist, visited the General Electric Company's laboratories at Schenectady, N. Y. He is here shown with Dr. Irving Langmuir, assistant director of the laboratories; Dr. R. B. Owens, secretary of the Franklin Institute; W. C. L. Eglin, vice-president of the Franklin Institute, and Dr. W. D. Coolidge, inventor of the Coolidge X-ray tube. He is seen examining a 20-kw. radio tube.

## Electric Steel Researchers Hold Convention

The Electric Steel Founders' Research Group held a convention at East Aurora, N. Y., on April 13 and 14, at which twenty-six representatives of the five electric steel casting plants forming the group joined in a discussion of important steel-foundry problems. W. H. Worrilow, president of the Lebanon Steel Foundry, Lebanon, Pa., presided. Papers on "Electric Steel Castings for Specialties," by W. J. Nugent, Chicago, and "Properties of Electric Steel Castings and Where They Should Be Used," by T. S. Quinn, Lebanon, were read. W. J. Corbett spoke on new uses for electric steel castings, explaining that some users of metal parts have not yet realized that steel castings having thin sections can be made by the electric process with considerable reduction in weight and economy in machining and assembling the castings.

## Last Chance to Take Course in Industrial Heating

In order that central-station sales engineers may have a final opportunity to take one of the industrial electric heating courses which were so successfully given last year under the auspices of the National Electric Light Association, arrangements have been made for one more course in 1923, under the supervision of the industrial electric heating division of the association. V. M. F. Tallman, of Charles H. Tenney & Company, Boston, Mass., who is vice-chairman of the Power Sales Bureau of the association, is in charge of enrollment.

The course will be held May 14 to 26 inclusive, the General Electric and the Westinghouse company giving parallel instruction during this period. The General Electric course will start at Schenectady, N. Y., and be completed at Pittsfield, Mass., and the Westinghouse course will begin at Mansfield, Ohio, include Pittsburgh, Pa., and be completed at Newark, N. J.

## P. G. & E. to Increase Water Storage at Bear River

The contemplated increase of the storage at Lake Fordyce on the South Yuba-Bear River development and improvements in the Drum power system have been announced by the Pacific Gas & Electric Company. The present 90-ft. dam at Lake Fordyce will be raised 47 ft., increasing the storage from 20,000 acre-ft. to 47,000 acre-ft. Two seasons will be required for this work.

Improvement work on the canal carrying the water to the Drum power house will be undertaken soon. The alignment will be rectified in places, detours of construction eliminated and leakage corrected. A second penstock is to be laid down the 1,375-ft. drop to the Drum power house in order that full load may be carried on the generators, making Drum the "peaking" plant of the system. An afterbay will be built in Bear River gorge half a mile below Drum in order to utilize the water from the plant's "peaking" operations.

## Operation the Keynote

### Pittsburgh Convention of Institute Will Be Devoted Mainly to This Phase

THE program of the meeting of the American Institute of Electrical Engineers to be held in Pittsburgh on April 24-26 (see ELECTRICAL WORLD for March 31, page 767) shows that the local section through its convention committee has well sustained the reputation of Pittsburgh for unostentatious accomplishment. The large attendance that is expected will be rewarded by the operating papers filled with definite data and practical conclusions that are to be presented on subjects of vital interest to the electrical industry.

The midwinter convention in New York presented the accomplishments of the electrical specialists. At Pittsburgh the operating specialists will be heard. Experiences with reactors, relays, grounded systems, surges, Peterson coils, arcing grounds, lightning disturbances and insulators on systems like those of the Public Service Electric Company, the Philadelphia Electric Company, the Alabama Power Company and the Duquesne Light Company will be described for the benefit of the industry. Another notable paper will be presented showing the performance of a good oil-burning locomotive in a series of tests on the Southern Pacific system. These tests are of a character to give real opportunity for accurate analyses of railroad electrification projects.

No convention of electrical engineers could well be held in Pittsburgh without papers on electric furnaces, and at the coming convention splendid papers will be presented on this subject by men who know it from the operating standpoint.

There is a place for discussion of every electrical engineering accomplishment in the Institute, and the Pittsburgh meeting appears to be particularly well suited to the operating group connected with central stations and industrial establishments. In addition to the convention itself, the Pittsburgh district, of course, contains actual engineering installations and developments that will afford instructive and interesting material to the delegates and visitors.

## Del Monte A. I. E. E. Convention Postponed

The date for the Pacific Coast convention of the American Institute of Electrical Engineers, to be held at Del Monte, Cal., heretofore announced as Sept. 25-28, has been changed to one week later, and the meeting will therefore be held from Oct. 2 to Oct. 5.

## State Ownership Failure in Europe, Says Barnes

Julius H. Barnes, president of the Chamber of Commerce of the United States, who recently returned from an extended trip in Europe, told his observations on the economic condition there at a dinner given in New York on Monday night. After telling of the return by the Italian government of the parcel-post system and the telephone to private hands and discussing general politico-commercial conditions in Europe, which he found improving in many countries, Mr. Barnes said:

"The outstanding fact which impressed us in all these countries in Europe is the very clear conviction that state ownership and state operation of public facilities—I won't say public utilities, but public facilities—has distinctly written itself as a failure. Not only is this shown in Italy's effort to get all its public state-owned facilities in private hands, but it is shown in Austria, where there is a recasting of the government railroad service and a discharge of 100,000 superfluous employees. It is shown in Great Britain, where the railroads under their return to private operation have greatly quickened the business and economic life of that island and greatly improved the service and at the same time reduced the rates. There is a general appreciation throughout all of Europe that these facilities must not only be in private hands but they must be regulated so wisely that they will present a field of attraction for the superior grade of private ability to enlist itself in their administration, and it is true that where this has been tried, as in Great Britain, they are meeting with satisfactory results."

## Anomalous Utility Situation in Menominee

A discontinuance of electric light and power service, as well as of electric railway operation and gas supply, may be the outcome of the situation in Menominee, Mich., which has been supplied with electrical energy for two years by the Menominee & Marinette Light & Traction Company without this company possessing a franchise or having authorization from the Public Service Commission. When its electric light and power franchise expired in March, 1921, the company continued to furnish electricity. Lately its two other utility franchises expired, and the Aldermen have prepared new contracts which the company thinks unfair. A threat to make the latter remove its wires from the streets and alleys of the city has been made.

Objectionable features contained in the terms of the new franchise, as enumerated by J. P. Pulliam, vice-president and general manager of the Menominee & Marinette Light & Traction Company, include the requirement that the company shall put its hydro-electric plants outside the city limits under municipal control, including future im-

provements and additions; the clauses providing that no increase in rates agreed on with the city shall be binding for more than a year unless indorsed by a three-fifths popular vote, and that the City Council by a majority vote may rescind such increased rates after three years; the provision giving the city mandatory power to order extensions; the stipulation giving the city street commissioner authority to withhold approval of expenditures for equipment, extensions, salaries, etc., and the right given the city to dictate the compensation of directors and officers.

Mr. Pulliam, in making known the company's stand, announced that it stood ready to expend approximately a million dollars in Menominee in the next two years for improvements in its various utility properties.

# Functions of Trade Associations

### Vote Taken by Nearly Seventeen Hundred Bodies Composing United States Chamber of Commerce Reveals General Agreement on What These Should Be

APPROVAL of properly functioning trade associations for each important branch of industry and commerce in the country was voted by business organizations affiliated with the Chamber of Commerce of the United States in a preliminary referendum canvass held on April 13 last, results of which have just been announced by the national chamber. Eight separate propositions relative to the activities of trade associations were submitted, and the affirmative prevailed by very large majorities in every case, negative votes ranging from 5 to 282 in a total poll of nearly 1,700.

The propositions that carried are as follows:

"First—Because of numerous useful and important functions of obvious propriety trade associations should exist for each important branch of industry and commerce.

"Second—A trade association should have such a membership that it can be representative of the industry in connection with problems affecting the general advance of the industry.

"Third—A trade association should be prepared to consider all problems affecting the general advance of its industry or branch of commerce.

"Fourth—Trade associations should continue free from special forms of governmental control.

"Fifth—Statistics of capacity, production, stocks and sales should be collected by a trade association for its industry or branch of commerce.

"Sixth—Statistics of actual prices in closed transactions should be collected by a trade association for its industry or branch of commerce.

"Seventh—Any interpretation of statistics or other comment which could induce or facilitate concerted action on the part of members should be omitted by a trade association.

"Eighth—Statistics of capacity, production, stocks, sales and prices a trade association should make as available to the public and to government agencies interested in following the course of the industry and commerce as to members."

The largest negative vote was cast against the eighth proposition.

The propositions were taken from the report of the special committee created by action of the board of directors of the Chamber of Commerce of the United States in 1922 to "make a general survey of trade associations and consider activities of trade associations which are in the interest of the public and of the fields of enterprise which are represented." Philip H. Gadsden of Philadelphia, vice-president of the United Gas Improvement Company, headed the committee as chairman.

The committee expressed itself as of the opinion "that, while a minority of trade associations may have engaged in practices which have laid them open to complaint under the law with respect to restraints of trade, the vast majority have proved their great value for the advancement, day by day, of the processes of production and distribution."

#### VIEWS OF COMMITTEE

In expressing opposition to government control of trade associations, the committee said: "The possibility that a trade association may err by violating a statute no more justifies any attempt on the part of governmental authority to control trade associations in all their activities than the possibility of illegal acts on the part of individuals warrants like supervision over all their actions. Such supervision would inevitably restrict the freedom of action of trade associations in meeting the problems which they exist to solve."

The committee laid down as its recommendations three rules with relation to the statistical activities of trade associations, as follows: "(1) Reports of members to their association should be accurate and sufficiently complete to prevent misconstruction. (2) As distributed to the membership, the statistics should not be accompanied with any interpretation or other comment which could induce or facilitate concerted action on the part of members. (3) All statistics regarding prices should be confined to closed transactions and should not refer to pending transactions or future transactions."

Summarizing its conclusions, the committee said: "The committee believes that trustworthy information concerning capacity, production, stocks, sales and prices is essential to the effective operation of industry and trade under competitive conditions. The voluntary reporting of such information to trade associations and the subsequent publication and dissemination of such information in a manner which makes it available not only to contributors but also to consumers and to the public generally is beneficial alike to the field of business and the public and does not constitute a restraint of trade."

## Gift of £100,000 for Research in England

The gift of £100,000 to the Royal Society of Great Britain by Sir Alfred Yarrow, a prominent shipbuilder, is announced. The object of the donation is the same as that pursued in America by Ambrose Swazey, who gave $500,000 to make possible the organization of the Engineering Foundation—the "furtherance of research in science and engineering" and the "advancement in any other manner of the profession of engineering and the good of mankind."

"I have for many years," Sir Alfred Yarrow said in announcing his gift, "held the view that the prosperity of England has been greatly hampered in the past for the want of better promotion of scientific investigation and its application to practical affairs. I am convinced that the future prosperity of England will be largely dependent upon the encouragement of original scientific research. The birth of new industries and the development of existing ones are due largely to the growth of science, thus insuring employment and advancing the welfare of the whole community. It is doubtful whether even yet it has been realized how completely this country would have been at the mercy of our antagonists in the late war had it not been for the research work done by our scientific men before the war and during its course."

## America May Participate in World Power Conference

American technical and business associations have been invited to take part in the World Power Conference to be held in London, England, next year. Preliminary conferences have already been had in New York on the question of American participation, and the matter has been brought formally to the attention of all the national organizations in this country that are interested in the question of power. An organization meeting at which definite action will be taken is tentatively scheduled to be held in the Engineering Societies Building in New York on June 13. At that time a draft of a suggested organization will be presented. O. C. Merrill, executive secretary of the Federal Power Commission, has acted as chairman of the preliminary conferences, and J. W. Lieb of the New York Edison Company is chairman of the sub-committee on suggested organization.

The purpose of the World Power Conference, as expressed a year ago by its British promoters, is "to consider how the industrial and scientific sources of power may be adjusted nationally and internationally."

## Talk of New Niagara Pact

### Treaty with Canada Permitting Diversion of 80,000 Second-Feet Finds Favor

RAPIDLY increasing need for more diversion from the Niagara River for the use of the Queenston plant of the Ontario Hydro-Electric Commission is expected to result in stimulating Canada's interest in a new treaty. Two years ago, when the State Department suggested the advisability of discussing the matter of additional diversion, Canadian officials did not encourage the proposal. Since then, however, the situation has changed materially. The load furnished to customers on the American side has increased very materially. On the Canadian side there has been steady expansion of the distribution system until it reaches as far westward as Windsor, opposite Detroit. The demand has reached a point where additional diversion is absolutely essential to the most efficient operation of the plants of the Hydro-Electric Commission.

It can be stated most emphatically that no official on either side will consider any diversion which will detract from the scenic value of the Falls. A total diversion of 80,000 second-feet, proposed as the amount to be agreed upon in a new treaty, would, in the opinion of engineers, have no bearing on this.

The demand for additional diversion is even greater on the American side than in Canada. The Niagara Falls Power Company has been running at full capacity for eight months. By the time that the 100,000 hp. of additional power which is the net gain represented by the improvements under way is available next fall it will be absorbed immediately.

The hope is expressed in Washington that the new treaty can be confined to the power phase of the situation, leaving other matters, such as the diversion at Chicago, to be handled separately. No controversy is anticipated over the diversions for power purposes, but the other questions are likely to result in extended discussion.

## Arkansas Company to Push Caddo River Project

The Caddo River Power & Irrigation Company has, it is announced, been merged with the Arkansas Light & Power Company, which will undertake the hydro-electric power development on the Ouachita River near Hot Springs and Malvern for which financing and engineering plans have been completed. The Arkansas company already has constructed a 66,000-volt line from its Pine Bluff-North Little Rock-Malvern-Arkadelphia system to within a few miles of the sites for the first dam and power stations.

Permits covering three sites on the Ouachita have been obtained from the federal and state commissions, engineers estimating that a total of 120,000 hp. will be developed. The first dam and generating station will develop 15,000 hp. and will cost between $1,500,000 and $2,000,000. It has not been definitely determined whether the first dam will be constructed at what is known as the Remmel site, a few miles north of Malvern, or at the Hot Springs site, about 10 miles south of Hot Springs. Surveys and tests for foundations show that either site will be satisfactory. The development will create large lakes and will go far to prevent floods on the Ouachita River. The three dams and generating stations will entail an ultimate investment estimated at $15,000,000.

It is planned to have the first station in operation within fifteen months. Through the existing transmission line of the Arkansas Light & Power Company, the hydro-electric energy will be made available to Pine Bluff and twenty-two other cities and towns immediately upon completion of the water-power station, and but little construction is necessary to connect up all the lines of the company and make the power available to the numerous cities and towns served by this company.

# Commercial Questions Are Up at St. Louis

### Second Day's Sessions of Middle West Division, N. E. L. A., Cover Appliance Load, Highway Lighting, Electrical Homes, Rural Service, Interconnection and Other Topics

AN ENTHUSIASTIC discussion of the commercial side of the central-station industry marked the Thursday morning session of the convention of the Middle West Geographic Division of the National Electric Light Association, held at St. Louis last week, the opening sessions of which were reported in last week's ELECTRICAL WORLD.

#### NEW BUSINESS CHANCES

E. W. Lloyd spoke interestingly on the work of the Joint Committee for Business Development. He believed enough appliances could be sold to make the yearly residential revenue from this source alone equal that from residential lighting consumption. One of the difficulties in the sale of appliances, he indicated, was that too many central-station men are not convinced of their value and therefore are not in position to sell them successfully. He called attention to the possibilities of highway lighting as a means of protecting life and property as well as facilitating travel. Pointing to the lack of man power that is forcing industry to develop new methods of accomplishing tasks, he declared that here lies an opportunity for the central station in the development of new business. He spoke also of heat treating and melting of metals electrically, expressing the opinion that in a generation all melting of non-ferrous metals will be done electrically.

Electricity on the farm, railway electrification and other commercial possibilities were cited, Mr. Lloyd contending that the individual member companies of the N. E. L. A. are not giving enough time to the consideration of the commercial problems involved in all these uses of electrical energy. He made a plea that each company detail at least one man to devote time to the development of the commercial work of the association and asked that more and better men be constantly added to the committees of the Commercial Section.

F. S. Dewey of Kansas City told of the experience of the Kansas City Power & Light Company with its electrical home exhibit. Between 37,000 and 40,000 people passed through the home in four weeks. A force was organized to take the visitors through and explain all the features of lighting and domestic uses of electricity so that the service offered would be thoroughly impressed on them. Results of this work, he said, are constantly developing. Co-operation between the various branches of the electrical industry in Kansas City had shown that the misunderstandings and mutual criticisms that so often arise could readily be avoided.

He criticised the policy of employing salesmen who will not take the chance of losing business by telling the customer frankly when the results desired cannot be accomplished. Honesty in telling the customer exactly what can be done and expected, Mr. Dewey said, is one of the most important elements in the sale of electric appliances and devices.

N. T. Wilcox made a plea for more money to carry on the commercial work of the N. E. L. A.; J. L. Harvey of Wichita suggested highway lighting as one of the elements through which rural electric service can be developed, and O. H. Simonds of Dubuque, Iowa, asked for greater support of the national association.

#### BANQUET SPEECHES

At the banquet on Wednesday night President Frank W. Smith of the national association told of the arrangements for the coming convention in New York, asking the delegates to make special efforts to attend. Vice-president Davidson and Executive Manager Aylesworth also spoke, the latter expressing belief in merchandising by the central-station company and also the opinion that those central stations that have got out of the merchandising phase of the business will go back into it.

Martin J. Insull at the Thursday afternoon session dwelt upon the public's interest in public utilities and told the delegates that unfavorable public

opinion is largely due to the fact that the public is misinformed as to the affairs of the utilities.

Rural Service Problem Worldwide

J. C. Martin, Western editor of the Electrical World, discussed the rural electric service problem, saying that it is not purely an American or central-station problem but is a worldwide agricultural economic problem owing to the need of the farmer to improve his living conditions and lower his production costs by supplanting hand labor with machine work as has been done in other industries. The work of the newly organized committee of electrical and agricultural interests to study the problem was described. Austin Burt of Waterloo, Iowa, said that confidence between the central-station companies and the farmers is the foundation on which the solution of the problem must be based and that central-station men must seek to establish that confidence.

Steps were taken by the committee having in hand the survey of the interconnection problem in the Middle West Division states to co-ordinate its work with that of a similar committee in the Great Lakes Division. Some of the interconnections that may seem logical in the future are more or less divided between the territory of the two sections because of the location of the systems.

The officers of the division elected for the coming year are: President, L. O. Ripley, Kansas Gas & Electric Company; vice-presidents, H. C. Roberts, Union Power & Light Company, Omaha; H. C. Blackwell, Kansas City Power & Light Company, and B. J. Denman, Tri-City Railway & Light Company. Horace M. Davis of Lincoln, Neb., is the secretary-treasurer.

## Report of Cities Service Indicates Marked Progress

The pamphlet report of the Cities Service Company for 1922, which has just been issued, shows an increase in net earnings from $12,944,716 to $14,205,674. Preferred dividends of the company were earned 2.41 times against 2.23, and the earnings on the average amount of common stock outstanding during the year amounted to $14.88 a share, as compared with $13.04 a share in the preceding year. Gross earnings of the Cities Service Company in 1922 were $14,658,971, as compared with $13,461,770 in 1921.

The earnings of the public utility properties increased 20.65 per cent over the preceding year, or from $6,918,741 to $8,347,546. This was not only sufficient to pay all Cities Service Company interest charges and the preferred dividends, but showed a comfortable return on the outstanding common stock.

General business conditions, according to the report, have improved in almost every territory where Cities Service public utilities are operated. The demand for power and light is constantly increasing, and the company is doing what it can to increase its capacity to meet this demand. Extensive construction programs are in progress in Ohio, Colorado, Joplin and Sedalia, Mo., and Texas.

## New York City Has Novel Electric Sign

An electric sign of novel and artistic type has been erected along the canyon of white lights on Broadway, New York, to announce a popular motion-picture entitled "The Covered Wagon." The wagon and entire upper portion of the sign are lighted by ten 500-watt floodlamps, and on the front of the wagon is a lantern which is an exact facsimile of the type used in 1849. A lighting effect which simulates water running under the wagon is obtained by six stereopticons automatically operated by motors which turn a color wheel with water painted on it. Each lamp is a 2,000-watt nitrogen-filled unit specially made for stereopticon purposes. In the center of the water is a small sign in raised bronze letters reading "Paramount Pictures." These letters are set in a box flush with the water and are illuminated by indirect lighting which causes the letters to stand out as if they were set in the water.


Electrical Devices Cause the Water on This Sign to Flow

The sign was constructed and installed by the Norden Company, under the supervision of Mortimer Norden, the company's engineer.

## Earnings of Northern States Power Increase

The annual report for 1922 of the Northern States Power Company indicates that the gross earnings ($13,881,919) increased 7.09 per cent and the net earnings ($5,781,092) 11.01 per cent as compared with 1921. After payment of the fixed charges and the regular dividend on the preferred stock a balance of $1,628,126 was available for amortization, depreciation, common dividends and surplus. The report further considered the development of an additional hydro-electric plant on the St. Croix River and the new steam plant now under construction in St. Paul, which will have an ultimate capacity of 200,000 hp. During the year the company gained 4,494 stockholders and added forty-five additional communities to its transmission lines.

## Power Problems Will Occupy New England Division

Papers on power problems by leading engineers will characterize the annual meeting and Technical Section day of the New England Division, N. E. L. A., at the Hotel Biltmore, Providence, Friday, April 27, beginning at 10:30 a.m. Officers of the division will be elected for the coming year, in accordance with a recent constitutional amendment, and the following technical papers, with discussions, will be presented: "Pulverized Fuel," by R. E. Dillon, Boston; "Use of Three-Phase Versus Single-Phase Transformers for Power Loads," by W. P. Schwabe, Thompsonville, Conn.; "Power-Factor Correction," by F. L. Hunt, Greenfield, Mass., and "Development in Power Production," by Oscar Junggren, General Electric Company, Schenectady, N. Y. After the meeting it is expected that delegates and guests will have an opportunity to visit the new service station of the Narragansett Electric Lighting Company at Melrose.

## Electrical Men Represented in Arbitration Society

The Arbitration Society of America, which, under the presidency of Emerson McMillin, is endeavoring to become a "people's tribunal" to which disputants may submit any form of controversy for immediate determination by arbitrators selected by themselves or, at their option, appointed by the society, has as chairman of the electrical industry J. A. Hawks of the Monroe Lamp & Equipment Corporation, New York City, who calls attention to the possibilities, under the arbitration law now in force in the State of New York, of substituting arbitration for litigation. The purposes of the society, which numbers among its indorsers E. Donald Tolles, Charles L. Eidlitz and Arthur Williams, are briefly stated to be:

First—To conduct a campaign of education in promotion of the general cause of arbitration in all disputes and differences.

Second—To organize, equip and operate in New York City, and later in the larger cities throughout the country, tribunals of arbitration for the speedy, inexpensive and just determination of controversies and misunderstandings.

Third—To have enacted a uniform arbitration law in all the states of the Union and to encourage the insertion of an arbitration clause in all trade and industrial contracts.

## General Electric Sales Managers Hold Conference

A three-day conference of sales managers of the General Electric distributing jobbers was held this week, beginning Monday, at the Bridgeport factory of the company for the discussion of timely problems in merchandising and trades policies. J. O. Wetherby was conference manager.

# Brief News Notes

**Montreal Company May Build New Plant at Cedars Rapids.**—The Montreal Light, Heat & Power Company, Ltd., shows in its report for the year ended Dec. 31, 1922, earnings of 8.15 per cent on common stock as compared with 6.54 per cent in 1921. An additional unit at Cedars Rapids is planned to provide a further 40,000 hp.

**"Farthest North" Radio.**—The Canadian government, it is announced, is planning a chain of six radio stations extending into the Arctic Circle. Five of the stations will be in the Northwest Territories and another at Dawson. The stations on or near the Mackenzie River will be at Fort Smith, Fort Resolution, Fort Simpson, Fort Norman and Fort McPherson.

**United Light & Railways Company Makes Record.**—For the first time in its history the United Light & Railways Company of Grand Rapids, Mich., has crossed the twelve-million-dollar mark in its gross earnings for a twelve months' period, showing $12,029,187 for the twelve months ended Feb. 28, compared with $11,235,196 in 1922.

**Danville Has New Turbine.**—A new 7,500-kva. turbine was placed on the lines of the Danville (Ill.) Street Railway & Light Company on April 4. This 2,300-volt, 1,800-r.p.m. unit doubles the present station capacity. Additions are also being made to the substation which will bring its capacity up to 6,000 kw.

**Michigan Electric Light Association Helps Meter School.**—Co-operating with the Michigan Electric Light Association, the electrical engineering department of the University of Michigan gave a short intensive course for electric metermen from April 9 to April 14. All work was done in the electrical laboratories of the university, and the course was directed by members of its department of electrical engineering.

**Southern Canada Power Plans New Plant.**—It is announced that the Southern Canada Power Company has determined to construct a hydro-electric station of 30,000 hp. at Hemmings Falls, near Drummondville, Quebec, on the St. Francis River. This is to meet demands in the eastern townships of the province and to carry out existing contracts. The report of this company for the year ended Sept. 30 showed a constant growth.

**Iowa Meter Course Successful.**—The short course for electric metermen at Iowa State College, March 12 to 16, closed with the largest attendance in the five years of its history. The total attendance was 130, representing forty-nine counties and forty-eight power companies, and sixteen manufacturing companies were represented. The students were classified in four groups covering beginners, men of some experience, fully experienced men, and meter superintendents, local managers and others.

**Southern California Edison Earns 9.78 per Cent.**—The Southern California Edison Company reports for the year 1922 a balance available for common-stock dividends of $3,731,855, equivalent to a return of 9.78 per cent a share on the company's outstanding stock. This compares with $2,532,532, or 9.02 per cent, in the year 1921. On Dec. 31 the profit and loss surplus stood at $2,786,890, against $1,244,777 on Dec. 31, 1921. At the end of the last current year the current assets of the company were $10,768,827 and current liabilities $9,343,867, leaving a working capital of $1,424,960.

**University of Colorado Meter School.**—Among the many universities and colleges which have held or will hold short courses for electric workmen this spring is the University of Colorado, which held classes from March 19 to March 24 with the co-operation of manufacturers and public service companies. Lectures were given by experts and plants were visited. A heavy storm, blocking the railroads, interfered to some extent with the attendance, but so much interest was manifested notwithstanding that the university is planning to repeat the course next year.

**Shawinigan Company Shows Growth.**—The annual report of the Shawinigan Water & Power Company for 1922 gave its gross earnings at $4,629,641, an increase of $405,596 over 1921 and of $686,282 over 1920. Net earnings amounted to $1,597,283, an increase of $6,471 over 1922 and a decrease of $11,759 as compared with 1920. The company's assets grew by $1,200,000 as compared with the previous year. The Laurentide Power Company, which is associated with the Shawinigan, had profits of $670,806, a gain of about $100,000 over 1921 and of about $238,000 over 1920.

**Standard Gas & Electric Earnings.**—Complete figures of combined earnings of the operated public utility properties of the Standard Gas & Electric Company for the twelve months ended Jan. 31, 1923, show that net earnings for the period increased 13.79 per cent as compared with net earnings for the previous twelve months. This was accomplished on an increase of 7.47 per cent in gross earnings. The combined earnings of all the properties for the same period compare as follows:

| | Gross | Net |
|---|---|---|
| 1923 | $37,703,978 | $14,154,573 |
| 1922 | 35,082,274 | 12,438,685 |
| Increase | $2,621,703 | $1,715,888 |

**Farmington River Company Plans Two New Hydro-Electric Developments.**—Construction will soon begin upon two new hydro-electric plants on the Farmington River, near New Boston, Conn., for the Farmington River Hydro-Electric Corporation, recently organized under the laws of Delaware to develop energy in this section of Connecticut. One development will include three dams, reservoirs and a 4,000-hp. plant to operate under a head of 300 ft., and the other a dam, pipe line and station of 3,600 hp., operating under 150-ft. head. New Hartford and vicinity will be served.

**Interconnection in Iowa.**—The last link in the interconnection of all the properties of the Iowa Railway & Light Company, the Iowa Electric Company and the Iowa Falls Electric Company will, it is reported, be completed this season, when a high-tension transmission line between Nevada and Boone will be built. The line will be approximately 28 miles in length and will have steel towers and aluminum conductors. When it is completed it will tie Nevada in with the Cedar Rapids, Marshalltown, Boone, Perry, Grundy Center and Iowa Falls power plants and provide a complete circuit over the state.

**Sponsors for Standardization Appointed.**—Sponsorship for radio standardization has been assigned by the American Engineering Standards Committee to the Institute of Radio Engineers and the American Institute of Electrical Engineers jointly. This action was taken in accordance with the recommendations of the large representative conference called by the Bureau of Standards. Sponsorship for the standardization of engineering and scientific abbreviations and symbols has been assigned to the American Association for the Advancement of Science, the National Research Council, the Society for the Promotion of Engineering Education and the United States Bureau of Standards jointly.

**New Water-Power Stations in Italy.**—The first units installed in the power station in the Val Formazzo, on the southern slope of the Simplon, in Italy, have been put in operation. This station derives its power from the Tannino, a mountain stream, and mountain lakes afford reservoirs with a combined capacity of 15,000,000 cu.m. Power is transmitted over a 74-mile, 60,000-volt line to a transformer station at Novara. Another company has just put in operation a new central station at Temu, on the Lake of Avio. Storage capacity of the reservoirs which will supply the plant will be 18,000,000 cu.m. This station is built for five units of 11,000 hp. each, of which two have been installed. Energy is transmitted at 125,000 volts to San Polo d'Enza, whence it will be sent to the central stations of central Italy.

**Iowa Goes Down with Radio-Controlling Devices Still Intact.**—When on March 22, in Panama Bay, the old battleship Iowa was sunk by modern superdreadnaughts under the eyes of Secretary of the Navy Denby there went down the first full-sized radio-controlled ship. The Iowa had been previously stripped of all equipment except her boilers and engines, and there were on board only the ingenious radio-controlling devices which were operated from storage batteries. The large mass of batteries was kept charged by a Kerr turbine, which had been purchased by the Navy Department in 1912. Elec-

tricity has been rapidly coming to the fore in the operation and control of equipment on board warships, and the possibilities in the directing and controlling of a battleship from a distance entirely by radio have been shown to be great.

**Portland (Ore.) Company to Spend $5,000,000.**—Announcement was made at the annual meeting of the stockholders of the Portland (Ore.) Railway, Light & Power Company that $5,000,000 would be spent this year on the company's construction program. Construction expenditures during 1922 amounted to $3,525,832. The greatest single item of expense this year will be the construction of the first unit of the Oak Grove hydro-electric project, which will bring in to the city of Portland 25,000 kw. of electrical energy. No changes were made in the board of directors or the officers of the company. Reports submitted showed that the company has 3,700 stockholders, more than 3,000 of whom reside in the state. Net earnings during 1922 showed an increase of $252,340, or nearly 7 per cent over the net earnings for 1921. After deducting interest, operating expenses, taxes and other expenses from the 1922 gross earnings there was a surplus left of $955,364.

**European Radio Development.**—William Dubilier, president of the Dubilier Condenser & Radio Corporation, who has just returned from Europe, announces that some very interesting radio developments have taken place there, among which is a radio-control system for trains, developed by the Germans. It is installed on locomotives and gives a signal to the engineer which, it is thought, will help to avert collisions. A new means has been devised for generating high-frequency oscillations which, Mr. Dubilier says, is much cheaper and easier to build and maintain than tubes for high power and can be used for power up to 25,000 kw. He reports also developments in the direction of splitting oils making insulation or obtaining nitrogen from the air to permit commercial currents to be used in a city. Many large radio plants are now contemplated, one of which is to be installed in Egypt, and condensers are being designed for these installations which are almost as large as a dwelling house and which will cost about $100,000 apiece.

**Sioux City Company Links Up Twenty-two Towns.**—Electrical energy for the supply of twenty-two northwest Iowa towns was made available recently when new transmission lines of the Sioux City Gas & Electric Company went into service. This marks the first step in the expansion of the company's field, which will include approximately seventy-five towns in the vicinity of Sioux City. The towns served by the lines already opened are Le Mars, Merrill, Remsen, Marcus, Cleghorn, Meriden, Kingsley, Washta, Quimby, Alton, Granville, Sheldon, Boyden, Sanborn, Primghar, Archer, Orange City, Sioux Center, Pock Valley, Hull, Doon and Alvord. The furnishing of electricity to these towns by the Sioux City Gas & Electric Company closes three local stations, two at Le Mars and one at Sheldon, according to an announcement made by William J. Bertke, general manager of the company.

**Maine Water Power Commission Fails of Continuance.**—By refusing to sign a bill providing for the appointment of a Water Power Commission of five members, of whom one would be appointed by the Governor for one year, two by the Speaker of the House for two years and three by the President of the Senate for three years, Governor Baxter of Maine, whose obstructive water-power policy was referred to in these columns last week (page 883), has cut off the continuance of the present commission's activities, leaving the state without an organization for the express study of water-power resources and development. The bill was left in the hands of the Governor at the close of the biennial legislative session. The present commission has been at work on conservation problems since its organization in August, 1919, and has published much valuable material on these resources of the state. Opposition encountered by the Governor in many quarters to his views in favor of state development of water powers is believed to lie behind his action. In a statement issued by him the Governor said that the best features of the commission's work would be continued under arrangements not yet made public.

# Associations and Societies

**Contractors to Discuss Technical Subjects.**—At a recent meeting of the Elcetrical Contractors' and Dealers' Association of San Francisco, it was decided to devote a part of the time at the weekly luncheons of the association to discussion of technical electrical subjects by qualified members for the profit of the entire membership.

**American Association of Operating Engineers.**—The regular biennial meeting of the American Association of Operating Engineers will be held with the Central Georgia Power Company at Macon, Ga., on April 26 to April 28 inclusive. Besides business and discussions there will be visits to substations and cotton mills and a trip to Jackson Dam, on the Ocmulgee River.

**Cleveland Men Charter Car for Pittsburgh A. I. E. E. Convention.**—Interest even greater than usual in the spring convention of the Institute to be held at Pittsburgh next week is indicated by the fact that the Cleveland Section is arranging to charter a car to carry its delegates to the rival city. A descriptive booklet is to be prepared by the Pittsburgh Section, with contributions from the Westinghouse, West Penn, and Duquesne Light companies and the Carnegie Institute.

**Public Hearing of Power Test Codes at Montreal.**—During the spring meeting of the American Society of Mechanical Engineers at Montreal, May 28-31, a public hearing on the "Code on Instruments and Apparatus," chapters 1 and 2, dealing with general considerations and with the accuracy of measuring instruments and the test code for internal-combustion engines, will be held. Papers on hydro-electric development in Canada, material handling, fuel and other subjects will be read.

**New England Rural Lines Committee Enlarged.**—Increasing interest in the problem of rural lines extension has led to the enlargement of the rural-lines committee of the New England Division, N. E. L. A., from a one-man to a seven-man basis. The chairman is H. M. Parsons, Central Massachusetts Electric Company, Palmer, Mass., and the other members are G. S. Williams, Augusta, Me.; J. Brodie Smith, Manchester, N. H.; F. L. Lovett, Montpelier, Vt.; R. W. Mitchell, Agawam, Mass.; P. F. Hodgkins, Pawtucket, R. I., and D. Loree, Willimantic, Conn.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society — New York, April 24-27.

American Association of Operating Engineers—Macon, Ga., April 26-28. H. C. Bristol, Alaco, Tenn.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Nebraska Section, N. E. L. A.—Omaha, May 10-11. Horace M. Davis, secretary-treasurer.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Empire State Gas and Electric Association, Electric Section—Utica, N. Y., May 17-18. C. H. B. Chapin, Grand Central Terminal, New York.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. Dean F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

# Recent Court Decisions

**Nonsuit Wrongly Entered Where Young Child Was Injured Through Trespass.**—In Costanza vs. Pittsburgh Coal Company it was shown that defendant maintained in a lot where children were accustomed to play an electric transformer with connecting lines carrying 6,600 volts. This instrument was within an inclosure, 6 ft. x 8 ft., two sides of which were formed by a shed, the other two sides by wire netting 5 ft. high, with large meshes at the top. A six-year-old child gained access to the inclosure either over the fence or from the shed through a window and was severely injured by contact with the electricity. The trial court entered a nonsuit on the ground of trespass, but the Supreme Court of Pennsylvania has held that this order was improperly made, because of the extreme youth of the child, and has ordered a retrial to establish the negligence or otherwise of the company. (119 At. 820.)*

**Can One Company Sue Another to Prevent Invasion of Territory?**—An action brought by the Fulton Light, Heat & Power Company against the Seneca River Power Company to prevent the latter from selling energy in the city of Fulton, N. Y., hinged on the power of one public utility to sue another one for violation of a clause in the Public Service Commission law which forbids an electrical corporation to begin the construction of a plant or the exercise of franchise rights without first obtaining the permission of the state commission. The defendant company maintained that if the plaintiff had any grievance its legal remedy lay not in the courts but in action by the commission. In overthrowing this contention and continuing an injunction against the Seneca River Power Company, the New York Supreme Court based its decision on the fact that while the commission could take action on its own initiative in such a case, the law provided no means by which the aggrieved company could set commission proceedings in motion. (197 N. Y. S. 319.)

**Arkansas Railroad Commission Without Jurisdiction Over Electric Service Companies.**—The Railroad Commission of Arkansas having granted a certificate of convenience and necessity to the De Queen Light & Power Company to sell and distribute electricity in De Queen, the receiver of the Commonwealth Public Service Company, operating in the same city under an "indeterminate permit" issued by the defunct Corporation Commission of Alaska, brought suit in the circuit court and won judgment invalidating the commission's action. The Supreme Court of Arkansas, being appealed to (De Queen Light & Power Company vs. Curtis), has sustained the lower court, holding that the act empowering the Corporation Commission to grant public service corporations a certificate of convenience and necessity having been repealed by an act conferring jurisdiction on municipalities to regulate public service corporations operating within their limits and specifying the public service corporations over which the jurisdiction of the Railroad Commission, substituted for the Corporation Commission, shall extend, the Railroad Commission cannot grant such a certificate to a company distributing electricity in a city under franchise from it. (248 S. W. 5.)

**Common-Law Water Right Not "Franchise."**—In Southern Nebraska Power Company vs. Taylor the defendant appealed from a decision of the Nebraska State Railway Commission fixing the value of a water right held by the company against which it wished to issue stock. The company contended that the valuation as made was too low. The Supreme Court of Nebraska, declaring that in direct appeals to it from orders of the commission the orders will be reversed only where it affirmatively appears from the record that they are clearly wrong, sustained the commission. In answer to a contention made by the Attorney-General of the state that the water right was in the nature of a franchise and could not be capitalized, the court said that where a public utility corporation has succeeded to the common-law water-power right of a riparian owner and makes application to the commission for authority to issue stock against it, the statute prohibiting stock based upon franchise value does not apply. (192 N. W. 317.)

**Rights of Existing Companies Cannot Be Taken Away to Avoid Competition.**—An order of the Pennsylvania Public Service Commission prohibiting the Harmony Electric Company from supplying service in the borough of Ellwood City because the Pennsylvania Power Company had also charter rights in that borough led the first-named company to appeal to the courts against the commission. The Supreme Court of Pennsylvania has found that the law does not contemplate that a certificate of public convenience need be obtained by a company which was doing business within the territory covered by its charter at the time the public service company law became effective for each step taken in the advancement of its service within its unabandoned territory; that it is not necessary for an electric service company to obtain the consent of a borough before rendering service within the borough where no streets are to be occupied in rendering such service, and that the commission cannot, either directly or indirectly, take away from an electric service company which was in existence before the public service company act became effective any of its chartered powers which it had not forfeited, even though the exercise of such powers created a competitive situation which the commission desired to prevent. (119 At. 712.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**Existing Utilities Desiring to Extend Service Are Not in Position of New Utilities Seeking to Enter Competitive Field.**—In granting to the Terre Haute, Indianapolis & Eastern Traction Company permission to operate as a general electric utility within the city of Indianapolis, the Indiana Public Service Commission, alluding to the footing gained in the city by the company through its supply of energy for railway operation and to certain manufacturers, said: "That being true, the situation is different from that of a proposed new utility desiring to begin organizing and investing capital for the purpose of entering this competitive field, because it had its capital invested and was rendering service some six years before the Public Service Commission act was enacted. As a light and power public utility and to that extent it is entitled to the same protection afforded by the scheme of regulation upon the same basis and for the same reasons as the other utilities operating within the field. . . . The law does not authorize existing utilities to prevent extensions to plants and service on the part of other existing utilities. If it were so, there could be no improvement of utilities if they restrained each other."

**Non-Operative Properties — Going-Concern Value—Power for Irrigation.**—In arriving at a valuation of the Idaho Power Company's property, the Idaho Public Utilities Commission held that property not now required for use in service and representing expenditures by predecessor companies, partly under the stress of competition, should be excluded from the rate base when the time at which service demands would justify the additional expenditure necessary to complete the property is uncertain. The going-concern value in the way of property development and business development of the company resulting from the reorganization of several precedent companies was determined by a consideration of the benefits resulting to the public, the difficulties of reorganization, service conditions and results achieved. Irrigation customers, the commission held, should not be charged with all of the investment represented in the generating and transmission parts of the system used for their service only a part of the year when that investment is not active all of the year around, nor should the carrying costs of the excess be charged to other customers; but the excess capacity in the system during the off irrigation months should be considered as not yet fully energized.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

### Dr. Hyde Resigns

Dr. Edward P. Hyde, who organized the Nela Research Laboratories in 1908 and who for the last few years has occupied the position of director of research of the National Lamp Works of the General Electric Company, has tendered his resignation, to take effect June 30 of this year. Dr. Hyde, who has been active in scientific and technical affairs for a number of years, has decided to take a prolonged rest abroad. He will temporarily discontinue many of his activities in the scientific and engineering societies, but will retain his office of president of the International Commission on Illumination until its plenary meeting, which is scheduled to be held in this country in 1924.

**H. F. Armstrong** of the Pennsylvania Power Company of Allentown, Pa., is now associated with the Georgia Railway & Power Company.

**H. B. Barnes**, consulting engineer of Denver, Col., is in charge of a hydroelectric power project in Hinsdale County which has been acquired by L. F. Hulen and associates from the Hinsdale Mining & Development Company and the Golden Fleece Consolidated Mining Company.

**F. C. Brown**, acting director of the United States Bureau of Standards, Washington, D. C., has been appointed a representative of the Department of Commerce on the American Engineering Standards Committee, succeeding S. W. Stratton, with E. C. Crittenden, chief of the electrical division of the bureau, as alternate.

**Dr. August Hund**, recently of the University of California, has been appointed an additional electrical engineer of the radio section of the United States Bureau of Standards. Dr. Hund was graduated from the Technische Hochschule, Carlsruhe, in 1911 and took the degree of doctor of engineering in 1913. He was employed by the General Electric Company under Dr. Steinmetz in 1915-17 and since that time has been doing graduate work at the University of California.

**S. P. MacFadden**, formerly secretary in the Texas district office of Stone & Webster, Inc., has been transferred to Port Arthur as superintendent of the Eastern Texas Electric Company, succeeding Joseph Bowes, who has been made general light and power superintendent of the company with headquarters at Beaumont. F. C. Taylor, formerly chief engineer of the Eastern Texas Electric Company, has been appointed superintendent of power stations.

**Dean J. Locke**, who has been associated for some years with Prof. Albert S. Richey of the Worcester (Mass.) Polytechnic Institute in consulting engineering activities and investigations connected with rate cases, has joined the staff of the Public Service Railway, Newark, N. J.

**Dean Gardner C. Anthony** of the Tufts College (Mass.) Engineering School, sailed April 19 for an extended European trip. Dr. Anthony is the founder of the New England Section of the Society for the Promotion of Engineering Education and is its present chairman. He will return about Sept. 1.

**Frank A. Easton**, formerly head of the gas department of the San Joaquin Light & Power Company at Bakersfield, Cal., has been promoted to the position of stock sales manager with headquarters at Fresno. His place as head of the gas department in Bakersfield has been taken by William Tyler, formerly his chief assistant.

**Thomas J. Hanlon, Jr.**, manager of the Tampa Electric Company, a Stone & Webster property, has been made manager of the Winter Haven (Fla.) Water, Ice & Light Company, recently acquired by Stone & Webster. J. H. Fuller, formerly sales manager of the Tampa company, will be assistant to the manager with headquarters at Winter Haven, and Gettis B. Henderson will take Mr. Fuller's place as sales manager of the Tampa company.

**W. E. Clement**, commercial agent of New Orleans Public Service, Inc., was elected president of the Electrical League of New Orleans on April 9. Mr. Clement is an enthusiast on all matters electrical and has taken an active part in the growth and welfare of the league. Percival Stern of the Interstate Electric Company was elected vice-president, and C. A. Disher of the Electric Appliance Company was elected secretary and treasurer.

**Tom P. Walker**, formerly manager of the Haverhill (Mass.) Gas Light Company, has been transferred to the managership of the Baton Rouge (La.) Electric Company. J. L. Alexander, manager of the Keokuk (Iowa) Electric Company, has been transferred to Haverhill, and Walter H. Burke of the Boston office of Stone & Webster, Inc., has been appointed manager of the Keokuk company. Roger A. Gordon, formerly sales manager of the Houghton County Electric Light Company, Houghton, Mich., and later of the Paducah (Ky.) Electric Company, has been appointed sales manager of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., succeeding E. S. Roberts, resigned.

### PenDell and Sedgwick Made Executives' Assistants

C. W. PenDell has been made an assistant to Vice-president John G. Learned of the Public Service Company of Northern Illinois, and H. P. Sedgwick has been appointed an assistant to Vice-president J. L. Hecht. Mr. PenDell has been associated with the Edison Electric Illuminating Company of Boston, the Chicago & Northwestern Railroad, the Atchison, Topeka & Santa Fé Railroad and the North Shore Electric Company, and for some years was an engineer in the contract department of the Public Service Company, the successor to the North Shore company. Mr. Sedgwick has been associated with the company since 1913, when he became assistant inspector. In 1921 he was made superintendent of District "E" and one year later was transferred to Chicago as a member of Mr. Hecht's personal staff.

**S. C. Bleckley** of the Westinghouse Electric & Manufacturing Company of Pittsburgh is now associated with the engineering department of the Georgia Railway & Power Company.

**S. D. Woodward**, manager of the Peshtigo & Oconto Service Company in Peshtigo, Wis., has tendered his resignation to the Northeastern Power Company, which recently assumed ownership of the local plant. Mr. Woodward was for many years affiliated with the Peshtigo Lumber Company, and when it ceased activities he was one of the promoters of the company which purchased the electric holdings. He has no plans for the future at the present time.

**Lewis Degen**, consulting electrical signal engineer of Berkeley, Cal., has been retained by the city of Los Angeles to supervise the installation of a fire-alarm system, to cost $1,500,000. Mr. Degen spent many years in South America and installed the first electric street railway on that continent in Rio de Janeiro in 1890. Later he acted as consulting signal engineer for the Brazilian government for eight years. He returned to the United States in 1913 and in 1914 prepared plans for a fire-alarm system for Los Angeles.

**Harry B. Joyce** has been appointed manager of the synchronous-motor department of the Ideal Electric & Manufacturing Company, Mansfield, Ohio. Mr. Joyce was at one time affiliated with the United Railway & Electric Company of Baltimore, handling substations, test, designs and reconstruction, and was later appointed power engineer for the United Electric Light & Power Company, New York City, in charge of all commercial power sales work, developing power applications and handling and developing new and adaptable high-tension rates. Mr. Joyce has also been consulting engineer of New York City, devoting special attention to application of electric drive for ice-making and refrigerating plants.

**John D. Goodliff** was recently elected vice-president of the Parr Electric Company, Inc., New York City.

**Arthur P. Amond** of Green Bay has succeeded George Martin as manager of the Denmark (Wis.) Light & Power Company. Mr. Martin has been manager for the past five years.

**Floyd Casler**, formerly manager of the Midland Public Service Company in Colby, Wis., has been transferred to the company's branch at Blair to serve in the same capacity.

**Walter E. Burke** of Boston has been made manager of the Keokuk Electric Company, succeeding J. L. Alexander, who leaves for Haverhill, Mass. Mr. Burke is a member of the Stone & Webster organization.

**H. L. Mode**, who until recently has been electrical engineer in the chief engineer's office of the Otis Elevator Company, is now in charge of sales for the Hoist & Crane Engineering Company of New York City.

**Emerson A. Armstrong**, formerly power salesman of the Joliet district for the Public Service Company of Northern Illinois, is now in the Chicago office as power engineer in charge of all power salesmen of the company.

**G. M. Pierce** of Blair, Wis., has been assigned to the Menomonie office of the Wisconsin-Minnesota Light & Power Company as district manager. Mr. Pierce has been manager of the Blair district for the last eight months.

**Kenneth A. McIntyre** of the field staff of the Society for Electrical Development has returned to headquarters after a 9,000-mile trip. Mr. McIntyre looks for a year of progress in co-operative work that will be of lasting benefit to every branch of the industry.

**L. U. Murray**, manager of the Columbus (Ohio) office of the General Electric Company, has been appointed district merchandise manager of the Cincinnati district and is succeeded by J. A. Davies as manager of the Columbus office. Mr. Davies was general salesman in the Indianapolis office until his recent appointment.

**Ray P. Jackson**, manager of the materials and process engineering department, and Marsden H. Hunt, ceramic engineer, of the Westinghouse Electric & Manufacturing Company, will have charge of the new high-voltage insulator plant of the Westinghouse company at Emeryville, Cal., near San Francisco. The plant is now under course of construction and will be completed and operating in a few months.

**B. E. Sunny**, chairman of the board of the Illinois Bell Telephone Company, was elected a director of the Middle West Utilities Company at the stockholders' meeting at Wilmington, Del., March 27. Mr. Sunny's appointment was made to fill the vacancy created by the death of Frank J. Baker. John F. Gilchrist, vice-president of the Commonwealth Edison Company, was elected a member of the executive committee.

**Arthur L. Williston**, for the past thirteen years principal of the Wentworth Institute, Boston, and widely known by New England electrical men, has resigned. He was formerly connected with the school of science and technology at Pratt Institute, Brooklyn, and during the war was educational director for New England army training detachments, having charge of military training departments in fourteen institutions.

**George F. Staal**, city engineer of Milwaukee for the last nine years, has handed in his resignation to the Mayor, to become effective at the expiration of his term on April 17. Mr. Staal will leave Milwaukee to become associated as chief engineer and general manager of the Pike Forest Development Company, in which he is personally interested, with offices in Denver. This company will carry on extensive construction and water-power work in Colorado.

**Col. Frank M. Gunby**, consulting engineer with Charles T. Main, Boston, has been elected president of the Boston Society of Civil Engineers. Colonel Gunby is well known in electrical circles and has been in charge of the Boston branch of the Main organization's work for some years. He has been active in hydro-electric and industrial-plant engineering. During the war he was stationed at Washington, D. C., in charge of engineering in connection with the construction of cantonments throughout the country.

**P. H. Gadsden** of Philadelphia has been nominated as a director from election district No. 2 on the board of directors of the Chamber of Commerce of the United States by the National Electric Light Association, the American Electric Railway Association, the American Gas Association and the Natural Gas Association. Mr. Gadsden is vice-president of the United Gas Improvement Company and is vice-president and one of the directors of the Philadelphia Chamber of Commerce. The election will be held at the time of the annual meeting of the chamber, May 8, in New York.

**Willis H. Booth**, vice-president of the Guaranty Trust Company of New York, was elected president of the International Chamber of Commerce at its convention in Rome on March 24. In addition to his banking activities, Mr. Booth has many large and important industrial interests. In 1910 he established the Hotpoint Electric Heating Company, which was later merged with the Hughes Electric Company and the electric heating division of the General Electric Company under the name of Edison Electric Appliance Company, with factories in California, Chicago and Canada. He is chairman of the board and of the executive committee of this corporation.

**David Elwell** has been appointed manager of the New York office of Lockwood, Greene & Company, succeeding Gen. W. H. Rose, who has resigned to join the organization of the American Machine & Foundry Company, New York. Mr. Elwell is well known in electrical circles, having been graduated from the Massachusetts Institute of Technology in 1904 and served with the Edison Electric Illuminating Company of Boston and the Westinghouse Electric & Manufacturing Company, representing the latter as superintendent on the electrification of the New York, New Haven & Hartford Railroad. For five years he was electrical engineer of the Boston office of Lockwood, Greene & Company, going to New York in 1920.

**W. F. Hendry** has resigned his position as assistant chief engineer of the Western Electric Company to become chief engineer of the Manhattan Electric Supply Company. Mr. Hendry had been associated with the Western Electric Company for almost twenty-three years.

**H. T. Melhuish**, formerly manager of the district sales office of the Radio Corporation of America at Chicago, has been appointed assistant general sales manager at the company's New York office. Mr. Melhuish had been associated with the Radio Corporation for only three months as salesman when he was selected for the position of district sales manager at Chicago. Previous to his connection with the Radio Corporation he was engaged in radio distribution in New York City in his own interest. For five years Mr. Melhuish has been active in radio sales work. J. M. Sawyer, who was responsible for the organization of the Radio Corporation of America district sales office at Chicago, has returned from the San Francisco office to become again sales manager of the Chicago office. Mr. Sawyer has just completed organizing the San Francisco sales department.

# Obituary

**Horace O. Stone**, lawyer and inventor, died on April 11 at Chicago after a stroke of apoplexy. Mr. Stone invented a glass device to prevent damage by freezing of water in engines and methods of effecting saving in blast furnaces.

**Fred S. Martin**, superintendent of the large industrial motor department of the Westinghouse Electric & Manufacturing Company for a period of eleven years and subsequently appointed staff superintendent, died recently in the West Penn Hospital, Pittsburgh, after three weeks' illness.

**Hanson M. Savage**, president of the Wetmore-Savage Company, Boston, and one of the best-known electrical supply jobbers in the East, died suddenly at Boston on April 10. Mr. Savage, after some years in the service of the General Electric Company, formed, in 1906, with V. C. Bruce Wetmore, the company bearing their names.

**Thomas E. Crossman**, who had served the National Electric Light Association, the American Institute of Electrical Engineers and the Association of Edison Illuminating Companies for almost forty years as official reporter, died suddenly on April 4 in the Congress Hotel, Chicago, where he had gone to report the meeting of the American Railway Engineering Association.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## A Method of Selecting Men

### A Simple Form of Question Test—Policies Toward Education, Habits and Entertaining—Other Practical Points

By R. J. Russell
Vice-President Century Electric Company, St. Louis

THERE are three things, we feel, that should be very carefully determined in the case of every man who is permitted to join our organization. We try to make sure of every man who enters our employ:

First—That he shall be a man of character, one who has had good home and social and educational training and has absorbed and not forgotten it.

Second—That if he does not possess the knowledge to enable him to handle the engineering end of the commercial and sales problem he will have the fundamental education that will enable him to "know how to find out."

Third—That he has made up his mind to continue indefinitely with us if he is to join our commercial organization.

I might elaborate on this at length, but, briefly, we are not attempting to operate in a corrective fashion, but rather definitely to develop ability, which is apparently quite possible.

R. J. Russell

#### As to Habits

We find it is best to select men who have inherited something that will be of substantial assistance in their business life. We are interested particularly that the man has been inclined to participate and has participated in society and organization work, which broadens a man's views and gives him a little confidence in himself. We are particular as to how he spends his Sundays, Saturday afternoons, holidays and evenings, and, if he is married, we want to know whether he spends them with his family or not.

Our experience shows that when the diversion indulged in by an individual after business hours, or the lack of physical and mental relaxation, leaves him in the position of, consciously or unconsciously, using the morning (especially Monday) to recuperate, he is not generally able to contribute that concentrated thought and determination to his business, or promptly to render the decisions which are required, that will enable him to keep up with those who are forced by the demands of the work to secure definite results. As a general proposition, he can hardly be considered as headed for the ultimate position of substantial responsibility and trust which we are hoping all will be qualified to fill if or when it is offered.

#### As to Education

We are not placing any one in a position above an ordinary clerkship in our commercial and sales organizations who does not possess a college education. Those who have acquired a technical education outside of a college are generally a little older than we find economical to try to break into our ways. They cannot so readily understand and absorb our practices and policies. We must have technically trained men, otherwise we would not possess the man who "knows how to find out" when he does not know the answer to the question or problem that is given him to solve. For many other departments in our works the standard practice is to hire college men; but elsewhere also, in the majority of cases, those who expect to rise above the point of workmen must have at least a high-school education.

In hiring men for our commercial organization we want them as soon after they come from college as possible, so that we may train them with the minimum effort to believe in and observe the plans and practices and policies of the Century Electric Company and so that they may feel they are an inherent part of the organization.

#### Analyzing Character

In examining men for employment in our commercial organization we require them to answer a series of very exacting questions, which we study with close scrutiny and find extremely helpful in analyzing character and weighing the value of a man to us. We secure a frank statement on the following points, different application forms being used for different departments:

1. Age.
2. Where have you lived, and the number of years spent in each place?
3. Father's or guardian's business now.
4. Nationality.
5. Descent.
6. Height.
7. Weight.
8. Supply late photograph with this record.
9. Physical defects.
10. Married or single?
11. Number of children.
12. Do you smoke cigarettes?
13. Do you use alcoholic liquors in any form?
14. Schools attended, name and location, course, how long, year graduated, degree: High school, preparatory, college, university, technical.
15. What manual training have you received at school?
16. Mention the most important studies you have taken in high school and university and have received satisfactory credits for, also studies you liked best.
17. What was the subject of your thesis upon graduation?
18. School work enjoyed most.
19. Scholarship record (your own opinion).
20. Scholastic honors.

21. Part taken in athletics, class organization, students' societies, etc.—offices held.
22. What societies are you a member of—educational, social, religious, fraternal, etc.—and what part taken in each?
23. All practical experience, including remunerative work during vacations or high school and university periods in order of date.
24. What experience, if any, have you had in selecting and applying motors for and to installations and apparatus?
25. If not answered above, what knowledge have you of single-phase and polyphase motors and fans, both theoretical and practical, and where did you acquire it?
26. Detail your sales experience if any.
27. Outline the division of engineering which you most desire to follow—factory, production, design, sales.
28. What languages have you studied?
29. What languages do you speak (state whether fluently or partially)?
30. Detail your connection with Century Electric Company.
31. Are you ready to go anywhere in the United States that we may designate?
32. State the particular line of work and class of apparatus, if any, on which you are now or have been making a specialty.
33. Name and address of firm with which you are connected at present, and your position.
34. Are you seeking temporary or permanent position?
35. Why do you wish to become connected with Century Electric Company?
36. Per cent college expenses earned.
37. Present financial obligations.
38. How do you spend your evenings?
39. Mention some of the books and magazines you have read during the past year.
40. General remarks bearing on your application that are not covered elsewhere herein that will help in arriving at a just decision as to whether to engage your services or not.
41. General impressions of interviewer: Appearance, approach, attitude, breadth, character, decision, expressiveness, enthusiasm, health, judgment, personality, quickness, refinement, tact, work best suited for.

A Few Requirements

Among our requirements are that the man must stand at least 5 ft. 8½ in., weigh not less than 140 lb. and be not less than twenty-two years of age. He must not smoke cigarettes or use intoxicating liquors. The Century Electric Company has never since it was organized allowed five cents for entertainment. The reason is that we expect our men to compete for business but not to compete in any "cafe endurance" contest, which in practice results in the salesman trying to entertain a different guest at least once a day. If we did not establish this rule, our salesmen would be worn out physically about the time they should amount to something to themselves and to us commercially.

We have no place in our organization for the man who is looking for experience, and we are particularly careful in selecting men in seeing that they take their time to investigate our company and our organization from all angles. We suggest many of the angles from which they do their investigating, being sure that we are not at all biased, so that when a man does come with us he is practically certain to stay.

As far as we can recall, no man connected with our sales organization who was technically educated and trained in our works and in the general office has left and gone with a competitor, except one case. A family reason caused that decision.

Our educational department consists of an educational director and an assistant director, who preside over our student employees, and an assembly room seating about 150. These men are looking after the routing through the works of from six to fifteen college men, from fifteen to fifty high-school graduates destined for foremen, clerical and directing positions, and from twenty to thirty young workmen apprentices all the time.

# Wanted: More Open Minds

### More Liberal Co-operation Needed from the Trade in Marketing New Electrical Conveniences

By a Manufacturer's Sales Engineer

Some years ago there was developed an electrical household convenience which was designed for usefulness in the kitchen, and now a company with which I am connected is trying to market this device. We manufacture no other household products, but are hoping to build up a sound and extensive business through the successful application of this equipment in many parts of the country. Why does the progress of this appliance make such moderate headway?

When intelligently applied to kitchen requirements, this device does its work better than the older competitors operated by other agencies than electricity. Yet it is like the proverbial " pulling teeth" to get the local central-station sales department executive interested in its application, and we find it almost as hard to arouse the electrical supply jobber and the dealer to the possibilities of its proper utilization.

Not only because I am personally interested in seeing this device take its place among recognized standard equipment for the home do I appeal for more co-operation. Every manufacturer of a comparatively new device will appreciate the difficulties of interesting the utility man, the jobber and the retailer in a modest piece of equipment like this, selling for far less than $100 in a common size, and requiring only the will to push it to insure popularity. I suppose that the trouble lies in part in the idea of many executives of central stations that the device in question is attacking a field of service which has often been looked upon as barren to commercial exploitation. It is unnecessary to state what this service is in order to make the point I wish to drive home, viz., that the men of this industry should never "freeze" to the conclusion that because some problem has been unsolvable it is bound to continue so.

So widespread is this impression among many central-station sales managers, for instance, that it is difficult to get complete trial installations on their own systems, and yet now and then one or another utility executive will put the outfit into his home, "try it on the dog" as it were, and then some day Mr. Sales Manager finds out that the "big boss" has one of these things under his own roof, that it works properly, and hence that it will work elsewhere. It ought not to be the case that the easiest avenue of approach to the sales manager in the lighting company or the jobbing establishment is sometimes via the "overhead" route passing through his superior's demesne.

So I ask that sales leaders throw their minds a little wider open in considering and trying new electrical devices; that they refrain from the error (centuries old) of supposing that because a scheme failed to work years ago, it is no good today. We, for instance, offer them a device which will do better work than its competitors made outside the electrical industry, and I frankly believe that a greater willingness to give such apparatus a more comprehensive try-out will be productive of good to the industry and to the waiting public.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

WITH the increasing demand for motors in various parts of the country, heavy pressure is being put on manufacturers to meet present requirements, and the time has now come when prospective purchasers will have to reckon on lengthening deliveries on orders involving even fair-sized total ratings of the more common machines. Experience of many years has shown manufacturers the wisdom of "long-distance" production and of the upbuilding of local stocks for the more immediate demands of the market, and at present a vigorous effort is being made to complete and maintain at least moderate stocks of the smaller integral-horsepower motors. A buying movement has begun to set in in some quarters in anticipation of possible price advances. It may fairly be said that many motor stocks are spotty, taking the country as a whole; but thus far no serious inconvenience appears to have been sustained from the fact that these stocks are being reduced, notwithstanding 100 per cent capacity output in representative plants.

## Competition Is Still Acute

IN SOME circles the opinion is still heard that competition is an adverse factor in the motor business, particularly in regard to margins of profit allotted to sales representatives. While it is true that there are a great number of motor producers in the field at this time, it is felt in some quarters that the real test of business-getting capacity is service. As stocks diminish, the sharpness of competition tends to increase; but the line of best results in building and maintaining a motor business appears to be that of intelligent application engineering and modern sales facilities, with all that these mean in the way of gaging requirements and holding interest in performance after sales.

## Betterment Work Never Stops

LOOKING into the distant future of the electrical industry, it is still impossible to discern a zone of complete saturation in motor applications in this country. Not only do the natural and still undeveloped resources of America beckon the motor builder to new achievements, but the constant changes in industry and the progress of application engineering are continually pointing the way to new sales. Transformations of war-material plants into establishments devoted to the production of other kinds of commodities have been completed in many localities. A great machine-gun factory is today turning out fuses, switches and other distribution material. Another is making electric starting and lighting systems for the automobile industry. Revolutionary changes in motor installations have gone along with such transitions, and the ceaseless fight against industrial waste takes close note of load variations in many plants whose product has not been changed in kind, although it has in quantity, during the past five or ten years. The immense stocks of used motors thrown upon the market at the close of the war have been absorbed into industry with slight effect upon prices as a whole, and the progress of new designs has stimulated interest in power problems throughout the trade.

## Record-Breaking Sales of Heating Pads Are Reported

AN UNPRECEDENTED demand for heating pads during the past four months has led to a marked increase in production in factory circles, and this has been sustained throughout the winter without the usual seasonal slump in orders. Some overtime work is necessary to keep up to the current volume of business, and it is impossible to build up any substantial stocks under present conditions. The supply of raw material for pads is reported ample as a result of manufacturing anticipation of requirements. The care required to produce reliable and satisfactory pads makes it necessary to build up factory forces gradually for such work. Labor is in fairly good supply. Prices are firm and little prospect of early change is evident. This class of equipment is rapidly getting into the staple line, and vigorous advertising effort, coupled with an unusually severe season in the northern part of the country, has contributed to the present satisfactory situation.

## Range Business Hitting Faster Stride as Spring Sets In

IMPROVEMENT in the electric range trade is in general evidence as spring demand opens wider. Manufacturers are increasing their production schedules and look for a substantial year's business. So far few complaints of labor shortage have found wide circulation, and raw materials are in fair supply for current needs. There is some prospect, however, of material scarcity before the end of summer. Deliveries are in good shape and the trend of prices is upward in some quarters. A great deal of study is being given to the marketing of electric ranges by both manufacturers and central stations. The growth of installment campaigns in central-station circles is helping to popularize electric cooking, but the full benefits of mass production have not yet been attained in the manufacturing plants. New England is rather apathetic at the moment as to range purchases, but the Far West and the South are showing new interest, and both inquiries and purchases are coming in at a much faster rate than a year ago. The central-station rate situation is getting better constantly, from the manufacturer's viewpoint. The continued high cost of domestic fuel and the improved automatic and convenience features which different range makers are developing are bringing the range home to the public in a more definite way than formerly.

## Conduit Boxes in Easy Supply

JUDGING from reports of Eastern distributors, any troublesome delays in the transportation of conduit boxes which were experienced during the winter have given way to an ample supply. Steady sales are being handled in connection with the building expansion program of the country, and prices are unusually free from violent fluctuations. The ups (and downs that were) of black and galvanized pipe quotations find little reflection in box prices.

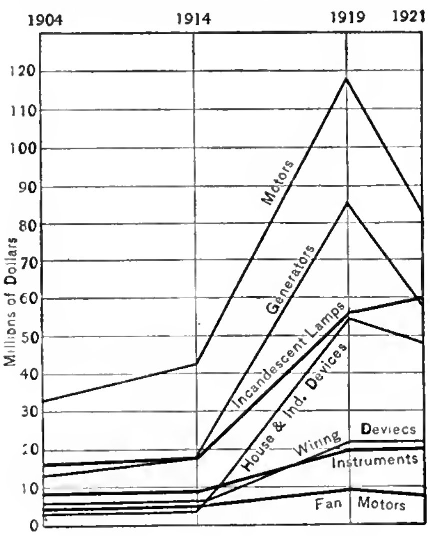
An intelligent attention to future requirements is, of course, necessary in handling this class of material, but so far the steel industry has given the jobber and the contractor very little trouble in relation to a fairly even stock maintenance in local centers from which the supply of conduit boxes are distributed.

## Purchasers Help Transformer Standardization

RECOGNITION by the transformer manufacturers of the co-operation of purchasers in standardization work is a gratifying sign of mutual understanding. Few buyers of transformers are perhaps in a position to contribute directly to the progress of engineering design in this field, but the willingness of more and more users to adapt their requirements to well-considered established types and ratings of equipment is helping to reduce superfluous production and so to keep down costs in a broad sense. A leading transformer engineer stated last week that plant and system operators have shown about as much active interest in standardization as the manufacturers, the collective result being along the line of elimination of undue variations from established equipment in specifications. Some operators may at times call for special combinations wherein a standard rating can be made to satisfy their needs, and each time that the decision is made to play the standard game the industry receives some benefit. All signs point to a continuance of this co-operation, and publicity on the part of operators and manufacturers is helpful to the cause.

## Chart Shows Some Interesting Production Values

ACCORDING to recent official figures by the Department of Commerce, the 1921 value of motors and parts, not including starters and controllers,




IMPORTANT 1904-1921 VALUES

amounted to $83,058,000; generating apparatus and parts, $58,861,000; incandescent lamps, $59,728,000; household and industrial devices, $48,815,000; wiring devices, $21,806,000; instruments, $21,033,000, and fan motors, $8,611,000. Production values for the census years 1904, 1914 and 1919 are indicated as shown in the accompanying chart.

## Industrial Electric Trucks Are in Better Demand

IN BOTH proposition work and sales manufacturers of industrial electric trucks are enjoying decidedly increased activity, following a long period of comparatively dull business. The effective use of these labor-saving equipments depends fundamentally upon the existence of a volume of material handling sufficiently large to keep them occupied a large portion of the working day, and in times of business depression industrial plants tend to become overequipped as well as overmanned. Sales of trucks at such times are consummated only with difficulty unless the economic balance in favor of the truck is so marked as to rebuke the intelligence of the purchaser who fails to substitute it for man-power.

## Truck Sales Start Other Equipment

EQUIPMENT of this type is again in demand to help solve the problems of internal transportation in factories and yards, on docks and at important railroad terminals. A projected new railroad terminal or union station may open a market for two dozen mail and baggage-carrying types, and labor shortage and high costs are turning the attention of specification writers in designing engineers' offices concerned with the above work to industrial truck requirements. Along with these comprehensive layouts for service of trucks in small fleets go demands for the latest types of battery-charging equipment, with a tendency toward the use of automatic control panels and an increased number of energy-recording instruments. The marketing of such equipment is essentially engineering salesmanship, and while competition among the dozen or so representative truck makers is active, the decision to buy particular units rests upon many other conditions than price. Present activity in this line is a most encouraging index of industrial prosperity.

## Manufacturing Industry Had 5.16 per Cent Labor Shortage

EXTENSIVE survey of the labor supply situation has just been completed by the National Industrial Conference Board. The object has been to establish whether labor shortage exists, and, if so, how much of a shortage and in what industries and where.

In the electrical manufacturing industry the board states that the March employment index number (July, 1914, equals 100) amounted to 147.7; that the total per cent of unfilled positions to the total employment of all firms in the electrical industry, as of March 15, was 4.72, and that the percentage of unfilled positions to employment in firms reporting shortages amounted to 5.16. Information from 1,011 firms in various parts of the United States, employing 369,405 wage earners and selected from practically every line of industry, it is stated, shows that there existed a labor shortage amounting to 2.5 per cent of the total employment on March 15. Of the firms reporting, 315 stated that they had unfilled positions due to inability to secure workers. These 315 firms employed 175,387 wage earners and could have employed 9,800 additional persons on March 15, according to the survey.

## February Electrical Exports Heavier than in 1922

TOTAL exports of electrical machinery, apparatus and appurtenances for the month of February were $4,839,738, a gain of $454,344 over February, 1922, when the total amounted to $4,385,394. The following figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR FEBRUARY, 1923, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

| Articles | Value February 1922 | 1923 |
|---|---|---|
| Electrical machinery, etc. | | |
| Turbines | $228,483 | $57,084 |
| Generators: | | |
| Direct-current— | | |
| Under 500 kw | 26,565 | 60,710 |
| 500 kw. and over | 11,962 | 114,726 |
| Alternating-current— | | |
| Under 2,000 kva | 11,302 | 23,926 |
| 2,000 kva. and over | 49,624 | 102,946 |
| Accessories and parts for generators | 18,412 | 20,523 |
| Self-contained lighting outfits | 22,498 | 25,972 |
| Batteries: | | |
| Primary | 72,243 | 98,073 |
| Storage | 85,363 | 182,454 |
| Transforming and converting apparatus: | | |
| Transformers— | | |
| Power | 231,431 | 280,135 |
| Other | 119,397 | 38,418 |
| Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters | 57,468 | 17,405 |
| Transmission and distribution apparatus: | | |
| Switchboard panels, except telephones | 43,063 | 68,481 |
| Switches and circuit breakers above 10 amp | 177,613 | 127,942 |
| Fuse and fuse blocks | 13,181 | 19,261 |
| Meters and measuring instruments: | | |
| Watt-hour and other measuring instruments | 68,672 | 19,962 |
| Volt, watt, and ampere meters and other recording, indicating, and testing apparatus | 40,353 | 79,258 |
| Lightning arresters, choke coils, reactors and other protective devices | 20,907 | 58,310 |
| Motors, starters and controllers: | | |
| Motors under 1 hp | 30,612 | 117,076 |
| Stationary motors 1 to 200 hp. | 169,604 | 182,874 |
| Stationary motors over 200 hp. | 54,271 | 107,027 |
| Railway motors | 19,963 | 13,167 |
| Electric locomotives — | | |
| Railway | 36,329 | 5,570 |
| Mining and industrial | 38,655 | 30,238 |
| Other motors | ....... | ....... |
| Rheostats, controllers and other starting and controlling equipment | 63,697 | 72,661 |
| Accessories and parts for motors | 57,859 | 83,899 |
| Electrical appliances, etc. | | |
| Electric fans | 77,229 | 122,725 |
| Electric lamps: | | |
| Incandescent— | | |
| Carbon-filament | 8,204 | 1,141 |
| Metal-filament | 120,830 | 89,403 |
| Other electric lamps | 14,658 | 16,870 |
| Flashlights | 11,077 | 29,391 |
| Searchlights and projectors | 34,567 | 49,522 |
| Motor-driven household devices | 37,817 | 64,003 |
| Domestic heating and cooking devices | 30,511 | 73,716 |
| Industrial electric furnaces and ovens | 2,647 | 5,584 |
| Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc | 33,855 | 50,385 |
| Signal and communication devices: | | |
| Radio and wireless apparatus | 283,950 | 173,909 |
| Telegraph apparatus | 17,688 | 37,734 |
| Magneto telephones | * | 5,544 |
| Other telephones | 430,559 | 14,875 |
| Magneto switchboards | * | 5,156 |
| Other telephone switchboards | * | 59,630 |
| Railway signals, switches and attachments | 9,338 | 109,427 |
| Bells, buzzers, annunciators, and alarms | 2,641 | 6,454 |
| Other electrical apparatus and appurtenances: | | |
| Spark plugs, magnetos and other ignition apparatus | 55,425 | 64,783 |
| Insulating material | 50,561 | 95,118 |
| Metal conduit, outlet and switch boxes | 24,005 | 32,058 |
| Sockets, receptacles, and lighting switches | 13,795 | 76,503 |
| Other wiring supplies and fixtures | 74,063 | 115,671 |
| Other electrical apparatus not elsewhere specified | 715,134 | 679,311 |
| Globes and shades for lighting fixtures | 23,883 | 38,927 |
| Electrical glassware, except for lighting | 20,522 | 141,160 |
| Electrical porcelain | 194,455 | 145,912 |
| Electrical carbons, carbon brushes and electrodes | 30,536 | 103,877 |
| Insulated wire and cable (iron or steel) | 11,736 | 40,686 |
| Other manufactures of aluminum | 56,333 | 44,673 |
| Copper: | | |
| Bare wire | 71,770 | 125,606 |
| Insulated wire and cable | 158,078 | 211,886 |
| Total electrical exports | $4,385,394 | $4,839,738 |

(*) Not separately stated prior to Jan. 1, 1923.

## The Metal Market

Sales of all metals are in smaller volume with prices generally holding steady. Metal in the market is used soon after delivery, and there is little of it in speculative hands. Most of the copper producers are holding at either 17.25 cents or 17 cents, delivered, level, but are doing little business. The St. Louis lead market is quiet, with most of the sales for small quantities and for April delivery or shipment, consumers preferring to postpone orders for May requirements as long as possible in the hope of a further weakening of the market.

NEW YORK METAL MARKET PRICES

| | April 11, 1923 Cents per Pound | April 18, 1923 Cents per Pound |
|---|---|---|
| Copper, Electrolytic..... | 17.37½ | 17.00 to 17.25 |
| Lead, Am. S. & R. price.... | 8.25 | 8.25 |
| Antimony.............. | 8.75 | 8.75 |
| Nickel, ingot........... | 30.00 | 28.00 to 30.00 |
| Zinc, spot............. | 7.55 | 7.37½ |
| Tin, Straits............ | 48.00 | 47.50 |
| Aluminum, 98 to 99 per cent.............. | 24.00 | 26.00 to 27.00 |

## March Delinquent Electrical Accounts Show Increase

REPORTS from the National Electrical Credit Association show that in the five sections reporting to the association the March, 1923, delinquent electrical accounts increased over February, 1923. In the Chicago territory the average amount jumped from \$107.49 to \$131.49. For the New York territory in March, 1923, 584 accounts were reported as against 283 in February, 1923, with a total valuation of \$73,655 as against \$36,045. The Philadelphia accounts for March, 1923, were \$204 against \$176 for February of the same year. Conditions in the New England territory for March, 1923, were much better than in March, 1922, since only sixty delinquent accounts were reported as against 129 delinquent accounts for the last year. On the Pacific Coast the number reported for March, 1923, totaled forty-eight against fifteen reported in February, although the average amount for this same period had decreased \$126.12. The March delinquent accounts are as shown in the accompanying table.

DELINQUENT ACCOUNTS IN MARCH

| Branch and Month | Number of Delinquent Accounts Reported | Total Amount | Average Amount |
|---|---|---|---|
| Central Division: | | | |
| February 1922.. | 638 | \$97,311.30 | \$116.12 |
| February 1923.. | 635 | 69,996.47 | 107.49 |
| March 1922.. | 978 | 98,569.53 | 100.79 |
| March 1923.. | 993 | 130,571.90 | 131.49 |
| New York: | | | |
| February 1922.. | 393 | 63,082.00 | 160.00 |
| February 1923.. | 283 | 36,045.00 | 127.00 |
| March 1922.. | 643 | 72,843.00 | 113.00 |
| March 1923.. | 584 | 73,655.00 | 126.00 |
| Philadelphia: | | | |
| February 1922.. | 126 | 16,878.00 | 133.95 |
| February 1923.. | 176 | 26,881.67 | 152.73 |
| March 1922.. | 277 | 28,095.09 | 101.42 |
| March 1923.. | 204 | 26,386.27 | 129.34 |
| New England: | | | |
| February 1922.. | 59 | 5,214.64 | 88.39 |
| February 1923.. | 48 | 2,495.35 | 51.99 |
| March 1922.. | 129 | 11,170.85 | 86.59 |
| March 1923.. | 60 | 4,782.71 | 79.71 |
| Pacific Coast: | | | |
| February 1922.. | 14 | 806.45 | 57.63 |
| February 1923.. | 15 | 4,245.63 | 283.04 |
| March 1922.. | 18 | 2,681.95 | 148.99 |
| March 1923.. | 48 | 7,522.26 | 156.92 |

# The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

DURING the week increased activities were reported in the market for appliances, especially fans, flatirons and toasters. Large orders for equipment to the utilities are reported in the West and Middle West. Motor sales in New England are said to be twice as satisfactory as one year ago, with this ratio applying even to the smaller producers. Replacements and increasing construction are doing much for lamp distributors. The fixture market is improving with much intensive selling effort. Collections throughout the country are unimproved.

**Boston** Little change in conditions is apparent, business holding its own in nearly all lines. Wire is moving very actively as the construction season develops and prices have stiffened in flexible armored conductor and high-tension insulators. Shortages continue in radio tubes, and the arrival of rigid conduit is delayed in some cases by railroad terminal congestion. Appliance sales are doing well, and heating pads are making new records in production. Motor sales in this territory are certainly twice as satisfactory in volume as a year ago, and this ratio applies even to the smaller producer. The upward pressure of prices is almost continuous. General business in New England is excellent, barring some retail slumps due to poor weather. The great industries of this section are intensively active. Financial conditions are well in hand.

**New York** Steady demand is the feature of a market of slightly increasing prices and unusually even stocks. Several decreases in prices of wire, devices and radio are expected at the end of two weeks because of lower raw-material costs. Orders for fans are being promptly filled, and jobbers are most optimistic about the season's possibilities. Conduit stocks are much improved. Collections are only fair.

**Atlanta** Spring weather is ushering in a large amount of additional outdoor work of various types and a shortage in crude labor is beginning to be felt. Skilled labor, while fully employed, still seems to be sufficient for demands, but there is no excess in the territory. Industrial establishments generally are on full or overtime operation, with the outlook excellent for a continued activity throughout the summer and early fall. Rains are preventing the planting of cotton, and this is causing some uneasiness in the rural communities. Electrical dealers report their business as good, particularly in building and line materials. Shipments on conduit have improved and stocks are better.

**Pittsburgh** The activity among the industrial companies is especially noticeable. Increased buying is being done by them in the electrical line, requisitions becoming larger. It is reported that one industrial firm bought electric tractors during the week to the amount of \$100,000. There is a decided increase during the week on armored cable and a slight increase on some conduit fittings. There was a slight drop in copper, although this has not as yet had any effect upon wire prices.

**Cleveland** The week has been a favorable one for jobbers, who report sales far in excess of the same period last year. Stocks are in good shape except for those products containing copper. Manufacturers are most concerned about the labor scarcity and the increasing costs of production. Prices are advancing slightly on lamp cord, weatherproof wire, conduit, tape, porcelain, transformers, insulators and switch boxes. Appliances are in fair demand and central-station expansion continues satisfactorily.

**Chicago** Business has remained quite active, with several announcements of increased prices. Flexible armored conductor increased \$5 per 1,000 ft. and connecters increased \$3 per 1,000. Motors rated at 250 hp. and above have increased 10 per cent. It is extremely difficult to obtain 1½-in. locust pins, since this size is almost entirely depleted. Building permits issued the first week in April amounted to \$21,996,000, or nearly \$5,000,000 more than in the whole month of April, 1922.

**St. Paul-Minneapolis** Jobbers say business is slow. The brisk buying of the winter months on a rising market has stopped. Construction in both cities continues excellent. Minneapolis construction is fair, but several large projects have been postponed because of high prices. The big radio and appliance exposition at the Minneapolis armory is drawing large crowds.

## Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Instruments, Farm Lighting Plants and Irons

| | Wire | Armored Cable | Conduit | Transformers | Poles | Pole Line Hardware | Porcelain | High-Tension Equipment | Fuses | Meters | Switches | Wiring Devices | Lamps | Commercial Fixtures | Motors | Radio | Conduit Boxes | Dry Batteries | Tape |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Boston** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Low | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml. | Low |
| Price trend | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Inc. |
| **New York** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. |
| Supply | Nml. | Nml. | Low | Nml. | Low | Nml | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. |
| Price trend | Firm | Inc. | Firm | Firm | Firm | Inc. | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Dec. | Firm | Firm | Inc. |
| **Baltimore** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Slow | Slow | Sdy. | Slow | Act. | Slow | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Atlanta** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Act. | Act. |
| Supply | Low | Nml. | Low | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **Pittsburgh** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Dec. | Firm | Firm | Firm |
| **Cleveland** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Sdy. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. |
| Supply | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Inc. |
| **Chicago** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Act. | Act. | Act | Sdy. | Act. | Sdy. | Act. | Act | Act. | Act. | Act. | Act. | Act. | Sdy. | Act. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low |
| Price trend | Inc. | Inc. | Inc. | Inc. | Firm | Firm | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **St. Paul-Minneap.** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Slow | Act. | Sdy. | Act. | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Firm | Firm | Inc. | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Inc. | Dec. | Inc. | Firm | Firm |
| **St. Louis** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy | Act. | Act. | Act. | Slow | Sdy. | Sdy. |
| Supply | Low | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Low | Nml. | High | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **New Orleans** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Slow | Act. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Low | Low | Nml. | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Denver** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Slow | Sdy. | Sdy. | Sdy. | Slow | Act. | Slow | Sdy. | Act. | Act. | Act. | Slow | Act. | Act. | Sdy. | Sdy. |
| Supply | Nml. | Nml. | Low | Low | Nml. | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Firm |
| **Salt Lake City** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Sdy. | Act. | Sdy. | Sdy. | Slow | Act. | Sdy. | Slow | Sdy. | Sdy. | Sdy. | Act. | Act. | Slow | Act. | Sdy. | Sdy. | Sdy. |
| Supply | Low | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Hi. | Nml. | Nml. | Nml. | High | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Firm | Inc. | Firm | Inc. | Inc. | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm |
| **Portland-Seattle** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Act. | Act. | Act. | Slow | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Low | Nml. | Nml | Nml | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Firm | Inc. | Inc | Firm | Firm | Firm | Firm | Firm | Firm | Firm |
| **San Francisco** | | | | | | | | | | | | | | | | | | | |
| Demand | Act. | Act. | Act. | Sdy. | Sdy. | Act. | Sdy. | Sdy. | Sdy. | Sdy. | Sdy. | Act. | Act. | Act. | Act. | Act. | Sdy. | Sdy. | Act. |
| Supply | Nml. | Nml. | Low | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. | Nml. |
| Price trend | Inc. | Inc. | Firm | Inc. | Firm | Firm | Firm | Firm | Inc. | Firm | Inc. | Inc. | Firm | Dec. | Firm | Firm | Firm | Firm | Firm |

**St. Louis** Activities in the building industry are being well sustained. The building permits for the month of March amounted to $4,237,585, which is an increase of 136 per cent over the same month in 1922. The car shortage has been improved by the reduction of bad order equipment and the delivery of new cars. In electrical lines jobbers report large stocks of conduit boxes. There has been a slight increase in some of the prices of schedule material, and increases are looked for in several other lines before very long. The sale of electrical appliances for the first quarter of the year has been more than 30 per cent greater than during the same period in 1922. Collections in retail circles are much improved.

**Denver** Business is good, though conservatism and caution are being exercised in placing of orders. Industrial plants are temporarily leading the field in new electrical business. Prices in nearly all lines are strengthening. Appliances and lamps are moving steadily. Range business in the Arkansas Valley is booming.

**Portland-Seattle** Construction continues active, and electrical permits for the first three months of this year were appreciably greater than for 1922. Most stocks are in very satisfactory shape, although Seattle still reports a shortage of conduit. Slight price increases were noted in a number of lines and further advances are expected. Labor is scarce and wages are increasing. Radio demands are decreasing in the cheaper sets, but the better-class sets continue active.

**San Francisco** Contractors' and jobbers' staffs are going at top speed, every available electrician is working, and several jobbers have increased their sales forces. Dealers' business is markedly better, especially in radio material and small heating appliances. Several big orders and inquiries are reported, such as for $50,000 worth of cross-arms from a power company, several 10,000 socket and plug orders from local manufacturing plants, 50,000 ft. assorted lamp cord and about $2,500 worth of safety switches.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Phoenix Light Company Sales Made Large Increase

Negotiations have been closed by the Phoenix Light Company, Milwaukee, for 20,000 sq.ft. of additional factory space at 531 Market Street, adjoining the company's present plant. The building consists of four stories and basement and will house the lamp department.

Company officials report an increase of 56 per cent in sales for the first quarter of 1923.

## American Insulated Wire & Cable Now Making Magnet Wire

The American Insulated Wire & Cable Company, Chicago, is now manufacturing magnet wire, having begun operations April 1. Its products are sold under the trade name "A-1 magnet wire" and consist of the following: Plain-enameled, single-cotton-covered, double-cotton-covered, single-cotton-enameled, double-cotton-enameled, single-silk-covered, double-silk-covered, single-silk-enameled and double-silk-enameled.

A factory manager has been engaged who has had twenty years' experience in this field and has developed magnet wire for two of the largest companies in the United States making this product. During that period he has supervised the production of upward of 60,000,000 lb. of magnet wire to meet every condition in use. He has both technical and practical knowledge of the uses of wire as well as of its manufacture.

## Westinghouse Receives Milwaukee Power Transformer Order

The Milwaukee Electric Railway & Light Company has ordered nine power transformers from the Westinghouse Electric & Manufacturing Company.

The order included one 3,000-kva., OIWC-SC three-phase, 60-cycle transformer of 27,600 volts and 13,800 volts high tension, 2,300 volts low tension, to have 2,200 kva. capacity without water in the cooling coils; two 3,000-kva. OISC three-phase, 60-cycle transformers, 27,600 volts and 13,800 volts high tension, 2,300 volts low tension; two 2,000-kva. OISC three-phase, 60-cycle transformers, 27,600 volt and 13,800 volts high tension and 2,300 volts low tension, and four 1,667-kva. OISC single-phase, 60-cycle transformers, 132,000 volts star high tension, 27,600 and 13,800 volts low tension.

The first five transformers are for substation use, to step down from the 27,600-volt network of the company to 2,300-volt circuits. The others are part of the equipment required for establishing a 132,000-volt line and connecting it to the 27,600-volt system at different points.

## Superior Switchboard Absorbs Meter Devices in Expansion

The Meter Devices Company and the manufacturing division of the Electric Motor & Engineering Company have been absorbed by a new corporation called the Superior Switchboard & Devices Company, Canton, Ohio.

The Superior Switchboard & Devices Company is moving into a new factory building with approximately six times the floor space of the old building. The executive personnel of the Superior Switchboard & Devices Company will be practically the same as was formerly connected with the Meter Devices Company and the manufacturing division of the Electric Motor & Engineering Company.

This change in name and location allows for an expansion that was needed. The Superior Switchboard & Devices Company will manufacture switchboards, panelboards, power-meter testing devices, steel boxes and kindred articles.

## Chain Battery System Moves Plant to Kansas City

The Chain Battery System, a company manufacturing storage batteries, has recently moved its plant and headquarters from Carthage, Mo., to Kansas City, where it has purchased a brick building at 1321 Virginia Avenue which is to be used as a factory. This company, which also is a wholesale distributor, is two years old and has assembling plants in Wichita and Chanute, Kan.; Carthage and Springfield, Mo.; Tulsa, Okla., and Fort Smith, Ark. C. E. Nordyke is its president.

## Western Electric to Build New $1,000,000 Warehouse

The Western Electric Company announced last week its intention to build a new merchandise building at its Hawthorne works in Chicago at a cost which is expected to be well in excess of $1,000,000. The new building will supplement the warehouse facilities at that plant and relieve a situation which has forced the company to rent 200,000 sq.ft. of storage space in buildings outside its Chicago plant.

The new structure will be four stories high and will have a floor space of 100,000 sq.ft. Ground will be broken within the next six weeks and the warehouse will be ready for use by early autumn.

## S. A. Woods Machine Company Enlarges Line

Increasing demand for motors is reported by M. F. Fitch, sales manager motor division, S. A. Woods Machine Company, Boston, business now running well over 50 per cent above that of a year ago. During the past few months the company has purchased and installed a number of additional machine tools, thereby increasing the proportion of motor production space allotted to this department, and additional employees have been engaged.

Mr. Fitch stated last week that foreign orders are increasing, notably from Japan, China and Australia. The company has been able to keep in line with the demand by careful advance ordering of raw materials and has lately increased its line to include motors up to 50 hp. rating. Some improvements in design are announced, and the outlook for the year is most favorable.

## G. E. Orders for First Quarter Show Gain of 56 per Cent

Orders received by the General Electric Company for the three months ended March 31 amounted to $80,010,045, according to an announcement just made to stockholders by President Gerard Swope. This is an increase of 56 per cent over a similar period last year, when orders totaled $51,335,300.

The International General Electric Company, Inc., reports net sales of $20,212,257 during 1922, against $38,359,012 in 1921. Despite the sharp falling off in total income, the profits for the year were larger than 1921. Net profits for the year totaled $2,265,477, which, after allowing for preferred dividends, left a balance equal to $15.65 a share on the $10,000,000 capital common stock outstanding, against $12.73 a share in 1921.

| | 1922 | 1921 |
|---|---|---|
| Net sales | $20,212,257 | $38,359,012 |
| Other income | 1,196,028 | 2,581,649 |
| Total income | $21,408,285 | $40,940,661 |
| Cost of sales, expenses and taxes | 18,803,944 | 37,714,544 |
| Interest | 338,864 | 1,254,044 |
| Net income | $2,265,477 | $1,973,073 |
| Preferred dividends | 700,000 | 700,000 |
| Surplus | $1,565,477 | $1,273,073 |

The balance sheet on Dec. 31, 1922, reported net current assets of $9,258,440 and net current liabilities in the form of notes and accounts payable of $4,715,240.

## Robbins & Myers Open New Sales Office in North Carolina

The Robbins & Myers Company, Springfield, Ohio, manufacturer of electric motors, generators and fans, has opened a new sales office in Charlotte, N. C., 217 Latonia Building.

Albert Milmow has been placed in charge of this office. Mr. Milmow has had many years' experience with electrical equipment and is a specialist in the textile field.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency is desired in New Zealand (No. 6,018) for small electrically driven refrigerators having a capacity up to one-eighth of a ton, direct-current, self-acting and self-contained, for use in private residences and hotels.

Purchase and agency is desired in Mexico (No. 6,019) for a small automatic electric machine for grinding ice and filling glasses, the placing of the glass making the electrical connection.

Purchase is desired in South Africa (No. 6,020) of lighting fixtures, electrotherapeutic equipment and signal system of sanitarium.

HADJI BEY ET CIE, McCurtain Street, Cork, Ireland, would like to receive catalogs of electrical novelties, mechanical figures, etc., for window display in a confectionery establishment.

PROPOSED EXTENSION TO THE HAVRE ELECTRIC SYSTEM.—The Société Havraise d'Energie Electrique has secured a fifteen-year extension of its concession to supply electrical service in Havre. A number of extensions are contemplated, including the installation of a 30,000-volt distribution cable connecting the station at Havre with the plant at Zainville, additions to both power stations, and erecting a telephone line connecting up the power houses and substations. The company will increase its capital stock from 25,000,000 francs to 45,000,000 francs to finance the work.

ELECTRIC SYSTEM FOR BATHURST, AUSTRALIA.—Permission has been granted the Municipal Council of Bathurst, New South Wales, Australia, to appropriate £40,000 for the installation of an electric system for the city, on which work will begin at once.

POWER PLANT FOR THE PROPOSED SUGAR MILL IN BRISBANE, AUSTRALIA.—Plans for the proposed sugar mill to be erected by the state government in the Tully-Banyan district, to cost about $2,000,000, include a power plant. The Australian Sugar Producers' Association is interested in the project.

AUXILIARY STEAM PLANTS NEEDED IN JAPAN.—As the hydro-electric companies in Japan have awakened to the fact that their present systems are inadequate to meet the demands at all times without auxiliary steam power stations, *Commerce Reports* states, there should be a good demand for equipment for steam-power plants. Shortage of water has become an annual problem in Japan, and for this reason it is recognized that an auxiliary steam-power plant is necessary for practically all hydro-electric plants if the companies are to be able to fulfill their contracts.

## New Apparatus and Publications

SLOTTING MACHINE.—The Martindale Electric Company, Box 35, Station C, Cleveland, has placed on the market a new commutator slotting machine.

ELECTRIC PUMP JACK.—An electric pump jack which will convert the ordinary farm pump into an electric pump is manufactured by the Cullman Wheel Company, Chicago.

FLOOR-GRINDING MACHINES.—The Campbell Machinery Company, Wollaston, Mass., is manufacturing a floor-grinding and polishing machine.

ELECTRIC WAX POT.—An electrically heated wax pot has been placed on the market by the Acme Electric Heating Company, Inc., 1217 Washington Street, Boston.

TURBO-GENERATOR SETS.—Bulletin No. 21 issued by the Wellman Turbine Company, Oshkosh, Wis., covers the "Wellman" turbo-generator units.

TURBO-BLOWER.—The Wellman Turbine Company, Oshkosh, Wis., is distributing bulletin No. 10, describing the "Wellman" undergrate turbo-blower.

PLURAL PLUGS.—The Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, is distributing a circular covering the use of six plural plugs.

HAND SHAPER.—The R. L. Carter Company, Syracuse, N. Y., has recently placed on the market a hand-type shaper for the woodworker, designed to use with a 1/9-hp. Westinghouse motor.

HIGH-TENSION SWITCHES.—The Pacific Electric Manufacturing Company, 827 Folsom Street, San Francisco, has issued three bulletins, Nos. 1,401, 1,500 and 1,600, covering its various types of high-tension switches.

GRAPHIC INSTRUMENTS. — "Some Things Being Done With Graphic Instruments" is the title of bulletin No. 223 issued by the Esterline-Angus Company, Indianapolis, Ind.

OUTDOOR EQUIPMENT.—Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, is distributing bulletin No. 202, describing the "S & C" high-voltage outdoor equipment.

BATTERY-CHARGING OUTFITS.—The Hobart Brothers Company, Troy, Ohio, is distributing leaflets covering the "HB" eight-hour constant-potential battery-charging outfit and the new "HB" 300-amp., 7½-15-volt outfit.

## New Incorporations

THE ATKINS LIGHT & POWER COMPANY, Marion, Va., has been incorporated with a capital stock of $10,000. The officers are: C. P. Shrock, president, and S. T. Crowe, secretary.

THE GLENVILLE (W. VA.) ELECTRIC COMPANY has been incorporated by C. W. Marsh, W. T. Smith, B. W. Craddock, Guy Stalnaker, J. Craddock and G. Smith, all of Glenville. The company is capitalized at $15,000 and proposes to supply electricity for lamps and motors in Glenville.

THE FARMINGTON RIVER HYDRO-ELECTRIC CORPORATION has filed articles of incorporation under the laws of the State of Delaware for the purpose of constructing two hydro-electric plants on the Farmington River. The officers are: L. B. Dow, New Boston, Conn., president; H. W. Ward, vice-president, and R. P. Ward, secretary and treasurer.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

CALAIS, ME. — The Hollingsworth & Whitney Company, 185 Devonshire Street, Boston plans to build a power plant in connection with its proposed local paper mill, to cost about $250,000.

PORTLAND, ME.—The Portland Terminal Company, a subsidiary of the Maine Central Railway Company, plans to build a power house in connection with its proposed car repair shops at South Portland, to cost about $1,500,000.

BOSTON, MASS.—Plans have been prepared by the Department of Public Works for a new fire-signal station to be erected on Boylston Street and also for changing the fire-alarm system throughout the city. The cost is estimated at about $500,000.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company is planning to install a new distributing and switching station on its Mill Street property.

WORCESTER, MASS.—The Worcester Electric Light Company plans to place about 3 miles of its overhead wires underground this season in various sections of the city, in accordance with its agreement with the city.

NEW BRITAIN, CONN.—The Farmington River Power Company will soon begin work on two new hydro-electric plants on the Farmington River, near New Boston, for the Farmington River Hydro-Electric Corporation, recently organized, to supply electricity in this section of the state. One development will include three dams, reservoirs and a 4,000-hp. plant to operate under a 300-ft. head, and the other a dam, pipe line and power station of 3,600 hp. operating under a 150-ft. head. The proposed plant will supply energy in New Hartford and vicinity. L. B. Dow, New Boston, is president.

SOUTH NORWALK, CONN.—Plans are being prepared by Westcott & Mapes, Inc., New Haven, architect and engineer, for an addition to the municipal lighting plant, to cost about $300,000.

## Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Corporation contemplates the erection of a high-tension transmission line from the Rotterdam distribution station to North Albany substation (18 miles), to cost $23,500 per mile.

MEDINA, N. Y.—The Western New York Utilities Company, Inc., expects to install a General Electric 3,200-kva., three-phase, 25-cycle, 115,000-volt vertical unit at its Waterport plant. G. W. Ide is manager.

NEW YORK, N. Y.—The United Electric Light & Power Company is taking bids for an addition to its Hell Gate electric plant.

ROCHESTER, N. Y.—Extensions and improvements are contemplated by the Rochester Gas & Electric Company during 1923, including a new substation and equipment in congested district, substation and equipment at western city line for industrial district, enlarging main steam station No. 3, and installing one 15,000-kw. turbine, new switchboard and other equipment, and extension to distribution and transmission systems. The cost is estimated at $3,060,477. Thomas H. Yawger is general superintendent.

ROME, N. Y.—Electric power equipment will be installed in the proposed addition to the plant of the Rome Brass & Copper Company, to cost about $175,000. A. F. Pashley, 431 South Dearborn Street, Chicago, is architect.

LAKEWOOD, N. J.—The Lakewood & Coast Electric Company contemplates extensions and improvements to its system.

ANNVILLE, PA.—The Annville & Palmyra Electric Light Company plans to rebuild all secondary lines in Palmyra. D. K. Bomberger is manager.

BETHLEHEM, PA. — Electric power equipment will be installed in the new five-story cold-storage, refrigerating and packing plant to be built by the Confederated Home Abattoirs Corporation, 314 American Casualty Building, for which bids will be received until May 15.

COLFAX, PA.—The Duquesne Light Company, Pittsburgh, is taking bids for the construction of an addition to its local generating plant, to cost about $500,000.

GIRARDVILLE, PA. — Extensions and improvements are contemplated by the Schuylkill Electric Company, including the construction of a 1,000-kw. substation (direct current) for railway service for the Schuylkill Railway Company, the installation of 120 series street lamps in West Mahoney Township and 25 series street lamps in Butler Township. Transmission voltage will be changed from 2,300 to 6,600 volts to Centralia and Lost Creek. Two outdoor substations, one of 400 kva. and the other 300 kva., will be erected. Emery Stern is electrical engineer.

HARRISBURG, PA.—The Harrisburg Light & Power Company plans extensions and improvements to its system to cost $700,000.

MIDDLETOWN, PA.—Officials of the Metropolitan-Edison Company, Reading, have organized the Metropolitan Power Company to construct and operate the steam-driven electric plant to be built on the Susquehanna River here. The first unit will have a capacity of 30,000 kw. and will cost about $1,000,000. The cost of the entire project is estimated at $3,000,000.

PHILADELPHIA, PA.—A power house will be erected at the plant of the Modern Laundry Company, Forty-first and Filbert Streets. William Lowenthal, 1208 Chestnut Street, is architect.

PHILADELPHIA, PA.—Bids will be received by the Department of Public Works, City Hall, until April 25, for electrical equipment for the Northeast Sewerage Treatment Works.

PHILADELPHIA, PA.—Electric power equipment will be installed in the proposed plant to be erected at Water and Bainbridge Streets by the American Bag & Paper Company, Second and Vine Streets, to cost about $550,000.

READING, PA.—Plans are under way for the installation of electric pumping ma-

chinery in connection with a proposed filter plant at the municipal waterworks.

SPARTANSBURG, PA.—The Spartansburg Oil & Gas Company, plans to build a substation at its proposed local oil refinery, to cost about $130,000.

SPRINGDALE, PA. — Electric power equipment will be installed in the proposed addition to the plant of the Heidenkamp Plate Glass Corporation, to cost about $500,000.

BALTIMORE, MD.—The Standard Sanitary Manufacturing Company, Bessemer Building, Pittsburgh, Pa., will build a power house in connection with its proposed plant, on Fifth Avenue, to cost $2,000,000.

BECKLEY, W. VA.—The Beckley Electric Light & Power Company contemplates the installation of an ornamental lighting system in the business district (about sixty lamps), erecting a new office building on Heber Street and purchasing a new compressor for the water plant. Charles C. Farmer is secretary.

MARTINSBURG, W. VA.—The United Steel & Car Company, recently organized, will build a power house at its proposed local plant, to cost about $1,000,000. F. Vernon Aler represents the company.

SUMMERSVILLE, W. VA.—W. H. Campbell & Son, owners of the local electric plant, contemplate the construction of a new electric plant. As yet details have not been decided upon.

FRANKLIN, VA.—A 13,000-volt transmission line is now being erected from the municipal electric plant to the town of Boykins, a distance of 21 miles. J. B. Lynch is superintendent of distribution.

NEWPORT, VA.—The Chesapeake & Ohio Railroad Company contemplates building a power plant in connection with its proposed locomotive and car repair shops, to cost $750,000. C. W. Johns, Richmond, is chief engineer.

YORKTOWN, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon take bids for the installation of equipment at the local power plant (Specification 4,826).

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until April 23, for 150 switch assemblies and 150 switch panel assemblies (Circular 23-138).

## North Central States

ALMA, MICH.—An additional 100-hp. or 150-hp. oil-engine-driven unit may be purchased for the municipal electric light plant. E. E. McKee is city clerk.

GRAND RAPIDS, MICH. — The Père Marquette Railroad Company plans to build a power plant at its Wyoming shops, to cost about $500,000.

KALAMAZOO, MICH. — Electric power equipment will be installed in the proposed addition to be erected by the Kalamazoo Paper Box Company, to cost about $200,000. Billingham & Cobb, Press Building, are architects.

LEXINGTON, MICH.—Plans are under consideration to connect the municipal system with the lines of the Great Lakes Power Company, Sault Ste. Marie, Ontario, Canada. W. Hatton is manager.

ZILWAUKEE, MICH.—The Consumers' Power Company, Jackson, has surveys in progress for its proposed 100,000-hp. steam-driven electric plant. The cost is estimated at $500,000.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until April 27 for distributing transformers for the division of light and power.

TORONTO, OHIO.—The Ohio & Pennsylvania Power Company contemplates building a power plant here to cost about $1,000,000. A transmission line will be erected.

LOUISVILLE, KY.—The Louisville Gas & Electric Company contemplates erecting a substation at Thirteenth and Magazine Streets, to cost about $150,000.

EVANSVILLE, IND.—Plans for the proposed local car and locomotive shops of the Chicago & Eastern Illinois Railroad Company include a power house. The cost is estimated at $1,000,000.

INDIANAPOLIS, IND. — Bids will be received by the Board of Sanitary Commissioners, Sanitary District of Indianapolis, City Hall, until April 24 for construction of dehydration building and furnishing equipment of section 5, division III, for the sewage-disposal plant, including electric wiring, stokers, coal storage and handling equipment, conveyors, fans and motors, traveling cranes, etc. Charles H. Hurd, Merchants' Bank Building, is consulting engineer.

VINCENNES, IND.—The Blackford Window Glass Company plans to build a power house at its new local plant, to cost about $1,000,000.

DURAND, WIS. — The Durand Light & Power Company is planning to raise its power dam at Eau Galle.

GALESVILLE, WIS.—The Davis Mill & Electric Company contemplates erecting some farmer lines this year. B. W. Davis is manager.

GREEN BAY, WIS. — The Wisconsin Public Service Corporation plans to start work on another large hydroelectric development at Caldron Falls on the Peshtigo River, to cost about $750,000.

IRON RIVER, WIS. — The Iron River Light & Power Company contemplates building a new hydro-electric plant this year, to cost about $400,000.

MENASHA, WIS.—The Municipal Electric and Water Department contemplates the purchase of equipment for changing the distribution lines from 2,300, delta, three-phase, to 2,300/4,000 star, three-phase, fireproofing plant building and installing additional water-pumping machinery. J. H. Kuester is superintendent of distribution.

LITTLE FALLS, MINN. — Plans have been prepared by the Little Falls Power Company for a hydro-electric development in the Mississippi River, to cost about $100,000. The project will include two dams and power house.

CEDAR ROCK, IOWA.—The Iowa Electric Company has been granted a franchise to erect a hydro-electric plant on the Wapsipinicon River, near Big Rock, this summer.

FORT DODGE, IOWA.—The Fort Dodge Gas & Electric Company contemplates replacing all gas lamps with electric lamps during the year. M. Anderson is manager.

MUSCATINE, IOWA. — The date for receiving bids for the construction of the municipal electric plant and distribution system has been extended from April 18 to April 25 by the board of electric light trustees. A. I. Mullergren, Gates Building, Kansas City, Mo., is consulting engineer.

NEOLA, IOWA.—The installation of an additional generating unit in the municipal electric light plant and establishing a twenty-four hour service is under consideration. E. L. Stinn is superintendent.

HOUSTON, MO.—The Houston Electric Light & Power Company expects to build a new dam and will probably install a new waterwheel and repair transmission lines. J. A. Johnston is president.

JASPER, MO.—Bonds to the amount of $40,000 have been voted for the installation of a municipal electric plant and waterworks.

LANAGAN, MO. — The Indian River Power Company will erect a transmission line to furnish electricity to the Elk Springs, Ginger Blue Lodge and Kansas City (Kan.) Boy Scouts' Camp. William Christensen is superintendent.

GRAND FORKS, N. D.—The Red River Power Company contemplates the erection of about 28 miles of transmission lines, to cost about $30,000.

STARKWEATHER, N. D.—The Northern Utilities Corporation contemplates the installation of a large fuel-oil storage tank. F. R. Irons is manager.

VALENTINE, NEB.—The Cornell Hydro Electric Company is considering the installation of an oil engine (stand-by) unit. P. S. Hyatt is manager.

EUREKA, KAN.—Bids will be received by the city clerk until April 24, for the installation of an ornamental lighting system.

KANSAS CITY, KAN. — The Atchison, Topeka & Santa Fe Railway Company, Chicago, plans to build a power house in connection with its proposed local locomotive and car shops, to cost about $300,000.

KANSAS CITY, KAN.—Electric power equipment will be installed in the oil-refining plant to be erected by the Sinclair Refining Company, 111 West Washington Street, Chicago, to cost about $500,000.

WICHITA, KAN. — The Roxana (Ill.) Petroleum Company, will build a power house in connection with its proposed local refining plant, to cost about $3,500,000.

## Southern States

BOONE, N. C. — An electric generator, switchboard and other equipment will be installed at the power house at the Appalachian Training School.

CARTHAGE, N. C.—Surveys are being made by the Smitherton Power Company, Troy, for proposed power development and dams on Drowning Creek, Moore County. The company will ultimately build a cotton mill on the creek.

DANBURY, N. C.—Pepper Brothers contemplate building a hydro-electric plant in connection with a new grain mill, to cost about $90,000.

MOORESVILLE, N. C.—Bids will be received by the Mayor and Board of Town Commissioners until May 7 for improvements to waterworks, including pumping station, auxiliary station, 5 miles of 2,200-volt transmission line, motor-driven centrifugal pumps and accessories, filter-plant equipment, etc. The Gilbert C. White Company, Durham, is engineer.

RED SPRINGS, N. C. — Bonds to the amount of $56,000 have been sold, the proceeds to be used for the installation of a lighting system and other municipal improvements.

KINGSTREE, S. C.—The Kingstree Electric Light & Ice Company will make extensions to its transmission lines and install a new oil engine this summer. F. B. Adams is manager.

EATONTON, GA.—The Putman Mills & Power Company contemplates the construction of a new power plant, to cost $70,000.

CRESCENT CITY, FLA.—Bids will be received by the Board of Bond Trustees until May 14 for the installation of a 100-hp. Diesel or semi-Diesel engine and an alternating-current generator for direct connection to engine, together with exciter and switchboards. C. H. Preston is chairman.

CLARKSVILLE, TENN.—The Kentucky Public Service Company contemplates installing equipment for emergency service. Energy to operate the local service is supplied from the Hopkinsville plant. E. H. Allen is local superintendent.

MEMPHIS, TENN.—The installation of an ornamental lighting system on Union Avenue is under consideration.

MEMPHIS, TENN.—The Memphis Power & Light Company has arranged a fund of $3,400,000 for extensions in plants and transmission system during the present year.

TREZEVANT, TENN.—The installation of an electric lighting system and waterworks, to cost about $35,000, is under consideration.

VICKSBURG, MISS. — The Arkansas Light & Power Company, Pine Bluff, Ark., has acquired the property of the Vicksburg (Miss.) Light & Traction Company. Extensions will be made to the system.

NEW ORLEANS, LA.—The Amalgamated Seaport Petroleum Company, recently formed, will build a power house at its proposed oil refinery, to cost about $1,500,000.

COMANCHE, OKLA.—Plans are under consideration for extending the high-tension transmission line of the municipal electric plant to three small refineries in the near future. E. A. Wine is superintendent.

FAIRFAX, OKLA.—C. I. Huffaker, owner of the local electric plant, expects to install a 300-hp. Fairbanks-Morse & Company engine and generator within the next four months.

PONCA CITY, OKLA. — Bonds to the amount of $140,000 have been voted for extensions to the municipal electric light plant.

SAND SPRINGS, OKLA.—A power plant will be built by the Consumers' Ice Company in connection with a new ice-manufacturing plant, to cost about $75,000.

BRONTE, TEX.—The City Council has granted C. Holder and F. E. Brown a franchise to construct and operate an electric lighting system here.

BURKBURNETT, TEX.—The Burkburnett Electric Company, recently acquired by new interests, contemplates extensions to its system.

COOPER, TEX. — The Cooper Power, Light & Ice Company contemplates rebuilding its distribution lines. E. D. Brodhead is president and manager.

HEMPSTEAD, TEX.—The Western Public Service Company, Colorado Springs, Col., has acquired the property of the Hempstead Light & Power Company and will make extensions and improvements.

FORT WORTH, TEX.—A power plant will be built by the Southwestern Portland Cement Company, El Paso, at its proposed local mill, to cost about $450,000.

JASPER, TEX. — The Jasper Electric Company is planning to install an additional generating unit. Wesley L. Neal is manager.

KERRVILLE, TEX.—The Kerrville Light, Heat & Power Company contemplates installing an oil or Diesel engine-driven unit of about 250 hp., complete with generator and switchboard. S. Eastland is president of the company.

LOCKHART, TEX.—The Citizens' Light & Water Company is considering the construction of an ice plant.

## Pacific and Mountain States

MILLWOOD, WASH.—The Inland Empire Paper Company contemplates extensions to its plant, including the construction of a dam on the Spokane River, to develop power to operate its works.

STAYTON, ORE.—A. D. Gardner has applied for permission to construct a hydro-electric power plant to furnish electricity to a number of local industries.

LONG BEACH, CAL.—Steps have been taken for the installation of an ornamental lighting system on Belmont Avenue.

LOS ANGELES, CAL.—The construction of an automatic power station, 45 ft. x 40 ft., is under consideration by the Los Angeles Railway Corporation.

MODESTO, CAL.—Bids will be received at the office of the Modesto Irrigation District, Modesto, until May 2, for material required in building an electric distribution system within the district. The apparatus to be purchased will include 900 butt-treated poles, hardware for approximately 40 miles of line, 139,500 lb. of copper wire, nine three-pole, 11-kv. switches, four 1,000-kva. and six 160-kva. transformers.

RIVERSIDE, CAL.—The Snowolene Refining Company, Pacific Mutual Building, Los Angeles, plans to build a power house in connection with its proposed oil-refining plant, to cost about $350,000.

SAN FRANCISCO, CAL.—The Electric Metals Company, care of Sanderson & Porter, Nevada Bank Building, consulting engineers, is preparing plants for a 100,000-hp. hydro-electric generating plant on the Klamath River, Siskiyou County, in connection with a metallurgical plant, to cost about $800,000.

SANTA BARBARA, CAL.—Plans are being prepared by Soule, Murphy & Hastings, 1206 State Street, for an orphanage, power house and laundry, to cost about $250,000, for the St. Vincent's Orphanage.

TURLOCK, CAL.—Steps are being taken for the installation of an ornamental street-lighting system. Horace Hall is city engineer.

VENTURA, CAL.—The Seaside Refinery Company will build a substation in connection with a new oil refinery, to cost about $100,000.

ISMAY, MONT.—The Ismay Light & Telephone Company contemplates increasing the output of its plant. Clifford Sweet is manager.

## Canada

BOTHWELL, ONT.—The Lighting Commissioners contemplate a general overhauling of the municipal electric system and installation of new transformers and erecting new wire. E. H. Crompton is secretary.

ORILLA, ONT.—The Water, Light and Power Commission contemplates installing approximately 300 additional street lamps in the town and suburbs and erecting a substation at Atherly. A 2,200-volt line is being erected to Victoria Point. R. H. Starr is chief engineer.

PETERBOROUGH, ONT.—The Peterborough Utilities Commission expects to erect a new main substation this year, to cost about $150,000. W. G. Henderson is secretary.

PORT STANLEY, ONT.—The construction of a steam-power plant at Port Stanley, to cost about $1,000,000 is under consideration by the Hydro-Electric Commission of Ontario.

STURGEON FALLS, ONT.—The Municipal Electric Light Department contemplates changing the street-lighting system from 4.4 amp. series lamps to 6.6-amp. series lamps with constant-load transformers, and also erecting a three-phase circuit throughout the town for power service. L. E. Carter is town engineer.

COATICOOK, QUE.—The Town Council contemplates a 1,200-hp. development under a 90-ft. head this summer. The project will include the construction of a power house and the purchase of electric generating equipment and waterwheel. E. E. Akhurst is superintendent.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued March 20, 1923)

1,449,784. INDUCTION-MOTOR SPEED REGULATION; W. Seiz, Baden, Switzerland. App. filed March 3, 1921. Commutator machine in concatenation with induction-motor secondary.

1,449,800. ELECTRICAL APPARATUS FOR MOTOR VEHICLES; L. M. Woolson, Dayton, Ohio. App. filed July 10, 1918. Mounting of motor on automobile-engine fly-wheel.

1,449,815. MEANS FOR CONTROLLING ELECTRIC SWITCHES; E. C. Gooch, Estes Park, Col. App. filed July 3, 1920. To prevent welding together of automatic closing devices.

1,449,825. STORAGE-BATTERY CONSTRUCTION; W. P. Loudon, Niagara Falls, N. Y. App. filed April 18, 1918. Improved venting plug.

1,449,830. CIRCUIT-CONTROLLING TELEPHONE-RECEIVER SUPPORT; D. M. Miller, Brooklyn, N. Y. App. filed March 18, 1921. Pivoted arm-holding receiver controls circuit.

1,449,833. PROCESS OF REGENERATING LEAD-STORAGE BATTERIES; H. O. Parker, Midland, Pa. App. filed Aug. 13, 1920. Battery filled with a hydroxide and then charged until solution becomes acid.

1,449,834. ROTATING OR OSCILLATING ELECTRIC FURNACE PLANT; A. H. Pehrson, Stockholm, Sweden. App. filed April 11, 1922.

1,449,852. ELECTROMAGNETIC APPARATUS; C. A. Cadwell, Cleveland, Ohio. App. filed Nov. 25, 1916. Device to regulate and control electrodes of welding apparatus.

1,449,861. FURNACE REGULATOR SYSTEM; H. King, Wilkinsburg, Pa. App. filed Dec. 13, 1919. Automatic regulation of electrodes.

1,449,863. TWO-PHASE HIGH-FREQUENCY ELECTRIC ALTERNATING-CURRENT GENERATOR; M. C. A. Latour, London, England. App. filed June 23, 1920. Homopolar alternator for wireless telephony and telegraphy.

(Issued March 27, 1923)

1,449,871. MODULATOR; J. B. Pratt, Schenectady, N. Y. App. filed Jan. 12, 1922. High frequency current magnetic amplifier.

1,449,878. MODULATOR; E. Austin, Schenectady, N. Y. App. filed Jan. 12, 1922. Magnetic modulator to control amplitude of antenna current.

1,449,879. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed April 4, 1919. Main control electromagnet operated by current flowing through furnace.

1,449,880. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed June 25, 1919. Regulator for operating electrode motor in accordance with voltage and current conditions of supply circuit.

1,449,881. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed June 25, 1919. Regulator governs operation of movable electrodes to maintain equal heating effects.

1,449,882. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed June 25, 1919. Automatic regulator prevents hunting section of electrodes.

1,449,883. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 26, 1919. Automatic regulation of movable electrodes.

1,449,884. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 26, 1919. Electrode movement controlled by current passing through it.

1,449,885. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 26, 1919. Two electrically operated switches control electrodes.

1,449,886. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Oct. 2, 1919. Electrode regulator controlled by amount of currents passing through electrode.

1,449,887. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Nov. 13, 1919. Governs operation of movable electrodes.

1,449,888. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Dec. 3, 1919. Two differential windings selectively energized to change setting of main magnet of electrode regulator.

1,449,889. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Dec. 3, 1919. Electrode regulator comprises a main control having a main and an auxiliary electromagnet and two switches.

1,449,890. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed April 14, 1920. Current electrode controlled in accordance with potential across supply circuit.

1,449,896. FURNACE REGULATOR SYSTEM; R. D. Evans, Wilkinsburg, Pa. App. filed Oct. 16, 1918. Separate motor for raising and lowering each movable electrode.

1,449,897. ELECTRIC FURNACE REGULATOR SYSTEM; R. D. Evans, Wilkinsburg, Pa. App. filed April 9, 1919. Automatic control of electrodes.

1,449,898. COIL-WINDING MACHINE; C. Fayer, New York, N. Y. App. filed Jan. 4, 1921. For winding coils used for producing high-tension currents, impulses and discharges such as X-ray machines.

1,449,904. TELEPHONE TRANSPORTATION SWITCHING BOX; E. Love, Prince Rupert, B. C., Canada. App. filed Aug. 22, 1921. For transposing long-distance telephone lines.

1,449,908. ELECTRIC VALVE GRINDER; J. J. McGuckin and John Peyer, Brooklyn, N. Y. App. filed April 2, 1921. For internal-combustion engines.

1,449,911. METHOD AND MEANS OF RECEIVING SIGNALS; R. H. Ranger, Brooklyn, N. Y. App. filed Nov. 12, 1921. Signal recorded by several stations and wave form compared to secure original signal sent out.

1,449,919. NON-INDUCTIVE INTERFERENCE SYSTEM; J. Slepian, Wilkinsburg, Pa. App. filed March 8, 1919. Counteracting any induced voltage by impressing equal and opposite voltage on line.

1,449,970. PLATE HOLDER FOR TAKING RÖNTGEN PHOTOGRAPHS; G. Bucky, Berlin, Germany. App. filed Jan. 20, 1921.

1,449,982. SELF-WINDING CLOCK; J. T. A. Gaucher (deceased), late of Montreal, Que., Canada. App. filed June 26, 1920. Electrically wound.

1,449,984. ALTERNATING CURRENT LOCAL CIRCUITS FOR CODE SIGNALING TELEGRAPHS; J. J. Ghegan, East Orange, N. J. App. filed April 8, 1919.

1,449,985. AUXILIARY DEVICE FOR TELEGRAPH KEYS; J. J. Ghegan, East Orange, N. J. App. filed July 10, 1919. Increased speed in transmitting possible.

1,449,987. STATIC POTENTIAL-CONTROLLING APPARATUS; R. M. Gilson, Pittsburgh, Pa. App. filed June 4, 1919. Series-circuit lamp contact.

1,449,991. METHOD OF AND MEANS FOR COUNTERACTING DESTRUCTIVE ELECTROLYSIS; L. O. Gunderson, Decatur, Ill. App. filed Nov. 4, 1921. Electrolysis in steam boiler neutralized by a secondary cathode.

1,450,002. ELECTRIC CONNECTOR; J. Lofgren and A. R. Ayers, Chicago, Ill. App. filed June 28, 1919. Especially adaptable for use on locomotives.

1,450,004. ELECTRODE ELEMENT FOR GALVANIC BATTERIES AND METHOD OF PRODUCING SAME; M. L. Martus, Woodbury, Conn. App. filed Feb. 8, 1922.

1,450,022. REFLECTING HEAT APPLIANCE; J. E. Doyle, Cleveland, Ohio. App. filed Oct. 15, 1921. Drying printed paper as it passes through press.

1,450,025. SAFETY X-RAY APPARATUS; E. L. Edwards and F. A. Farwell, Indianapolis, Ind. App. filed Nov. 6, 1920. Inclosure for high-tension transformer.

1,450,038. COMBINED WAVE CHANGER AND WAVE METER; G. Hill, Washington D. C. App. filed April 28, 1920. For determining wave length of wireless receiving set at all times.

1,450,043. PRIMARY BATTERY; M. L. Martus, Woodbury, and J. G. Ross and E. H. Becker, Waterbury, Conn. App. filed Oct. 24, 1921. Zinc electrode with annual rib on its outer surface.

1,450,046. SWITCH COVER AND SUPPORT; W. J. Newton, Bridgeport, Conn. App. filed Jan. 13, 1920. For automobile lighting and ignition systems.

1,450,057. TROLLEY SWITCH; A. Zimmerman, Ansted, W. Va. App. filed Jan. 12, 1922. Section insulator.

1,450,059. PRIMARY BATTERY; E. H. Becker, Waterbury, Conn. App. filed Nov. 18, 1921. Indicating apparatus attached to battery shows state of exhaustion.

1,450,061. OPTICAL METHOD FOR PRODUCING PULSATING ELECTRIC CURRENT; W. W. Coblentz, Washington, D. C. App. filed Aug. 6, 1920.

1,450,080. METHOD AND ELECTRIC CIRCUIT ARRANGEMENT FOR NEUTRALIZING CAPACITY COUPLING; L. A. Hazeltine, Hoboken, N. J. App. filed Aug. 7, 1919. Prevents the transmitting of undesirable disturbances from one circuit to another.

1,450,141. SUPPORT FOR ELECTRIC CURRENT COLLECTOR SHOES; E. A. Davis, Harvey, Ill. App. filed April 30, 1921. For traveling cranes.

Electrical World

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# The Essence of Public Relations

HERE is a healthful message for all utility executives. It comes from the heart of an American citizen — a householder, a consumer, a customer, one of those buyers of service and securities who regulate and in the last analysis own all public utilities. It is for this man and others like him that public service corporations are operated. He writes:

What better advertising matter could the Chamber of Commerce of Syracuse have than a reprint of the article in the April 14 issue of the *Electrical World* describing the wonderful service rendered by the Syracuse Lighting Company? If any other large lighting companies in this country are giving service that in any way approaches that of the Syracuse company, please print a few more stories about them. Give them your front-page editorial space. They have earned it. Perhaps if a few of these stories appeared some of the other central stations in the country would wake up enough to be ashamed of their methods and would reform.

I was once with one of the largest managing organizations of this country. I know the problem from the inside. And let me say right here that I do not believe that the problem is one bit harder than the sales problems of large non-public utility organizations. My sympathy has always been for the utility, but I confess that it is waning for one utility whose annual output ranks high in your recent list. Here is the way that utility does it:

On rather short notice I found it necessary to change my apartment. I went to the main office of the lighting company to request the change. Before me was a sign telling all comers that the business of the company is service. I waited twenty-five minutes in front of my sign-greeting. This time was not all wasted because I was entertained by the troubles of others. I could hear only the eight directly in front of me. Three of these eight came about new problems. Five had complaints.

When my turn came I was instructed where to sign and told that accedance to my desire to have the service changed in one week was rather doubtful as the company required a ten-day notice and in addition this was its busy season. I was assured, however, that the matter would have the company's best attention. While I waited the locations were looked up, verified, and, as if to cheer me up, I was told that my move was to a new apartment and that a permit for connection had been issued to cover the entire building. My impatience at waiting had subsided, and I went away feeling that the company had a large problem on its hands and that I really might have service in a week instead of ten days.

Moving day arrived. No electric service. A telephone call gave me the information that no permit had been issued. No arguing on my part about the casual remark made at the main office on this subject when I applied for the change was of avail. What was I to do? Oh, I could call the main office and tell them they were all wrong on the permit stuff, or I could get the owner of the apartment to get after the town wire inspector.

I called the town wire inspector myself, and he told me that he would issue a permit any time the lighting company requested it. He had inspected the building but only issued service connection permits when the lighting company requested them for each apartment.

Another call to the lighting company. They agree to connect. When? Tomorrow, perhaps; no connections were made in that town on Tuesdays. Result, I go to the corner store and buy my candles, and forever and a day—try as I will to forget this petty incident—I will just naturally feel that the company cares not for its customers and that I must do my part as a loyal citizen to oppose any rate increases.

Perhaps I had better take an active part in the local movement to require the lighting company to place all of its wires on the main streets underground. No, I am not a grouch by nature, so I am going up to the gas office to smoke a cigar with the manager. He changed my service on the day I wanted it changed and did it all by telephone request. But, then, the gas company only serves a territory of thirty thousand people and the lighting company serves one of over a million. Perhaps that is why the gas company is still a he while the lighting company is they.

PICTURED in this letter we have the very essence of public relations—that thing in which the industry is so absorbed today. It seems a small matter from within — the coming of a stranger to the application window. But these are the contacts of which good will is builded, the elements in service which make the central station and its manager well and favorably known — or not.

# James Berry Foote

*A pioneer in the development of hydro-electric power and transmission and a constructive influence in interurban railway practice.*

THE economical utilization of hydro-electric power has been made possible by high-voltage transmission, and in the development of engineering equipment and methods some remarkable contributions have been made by central-station engineers.

James Berry Foote, pioneer in the development of hydro-electric power and transmission at high voltage in southern Michigan and chief engineer of the Consumers' Power Company, was born at Adrian, Mich., in 1867. His early electrical experiments were made in Adrian, and he started the plant that furnished the first electric light in that community. He went to Jackson in 1886, where in company with his elder brother, W. A. Foote, he initiated the first comprehensive street-lighting system, one which later developed into the present system of the Consumera' Power Company.

It is in the development of high-potential transmission lines and equipment that Mr. Foote's most important engineering work has been carried out. In 1898 he designed and built the transmission line, 25 miles in length and operated at 25,000 volts, from the Trowbridge, Otsego and Plainwell plants on the Kalamazoo River to Kalamazoo. Between 1900 and 1902 he raised the voltage of this line to 40,000 and extended it to Jackson, a total distance of 93 miles. In 1905 the transmission line from Rogers Dam, on the Muskegon River, to Grand Rapids, 55 miles long, was built and placed in service at 72,000 volts. So far as is known this was the highest transmission voltage in use in the world at that time.

In 1906 the Croton-Grand Rapids line was built and placed in service and operated at 110,000 volts. This line, 43 miles in length, was one of the earliest to use the steel tower and suspension-type insulator. The 140,000-volt transmission line from the Au Sable River generating plants to Saginaw, Flint and Owosso was designed by Mr. Foote and placed in service without revision in 1911. This line was originally 151 miles long, on steel towers, with suspension insulators, and was the highest-voltage transmission line in the world for several years.

The 140,000-volt line now extends from Mio, on the Au Sable River, to Battle Creek and Jackson, a total distance of 343 miles. With the 175-mile line from the Manistee River to Kalamazoo and Battle Creek, the Consumers' Power Company now has a total of 517 miles of 140,000-volt lines in operation. By Mr. Foote's constructive leadership in transmission-line design the distance of economical transmission of power has been increased to over 300 miles.

# Editorial Comment

Electrical World, April 28, 1923

Volume 81 Number 17


### Relative Effectiveness of Direct and Indirect Illumination

NO SUBJECT connected with illumination has been the cause of more controversy than the relative merits of direct and indirect lighting. The quarrel has not been merely a commercial one such as might be reasonably expected, but a technical one also, and in that aspect there is less reason for variations of opinion. A number of so-called practical studies have been made dealing with the properties of light falling directly on the page and falling upon it after reflection from the walls and ceiling, and utterly diverse data have been obtained. The probable cause of these striking discrepancies is the fact that any investigation of this sort tends to emphasize psychological rather than physical values, values therefore determinable only in vague impressions of comfort and discomfort, of ease and difficulty, of fatigue and facility.

In any tests made upon the eye other factors than the ordinary ones of shade perception and acuity of necessity enter. The particular kind of work attempted, the extent to which the several illuminations are pushed above the limit for moderate acuity, the contrast of the things observed and the length of time for which the observations may be continued, all are things which enter the final judgment as to the sufficiency of the illumination received. There is added to these causes of uncertainty a still greater one in the element of unconscious suggestion in the manner of the test or the instructions given for carrying it out. It would not be difficult to make a given group dissatisfied with almost any system of illuminaion without an expressed word of disapprobation. As a matter of fact there can be no sweeping decision between direct and indirect lighting. Some of the worst and some of the best examples of illumination alike belong to each.

### Rivalry Between Electrical Men's Own Home Equipment Good for Us All

IT IS generally agreed that the electrical man himself has been about the hardest "prospect" to interest in the use of electrical appliances in his own home. Theoretically he has believed in them from the beginning, but he has thought about them and supported them mainly during business hours. He has not tried very hard to "sell" his wife on the daily use of electricity for saving labor, and the electrical equipment of the electrical man's home has never been a beacon to the community. The action of the New York Electrical League in holding a contest among its members to determine whose house is the most completely electrified is, therefore, worthy of attention. It offers a basis for developing interest and rivalry between the men and women of any electrical group or within any electrical organization that is bound to stimulate acceptance of the responsibility which all electrical people should feel to set an example to the public in the enjoyment of and dependence upon the good things which electric service offers in the home today.

The idea was born on the special car that carried the delegates west to the N. E. L. A. Commercial Section meetings in Denver some months ago, and the "Electrify Club" was formed as an informal organization to promote contests among electrical men and bring publicity to those whose homes are well equipped. Prizes are awarded by rating houses on a point system, crediting each type of outlet and appliance, and the plan offers a spectacular demonstration of the degree to which comfort and convenience can be introduced into the modern home—electrically. Here is an idea that can profitably be furthered by the central-station company in every community.

### Noted Electrical Engineer and Motor Manufacturer Passes Away

SCHUYLER S. WHEELER, who died last week, was one of the pioneer electrical engineers of the country and throughout his entire professional life lent distinction and adornment to the profession. All that he undertook was performed with precision and thoroughness, and once convinced of the accuracy and justice of an opinion he clung to it tenaciously and fought for it with determination. Dr. Wheeler was one of those rare men who combine the knowledge and thoroughness of the engineer with the skill and executive ability of a captain of industry. Moreover, he always commanded the highest admiration because of the ethical standards on which his entire career was built.

Starting originally in the electric light and power field he engaged soon afterward in the field of electrical manufacture and was among the first in the country to recognize the necessity of a standard line of high-grade small electric motors. Owing to his accurate mechanical perceptions and creative ability, the products of his company received from the outset widespread recognition for superiority of design and efficiency. Among the outstanding electrical contributions of Dr. Wheeler to our modern civilization was the electric fan.

Professionally Dr. Wheeler always stood high. He served a term as president of the American Institute of Electrical Engineers and was the author of an engineering code of ethics which commended itself to professional men throughout the world. His keen interest in the electrical engineering profession and its traditions is evidenced by his presentation of the most complete and rare collection of electrical books in the world, the Latimer Clark library, to the American Institute of Electrical Engineers, and also by his choice of the name Ampere for the delightful industrial and residential community surrounding the works of the Crocker-Wheeler Company in New Jersey. To house the Latimer Clark libary was one of the objects which moved Andrew Carnegie to provide the funds for the Engineering Society Building in New York City.

In his dealings with men and corporations Dr. Wheeler

was absolutely fearless. He rid New York City of the labyrinth of overhead wires in the late eighties when he was expert of the Board of Electrical Control, and the utilities which then fought him have since come to honor and respect him for his fairness and the real protection which arose from his action at that time and have since surrounded the telegraph, telephone, electric and railway services of the city.

Although outwardly somewhat brusque and austere, inwardly Dr. Wheeler was a man of warm human sympathies and affections, as shown in the way he helped the maimed and blind to maintain their self-respect and to be self-supporting. His death robs the profession of one of its most verile and picturesque characters.

### Return to Private Ownership in Europe

CLOSE observation of conditions in Europe revealed hopeful signs to members of the United States Chamber of Commerce who recently went over there for that purpose. The information and the opinions presented by their spokesman, Julius H. Barnes, ought to be valuable to American business men in that they stimulate optimism and indicate that a normal Europe is within the range of vision. If ever we are to get a proper perspective of Old War conditions, it must be through American eyes. Italy Mr. Barnes considers to be "the most promising country of those in the war." Since the communistic control of industry has been destroyed by the popular Mussolini, manufacture has greatly increased. Poor Austria, the Chamber of Commerce observers find, is traveling an apparently safe road to early rehabilitation. British trade is expanding, and even in Russia commercial conditions are growing better.

Mr. Barnes recognizes as "the outstanding fact" in European conditions the tendency to get away from state ownership and operation of what he calls public facilities. "Not only," he says, "is this shown in Italy's effort to get all its public state-owned facilities in private hands, but it is shown in Austria, where there is a recasting of the government railroad service and a discharge of a hundred thousand superfluous employees. It is shown in Great Britain, where the railroads under their return to private operation have greatly quickened the business and economic life of that island and greatly improved the service and at the same time reduced the rates. It shows there is a general appreciation throughout all of Europe that these facilities must not only be in private hands, but they must be regulated so wisely that they will present a field of attraction for the superior grade of private ability to enlist itself in their administration, and that it is true that where this has been tried, as in Great Britain, they are meeting with satisfactory results."

These unofficial American observers see in all this a strong and compelling argument for the further development of public facilities in this country under private ownership but with an intelligent measure of government supervision. Facts like these ought to be brought home to every citizen at this time, when private ownership is being attacked and commission regulation scoffed at. Adversity and distress have revealed to Europe the shortcomings and fallacies of government ownership and the necessity of the stimulating and driving force inherent in private ownership. Like us, Europeans recognize that public service monopolies require regulation—a little more constructive perhaps than that experienced by the railroads—and they are preparing to follow in our footsteps, which may be regarded as a wonderful indorsement.

### A Family Triangle

OPERATING companies need trained men for subordinate positions, and also better educated professional men for positions of administrative responsibility and for those requiring advanced technical skill. It is the purpose of the trade schools to furnish training of the first kind, and it is one of the functions of high-grade universities and technical institutes of similar rank to provide men who can advance to higher positions. In this respect the two kinds of schools and the operating companies form a harmonious three-cornered family. This relationship is clearly and convincingly expounded in M. S. Sloan's article, published elsewhere in this issue, and every statement in it should be read with interest both by operating men and by teachers.

It seems much easier to establish a close relationship between the operating companies and the trade schools than between the operating companies and universities. In other words, in the family triangle the vertex which represents the institutions of higher learning seems to be quite remote from the other two vertices. Mr. Sloan desires to make the triangle more nearly equilateral through the activities of the N. E. L. A. committee on co-operation with educational institutions. This work properly conducted should prove of great benefit to all concerned.

It is refreshing to read Mr. Sloan's plea for less quantity and more quality in university training—for a training in reasoning, in observation, in service and in life problems, rather than in specific details of the electric light and power industry. This should be encouraging to faculty committees on courses, which oftentimes spend weary hours arguing how to put five gallons of information into four-gallon heads.

### The Radio Telephone in Transmission-Line Service

IN THE very interesting experiments on communication over transmission systems with the so-called "wired wireless" as a substitute for ordinary telephony, commented on recently in the ELECTRICAL WORLD, some of the weak as well as the strong points of the system have been brought to the front, the chief difficulty being that inasmuch as radio in this sense is dependent on the transmission lines and these are the usual seat of serious trouble, the power service is in an emergency very likely to take the radio service out of duty with it. Ordinarily radio transmission is at least free from entangling complications due to the power wires, but, as thousands of readers well know, it is now and then afflicted with troubles of its own. The broad question regarding the usefulness of radio on the transmission system simply resolves itself into this: Can radio distribution with a moderate amount of energy and conveniently practicable apparatus be relied upon to transmit intelligence over a radius of a hundred or two hundred miles under substantially all conditions?

It is a gratification to put on record the experience of the San Joaquin Light & Power Corporation in patiently thrashing out a solution. The full description of the sending set will well repay careful reading as it

represents the result of a great deal of experience. The main thing is that the whole set was built up of standard parts and at a total cost of only about $750, and that, working initially on a four-wire antenna 75 ft. high and 175 ft. long with a counterpoise of the same size, the sending set actually radiated 4 amp. at 360 meters wave length. When used as a broadcasting station to test its capacity, it worked clearly to stations on the Atlantic Coast more than 2,500 miles distant, and within the small radius over which it is necessary to work in transmission service there was remarkably good and regular reception everywhere. Reports even from the more distant stations showed that the volume was good and the modulation excellent. Of course, to duplicate such a system between important stations one has to adopt the usual expedient of sending at one frequency and receiving at another, the latter being the sending frequency for the duplex station and the former its receiving frequency.

It looks as if the San Joaquin experiments had reached a thoroughly practical result and had established the right of a well-planned radio system to be considered reliable. Just what difficulties may be met at times remains yet to be seen, but the results are highly encouraging. On a radio system of any kind there is not the facility for cutting in and talking back with which an ordinary telephone line is endowed, but whether in the direct-wave or free-wave form radio seems capable of fulfilling a very useful purpose in dealing with networks too large to be intrusted solely to ordinary telephony.

## New Ideas Needed on Circuit-Breaker Construction

REMARKABLE increases in the rupturing capacity of oil circuit breakers have been gained in the last few years through various improvements. However, the majority of increases in rupturing capacity have been made by increasing the dimensions or speeds of operation of the circuit breakers. As H. A. Barre, electrical engineer of the Southern California Edison Company, once expressed it, the present high-voltage circuit breakers are composed essentially of a Standard Oil tank with a wagon tongue carrying the movable contacts. The disadvantages of increasing ratings by increasing dimensions are so obvious that the engineering talent of this country should be stimulated to devise a means of performing the same results in another manner.

Just with the idea of promoting thought on the subject, it is perhaps worth while to cite one scheme proposed which, while it may not be itself the solution, may suggest other means of attacking the problem. The proposal is to build the tank for supervoltage circuit breakers below the ground level and to build it of concrete lined with sheet metal welded at the joints. There would be no stationary contacts. Each pair would be moved in a horizontal plane by a grasshopper motion. Existing improvements in circuit breakers could be made part of the plan. The results sought by this construction would be the elimination of transportation difficulties, an increase in separation of contacts, the rupturing of the arc in a position which would facilitate its extinguishment, the reduction of oil fire hazard, and possibly the reduction of oil required.

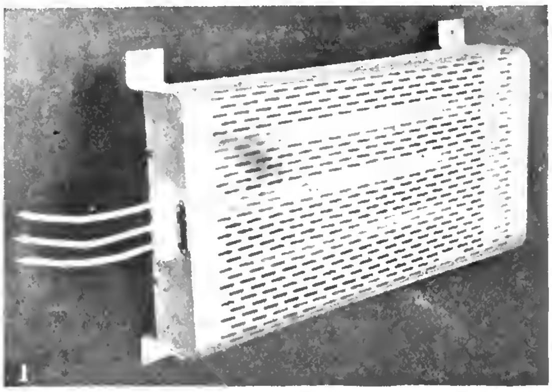
Reduction of high-potential bushings has been proposed by combining the transformers, disconnecting switches and circuit breakers in similar underground tanks separated by barriers and sealed with manhole covers. These proposals, while sounding like some of the tales of Jules Verne, will be of value if they do no more than stimulate new ideas on the construction of high-potential apparatus.

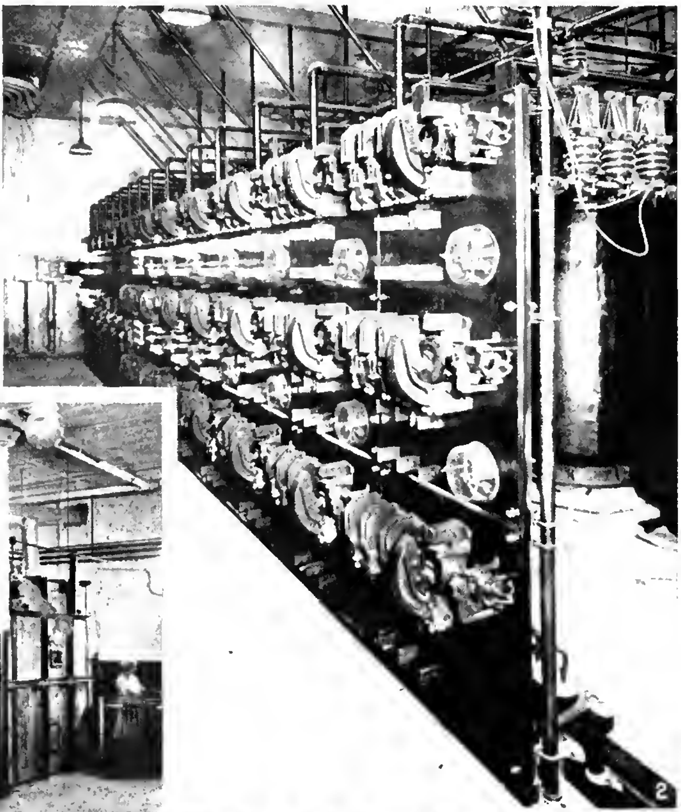
## Wider Vision Required in Regulation

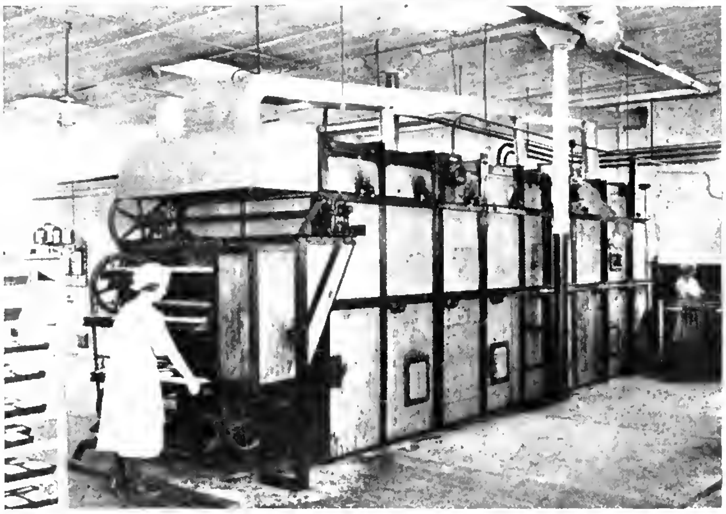
FROM time immemorial the desire for gain, whether of territory, prestige, position, fame or money, has been the impelling motive that has urged nations, communities, companies and individuals onward. Robbed of that incentive they either stand still or go backward and their contribution to society becomes nothing or less than nothing. Who cares to labor if the only compensation is a wage fixed and never increasing? Ditch diggers we must have, but even a ditch digger longs for the time when he can lay his pick and shovel by for some task less trying on his back and more remunerative in its return. To that end he does his appointed task well and fits himself for something better, and what is true of the humblest individual is true of a group or of a nation. Ambition is a natural trait, and reward usually crowns the effort of the one who succeeds at his task.

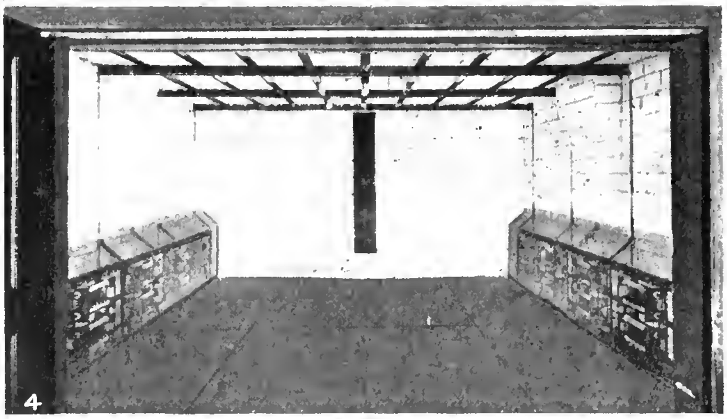
It is unfortunate that the trend of modern regulation does not take proper cognizance of this human instinct. In the desire to fix rates which are just and reasonable very little thought is given to incentives which might result in improved service. There is no fault to be found with the law; the trouble lies in its application. Courts generally recognize that the power to regulate is not a power to destroy and that limitation is not the equivalent of confiscation. But commissions are usually so engrossed and occupied on cases of the present that they have little time for consideration of the broader application of these principles and their effect in the future. Thus, whether a company exercises initiative and enterprise in the development of its territory and shows extraordinary skill and efficiency in the operation of its system or whether it does not apparently matters little. All that it is allowed is a fixed return on the investment. No distinction is made between sheep and goats. If a well-managed company, because of the exercise of extraordinary skill, succeeds in earning more than its allotted return, the surplus is virtually confiscated by the state through reduction in rates. Thus a check is placed on ambition and the exercise of initiative and enterprise is discouraged rather than encouraged. Fortunately, the electric light and power industry still takes pride in keeping its rates as low as possible, and because of higher costs of labor and material this has necessitated greater improvements in efficiency of equipment and in operation, the fruits of which have been passed on to the public. This process cannot continue indefinitely, however, and unless some reward is offered for efficiency great effort will scarcely continue to be made to attain it. The electric light and power business requires an uncommon degree of skill and experience in its conduct. It is still subject to risks, and industry, rather than make the venture itself, looks to the electric public utilities for service. Every encouragement should be given to them to expand and grow, to attract brains and capital and to help develop and perfect an art and science so universally serviceable to the race.

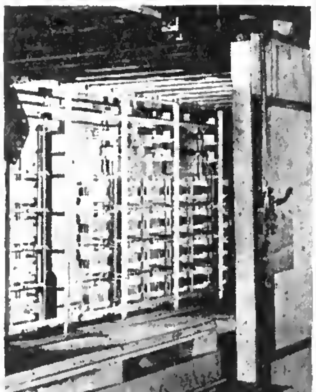
# Typical Electric Heat Applications











No. 1—An industrial air heater containing four 500-watt steel-clad heaters. An aluminum reflector is mounted in the rear.

No. 2—Automatic-control panels for maintaining constant temperature in an enameling oven at the Cadillac Motor Company's Detroit plant.

No. 3—A continuous-conveyor sectional type of bread-baking oven can produce more than 1,200 loaves per hour.

No. 4—A truck-type enameling oven for doors and cornice work.

Nos. 5 and 6—A semi-continuous conveyor type enameling oven at the plant of the Packard Motor Company, Detroit. At the left the fenders are shown, at right the resistors.

No. 7—A core-baking oven operates at around 400 deg. to 450 deg. F.

# To Paint or Galvanize Steel Structures?

## Results of a Questionnaire on This Debated Subject Give No Conclusive Answer—Proofs Are Not Forthcoming and Definite Data Are Few, but Positive Opinions Are Expressed by Some

In an attempt to answer the many questions asked about the relative merits of painting and galvanizing outdoor steel structures a questionnaire was sent to operating companies and consulting engineers. The accompanying analysis of the replies and the definite material presented should prove of value, but all the evidence shows that definite steps should be taken to obtain more accurate cost and performance data. Operating companies have kept very insufficient records on this subject, which has become increasingly important.—*Editors.*

OUTDOOR steel structures are widely used in the electrical industry, but they have been adopted so rapidly that despite this widespread employment few field data have been available on which to determine the relative merits of galvanized and painted structures of the various kinds. The experience of other industries helps little because of the distinctly different construction and application features of the structures used for electrical purposes.

For transmission-line towers and for substation structures the fabricated steel must be light and of many parts, and it must be economical as regards first cost and maintenance cost. Bridge practice and the general application of sheet steel give few data of a type which can be applied to these electrical structures, and there has been little real engineering study devoted to them by electrical engineers.

A survey of this matter in the electrical industry has brought out facts that show the existence of fields for both galvanized and painted structures. Many positive opinions have been elicited, as well as a few accurate data on installation costs, maintenance costs and length of life of the protective coating.

### Advantages and Disadvantages Summarized

A summary of the advantages of the galvanized structure may be thus given:

1. Where parts of the structure are not readily accessible or dangerous to life—for example, near live wires—galvanizing has advantages.

2. Where the structures are widely scattered and the cost of a careful inspection would be heavy, galvanizing is also advantageous.

3. Where a permanent installation of sufficient magnitude to warrant a company doing its own galvanizing is made, the cost of galvanizing adds only 20 to 30 per cent to the cost of the steel.

4. In fabricated structures where bolts are used galvanized parts have a longer life.

5. In some structures it is possible to use lighter steel if it is galvanized than if paint is used. For example, one company reports that galvanizing increases the cost about a third, but permits the use of ¼-in. angles as compared with the $\frac{5}{16}$-in. angles required for painted structures.

6. The length of life of the galvanizing is from eight to fifteen years as compared with two to four years for paint.

The disadvantages of galvanized structures are:

1. First cost is high—reports give figures varying from 30 per cent greater to nine times the cost of painting.

2. The quality of galvanizing varies, necessitating rigid specifications.

3. In certain locations—for example, in a damp, salty atmosphere and in a sulphur-laden atmosphere—galvanizing has a very short life, so that its application is somewhat limited.

The advocates of painted structures are rather numerous, particularly where certain types of structures are concerned. Certain of the advantages of painting are:

1. It is cheaper than galvanizing, and this makes it particularly advantageous for new installations in which the capital charge must be kept low until the load grows.

2. It costs little to have painting done by the normal line crew during odd moments.

3. Paint of different qualities can be found suited to peculiarities of the location of each structure as regards weather conditions, air conditions and a changeable environment.

On the other hand, paint has some disadvantages, for:

1. It is difficult to obtain paint of the proper quality for each application.

2. Two or more kinds of paint must be used to obtain good results.

3. Repainting must occur in from two to four years, and in many cases this is a very costly operation, particularly if structures are brushed or scraped before repainting.

4. Repainting of live structures is hazardous and it is difficult to "kill" substations or lines.

Several companies state that their practice is to use both galvanized and painted structures. For tower lines galvanizing is generally preferred, but under special conditions painted towers are used and very frequently the bus structures, arrester tanks and breaker tanks are painted. Nearly all say that the quality of the galvanizing and of the paint is very important. A wide variety of choice in paints is found, with a red-lead base and aluminum top coat in general favor.

### Variation in Costs

One company reports the cost of painting a steel-tower line installed in 1916 as $8.95 for labor and $1.42 for paint per tower, or about $1.50 and 24 cents per tower-year respectively. Another company gives the cost of painting as ½ cent per pound of steel painted, while the cost of galvanizing is 1 cent a pound or higher, depending on the tonnage of the order.

It is rather difficult to make positive deductions from reading the various answers, but a consensus of opinion exists to the effect that galvanizing can be used advantageously for transmission-line structures and isolated substation structures where these are just outside of

more or less thickly populated sections. Galvanizing also has advantages over painting for parts of switching structures which are rather inaccessible because of the proximity of live parts which cannot be "killed." If such structures are exposed to acids or fumes, extra-heavy galvanizing should be specified and paint put on the galvanizing after it has weathered better to protect it from fumes.

For all other structures painting seems to be as satisfactory a method for protecting steel as can be obtained, provided that a first-class paint is selected, suited to the purpose for which it is used, and that at least three coats of the paint are properly applied. Skilled painters should do the work if a good job is to be obtained.

In order to report the conditions ascertained more definitely a selected list of companies and the statements made by their representatives are given below. It is hoped that a more thorough investigation of the subject will be undertaken by the industry and that field records will be kept by companies located in widely scattered locations.

## Opinions from Users of Outdoor Steel

### Connecticut Light & Power Company

Waterbury, Conn.

We have not made any extensive tests to determine the relative final cost of galvanizing versus painting. We have used different kinds of paints for some years and have come to some very definite conclusions as to the value of different paints under different conditions.

As far as galvanizing is concerned, it is our general policy to galvanize all such parts of steel structures as after erection are not readily accessible on account of their close proximity to live parts of conductors and equipment. This refers to steel used in outdoor substation work. On line towers and other steel structures we are using, wherever possible, galvanized iron, because part of the structure is not readily accessible for painting on account of proximity to live parts, and because on the whole the structures are scattered so far that a painting job would be expensive. Moreover, the close supervision necessary to determine when painting is required would add materially to the cost of inspecting the line. Of course, there is always a chance of rust, even with galvanizing. However, rusting does not progress very rapidly, and very infrequent inspections will be sufficient to discover it and to permit taking the necessary steps to arrest it.

As far as the painting is concerned, we first used a red lead and various paints on top of it as a second and third coat, some dark green and others battleship gray. We even tried some of the heavy black compound paints in an endeavor to obtain a paint that would last some time. As a rule we found that we could not let painting go more than three years at the most without considerable rusting taking place. This refers particularly to Waterbury, where the conditions may, of course, be more severe on account of the close proximity of a spray cooling system. We accidentally started to use the paint which is now our standard, namely, the aluminum paint. We first used it in New Britain, where we were installing the first outdoor station, using galvanized trusses, but painting posts so that a post should as nearly as possible look like the truss—therefore the aluminum paint.

We first mixed this aluminum paint with banana oil. The experience was most discouraging, because the paint was flaky and did not last very long. After considerable experimenting we were finally advised by a paint manufacturer to use the following mixture: 1 lb. of powder aluminum paint to 2 qt. of Sipes "bronze liquid." Ever since we have done this the results have been most encouraging. As a matter of fact, they have been so encouraging that we have standardized on the aluminum paint not only for the steel structures but also for the circuit-breaker tanks, lightning-arrester tanks and rain shields (O. F. arresters) and power transformer tanks.

It was about three years ago that we started to use the new mixture for the aluminum paint, and the parts painted since do not show any signs yet of needing repainting. Just how long we can go without repainting I am unable to tell at this time. E. J. AMBERG,

*Electrical Engineer.*

### Cumberland County Power & Light Company

Portland, Me.

All our outdoor steel structures are painted. Our Hiram transmission line, approximately 15 miles long, is a tower line of A frames and rigid towers. This was placed in service in 1916 and was painted this year at a cost of $8.95 per tower. The original paint was so-called "Carbon Elastic." This year we used "Valdura," which is practically all "Gilsonite." The price of $8.95 is for labor only and this represents a cost of about $1.50 per tower per year. The cost of the material used amounted to $1.42 per tower, or at the rate of about 24 cents per tower per year.

GEORGE E. HAGGAS,

*Chief Engineer.*

### Public Service Production Company

Newark, N. J.

All our outdoor steel structures are painted. We have used no galvanized structures to date. We have no data as to the average life of protective coating, but our practice is to use the best grade of paint and repaint structures about every two years. As to kinds of paint, we have had satisfactory results using Patton's "Iron Hide," Suydam's "Dock Department" paint and "De-re-ko."

We have no data showing the cost of painting based on the life of protective covering. Our climatic conditions are bad on account of salt air and acid fumes. We do not believe that galvanizing would provide a complete protection unless members were double galvanized. Even in this case, structures would have to be painted after 5 or 6 years use. E. B. MEYER,

*Chief Engineer.*

### Niagara, Lockport & Ontario Power Company

Buffalo

I am sorry that I cannot give you any exact dollars-and-cents figures which will support our decision in favor of painted instead of galvanized transmission structures for our recent order, but I can state some of the general considerations which have led to this policy at the present time.

We installed in 1905-1906 more than a thousand towers of each type. The painted towers have been repainted approximately every four years. Some of the galvanized towers erected near the industrial centers or near railroad right-of-way, where they are exposed to gases and smoke, showed serious impairment of the galvanized protection after seven years of service, although others, erected in the open country, are still in fairly good condition. I believe, however, that I can conservatively state that all structures in the vicinity of railroad right-of-way and in the outskirts of settled communities were badly in need of repainting after ten years of service. For such towers, therefore, the saving effected by galvanized structures is roughly represented by the cost of two and one-half repainting jobs. In computing the cost of such repainting jobs a very substantial credit should be made on the cost of labor, because this work can be done by the regular line organization at odd times when there is no need for their services on other maintenance or emergency work. It should also be considered that the first painting job on a galvanized tower after rusting has started in is considerably more than the repainting of a well-painted structure. We have also found that there is a good deal of difference in the durability of different galvanized structures, sometimes from the same firm but manufactured at a different date. Such difference could possibly be avoided by more rigid inspection, but a rigid inspection of the galvanizing of all tower parts is necessarily very expensive and would add materially to the cost of galvanized structures. It is, therefore, our judgment that for our lines in western New York, which parallel and frequently

run adjacent to railroad rights-of-way and through the outskirts of several industrial communities, the painted structure is better adapted; but if we had to build a line in open country, free from gases and fumes, we should probably favor galvanized construction.

It also should be considered that the expense of a transmission company is necessarily represented to a very large extent by fixed charges on investment, which cannot be adjusted to changes in earnings, whereas maintenance can always be somewhat synchronized with the earning situation, increased in good times and curtailed when earnings fall off. In spite of the fact that fixed charges on the additional cost of galvanized structures may be less than the average cost of repainting structures during the first ten or fifteen years, it may be better policy to keep down the initial investment for the reasons stated before and also because in most cases it is not possible to show a profitable return from the initial business reached by any new extension, whereas the future growth of this business is usually sufficient to earn eventually a profitable return and increased maintenance charges. I am not sure whether at the present time this relation still obtains, but not so long ago we found that increasing the thickness of all parts of a transmission structure by ⅛ in. did cost less than the galvanizing of the lesser thickness of metal. This, of course, raises the question whether ⅛-in additional metal is not a better protection than the thin galvanized coating. S. PIEK,
*General Manager.*

**East Massachusetts Electric Company**
Salem, Mass.

We use only painted outdoor steel structures and get an average life of about two years for the protective coating. We have no definite cost figures, but we repaint every two years with graphite paint. H. G. JENKS,
*General Superintendent.*

**Narragansett Electric Lighting Company**
Providence

We have but few steel structures, but those we have are not galvanized and, owing to the fact that they are built near the salt water where dampness and frequent fogs prevail, it is essential that they be covered each year with a protective paint.
W. T. OVIATT,
*General Superintendent.*

**Central Maine Power Company**
Augusta, Me.

Our outdoor steel structures are painted, the average life of the paint being three years. We have had no experience with galvanized-steel structures. No data are available for the cost of painting. We have very few of these structures and so have not gone very carefully into the cost of maintenance and upkeep of the same.
GEORGE S. WILLIAMS,
*General Superintendent.*

**Indianapolis Light & Heat Company**
Indianapolis

We have just recently started high-tension outdoor substation construction. Most of our substations are made from 2-in. galvanized pipe and fittings. We have some painted structures also made from Bates steel poles. I have no exact data on the length of time either method will last, but I will say that neither seems to hold up very well for us. The painted structures should really be painted every two years.

We seem to have more trouble with galvanizing on the bolts than we do on the pipe itself. We have several small home-made fittings installed on these stations which were dipped in red lead and then painted with aluminum paint. I do not know just what the cost of this would be if it were done on a large scale, but I am sure it will last twice as long as ordinary galvanizing, judging from our experience in the past two or three years. E. G. RALSTON,
*Chief Electrical Engineer.*

**Northern States Power Company**
Minneapolis

We have on our system several hundred miles of high-tension steel tower or pole-line construction, also innumerable steel-skeleton frame outdoor substations, special switching towers and heavy long-span river and valley crossing towers.

On many of these, erected some time ago, we were unable to obtain galvanizing, as the manufacturers did not have tanks long enough to take the larger members. Of late years, however, many large hot-galvanizing plants have been installed. (One which I know of can take an entire 35-ft. expanded pole section in one dip.) It is therefore now relatively easy to get hot-galvanized outdoor steel members of almost any size.

Hot galvanizing can be regarded as a permanent investment. Our experience has shown that in our climate, remote from salt air, it will last almost indefinitely. The approximate added cost for such galvanizing runs from 15 to 20 per cent of total cost, so that the fixed charges on this extra investment can be balanced against cost of periodic painting. On this basis of comparison galvanizing will nearly always win out on a dollars-and-cents basis.

On outdoor electrical structures in general the electrical equipment must be kept alive at all times. This means painting around live equipment and wires and requires a skilled electrical worker with a knowledge of painting methods—a combination not always easy to find.

Where painting is used for protective purposes it must be carefully watched and repainted before rust sets in. On one of our long transmission lines we were forced by war-time conditions to miss one periodic repainting schedule. When we finally got around to the work we had to scratch-brush every tower, and the repainting cost probably exceeded what would have been paid for hot galvanizing could it have been obtained when these towers were fabricated.

The selection of suitable paint is a problem too deep for the average central-station engineer and further complicated by the fact that a really good paint may give poor service if improperly applied. Most of us fall back on the old rule for selecting a strictly fresh egg—break it open and judge by the smell. In other words, if the paint used gives long service, it is good, otherwise not. In either event we have spent our money to find out.

Our chemical laboratory has recently made exhaustive tests and experiments on paints for various classes of service, and we now have standard paints made to our own special formulas. Even with these we never paint outdoor steel if it is practicable to get it galvanized. On all outdoor hardware and standard fittings, including substation frames, standard towers, etc., we have a standing rule that the workman must not take them out of the storeroom unless they are galvanized, except where order specifically calls for ungalvanized stock. S. B. HOOD,
*Superintendent of Distribution.*

**Public Service Company of Northern Illinois**
Chicago

We have very little definite information on this matter, but consider galvanizing to be more satisfactory than paint. We have a few galvanized towers which have been in service for about ten years without painting and which are just beginning to show signs of slight rust. We have several outdoor steel substation structures which were painted. The paint on them does not seem to stand up for more than about two years. D. A. PIERCE,
*Engineer of Electrical Distribution.*

**Twin State Gas & Electric Company**
Boston

We specify galvanized steel for outdoor substations. Our operations have not to date given us any definite idea as to the probable average life or definite cost data.

Our climatic conditions are rather severe. In one of our localities structures are exposed to some spray from salt water. Galvanizing is in accordance with standard galvanized specifications. Bolt holes are drilled and tapped before galvanizing.
R. J. ANDRUS.

**Scofield Engineering Company**
Philadelphia

Regarding the merits of galvanizing and painting for the protection of outdoor steel structures, we believe there is no question that under most conditions galvanizing is very much more effective.

The average life of protective coating naturally varies widely, depending on the coating and the conditions. For instance, we have had cases where galvanized corrugated sheets have been in position for twenty years without any

apparent deterioration and other cases where such sheets have deteriorated to a point necessitating renewal in ten years or even much less.

Painting of steel structures is ordinarily required every two or three years, and there are some conditions where painting yearly is necessary to secure any adequate protection.

As a general rule, we should say that galvanizing was cheaper than painting in the long run for thin sheets and shapes where any serious damage to the metal requires immediate replacement, and that painting is probably cheaper on heavier structures where a slight amount of corrosion under painting does not seriously endanger the structure.

F. DAUGHERTY,
*Vice-President.*

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**Wisconsin River Power Company**
Madison, Wis.

We use both galvanized and painted outdoor structures. We have galvanized structures in good shape after twelve years; paint lasts about four years. During the war the cost of galvanizing was high, but now it is cheaper to buy galvanized steel. Our temperature ranges from — 30 deg. F. to + 98 deg. F. with a rainfall of about 30 in.

G. C. NEFF,
*General Superintendent.*

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**Pennsylvania Power & Light Company**
Allentown, Pa.

We use both galvanizing and painting material on outdoor steel structures. On transmission towers and switching towers we standardize on galvanized material.

Galvanized transmission towers and switching structures have shown no depreciation in ten years except in isolated cases. Painted structures have had to be repainted in from one to five years, according to local conditions.

No comparative data can be given as to the cost of galvanizing or painting based on the life of protective covering, as this varies very greatly on painted structures, while on the galvanized structures there has been practically no deterioration. We have had one galvanized transmission tower out of approximately a thousand which has shown deterioration due to heavy sulphur conditions. Several galvanized towers in culm banks have also rusted at the ground line and have had to be concreted. These are unusual sulphur conditions, however, and isolated cases exist among both painted and galvanized structures of excessive deterioration. However, in ten years there has been no deterioration in galvanized structures where the galvanizing has been satisfactorily done.

The following data give an idea of operating conditions:

Average rainfall, 45 in.; snow and sleet during winter months; heavy lightning storms in summer; temperature range, — 15 deg. + 90 deg.

Frequency of painting is dependent on local conditions and quality of original painting. Normally, steel structures have to be repainted in about three years. Where painting has started to scale and rust it is wire-brushed and red lead or red oxide paint is first used. A carbon paint is used for the finishing coat. Galvanizing is done according to N.E.L.A. specifications or those of the Electric Bond & Share Company of New York.

A special condition affecting the life of galvanizing is the presence of sulphur fumes from coal. This has affected structures where conditions have been very extreme and steel surrounded by heavy coal smoke. In coal-culm piles at the ground line galvanizing has deteriorated. In regard to painting, the quality of the original preparation of the steel, the manner of applying the paint and weather conditions at the time of painting very materially affect its life.

ALEXANDER COLT,
*Superintendent of Transmission.*

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**Southern California Edison Company**
Los Angeles, Cal.

All of our steel structures, such as transmission-line towers, steel framework for outdoor substations, latticed steel poles and work of that type, are galvanized and not painted. It is hard to tell what the average life of this galvanizing is. We have some structures that have been in use for twenty years that are still in good condition. We have found, however, that in certain localities where the galvanized steel is buried in alkaline soil the galvanizing is being attacked and the steel will clearly have to be replaced. This condition has been noted on the Big Creek line, which is now seven or eight years old; I believe in some instances the galvanizing has disappeared, although the steel has not yet been attacked very badly.

We have constructed many buildings of galvanized corrugated iron, and find it is best to paint this galvanizing after it has been weathered for a few months. The galvanized sheet iron that is purchased in the open market is of rather poor quality and does not seem to be equal to the heavier galvanized sections that are used in steel towers, etc.

H. L. DOOLITTLE,
*Assistant Construction Engineer.*

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**San Joaquin Light & Power Corporation**
Fresno, Cal.

The question of galvanizing has received considerable consideration from us. Galvanizing is sometimes a large item of expense, and it can be carried to extremes. For instance, material which is satisfactory in a climate such as exists in the central portion of the state would be very unsatisfactory in sections subjected to a great deal of dampness and sea fogs, etc. Material used in the San Joaquin Valley would not stand up when exposed to atmospheric conditions such as exist in the counties on the coast.

All towers which we have purchased, whether for use in the valley or on the coast, are galvanized. Towers such as are used in substation yards to carry high-tension buses are painted. We find that it becomes necessary to repaint these towers about every three years. The galvanizing, if properly applied, will last much longer than that. The cost of galvanizing adds about 15 to 20 per cent to the original cost of the metal.

In the San Joaquin Valley we do not use any galvanized pole-line hardware with the exception of the hooks and eyes, etc., which are used with suspension-type insulators. Our cross-arm braces, bolts, etc., are plain black iron. This climate is very dry, while in Santa Barbara, San Luis Obispo and Monterey Counties the climate is much damper. In these counties we use galvanized hardware throughout.

Our specifications on sheets for corrugated iron buildings is as follows: "Galvanizing on sheets furnished under this proposal must show a uniform surface, clean and smooth throughout and must weigh not less than 1.2 oz. on each side per square foot of area treated, and the lightest spot on any sheet must not fall below the above stipulated minimum."

I might add in conclusion that in my opinion galvanizing is a necessity in most climates, but we have found that in the San Joaquin Valley plain black iron will outlast other material which enters into the construction of a pole line.

E. A. QUINN,
*General Superintendent.*

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**Kansas City Power & Light Company**
Kansas City, Mo.

We are using both galvanized and painted outdoor steel structures. We use the painted structures in some localities, such as isolated outdoor steel substations or places where the ground is high and there is not so much smoke as occurs in railroad districts. We find that two coats of paint—the first coat, say, of red lead and the second coat of carbon paint—will last two or three years. Paint on structural steel at lower elevations and in districts where there is a considerable amount of smoke from industries and railroads will barely last a year.

We find the cold process of galvanizing such as has been used around Kansas City unsatisfactory. Some of it showed evidences of rusting after a week. Hot-dip galvanizing, we have found, will last five years or more without any evidence of deterioration. This again, however, depends entirely on the location of the structure. We have no definite cost data on a comparative basis.

Our summers are rather warm and dry. In the fall, starting about the first of October, there is no wind, which tends to keep all of the impurities of the air near the ground. This seems to be the most severe condition of the year. Our winters usually are fairly mild. In general, I would not consider the climatic conditions very severe on the structural steel work.

We have had occasion to observe the difference in results between the use of graphite paint and of a carbon paint. There are several large oil

tanks along the river where the most severe condition that we have in our district exists, and we find that after one year's time the graphite paint shows a complete loss while the carbon paint shows no evidence of losing its value. These tanks are in a district where there are smoke and fogs from the river. A. E. BETTIS,
*Superintendent of Distribution.*

**New England Power Company**
Worcester, Mass.

It has been our practice during the last few years to galvanize all steel used on transmission lines. However, we have painted a great many of our steel structures for outdoor substations. The average life of the protective coat of paint is about three to four years. We have to date noticed no deterioration in galvanized structures, some in service fourteen years.

The cost of original painting and subsequent painting averages about ½ cent per pound of steel painted. The cost of galvanizing runs from 1 cent a pound up, depending on the tonnage of the individual orders.

Our system covers a large part of the central portion of New England, extending from Bellows Falls to the coast at Providence and Fall River. We have noticed no difference in deterioration on any part of the system to date.

It is necessary to paint steel structures every three or four years. This we do by scraping off all rust, following this by a protective coat of red lead on the scraped portion of the steel and then by a color coat over the whole structure. All our galvanizing has been done under the standard "B" specifications. C. R. OLIVER,
*Assistant General Manager.*

**Turners Falls Power & Electric Company**
Greenfield, Mass.

We have had experience with both painted and galvanized structures and recommend galvanized structures wherever bolted connections are allowed. On railroad crossings where riveted connections are made we use painted structures. Galvanizing in Seekonk and Somerset, Mass., on windmills is in good condition after twenty-five years. Painting is required about every three years where such structures are used.

Galvanizing increases the cost of the steel about 33⅓ per cent, but this is offset by the fact that we can use ¼-in. angles while painted structures use $\frac{5}{16}$-in. angles as a minimum. The cost of two field coats of paint is roughly $35 per ton.

We have a temperature range from — 20 deg. to + 90 deg. F. with high humidity, inland location and altitude from 50 ft. to 2,000 ft.

We use on our painted structures originally one shop and two field coats and repaint about every three years. Repairs consist of spot red oxide and one coat of paint (we have experimented with various kinds). Coal gas, salt water and acid fumes seriously affect painting. Galvanizing is done in accord with American Telephone & Telegraph Company specifications.
H. D. SEAVEY,
*Superintendent of Distribution.*

**Oklahoma Gas & Electric Company**
Oklahoma City, Okla.

We use both painted and galvanized outdoor structures. The average painted structure must be repainted about every two years. We have no definite data on the life of galvanizing. Our summers are rather warm with winters typical of the Southwest. All painted steel work receives one coat of graphite paint and two coats of aluminum paint when first installed, then each two years one coat of aluminum paint only is used. J. M. BROWN,
*Superintendent of Distribution.*

**The California Oregon Power Company**
Medford, Ore.

As far as line hardware and substation structures and power-house buildings are concerned, we use galvanizing instead of painting. We do not have sufficient data at hand to determine average life of this coating.

Climatic conditions in our territory are generally favorable to a long life for steel structures. The precipitation is in general light, the altitude comparatively high, and we do not have the salt atmosphere which causes deterioration of steel structures along the coast. The only data which we have in this connection are in regard to steel penstock pipes. We have a pipe line installed in 1903 and coated with an asphaltic dip. This coating is still in very good condition. We have another pipe line painted in 1912 with graphite paint, and this also appears to be in good condition. The steel pipe on Unit No. 1 of our Copco installation was painted in 1917 with a bitumastic paint, and we are at present repainting this pipe, although it is not in very bad condition. C. E. BLEE,
*Assistant Engineer.*

**Puget Sound Power & Light Company**
Seattle, Wash.

We use both galvanized and ungalvanized steel structures. The average life of the galvanized is rather uncertain and depends upon the character of the original paint, the method of handling during construction and the amount of fitting and damage done during construction.

The average life of galvanized structures could be taken as about nine or ten years; the life of protective paints, if a good type of paint is used and properly applied, could be taken as about five years. We have some steel towers in the vicinity of a smelter where galvanizing lasted only about a year and acid-proof paint coatings lasted only from one to two years.

The cost of galvanizing as compared with painting on steel towers is about nine times that of painting. I have no data on the comparative costs of galvanizing and of painting sheet-metal structures.

Our climate is damp with a good deal of salt air near the coast, and all painted structures are repainted about every four or five years. All galvanized structures should be inspected once a year for rust spots, and these should be thoroughly cleaned and a protective paint applied. S. C. LINDSAY,
*Engineer.*

**New Bedford Gas & Edison Light Company**
New Bedford, Mass.

We cannot give you any accurate data on the relative merits of galvanized and painted structures. Though we have both types of structures in and about our plant under varying degrees of exposure to weather and salt fogs, we have not made a record of the results obtained. We have some galvanized structures quite near the seacoast, and also painted structures, but no satisfactory statement can be made regarding their relative merits as regards the protection of the iron.
DAVID W. BEAMAN,
*Supt. Electrical Department.*

**United Hudson Electric Corporation**
Poughkeepsie, N. Y

Most of the outdoor substation structures erected during the past three years have been galvanized. The few exceptions that have been painted during this period already need repainting. Prior to 1920 all such structures were painted. All transmission-line towers are galvanized with the exception of a few narrow-based steel poles erected about five years ago, which are painted with a shop coat of red lead and linseed oil and a field coat of black graphite paint.

The average life of paint as an effective protective coating on outdoor substations is about three years. Generally speaking, the use of galvanizing as a protective coating is of such recent practice with this company that no statement of its life can be made. However, galvanized transmission towers in service since 1917 are today apparently as good as new. Ground-wire bayonets, composed of 2½-in. x 2½-in. x $\frac{3}{16}$-in. angles, galvanized about ten or twelve years ago are still in excellent condition. The expectation is that galvanizing as compared with painting will justify itself in about six years.

Climatic conditions are not unusually severe. Most fogs are fresh mountain mists, and it is doubtful if any of the salt fogs of the coast reach this territory. Very little trouble from industrial fumes is experienced. The worst conditions are in cases where the towers cross or parallel railroads, and these cases are causing no trouble.

Painting of outdoor substation structures is done about once every three years. The paint used is generally of lead or graphite pigment with linseed oil, though no standard practice has been developed. Galvanizing is in accordance with N. E. L. A. specifications.
E. A. VAN DEUSEN,
*Assistant Structural Engineer.*

# Line Regulation and Power Factor Correction

### Effect of Line Voltage Changes on Loads of Various Kinds, Particularly Those Arising with the Employment of Power-Factor Corrective Devices

BY CLIFFORD W. BATES
Research Engineer, Philadelphia Electric Company

WHEN considering the installation of condensers to improve the power factor of a system, it is important to consider the effect of voltage variation on the amount of correction obtained, particularly as the effect is quite different on the two available types of apparatus in use—the static condenser and the so-called synchronous condenser. It is also interesting to note the effect of voltage variations on the input to loads of various kinds.

The static condenser behaves exactly like a resistance of any type, such as lights, heating devices, etc.; that is, the current is directly proportional to the voltage and the kva. input or kw. input in the case of heating devices is proportional to the square of the voltage.

Synchronous condensers, on the other hand, being essentially synchronous motors operated at no load with the field overexcited, behave very differently. If the line voltage increases with the excitation remaining the same, the current and kva. input fall, since the increase of voltage is equivalent to a relative decrease of overexcitation. In fact, if the line voltage should increase so as to equal the voltage to which the motor is excited, the current would be reduced to zero, except for the small power component necessary to drive the motor, and a further increase would result in a lagging current. A decrease in line voltage operates in exactly the opposite way, as this is equivalent to a relative increase in the overexcitation. The magnitude of the change depends to some extent on the design of the condenser. The curves given in the analysis correspond to a motor having 50 per cent synchronous impedance.

Induction motors vary considerably in their characteristics, depending principally on the type (squirrel-cage or wound-rotor) and on the size. The curves of Figs. 1 and 2 are based on a 20-hp. squirrel-cage induction motor of average characteristics. They are based on constant torque duty, such as driving machine tools and hoists, but the values were calculated for the motor driving a fan, for which the torque varies as the square of the speed, and are found to differ very little from the constant-torque values for the range of voltage variation included by these curves.

The very small change in the power input to induction motors as the motor voltage varies from 20 per cent below to 20 per cent above normal is particularly striking. This is mainly due to the fact that the speed change is comparatively small within this range, and that any variation of power taken by the load from the motor depends on the speed. Although the output does decrease slightly because of reduced speed the losses increase in such a way as practically to neutralize this decrease. The reactive component, on the contrary, decreases rapidly with a decrease of voltage.

In the case of synchronous motors the power output is independent of voltage variations and the power input is virtually so. The power component of the current will then vary in inverse proportion with the voltage. The reactive component will vary in general like that of a synchronous condenser.

### CONCLUSIONS

The curves show that the synchronous condenser is more effective under variable voltage conditions than the static condenser. The correction afforded by the static condenser tends to decrease at the very time when it is needed most, while that given by the synchronous condenser increases even more rapidly than the voltage decreases, thus automatically compensating to some extent for the drop in voltage, particularly if this drop be due to a heavy overload at low power factor. However, the use of static condensers should not be entirely condemned as their relatively lower losses, the decrease in amount of attendance necessary and their smaller bulk, together with their lower cost in the small sizes, may often result in a static condenser being installed for correction purposes in a location where no condenser would be installed if the synchronous condenser were the only type available.

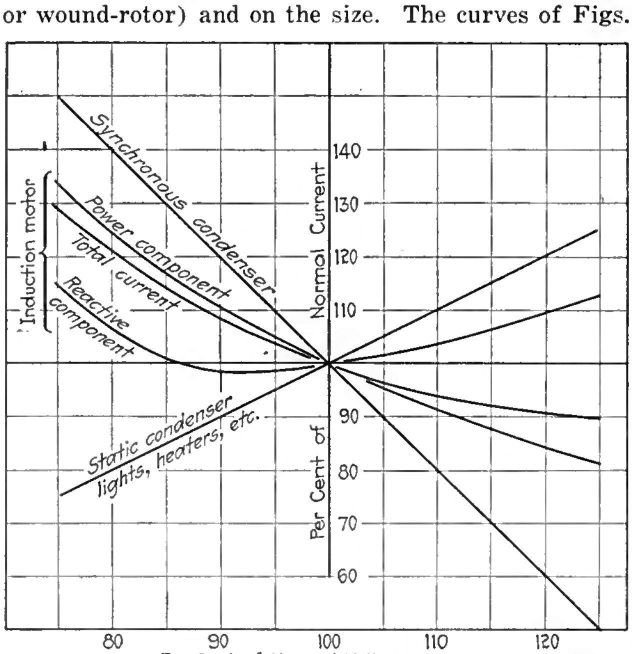



FIG. 1—EFFECT OF LINE VOLTAGE CHANGES ON THE CURRENT INPUT

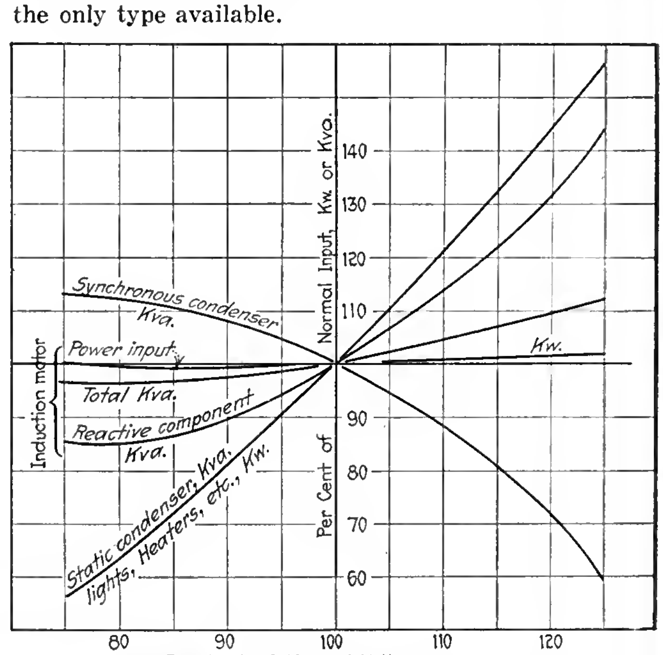



FIG. 2—EFFECT OF LINE VOLTAGE CHANGES ON KW. AND KVA. INPUT

# Industrial Electric Heat Applications—I*

## A General Résumé of Industrial Heating-Oven Practice—The Solution of the Control Problem and Limitations in Furnace Applications—Different Types of Furnaces in Use

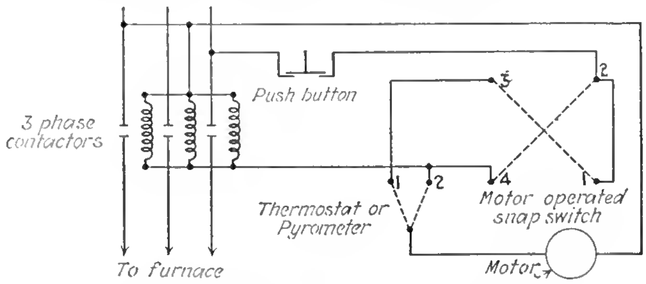
By J. L. McK. YARDLEY
*General Engineer Westinghouse Electric & Manufacturing Company*

IT IS difficult to astonish any one with the achievements in any branch of the electrical industry. Frequently a sprout from the parent tree has grown unnoticed until it has acquired a magnitude that compels comment. In fact, the tendency now is to heap public encomiums on everything accomplished electrically, independently of comparative merit.

One of the most recent activities of the electrical industry is connected with the electric furnace or oven and its application to industrial heating purposes. In the face of fierce competition this activity has won a secure place and has an encouraging outlook. Yet the art is not sufficiently advanced or the economical situation sufficiently sound to warrant predictions to the effect that it will or even should be the universal agency for industrial heating. Each application and industry affords a specific occasion for engineering and economic analysis before a decision can be rendered intelligently.

It seems unquestionable that the field of industrial heating by electricity will expand greatly, owing to the abundance, cheapness and reliability of electric power and to the superior results of one kind or another which are often experienced. Because of these results it will extend particularly and quickly in the industries in which it has already started. The other industries and new applications must be approached by experts capable of applying both economics and science with good judgment to the problem.

Many improvements are being and will be made in fuel-fired furnaces to meet the competition of electric furnaces. Much of the improved thermal efficiency of the electric furnace attained by the use of large quantities of improved heat-insulation materials may also be attained with fuel-fired furnaces, the design of which has been improved to include similar qualities of the same insulation materials. The essential factor is that in industry, in the final analysis, the foremost consideration is over-all cost. Another point to consider frankly is that whereas, theoretically, the atmosphere in the electric furnace chamber may be whatever is desired, practically, using the metallic resistor furnace, it is exceedingly difficult to have anything but a somewhat oxidizing atmosphere in the furnace chamber. This fact makes some process applications, as, for example, the bright annealing of steel, formidable problems for the electric furnace, such as can be and will be worked out only by experts.




SCHEMATIC DIAGRAM OF THERMOSTATIC OR PYROMETER CONTROL OF CONTACTORS FOR INDUSTRIAL OVENS

The thermostat is at 1 and the motor switch at 4-2. To start the furnace the push-button is closed, closing the control circuit through the coils of the contactor, which then closes and connects power to the resistors. When the furnace reaches a predetermined temperature the thermostat makes contact at 2 and closes the circuit through the motor-operated snap switch, which moves to position 1-3. This breaks the contactor-coil circuits, opens the contactors and opens the circuit of the motor-operated switch. As the furnace cools the thermostat goes back to position 1, which causes the motor switch to return to position 4-2. The angle then repeats itself.

The industrial oven or furnace, of course, consists essentially of some electrical resistor material and some heat-insulation material carried in a metal frame for mechanical support. Many kinds, types and varieties have been produced. The fundamental material is the resistor, and the table shows some of the kinds now used or suggested for use in industrial furnaces.

The heat insulation materials have gained great prominence in recent days, because they directly affect the thermal efficiency of the oven. There are a great many materials used commercially, such, for example, as (1) mineral wool, which is a product of silica, alumina and iron oxide, made by blowing a powerful jet of air or steam through blast furnace slag, and (2) insulating bricks of various kinds, such as "Sil-O-Cel," "Insulbrix" and "Nonpareil." As refractories, or material that is close to the heating elements in

*This article is based on an address given by the author before the Toronto Sections of the A. I. E. E. and A. S. M. E.

TABLE I—ELECTRICAL RESISTOR MATERIALS

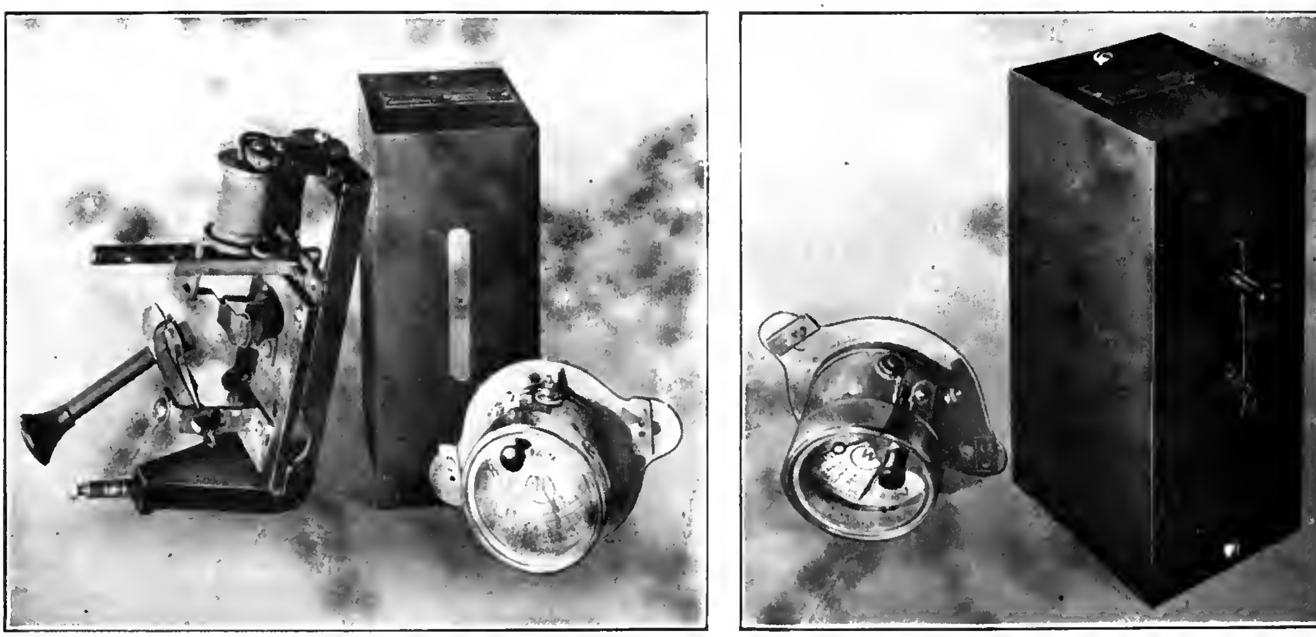
| Type | Content | General Remarks |
|---|---|---|
| Nichrome | 60 to 66 per cent nickel<br>12 to 22 per cent chromium<br>26 to 10 per cent iron<br>2 per cent manganese | Maximum working temperature of resistors about 1,800 deg. F. |
| Chrome or No. 1 chrome-nickel alloy | 80 per cent nickel<br>20 per cent chromium | Contains no iron or other impurity; highly acid-resisting and has high resistance to oxidation; maximum working temperature of resistors 2,000 deg. F. |
| Nickel-steel or ferro-nickel alloy | 25 per cent nickel<br>75 per cent iron | Maximum working temperature of resistors 1,100 deg. F. |
| Copper-nickel alloy | 45 to 65 per cent nickel<br>30 to 55 per cent copper | Maximum working temperature of resistors 900 deg. to 1,100 deg. F., and practically negligible temperature coefficient of resistance. |
| Carbon-granular or plate | Carbon | Maximum working temperature about 5,500 deg. F. |
| Carborundum | Amorphous carbon | Not a commercial success; decomposition occurs at about 4,000 deg. F., but hot spots develop so that furnace temperatures seldom exceed 2,500 deg. F. |

high-temperature furnaces, "Star" silica brick, "Quartzite" brick, first-quality "Woodland" brick, "Carbofrax" brick and other materials are used. Some of the insulating bricks weigh about 30 lb. per cubic foot, whereas the refractory brick weighs about four times this amount.

One of the problems of the industrial oven and furnace has been to determine the temperature with the degree of precision required. It is practically a universal practice to use the thermocouple up to 2,500 deg. F. The base-metal thermocouple usually is made of constantin and iron or nickel chromium and nickel alloy and is used up to 2,000 deg. F., although it deteriorates rapidly above 1,800 deg. F. The platinum or platinum-rhodium thermocouple is used up to 2,500 deg. or 3,000 deg. F., while the optical pyrometer is used above 2,500 deg. F. The base-metal resistance is not so constant, but the electromotive force is as constant as in the platinum theromocouple and several times greater. Readings are obtained by galvanometric or potentiometer methods.

steel sheath. The flanges of this sheath are pressed down with a 10-ton pressure, and upon installation of the terminals the space heater is complete. The individual heating element is made in several sizes up to 1,250 watts, and the maximum operating temperature is about 1,000 deg. F. or 800 deg. F. at the work. In the steel-clad heater a punched ribbon resistor of nickel steel is employed. This is laid flat between sheaths of mica insulation. For this type the maximum operating temperature is about 600 deg. F., or 450 deg. F. at the work. These elements are made in several sizes up to 1,000 watts. The terminals are at one end so the heaters may more readily be inserted in the work.

The space heater is employed in a great variety of applications. It may be assembled in any desired numbers, depending upon the purpose for which it is to be used. One particular purpose is for use in air heating. Other applications of the space heater or steel-clad heater are in foot warmers, such as are used in traffic regulation, industrial hot tables and restaurant grills,



A SAFETY THERMOSTAT CIRCUIT BREAKER FOR CONNECTION IN THE CONTROL CIRCUIT OF AN OVEN OR FURNACE—COVER ON OR COVER OFF

The resistor materials are arranged in some manner to form unit heating elements. Of these one of the most common is the grid-type heater made of nickel steel for immersion in oil, fats and greases. Still another is called the cartridge type, which consists of nichrome resistors wound on fireclay insulation and mounted in brass shells of various diameters to fit holes of different sizes. The wattage runs from 75 to 1,000 per heater and the maximum operating temperature is around 900 deg. F.; that is, 750 deg. F. at the work. These heaters are used in special machinery applications, largely in the rubber and shoe industries.

Still other types of heaters are the steel-clad and space heaters. These are so named because the heating elements are incased in steel and are designed to economize in space occupied. Mica insulation is employed for the space heater. The mica sheet is rolled into a tube on which the nichrome resistance ribbon is then wound. The tube is flattened, one terminal is placed at each end, and the flattened tube is then placed in a mica sheath, which in turn is placed in a heavy sheet-

heating of water tanks, mangle shoes and heating of pattern plates in molding machines.

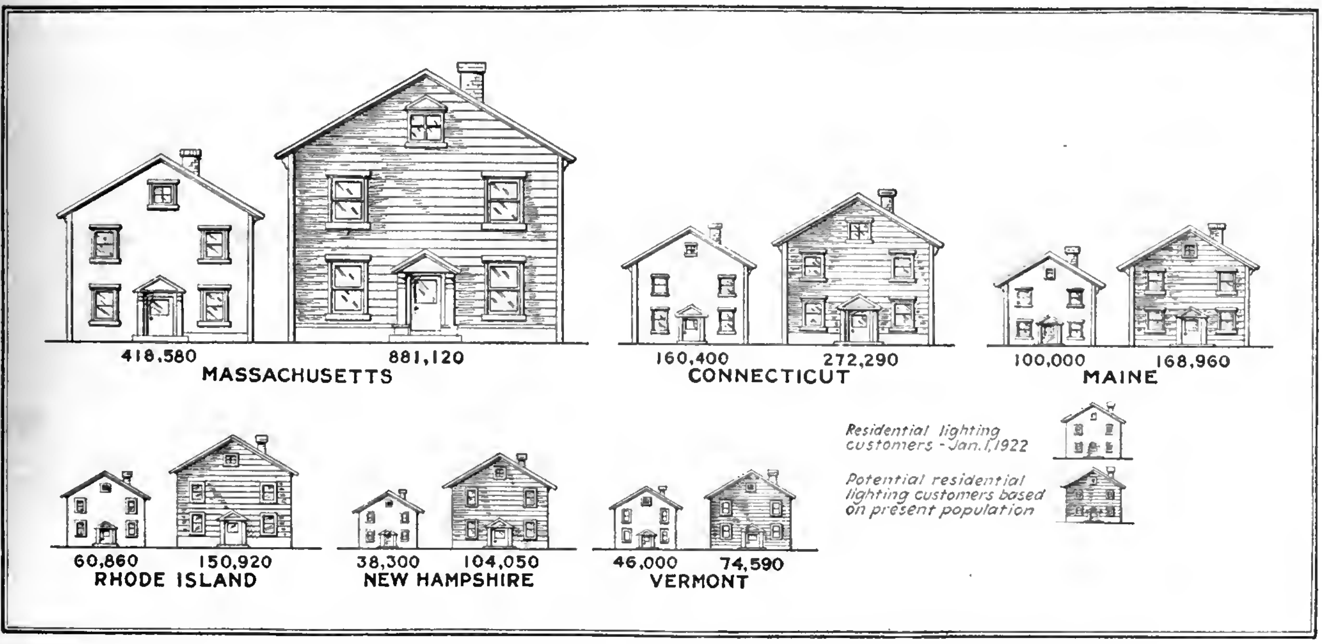
Still another type of heater is the industrial-oven heater. This consists of a nichrome resistance ribbon wound on fireclay insulators and mounted in a steel-rack frame of open construction. The element is made in various sizes from 1¾ kw. to 5 kw. for 110/220-volt service. The maximum operating temperature is around 900 deg. F., or 700 deg. F. at the work. Standard connectors and hooks for hanging in position are provided, and two 110-volt heating elements may be connected in series to operate on 220 volts, single-phase, or two 220-volt heating elements may be connected in series to operate on 440 volts, single-phase. Six 110-volt heating elements may be connected three-phase for operation either on 110-volt or on 220-volt, three-phase circuits. The installation and the connection of these heaters in the industrial ovens is a very simple matter indeed.

The control of the electric heating oven is a very important part of the operating process. As previ-

ously indicated, this is insured by means of the thermostat, or thermocouple and controlling pyrometer if the temperature is high. For a small industrial-oven installation a single-section control panel is employed. For example, for a capacity of 40 kw., or the equivalent of 120 amp., three-phase, 220 volts a single panel is used. For a larger oven or furnace installation individual section control panels are grouped into a board. For example, 2,200 kw. of heat at 550 volts employed in air heating in a large cotton mill of the Canadian Cotton Company near St. Stephen's, N. B., is controlled from two switchboards into which the individual sections are grouped. When grouping the control in this way the sectionalizing switches are usually segregated at one part of the board and the main automatic control contactors at another part. In some installations it is considered desirable to have a safety thermostatic circuit breaker connected in the regular control circuit in such a manner as to cause the opening of the main contactor in case the temperature accidentally becomes too high. This feature has been employed especially in armature insulation baking.

# Potential Customers in New England Total 2,069,000

"Electrical World's" Estimate of Present and Potential Customers of the New England States by Counties Indicates that a Total of About 48.3 per Cent of the Homes in This Section Are Electrified




IT IS POSSIBLE FOR THE NEW ENGLAND CENTRAL STATIONS AS A WHOLE TO DOUBLE THE PRESENT NUMBER OF DOMESTIC LIGHTING CUSTOMERS

ONE of the greatest problems involved in the distribution of electrical energy and of electrical apparatus and supplies is to obtain a reasonably accurate and detailed knowledge of the extent of the present market and of the potential possibilities of the market which is to be served. Given such a basis, it is a comparatively simple matter to apportion this market and to lay plans to take care of its future development.

With the idea of supplying this need, the ELECTRICAL WORLD has initiated a series of investigations which it is hoped will give the industry a reasonably accurate basis for ascertaining the extent of the present market for electrical energy and electrical apparatus and supplies in any desired locality and also for prognosticating the future market in that locality.

The first study undertaken is a segregation of the present central-station customers into the various counties of the states and an estimate of the potential number of the various classes of customers in each county under present conditions of population. Such figures are presented in the accompanying table for the various counties of the six New England States.

This study is based upon reports which have been received by the ELECTRICAL WORLD from operating companies representing about 70 per cent of the installed generator rating of the country supplemented by population and industrial power data issued by the United States Census Bureau. The data obtained in this way were referred to a representative company operating in the county concerned with the request that an opinion be given as to whether the data represent with a fair degree of accuracy conditions existent in that county. In the few cases where the company to which the figures were sent indicated that the ELECTRICAL WORLD figures were at variance with conditions in the

county a new study was made and the data were corrected accordingly.

The method used in determining the number of potential residential lighting customers, potential commercial lighting customers and potential industrial power customers was adopted after careful study. To arrive at the number of potential domestic lighting customers of any county it was assumed that all the families residing in the urban districts of that county fall within this category. It was also assumed that all the families residing in rural towns are potential domestic lighting customers, and that 50 per cent of the remaining families in rural districts are potential customers. Adding these three quantities gives the total potential domestic lighting customers of the county.

The number of potential commercial lighting customers was estimated by determining the present number of commercial lighting customers in the towns and cities reached by central-station lines and assuming that this number bears the same relation to the potential commercial lighting customers as the present number of domestic lighting customers in these towns and cities bears to the number of potential domestic lighting customers.

## Present and Potential Central-Station Customers in the New England States by Counties

| State and County | Population (Census of 1920) | | | Domestic Lighting Customers | | Commercial Lighting Customers | | Industrial Power Customers | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Urban* | Rural | Total (Jan. 1, 1922) | Total Potential (Including Present Customers) | Total (Jan. 1, 1922) | Total Potential (Including Present Customers) | Total (Jan. 1, 1922) | Total Potential (Including Present Customers) |
| MAINE | 768,014 | 551,055 | 216,959 | 100,000 | 168,960 | 24,600 | 37,190 | 4,790 | 16,260 |
| Androscoggin | 65,796 | 60,522 | 5,274 | 9,380 | 14,880 | 2,600 | 3,900 | 440 | 2,090 |
| Aroostook | 81,728 | 39,554 | 42,174 | 6,010 | 12,130 | 1,710 | 2,560 | 290 | 840 |
| Cumberland | 124,376 | 111,188 | 13,188 | 18,430 | 29,680 | 4,740 | 7,120 | 1,090 | 2,890 |
| Franklin | 19,825 | 12,306 | 7,519 | 3,000 | 4,820 | 750 | 1,120 | 190 | 550 |
| Hancock | 30,361 | 10,048 | 20,313 | 3,320 | 6,450 | 710 | 1,070 | 250 | 730 |
| Kennebec | 63,844 | 49,905 | 13,939 | 8,620 | 14,220 | 2,250 | 3,380 | 370 | 1,490 |
| Knox | 26,245 | 20,296 | 5,949 | 4,260 | 7,060 | 910 | 1,360 | 280 | 820 |
| Lincoln | 15,976 | 10,787 | 5,189 | 2,600 | 4,270 | 570 | 860 | 130 | 380 |
| Oxford | 37,700 | 21,339 | 16,361 | 4,650 | 8,020 | 1,170 | 1,750 | 270 | 790 |
| Penobscot | 87,684 | 65,679 | 22,005 | 11,080 | 18,730 | 2,270 | 3,400 | 400 | 1,440 |
| Piscataquis | 20,554 | 13,738 | 6,816 | 2,360 | 4,170 | 600 | 900 | 100 | 290 |
| Sagadahoc | 23,021 | 19,587 | 3,434 | 3,480 | 5,560 | 890 | 1,330 | 210 | 400 |
| Somerset | 37,171 | 23,692 | 13,479 | 5,080 | 8,520 | 1,260 | 1,890 | 220 | 640 |
| Waldo | 21,328 | 9,064 | 12,264 | 2,780 | 5,050 | 380 | 870 | 100 | 790 |
| Washington | 41,709 | 22,210 | 19,499 | 3,980 | 7,780 | 950 | 1,420 | 230 | 670 |
| York | 70,696 | 61,140 | 9,556 | 10,970 | 17,620 | 2,840 | 4,260 | 220 | 1,450 |
| NEW HAMPSHIRE | 443,083 | 376,860 | 66,223 | 38,300 | 104,050 | 9,500 | 24,290 | 2,370 | 8,540 |
| Belknap | 21,178 | 19,908 | 1,270 | 2,360 | 6,270 | 580 | 1,490 | 120 | 470 |
| Carroll | 15,017 | 7,700 | 7,317 | 1,080 | 3,260 | 260 | 670 | 70 | 210 |
| Chesbire | 30,975 | 28,100 | 2,875 | 3,200 | 7,710 | 780 | 1,990 | 210 | 210 |
| Coos | 36,093 | 30,600 | 5,493 | 2,560 | 7,090 | 640 | 1,630 | 240 | 610 |
| Grafton | 40,572 | 38,182 | 2,390 | 4,500 | 12,160 | 1,110 | 2,850 | 200 | 610 |
| Hillsborough | 135,512 | 126,600 | 8,912 | 11,240 | 30,260 | 2,804 | 7,170 | 810 | 2,980 |
| Merrimack | 51,770 | 46,600 | 5,170 | 4,630 | 12,480 | 1,180 | 3,010 | 310 | 910 |
| Rockingham | 52,498 | 26,900 | 25,598 | 3,520 | 10,720 | 860 | 2,190 | 230 | 930 |
| Strafford | 38,546 | 36,300 | 2,246 | 3,470 | 9,260 | 860 | 2,190 | 80 | 640 |
| Sullivan | 20,922 | 15,970 | 4,952 | 1,740 | 4,840 | 430 | 1,100 | 100 | 300 |
| VERMONT | 352,428 | 204,464 | 147,864 | 46,000 | 74,590 | 11,510 | 18,570 | 2,260 | 3,780 |
| Addison | 18,666 | 4,531 | 14,135 | 1,370 | 2,820 | 250 | 520 | 110 | 190 |
| Bennington | 21,577 | 11,456 | 10,121 | 2,600 | 4,430 | 630 | 1,070 | 150 | 260 |
| Caledonia | 25,762 | 14,701 | 11,061 | 3,940 | 6,095 | 960 | 1,490 | 160 | 280 |
| Chittenden | 43,708 | 28,956 | 14,752 | 5,100 | 8,515 | 1,340 | 2,240 | 310 | 660 |
| Essex | 7,364 | 2,653 | 4,711 | 790 | 1,390 | 190 | 330 | 20 | 30 |
| Franklin | 30,026 | 17,857 | 12,169 | 3,490 | 5,930 | 870 | 1,480 | 90 | 160 |
| Grand Isle | 3,784 | 0 | 3,784 | 90 | 455 | 10 | 50 | 10 | 20 |
| Lamoille | 11,858 | 7,398 | 4,460 | 1,660 | 2,625 | 420 | 660 | 80 | 140 |
| Orange | 17,279 | 6,506 | 10,773 | 2,280 | 3,855 | 510 | 860 | 100 | 170 |
| Orleans | 23,913 | 8,979 | 14,934 | 3,020 | 4,905 | 780 | 1,280 | 90 | 160 |
| Rutland | 46,213 | 31,796 | 14,417 | 6,270 | 9,955 | 1,620 | 2,580 | 290 | 460 |
| Washington | 38,921 | 30,178 | 8,743 | 6,320 | 9,275 | 1,680 | 2,460 | 520 | 680 |
| Windham | 26,373 | 14,385 | 11,888 | 3,670 | 5,865 | 840 | 1,340 | 170 | 290 |
| Windsor | 36,984 | 25,068 | 11,916 | 5,400 | 8,475 | 1,410 | 2,210 | 160 | 280 |
| MASSACHUSETTS | 3,852,356 | ........ | ........ | 416,580 | 881,120 | 96,710 | 176,800 | 20,930 | 44,930 |
| Barnstable | 26,670 | ........ | ........ | 3,840 | 7,750 | 600 | 1,210 | 50 | 90 |
| Berkshire | 113,033 | ........ | ........ | 13,020 | 26,300 | 2,020 | 4,080 | 310 | 1,010 |
| Bristol | 359,005 | ........ | ........ | 38,700 | 78,100 | 6,000 | 12,100 | 900 | 4,170 |
| Dukes | 4,372 | ........ | ........ | 630 | 1,270 | 100 | 200 | 20 | 40 |
| Essex | 482,156 | ........ | ........ | 55,300 | 111,600 | 8,560 | 17,300 | 1,850 | 7,170 |
| Franklin | 49,361 | ........ | ........ | 5,950 | 12,020 | 920 | 1,860 | 320 | 490 |
| Hampden | 300,305 | ........ | ........ | 41,840 | 75,000 | 10,460 | 15,000 | 3,490 | 5,000 |
| Hampshire | 69,599 | ........ | ........ | 7,670 | 15,500 | 1,190 | 2,400 | 420 | 640 |
| Middlesex | 778,352 | ........ | ........ | 89,000 | 179,500 | 14,310 | 28,850 | 2,320 | 4,800 |
| Nantucket | 2,797 | ........ | ........ | 430 | 880 | 70 | 140 | 10 | 20 |
| Norfolk | 219,081 | ........ | ........ | 33,000 | 50,000 | 7,300 | 14,600 | 910 | 1,560 |
| Plymouth | 156,968 | ........ | ........ | 19,200 | 38,700 | 2,960 | 5,960 | 630 | 1,570 |
| Suffolk | 835,522 | ........ | ........ | 58,000 | 183,700 | 34,500 | 57,500 | 7,260 | 13,200 |
| Worcester | 455,135 | ........ | ........ | 50,000 | 100,800 | 7,720 | 15,600 | 2,440 | 5,170 |
| RHODE ISLAND | 604,397 | ........ | ........ | 60,860 | 137,970 | 10,690 | 23,990 | 3,800 | 10,020 |
| Bristol | 23,113 | ........ | ........ | 2,150 | 5,110 | 370 | 900 | 90 | 240 |
| Kent | 38,269 | ........ | ........ | 6,790 | 9,660 | 1,360 | 1,830 | 260 | 360 |
| Newport | 42,893 | ........ | ........ | 3,990 | 9,480 | 690 | 1,640 | 140 | 390 |
| Providence | 475,190 | ........ | ........ | 45,200 | 107,250 | 7,800 | 18,500 | 3,240 | 8,780 |
| Washington | 24,932 | ........ | ........ | 2,730 | 6,470 | 470 | 1,120 | 70 | 250 |
| CONNECTICUT | 1,380,631 | 1,016,227 | 364,404 | 160,400 | 272,790 | 27,570 | 47,520 | 9,330 | 19,390 |
| Fairfield | 320,936 | 243,158 | 77,778 | 36,280 | 65,200 | 6,410 | 11,500 | 2,030 | 4,680 |
| Hartford | 336,027 | 241,360 | 94,667 | 44,920 | 63,770 | 7,370 | 11,030 | 3,130 | 3,860 |
| Litchfield | 76,262 | 38,911 | 37,351 | 6,910 | 14,010 | 1,130 | 2,290 | 300 | 1,060 |
| Middlesex | 47,550 | 26,059 | 21,491 | 4,340 | 8,560 | 720 | 1,420 | 470 | 870 |
| New Haven | 415,214 | 350,571 | 64,643 | 48,790 | 84,850 | 8,760 | 15,240 | 2,390 | 6,810 |
| New London | 104,611 | 64,533 | 40,078 | 10,440 | 20,140 | 1,670 | 3,220 | 600 | 1,190 |
| Tolland | 27,216 | 19,300 | 7,916 | 3,290 | 5,910 | 580 | 1,040 | 170 | 300 |
| Windham | 52,815 | 32,335 | 20,480 | 5,430 | 10,350 | 930 | 1,780 | 240 | 620 |

* Cities and towns over 1,000 population.

# Central Stations and Technical Schools*

## Need of Closer Relations Between Operating Companies and Educational Institutions — Mutual Benefits of Co-operative Courses— What Is Being Done by the Brooklyn Edison Company

By M. S. SLOAN
*President Brooklyn Edison Company*

TECHNICAL training has progressed in the past thirty or forty years to the point where the graduate of a two-year industrial training course probably knows more about electricity than Edison did when he built the Pearl Street station in New York City. What will the future require of men entering the industry in comparison with our present needs?

We must sharply differentiate between the two types of educational institutions and the two types of training for which we have use in our industry. First and more extensive, there is the trade or vocational training, which fits men for various manual or semi-manual employments, which produces the rank and file and the non-commissioned officers of the industry; second, there is the professional or university training which provides staff and line officers.

There are in the country today a few good vocational schools—all too few, be it said. To these we should give every possible encouragement and guidance, and to them our industry can offer very much in the way of direct, specific, tangible help. These schools take young men fresh from high school, or without even a high-school diploma, give them familiarity with the specific arts and methods of the various industries, train them in process, acquaint them with fact and incidentally teach them how to think.

To such schools we can supply much detailed information concerning the needs of our industry. For them we can supply opportunity for inspection trips and to some degree field tests. With them it is possible for us to develop co-operative relations wherein the students may be employed on part time on our properties. To them we can send some of our more promising men for night or part-time day instruction, ourselves deriving a direct benefit through specific individuals among the student body.

### Fundamentals Basis in Professional Training

In the other class stand the great professional schools and universities which, on more or less rigid entrance requirements, admit students from preparatory schools, which give those students training intended not primarily to make them of direct value to my company or to yours, to this particular industry or to that; but which do plan with a certain amount of training in the specific arts to produce first a trained mind, the power to observe, intellectual vigor and a sense of discrimination.

Our service to such schools and the service which we may expect to receive from them must of necessity be indirect, somewhat intangible and general in character. As these schools do not pretend to communicate to their students the specific and immediate facts of today concerning the industry, what we can contribute to them in the way of information must of necessity be of value only as the faculties themselves can use this information as source material on which to base their educational process. Remote and intangible though such co-operative effort must of necessity be, it is at the same time well worth the making.

I am profoundly convinced that much of the difficulty which we have had with the so-called socialistic college professor is not a result of any fundamental incapacity to think or of perversity of either spirit or mind, but is rather the direct consequence of the fact that he does not know either the facts of our industry or us as individuals. Anything we can do, then, to bring ourselves in touch with professors of economics and business administration, of law and political science, in our institutions of higher learning will, unless our industry is on a lower plane than I conceive it to be, have the effect of giving these men the opportunity which they as searching apostles of truth should, and I believe do, welcome to get the basic facts from which their conclusions must be drawn.

The academic mind runs pretty straight once started in the right direction, but given an initial prejudice, runs equally straight under that impetus.

### Research Fellowships Point the Way

I can conceive of no greater co-operative service, valuable alike to our universities as institutions where above all else the truth is esteemed and to us, who desire above all else that the truth about us shall be believed, than that we should, through the establishment of research fellowships, offer our industry as source material for graduate students and professors competent to make a study of public utility problems. More will be heard of this in the not distant future through the N. E. L. A. committee on co-operation with educational institutions, in whose work my own company is taking a very active interest.

Both in industry and in academic circles there is a persistent query as to what the schools can do for industry, meaning thereby what direct, tangible things the schools can do to stimulate our industrial activities and to increase our prosperity. Without disparagement of the value of research and of the solution of our specific problems, I suggest that the greatest service which any school can possibly render to the nation and to industry is to be an *educational* institution. The chief reason for the existence of our universities is to prepare young men for life and for the service of society. So long as specific undertakings contribute to that purpose, these specific undertakings are to be encouraged; but above all else, if our civilization is to be progressive, the schools must produce men who can advance human knowledge and the application of it to the well-being of humanity.

Many young men fresh from college have a tremen-

*From a paper presented before the New England Division of the N. E. L. A. at a public policy session in Boston, March 8, 1923.

dous store of "facts" which would be so if they were true! They know how to design anything from a major power plant up, but do not have their feet securely on the ground when it come to rigorous thinking from facts carefully observed. We must encourage our colleges to teach little, to teach that little well, and to develop in the students the habit of work.

In earlier days young men gained their acquaintance with our industries through apprenticeships at nominal wage, at no wage at all, or sometimes even paying for the privilege. That day is past. The young man fresh from college can today earn a living wage which will enable him to keep body and soul together until he has developed some practical value. I believe it to be our responsibility to create more full opportunity for the modern equivalent of the old type of apprenticeship —something after the fashion earlier established by the Santa Fé Railroad and by the great manufacturing companies in the electrical industry. My own company now has in formation a cadet course for college graduates. We may take on more young men than we can ultimately absorb. Future opportunity for them must be created either by graduating out of the company bureau heads who can go to larger responsibility with other concerns or through losing some of our cadets after a year or two of experience with us. What we have invested in the entire group will doubtless be repaid through an opportunity to select from the group whatever percentage we are able ultimately to retain.

#### Co-operation with the Brooklyn Polytechnic

With the other type of institution and with its possibilities of service to us we have had nearly a year of actual experience. We formerly had in our company an educational department internally manned. For various reasons the results were not altogether satisfactory. We have in Brooklyn one of the best of semi-vocational schools—the Brooklyn Polytechnic Institute. Like few other institutions of its class, it approaches closely to the university standard. This institute is headed by Dr. F. W. Atkinson, a man of the highest attainments, of broad perspective, a splendid administrator, and with an admirable faculty under him. Being peculiarly a Brooklyn organization and convenient to our work it occurred to me as a trustee of the institute that the Brooklyn Edison Company might profitably use it in improving the utility's training courses.

We created in the department of economics and statistics a Bureau of Education, under the immediate supervision of Prof. Robin Beach of the institute's electrical engineering department. In the educational work given to company employees we have been able to utilize members of the institute faculty and company employees. The former have been placed on the company payroll at modest but at the same time adequate salaries. Some twenty-five of our own employees, department and bureau heads for the most part, are used as special instructors and lecturers. To these latter we pay an "honorarium" of $5 per evening. Courses are offered under two general classifications, technical and commercial. The former cover such subjects as the elements of electricity, direct-current and alternating-current machinery, meter practice, principles of combustion, switchboard operation and industrial applications. The latter include such topics as sales of electrical appliances, theory and practice of filing, personnel and office efficiency, accounting, general organization, sales department organization and English.

Although most of these courses are offered in the evening, some are given at daytime hours convenient to men working on the night shift. Usually the sessions last one hour, but two hours are allotted to laboratory sessions. Four courses last about eight weeks, but most of them run twenty-five weeks.

#### One-fifth of the Brooklyn Edison Company Employees Enrolled

Against 209 enrolled students in company courses last year, we now have 934 enrolled in the co-operative courses. The course elections last year were 217; now they are 1,364. Twenty-one and one-half per cent of our employees are registered in courses, the secretary's department having a 71 per cent enrollment, one engineering department 57 per cent and the sales department 44 per cent. Attendance and interest have been most satisfactory.

As this work is vocational training and not a process of general education, we are attempting to relate the subject matter of the courses as closely as may be to the specific problems occurring in the company's work. I do not believe that good results flow from doing so much for an employee as to make him feel that he is the subject of a kindly paternalism. We have, therefore, required those enrolling to pay a fee at the time of electing the course, but in recognition of the earnestness and application of those who complete the courses satisfactorily the fee is refunded at the conclusion of the instruction.

While it is too early to discuss definite results, I and all my department heads are sensible of certain benefits which were predicted by Professor Beach. These are mutual to the institute and to the company. The advantages to the company reside in the fact that under a centralized system of company industrial education employees are efficiently, economically, expeditiously and consistently trained to perform their duties. Their perspective becomes broadened so that they grasp better the relation of their work to the general activities of the company. Whatever increases the earning capacity of employees increases their value to the company. This educational opportunity serves to draw together employees of different departments in a common undertaking, thereby promoting mutual appreciation.

Our practical men, on the other hand, communicate through their lectures something which the schoolmen can use with a great deal of advantage in their regular work in the institute. We have gladly placed at the disposal of the institute much of our machinery and equipment and have encouraged inspections of our properties by faculty and students. The faculty derives opportunity to keep in touch with our most recent advances, to gage the needs of at least one industry and to find an outlet for institute graduates. We are incidentally creating some opportunity for the institute instructors to collaborate with our engineers and investigators on certain special problems.

I do not mean to say that we have worked this problem through to anything like its final conclusion, but the results are so good that we cannot consider as anything other than profitable the increase of our 1921-1922 educational budget from $12,000 to $17,000 for 1922-1923, and I am not in the least degree hesitant in suggesting that no company which has closely at hand such an institution as the Brooklyn Polytechnic Institute can afford not to utilize its faculties and its laboratories in carrying on a company educational program.

# Experience with the Radiophone

## First Report of Any Length Relating the San Joaquin Light & Power Corporation's Experience with Radio—Conditions that Led to the Adoption of Equipment—50-Watt Tubes Used—Consistent Reception Reported from Distance

By R. C. DENNY

*Operating Engineer San Joaquin Light & Power Corporation, Fresno, Calif.*

COGNIZANT of the need of an emergency means of communication to carry on system dispatching during periods when the telephone lines were from any case disabled, the San Joaquin Light & Power Corporation of Fresno, Cal., in the fall of 1921 undertook the development of a practical radiophone. The chief requirement in such an instrument was that of consistent operation day or night over a maximum radius of 135 miles from the dispatcher's office at Fresno in a southwesterly direction. The distance requirements in other directions were approximately half as great, but, owing to the fact that these shorter distances were over a mountainous country into deep canyons, the requirements were quite severe, nevertheless.

The fact that transmission was desired in all directions out from the operating center of the system rather eliminated the "wired wireless" or carrier-current system, with its limitations, from consideration. Moreover, the failure of communication is in the majority of cases incidental or secondary to failures of the transmission lines, which, in case either telephone lines or transmission lines were used for the purpose, would render the carrier system useless just at the time it was most needed.

### System Used Must Be Reliable in Emergencies

Obviously, then, to be practicable under the most adverse conditions emergency communication must be entirely separate and independent of the lines. Manifestly, it is only adverse conditions constituting emergencies that really justify any system of radio, as fully 95 per cent of the time the line telephone system functions properly and is entirely adequate. Therefore, in view of the notorious inefficiency of radio transmission, it would seem extremely uneconomical to use any form of radio where the telephone would suffice, except, of course, for emergencies.

Particularly is this true in cases in which radio is applied to systems where telephone lines already exist and where they are strung beneath the transmission lines. It is admittedly a fact that on new projects where long transmission lines are to be built the carrier-current telephone system may be used for routine work over the transmission conductors in lieu of building separate telephone lines. A saving can be thus effected provided that the initial cost of the carrier-current apparatus is kept down within reason. However, unless the transmission lines are provided in duplicate it is rather doubtful whether the carrier system would suffice in the case of line failures where one or several spans have come down or are tangled up and grounded.

Thus it is very dubious whether the carrier-current system will be of any great value in emergencies. At any rate, it becomes rather apparent that each of the two systems of communication has its own field—the radiophone where an extensive interconnected transmission network of one, two or three voltages is to be talked over in any or all directions, and the carrier-current scheme for talking over especiallly long and important transmission lines where communication is desired only at the terminals. In fact, several companies are adapting the carrier-current system to certain more important stretches of their transmission system because of the government radio regulations, which are rather inclined to handicap the use of the radiophone even for emergency operation. Whether carrier current will prove entirely successful in emergencies is yet to be demonstrated.


FRONT AND REAR VIEWS OF 50-WATT RADIOPHONE SET

The power tubes and rectifiers are mounted on the top shelf, the oscillatory circuits and apparatus on the next shelf, the filter and choke system below, and the power supply equipment on the bottom shelf.

Another requirement to be met in the development of a practical radiophone for emergency use was that it should not cost one whit more than was commensurable with successful and consistent operation. Still another was that it should be simple in operation and adjustments and involve low maintenance expense. With these and the distance requirements in mind the writer set about the development of such a radio-telephone set. At that time, and with only the experiences of two other radio-telephone installations to be judged from, it was

decided that a set of 50 watts output rating, if that output were properly modulated, would meet the distance requirements. Advice from several of the large manufacturers that at least 250 watts would be required, and that 1,000 watts was recommended, did not affect the original decision.

From the outset it was decided to eliminate the one item of greatest expense formerly used in such sets, that being the motor-generator set for the production of high-voltage direct current. Experiments with an electrolytic rectifier proved conclusively that alternating current could be used if the resultant pulsating direct current could be sufficiently filtered or smoothed out to minimize if not eliminate the fundamental hum. It was soon demonstrated, though, that, because of overheating, the chemical device for rectification was inadequate for constant use on currents even as low as 300 milliamperes at 1,000 volts. Besides being very inefficient, it was cumbersome and "mussy," which militated against its use in a compact and finished set. Having served the very useful purpose of demonstrating the possibilities of rectified alternating current, it was discarded in favor of vacuum-tube rectifiers.

### Heat Filaments with Alternating Current

It was also very desirable to use alternating current for heating the filaments of the various vacuum tubes to be used in the set. Besides being more economical than using storage batteries and much more simple as well than low-voltage generators, and more easily regulated, it actually results in a longer filament life as emission is more even from all parts of the filament. In actual service it was found very feasible to use alternating current for this purpose if certain precautions were taken. One was to bring out the center tap of the transformer winding for connection with the negative high-voltage lead which forms the negative or common connection for the entire set. Telephone condensers rated at 1 mf. should be bridged across from this center tap to each end of the winding, these to serve as a low-impedance path or bypass for the high-frequency currents from the oscillator tube. Ordinary potential transformers were rebuilt or remodeled for the purposes of filament heating and high voltage for the rectifier, and these, too, proved to be inadequate owing to overheating when used continuously. However, they served their purpose, permitting the experiments to be carried on while properly designed apparatus of adequate capacity was being developed.

One thing that became apparent in the early stages of the experiments was the necessity for low antenna resistance. An aërial and ground system that had been perfectly satisfactory for the spark system of radio telegraphy, employing spark frequencies on the order of 1,000 per second, would not serve at all for the high frequency of the radiophone carrier wave, which was something over 833,000 cycles at the particular wave length at which the experiments were carried on. Accordingly a counter-capacity antenna or counterpoise was designed having the same physical dimensions as the antenna and erected directly beneath it and parallel to it at a distance of 40 ft., this being influenced by local conditions. Every precaution was taken to keep the ohmic resistance as low as possible, stranded copper conductors being used, heavy leads employed and all joints soldered. A marked increase in radiation was the result, practically three and one-half times the former current. It was found possible to increase the radiation further by connecting the ground lead to a certain point on the inductance coil, so that with the combination of counterpoise and ground connection radiation was four times that obtained with ground alone.

In order to bring in reports from all directions on the operations during the experimental development of the radiophone it was necessary to do a certain amount of broadcasting. Another and fully as important reason for broadcasting was to stimulate an interest in radio among the power-house and substation employees about the system. It was considered that such interest was vitally important to the successful future operation of an emergency radiophone service. This was done under an experimental license until a ruling of the Department of Commerce necessitated taking out a special broadcasting license for the purpose. It was thus that the company's broadcasting station KMJ came into existence, but with the idea of a broadcasting station secondary to the development of the set for use in emergency communication.

After many months of delay occasioned by the inability to get satisfactory tubes and apparatus, hardly any of which were more than out of the experimental stage and on a production basis, a complete set of standard parts was evolved. A satisfactory filter system had in this time been developed, utilizing the primary winding of a 1-kw., 2,300-volt distribution transformer as a choke, the two coils each in series with one side of the rectified high-voltage supply. Three 1-mf. condensers insulated for 1,750 volts were shunted across this circuit on the power side and one on the radio side.

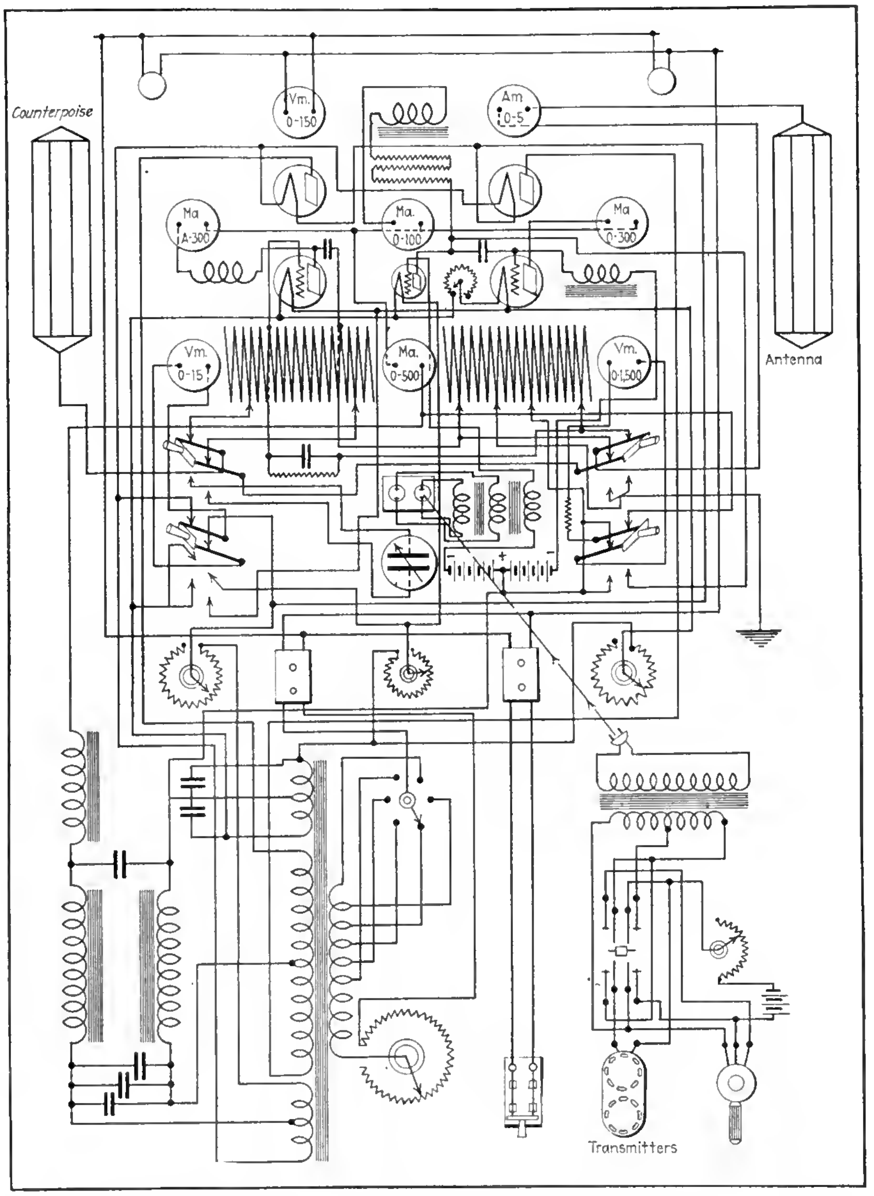
A special but standard transformer of 750 watts rating was used for the one source of power. This transformer has one primary winding, with taps for operation on from 102.5 volts to 115 volts, and three secondary windings, two of which give 10.5 volts for filament heating and one 3,000 volts for the rectifier tubes. Each of these secondary windings has its center tap brought out, a connection which is absolutely essential. It was found in actual practice that this transformer, which is of the dry type, when operating continuously at just full load for an hour at a time became dangerously hot. For this reason it was necessary to rearrange the terminal connections, soldering on long leads and sawing out sections of the end shells preparing the transformer for operation under oil. It was put into a 1-kw. distribution transformer case, submerged in oil, and the operation since has been entirely satisfactory. Owing to the primary voltage sometimes going above the transformer voltage rating, a 40-ohm rheostat is provided in the primary circuit.

Power for the set is supplied from the 115-volt lighting circuit of 60 cycles frequency. Entering the set through a fused knife switch it passes through a flush-type lock switch to the main power bus and thence to the bracket lamps and alternating-current voltmeter. This meter indicates which voltage tap to work on, so the tap selector switch is moved to the proper point and with the primary resistance all in the flush push switch is snapped on. The primary resistance is then cut out gradually and the set brought up to normal operation.

Power tubes of 50 watts output rating are used, one as an oscillator and the other as the modulator. The constant-current system of modulation is used in connection with a 5-watt speech amplifier. A special reactor

of 300 milliamperes capacity is used in the main positive lead to the plates. The power tubes require at least 1,000 volts on the plates, while the speech amplifier tube requires 350. A resistance of 15,000 ohms having a continuous carrying capacity of at least 50 milliamperes was found necessary to reduce the voltage to the proper value. This resistance was composed of three standard 5,000-ohm resistors. A direct-current voltmeter is provided which by means of a double-pole, double-throw switch may be thrown on the power-tube plate circuit or upon that of the amplifier tube. The rectifier tubes have an output rating of 150 watts each, and the two carry a load of 300 milliamperes at 1,300 volts without undue heating. Two standard rheostats of 15-amp. continuous carrying capacity are provided, one for each set of tubes that operate in multiple. An additional rheostat is provided for the modulator tube, which sometimes requires a slightly different adjustment from the oscillator. A separate rheostat is provided for the speech-amplifier tube, which requires a considerably lower voltage for its filament.

The constant-potential method of filament control is used rather than maintaining the constant rated current throughout the life of the tube. It is found that this method greatly prolongs the life of a tube, since the current is automatically reduced as the filament resistance increases because of disintegration. An alternating-current voltmeter is provided for this purpose which by means of a double-pole, three-way switch may be thrown upon either the rectifier tube bus or the power-tube bus or onto the speech-amplifier tube and the voltage adjusted by means of the respective rheostats. The plate current of the oscillator and modulator tubes and the speech-amplifier tubes are indicated separately by milliammeters and collectively by one meter which gives the total load on the rectifier tubes.




WIRING DIAGRAM OF 50-WATT ALTERNATING-CURRENT-OPERATED RADIOPHONE TRANSMITTING SET OF SAN JOAQUIN LIGHT & POWER CORPORATION

### Oscillatory Circuit Arranged for Long and Short Wave Work

In the oscillatory circuit are utilized two standard inductance coils of twenty-five turns each, two fixed-capacity 3,000-volt mica condensers of 0.002 mf. each, one variable mercury-mica condenser of 0.0012 mf. insulated for 4,000 volts, and one 5,000-ohm resistor which is used as a grid leak on the oscillator tube. One of the inductance coils is to be used as a loading coil for long-wave work, while the variable condenser is for short-wave work, either of which may be introduced into the counterpoise lead by the proper operation of a double-pole, double-throw switch. Another double-pole, double-throw switch is provided, which is used either to connect the antenna and counterpoise to the active inductance or to ground them both. Small choke coils of 1 henry reactance at audio frequencies are inserted in the grid circuit of the modulator tube and the plate circuit of the speech amplifier to prevent the dissipation of the audio-frequency impulses and practically forcing the effect of the speech amplifier upon the grid of the modulator tube. A radio-frequency choke coil is inserted in the plate lead of the oscillator tube to prevent the high-frequency output of that tube getting back into the other circuits. The output or plate circuit of the speech-amplifier tubes is capacitatively coupled to the grid of the modulator by means of a ½-mf., 1,750-volt condenser. Negative potential for the grids of the two tubes is supplied by small dry batteries, the values approximating 30 volts.

A three-winding modulation transformer is used, the secondary of which connects with the grid of the speech-amplifier tube. The primary winding connects with a receptacle on the panel for external connection to the speech-input circuit. The tertiary or third winding also connects to a receptacle so that the input may be monitored by plugging a telephone receiver in on it. The microphone system, which is external to the trans-

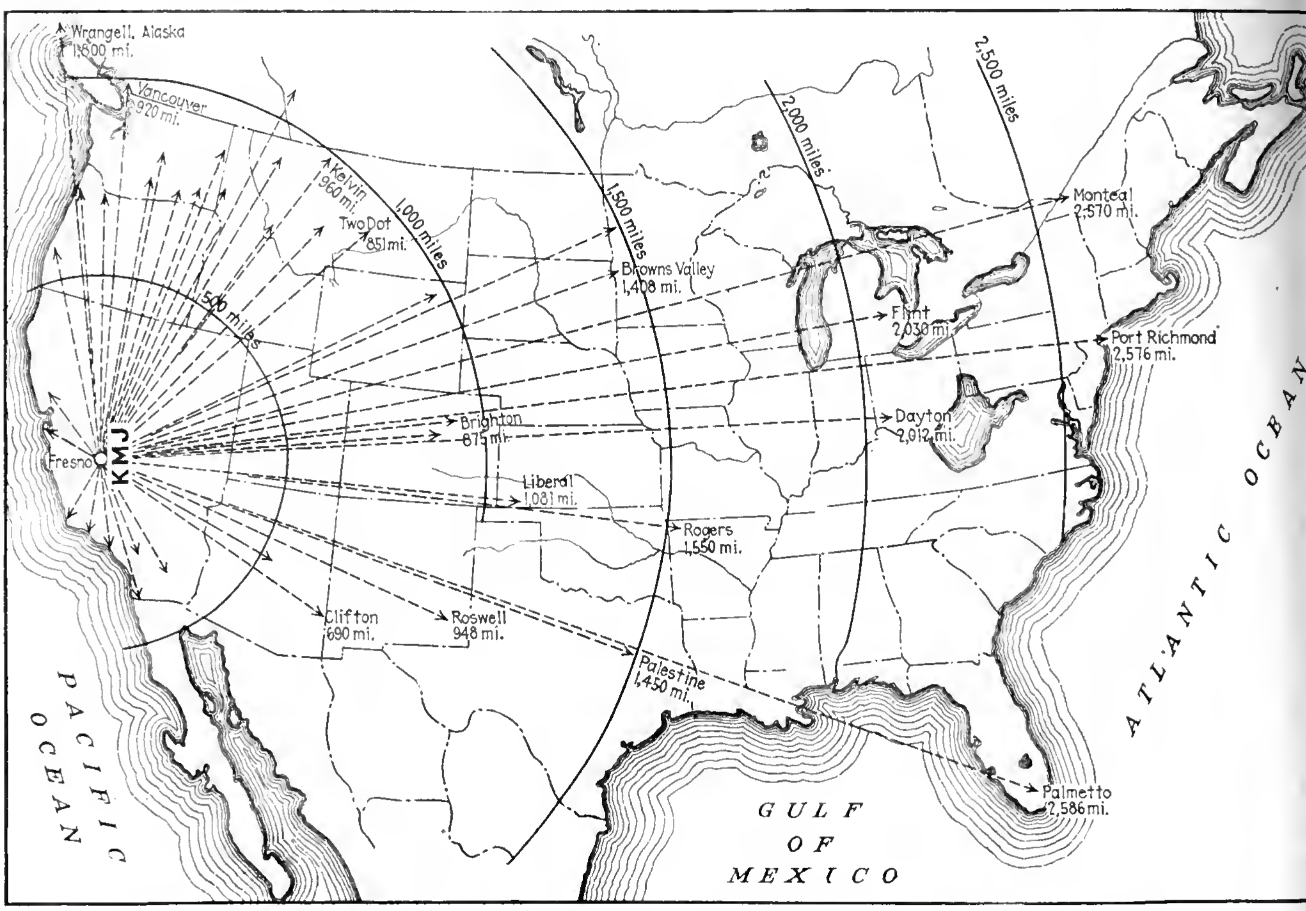
mitting set proper, consists of an induction coil with the center tap of the primary winding brought out for connection with the differential transmitter, which is a hand set used for announcing. The other transmitter is an especially sensitive device used for picking up vocal and instrumental music rendered in the studio. A four-point, double-throw telephone key switch serves to throw from one transmitter to the other, while the one battery and rheostat are used for both transmitters, the rheostat to control the volume.

The detailed description of the set may be followed with the aid of the wiring diagram reproduced. The set was designed by the writer and built up, switchboard style, in the shops of the company as illustrated in the accompanying front and interior photographs.

The fact that the set is principally used for broadcasting does not mean that it contains any special features except the pick-up transmitter, which does not materially add to the cost of the set. In fact, built of standard parts as it is, there is no reason why it cannot be duplicated by any power company having even meager shop facilities, at a total cost of $750. It may be built for even less, but hardly in such compact, shipshape form. It would be ill advised, however, to reduce the cost by eliminating any of the meters, as they are very essential to the proper adjustment of various circuits. Needless to say, the set may be used for carrier-wave transmission just as well as for radio, with certain additional apparatus for transferring the output to the lines.

Operating at normal power input rating, on a four-wire, flat-top T-type antenna 75 ft. high and 175 ft. long and a counterpoise of similar dimensions, this set has a normal radiation of 4 amp. at 360 m., which is indicated by a radio-frequency ammeter of the thermocouple type. Modulation, effected by speaking or whistling into the transmitter, produces from 0.2 amp. to 1 amp. variation in the radiation. This is known as the percentage modulation, and it is upon this that the voice range of the set depends to a large extent. It is possible to get a higher percentage modulation, but hardly without distortion.

Of the total number of reports on overland reception of speech and music from this set, 2 per cent were from stations more than 2,500 miles from Fresno, 1½ per cent between 2,500 and 2,000 miles, 2 per cent between 2,000 and 1,500 miles, 7 per cent between 1,500 and 1,000 miles, 51½ per cent between 1,000 and 500 miles and 37 per cent within 500 miles. Nearly every report pronounced modulation excellent and volume good. One person at a distance of 700 miles reported hearing ten consecutive concerts, which seems to prove the operation consistent. On several occasions conversations have been carried on by voice with Portland, Ore., a distance of 650 miles, and on one occasion with Denver, Colo., at 865 miles, the latter conversation being overheard in its entirety by a novice in Dayton, Ohio, 2,012 miles from Fresno. The remarkable thing about this record was that the novice used only a simple regenerative detector set without any amplification. These records were practically all made at 360 m. operation and subject to interference from a multitude of other stations broadcasting at the same or very nearly the same wave length.




LARGE PORTION OF UNITED STATES HEARS 50-WATT RADIOPHONE OF SAN JOAQUIN COMPANY AT FRESNO, CAL.
(Distance records obtained up to Feb. 23, 1923)

Therefore it is obvious that operating at much higher wave lengths, which would be the case in emergency operation as limited commercial stations, there would be virtually no interference and very consistent results would be had.

These records might seem to indicate that much more power than necessary was being used to cover the power system in question. Possibly so, but the power tube of the next smaller size has an output rating of only 5 watts, which is ostensibly not enough. Operating tubes in multiple to increase the output rating of a set is not particularly satisfactory without a complication of controls and meters, which immediately runs into expense. For such reasons it was considered inadvisable to experiment with less than a 50-watt tube; it was felt also that for operation through the summer months such capacity was not in any great excess for the service demand of the equipment.

### Continuity of Reception Largely a Matter of Training

Although it was not the intention that problems of reception should be within the scope of this article, the writer desires to remark that in his opinion the success of duplex operation of the radio telephone is going to hinge pretty much on the receiving end; but, after all, this is largely a matter of training the operating personnel. Broadcasting is having just that effect—not merely the San Joaquin corporation's efforts, but broadcasting in general is serving to acquaint the power man with receiving sets, getting him accustomed to the more or less delicate adjustments of the instruments. Numerous tests made about the San Joaquin system have well demonstrated the success of ordinary receiving sets employing one or two stages of audio-frequency amplification, connected with outdoor antennas. However, before duplex operation of the radiophone can be a complete success it will be necessary to resort to loop reception and radio-frequency amplification. This will permit stations transmitting at one wave length and, while transmitting, receiving at another wave length without interference from their own transmitter. This is the next problem to be attacked, now that much has been learned about radio-frequency amplification. A complete receiving set including a loud-speaking device should not cost more than $250, making a total investment of perhaps $1,000 for a complete two-way radio station.

## Making Water Work Upward

ARTESIAN wells are quite prevalent in the northern and middle parts of Florida, the necessary pressure evidently coming from some northern elevation, perhaps the Appalachians. It occurred to a local inventor with some vision that a water pressure upward is, as a source of power, just as good as the usual pressure downward. So he developed some small reaction turbines which could be mounted directly over an artesian well. They are made in sizes from 150 watts to 2,000 watts, directly connected to 32-volt or 110-volt direct-current generators. A storage battery is used with each outfit, and the main purpose of the generator is that of charging the battery continuously at a low rate.

The conditions are such that no centrifugal governor or electric regulator is necessary, and the outfit is exceedingly simple. Since an overflow is desirable, anyway, to keep an artesian well in a good condition, the farmer gets his light and power and still has his irrigation water. This method for producing power locally can be applied to advantage in several localities along the Gulf Coast where these artesian wells are found.

## Chemicals Produced by the Aid of Electricity

THE Department of Commerce announces that the reports made to the Bureau of the Census show a production of chemicals by processes involving the use of electricity of the value of $58,180,500 in 1921, as compared with $82,590,000 in 1919, a decrease of almost 30 per cent. In 1914 the value of chemicals produced by the aid of electricity was only $29,661,949. The increase, therefore, for the seven-year period, 1921-1914, was 96 per cent. The establishments reporting were 127 in number in 1921, 114 in 1919 and 36 in 1914. The principal products so produced, named in the order of value, are aluminum, the ferro-alloys, calcium carbide, chlorine bleaches (including chlorine and the hypochlorites), sodium hydroxide, the abrasives (including aluminous and siliceous), peroxide of hydrogen and oxygen. Many of these products serve as basic raw material for the production of a great variety of other chemicals.

Detailed statistics for 1921 and 1919 are given in the accompanying table. The statistics for 1921 are preliminary, and subject to such change and correction as may be necessary from a further examination of the original reports.

CHEMICALS PRODUCED WITH THE AID OF ELECTRICITY

| | 1921 | | 1919 | |
|---|---|---|---|---|
| | Quantity | Value | Quantity | Value |
| Chlorine Bleaches: | | | | |
| Chlorine (for sale), lb. | 36,211,000 | $1,955,900 | 34,392,000 | $1,425,917 |
| Hypochlorites, lb. | 168,774,000 | 4,509,500 | 252,850,000 | 4,781,348 |
| Hydrogen, cu. ft. | 92,757,000 | 639,600 | 137,082,000 | 851,397 |
| Oxygen, cu. ft. | 136,460,000 | 1,791,900 | 131,477,000 | 1,855,911 |
| Sodium hydroxide (for sale), lb. | 133,662,000 | 5,975,000 | 173,021,000 | 6,228,682 |
| Abrasives, aluminous and siliceous lb. | 23,533,000 | 5,500,300 | | |
| Bromine (for sale), lb. | 187,400 | 28,400 | | |
| Calcium carbide, net tons | 69,300 | 7,482,000 | | |
| Ferro-alloys, net tons | 48,500 | 8,835,400 | | |
| Halogen Derivatives (for sale): | | | | |
| Inorganic,[1] lb. | 10,217,500 | 214,100 | | |
| Organic,[2] lb. | 5,289,400 | 777,500 | | |
| Oxidized halogen compounds,[3] lb. | 5,136,500 | 410,800 | ........ | 67,446,750 |
| Peroxide of hydrogen, lb. | 27,296,000 | 2,157,600 | | |
| Peroxides and persalts,[4] lb. | 5,564,000 | 1,204,300 | | |
| Rare metals and alloys,[5] lb. | 1,078,000 | 1,289,400 | | |
| Metals n.e.s. (for sale),[6] lb. | 60,643,000 | 12,197,000 | | |
| Miscellaneous (for sale),[7] lb. | 35,624,000 | 3,211,800 | | |
| Total value | | $58,180,500 | | $82,590,005 |

[1]Hydrochloric acid, sulphur, zinc and iron chlorides, silicon tetrachloride, etc.
[2]Carbon tetrachloride, chloroform, iodoform, bromoform, ethyl chloride, etc.
[3]Sodium iodate, chlorate, bromate, etc.
[4]Peroxide of sodium, of barium, perchlorate of potassium, perborate of sodium, other peroxides, permanganates, persulphates, etc.
[5]Chromium, chromium-cobalt, magnesium, manganese, molybdenum, silicon, silico-manganese, tungsten, vanadium, etc.
[6]Aluminum, aluminum alloys, sodium, phosphorus and compounds.
[7]Sodium cyanide, carbon electrodes, carbon bisulphide, nitrites, oxalic acid, vanadic acid, hypophosphites, etc.

# Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

## Charging for Reactive Kva.-Hours and Active Kva.-Hours Separately

*To the Editors of the* ELEC RICAL WORLD:

The question is frequently raised: "Would it not be better to have the active component and reactive component of the kva. registered separately and have a different rate for each of them?"

Personally, I do not believe that public service commissions will ever allow such a charge to be made against customers. Public utilities must show costs in nearly every instance as a basis for the price of that which they sell. The cost of producing a reactive volt-ampere-hour is not in any way a fixed figure. For instance, a customer with a small load at 0.707 power factor would carry equal values of reactive kva.-hours and kilowatt-hours; a customer with a larger installation operating, say, at 95 per cent power factor might show the same value in reactive kva.-hours and hence pay the same price as paid by the customer with lower power factor. I do not believe any utility can show that a reactive volt-ampere-hour costs it a definite amount at any time, and certainly it does not represent any useful value to the customer, since the rating of electrical generating substations and distribution equipment is in volt-amperes.

However, a utility can show that with a certain volt-ampere demand a certain percentage of its capacity is tied up, and it can assign to this a definite value. The same is true if the bill is corrected by a power-factor clause which is properly worked out, although the power-factor clause complicates both the calculation of the customer's account and the metering of his load.

R. C. FRYER,
Superintendent Electric Meters.

Union Gas & Electric Company,
Cincinnati, Ohio.

## A Student's Viewpoint

*To the Editors of the* ELECTRICAL WORLD:

I should like to come to the defense of the instructor mentioned in a recent letter in the ELECTRICAL WORLD: "Where the College Instructor Falls Short." At present I am a student of electrical engineering and have had some practical experience in that work. The average man who expects to matriculate into a technical profession realizes that the work given by colleges is very theoretical and that these principles must be applied to the methods and peculiar business conditions of the company which he represents before he can hope for gratifying results. Admitting the large amount of discussion raised by the issue of practical versus theoretical instruction, I believe that for the average student the instructor who can teach the principles involved is more valuable than the man who has had the practical experience but cannot get his ideas across to the student.

A man must obtain his knowledge of the fundamental principles in college if he is to gain a working knowledge of the subject. The practical application can be learned in the business world by actual contact. For this reason, if one of the two must be sacrificed, it is much better to give up the practical side while in school. Most technical schools require a certain amount of practical work and a satisfactory report on it. The student receives more benefit from his personal contact with business than from the practical instructor. It would be an ideal condition, one for which we can hardly hope, if the instructor had had valuable practical experience and was also able to present his subject efficiently to a group of students. Such men are at a premium in the industrial world.

As a student I feel that colleges are sources of knowledge of the principles which we need in our chosen line. It is a question of first getting equipped and then using this equipment most advantageously.

EMMET G. GARDNER.

Ohio State University,
Columbus, Ohio.

## Report on Post Office Illumination Criticised

*To the Editors of the* ELECTRICAL WORLD:

I read with much interest the article entitled "Illumination of Post Offices" published in the March 24 issue of the ELECTRICAL WORLD. I also have a copy of the bulletin issued by the Post Office Department, which I understand from the Office of Industrial Hygiene of the United States Public Health Service is a preliminary report issued by it to the Post Office Department covering work which it has completed on the New York Post Office. I should like to comment on the article appearing in the ELECTRICAL WORLD on this subject as follows:

The specifications for the luminaires for the general workrooms and for the offices is to my mind a very poor one. In the first place, there is no authority for the limitation of brightness at any point not to exceed 2½ cp. per square inch when used with a 200-watt lamp. The flux percentages in the various zones called for in the specification describe very inefficient units of the diffusing type as almost any unit of poor quality could conform to the specifications.

The specifications also state that at least 28 per cent of the bare lamp flux should be emitted in the 0-60-deg. zone and at least 48 per cent in the 0-90-deg. zone, which in substance means that there should be at least 20 per cent of the bare lamp flux emitted in the 0-60-deg. zone. It is a well-demonstrated fact that the light flux in the 60-90-deg. zone is undesirable as it is a cause of glare. In view of this it is evident that the light flux should be limited in the 60-90-deg. zone and that, instead of specifying at least 20 per cent in this zone, the specification should read "not more than — per cent in this zone."

I also note that the luminaires should be in such number and so spaced that the brightness of the units measured in lumens per square foot would not be more than one hundred times as great as the intensity of illumination measured in foot-candles. The number of luminaires used and their spacing would have little effect on the proportion-brightness divided by foot-candles. Furthermore, there is no authority for the figure 100 representing this proportion.

The vertical plane in post office work is quite as important as the horizontal plane. This has not been sufficiently taken into account inasmuch as the specifications for the general workroom and office luminaires

do not include any specific data which would specify illumination on vertical surfaces approximating the illumination on the horizontal surfaces. In fact, luminaires conforming to the specifications would produce illumination intensities on vertical surfaces of approximately one-half those produced on horizontal surfaces.

Regarding the paragraph relating to glare and surface brightness, there are six elements of glare listed and the total flux of light in the angles of 60-90 deg., which is a very important glare factor, has been totally omitted.

If glare is defined as the decrease in the ability of the eye to define objects, there are important data on record which indicate that the brightness of the light source is of little practical effect in producing glare and that the total flux of light which enters the eye is the important factor. Moreover, it has been found that the glare increases as the angle at which this flux enters the eye approaches 90 deg.

The paragraph defining direct, semi-direct, semi-indirect and indirect lighting is very much out of date. At the 1922 convention of the Illuminating Engineering Society Dr. Luckiesh presented a paper on this subject which indicated the common-sense way of defining luminaires as regards their direct and indirect components, and the data given in this paper should by all means be used in any recent literature on the subject.

It is to be hoped that the authors of the "Illumination of Post Offices" will give further thought and study to the subject before issuing their final recommendations as it is customary for the layman to regard data given out from the United States government departments as authoritative, which it should be.

DAVIS H. TUCK,
Electrical Engineer.
Holophane Glass Company, Engineering Department,
New York, N. Y.

## The Specifications for Overhead Lines

*To the Editors of the* ELECTRICAL WORLD:

In the editorial "The Specifications of 1914 are Retired" (page 616 of the March 17 issue of the ELECTRICAL WORLD) are some statements and inferences not quite in accordance with the facts, or at least with certain understandings as to the program to be pursued. It would be unfortunate if the ELECTRICAL WORLD were to cause further misunderstandings of this unhappy subject.

Without going into ancient history as to joint specifications that did not stay "joint," it would be fairer to admit that some rather important interests have never accepted the code as a specification. The status at present is that the code was adopted as an American standard provided that it was to be at once revised by a joint body or sectional committee and, further, that after such revision that body should prepare a specification for crossings. There has been some criticism that it was unusual to adopt an engineering rule subject to an unmade revision, but it has been expected and promised that there would be no attempt to rush the general adoption of the present code as a crossing specification. In the view of the writer it is well to allow the matter to rest, without propaganda from either side and without the adoption by regulatory bodies of any specification, until our sectional committee has had a fair chance to agree on something.

R. D. COOMBS.
R. D. Coombs & Company,
New York, N. Y.

## Easy Solutions to Hyperbolic Functions

*To the Editors of the* ELECTRICAL WORLD:

In view of the growing importance of hyperbolic functions in electrical engineering and the somewhat meager, or at least inaccessible, published information in regard to the computation of the inverse functions, it would seem that material of this kind is of sufficient general interest to warrant publication.

The material is not particularly new, but I have never seen the formulas in this form and believe that they are suitable for presentation in your columns. They were derived by means of Euler's exponential expressions for the sine and cosine, and apply for all values of $u$ and $v$, positive, negative and imaginary.

The last three expressions can be derived in order from the first three by using the reciprocal of $u + jv$ in place of $u + jv$ itself.

The results are:

$$x + jy = \sinh^{-1}(u + jv) = \log_\epsilon[u + jv \pm \sqrt{1 + (u + jv)^2}].$$

$$x + jy = \cosh^{-1}(u + jv) = \log_\epsilon[u + jv \pm \sqrt{(u + jv)^2 - 1}].$$

$$x + jy = \tanh^{-1}(u + jv) = \frac{1}{2}\log_\epsilon\left[\frac{(1 + u) + jv}{(1 - u) - jv}\right].$$

$$x + jy = \operatorname{cosech}^{-1}(u + jv) = \log_\epsilon\left[\frac{1 \pm \sqrt{(u + jv)^2 + 1}}{u + jv}\right].$$

$$x + jy = \operatorname{sech}^{-1}(u + jv) = \log_\epsilon\left[\frac{1 \pm \sqrt{1 - (u + jv)^2}}{u + jv}\right].$$

$$x + jy = \coth^{-1}(u + jv) = \frac{1}{2}\log_\epsilon\left[\frac{(1 + u) + jv}{(u - 1) + jv}\right].$$

For numerical work the third and sixth expressions are particularly convenient. They must, of course, be evaluated by the methods usual in vector work. The positive value of the double sign is used in connection with the others.

As an illustration take the following example:

$$\begin{aligned}
\tanh^{-1}(1.315 + j0.608) &= 0.5 \log_\epsilon \frac{(1 + 1.315) + j0.608}{(1 - 1.315) - j0.608} \\
&= 0.5 \log_\epsilon \frac{2.315 + j0.608}{-0.315 - j0.608} \\
&= 0.5 \log_\epsilon \frac{2.39 \;/\underline{14^\circ 43'}}{0.685/\underline{117^\circ 23'}} \\
&= 0.5 \log_\epsilon 3.49/\underline{132^\circ 6'} \\
&= 0.5 \log_\epsilon 3.49/\underline{2.30} \\
&= 0.5\,(\log_\epsilon 3.49 + j2.30) \\
&= 0.625 + j1.15.
\end{aligned}$$

Thus:

$$x = 0.625, \quad y = 1.15.$$

Work of this kind is facilitated a great deal by use of a slide rule with a set of scales graduated so that a vector quantity can be transferred quickly from polar to rectangular co-ordinates and vice versa. A number of such rules have been constructed by a leading manufacturer and are quite successful. Such slide rules would be useful also in mechanical engineering and in bridge-design work.

A. F. PUCHSTEIN,
Assistant Professor.
Ohio State University,
Columbus, Ohio.

# Central Station and Industrial Practice

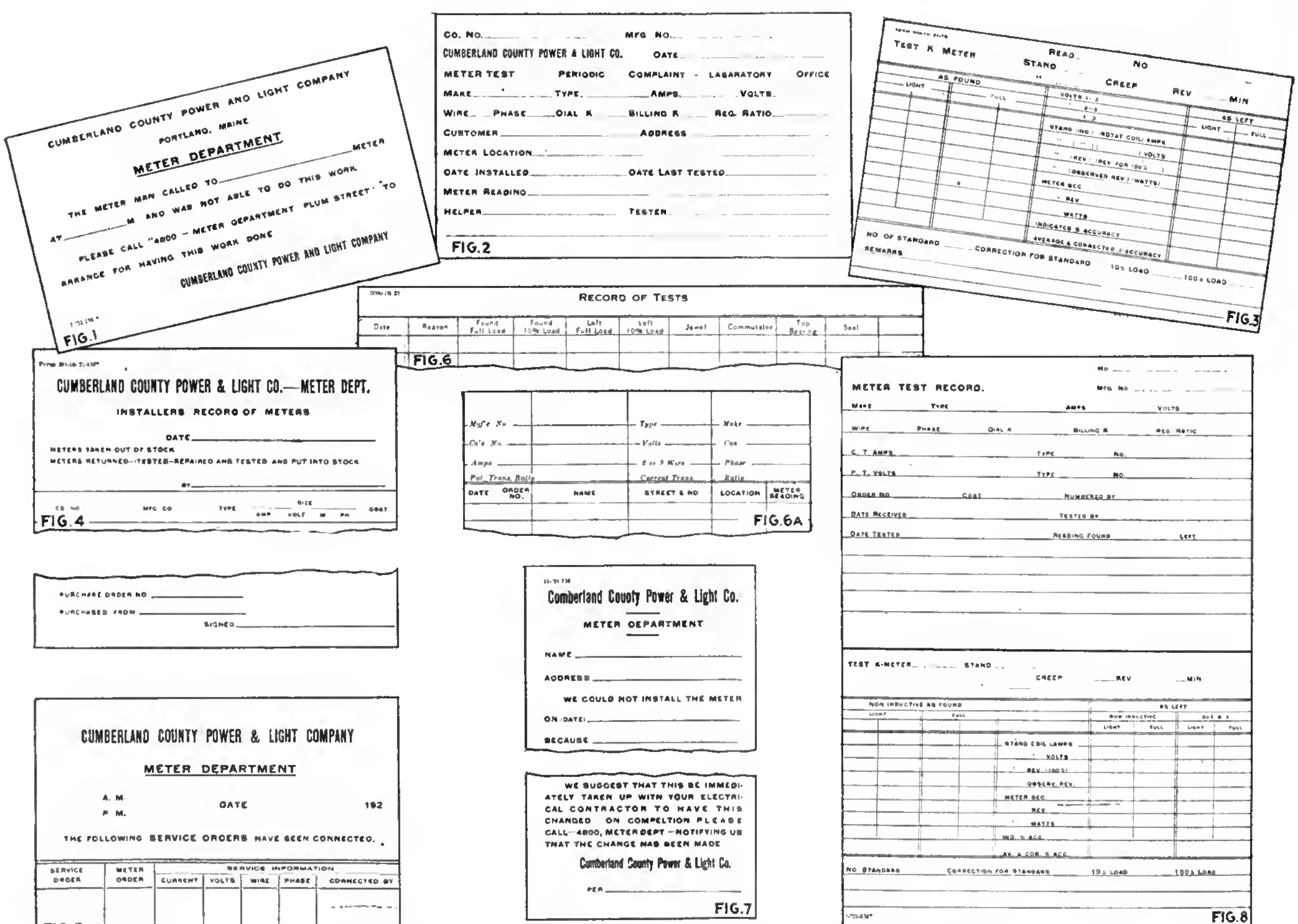
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Meter Testing in Maine

METER tests on the system of the Cumberland County Power & Light Company, Portland, Me., include shop tests, periodic and complaint tests. In the first class are included tests on new meters, tests on meters returned from customers' premises and tests on repaired meters. Periodic tests are made on customers' premises according to service requirements, and these include an inspection of the installation with reference to proper metering, the working condition of the meter, connected load and general conditions. This test helps the company's public relations, inasmuch as courteous meter testers afford evidence that the company checks its meters regularly and helps allay the idea that all meters are set fast. Complaint tests are made to remove a customer's suspicions, and these are helpful in securing better conditions on the premises.

At Portland the company has a standardizing set going back to the standard cell by which an indicating laboratory wattmeter is calibrated. Against this wattmeter is calibrated in turn another rotating standard. Using this rotating standard as a laboratory standard, we are able to check our portable rotating standards whenever conditions do not work just right, or else periodically once every week. This laboratory rotating standard is checked every three months to make sure that no conditions have changed it. All calibrations, and especially when the laboratory rotating standard is used, are done by qualified men, and every precaution is taken to prevent overloads or damage to the rotating standard. In this way we feel perfectly safe regarding our standards.

*Meter Testing.*—With reference to meter testing, tests are conducted on single-phase, two-wire meters, single-phase, three-wire meters and polyphase meters. The actual test-




TYPICAL FORMS EMPLOYED BY ONE COMPANY FOR KEEPING ITS METER RECORDS

Fig. 1—Form to show that meter installer was at premises but was unable to get in.
Figs. 2 and 3—Subsequent test record. Fig. 3 printed on back of Fig. 2.
Fig. 4—Form used as a check of meters taken out or returned by meter installers.
Fig. 5—Record of services as reported by service department.
Figs. 6 and 6A—Meter record card. Gives the complete history of the meter. Fig. 6A printed on back of Fig. 6.
Fig. 7—Form used when wiring is defective or rules have not been followed.
Fig. 8—Original record of shop tests.

ing on all meters is the same. The tester always notes the general condition of the meter and its surroundings, especially meter seals and evidences of tampering. He checks coils, bearings, rusting of the meter, the position of the magnets, the position of light-load adjustment, creeping and anything wrong that should be corrected. The single-phase two-wire and three-wire meters are used on house service and are tested non-inductively, although with the type of appliances that is beginning to be used by houses it may be well to have the power-factor adjustment within 4 per cent. Where a single-phase meter, however, is used for power, as on single-phase motors, just as much care should be used on the power-factor adjustment of this meter as on a polyphase meter. In our own case the 220-volt, two-wire meters used for this purpose are adjusted for power factor.

In the polyphase meter we have a different condition and the method of testing has to be well looked into. All polyphase meters are tested with coils in series. To check correctness in doing this a series of tests were run of a polyphase meter on polyphase load against two single-phase rotating standards. These tests proved that the meter on polyphase load has the same accuracy as the meter with coils connected in series. Testing each element separately is liable to make the meter fast. The routine of testing a polyphase meter is as follows:

ROUTINE TESTING OF METERS

The potential coils are connected in parallel and the current coils in series but bucking so as to make one element rotate backward. The electric elements are moved in or out from the shaft till no tendency to rotate is apparent. The meter is then reconnected, coils in series, and adjusted for 100 per cent non-inductive load.

*Power-Factor Test.*—Leaving the meter as connected for the unity-power-factor test and throwing the potential on the other phase will immediately give a power-factor test. If the meter is found off, each element is tested separately to see where the error lies. This element is then adjusted to bring the power-factor accuracy to 100 per cent, after which the meter is rechecked with the coils in series.

The question of power factor is becoming of primary importance, and a discussion as to various methods of power-factor tests and as to what should be done with reference to power factor would be of value. Another method is, instead of checking power factor at 50 per cent, to check a meter as low as 20 per cent or 30 per cent power factor.

On alternating-current meters the light-load test should be made around 5 per cent load. This is done to prevent creeping. Alternating-current meters have a very rapid percentage accuracy curve upward with decreased load, and should a meter be set accurate at 10 per cent load it may creep, owing to the high overcompensation. Full load should be taken at points above 75 per cent load.

*Meter Records.* — For keeping records of meter tests we have a general system of folders and test cards. These folders contain all data on the meters together with the original shop test. As subsequent tests are then made on the same meter these tests are recorded either on a stiff card for outside tests or on the light-weight form for shop tests. Every test made on a certain meter is put into this folder, giving a complete record of all work done on that particular meter.

The tests are also recorded on the meter record so that by taking out this card the various periods of tests, together with the accuracy found, can be used to determine how often this meter should be tested. The meter-record cards have various colors which designate the type of installation, giving an idea of the importance of the meter. These colors are as follows: White — 5-amp. watt-hour meters, single-phase; red — alternating-current single-phase meters from 10 amp. up and self-contained and alternating-current polyphase meters; blue—meters either used with current or potential transformers or both; buff—direct-current meters.

H. BURGI, JR.,
Meter Department.
Cumberland County Power & Light Company,
Portland, Me.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Induced-Draft Fans

WHEN starting forced-draft fans, the stack draft damper should be closed to enable the fan to start under minimum load and also to enable the boiler operator to make proper adjustments more readily than if the dampers were left open. The following instructions, as abstracted from the operating code of the Philadelphia Electric Company, pertain to starting and shutting down induced-draft fans:

STARTING

1. See that the stack damper is closed.
2. Turn on the cooling water to the bearings.
3. Start the turbine or motor.
4. See that the oil rings are operating and supplying oil to the bearings.
5. Bring the unit up to speed.
6. Inspect the unit for excessive vibration and, if excessive vibration is discovered, report the trouble to the shift superintendent.
7. If the main oil switch (controlled at the boiler operating boards) should trip, have an inspection made by the electrical mechanic and any trouble corrected before closing it again.

SHUTTING DOWN

1. Shut down the turbine or motor.
2. Shut off the cooling water from the bearings.
3. Close the induced-draft dampers (or bypass the induced-draft fan).

## Testing Overspeed Devices

TESTING overspeed devices on rotary converters and motor-generators should be done under the direct supervision of the substation supervisor or foreman, according to the operating code of the Philadelphia Electric Company. This test can only be made when the machines being tested are running in parallel with another source of direct current.

The following instructions for testing overspeed devices as abstracted from the operating code referred to above should prove of value to any one making these tests:

1. Disconnect or block the reverse-current trip.
2. Adjust the field rheostat so that the speed will remain close to normal (about unity power factor or slightly leading); open the oil switch, leaving the direct-current switches and circuit breakers closed and the neutral switch open.
3. Cut in the field resistance slowly, observing the speed of the machine with a tachometer, until the overspeed device opens the circuit breakers (not exceeding 15 per cent above normal speed).
4. Observe the speed at which the overspeed device operates; this speed should be about 10 per cent above normal.
5. If the device does not operate at this speed, make adjustments and repeat the test.

## Signposts of Steam Plant Economy

WITH the advent of boilers built to operate on 650 lb. pressure and corresponding advances in the design of prime-mover equipment, expected total plant efficiencies will closely approach the record of the Diesel engine. This statement was made by E. F. English, chief engineer General Engineering & Management Corporation, New York, at a recent meeting of utility managers of the organization. Boilers are now being installed to operate at 525 lb., and today turbo-plants are operating at 350 lb. and more than 700 deg. steam temperature. Plants are now operating on powdered coal at monthly boiler efficiencies of 82 to 84 per cent. The speaker held that within ten or fifteen years all coal under the larger boiler plants will be burned in powdered form. The supply of fuel oil is relatively limited, known deposits embracing only fifty years' requirements against several hundred years' coal resources.

TABLE I—HEAT LOSSES IN AN AVERAGE BOILER ROOM

| How Lost | Per Cent of Heat in Coal |
|---|---|
| 1. Handling at plant | 1 0 |
| 2. In ash | 3 9 |
| 3. By radiation | 2 9 |
| 4. By incomplete combustion | 0.7 |
| 5. On account of air leakage in furnace and boiler | 9 8 |
| 6. On account of excess air through gates | 9.8 |
| 7. Because of short-circuiting of gases in gas passages of boiler | 1.1 |
| 8. From soot on heating surface | 3.9 |
| 9. From scale in boiler | 5 0 |
| 10. Because of incorrect amount draft for load | 3 8 |
| 11. Because of leakage of water and steam | 0.7 |
| Total preventable or reducible losses | 42 6 |

The preventable losses in boiler plants of average rating are shown in Table I. These preventable losses are seldom below 25 per cent in medium-sized boiler plants. Important gains in economy in late years have resulted from the use of higher settings. In the speaker's practice, the front header is set from 10 ft. to 15 ft. above the floor. Tight furnace walls, unwarped baffles, unburned baffles and tubes free from soot are essential to efficient operation. Inadequate draft has caused poor efficiency in many cases, although excess air beyond combustion necessities is even worse. The losses resulting from excess air for combustion are shown in Table II. Scale in tubes is also a source of waste, ⅛-in. scale causing a loss of 12 per cent in heat transmission.

TABLE II—RELATION BETWEEN EXCESS AIR, $CO_2$ AND FURNACE TEMPERATURE

| Per Cent of $CO_2$ in Flue Gas | Pounds of Air per Pound of Fuel | Fire Temperature, Deg. F. | Approximate Percentage of Excess Air | Fuel Tonnage, Per Cent |
|---|---|---|---|---|
| 20 | 12 | 3,910 | 9 | 11 |
| 16 | 15 | 3,190 | 36 | 12.5 |
| 13.4 | 18 | 2,700 | 64 | 15 |
| 11.4 | 21 | 2,340 | 91 | 17.5 |
| 10 | 24 | 2,060 | 118 | 20 |
| 8.9 | 27 | 1,850 | 146 | 22.5 |
| 8 | 30 | 1,680 | 173 | 25 |
| 7.3 | 33 | 1,535 | 200 | 27.5 |
| 6.7 | 36 | 1,415 | 227 | 30 |
| 6.2 | 39 | 1,315 | 254 | 32.5 |
| 5.8 | 42 | 1,225 | 282 | 35 |
| 5.0 | 48 | 1,085 | 336 | 40 |

The chief item entering into the cost of power production is fuel. It is probable that the boiler-room foreman can save or waste more money than any other man in the plant organization. Cheap labor in the boiler room is the most expensive help available. Table III shows the proportion of fuel costs to total in a group of seven plants.

Care in fuel selection from the standpoint of heat content per unit of cost, the use of adequate indicating and recording instruments, attention to vacuum and feed-water heating, all are needed in the campaign for plant efficiency. The heat in a pound of coal from various mines may vary as much as 100 per cent, against a maximum of 8 per cent in fuel oil over a wide range of gravity. Roughly, 1 per cent of fuel is saved for each 11-deg. increase in feed-water temperature. The variation of an inch in vacuum at the exhaust end of a modern steam turbine may change the water rate by 1 lb. Boiler-feed pumps should have at least 10-ft. head on the hot-water suction inlet, and the formation of scale or sludge in condenser tubes seriously impairs heat transmission and should be checked by inspection and temperature records.

### Instruments and Records

Instruments for boiler and engine room operation have been sadly neglected till quite recently, and even now a large amount of steam is generated with the aid of no other instruments than a steam gage and gage glass. The instruments which tend to give us a strong grasp on varying conditions are really signposts on the road to economy, and when properly used are worth-while investments.

Among these most deserving of installation are a draft gage connected so as to read furnace, ash-pit and uptake pressures and the drop through the boiler; a pyrometer to read flue-gas temperatures, one instrument being so connected as to serve a number of boilers; the $CO_2$ recorder or, where expense prevents, an Orsat; a thermometer in the feed line, some method of determining the weight of coal and ash, and a steam-flow meter is also desirable.

By the use of the indicator varying conditions in engine operation can be detected and corrections made. The vacuum gage, preferably a mercury column, and thermometers for indicating the inlet and discharge temperatures of the condenser circulating water are of great assistance in the efficient operation of the condenser and its auxiliaries.

Only useful records should be kept. Some operators require power-plant employees to keep many records, most of which are filed away and never consulted afterward. The chart form is much better than a column of figures in emphasizing changes in conditions. It is of primary importance that an accurate record should be kept of output and fuel. A continuous record of fuel burned, water evaporated and output is of far greater value in showing production costs and condition of equipment than any spasmodic tests of apparatus no matter how thorough. Important boiler-room records con-

TABLE III—ELEMENTS OF PRODUCTION COST IN PERCENTAGE OF TOTAL

Plants Nos. 1, 3 and 5 are oil-burning and have 705,570, 1,604,430 and 1,710,410 kw.-hr. yearly output respectively. Plants Nos. 2, 4 and 6 are coal-burning and have 681,230, 2,208,220 and 4,347,400 kw.-hr. yearly output respectively. Plant No. 7 gives an average type of large-power-plant operation with an approximate average yearly output of 79,000,000 kw.-hr. The figures are for the twelve months ended Dec. 31, 1922.

| Plant: | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Fuel | 51.2 | 61.8 | 67.9 | 68.7 | 70.4 | 75.0 | 69 |
| Labor | 29.5 | 18.8 | 11.0 | 19.4 | 17.9 | 17.4 | 18 |
| Maintenance | 15.8 | 14.3 | 17.3 | 6.7 | 8.1 | 3.5 | 9 |
| Miscellaneous | 3.5 | 5.1 | 3.8 | 5.2 | 3.6 | 4.1 | 4 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

cern quantity and temperature of feed water, boiler pressure, draft and temperature of gases leaving boiler; time of cutting in and cutting out boilers, and when and how long boilers were blown down. Important engine-room records are on load carried, vacuum, temperature of circulating water entering and leaving condenser, and hot-well temperature. Time of starting and stopping units should also be recorded.

Much of the foregoing, in a general way, applies also to Diesel plants, gas plants and ice plants.

The Diesel engine requires careful maintenance and attention to details. In general, after a certain time has elapsed, inspection should be made to see whether attention is required, and at intermediate times, if there is any indication of the improper functioning of any part, investigation should be made and such maintenance work as is necessary done. For proper maintenance a chart should be made up on which are listed all parts of the engine that require attention, and for each item an estimate should be made as to how often it should be inspected. Notes should also be made of the condition on previous inspection. Of course, the lubricating and cooling system requires constant supervision. As one manufacturer has said, "The lubricating system is the heart of the Diesel engine."

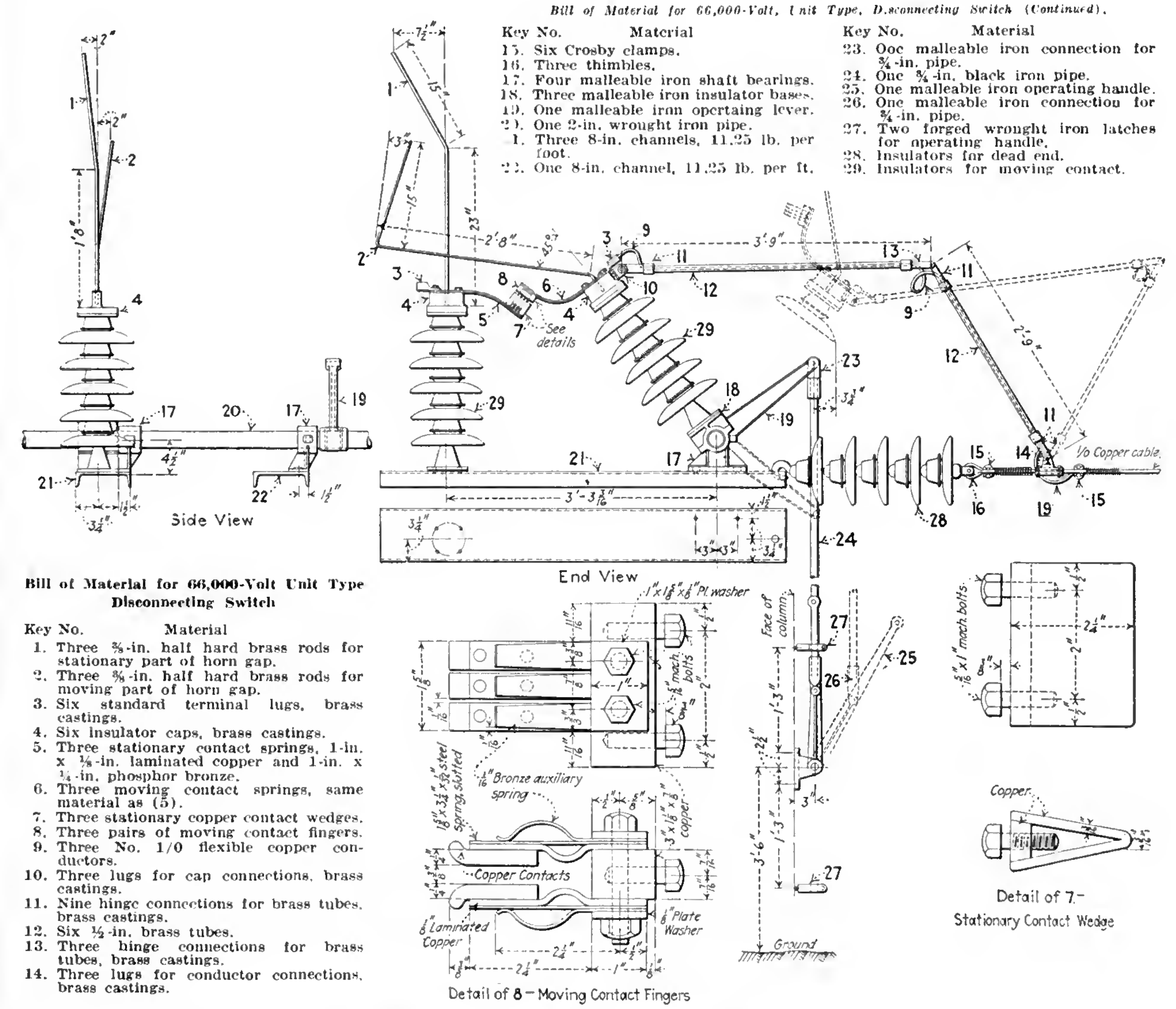
FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Tennessee Company's New "Disconnect"

WHEN poles settle, most of the disconnecting switches which the Tennessee Electric Power Company has used up to this time tend to get out of alignment. Furthermore, most of these switches require four poles and more than two insulators per phase. To eliminate these and other objections the company has developed the rocking type of "disconnect" shown, which requires only two poles for mounting and which has the advantage of not getting out of alignment easily.

It may be observed that one insulator per phase is fixed and supports one end of the line, a stationary contact and an arcing horn. The other insulator rocks about a horizontal axis, carrying with it the movable contact and an arcing horn. Connecting it with the other terminal of the line is a jack-knifing tube which contains a flexible lead, this being hinged at both ends and the middle.

E. C. WILLIAMSON,
Electrical Engineer.
Tennessee Electric Power Company,
Chattanooga, Tenn.




**Bill of Material for 66,000-Volt Unit Type Disconnecting Switch**

Key No. Material

1. Three ⅜-in. half hard brass rods for stationary part of horn gap.
2. Three ⅜-in. half hard brass rods for moving part of horn gap.
3. Six standard terminal lugs, brass castings.
4. Six insulator caps, brass castings.
5. Three stationary contact springs, 1-in. x ⅛-in. laminated copper and 1-in. x ¼-in. phosphor bronze.
6. Three moving contact springs, same material as (5).
7. Three stationary copper contact wedges.
8. Three pairs of moving contact fingers.
9. Three No. 1/0 flexible copper conductors.
10. Three lugs for cap connections, brass castings.
11. Nine hinge connections for brass tubes, brass castings.
12. Six ½-in. brass tubes.
13. Three hinge connections for brass tubes, brass castings.
14. Three lugs for conductor connections, brass castings.

*Bill of Material for 66,000-Volt, Unit Type, Disconnecting Switch (Continued).*

Key No. Material

15. Six Crosby clamps.
16. Three thimbles.
17. Four malleable iron shaft bearings.
18. Three malleable iron insulator bases.
19. One malleable iron opertaing lever.
20. One 2-in. wrought iron pipe.
21. Three 8-in. channels, 11.25 lb. per foot.
22. One 8-in. channel, 11.25 lb. per ft.
23. One malleable iron connection for ¾-in. pipe.
24. One ¾-in. black iron pipe.
25. One malleable iron operating handle.
26. One malleable iron connection for ¾-in. pipe.
27. Two forged wrought iron latches for operating handle.
28. Insulators for dead end.
29. Insulators for moving contact.

ROCKING-TYPE "DISCONNECT" DEVELOPED BY TENNESSEE COMPANY FOR 66,000-VOLT LINES

## Strength of Wood Poles Not Affected by Perforating

THAT the exact loss of strength due to the perforation of wood poles to insure better penetration of the preservative oils is not of sufficient importance to justify the making of strength tests unless an unusual opportunity arises is the conclusion of a committee of the American Wood Preservers' Association, which presented a report at a recent convention in New Orleans. The committee said that theoretical loss of strength had been determined as being a function of the depth of the holes and the maximum percentage of the circumference cut in a horizontal plane, and it was of opinion that the recognition of this principle gives the essential information and that the only value of making strength tests is to check the actual and theoretical strength losses. The committee is expected to continue consideration of the subject, making tests if the proper opportunity offers.

The committee also asserted that no improvement in the perforating patterns now in use can be made until greater knowledge is gained as to seasoning and its effect or that of other unknown factors upon the oil travel. No conclusion was reported on the study of the committee to determine the effect of seasoning on penetration and whether it would be possible to classify poles as to condition of seasoning and then find a way quickly and accurately to identify such classifications.

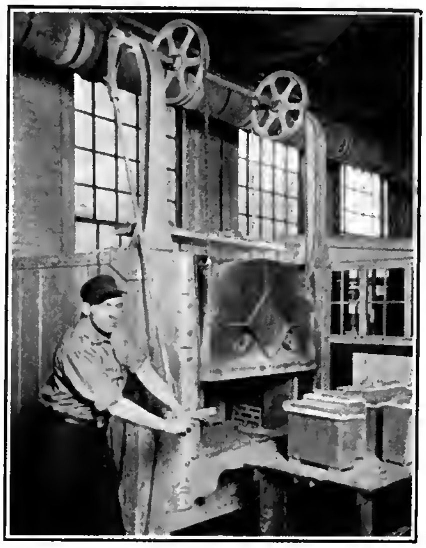
The committee's study showed that the effect of the perforated treatment is to prevent harmful checking and to a marked degree to close checks which are in the timber at the time of treating. The non-perforation treatment does not prevent checking in green timber, but lessens the checking in partially seasoned or seasoned timber. The report further said that perforation without the treatment lessens checking to a greater extent than the non-perforation treatment. The experiments on which the conclusions were based were carried on at St. Paul, and the committee thought that results in other latitudes might vary. An investigation of the records of representative pole lines with perforated and unperforated poles is being made.

The committee on pressure treatments continued its work in the examination of the life history of full-cell process-treated poles and submitted some tentative full and empty process-treatment specifications and also information on empty-cell treated pole lines in Europe. Hundreds of thousands of poles are reported to have been treated by this process and erected in England with no cases of failure as yet brought to the attention of telephone and telegraph officials.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Small Parts Heat Treated Electrically for 0.33 Cent per Pound

RECENTLY the engineers of the Royal Typewriter Company, Inc., Hartford, Conn., were confronted with the problem of producing slide rails for their product which would withstand indefinite wear. These pieces are of such shape that ordinary methods of carburizing, such as coal-fired or gas-fired furnaces, were unsuccessful owing to the distortion from uneven heating. After a study



NOT A SINGLE FAULTY HEAT TREATMENT HAS OCCURRED IN FIRST HALF YEAR'S OPERATION OF THIS FURNACE

of the available apparatus a Hagan electric furnace was installed, and this has operated for more than six months without the discovery of a single faulty heat treatment.

The furnace specifications called for the following service:

Heat treatment: Case hardening.
Material to be hardened: Drop-forged steel, 10-point to 20-point carbon.
Estimated weight of pieces per heat: 225 lb.
Estimated weight of containers per heat: 775 lb.
Estimated weight of compound: 90 lb.
Total weight of parts to be case-hardened per week of fifty hours: 3,750 lb.
Dimensions of containers, approximate: 15 in. x 7 in. x 12 in. deep, outside.
Electrical supply available: 220-volt, 60-cycle, two-phase energy.
Furnace temperature required: 1,650 deg. F.

To meet these requirements the furnace built has a working chamber 4 ft. 10½ in. long x 3 ft. wide x 1 ft. 11 in. high and a connected load of 60 kw. The insulating walls are 9 in. thick and the door specially insulated. A view of the furnace is shown herewith. Leeds & Northrup full automatic control was utilized, and the thermocouple is mounted directly above the work in the front center of the furnace. Alloy pots are used.

Five to six hours are required for the furnace to attain its operating temperature of 1,650 deg. F. when starting cold. The work is then placed in the furnace and the temperature falls to about 1,100 deg. F. After this about one and a half hours is required to bring the charge up to 1,650 deg. F. A six-hour bake produces the desired penetration of thirty to forty thousandths of an inch. To every rail is given a Rockwell hardness test.

A production of fifteen heats per week is the regular schedule. This consists of: Work, 2,475 lb.; charge, 3,300 lb.; pots, 11,940 lb.; total, 17,715 lb. The total consumption of electricity for a week's run is 3,500 kw.-hr. The cost per pound of actual work done is 2.38 cents, or 0.33 cent per pound of total charge.

Temperature readings show that the furnace walls average only about 150 deg. F. except around the door and at the point where the leading-in cables enter the furnace walls. The radiation loss is about 6 kw. A rough comparison with a coal-fired furnace having two compartments 2 ft. wide x 5 ft. long showed that the fuel expense was slightly less than the electrical cost, but the cost of handling coal and ashes brought the total cost per pound of work carburized about to the level of the electrical cost. With electric heating there is no guesswork as to temperature conditions on the part of the operator and high quality is assured.

H. W. DERRY,
Power Engineer.
Hartford Electric Light Company,
Hartford, Conn.

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## A Survey of the Appliance Load*

### Investigation of Three Groups of 270 Residences in Chicago Indicates that Household Devices Account for Approximately 20 per Cent of Energy Used in Homes


BY H. B. GEAR

Commonwealth Edison Company, Chicago


THE use of household appliances has for some years been encouraged by central-station men who have seen in such devices a means of increasing the revenue derived from the residence customer. To determine just what this business meant to the company in energy consumption and revenue the Commonwealth Edison Company recently made a survey of a number of typical residences of various classes.

#### PLAN OF THE SURVEY

The customers chosen were selected to form three groups of about 270 each, classified as "above medium," "medium" and "below medium." The "medium" group was selected on the basis of the average kilowatt-hour consumption per year of all residence customers and on the general character of buildings as regards rental values. This group consisted of 119 houses and 158 apartments whose average annual consumption was 367 kw.-hr. The "above medium" group consisted of 75 houses and 147 apartments with an annual consumption of 525 kw.-hr. The "below medium" group included 85 houses and 229 apartments, with an annual consumption of 216 kw.-hr. Each of these 813 customers was interviewed by two census takers, one to inspect lamp and appliance ratings and one to fill out a very complete record sheet.

The customers were selected in groups supplied by a separate transformer installation. Curve-drawing meters were used to get from each such transformer the load records of the group for seven consecutive days. In order to obtain data as to energy consumption of different appliances, records were taken of six to eight of each group for seven days from a meter set on the premises. The co-operation of customers was readily obtained by presenting them with an electrical appliance to compensate for their trouble.

The number and general characteristics of the residences surveyed are given in Table I. It will be seen that there are considerable differences between the various classes as regards the size of the residence, the number of persons in the family and the energy consumption. It is of interest to note that the connected load in appliances exceeds that in lamps in most cases.

The data from the census of appliances are presented in Table II The number of appliances per 100 residences is indicative of the degree of saturation reached with the various devices. The flatiron is easily the leader, as it constitutes about 40 per cent of the total number of appliances found, the vacuum cleaner and toaster being next in order, with 18 per cent and 13 per cent respectively. The washing machine is 8 per cent, the percolator 6 per cent and all other devices are 14 per cent of the total found. Two thousand and five appliances were found in 813 houses, or 2.4 per residence. The washing machine is not as generally found in apartments as in houses, and this is true to a less extent with vacuum cleaners, but the reverse is true with the toaster.

From the test charts the hourly kilowatt-hour consumption by lamps and appliances was determined and the consumption of the various ap-

TABLE II—CENSUS OF APPLIANCES

| | No. per 100 Residences | | Per Cent Not Ordinarily Used | | Per Ceut Residences Having No Appliances of Stated Kinds | |
|---|---|---|---|---|---|---|
| | Houses | Apts. | Houses | Apts. | Houses | Apts. |
| Flatirons: | | | | | | |
| Abovo medium | 106.8 | 111.5 | 3.7 | 6.1 | 4.0 | 3.4 |
| Medium | 88.2 | 98.1 | 3.8 | 5.8 | 12.6 | 6.3 |
| Below medium | 78.8 | 93.0 | 1.5 | 3.3 | 21.2 | 7.0 |
| Vacuum cleaners: | | | | | | |
| Above medium | 82.7 | 64.6 | 6.5 | ... | 20.0 | 35.4 |
| Medium | 42.8 | 51.3 | ..... | 6.2 | 57.2 | 48.7 |
| Below medium | 21.2 | 29.3 | ..... | 3.0 | 78.6 | 70.7 |
| Washing machines: | | | | | | |
| Above medium | 62.7 | 14.3 | 4.3 | 14.3 | 37.3 | 85.7 |
| Medium | 46.2 | 8.2 | 7.3 | 15.4 | 53.8 | 91.8 |
| Below medium | 25.9 | 6.5 | ..... | 13.3 | 74.2 | 93.2 |
| Toasters: | | | | | | |
| Above medium | 41.3 | 51.7 | 12.9 | 17.1 | 61.3 | 49.0 |
| Medium | 21.0 | 31.0 | 24.0 | 26.5 | 80.8 | 70.3 |
| Below medium | 3.5 | 34.1 | 33.3 | 15.4 | 96.5 | 65.9 |
| Percolators: | | | | | | |
| Above medium | 28.0 | 27.2 | 42.9 | 27.5 | 73.3 | 73.0 |
| Medium | 12.6 | 16.5 | 53.3 | 57.7 | 87.5 | 84.3 |
| Below medium | 1.2 | 11.8 | 100.0 | 63.0 | 98.9 | 88.0 |

*Abstract of a paper given before the Illinois State Electric Association, March 15, 1923.

TABLE I—STATISTICS OF AVERAGE RESIDENCES SURVEYED

| | Houses | | | Apartments | | |
|---|---|---|---|---|---|---|
| | Above Medium | Medium | Below Medium | Above Medium | Medium | Below Medium |
| Number surveyed | 75 | 119 | 85 | 147 | 158 | 229 |
| Number of rooms | 12.3 | 8.5 | 6.9 | 10.3 | 8.9 | 5.8 |
| Number of persons per residence | 4.5 | 4.2 | 4.3 | 3.4 | 3.8 | 2.7 |
| Annual kw.-hr. | 556 | 324 | 219 | 508 | 399 | 215 |
| Connected load, watts: | | | | | | |
| Lamps | 1,366 | 738 | 547 | 1,068 | 821 | 500 |
| Appliances | 1,191 | 773 | 519 | 1,026 | 756 | 698 |
| Number lamps per residence | 26.9 | 13.6 | 9.4 | 20.3 | 15.0 | 9.0 |
| Per cent residences having no appliances | 2.7 | 9.2 | 18.9 | 3.4 | 4.4 | 6.6 |

TABLE III—COMPARISON OF ESTIMATED AND COMPUTED CONSUMPTION

| | Annual Kw.-Hr. Used by Appliances | |
|---|---|---|
| | Estimated | Test Week $\times$ 50 |
| **Flatirons:** | | |
| Houses | 63 | 94.2 |
| Apartments | 48.5 | 69.7 |
| **Vacuum cleaners:** | | |
| Houses | 6.2 | 7.8 |
| Apartments | 4.8 | .... |
| **Washing machines:** | | |
| Houses | 23 | 32.8 |
| Apartments | 22.3 | .... |
| **Toasters:** | | |
| Houses | 16.5 | 18.5 |
| Apartments | 16.7 | 18.1 |
| **Percolators:** | | |
| Houses | 21 | 25.7 |
| Apartments | 22.7 | .... |

pliances was then segregated. The use of appliances, while heaviest on Tuesday owing to the ironing load, was remarkably well distributed through the other days of the week. The appliance consumption expressed as a percentage of the total consumption during this week was: "Above medium" houses, 44; "medium" houses, 37; "below medium" houses, 41.1. "Above medium" apartments, 26.9; "medium" apartments, 19.1; "below medium" apartments, not tested.

If it be assumed that 15 per cent of all houses served are "above medium," 45 per cent are "medium" and 40 per cent are "below medium," the weighted average of energy used for appliances by houses during the test week would be 41 per cent and for apartments 21 per cent of the total consumption.

The monthly variation of energy consumption is such that during the month of May the total consumption is about 75 per cent of the average for the year. In the case of the houses tested this would mean that if the appliance consumption is 41 per cent during May, it would average about 75 per cent of that amount, or 30 per cent, for the year. In the apartments tested it would be about 16 per cent for the year. In connection with the survey each customer was questioned as to the use of the various appliances in different months of the year. These customer estimates averaged about 20 per cent for houses and 14 per cent for apartments. This leaves a discrepancy between the 30 per cent for houses computed from tests and the 20 per cent obtained from estimates made after talking with the customer. In the case of apartments the figures of 16 per cent for the test and 14 per cent for the survey are in practical agreement. The difference in the case of houses may be attributable to a disposition to underestimate or to the possibility that seasonal variations in use of appliances are greater than was assumed in the calculations. It is probable that the correct figures for yearly appliance consumption for houses is between 20 per cent and 25 per cent.

The consumption of energy by the various appliances as computed from the joint estimates of customer and surveyor appears in Table III. In the same table is given the consumption of the same appliances as measured in the houses tested for one week multiplied by fifty to give a figure approximating annual consumption if the use of appliances is the same throughout fifty weeks of the year. Two weeks have been allowed for the customer's absence from home because of vacation or for other reasons.

An application of the data obtained to the Chicago residence rates and average consumption reveals an annual appliance use of about 68 kw.-hr. by the average customer, which adds about $2.75 per year to his bill. With a total of 500,000 residence customers, this adds $1,375,000 per year to a gross residence revenue of about $10,000,000, which is sufficient to make this class of business desirable to the company.

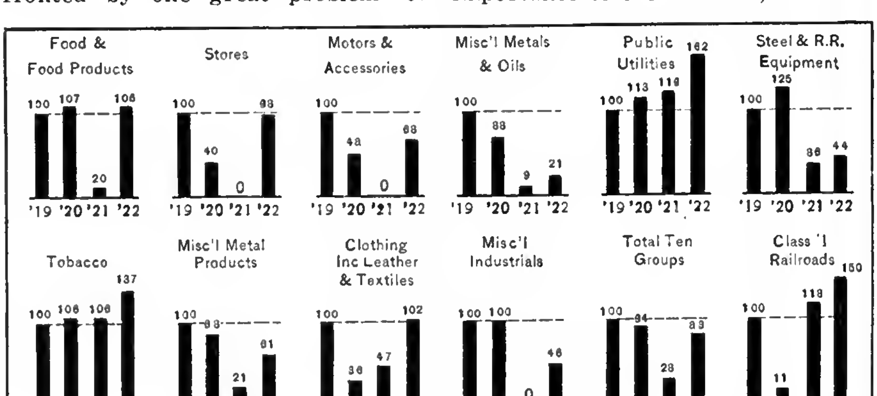
# Moody Classes Public Utility Securities as Most Desirable Investment

PUBLIC utility securities are now considered by high financial authorities as one of the most desirable forms of investment, and the reasons for this favorable opinion are stated concisely by John Moody, president of Moody's Investors' Service, who, in a recent special analysis of the public utility field, says:

"We have come to regard public utility securities taken as a whole as the most desirable and attractive class in the investment market today. More favorably and intelligently regulated than the steam railroads, fundamentally more stable in every respect than the average industrial enterprise, the public utilities of the country face an assured future confronted by one great problem—to finance expansion of their facilities rapidly enough to take care of the steadily increasing volume of business offered them."

"It is evident," Mr. Moody goes on, "that the power companies represent one of the most important and most stable of the basic industries; that their future, simply on the basis of past accomplishment, is definitely assured for a considerable time to come, and that well-placed mortgage bonds of the strongest of these companies may be freely classified among the highest grade of investment securities."

That the securities of these companies combine to a marked degree safety and stability, factors of prime importance to the investor, is shown




ANNUAL NET PROFITS OF 122 MANUFACTURING AND MERCHANDISING CONCERNS AND OF THE CLASS 1 RAILROADS (1919 PROFITS = 100 PER CENT)

in the accompanying chart from the March "Monthly Review" of the Federal Reserve Bank of New York. It represents graphically business profits for ten groups of industries in the years 1919-1922 inclusive. In this respect the public utilities stand head and shoulders above the other nine groups, a direct reflection of the fundamental soundness of the industry.

Either in good times or bad there is always a demand for electric light and power because these services are indispensable both to cities and rural communities, to individual householders and to large corporations. Thus the earnings of well-managed public utility companies are safeguarded by the very necessity of the service rendered.

## Promoting Rural Service in France

DEVELOPMENT of rural service in France is presenting much the same problems to the central-station companies there as it is in this country. Different methods of promoting the use of electricity by farmers have been tried, and a particularly interesting program that is in use by one company and might be used in similar form in this country has been described by William W. Brunswick, American Consul at La Rochelle.

To encourage the use of electrical energy in rural communities of that district where a certain prejudice exists against its use, the electric power company has been giving lectures upon the utility of electricity to the farmers and country people in general. The company has sent a circular letter to all possible users of electricity in the rural districts and has also published it in the local newspapers. The contents of this circular explain the many usages to which electricity can be applied on the farm, in the home and in farm buildings and are as follows:

1. *What One Can Do with a Kilowatt-Hour of Light*:

Economize 4 liters (1.05 gal.) of kerosene.

Illuminate during twenty-five hours the kitchen, the halls, the cellar, the blacksmith shop and the carriage house, a stable for twenty cows, a stable for sixteen horses, a sheepfold for 100 sheep, a hogpen for thirty hogs, a granary of 300 sq. m. (359 sq. yd.), a carriage house or harness room of 60 sq. m. (72 sq. yd.) a dairy of 40 sq. m. (48 sq. yd.), a shed of 100 sq. m. (119 sq. yd.)

Sew with a sewing machine during twenty hours.

Clean fifteen knives during one year.

Clip five horses or twenty-five sheep.

Heat water for shaving each morning during one month.

Light a cigar after each meal during five years.

Iron during four hours.

Warm your bed during four nights.

Heat your room during one hour.

Bring to a boiling point 9 liters (2.37 gal.) of water.

Fry fifteen chops in fifteen minutes.

Warm a coffee pot or dishes during five meals.

Warm your feet during ten hours.

Curl your hair each morning for twenty days.

Incubate 250 eggs.

2. *What One Can Do with a Kilowatt-Hour of Power*:

On the farm: Work an are (120 sq. yd.) to a depth of 30 cm. (11.81. in.); work two ares (240 sq. yd.) to a depth of 22 cm. (8.66 in.); work three ares (360 sq. yd.) to a depth of 15 cm. (5.90 in.); plough up the stubble of 4 ares (480 sq. yd.); illuminate the farm during two hours; irrigate a hectare (2½ acres) during fourteen hours with 3.50 m. (3.82 yd.) elevation.

In the barn: Thresh 140 sheaves of wheat of 3,500 kg. (7,716 lb.); illuminate the thrashing room during five hours.

In the dairy and cow barn: Milk with a machine twenty cows; separate the cream from 1,400 l. (370 gal.) of milk; heat 1,000 l. (264 gal.) of cream; churn 200 kg. (441 lb.) of butter.

In the wine shed: Crush 10,000 kg. (11 tons) of grapes; draw from barrel 300 hectoliters (7,925 gal.) of wine and pour into other barrels; crush 170 kg. (374 lb.) of the dead wood of vines; fill and cork 250 bottles.

In the granary: Lift seventy sacks of wheat to a height of 10 m. (33 ft.); sort 100 sacks of wheat; clean with winnowing machine 10 sacks of wheat; thrash 100 kg. (220 lb.) of oats.

In the bakehouse: Knead eight sacks of flour.

For your alimentation: Produce 4 kg. (8.8 lb.) of ice; raise 3,000 l. (793 gal.) of water to 20 m. (22 yd.); sterilize 10,000 l. (2,642 gal.) of water with ozone; crush 2,000 kg. (2.2 tons) of apples for cider.

In the work shop: Saw 90 m. (98 yd.) wood; sharpen 200 sections of blades for mowing machines.

In the feed room: Cut 400 l. (45.4 pecks) of oats for horses; crush 250 kg. (551 lb.) of furze; crush 600 kg. (1,323 lb.) of oil-cake; pound 100 kg. (220 lb.) of rye; pound 300 kg. (661 lb.) of corn; pound 200 kg. (441 lb.) of wheat; cut 5,000 kg. (5½ tons) of beets; cut 500 kg. (½ ton) of straw; mix 500 kg. (½ ton) of fertilizers; grind 50 kg. (10.23 lb.) of barley.

## The Economic Value of Street Lighting

SIX HUNDRED persons are killed each year in the United States because of inadequate street lighting, says a report of the American Society for Municipal Improvements. Property damage resulting from the same cause is put at $54,000,000 a year, whereas the entire country's bill for street lighting is but $50,000,000 a year.

Urging the need for higher standards of lighting as a preventive both of accidents and of crime, the society quotes municipal statistics showing that modern street lighting has reduced crime on certain streets as much as 41 per cent, as compared with other streets in the same cities.

## Chart Showing Stockholders Stimulates Sales

By Henry Bosch
Chief Draftsman Pacific Gas & Electric Company, San Francisco

TO STIMULATE its stock sales the Pacific Gas & Electric Company uses seventeen charts similar to the one shown in the accompanying illustration, which visualize graphically the actual number of


EVERY ONE OF 25,000 STOCKHOLDERS IS REPRESENTED BY A DOT

stockholders on the company's books. These charts measure 58 in. x 60 in. and are placed on an easel as shown. Each stockholder is represented by a colored dot $\frac{3}{16}$ in. in diameter. The annual stock sales are shown in relation to each other by using carefully selected color contrasts. Seventeen of these charts were made and placed on display in the various division offices of the company, at a cost of $35 each.

Although the advantage accruing from these charts is indirect, the attention given them by prospective stockholders has justified their existence. It is interesting to note that largely as a result of the favorable interest awakened by this display and other forms of publicity, the number of the company's stockholders increased by more than five thousand during the first five months after the appearance of these charts.

## Wiring Old Houses in St. Louis

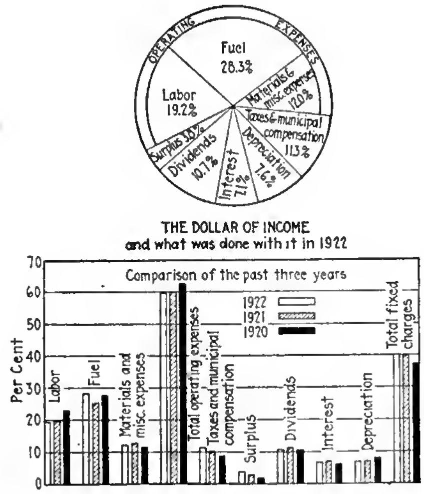
A HOUSE-WIRING campaign is being conducted by the Union Electric Light & Power Company of St. Louis which provides a financing plan whereby licensed electrical contractors may install wiring and fixtures in already-built homes and upon satisfactory completion of work may obtain payment in full from the company, which in turn will collect from the purchaser in monthly installments. The financing plan covers the new installation of wiring and fixtures or the installation of additional wiring and fixtures in already-wired homes, but does not cover Installation of fixtures only.

A contractor upon developing a "prospect" sends to the Union Electric Light & Power Company an inquiry for service and credit. The company makes investigation and notifies the contractor by letter as soon as the credit of the purchaser and availability of service have been established. The contractor receives payment from the company, upon completion of wiring and installation of fixtures, after the work has been inspected and approved by the municipal authorities, by presenting a signed contract for the work together with an initial payment of at least one-twelfth of the total and a statement from the purchaser that the work has been satisfactorily completed. The campaign was started on March 12 and will continue for an indefinite period.

## Commonwealth Edison Year Book Analyzes Growth

FOLLOWING the policy started in 1922 of acquainting stockholders with the details of their property and also furthering customer ownership, the Commonwealth Edison Company has just issued its 1923 Year Book. It contains a carefully prepared and condensed record of the company's growth presented in terms that any reader not generally familiar with financial statements can readily understand. The explanations of the income and expense account and the balance sheet follow in the same order as the customary annual report, but under each notation is a paragraph giving the details of and reason for that particular charge.

Included in the Year Book is President Insull's address to the stockholders at the annual meeting on Feb. 26, which was broadcasted by radio to stockholders and reported in the ELECTRICAL WORLD for March 3. The book shows the growth and




THE EDISON DOLLAR OF INCOME

The "wheel" represents the dollars received from customers during 1922. The "spokes" divide the dollar and show in percentages what was done with it. The blocks at the bottom of the chart compare the expenditures during 1922 with those of 1921 and 1920.

expansion of the company by charts and illustrations. Of particular interest is a diagram giving the proportionate expenditures of each dollar of income for operation, maintenance, interest, taxes, dividends and so forth. This diagram also gives a comparison of these expenditures for the past three years.

## What Other Companies Are Doing

**Albuquerque, N. M.**—The Albuquerque Gas & Electric Company proposes to apply for an extension of its franchise and has submitted a tentative schedule calling for a reduction in rates and increased service. It is probable that the city authorities will consider the installation of a better street-lighting system in connection with this matter.

**Chicago, Ill.**—The Utility Securities Company, which has grown out of the investment department of the Public Service Company of Northern Illinois and the Commonwealth Edison Company, is offering $250 in prizes for a better slogan than the one it is now using—"Investments that Endure." The requirements for the winning slogan are that it must not contain more than ten words and must be strong, direct, easy to grasp and easy to remember. To assist people in preparing slogans the company has issued a pamphlet listing a number of reasons why public utility securities are sound investments.

**Davenport, Iowa.**—A two-million-dollar group life insurance policy has been taken out by the United Light & Railway Company, covering its employees. Approximately two thousand employees of the company are protected by the policy, one thousand in the "Tri-Cities" and one thousand in other cities in Iowa, Illinois, Michigan, Indiana and Tennessee. The policy covers all employees in every department, irrespective of class of employment. The amount of insurance varies with the number of years each employee has been continuously in the company's service, up to ten years, after which the maximum amount, $1,500, is obtained.

**Salt Lake City, Utah.**—The good roads committee of the Salt Lake Chamber of Commerce, state, county and city officials witnessed a demonstration of a new system of highway lighting on the evening of March 23. The experimental system, consisting of fifteen highway units of 250 cp. each spread over a distance of about a mile at intervals of from 350 ft. to 400 ft., was installed at the instance of the good roads committee and the State Highway Commission. That part of the road selected for the demonstration was chosen because it presented the three most difficult problems in highway illumination, a curve, a hill and a railroad crossing. When the roadway was illuminated it was apparent that there was sufficient light at every point to make it safe to drive automobiles along the highway without headlights. The installation was made by engineers of the Utah Power & Light Company and the General Electric Company.

**Boston, Mass.**—Electric appliance sales in nine companies managed by Charles H. Tenney & Company totaled $19,698 for January, 1923, against $13,104 for January, 1922, a gain of about 50 per cent. The leading companies for the first month of this year were: Malden, Mass., $5,458; Fitchburg, Mass., $3,487; Salem, Mass., $3,027, and Montpelier, Vt., $2,995. As good an increase was marked in preliminary reports for February, 1923. For the week ended March 10 last twelve Tenney companies sold about $10,800 in appliances, of which some $8,100 were electric.

# Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Burning Pulverized Coal with Reduced Furnace Volumes.* — N. W. ARROWOOD.—The author argues that by thoroughly mixing coal and air in a proper burner moderate furnace volumes may be employed and excess air reduced; also, by injecting the fuel mixture into the furnace horizontally and at low velocity, temperatures will be highest at the center of the gas volume and lowest at the furnace walls. He describes the burner designed to meet these conditions.—*Power*, March 13, 1923.

*Gennevilliers Power Station.*—M. BLONDIN.—Five banks each consisting of three 60,000/3,000-volt single-phase transformers of 15,000 kva. are installed within this station. Each bank is directly connected to its 40,000-kw. turbo-generator set, with only current transformers between the two. The transformers are water-cooled. One bank of three 4,000-kva. single-phase transformers supplies the auxiliary power requirements. The oil switches used have a safe rupturing capacity of 600,000 kva. The Merz-Price selective protection system is used, protecting all feeders. To localize short-circuit currents within the internal power-supply system a number of air-core reactors are installed. These reactors are oil-cooled and are placed within tanks made of copper with a bottom and a cover of bronze. More than 125 km. of single-conductor, 60,000-volt underground cable has been laid out in concrete ducts, three cables in one duct representing one feeder. A very detailed description of this cable is given. The cable was successfully tested on the drums with 175,000 volts for one hour. Nine-petticoat porcelain bushings, cemented upon a bronze funnel, form the cable potheads, which were tested with 220,000 volts against ground.—*Revue Générale de l'Electricité*, March 3, 1923.

## Generation, Control, Switching and Protection

*Cable Protection System.*—W. PFANNKUCH.—This system, known under the name of the author, requires specially built cables with the main conductors in the center and a concentric layer of auxiliary conductors insulated from one another and from the main conductor. All of the conductors, however, transmit power according to their cross-section. At the start and the end of the cable a differentially connected combination current and potential transformer is connected to the cable, causing a slight potential difference between the main conductor and the outer conductors of the cable. As long as the cable is in perfect condition the magnetic fluxes in this special transformer resulting from the current and voltage windings will balance one another, and no current will be induced in the secondary winding. This protection system gives a warning signal for less than 1 per cent unbalance in the cable. The finding of a fault in the cable is much simplified by the aid of the insulated outer conductors and can be localized by calculation to within a few inches. The special construction of the cable increases its price about 5 per cent. The system is specially adapted to the protection of high-voltage cables and has been in successful operation for the last two years on transmission systems in Germany, Sweden, South America and Turkey, with voltages of 10,000 to 35,000.—*A.E.G. Mitteilungen*, February, 1923.

*Large-Capacity Oil Circuit Breakers.—I.*—G. BRÜHLMANN.—A large amount of valuable information on the construction and performance of oil circuit breakers can be found in this publication, dealing with the latest types of breakers up to the highest voltages. On breakers up to 500-amp. capacity no great attention need be paid to the contact surface as long as the contact pressure is high. Arcing tips are not required. Above 500 amp. well-designed brushes combined with high pressure and arcing tips must be used. Excellent insulation, avoiding dangerous creepage, is essential. In the open position only oil should be used between live and dead parts of the switch. All breakers must withstand repeated closing upon a short circuit without necessitating an inspection of the contacts. Abnormal generation of smoke may cause an arcing against the tank or between phases, against which insulating casings and partitions of heavy material are a reliable remedy. The gases developed in the oil at a violent rupture are inflammable and give, mixed with air, an explosive mixture. To avoid ignition of these gases the oil level should be high enough above the contacts to cool these gases below the flame point before they reach the oil surface. The sudden generation of these gases causes pressures of up to 8 atmospheres within the oil tank, and these pressures are usually of an oscillatory character having about 500 cycles per second. Steel boxes with very carefully made welded joints, with seams slightly beyond the edge of the tank, gave the most reliable switch tanks, rupturing at about four times the expected pressure. A contact arrangement with multiple breaks shortens the duration of the arc and lessens the danger of ignition of the gases. Congealed oil is very dangerous, because it slows down the speed of the opening and prevents the quick quenching of the arc. Using oil under pressure, as suggested repeatedly in the literature of the subject, was found in actual tests to be a decided disadvantage. With oil under 7 atmospheres pressure the arc lasted 70 per cent longer as compared with its performance under barometric pressure. At the same time, the volume of generated gases amounted to about twenty times the volume without the pressure. Excellent protection of the switch itself may be obtained with a resistor connected externally between one of the contacts and the two middle contacts (quadruple break), for which purpose a third insulated lead is usually provided on the cover of a single-phase breaker. — *Brown-Boveri Mitteilungen*. March, 1923.

## Transmission, Substations and Distribution

*Applications of Heaviside Expansion Theorem.*—LOUIS COHEN.—The author has worked out a few examples relating to somewhat different branches of electrical engineering, in order to show the wide range of application of the expansion theorem in the solution of electrical problems.—*Journal of the Franklin Institute*, March, 1923.

*Three-Phase, Four-Wire Distribution Systems.*—H. W. SMITH.—The characteristics of the three-phase, four-wire primary circuits as an ideal system of distribution are fully discussed by the author. He points out that even in very small communities this four-wire system has many advantages. Single-phase branch-feeders can be tapped from a main feeder at any point, and the improvement in regulation obtained by tying together the neutrals of two long single-phase feeders fed from a four-wire main is quite large. Small blocks of polyphase power can be supplied much more cheaply than by any other system. The necessary changes in equipment motors, transformers, etc., upon the adoption of the four-wire system are related.—*Electric Journal*, April, 1923.

## Units, Measurements and Instruments

*Derivation of Hydraulic Equation for Gage Relations and Discharges.*— D. K. C. STRATHEARN.—Methods of deriving gage relation and discharge equations employed during the recent St. Lawrence River power investigation are described.—*Canadian Engineer*, March 20, 1923.

*Current Capacity of Wires and Cables.*—G. E. LUKE.—In the December, 1919, issue of the *Electric Journal* a table giving the current capacity of conductors in still air outdoors for 40 deg. C. rise was published. Extensive tests conducted by the author and made with carefully calibrated instruments under most favorable conditions indicate that the temperatures produced by a given current are considerably higher

than indicated by the formula which was the basis of the above-mentioned table. These tests have been furthermore corroborated by entirely independent tests, which, though not extensive, check closely. The results of the author's tests are given. — *Electric Journal*, April, 1922.

### Illumination

*Ornamental Street-Lamp Installation.* —In spite of the fact that proper street lighting has been found to reduce the number of accidents, the advance in the use of new lighting units has not been so rapid as the advance in other civic improvements. This article gives data on accidents caused by inadequate illumination and on cost of street lighting and information on other important features.—*Journal of Electricity and Western Industry*, March 1, 1923.

*Car-Lighting Maintenance Methods.* —Regularity in greasing and inspection of car-lighting equipment is unquestionably one of the first requisites for its successful operation. Very good results have been accomplished on the Erie Railroad by the inauguration of a system of record keeping by means of which it becomes practically impossible for any car to be neglected without that fact being known at headquarters. Typical forms are included which include greasing and overhauling reports, inspection of axle-light equipment, battery-flushing chart, ball-bearing inspection, etc.—*Railway Electrical Engineer*, March, 1923.

### Motors and Control

*Electrification of a Large Carpet Mill.*—H. KETTON.—A detailed description is given of the complete electrification of a very large and old-established factory in which a complex series of processes contribute to the manufacture of the finished products. About 4,000 hp. of motors, together with the necessary power plant, were installed with practically no stoppage of work. A very detailed description is given of the power plant and the arrangement of the various machines.—*English Electric Journal*, Vol. 2, No. 3.

*Variable-Speed Alternating-Current Motors Without Commutators.* — F. CREEDY.—After a short general discussion, a new method of pole changing, involving the use of a number of phases greater than that in the line, is explained, together with means for simplifying the connections by the use of mutually reversed coils and by a star-mesh connection. The phase transformer needed to produce the increased number of phases is next decribed, and it is shown that the current in the windings intermediate between the three-phase tapping points is reduced to a very low value as in the rotary converter, making the apparatus small and inexpensive. The switchgear employed is discussed, and it is pointed out that the methods described render the squirrel-cage motor adaptable to almost all purposes, since they enable it to give good starting torque with low current. Machines with slip-ring characteristics are also described and test results discussed. A description is given of the cascade motor, and its unique characteristic of giving gradual adjustment between speeds is explained. Two-speed, three-speed and four-speed motors having this characteristic are referred to. Some tests of large rolling-mill and other motors are described, and finally an account is given of the application of the cascade motor as a short-circuit motor machine with slip-ring characteristics and as a unity-power-factor synchronous machine of greater simplicity and less cost than any other type.—*Journal of Institution of (British) Electrical Engineers*, March, 1923.

*Flywheels on Rolling-Mill Drives.*—F. R. BURT.—Various mill power loads and rolling characteristics which determine the advisability of flywheels for such service are discussed. In determining the size of the motor for driving a mill, both the root-mean-square or equivalent heating load and the peak load must be considered. The relative importance of heating and peak load depend roughly on what percentage of the total passes contain metal simultaneously. — *Blast Furnace and Steel Plant*, March, 1923.

### Heat Applications and Material Handling

*Scrapping Steel Cars by Means of the Carbon Arc.*—E. H. DRALLE.—The electric cutting process has proved to be an economical method of reducing scrap to sizes that can be handled and cut by shears. The work done thus far on dismantling cars by the carbon-arc process has shown that this method is decidedly superior to other methods of scrapping, and it is entirely possible that a more widespread use of this process will result in an improved means for wrecking cars which will still further decrease the already low cost of dismantling by the arc process. —*Railway Electrical Engineer*, March, 1923.

### Telegraphy, Telephony, Radio and Signals

*Wireless Antennas.*—From a consideration of the usual radiating structure it is evident that in many cases great improvement is possible, and methods by which improvement may be achieved are described. A method of calculating the various antenna constants is given. —*Wireless World and Radio Review*, Feb. 17 and March 17, 1923.

*Wind-Pressure Assumptions as Affecting the Design of Radio Towers and Masts.*—In all theory, design and specifications some assumptions are necessary, and as experience is gained the value and accuracy of these assumptions are made apparent. The ultimate weight and cost of a structure are influenced in no small degree by the initial considerations, and in the particular field under review the question of maximum wind pressures and the law connecting such pressures with height above ground level are of primary importance. The paper reviews briefly the results of past experiments and endeavors to point out what are safe and economic values of wind pressures for design purposes. The need for the standardization of wind-pressure assumptions is also brought out.—*Journal of the Institution of (British) Electrical Engineers*, March, 1923.

*The Hot-Cathode Rectifier as Applied to Radio Transmitters.*—D. G. LITTLE.—This rectifier has found a new application as a source of high-voltage direct current in connection with radio telephone and telegraph transmitting apparatus. The difficulties of a direct-current generator for voltages of 2,000 v. and above are overcome with the rectifier. Circuit diagrams and characteristic curves of this rectifier are given. The hot-cathode rectifier, using tubes of the high-vacuum electron type, offers a very convenient means of obtaining direct-current power from alternating-current supply when the current required is 5 amp. or less with voltages of 2,000 to 20,000 or even higher.—*Electric Journal*, April, 1923.

*Flat-Type Relays for Telephone Circuits.*—D. D. MILLER.—A relay for opening and closing telephone circuits is described that is flexible, reliable and economical. This relay is made up in three thousand varieties of windings and switching arrangements, but is essentially a punch-press product. — *Electrical Communication* (published quarterly by the International Western Electric Company), February, 1923.

### Miscellaneous

*Future Industrial Use of Electron Tubes.*—M. LEBLANC.—Having solved practically all mechanical difficulties in the design of electron tubes up to about 1,000 kw. output, the author foresees in a somewhat visionary article, the future uses of these tubes for industrial purposes. With the possibility of building what the writer calls an electromagnetic valve, it is theoretically easy to transform alternating current into direct current of high voltage, to transmit this current and to transform it at the end of the line back to alternating current with a satisfactory over-all efficiency. It would further be possible to use a high-frequency alternating current to transmit energy to locomotives or electrically driven automobiles without a metallic connection between the source and the vehicle. An overhead or underground condenser-trolley fed with 20,000-cycle alternating current could be devised within the field of which the vehicle, which would contain a secondary winding, would run. In this winding a high-frequency alternating current would be induced which could be transformed with the aid of electromagnetic valves into three-phase current of low frequency to energize the motor and control equipment of the vehicle.—*Bulletin de la Société Française des Electriciens*, January, 1923.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## New Telegraphic Alphabet

**System Invented by General Squier Doubles Speed of Radio, Wire and Cable Systems**

INVENTION of a new telegraphic transmitting alphabet applicable alike to radio, land lines and submarine cables was announced by Major-Gen. George O. Squier, Chief Signal Officer, U.S.A., at the annual meeting at Washington last Tuesday of the National Academy of Sciences. This alphabet, General Squier said, was more than two and a half times as fast as the international Morse alphabet now employed.

The principle upon which the new method is based is that the dots and dashes occupy equal lengths of time. No consecutive signals are of the same size, and the limit of legibility for each letter of the alphabet is practically uniform. The dots, dashes and spaces are differentiated by different intensities of the sinusoidal wave employed, in exactly the same manner that music and speech are formed. The principles of the new alphabet, General Squier said, serve to bring telegraphy into line with telephony and to base the two arts on the same fundamental principle of modulation.

General Squier claimed in his paper that this method of transmitting messages offers a plausible solution of the problem of interference and of "static" elimination and also of multiplexing a single radio-frequency channel.

## Burgess Heads Standards

**Appointed by President to the Post of Director of Bureau to Succeed Dr. Stratton**

AT THE suggestion of Secretary of Commerce Hoover, the President has appointed George K. Burgess to be director of the Bureau of Standards. Since 1913 he has been chief of the bureau's division of metallurgy. His service with the bureau dates from 1903, when he was appointed as an associate physicist. In 1905 he was promoted to be a physicist.

The appointment of Mr. Burgess follows several months of futile search on the part of Secretary Hoover for an outstanding physicist who had not been connected with the government service and who had sufficient means to allow him to make the sacrifice of income which would be entailed in the acceptance of a bureau directorship. Mr. Hoover's investigations revealed that physicists in the front rank of their profession are being paid salaries ranging from $18,000 to $20,000. He combed the country for a man possessing the requisite qualifications for this important government post, but found no one who was acceptable to him who could be induced to take the place at the salary available.

While it was Mr. Hoover's desire to bring into the bureau a man from the outside who could be expected to have ideas and plans prompted by his outside contacts, he recognized that the next best thing would be to promote some member of the bureau's staff, who would have the advantage of an intimate knowledge of its work and problems. His choice happened to fall on the ranking member of the bureau's staff, and Mr. Burgess' colleagues are unanimous in agreeing that he is best qualified to undertake the directorship.

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George K. Burgess

Mr. Burgess was born at Newton, Mass., in 1874. He received his B. S. from the Massachusetts Institute of Technology in 1896, and he held a fellowship at that institution from 1898 to 1900. His Sc.D. was obtained in Paris in 1901. He served short terms as instructor at the University of Michigan and at the University of California. He is the author of a number of scientific articles and treatises.

Mr. Burgess has been active in the work of the National Research Council. During the war, in addition to his regular duties, he was an adviser to the requirements division of the War Industries Board and to the Ordnance Department of the army. In 1917 and 1918 he was chairman of the light alloys committee of the National Advisory Committee for Aeronautics. During the same period he was a member of the National Aircraft Standards Board.

## Smith Bills Slaughtered

**Assembly Defeats All Utility Measures by 69 to 59—Water-Power Bill Awaits Same Fate**

BY A VOTE of sixty-nine to fifty-nine on almost straight partisan lines, the Republican Assembly at Albany defeated on Wednesday the six public utility bills advocated by Governor Smith of New York. These bills had all passed the Democratic Senate. It is very unlikely that they can be brought up again this session. The New York City transit bill had been killed in the Assembly the day before. The Governor's water-power bill has not yet been brought to a vote in the Assembly, where the same fate in all probability awaits it. The six bills slaughtered Wednesday were:

The bill to create a department of public utilities for New York City, with power to own, lease, operate and control gas plants, electric plants, heating plants and telephone lines.

The bill to abolish the present Public Service Commission of five members and create in its place a commission of three, to be appointed by the Governor.

Senator Walker's so-called 5-cent fare bill, which would restore to up-state cities full power over franchise agreements with traction companies.

The bill to permit all cities to own, operate, lease and control public utilities, designed chiefly for up-state cities, so that they would have the same broad powers as were designed for New York City.

The bill to create public utility commissions in up-State cities to have control over utilities which the city might elect to own or operate, the commissions to have the same powers as the present Public Service Commission exercises.

A bill to change the wording of the Public Service Commissions law to make it conform with the proposed legislation.

## Newfoundland to Vote on Big Hydro-Electric Program

Newfoundland has been called upon, by the dissolution of its Parliament, to determine whether it wishes its vast natural resources developed by the harnessing of the unlimited power of the Humber River and the utilization of its lumber reserves for the manufacture of paper. Sir Richard Squires, leader of the Liberal party in Newfoundland, is appealing to the country for a mandate to put through a huge water-power development program with

resultant pulp and paper mills having a daily capacity of 400 tons, together with various other industrial programs. The water-power development program will be undertaken under the joint guarantee of the British government and the Newfoundland government provided that the people of Newfoundland indorse the proposal at the polls. Sir Michael Cashin, the executive head of the opposing party, is aggressively opposed to the program and has issued a circular to the electorate describing the undertaking as visionary.

The entire north and west sections of Newfoundland are strongly supporting the industrial development policy of Premier Squires, but Sir Michael Cashin is said to have a considerable following in the southeast section. The opposition is attributed to a feeling among the big fishing interests that inland industrial development will take their labor away, consequently compelling them to pay higher wages to fishermen. It is predicted that Premier Squires will be indorsed by a very large majority.

# Triumph of Superpower Seen

## Spring Convention of A. I. E. E. Discusses Technique and Policy of Electric Power Supply, Indorsing Use of Grounded Neutral and Ground Relays

ALMOST a thousand engineers from all parts of the United States and some from foreign lands listened at Pittsburgh this week to the group of splendid technical papers, filled with operating data, field experience and technical analysis of important subjects in the light and power industry, that were presented at the spring convention of the American Institute of Electrical Engineers. The papers and the discussions which followed were noteworthy for the crystallization of opinion as to the best engineering practice to be followed in lines which have been largely controversial heretofore. The use of the grounded neutral and of ground relays was accepted by power engineers and telephone engineers alike, the only difference of opinion being in regard to the use of high or low resistance, the number of multiple grounding points and similar details. It was generally accepted that no agreement on a single method applicable to all systems was likely to be reached, the individual characteristics of systems determining the exact method on each system.

### Petersen Coil Discussed

Experience with the Petersen coil was presented, indicating its usefulness at least on low-voltage, singly-fed, single-circuit lines. More extended use of grounded relays, greater perfection in the relays themselves and the development of two new types were the outstanding points in the discussion on relays. The balanced-differential current relay had its first installation on the Duquesne Light Company's ring. The second new type was a distance time relay involving the application of a voltage coil and a current coil and the balanced-differential principle.

The electric furnace session brought out the admittedly good performance in the steel industry and the trend toward its wider application to the production of alloys. The magnetic-field effect on atomic structures in the operation of the electric furnace and its application to refining processes were suggested for investigation. More refined tests on steam locomotives indicated further advance in locomotive practice, but discussion showed that electrification still offers advantages over steam operation.

### Superpower the Banquet Theme

By their applause of the speakers at the banquet on Wednesday evening the seven hundred men in attendance put themselves on record as in favor of a vigorous policy of superpower development and indorsed the necessity of interstate and international networks which must be allowed to develop unfettered by the restrictions of state lines, of needlessly obstructive laws and of politics. There was an agreement that politicians must be educated by educating the public, rural as well as urban, to the benefit which will inure to it as a result of an intelligent utilization of the country's natural power resources.

Three addresses were made on this subject in addition to the remarks of President F. B. Jewett, who served as toastmaster. President Jewett dwelt on the point that all the many necessary, useful and enjoyable things that the human race has learned to do or make require power somewhere, either in operation or in construction. Therefore, as the use of these things grows and as consequently the use of power grows, there must ultimately come a time when man will have to reduce his wants because of lack of power-producing facilities unless he meanwhile develops a plan for more efficient power production and utilization. In this regard superpower development with a maximum use of water power plays a necessary part.

Paul T. Brady of the Westinghouse Electric & Manufacturing Company recalled the advance made during his lifetime in the development and use of electric power and predicted unlimited future development, but showed that interconnection was an economic necessity for adequate utilization of resources to supply the necessary power. He said in part:

"To take the next step in social progress, not only must we utilize our water-power resources to the fullest extent, but we must also use huge steam plants which will supplement the water power. The ideal location for these steam plants is beside the rivers of the coal regions, where fuel can be delivered to the boilers with a minimum of transportation and where ample supplies of condensing water can be obtained. There is a tendency on the part of certain power engineers connected with plants thus favorably located to take a short-sighted view of the power situation. 'Why should our plants co-operate with water-power plants?' they ask. 'Here we have abundant supplies of cheap fuel for generations to come. We can gain nothing by becoming part of a larger system and are therefore not interested in the project.'

"These people forget that outside the narrow limits of their own systems there are millions of people who are either paying high prices for electricity or are unable to get it at any price. They forget that their properties form an essential element in any plan to supply the country as a whole with power at the lowest cost. They forget that, if their plants become a part of such a system, they will have the widest possible market for their excess power and their surplus coal. They forget that, after all, their systems are not absolutely self-sufficient and that, unless connected with other sources of power, they may fail to give service in event of serious accidents. Finally, they forget that it is precisely this attitude of self-interest that forms one of the strongest arguments for the governmental ownership of the unified power systems. They must see the larger picture. Up north in Canada there is 18,000,000 hp. of the finest water power in the world; down here in Pennsylvania, West Virginia and Ohio there are billions of tons of coal. Employed separately, each will indeed benefit many people, but used together to the best advantage they will bring ever-increasing prosperity to all of the people in Northeastern North America.

### Better Work Must Follow Good

"I must not be understood to be criticising our central stations. Their splendid work has alone made possible life as we know it today and has opened the way to the even fuller life that we can confidently expect the next generation to enjoy. Furthermore, no one can be censured for acting in the best interests of his own people, but good work is no excuse for not doing better work. Nothing better can be given to the people of the United States and Canada than a single international power system that will permit the utilization of our water power and coal to the best advantage and will provide every one with an abundant supply of electricity."

R. F. Schuchardt of Chicago, in discussing engineering phases of superpower, also traced the growth of power and its effect on civilization. "Cheap power has caused a rapid growth in industrial centers, and every com-

munity that has had this cheap power has prospered," he said. Virtually every European country has appointed a commission to study the means of obtaining most economically power to offset the great loss in man power, and they turned for guidance to what they term the superpower systems of America. But America is not resting on her oars, Mr. Schuchardt continued. She is going ahead to develop more power economically to relieve mankind and maintain her industrial supremacy and high standards and at the same time retain for American labor and American investment their fair share of the world's trade. Interconnection and still more interconnection is the answer, and this is at once in the interest of the industry and of the nation.

As to the engineering, it is its work to save fuel and dollars, dollars meaning labor and material. Fuel economies are understood. Dollars are saved by realizing savings due to diversity factor, a natural result of interconnection. Mr. Schuchardt issued a challenge to and yet expressed confidence in the engineer when he spoke as follows:

### WHO SHALL SET THE STANDARDS?

"The electricity supply industry in its onward march is bringing about many extensive interconnections. Is this development following a definite, logical engineering plan? No such plan has as yet been developed except that for the North Atlantic Coast area. What assurance have we that when the grouping of groups which is on the horizon arrives the systems will be found readily adaptable to economical interconnection? Is the frequency common and how about the voltages? Who should set up the standards and see that investments made for present extensions will have their proper value in the coming years? Who will see to it that the industry lives up to its obligation, to its trust? Naturally, the industry itself, for it is keenly alive to its obligation. Already there are committees of the industry's organization, the National Electric Light Association, studying the problem in various parts of the country, and more will undoubtedly be formed. The society of the profession most interested—that is, the American Institute of Electrical Engineers—will be an important factor in solving the problem, of course. Co-operation between all these will assure uniformity at least in the fundamentals of such studies."

M. H. Aylesworth, discussing superpower as a national policy, said in part:

"As professional engineers have good reason to know, the installation of superpower stations and systems is not hindered by questions of engineering but by weightier matters of finance, law, economics, politics and policy. These handicaps still beset us, and when they are once disposed of superpower stations will spring up with remarkable rapidity. The whole trend of economics in tho electrical industry is toward larger stations and systems, and notable examples of these are to be found here in the Pittsburgh district and in numerous other sections of the country. Eventually the United States will be studded with large superpower stations, for the ultimate destiny of the country is to be covered with a network of interconnected transmission lines fed from such stations and reaching every city, town and village.

### BULK SUPPLY NOT NEW

"The idea of bulk supply is not new; it is as old as the electric lighting industry itself. From the very beginning it was recognized that the economics of the situation demand that the supply of electricity for the home, for the store, for the factory and for transportation should come from one central source. Manifestly, if we are to maintain the high standard of living which is characteristic of America, the per capita earnings of the country must also be high. With the competitive markets of the world, it would be impossible to bring this about without the aid of machinery, and therefore in this country use is made of every trade facility, invention and appliance. The United States, through its great use of machinery and electricity, is able to maintain a higher standard of living than any other country because its labor produces more and earns more. During the twenty years prior to the war the annual national per capita earnings in the United States increased 116 per cent, those of Germany 52 per cent, France 27 per cent, and Great Britain 21 per cent.

"These percentages reveal much. They show what an enormous influence cheap power, which means electricity, has on the productive capacity of a nation and people, and it is chiefly because they are such great users of electricity that Americans excel in so many directions. But if we are to continue to enjoy an abundant and cheap supply of power, we must concentrate more and more in its production; we must erect fewer but larger stations; we must develop our water powers, conserve our fuel resources, and through interconnected networks of transmission lines make power available in every market. Full use of power means taking the city to the farm, giving city electrical facilities to the farmer, and this will be the salvation of this country.

### SUPERPOWER AND CIVILIZATION

"Superpower is a measure of advancing civilization. It is machinery raised to the $n$th degree, superseding municipal and state boundaries and becoming national and continental in its character. It can find no abiding place in countries where life is primitive and labor cheap.

"The advance of machinery and of unified operation has had in past generations to combat two fears—the fear of the hand workman that his displacement means his destruction and the fear of the people at large that monopolies for their exploitation and oppression will spring up. The march of events in America has shown that—aside from such temporary individual hardships, regrettable, but inevitable, as every great change must bring—both fears are illusory. Nowhere else is machinery so firmly installed and nowhere else is the workman half so prosperous. Nowhere else are public service companies so large and so tied together and nowhere else are their rates and their service more firmly under the control of governmental agencies for the protection of their customers and the public at large. Superpower is a further extension of the principles of machinery and co-operation. Government regulation and customer ownership will travel with it. Cheaper energy, better service, progress, prosperity, profit and plenty will follow in its train."

Several inspection trips, including one by special train to the Westinghouse works, were scheduled for Thursday afternoon and Friday.

## Massachusetts Superpower

**Bill Signed by Governor Cox Foreshadows Union Plants at Fall River and Other Points**

AN IMPORTANT step toward economic power development occurred last week in Massachusetts when Gov. Channing Cox signed a bill permitting electric light and power companies to unite in financing and building generating stations and the necessary interconnecting transmission lines and equipment. Hitherto plant developments have been by individual companies, but the new law enables the advantages of interconnection and the supply of larger areas from tidewater stations to be realized more effectively through co-operative action by utilities interested in comprehensive developments. The Department of Public Utilities will maintain its usual regulatory interest in what is done.

The bill was brought before the present session for the immediate purpose of financing and building a plant of 200,000 kw. ultimate capacity on Mount Hope Bay, Fall River, in the interest of the Fall River Electric Light Company, the Edison Electric Illuminating Company of Brockton, Mass., and the Blackstone Valley Gas & Electric Company of Pawtucket and Woonsocket, R. I. The general program of this development by the proposed Montaup Electric Company has been reported in a former issue of the ELECTRICAL WORLD (issue of March 17, page 648). Energy will be transmitted from Fall River to the Brockton and the Pawtucket-Woonsocket districts. The initial outlay will total about $5,500,000 and will include the generating station, a 30,000-kw. generating unit, boilers, auxiliaries and a part of the transmission lines. The first unit is to be placed in operation in 1924 and a second unit soon afterward. The design and construction of plant and lines will be handled by Stone & Webster, Inc., Boston, under whose management are the Blackstone Valley and Brockton companies.

# Schuyler S. Wheeler Dies Suddenly

## Noted Electrical Inventor, Manufacturer and Engineer Was in Full Tide of Vigor—Edison Pioneer, Builder of Ampere, N. J., and a Leading Exponent of Professional Ethics

SCHUYLER SKAATS WHEELER, electrical inventor, engineer and manufacturer, who was president of the Crocker-Wheeler Company of New York and Ampere, N. J., died suddenly of angina pectoris on Friday, April 20, at his home in New York City. Funeral services, attended by many men prominent in the electrical industry and in scientific and other circles, were held in St. Bartholomew's Church on Monday. Among the organizations represented were the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Society of Civil Engineers, the International Electrotechnical Commission, the New York Electrical Society, the Chambers of Commerce of the United States and New York State, the Electrical Manufacturers' Club and the Electric Power Club. The pallbearers included Dr. Michael I. Pupin, Charles G. Curtis, John W. Lieb, A. L. Doremus and J. J. Carty.

Many messages of sympathy and tributes to Mr. Wheeler's character, ability and accomplishments were received at his home from men of prominence in the engineering world—among them Dr. M. I. Pupin, professor of electromechanics at Columbia University; Charles G. Curtis, with whom and the late F. B. Crocker Mr. Wheeler first entered the manufacturing business; Frank B. Jewett, president of the American Institute of Electrical Engineers; Alfred D. Flinn, secretary of the United Engineering Society; John J. Carty, vice-president American Telephone & Telegraph Co., and James H. McGraw, president McGraw-Hill Company.

Born in New York City not quite sixty-three years ago, the son of James E. and Annie Skaats Wheeler, Schuyler Skaats Wheeler came of age at the very time when electric light was emerging from the laboratories of the inventors to illuminate the streets and buildings of cities and villages. He left Columbia College in 1881 and obtained the post of assistant electrician in the American branch of the Jablochkoff Electric Light Company, subsequently transferring his services to the United States Electric Light Company, at that time coming into the field with the direct-current arc lamp, and then, with an unfailing sense of the lines along which electrical progress would be made, seeking and obtaining a place on the staff of Thomas A. Edison. Young Wheeler was one of the historic group present at the opening of the Pearl Street central station in New York City forty-one years ago. He superintended the installation of a number of the distribution systems that followed this pioneer—notably the underground systems at Fall River, Mass., and Newburgh, N. Y., and was in charge of operation in the latter city.

The field of invention and manufacturing soon, however, came to have a greater appeal to the young electrical engineer than that of installing and operating plants, and in 1886, after acting as electrician for the Herzog Teleseme Company, to which he contributed important inventions, he became connected with the C. & C. Electric Motor Company, just organized by two friends of his, Charles G. Curtis, of Curtis turbine fame, and the late Francis B. Croker, whose name and Wheeler's became permanently associated and who died two years ago. The C. & C. company manufactured small electric motors—a novelty at that time—and, under Dr. Wheeler's guidance as designer, electrician and factory manager, the company grew rapidly. In 1887 and 1888, however, Crocker and Wheeler severed their connection with it and founded the Crocker-Wheeler Company, of which Dr. Wheeler was president from 1889—when Mr. Crocker was appointed to the newly established chair of electrical engineering at Columbia University—to the time of his death. This company at once assumed and has always maintained a foremost position in the manufacture of motors.

Schuyler S. Wheeler

From 1888 until 1895 Dr. Wheeler, in addition to his private business, acted as electrical expert of the Board of Electrical Control for New York, during which time the task fell to him of seeing that all overhead lines were placed under ground. He carried out this duty faithfully and energetically and did not hesitate to remove poles by force when other means failed. In the year last named he resigned his municipal duties to devote his whole time to his manufacturing enterprise.

It was in 1895 that the works of the company, which a few years after its organization had been moved to the new town of Ampere, near East Orange, N. J.—a town that owes its existence and its name to the Crocker-Wheeler Company—were completely destroyed by fire. Almost before the ashes had cooled a larger and ultra-modern plant began to rise on the same site, while the business of manufacture went on in tents and sheds with electrically driven tools. The company was able to fill most of its orders, its business continued to increase by leaps and bounds, and the disaster was changed into an ultimate blessing.

The Latimer Clark library, the largest collection in existence of electrical books, was purchased by Dr. Wheeler in 1900 and presented to the American Institute of Electrical Engineers. This splendid collection contains every publication in the English language on the subject of electricity printed prior to 1886, including the rare sixteenth and seventeenth century works. It forms a literary monument alike to Dr. Wheeler's love of learning and his public spirit. He served as president of the Institute in 1905-06 and was at the time of his death chairman of the committee on code of principles of professional conduct, a subject that appealed to him so strongly that he had made it the theme of his inaugural presidential address, in which he expounded the duty of the engineer to his client, to the public and to his professional society.

Dr. Wheeler is said to have himself designed more than a thousand electric drives, including those for the complete equipment of the Government Printing Office and the Bureau of Engraving and Printing at Washington and other government plants. His activities and sympathies were not, however, limited to his great manufacturing enterprise. Besides the A. I. E. E., he was a member of the American Society of Civil Engineers and the American Society of Mechanical Engineers and was one of

the founders of the United Engineering Society. As recently as last November he served as one of the American representatives at the meeting of the International Electrotechnical Commission held at Geneva, Switzerland, and while in Europe he visited a number of countries, attending meetings of those interested in electrical manufacturing problems and investigating post-war conditions as they affected the electrical industry.

One side of his nature was shown by his institution at Ampere of a workroom devoted to teaching blind men and women to wind armature coils with tape. During the war this enterprise was carried on with special reference to soldiers who had lost their sight, and some of these were trained to be themselves teachers of others.

He contributed articles on technical subjects to various magazines and engineering journals, and his book on the "Practical Management of Dynamos and Motors," written in his earlier years conjointly with Professor Crocker, went through a number of editions and attained a large circulation.

### As Organizer and Executive

Perhaps a better estimate of Dr. Wheeler's abilities and the personal characteristics on which was built his great success as an engineer-manufacturer could not be given than that made many years ago, but as relevant today as ever, by Gano S. Dunn, then chief engineer of the Crocker-Wheeler Company, now president of the J. G. White Engineering Corporation. Mr. Dunn said:

"While Dr. Wheeler possesses the true engineering mind, that broad judgment which seems to rise above calculations and intuitively determine the salient principles of an engineering problem, and while it is to this characteristic, producing valuable inventions and designs, that his early successes were due, it is not in this direction that he has done his latest and best work. It is as an organizer and an executive, as an inventor of new methods of factory operation, to win success out of latter-day competition, that he has been pre-eminently successful and has blazed a way into a comparatively new country of manufacturing economics. Industrial organization in this country is carrying the lamp of progress far ahead into the darkness of old-fashioned and inadequate methods, and to such progress Dr. Wheeler is one of the men who have made great contributions."

Describing in some slight detail how meticulously every item of material and every finished part was followed through the factory by ledger entries, and how the writing of specifications, the issuing of orders and requisitions and the reporting of receipts and deliveries were checked at every step by a system that worked almost automatically, Mr. Dunn said:

"The result of such provisions for dealing with the minute as well as with the greater elements of manufacture has proved to be a greatly increased output, a diminished cost of production, a minimum of capital locked up in inactive stock, shutdowns for inventories no longer a necessity, and a promptness and certainty of delivery that attract business. The mob, organized into files, ranks, corporals, sergeants, captains, becomes an army, mobile and efficient. Many others have contributed to the higher industrial organization here referred to, but Dr. Wheeler has led in carrying it to some of its most successful developments."

He was a member of the Chamber of Commerce of New York and of the American Association for the Advancement of Science, as well as of a number of social and country clubs. He was also a director of the City Trust Company of Newark and of the Helicopter Company, Inc. Of the latter he was secretary.

In 1904 Dr. Wheeler received the John Scott medal of the Franklin Institute for the invention of the electric buzz fan. The degree of doctor of science was conferred on him by Hobart University, Geneva, N. Y., in 1894. Besides his New York residence, he maintained a home at Bernardsville, N. J.

## Cut in Commercial Lighting Rates of Detroit Edison

A reduction in the commercial lighting rates of the Detroit Edison Company has been directed by the Michigan Public Utilities Commission, this cut taking place in the second rate block and bringing a rate of 4 cents a kilowatt-hour in that block instead of 5 cents as formerly. This restores the pre-war rate.

Alex Dow, president of the company, in commenting on the order said: "The proposed reduction of commercial rates is in accordance with the arrangement arrived at a year ago with the Public Utilities Commission. At that time the question arose whether available earnings should be applied to reduce the rate for residential service, or the rate for commercial service, or should be split between the two, and it was the opinion of the commission, and ordered by it, that the reduction should be made in the rate for residential service as the place where it would do most good to the ultimate consumer, with the understanding that as soon as continuing improvement of business warranted further reduction would be given to the commercial consumer. This present reduction carries out that understanding. It is warranted by the present and expected earnings of this fiscal year.

"General business conditions in Detroit are very good," Mr. Dow went on, "and the demand for new connections and industrial power is likely to run over available capacity during the fall of the year. The output from the company's plants for the first three months of this year was 339,000,000 kw.-hr. as compared with 242,000,000 kw.-hr. for the similar period last year."

## Southern Power to Go Slow

### Soaring Construction Prices May Cause Postponement of Contemplated New Development

Reports from North Carolina indicate that increasing building costs are proving a serious bar to the construction program which the Southern Power Company had planned for this and succeeding years, and that because of these increased prices the program may be indefinitely delayed. While no Southern Power Company official is willing to be quoted to this effect at this time, there is thought to be no doubt of the correctness of the statement. The company finds that rates as they now are and construction costs as they now are eliminate any possibility of a dividend from new construction, and without dividends reasonably in sight it cannot secure money for building.

As readers of the Electrical World have been informed, the company now has under construction two great hydro-electric plants, one at Mountain Island, near Mount Holly, N. C., to develop 80,000 hp., and one at Great Falls, S. C., to develop 60,000 hp. The Great Falls plant, where it was only necessary to build a power house, the company already having a dam, will soon be completed, and the Mountain Island plant will be completed during the present year. In addition the company is building two 10,000-hp. auxiliary steam plants, one at Mount Holly and one at Eno. About two hundred miles of transmission lines and the necessary substation equipment are also being built. The power demand is now away ahead of the supply which the company is able to furnish, and while it is true that the company will soon have an additional 100,000 hp., that was all contracted for many months ago.

### Construction Prices Soar

The company's engineers have for months been figuring on possible sites for new development, the effort being to find where the most power could be developed for the least money. The engineers finally settled on a 50,000-hp. site on the Catawba near Rhodhiss. It has developed during the last few days, however, that at present costs of labor, material and hydraulic and electrical equipment it may be impossible to develop even this site because the income from the power that would be produced would not take care of the investment. Engineers and construction men have recently declared that the contracts for the Mountain Island plant and the Dearborn plant at Great Falls, let about Dec. 1, 1922, were at figures about 25 per cent or more under the present level of prices.

The public has been keenly interested in the prospective further development of the Southern Power Company, not only because of the large investment directly entailed but because of its far-reaching effects on the industrial development of the Carolinas.

## Electrical Men Speak

**Britton and Ballard Address Pacific Coast Meeting of A. S. M. E. on Utility Questions**

JOHN A. BRITTON, first vice-president and general manager of the Pacific Gas & Electric Company, acting as toastmaster at the banquet of the first Pacific Coast regional convention of the American Society of Mechanical Engineers in Los Angeles on the evening of April 18, struck the keynote of the sessions when he urged upon his hearers the necessity of their becoming more familiar with questions of public policy affecting present-day utilities. The proper and delicate handling of these matters, he said, made the continued services of the mechanical engineering profession profitable to its members and useful in the upbuilding of the nation.

J. L. Harrington, president of the A. S. M. E., alluded to the fact that a century ago 90 per cent of the population of America followed agricultural pursuits, while today only 30 per cent of our population is so engaged. He urged the engineer to contribute in larger part to the running of government. Ira N. Hollis, past-president of the society, alluded to the necessity of solidarity in engineering effort. H. M. Robinson, president of the First National Bank of Los Angeles, declared that within the next three years San Francisco and Los Angeles will see in full production the local manufacture of pig iron and steel.

### How One-Tenth Cent May Mean Much

R. H. Ballard, vice-president and general manager of the Southern California Edison Company, impressed upon his audience the fact that in those sections of America where strong, prosperous public utilities prevail the most prosperous communities are to be found. He showed how delicately the whole fabric of utility prosperity is interwoven with slight changes of rates when he brought out that in California a difference of one-tenth of a cent per kilowatt-hour would make a difference of 5 per cent in the surplus of earnings and thus assure the continued prosperity of a utility.

William Mulholland, chief engineer of the Los Angeles Bureau of Light and Power, paid a tribute to the genius of the engineer. Robert Sibley, Pacific Coast consultant for the McGraw-Hill Company and vice-president of the A. S. M. E., in speaking of the industrial and electrical West, pointed to the necessity of breaking the deadlock in the proposed development of the Colorado caused by the failure of the Arizona Legislature to approve the interstate compact and urged that pressure be brought to bear to get action, to the end that the present generation might receive some of the benefits that must accrue from this great storehouse of hydro-electric energy.

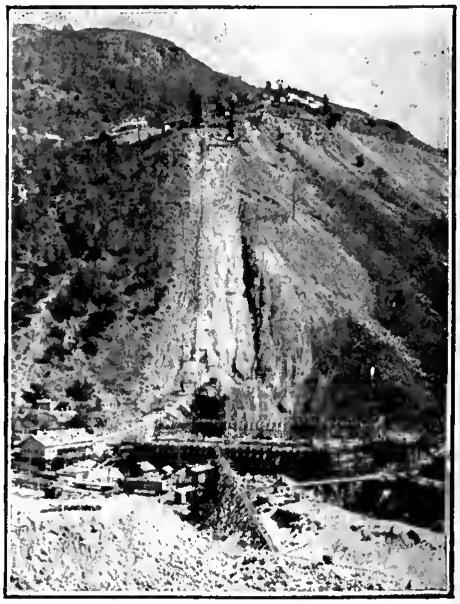
There were about two hundred engineers in attendance at the three-day sessions, many of them being from Eastern manufacturing centers and making their first visit to the West.

# Fourth Plant on Big Creek Started

**Southern California Edison Company Begins Work on the Superstructure of Power House—Eventual Rating to Be 210,000 Hp.—Operation in the Fall Expected**

WORK on the superstructure of the fourth power house on the Southern California Edison Company's Big Creek project, known as Big Creek plant No. 3, which will have a larger generating capacity than any other hydro-electric plant in the West, was started by the company on April 12. The completion of this plant will be the consummation of the fourth step in the Edison company's Big Creek project, which contemplates the development of 1,400,000 hp. from the watercourses of the high Sierra Mountains in central California, at a cost of $375,000,000. The company's budget for 1923 is $26,000,000, which includes, besides the work on the Big Creek project, large expenditures for transmission lines, distribution lines, substations and other construction. More than four thousand men are now engaged on the various phases of the Big Creek project.

The initial installation in this new plant will consist of three 35,000-hp. units, which is one-half of its ultimate development. These will be vertical turbines, built by the Wellman-Seaver-Morgan Company, operating at a speed of 423 r.p.m. and under a head of 760 ft. The generators, which are being built by the Westinghouse Electric & Manufacturing Company, will be rated at 25,000 kva., 11,000 volts, 50 cycles, and will have direct-connected exciters. The building will be 200 ft. long, 139 ft. wide and 110 ft. high from the tailrace floor to the roof and will be of reinforced concrete and structural steel. A feature of the design of the building is the elimination of the basement in the generator room. As the plant is laid out, the operating floor will be on two levels, one at the base of the generators and the other at the elevation of the turbines, so that virtually all of the equipment will be in view of the operator at all times. The switching station will be 195 ft. wide and 430 ft. long and will consist of a series of concrete benches placed on the slope of the mountain, there being a difference in elevation of 46 ft. between the upper and lower benches. These benches will support the 220,000-volt transformers, oil switches and bus.



CONSTRUCTION WORK ON CALIFORNIA EDISON COMPANY'S BIG CREEK NO. 3 PLANT WILL REQUIRE ONLY 141 DAYS

Water will be diverted from the San Joaquin River at a point 6 miles above the power house and just below the tailrace of Big Creek plant No. 8, and conveyed through a 6-mile tunnel having a bore of 21 ft. The tunnel, excavated from solid granite, will be unlined throughout except for one or two places where bad ground was encountered. It will have a capacity of 3,000 second-feet. The excavation is being done by air-operated steam shovels adapted to work in a 21-ft. bore. The muck is being removed by combination trolley and storage-battery type locomotives. Work on this tunnel is now nearly completed.

The penstocks will be made entirely o lap-welded pipe, varying in diameter from 7½ ft. to 6 ft. The valves at the bottom will be of the needle type, and those at the upper ends of the penstocks will be butterfly valves controlled from the power house. At the upper end of the penstocks a surge tank excavated from solid rock will be installed. It will have a shape similar to an hourglass, the largest portion being about 75 ft. in diameter.

The first generating unit in the new plant will be placed in operation about Aug. 1 and will be followed by the second unit about Sept. 1, and it is expected that the entire plant will be completed and the power placed on the lines about Oct. 1 of this year. The power will be transmitted a distance of 240 miles over the first commercially operated 220,000-volt transmission line in the world.

Construction work is now under way on the 13-mile tunnel connecting Lake Florence and Lake Huntington, and with the completion of this tunnel the great watersheds of the High Sierras, having an area about the size of the Hawaiian Islands, will be tapped and the water utilized for an ultimate development of 1,400,000 hp., with a total head of more than two miles.

## Innocent New York Officials Ask About Superpower

The Water Power Commission of the State of New York apparently is not familiar with the superpower survey of the Boston-Washington area made by the United States Geological Survey. Recently the Governor of New York was asked by the Federated American Engineering Societies if his power-development policies would conflict with the superpower plan. Governor Smith referred the letter to the Water Power Commission, which, in replying, said: "Inasmuch as you have not stated how your so-called 'superpower system' is to be carried out and its sources of power, it is impossible to say whether same would be in conflict with the Governor's policies. Would be pleased to have you advise us more fully of the real plan of the superpower system."

With regard to Governor Smith's ideas as to the handling of power development, the letter reads:

"The policy of the Governor relative to power development in behalf of the State of New York is well known in this state. His message to the Legislature declares in effect that the undeveloped water power on the Niagara and St. Lawrence should be developed by the state, that the base power available therefrom should be transmitted to the various municipalities over lines state-owned and controlled, that the electricity so generated be sold to the municipalities at approximately the cost of production and delivery, that the final distribution to the ultimate consumer be made through the agency of the municipality, through existing companies, or by the municipalities, subject to the approval of a state hydro-electric commission as to rates and service."

## Electrical Men Competing in Electrified Homes

Members of the New York Electrical League held a voting contest at a regular meeting on Tuesday of this week to determine which one of them lives in the most completely electrified home. The purpose of the contest was to develop a wider interest locally in the idea that electrical men themselves should lead the community in the completeness with which their homes are wired and the number of appliances which they use.

A special schedule crediting an appropriate number of points to various classes of wiring outlets and to all types of household appliances has been developed as a basis for such contests in the interests of the so-called "Electrify Club," which has been promoted by R. S. Hale, chairman of the N. E. L. A. wiring committee. Copies of this schedule were mailed to all members of the New York Electrical League in advance, and all members and guests at the meeting were invited to make reports on their home equipment and compete for the several prizes offered.

An electric coffee urn, with cream jug, sugar bowl and tray, was contributed by the Edison Electric Appliance Company; *Electrical Merchandising* offered an electric waffle iron, the Illuminating Glassware Guild a portable lamp, the General Electric Company an electric fan, the Simplex Electric Heating Company and the Western Electric Company electric flatirons, and the Westinghouse Electric & Manufacturing Company a tumbler immersion heater.

The highest score turned in was that of Clarence Law of the New York Edison Company, with 227 points. F. S. Montgomery of Wynkoop, Hallenbeck & Company followed with 216 points. A. Lincoln Bush, president of the New York Electrical Contractors' Association, was third with 195 points. Walter Neumuller, New York Edison Company, had 193 points; H. M. Walter, electrical contractor-dealer, 172 points; Roger Williams, Simplex Electric Heating Company, 157 points; F. S. Hartman, General Electric Company 146 points, and Albert Goldman, New York Edison Company, 145 points.

## "Tri-State" Changes Name

**Four Other Commonwealths Join It and Make Up the Southeastern Water and Light Association**

AT THE annual convention of the Tri-State Water and Light Association, held in Birmingham, April 17, 18 and 19, the name of the association was changed to the Southeastern Water and Light Association, and Alabama, Tennessee, Mississippi and Florida were added to the constituent states, which formerly included only Georgia and North and South Carolina.

The convention was given over largely to waterworks and piping, but on Tuesday E. T. Austin, General Electric Company, Atlanta, discussed the development of street lighting, and on Wednesday L. V. Gaffney of the Gaffney (S. C.) electric plant spoke on "Increasing the Day Load." On Thursday the delegates made a visit to the plant of the Alabama Power Company at Lock 12 and to Mitchell Dam, under construction on the Coosa River. Other visits were made to manufacturing plants in Birmingham. Following a banquet Thursday night at the Tutwiler Hotel, "The Power Factor: What It Means to the Central Station," was one among other subjects discussed by the delegates.

### Officers Elected

J. E. Gibson of Charleston, S. C., was re-elected for the third term as president. The following were elected as vice-presidents: D. L. Caston, Gainesville, Ga.; E. M. Foster, Greenville, Miss.; R. O. Polglaze, Gadsden, Ala.; I. S. Robinson, Columbia, Tenn.; Frank Schnabel, Clearwater, Fla., and C. L. Korner, Charlotte, N. C. W. F. Stieglitz of Columbia, S. C., was elected secretary and treasurer for the ninth consecutive time.

The selection of the place for holding the next convention was left to the executive committee. More than one hundred engineers, publicity utility managers and makers of machinery attended.

## Date for Iron and Steel Exposition Set

Sept. 24 to Sept. 28 has been selected as the time for the Iron and Steel Exposition to be held under the auspices of the Association of Iron and Steel Electrical Engineers in the Broadway Auditorium, Buffalo. This building will seat twelve thousand people. The main exhibition floor has 50,000 sq.ft., which will be devoted exclusively to display of apparatus used in the iron and steel industry, and this space is rapidly being reserved by the manufacturers who supply the millions of dollars' worth of steel-mill equipment purchased each year. More than three thousand industrial establishments alone in the vicinity of Buffalo will co-operate in making the exposition a highly specialized form of education.

## Promptness the Keynote

### N. E. L. A. Plans to "Pull Off" Its June Convention at New York City Right on Schedule

PROMPTNESS is to be an outstanding characteristic of the forty-sixth convention of the National Electric Light Association, to be held in New York City at the Hotel Commodore during the five-day period from Monday, June 4, to Friday, June 8, inclusive, and the hours given in the following paragraphs mean "sharp" time, according to the "General Convention Circular" just issued from headquarters.

The general and executive sessions will be held on the mornings of Tuesday, Wednesday, Thursday and Friday, 9.30 a.m., adjourning about 1 p.m. These four sessions will be held in the main ballroom of the hotel. There will be no meetings held in parallel with them.

The public policy committee session will be held on Thursday at 9 p.m. in Carnegie Hall, Seventh Avenue and Fifty-seventh Street. It is planned to broadcast this session by radio.

The customer-ownership committee session will be held on Thursday at 2:15 p.m., at the Hotel Commodore.

The Accounting National Section sessions will be held on Monday, Tuesday, Wednesday and Thursday at 2.15 p.m., adjourning about 5.30 p.m. All four sessions will be held in the music room, Hotel Biltmore, immediately adjacent to the Hotel Commodore.

The Commercial National Section sessions will be held on Monday, Tuesday, Wednesday and Thursday at 2.15 p.m., adjourning about 5.30 p.m. All four sessions will be held at the Hotel Commodore.

The Public Relations National Section sessions will be held on Monday, Tuesday and Wednesday at 2.15 p.m., adjourning about 5.30 p.m. All three sessions of this section will be held at the Hotel Commodore.

The Technical National Section sessions will be held on Monday, Tuesday, Wednesday and Thursday at 2.15 p.m., adjourning about 5.30 p.m. All four sessions will be held at the Hotel Commodore.

The president's reception will take place on Monday evening at the Hotel Commodore. There will be entertainment on Tuesday and Wednesday evenings. Automobile and sight-seeing trips and other forms of diversion will be provided for the ladies attending the convention.

All delegates who have not engaged transportation and made their hotel reservations should do so at once.

## Commonwealth Edison Orders 60,000-Kw. Generator

For its new Crawford Avenue power house the Commonwealth Edison Company of Chicago has just placed with the General Electric Company an order for a 60,000-kw. cross-compound steam-turbine generating unit, the largest generator ever purchased by the Chicago company and equal in rating to any yet manufactured. This is the third generating unit ordered by the Commonwealth Edison Company for its Crawford Avenue station. As previously reported by the ELECTRICAL WORLD, it has an order from C. A. Parsons & Company of England a 40,000-kw. unit and from the Westinghouse Electric & Manufacturing Company one of 50,000 kw. rating. The Crawford Avenue station is to have an ultimate capacity of from 400,000 kw. to 600,000 kw.

# No Action Taken on Colorado Projects

### Following Decision of Cabinet, Federal Power Commission Refuses to Issue License for Diamond Creek Now—Arizona Resents Coercion from Washington

DISCUSSION of the Girand project at Diamond Creek on the Colorado River at the Cabinet meeting on April 20 resulted in a decision that no action should be taken at this time on the application for a license. This led the Federal Power Commission, at a meeting on April 23, to deny the plea of Mr. Girand for immediate action. It had been pointed out to the Cabinet officers composing the Federal Power Commission by the members of the commission's staff that all provisions in the Colorado River compact could be made conditions in any license issued for the Diamond Creek development. The action was taken with full knowledge that the Arizona Legislature while in session had telegraphed the commission protesting vigorously against withholding action on the Girand application and stating that any such action on the part of the Federal Power Commission would be regarded as an intolerable effort to coerce a sovereign state.

#### Girand Project Goes Over

The Federal Power Commission first took up the discussion of its Colorado River policy at a meeting on April 19. At that meeting L. Ward Bannister, an attorney representng the Governor of Colorado, told the commission that Colorado is radically opposed to the granting of the Girand license until the Colorado River compact shall have been ratified. He expressed Colorado's opposition to any more interstate litigation and declared that the doctrine of an equitable division of water on which the compact was based is much sounder than the doctrine of prior appropriation of water. Senator Kendrick of Wyoming told the Commission that more money had been spent in lawyers' fees than in project works and urged that no chance be taken in granting the Girand license. Senator Cameron of Arizona, strangely enough, also opposed the Girand project on the ground that Arizona would be more greatly benefited by the Stetson project, providing for a 1,200-ft. dam at Boulder Canyon, which would flood out completely the proposed Diamond Creek dam.

Members of the Federal Power Commission's staff made it very clear that in their opinion the only valid argument against granting the Girand license is that the delay holds a club over Arizona. They do not share the optimistic opinion expressed in some quarters that a special session of the Arizona Legislature will be called and the compact ratified promptly. Fear is expressed, on the contrary, that the probability of another long delay will be very discouraging to the financial interests which were prepared to pour nearly $100,000,000 into the Diamond Creek development.

## Abilene (Tex.) Has Model Ice and Electric Plant

A new ice and electric plant at Abilene, Tex., built along model lines to replace one destroyed by fire in the spring of 1919, has recently been put into operation by the Abilene Gas & Electric Company. The electric station serves Abilene and twenty-seven other communities by a system of high-tension transmission lines extending in four directions over a territory of 286 square miles. The company has 8,600 customers, and the connected load is 10,000 kw., about equally divided between lighting and power. The territory served is building up rapidly, and work on an extension to three more towns has been begun.

The building is of reinforced-concrete and hollow-tile construction. The generating equipment consists of two units, the first being a Westinghouse 2,500-kva. turbine-generator with a direct-connected exciter and the second a General Electric 1,250-kva. turbine alternator with the exciter independent and motor-driven. As a reserve unit a steam-driven General Electric exciter is provided. Energy is generated at 4,150 volts and is distributed through eight feeder circuits. From a 33,000-volt switching structure, provided with remote-control oil circuit breakers and metering equipment, transmission lines extend north, east, south and west. The switchboard was built by the Westinghouse company.

The boiler plant consists of three 414-hp. Stirling boilers, two of which are arranged in one battery with the third forming a half battery but so arranged that the installation of another boiler will complete it. These boilers are equipped with Babcock & Wilcox superheaters for 150 deg. of superheat, and the plant carries a steam pressure of 200 lb. The boilers are equipped with Duquesne burners of the combination oil and gas type. Water is obtained either from the city's supply or by gravity from a lake which is located near by.

In the engine room there are two York ammonia compressors of 75-ton and 40-ton capacity. To each of the machines is connected a York uniflow steam engine which operates condensing. The condensing equipment is a 1,000-sq.ft. condenser, with motor-driven air and condensate pump and motor-driven circulating water and booster pumps. A natural-draft cooling tower with spray nozzles in the upper section is provided. Water for ice making is taken from the condensate of the ice-machine engines and the turbines of the electric plant and is boiled in a vacuum-type reboiler.

## Brief News Notes

**Progress in Guatemala City.**—A contract recently signed on behalf of the government of Guatemala gives authority to concessionaires to acquire hydro-electric rights and distribute light, heat and power in the capital city for a period of thirty-five years, U. S. Consul A. C. Frost reports. An electric belt-line street-car system will replace the present mule-drawn cars.

**Oskaloosa Will Not Build Municipal Plant.**—Rates for electrical energy for both light and power will drop 40 per cent in Oskaloosa, Iowa, as the result of the action of the City Council in accepting an offer made by the McKinley interests, owners of the Oskaloosa Traction & Light Company. Because of this reduction of rates the city will not build the municipal plant for which a bond issue of $370,000 was recently voted.

**Albuquerque Utility Gets Long-Term Franchise.**—By a close vote the City Commissioners of Albuquerque, N. M., have granted to the Albuquerque Gas & Electric Company a twenty-five-year extension of its present franchise, the company having agreed to make a reduction to all users amounting to 1 cent a kilowatt-hour on the residential rate and ½ cent on the power rate. The company has 4,985 consumers of energy on its books.

**Electric Truck Show in N. E. L. A. Convention Week.**—The annual New York electric truck show, to be held during the week of June 4 in the Irving Place showroom of the New York Edison Company, will include exhibits by all the manufacturers represented in the metropolitan territory. This is the week of the annual convention of the National Electric Light Association, which will devote a session to discussing the electric truck.

**Carnegie Summer Courses.**—Courses to interest nearly any one in need of technical training will be given this summer at Carnegie Institute of Technology, at Pittsburgh, according to a preliminary announcement. Of special interest to electrical students are the courses offered in the College of Industries, which will include elementary electric wiring, advanced electric wiring, elementary principles of electricity and direct-current machinery.

**Electricity from Nature's Steam.**—The development of electric power from steam generated in the earth by nature will be a reality in the near future if the Geysers Development Company is successful in its efforts to harness the steam. One well has been bored and capped and, according to estimates of engineers, there is sufficient steam to generate 2,000 hp. of electricity. About $35,000 has been subscribed by residents of Healdsburg, Cal., a town near the geysers. In Italy steam from the earth has been successfully used for generating electricity for some years.

**Quebec Fights Speculation in Water-Power Sites.**—Quebec is determined, reports from that province indicate, to put an end to the withholding from development for speculative reasons of the province's water-power resources. Honoré Mercier, the Minister of Lands and Forests, is urging that leases shall contain specific requirements as to the program of development. In this he has the backing, it is declared, of a strong public opinion which is opposed to the retention of natural resources by those who are not disposed to develop them. It is estimated officially that Quebec has 6,915,244 hp. of primary hydraulic power and 11,640,052 hp. of power which could be utilized for at least six months of the year.

**Radio Medical Service for Seamen.**—A year ago the United States Public Health Service announced that it had completed arrangements to expand the medical aid service to American seamen with which it had first been charged by Congress a century and a quarter ago by prescribing by radio for any sailor who might be taken ill at sea and who might apply. Messages for aid were to be forwarded to the service by the ship's radio. It is now reported that the range of diseases and mishaps for which aid has been invoked during the first year has been amazing, extending from appendicitis to hiccoughs and the swallowing of broken glass. The Public Health Service physicians at hospitals ashore prescribe treatment by radio with the knowledge that the drugs they specify are probably in stock on the vessel.

**New York Edison Lectures on Trucks Score Big Success.**—The course of lectures for electric truck owners, operators and garage attendants held under the auspices of the New York Edison Company, which came to an end on April 12, proved so successful that plans are already under way for its repetition next year. It was said to be the first attempt that had ever been made to give a systematic course of instruction in the principles of the electric truck, and those enrolled, representing many New York business houses, included both employer and employee. When the course was planned and a fee of a dollar was announced, it was hoped that at least twenty-five and possibly forty could be enrolled. But the enrollment exceeded three hundred in spite of every effort to hold it down. Some of the classes were so large that the lectures had to be repeated.

**Monticello, Ind., Has Largest Hydro-Electric Plant in State.**—Negotiations for the sale of the electric plants at Monon, Francesville and Medaryville, Ind., owned by the Continental Utilities Company of Michigan, to the Interstate Public Service Company for $90,000 have been completed. The Interstate company has been supplying these distribution plants with power from the hydro-electric power plant constructed at Monticello by the Indiana Hydro-Electric Company, which the Interstate Company operates. The new Monticello plant is the largest hydro-electric development in Indiana. It will provide 10,000 hp. daily for light and power, serving at least twenty-five cities and towns in the northern part of the state. The Interstate company is completing a transmission line from Monticello to Logansport, connecting with the Indiana Service Corporation, and it already has a line connecting near Kentland with the Central Illinois Utilities Company, carrying power into Illinois.

**Federal Government Asked to Start Safety Program.**—The United States government sanctions working conditions that would not be tolerated by private employers, it is declared by the Federated American Engineering Societies, which appeal for a federal safety program. Congress is asked to enact safety legislation providing for the safe construction and equipment of buildings, regular inspection of conditions and the training of employees to observe proper precautions against accident. "The government should in its industrial plants set an example to private employers by providing for its own employees working conditions which are safe, hygienic and sanitary," says the statement issued by the federation and prepared by Morton G. Lloyd. The federation also recommends the adoption by the several states of uniform legislation aiming at the creation of administrative officials who shall have power to make and to enforce regulations for the prevention of accidents and industrial diseases.

**Electric Drive in the Golden Gate.**—Three electrically driven vessels recently received trial trips at San Francisco. Two of these were ferryboats and the other was an oil tanker. The latter is the first electrically driven tanker ever constructed. Its equipment includes two 750-hp. Pacific Diesel engines, two General Electric marine-type generators and two General Electric marine-type motors connected to the same propeller shaft. The ferryboat Hayward was built for the San Francisco-Oakland Terminal Railways and will be used in the passenger service on San Francisco Bay. The propelling equipment consists of a Curtis turbo-generator set, rated at 1,100 kw., with direct-connected exciter. Each of the two propellers is driven by a 1,200-hp. General Electric marine-type motor. The ferryboat Golden West is a sister ship to the Golden Gate, which has

been in operation on San Francisco Bay for some time. It is driven by two Pacific Diesel engines with General Electric generators and two marine-type General Electric motors, one on each propeller.

**Survey of Colorado River to Go On.**—The deep and narrow gorges of the Marble and Grand Canyons, said to be the most treacherous in the world, will be surveyed by a party of engineers and geologists of the Department of the Interior this summer, when a complete group of maps will be made of the Colorado River for a distance of 300 miles from Lee's Ferry to Grand Wash, Ariz. A program of special stream surveys, showing the plan and profile of streams with sufficient topography to cover all possible locations for structures needed in a comprehensive scheme of water development, was initiated in the Colorado River basin in 1909. An aggregate of about 1,200 miles on Colorado and Green Rivers and several hundred miles on principal tributaries had been mapped by the end of 1922. There are now available, with the exception of the stretch of about 300 miles to be surveyed this year, maps of a continuous river survey from the town of Green River, Wyo., on the Green River, and from Grand Junction, Col., on the Colorado River, to the Mexican boundary. This year's exploration party will consist of ten men, including two topographic engineers, one hydraulic engineer and one geologist. Detailed examinations of possible dam sites, both from an engineering and a geological point of view, will be made.

**Salt Lake Holds Electrical Convention.**—At the second annual convention of the electrical interests of Salt Lake City and the adjacent territory, held on April 6 at the Hotel Utah, Salt Lake City, under the auspices of the Rocky Mountain Electrical Co-operative League, approximately a hundred members, representing various branches of the industry, were in attendance. Sidney W. Bishop, the executive manager of the league, outlined its many activities, and the "get together" spirit prevailed.

# Associations and Societies

**New England Division, N. E. L. A.**—The New England Geographic Division of the National Electric Light Association will hold its next convention at Swampscott, Mass., on Sept. 6-8.

**Iowa Section, N. E. L. A.**—The annual convention of the Iowa Section, N. E. L. A., and the Iowa Electric Railway Association will be held at the Hotel Hanford, Mason City, Iowa, on June 20, 21 and 22.

**Pacific Coast Electrical Association.**—Plans for the seventh annual convention of the Pacific Coast Electrical Association, to be held in San Francisco June 19-23, have been put into shape. The opening day will be devoted to registration, and in the evening motion pictures will be presented. On June 20 James B. Black will give the president's address. Technical and Commercial Section meetings will be held in the afternoon and continued on the morning of June 21. The second business session will be held on the next morning, and the Western conference is scheduled for the afternoon with the banquet in the evening. On Saturday the delegates will take a trip up Mount Tamalpais and into Muir Woods.

**American Electrochemical Society.**—When this society assembles at the Commodore Hotel, New York, on Thursday, May 3, there will be a session devoted to reading and discussing seven papers on electrode potentials. Papers on electrodeposition will follow in the afternoon. On Friday, among other papers, will be "Heat-Insulating Material for Electrically Heated Apparatus," by J. C. Woodson; "Methods of Handling Materials in the Electric Furnace and the Best Type of Furnace to Use," by Frank W. Brooke; "Relation Between Current, Voltage and the Length of the Carbon Arcs," by A. E. R. Westman, and "Electric Furnace Detinning and Production of Synthetic Gray Iron from Tinplate Scrap," by C. E. Williams, C. E. Sims and C. A. Newhall. "Production and Application of the Rarer Metals" will be general subject of eight papers on Saturday.

### Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Nebraska Section, N. E. L. A.—Omaha, May 10-11. Horace M. Davis, Lincoln.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Empire State Gas and Electric Association, Electric Section—Utica, N. Y., May 17-18. C. H. B. Chapin, Grand Central Terminal, New York.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-23. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Institute of Electrical Engineers—Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

ROCKY MOUNTAIN ELECTRICAL MEN GATHER AT SALT LAKE CITY

## Recent Court Decisions

**Assumption of Risk in Pole Climbing.**—The District Court of Appeal of California found, in Richardson vs. Southern Pacific Company, that where the plaintiff, an experienced telegraph lineman, ordered to ascend a pole, called his foreman's attention to surface rot at the foot of the pole, but the foreman assured him that the pole was all right, and plaintiff was injured by the breaking of the pole, plaintiff had not assumed the risk as a matter of law and the question of contributory negligence was one for the jury. (212 Pac. 959.)*

**Hearings Under Florida Commission Law.**—The United States District Court at Jacksonville, Fla., found, in Jacksonville Gas Company vs. City of Jacksonville, that the act providing for the fixing of rates by the City Commission of Jacksonville, and for appeal to the Railroad Commission, did not deny the company due process of law in violation of the Fourteenth Amendment, in according no hearing to the company, inasmuch as the company had the prescribed notice and had opportunity to appeal to the Railroad Commission, where it could have had a hearing. (286 Fed. 404.)

**Public Interest in Preventing Bankruptcy of Utility.**—Dismissing injunctions found in the lower court, the Court of Appeals of Kentucky found, in Stafford vs. Johnson County Gas Company, that where it appeared that a utility company was losing money and could probably not continue to operate, or would be forced into bankruptcy, if the rates were not increased, the interest of the public in continuance of the service was a good and valid consideration for the enactment by the board of trustees of the town of Paintsville of ordinances amending the franchise so as to permit the company to charge increased rates. (248 S. W. 515.)

**Evidence of Negligence Justifying Submittal of Damage Suit to Jury.**—Sustaining a verdict of $10,000 damages in Graham vs. City of Ames for the death of a young man who came in contact with a broken transmission wire of the municipal plant and was killed in an alleyway while delivering papers in the early morning, the Supreme Court of Iowa held that the lower court did right in refusing a directed verdict. Three grounds for the charge of negligence against the city were submitted to the jury, rightly as the Supreme Court held: (1) That the defendant had constructed its line out of inefficient material and that it was inadequate for the service required; (2) that the defendant had failed to use diligence either to repair the broken wire or to shut off the current therefrom; (3) that the defendant had failed to equip its plant with suitable devices to enable it to discover promptly a break in its primary wires. The contention that pedestrians had no right to use alleys as a path was overruled. The presumption, in the absence of any eye witness to the accident, was that the victim used due care. (192 N. W. 299.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

**Powers of West Virginia Commission.**—In Berkeley Springs Waterworks vs. Public Service Commission of West Virginia, an experimental order of the commission valuing the plant of, and fixing the rates to be charged by, a public utility, and retaining the case on the docket for future report and action after the results of such experiment are ascertained, was not final, according to the ruling of the Supreme Court of Appeals of West Virginia, and an appeal therefrom to the court was dismissed, without prejudice to further action thereon by the commission. (116 S. E. 140.)

## Commission Rulings

**Special Rate for Surplus Power Supplied to One Customer Only Cannot Be Granted.**—The Wisconsin Railroad Commission has refused to allow a special surplus power rate to be made to the Dells Paper & Pulp Company of Eau Claire, on the ground that such a rate cannot be granted where only a single customer would benefit.

**Historical-Cost Valuation Method Defended.**—The New Hampshire Public Service Commission in investigating the rates of the Exeter Water Works declared its belief that the historical cost of a plant is always more satisfactory as a measure of value than the reproduction cost, since the first is based upon facts while the latter is based upon estimates which at most are only intelligent guesses; but, the commission added, the enhanced value due to present prices must receive due consideration.

**Free Service for Right-of-Way Illegal.**—Free service as part of the consideration for a right-of-way is unlawful, according to a decision of the Pennsylvania Public Service Commission in complaints made against the Manufacturers' Light & Heat Company. It held that the facts that the grantor in the contract was an individual instead of a municipal corporation and that the thing granted in consideration of the free service consisted of a right-of-way over private property instead of a municipal franchise on or along public streets did not take the case out of the scope of the legal principle involved in cases where free service to municipalities had been discontinued. The question was also presented whether the public utility while refusing to deliver free service could continue to occupy the right-of-way. The commission stated its opinion that the question raised on this ground was judicial and beyond the scope of the commission's jurisdiction.

**Basis for Overhead Allowance.**—According to a decision of the Vermont Public Service Commission concerning the Rutland Railway, Light & Power Company, a percentage allowance for overhead expense in an estimate of original cost should not be based on the depreciated value of the property. "The services of engineers and superintendents," the commission said, "were rendered upon the original construction; therefore, if the amount to be allowed is computed on a percentage theory, the proper base is original cost and not the value of the property as it might be after years of use."

**City May Intervene in Action to Raise Franchise Rates.**—The New York Public Service Commission held in considering a petition from the Peekskill Lighting & Railway Company to increase fares that the municipality had a right to intervene in an endeavor to maintain the franchise rates. "The reference in the statute to the rate theretofore prescribed by local municipal consent and the requirement that the commission shall regard the estimated earning capacity of the property under that rate show to my mind," said the commissioner who handed down the decision, "that the contract or franchise rate is one that the municipality has a clear right to come in and defend. The rate so fixed by the franchise or contract is, in my opinion, a binding rate until on facts shown to the commission it shall determine that in the public interest a different fare is necessary for the safe and adequate service of the public. On this question and on this proof the municipality has a right to be heard."

**Dividing Line Between Responsibility of Commission and of Company Management.**—In adjusting a complaint made against the Philadelphia Rapid Transit Company, the Pennsylvania Public Service Commission adverted to the danger of a commission infringing on what is properly managerial territory, saying that the commission's duties "are not to be performed by its assuming managerial control over public utilities, nor by substituting its judgment for theirs in the performance of those things for which, for the public benefit, the law holds these utilities responsible. The line of demarcation between the duty of a company to exercise its managerial judgment and the responsibility resting upon this commission to regulate is established where the utility is exercising its initiative responsibility in a way which adversely affects the public. The commission must exercise care that it does not relieve utilities by its orders of a managerial duty which they ought to perform and of a responsibility which, if they are to function properly in public service, must continue to be theirs."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## D. Farrand and J. L. O'Toole Made Vice-Presidents

Dudley Farrand and John L. O'Toole, assistants to the president of the Public Service Corporation of New Jersey, were elected vice-presidents of the Public Service Corporation of New Jersey at the annual meeting on April 18 of the directors of the company and twelve subsidiaries. Mr. O'Toole became connected with the Public Service Corporation in 1909, after having been in newspaper work in Newark for seventeen years. For nine years prior to becoming publicity agent for the corporation he was city editor of the Newark *News*. In 1917 his title was changed from publicity agent to assistant to the president. Mr. Farrand has been with the predecessors of the Public Service Electric Company and with the corporation continuously since 1887. He was first elected a director and assistant treasurer of the Newark Electric Light & Power Company. In 1895 he became assistant general manager of the People's Light & Power Company and three years later its general manager.

The following year Mr. Farrand became general manager of the United Electric Company of New Jersey and in 1903, the year of reorganization, he was made general manager of the electric department of the Public Service Corporation. In 1910 Mr. Farrand was made general manager of the Public Service Electric Company and five years later was made its vice-president and general manager. In 1917 he also was made assistant to the president. Mr. Farrand was president of the National Electric Light Association in 1907 and the following year was appointed by President Roosevelt as technical adviser representing the electrical interests to the National Conservation Commission.

The election of Messrs. O'Toole and Farrand was announced with other important changes in the staff of officers of the Public Service Corporation. Thomas N. McCarter was re-elected president of the corporation and subsidiaries for the twenty-first consecutive term. Vice-presidents Randell Morgan of Philadelphia and Colonel Anthony R. Kuser of Bernardsville, both of whom have been officials of the company for about fifteen years, resigned. They will continue as members of the board of directors of the corporation and as members of the executive committee.

Under the reorganization plan Percy S. Young is vice-president in charge of finance, Edmund W. Wakelee is vice-president in charge of law, Dudley Farrand vice-president in charge of

DUDLEY FARRAND

industrial relations, and John L. O'Toole vice-president in charge of public relations. Mr. Wakelee, who has been general solicitor as well as a vice-president, has relinquished the first title to George H. Blake, who has been assistant general solicitor. He also will relinquish some of his work as vice-president in charge of public relations to Mr. O'Toole, devoting his entire time to the law.

Mr. Young, as heretofore, will be chief financial officer. The scope of the work of Mr. Farrand as vice-president in charge of industrial relations is wide. He will keep in close touch with the employees of the various subsidiaries and will deal with operating problems. Mr. O'Toole's work will be along the same lines as it has been, together with additional duties to be taken over from Mr. Wakelee.

J. L. O'TOOLE

## R. E. Danforth Heads New Power Company

Richard E. Danforth, vice-president and general manager of the Public Service Railway, Newark, N. J., has been elected president of the Public Service Electric Power Company, a subsidiary of the Public Service Corporation of New Jersey. Mr. Danforth retains his executive position with the railway company. The following officers were also elected: Henry D. Whitcomb, vice-president; William H. Feller, secretary, and Frederick A. Neis, treasurer.

**C. I. Rhodes**, formerly chief of the hydraulic division of the California Railroad Commission, has resigned to become associated with Chester H. Loveland, consulting engineer of San Francisco.

**Joseph Pope** has been transferred from the power-station betterment division of Stone & Webster, Inc., Boston, to steam-power plant research. His former position as head of the betterment division will be filled by Walter H. Balcke.

**R. A. Bruce** has succeeded F. J. L. Doyle as assistant secretary and assistant treasurer of the West Virginia Utilities Company and as auditor and assistant treasurer of the Wheeling Public Service Company, both in Wheeling, W. Va.

**George W. Wood**, formerly manager of the Mansfield (Mass.) Municipal Lighting Department, is now associated with the C. D. Parker Company, bankers, of Boston, who operate the Fibreboard Company, manufacturer of a patented leather-fiber board. Mr. Wood is stationed at the Fibreboard Company's Amesbury plant.

**Henry Trumbower**, member of the Wisconsin Railroad Commission since 1916, has resigned, effective May 1, to accept an appointment with the United States Department of Agriculture in charge of an investigation of the economics of transportation as it relates to marketing and distribution of farm products.

**K. E. Van Kuran**, district manager of the Westinghouse Electric & Manufacturing Company, and **R. E. Fisher**, vice-president of the Pacific Gas & Electric Company, both of San Francisco, have been appointed a committee of two to arrange for transportation to the annual convention of the National Electric Light Association to be held in New York City June 4-8.

**Howard S. Snell** has been appointed chief engineer for the Montana Public Service Commission to fill the vacancy caused by the resignation of James H. Bonner. Mr. Snell goes to the Montana commission with twelve years' experience in public utility work. He was engineer for the Public Service Commission of Kansas for three and one-half years and was consulting engineer for the Kansas City, Mexican & Orient Railway Company. He has had five years' experience in valuation of utility properties.

### W. H. Taylor Made General Manager

W. H. Taylor, vice-president of the Georgia Railway & Power Company, Atlanta, has been appointed general manager of the business of the company. He will be designated as vice-president and general manager and will have general supervision over various departments, assisting H. M. Atkinson, chairman of the board, and P. S. Arkwright, president.

**I. A. Rosok** has succeeded H. B. Johnson as manager of the Bisbee (Ariz.) Improvement Company.

**Kurt C. Barth**, formerly associated with the Barrett Company, which was recently taken over by the Allied Chemical & Dye Stuff Company, has been appointed Eastern manager at Chicago for the E. T. Chapin Company, Spokane, Wash.

**Calvert Townley**, assistant to the president of the Westinghouse Electric & Manufacturing Company, has been re-elected a vice-president of the American Engineering Council and has been appointed a member of its finance and public affairs committees.

**G. H. Froebel**, manager of the Houston (Tex.) branch office of the Westinghouse Electric & Manufacturing Company, has been appointed manager of the marine sales department. Mr. Froebel's headquarters will be at East Pittsburgh.

**R. T. Gordon**, who for the past eight years has been connected with the Alberger Pump & Condenser Company, has resigned to join the sales department of the Dean Brothers Company of Indianapolis, manufacturer of pumping machinery, and will be with its New York office.

**Carl O. Martin**, formerly in charge of the Northwest territory of the Benjamin Electric Manufacturing Company, has been transferred to a larger field with headquarters in San Francisco. There he will be assistant to Miles F. Steel, Pacific Coast manager for the company.

**A. S. Childs** has resigned as sales manager of the Cooper Hewitt Electric Company after twenty years' association with that company. Charles F. Strebig, formerly manager of the Philadelphia office, succeeds Mr. Childs as sales manager. Mr. Strebig has been with the company fifteen years.

**William H. Welch**, formerly manager of the Hartford (Conn.) branch of the Electric Supply & Equipment Company, has been appointed sales manager of the Hartford Electrical Supply Company. M. G. Francoeur has been appointed sales promotion manager of the latter company. E. F. Irlbacker, formerly manager of the fixture department, has resigned from the company.

**Henry D. Jackson**, formerly electrical and mechanical engineer with Monks & Johnson, engineers of New York and Boston, and William P. Mower, his assistant on the mechanical work, are leaving the organization to associate themselves with W. R. Templeton in the manufacture and sale of the "Templeton" return and boiler-feed trap.

**J. H. Klinck** has been appointed assistant supervisor of production of the Westinghouse Electric & Manufacturing Company. Mr. Klinck, who has had wide experience in electrical and general engineering and sales work, has been associated with the Westinghouse company since 1904, when he joined the industrial and power sales department.

### R. Collier Leaves Poughkeepsie

Rawson Collier, general sales manager of the Central Hudson Gas & Electric Company and affiliated companies, with offices at Poughkeepsie, N. Y., has resigned to join the organization of Dwight P. Robinson & Company, Inc., engineers and constructors, New York, on May 1. Prior to his connection with

Rawson Collier

the Central Hudson Gas & Electric Company, Mr. Collier was for five years a member of the firm of Collier & Brown, consulting engineers, Atlanta, leaving this firm to become connected with the Georgia Railway & Electric Company. Here his work covered sixteen years, during which time he was connected with practically every department in the company. At the time of leaving he was general sales manager of the company. Mr. Collier is a graduate of the Massachusetts Institute of Technology, and for a number of years he has been prominently indentified with the work of the National Electric Light Association, the American Institute of Electrical Engineers, the American Gas Association and the Illuminating Engineering Society.

**August Lutz**, Oakland manager of the Pacific States Electric Company, was recently elected president of the Electric Club of Oakland.

**C. H. Kurz**, has been appointed to succeed Dyer Thomas as the manager of the Federal Electric Company in Denver, the latter having been transferred to Detroit as sales manager of the company.

## Obituary

**William F. McNally**, president of the Crookston (Minn.) Water Works, Light & Power Company and of the Manistique (Wis.) Light & Power Company, died recently at his home in New Richmond, Wis., at the age of sixty-three. Mr. McNally's life was largely devoted to the practice of law.

**John Gilbert Ward**, for thirty years treasurer of the Babcock & Wilcox Company, died on Sunday at his home in Glen Ridge, N. J. Mr. Ward entered the treasurer's office of the Babcock & Wilcox Company as a clerk in 1888, later becoming assistant to the treasurer, and in 1893 he was elected treasurer and a director of the company. He was sixty-eight years of age.

**Samuel C. D. Johns**, identified for thirty-five years with the Cleveland Electric Illuminating Company and its predecessor, died on April 20 after a brief illness. Mr. Johns was secretary of the company when he retired in 1918. He was born in England but educated in Cleveland. Previous to his association with the power company he had been a railroader and telegraph operator. Mr. Johns was eighty years of age.

**C. F. Beames**, consulting engineer with the Columbia Gas & Electric Company, New York City, died suddenly on Sunday, April 22. Mr. Beames was at one time connected with the General Electric Company at its Schenectady and Chicago offices and later was sent to Mexico. Subsequently he allied himself with the Mexican Gas & Electric Light Company in Mexico City. Later Mr. Beames became associated with the J. G. White Corporation in Porto Rico and also was connected at one time with the Electric Bond & Share Company. During the war he was lieutenant-colonel in the Ordnance Department, U.S.A.

**Thomas C. Gordon** of Little Falls, Minn., died at his home in that city on April 16 after a year's illness. Mr. Gordon became associated with the Little Falls Water Power Company in 1887. In 1889 he was made secretary-treasurer, and in 1903 the duties of general manager were conferred on him. In 1918 Mr. Gordon disposed of his interests in the water-power company and shortly thereafter engaged in the automobile and garage business. In addition to his duties with the Little Falls Water Power Company and the Gordon Motor Company, he found time to take an interest in many other business ventures. He was instrumental in forming the Morrison County Electric Light, Heat & Power Company, now out of existence, and was its secretary-treasurer. He filled the same office for the Pike Rapids Hydro-Electric Company, which owned and controlled a power site a few miles below the city.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Pruning the Wiring-Device Line

**How Excess Varieties Are Crippling the Electrical Trade—What One Manufacturer Has Done—Great Promise if Courage Lasts**

By Earl E. Whitehorne
*Commercial Editor* Electrical World

THE other day in the office of a prominent jobber of electrical supplies I saw three piles of inventory cards stacked up in the corner. Each card represented a different item in that jobber's stock. On the card were entered the number of units and the quantity of that commodity in stock at the time of the January inventory. Two of these piles reached a little over three feet up the wall; the other was two feet high. The two big piles represented the articles that were to be continued in stock. The short pile represented obsolete material that was to be thrown out of stock. In short, the obsolete material in that jobber's stock on the first of January had amounted to about one-fifth of his entire line, in number of varieties—say 1,500 items out of a total of 7,500. Because this man is progressive and a firm believer in the present movement for simplification in the jobbing line, he is going to quit selling these obsolete types, although some demand still continues. But Heaven knows how many excess and duplicating varieties he will go on carrying on his shelves. The noose is still around his neck and the manufacturer holds the business end of the rope.

### The Epidemic

The disease with which the electrical jobber has been suffering for a number of years can undoubtedly be diagnosed as congestion of stock—with complications. He caught it from the electrical manufacturer. The electrical manufacturer contracted the disease as the result of a bad habit. He had begun in the early days to manufacture a socket, a receptacle, a conduit fitting, or, say, a fuse, and developed a necessary line. Then people began asking for special stuff. He made it because it seemed to be needed and because it was profitable to make it—which was quite proper. But instead of calling it "special," he made the fatal error of listing and picturing all this special stuff in his catalog as standard. "Watch my line grow!" he said. "I'm getting ahead!" Naturally people saw these new varieties and asked the jobber for them. The jobber began to stock them, but because they were special fittings for unusual needs there were few orders. But this slow-moving stock has grown as every manufacturer in almost every line has madly proceeded with this competition for bigger lines until finally excess varieties began to choke the industry to death.

Jobbing stocks had swollen until one jobbing house at least today is listing over 50,000 items, and catalogs of 12,000 and 20,000 are common. And because they have been smothered under this load of varieties, jobbers, sales managers and salesmen have been demoralized into a class of overburdened order takers. For what man can do creative selling and develop a market for 50,000 articles—or 7,500?

Too many manufacturers have been making too many articles in too small volume. Too many jobbers have been selling too many varieties in too small volume. And to try to get more volume manufacturers have gone on giving opportunity to too many semi-jobbers to compete with established houses. And the jobbers in turn have been selling to anybody to get an order and building up "curbstone" competition for their best contractor customers. And there you are!

### Jobbers Have Decided to Act

But the worm will turn. The burden has grown too heavy for either manufacturer or jobber. So for some time each has been calling on the other to do something toward simplification. "Stop ordering these excess varieties and selling them!" the manufacturer has said. But he has continued to list these varieties and send his catalogs into the jobber's territory.

Therefore the trade has continued to order them and the jobber has gone on selling them. It was inevitable, however, that both parties to the situation should ultimately be compelled to do something to help themselves.

Last February the executive committee of the jobbers' association called upon all its commodity committees to study the opportunities for the elimination of excess, obsolete and duplicating varieties in each line and bring in definite recommendations at the coming meeting of that association in Hot Springs, Va., next month, specifying what the jobber himself should do and what the manufacturer should do. Meanwhile a few manufacturers also have decided to quit discussing it and act. Here is a good example in the wiring-devices line.

### One Manufacturer's Discovery

It was decreed by the executive of one of the largest manufacturers that their line should be reduced. They had listed in their catalog the following articles:

| | |
|---|---|
| 344 | sockets |
| 236 | receptacles |
| 269 | switches |
| 82 | plugs and receptacles |
| 29 | rosettes |
| 421 | cut-outs and fuses |
| 1,381 | devices in all |

When the pencil was sharpened and they went to work, they found that they could eliminate as either obsolete or duplicating or unnecessary excess varieties:

| | |
|---|---|
| 175 | sockets |
| 192 | receptacles |
| 77 | switches |
| 51 | plugs and receptacles |
| 20 | rosettes |
| 107 | cut-outs and fuses |
| 622 | devices in all |

This left in the line as essential:

169 sockets
44 receptacles
192 switches
31 plugs and receptacles
9 rosettes
314 cut-outs and fuses

759 devices in all

Even this was not all. They went back at it again, and when they had analyzed the line once more over 800 numbers had been eliminated. Some were sockets or receptacles or switches that were obsolete. Some were practically duplicates of other numbers. Some were varieties popular in one section but differing only superficially from another number that is in general demand elsewhere. They were all excess varieties. For instance the entire line of standard-depth switches was eliminated, and the standard numbers were given to the shallow switch line. The trade was notified that only shallow switches would be shipped thereafter because shallow switches will do all that the deep ones will do.

### The Economic Loss

A group of jobbers got together and studied the lines of schedule material cataloged by four different manufacturers. They decided that these eliminations could be made:

Manufacturer A-553 varieties
Manufacturer B-350 varieties
Manufacturer C-239 varieties
Manufacturer D-247 varieties

One of these jobbers, who by the way had argued for 100 more eliminations, said: "This means that those manufacturers are listing, advertising, cataloging and keeping forms, castings, patterns, etc., to manufacture these obsolete items whenever demanded. The same thing is true with the jobbers. They carry the articles in stock, where they take up room on shelves that is valuable and costs money; they put them in their catalogs. If they have ten of an item in stock and get an order for ten or fifteen, they order a standard package of possibly as many as 500 to rot on their shelves and increase their overhead. The ultimate consumer could be better served at lower costs if these duplications were eliminated.

"We haven't got very far with the manufacturers themselves," he continued. "They all appear to be afraid of each other, yet you talk to them all individually and personally and they seem to be for it. When you get through talking to them, go home and write them a letter; however, each one comes out and tells you that an ideal result could be accomplished if all would work together, but that he can't do it because he is afraid of the other fellow.

"As I see the proposition, the only thing to do is to arouse a public opinion against these expensive duplications and do away with them, or go down to Washington and demand that the government practice a little paternalism. But I don't believe the government would dabble in a matter of this kind unless the manufacturers compel it by their indifference."

A JOBBER'S INVENTORY—7,500 CARDS

The short pile, 20 per cent of the entire line, represents obsolete varieties which can be eliminated.

### Whose Move Is It?

One manufacturer, in discussing the problem recently, said to me: "The matter can be better handled by the consumer or the distributor than by the manufacturer. The manufacturer must continue to supply any demand. A campaign of general educational work carried on by every one interested can do a great deal by removing the demand. We are always ready to meet our customers or distributors half way." In that attitude, I believe, lies the source of much of the difficulty, but as a matter of actual fact the manufacturer does not meet any demand any more than a street car runs up any street because somebody wants it to. There is always an end to any line and it is the manufacturer who sets the point where the line stops.

The trouble is that he hesitates to take the drastic step, even though he knows that it will save him money on production. To quote a jobber who has thought much on the subject: "Three or four manufacturers can take a decisive step and put it over, whereas 200 distributors pulling this way and that will accomplish nothing. One distributor says that some device is a good seller; another says that it is not. It doesn't matter who is right. The manufacturer for economic reasons can refuse to make it, catalog it or sell it and the deed is done. Both distributors will from then on sell the remaining variety with no less success."

### Only Courage Needed

One manufacturer wrote to me: "There is much to be said for it. However, on the other hand, much against it—etc., etc.," which is a pretty good example of what the general attitude has been in recent years. In the meantime the burden of excess varieties has been getting steadily worse. More refinements and improvements and extensions have been added to the line—every line—and few taken off the market, and, of course, this has been no less the fault of the jobber than the manufacturer. One jobber recently put it in these words: "The manufacturer naturally has objected to eliminating some numbers that have been good sellers with us, for instance. However, we know that many of these items continue to be good sellers here because we do not direct customers to the selection of proper products and they are left to buy at random anything we may show in our catalog."

All this refers not alone to sockets, receptacles and switches. It applies to fuses, to conduit fittings, to insulators, to lamps, to reflectors, to as many other lines as you can count on your two hands. Why should there be both galvanized and black outlet boxes, why both galvanized and black pipe—when galvanized is better and would be cheaper if the product were made in that style only? Why should there be five kinds of heater cord?

The economic principle involved in all of this is unassailable. Any one who does not believe it need but look through any jobber's stock or catalog. The only question is with the individual. Has he the moral courage to act on principle and tell his salesmen and his customers and his suppliers or his distributors that they must stop doing something that is not good for all of them? It is encouraging to see that some manufacturers at last have had the nerve to face the situation and proceed to clean up their own lines and free themselves from the dragging chains with which these excess varieties so long have hobbled them.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

CONTINUED expansion of business characterizes virtually all branches of the electrical trade. Conservative financing and careful buying by manufacturers and jobbers are keeping most sections of the country reasonably free from inflation, and although increasing scarcity of labor is being felt, production is at a high rate and transportation conditions are much improved on railways. Important central-station construction is under way in southern New England, and work is being rapidly pushed on some trunk-line high-voltage interconnections. Wire factories and electrical machinery makers are working close to capacity, and appliance and specialty makers are crowded with orders. Central-station outputs are growing by leaps and bounds. House-wiring developments are in immense volume, and there is little sign of recession in the equipment of old houses or the building of new ones. Here and there industrial-plant expansion is beginning to take on the appearance of war-time plant development. Manufacturing in general is on a full-time basis. The textile industries are working very near capacity and the metal-working establishments are busy caring for past orders, new business being obliged to face a lengthening delivery situation. Retail trade is improving with better weather and easier highway travel. Non-employment is scarcely heard of, and recent wage increases in the textile field appear to have been promptly translated into increased buying of commodities. Electrical appliances are in greater demand, and popular interest in the "electrical home" movement and in better home displays is finding an outlet in growing purchases of electrical labor-saving devices and comforts.

## Irons for Reserve Purposes a Feature of Present Market

SALES of electric flatirons continue to be well maintained and deliveries are reported as very satisfactory. These devices are probably first in popularity after the electric lamp, and the point of local saturation seems as far off as ever in many electrical utility areas. A feature of this spring's business is a tendency toward ordering a duplicate iron or a unit of a second make for reserve purposes in the home. Retailers apparently have not attempted to push irons on this basis to a great extent, and the realization of the convenience of a second outfit in the ordinary home has come largely from satisfied users. New designs in irons are coming into the market this spring and arousing much popular interest. Price conditions appear to have little bearing upon sales developments, and there seems to be a market for American irons of diversified quality and reputation. Some central-station tests of cheaply made and inferior makes of irons, especially of German "extraction," have been a powerful deterrent to the flooding of the American market with unsuitable products.

## Tool Makers Advising Customers to Anticipate Requirements

MANUFACTURERS of electric tools are finding some difficulty in obtaining prompt delivery of certain sizes of steel, which makes it necessary for them to increase their stocks of raw material to provide against delays. Prices on their lines are stiffening, skilled labor is increasingly difficult to obtain, and wages are on the upward trend. These manufacturers are advising their customers to anticipate their requirements as far ahead as possible to avoid disappointments or non-delivery. Makers of belts and safety straps are experiencing considerable difficulty in getting enough leather to keep up with the present unusual demand.

## Electric Refrigerating Outfits Moving Well

CONSIDERABLE activity in manufacturing circles devoted to the production of electrically driven refrigerators is apparent as the warmer season approaches. Interest among central-station power sales departments has begun to quicken as a result of renewed efforts of manufacturers to develop a wider line of equipments suited to more moderate-sized homes than were the large outfits put earlier on the market. New apparatus has lately been brought out with remarkably simple mechanical details in comparison with former designs, and while it would be exaggeration to state that the smaller residence can at present be supplied with refrigeration at low cost from the investment standpoint, the trend of development is in that direction. For many years the development of such equipment centered around hotels, markets, fruit establishments and provision houses; gradually equipments began to appear suited to large residences, and today the outlook is bright for a great advance in electric cooling applications into the field of the medium-sized home. Some of the apparatus available may fairly be said to have settled down to a standard production basis, and as the market widens the costs of development will be absorbed by sales and the development of much smaller machines hastened.

## Heater Sales Reported Dull in New England

SPRING sales of electric heaters for socket attachment have been rather slow during the past few weeks, although the coal situation has cleared only gradually. Distributors and retailers were prepared to handle a considerably larger business than materialized. Weather conditions appear responsible in part for this falling off in demand, there having been few sudden and sharp drops in temperature and more even conditions than usual for this season. In trade circles the opinion is generally held that the fall is the best time to push heaters at retail, but with fuel costs at present high levels, and with a growing popular appreciation of the sphere of usefulness of heating apparatus in the home and in special locations in industry, there appears to be a potential market which can be uncovered by more energetic sales effort. Stocks are likely to be drawn down somewhat by sales of heaters for summer camps in this section, but the outlook for early purchases for warehousing purposes is not very bright. A good business is expected after the vacation season, but the present market is without feature.

## Variety of Demands for Magnet Wire Increasing Weekly

PRODUCERS of enameled wire report vigorous activity. The automotive industry is a large buyer and the radio manufacturer is also keenly interested in high-grade material of marked space economies. The variety of demands for magnet wire, both enameled and non-enameled, increases almost weekly, and in representative plants production has to be upon a practically continuous basis to satisfy current requirements. Raw-material costs are stiffening at this time, and prices are relatively unstable. The higher quality material tends to sell upon its merits, however, and builders of motor cars and other products who exercise discrimination in the selection of their material are contributing to the stabilization of the market when they purchase wire in mass or in coil form on the primary basis of quality. This has no direct appeal to some purchasing agents, apparently, but the preparation now given high-grade wire for use in automobile service and other important applications warrants thorough study of the material and more appreciation of processing requirements on the part of users.

## Farm Lighting Sets Are Expected to Move Faster

REPORTS of farm-lighting-set sales for the first quarter of 1923 indicate a much healthier trade than a year ago, and now that highway conditions in the rural districts of the north are improving, sales activity seems certain to increase still more within the next few weeks. It is not easy for the manufacturer or distribu-

tor in a city or large town to visualize some of the difficulties which accompany sales work in the field during the winter and early spring, under conditions where road travel is bad. In one Northern state last week a salesman started from a small town by motor to a sales district only 20 miles away, leaving at 8 a. m. He arrived at 8 p. m., after a day's battle with muddy roads and an outlay of some $20 for haulage. In the locality where this took place conditions will improve rapidly during the next fortnight, but the absence of convenient railroad service and sometimes the total lack of train facilities in such regions, coupled with highway difficulties, makes it costly and trying to sell this kind of equipment in areas far from central-station lines. It is done, none the less.

## Farm Sets Help Introduce Electric Service

REPORTS are coming in to the effect that in not a few communities the entrance of farm-lighting outfits is regarded with satisfaction by near-by central-station systems at present unable to reach these consumers except at excessive outlay. There appears to be a more cordial relationship between central-station sales departments and the farm-lighting-set representatives than was evident a while back. Some problems of difficult character remain in this relationship and in relation to the future customer and his equipment; but, on the whole, a leading distributor states, the outlook is gratifying and constructive in its possibilities. Local stocks of sets are, on the whole, well prepared for the spring and summer business. Prices are firm and may advance later, according to widespread ideas of the trend of costs. Year by year this class of equipment finds a growing market, and replacement business is a factor of increasing importance in the older sets, especially along the line of new battery plates. Optimism as to 1923 business was very generally manifested by those who attended one of the larger factory sales conferences in this line of equipment production a week or two ago.

## New England Collections Show General Improvement

IMPROVED credit conditions are still evident in New England, and increased discounting of bills is reported by jobbers. Railroad, public utility and large industrial-plant buying is on a more satisfactory basis than for a long time. Some contractor-dealer accounts are reported as slow, but underlying conditions are unusually good. Credit managers are working hard to keep conditions favorable as long as possible, and nothing like a "wide-open" policy can be discerned when expansion is proposed. Throughout this territory a tendency toward careful buying has unquestionably helped the credit situation. A few weeks ago collections were handicapped by severe weather and excessive delays in freight shipments, but these conditions are rapidly yielding to better transportation achievements and a rising tide of new business. While some contractor accounts run as high as ninety days, a fair average is about sixty. Much good work is being done by jobbers along the line of helping to stabilize retail business methods.

## Magnetic Clutch Sales Active with Advance Into Paper Field

VIGOROUS activity in the sale of magnetic clutches is reported in leading manufacturing circles, and the advance of this class of equipment into the paper-making field is a recent development that has been more or less overlooked. While a large part of the business in this line of products involves specialized engineering design and intelligent application analyses for lasting sales, the broader development of clutch production to include a wider contact with the requirements of the machine-tool industry is on the way, and a degree of standardization appears to be at hand. As in most other apparatus lines, prices are firm, labor none too plentiful in the factories, and deliveries not yet on a stable basis, although anticipation of raw material requirements and improving transportation conditions are working in favor of the buyer.

## Diversified Demand for Control Apparatus

WIDENING applications of control equipment are contributing to put manufacturers in this class of electrical products upon a plane of production taxing all their present facilities. The growth of motor sales and tendency toward the individual drive of machinery, coupled with severe requirements in speed variation, has thrown increased business upon controller builders. So far as motor control goes, the situation seems well in hand, however. The development of motor business from the dull period of a year or more ago to the present excellent volume has been very gradual, and it is highly creditable to control manufacturers that they are still able to make reasonably good deliveries on standard outfits, keeping well within the delivery promises of the motor builders. The marketing of modern control equipment is greatly influenced by the engineering requirements of great industries into which the variable-speed motor drive is making new records of efficiency. In the printing-press and paper-making fields, especially, the refinements of control demanded have opened new problems to the manufacturing engineer, and the solution of these on a shop rather than on a laboratory basis has resulted in a quickening of the market throughout these industries. Other developing industries are interactive with controller production. The steady advance of electric vehicle and industrial electric truck applications, the requirements of control in electric heating apparatus designed for chemical and physical laboratory service and the demands of a vacuum-tube set regulation by rheostatic control in radio work all spell increased orders for makers of control apparatus. One house alone has sold more than 500,000 small rheostats for radio service since last summer.

## Sales Service a Real Factor in Industrial Truck Situation

FIRM prices and a tendency toward longer deliveries mark the industrial truck situation, but as yet it is not difficult to meet reasonable requirements with satisfactory promptness. In this class of work 100 per cent service between the factory and the field representative has an immediate bearing upon the success of sales efforts. Delays in furnishing quotations and information to prospective buyers are injurious because of the detailed investigations which must precede contract awards in the great majority of cases. Poor mail service has hampered this business not a little in the past winter, but despite various handicaps sales have been made in increasing numbers and the outlook for a good year is excellent.

## Lamp Sales Reflect Growth of Industry

SUPERSEASONAL lamp sales are reported from manufacturers and distributors, and if production facilities had not been developed many months ago in far-sighted anticipation of the growing demand, a shortage could scarcely have been escaped during the past winter. The extension of electrical service grows like a rolling snowball in practically all parts of the country; replacement orders continue to mount higher each year, and the increased attention now paid to decorative lamp

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.0326 | $0.0322 | $0.0229 |
| Cold finished shafting, per lb. | 0.0406 | 0.0406 | 0.035 |
| Brass rods, per lb. | 0.1913 | 0.1870 | 0.1533 |
| Solder (half and half), per lb. | 0.30 | 0.2833 | 0.20 |
| Cotton waste, per lb. | 0.1231 | 0.1181 | 0.104 |
| Washers, cast iron (½-in.), per 100 lb. | 4.66 | 4.33 | 3.83 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.11 |
| Machine oil, per gal. | 0.349 | 0.349 | 0.40 |
| Belting, leather, medium, on list | 42% | 49% | 48½% |
| Machine bolts, up to 1-in. x 30-in., off list | 44¼% | 51¼% | 64¼% |

design and the enormous expansion of utility lamp applications in commerce, industry and the home, in the automobile field and in science tends to swell the totals of recurrent sales. Lamp prices are firm, with few if any recent changes; raw materials are well in hand at the factories, and labor-saving machinery is constantly being more effectively adapted to production conditions. While it is true that the winter season brings the peak of consumption to its annual maximum in this branch of the electrical industry, the highly organized sales efforts of the lamp maker are so carefully planned and carried out through the year, with remarkably able advance gaging of demand, that requirements are met with little outward evidence of wear and tear upon producers and distributors.

### Atlanta Shows Tendency to Increase Cash Discounts

COLLECTIONS for the past thirty days show improvement over the prior month, with a tendency toward an increase in the number of cash discounts taken. Credit men, as a rule, are extending a more liberal line of credit than has been the case for some time past, but are more cautious than during the last period of good business. A number of the jobbers report an increasing amount of cash sales, with money easy in middle and south Georgia and Florida. There has been voiced in isolated instances the fear that easy money will cause firms to overreach, with a resultant reaction in the late fall. Volume of business is on the increase, as is illustrated by the debits to personal accounts for twenty-five southeastern cities for March, the increase amounting to $30,000,000 over February.

## The Metal Market

A dull week with lower prices is reported. Rarely does it happen that demand for all metals should be so poor at one time. As consumption continues excellent in almost all lines, it is to be inferred that metal buyers have heeded the warnings of a possible inflation and the lessons learned in 1920 and are reducing their stocks and orders for future supplies of raw materials to the lowest possible amount consistent with safety.

NEW YORK METAL MARKET PRICES

| | April 18, 1923 Cents per Pound | April 25, 1923 Cents per Pound |
|---|---|---|
| Copper, Electrolytic | 17.00–17.25 | 17.00 |
| Lead, Am. S. & R. price | 8.25 | 8.25 |
| Antimony | 8.75 | 8.37½ |
| Nickel, ingot | 28.00–30.00 | 28.00 to 30.00 |
| Zinc, spot | 7.37½ | 7.37½ |
| Tin, Straits | 47.50 | 46.62½ |
| Aluminum, 98 to 99 per cent | 26.00–27.00 | 26.00 |

**Electrical Slate Sales in 1922.**—Sales of electrical slate in the United States during 1922 amounted to $976,022, according to the Geological Survey in a report just made to the Department of the Interior. Quantity sold amounted to 1,329,500 sq.ft.

# Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

### Copeland Products, Inc., Will Make Refrigerating Units

Copeland Products, Inc., has been organized as a Delaware corporation for manufacturing electric household refrigerating units, with factories in Flint, Mich. Capitalization consists of 200,000 shares of no-par-value stock, 100,000 shares of which have been subscribed by Flint and Detroit people. Development work in connection with production has been in progress for a year, the work having been done by the Electricold Corporation, which the new company succeeds. Work will commence during the summer on a new building, but for the time being temporary facilities are being used. E. J. Copeland is president of the company.

### Westinghouse Electric Entertains McGraw-Hill Editors

Realizing the better service to their industries that technical editors can render by closer knowledge of manufacturers' problems and accomplishments, the Westinghouse Electric & Manufacturing Company entertained a group of McGraw-Hill editors at its East Pittsburgh works this week. The trip was specially arranged to see the company's engineers who were handling the work in which the editors were most interested. Special shop visits were also arranged so that they could see special equipment in course of construction. A luncheon and a dinner afforded still further opportunity for the editors and the company engineers to get acquainted and discuss problems of mutual interest.

### Cook Electric Will Manufacture in Chicago

The Cook Electric Company, 900 West Van Buren Street, Chicago, has sold its Zion plant to Wilbur Glenn Voliva and will move about May 1 to its recently purchased new plant at 2700 Southport Avenue, Chicago. This new building cost $150,000 and will contain the general offices and factory of the company. The floor area is 40,000 sq.ft., being equivalent to its floor capacity at Zion City. There is also about 32,000 additional square feet of vacant land.

President G. R. Folds stated that this change was made in order to obtain better unity of action since there has been considerable lost motion in manufacturing at Zion City and assembling in Chicago. The new arrangement, however, will afford better manufacturing facilities in the production of telephones and telephone equipment. About 1,000 sq.ft. of floor area will be added at the present time in the form of a tool vault. No change in the management occurred and the officers still remain: G. R. Folds, president; A. D. Edwards, vice-president; E. R. King, secretary-treasurer.

### Consolidated Supply Firms Move to New Quarters

The Fobes Supply Company, 523 Mission Street, San Francisco, wholesale electrical supplies, on May 1, will be consolidated with the Electric Railway & Manufacturers' Supply Company under the firm name of the Fobes Supply Company. On the same date the new company will move to its new building at 260 Fifth Street. Officials of the firm will be: F. N. Averill, president; R. J. Holtermann, general manager; B. S. Manuel, sales manager; R. F. McDonald, assistant sales manager, and E. J. Duggan, purchasing agent.

### Electric Machinery Firm Moves

The Electric Machinery Manufacturing Company, Minneapolis, has changed its Chicago office from the Fisher Building to 1141 Monadnock Building, 53 West Jackson Boulevard. This office will now be in charge of Will H. Peterson, district manager, with Howard B. Johnson as assistant district manager.

### Allis Chalmers 1922 Profits Amounted to $2,208,549

The net profits of the Allis Chalmers Manufacturing Company, Milwaukee, for 1922 were slightly lower than that of the year before, while the unfilled orders on hand at the close of 1922 were in excess of those of 1921, as shown in the annual report of the company just made public.

The net profit of the company for 1922 was $2,208,550, while in 1921 the net profit was reported as $2,215,468. Unfilled orders on hand at the close of the year amounted to $8,215,545 as compared with $7,300,574 in 1921.

In his report to the stockholders, President Otto H. Falk said that while the amount of unfilled orders on hand on Dec. 31, 1922, was not largely in excess of the year before, the prospect for 1923 is favorable and the orders for the present year will show a "substantial increase over the preceding year."

Inventories were priced at cost or market, whichever was lower. This resulted in a write-off of $333,903. The total value of all inventories on Dec. 31, 1922, was $10,009,030 as against

$12,504,188 the year before. During the year the holders of preferred stock increased from 3,295 to 3,591 and holders of common stock decreased from 3,833 to 3,715.

## Hubbard & Company Sales Appointment

Warren M. Heim, who has been district manager of Hubbard & Company, Pittsburgh, with headquarters at 30 Church Street, New York City, for the past two years, has recently been made assistant manager of the electrical materials department of this company in charge of sales, service and production.

Mr. Heim has been associated with the industry since 1910, when, after his graduation from the Pennsylvania State University, he joined the Long Island Lighting Company as construction engineer.

## Cutler-Hammer Arranges Texas and Oklahoma Agency

The Cutler-Hammer Manufacturing Company, Milwaukee, has made an agency arrangement with O. T. Jenkins, 1002 Pacific Avenue, Dallas, Tex., effective March 1, 1923, covering the sale of wiring devices, radio apparatus and standard industrial heating apparatus, such as soldering irons, space heaters, confectioners' appliances, water heaters, etc. The territory covered is Texas and Oklahoma.

## General Electric Completes Oakland Factory

To meet the increasing demands for electrical equipment in the West the General Electric Company has just completed and is now occupying its new $250,000 factory in Oakland, Cal. The building is of steel and brick construction and contains 45,000 sq.ft. of floor space. The factory will be used as an assembling plant and for the manufacture of transformers, switchboards and other equipment and will contain a service shop as well.

The lighting of the building received special consideration and is attracting attention because of the high intensity of illumination and the even distribution of light in all parts of the building.

An interesting feature of the operations that will be conducted in the plant is the instrument laboratory, in which will be maintained many electrical standards secured from Washington. About 150 men will be employed when the plant is in normal operation.

**The Inland Glass Company**, Chicago, incorporated for $750,000, to manufacture illuminating glassware, has begun operation on its new $500,000 plant. The project was promoted by J. B. Weaver, formerly vice-president of the Pullman Company, who is president of the new company, and H. Pickett Whithers, formerly of Marshall Field, Glore, Ward & Company, who is secretary-treasurer of the new company.

**The Gardner Electric Manufacturing Company**, Emeryville, Cal., recently incorporated with a capital stock of $50,000, has completed the erection of its building and the installation of machinery and is now on an operating basis. W. C. Gardner heads the company.

**The Kent Oil Burner Corporation**, 111 Broadway, New York City, has been organized to manufacture oil-burning equipment. Arrangements will be made to have the company's products manufactured by an outside plant, the corporation simply engaging in marketing and selling. This arrangement, however, is only temporary, and later the company expects to build a plant of its own. T. F. Kemp is president of the company.

**The Blaw-Knox Company**, Pittsburgh, manufacturer of steel transmission towers, reports the largest amount of unfilled business on its books in the history of the company. The company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock and 2 per cent on the common stock, both payable May 1, to stockholders of record of April 20.

**The Foxboro Company**, Foxboro, Mass., manufacturer of electrical recording instruments, plans the erection of a four-story addition, 60 ft. x 160 ft.

**The Pacific Electric Manufacturing Company**, San Francisco, has leased additional floor space of approximately 15,000 sq.ft. in a building adjoining its present quarters. The new space will enable it to increase its manufacturing facilities so as to take care of the large volume of new business which the company is receiving.

**The National Carbon Company, Inc.**, is removing its "Ever-Ready" plant from Long Island City, New York, to Cleveland, where, it is stated, the company's production of flashlights and radio batteries will be quadrupled. The battery department will occupy a three-story building, erected during the war, which has been equipped for the new department. Among the executives who will be transferred from the Long Island plant will be A. V. Wilker, general superintendent; Charles Randall and W. H. Hines, in charge of production.

**The Walker Vehicle Company**, State and Eighty-seventh Streets, Chicago, manufacturer of commercial automobiles, has tentative plans for a new branch plant at New Orleans, to be used for electric trucks.

**The Peterson Storage Battery Company**, 323 South Lafayette Street, South Bend, Ind., is planning the erection of a new one-story factory, to cost approximately $30,000.

**The Electric Power Equipment Corporation** has just completed its new plant at 412 North Eighteenth Street, Philadelphia, where 30,000 sq.ft. of floor space will be used for manufacturing purposes. The former address of the company was at Thirteenth and Wood Streets.

**The Mercury Manufacturing Company**, manufacturer of storage battery trucks, 4118 South Halsted Street, Chicago, has let contracts for a one-story addition to its plant, to cost $40,000.

**The Metal Ware Corporation**, Two Rivers, Wis., which has increased its capital from $300,000 to $350,000, is taking over the manufacture of the electrical appliance line of the Harvey Electric Company, Chicago. D. C. Hughes, production manager of the Harvey Company, has been transferred to Two Rivers to supervise the department, in which electric irons, toasters and other electric products will be manufactured. C. F. Kirst is president of the Two Rivers Company.

**The Armature Rewinding Company**, 3305 Washington Avenue, St. Louis, has awarded a contract for a two-story plant, 50 ft. x 125 ft., at 605 North Leonard Avenue, for the manufacture and repair of electrical machinery, estimated to cost $50,000.

**The Quality Electric Company**, Los Angeles, manufacturer of electrical products, has plans for a new one-story factory, 40 ft. x 175 ft., at 812 San Pedro Street.

**The Marko Storage Battery Company**, 102 Jefferson Avenue, Brooklyn, N. Y., will soon take bids for the erection of a new two-story addition, 70 ft. x 90 ft., for considerable increase in capacity. It will cost approximately $50,000.

**Landers, Frary & Clark, Inc.**, New Britain, Conn., manufacturers of electric heating and cooking appliances, have completed plans for the erection of a three-story addition to their plant, to cost approximately $70,000. The company purposes to remove its present plant at Newark, N. J., to the main factory.

**The Connecticut Telephone & Electric Company**, Britannia Company, Britannia Street, Meriden, Conn., has completed plans and will take bids at once for the erection of a large addition to its plant.

**The H. T. Electric Service Company**, Indianapolis, has plans under way for the erection of a new two-story plant, 55 ft. x 195 ft., on North Capitol Avenue, estimated to cost $30,000.

**The Esterline-Angus Company**, 227 East South Street, Indianapolis, manufacturer of electrical equipment, is planning for the erection of a two-story plant at Blackford and New York Streets, to cost about $70,000. The present factory will be removed to the new location as soon as the structure is ready.

**The William A. Baehr Organization** has changed its Chicago office from the People's Gas Building to the Illinois Merchants Bank Building, 230 South Clark Street.

**The Louis Allis Company**, Milwaukee, manufacturer of motors, announces the establishment of its Alabama agency, the Commercial Electric Sales Company, 1322 Empire Building, Birmingham.

## Foreign Trade Notes

THE YATAWA (JAPAN) IRON WORKS TO BE EQUIPPED FOR ELECTRICAL OPERATION.—Definite plans are now being prepared, *Commerce Reports* states, for the general electrification of the Yatawa Iron Works of the Japanese government, which will involve an expenditure of 18,000,000 yen ($9,000,000) and cover a period of three years. The work will include the installation of electric cranes, conveyors, motors, etc.

ELECTRIC RANGES IN SOUTH AFRICA.—The Town Council of Durban, South Africa, according to *Commerce Reports*, is looking into a scheme for renting electric ranges to consumers of electricity. Electric heating devices are already freely used.

EXTENSION TO ELECTRIC PLANT IN YUNNANFU, CHINA, PROPOSED.—Plans are under consideration for extensions to the electric power plant in Yunnanfu, China, *Commerce Reports* states, which will include the installation of two 420-hp. water turbines, two generators, one of 350 kva. and one of 400 kva. capacity; switchboard equipment and accessories.

HYDRO-ELECTRIC SCHEME FOR CHINA.—The Foochow Electricity Company is planning to build a hydro-electric plant at the waterfalls between Shipping and Lungting, in the Kutien district, China.

NEW COMPANY FORMED TO SUPPLY ELECTRICITY IN MINAS GERAES, BRAZIL.—A company is being organized with a capital stock of 400,000 milreis (one milreis = $0.5462 at normal exchange), according to *Commerce Reports*, to supply electricity for lighting and power purposes in two cities in the State of Minas Geraes.

ELECTRICITY FOR ILOILO, PHILIPPINE ISLANDS.—Electricity for the city of Iloilo, Philippine Islands, *Commerce Reports* states, is to be provided by a new plant which is being installed by the Philippines Engineering Company. Plans are also being prepared for establishing an electric railway system, to cost about $500,000.

THE SUTLEJ VALLEY (INDIA) HYDRO-ELECTRIC PROJECT ABANDONED.—The Punjab Electricity Board is understood to have abandoned the Sutlej Valley hydro-electric project. The government proposes to concentrate on the Uhl River scheme in the Mandi State.

PROPOSED ELECTRIC PLANT FOR DURBAN, SOUTH AFRICA.—Application has been made to the Union government by the Town Council of Durban for permission to build a power station at Congella, under the new electricity act. A conference has been suggested by the government between the representatives of the Durban municipality, the Electricity Supply Commissioners (a body to be appointed) and the South African Railway Administration.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN NEWFOUNDLAND.—A scheme has been approved by the advisory committee under the trade facilities act which aims to develop hydro-electricity to operate pulp and paper mills. It is proposed to utilize the water power of Deer Lake, from which it is estimated that between 230,000 hp. and 240,000 hp. could be developed. The plans provide for an initial plant of 100,000 hp. It is proposed to use electric boilers on a large scale for producing steam necessary for the production of pulp and paper. A sum of £4,000,000 will be guaranteed jointly by the British and Newfoundland governments. The hydraulic work will be in charge of W. G. Armstrong, Whitworth & Company, Ltd., who are interested in the project.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Turin, Italy (No. 6,127), for electrical novelties, etc.

An agency is desired in Paris, France (No. 6,137), for telephone and telegraph apparatus, including wireless.

An agency is desired in London, England (No. 6,146), for small motors, vacuum cleaners, washing machines, electric heating appliances, electric refrigerators, electric table fountains and similar specialties.

Purchase and agency are desired in Shanghai, China (No. 6,147), for rubber jars for storage batteries, 6-volt and 12-volt, etc.

An agency is desired in London, Canada (No. 6,148), for electrical specialties, lighting fixtures and wiring supplies.

An agency is desired in Melbourne, Australia (No. 6,168), for electrical supplies, automobile accessories and specialties and tools of these trades.

Purchase is desired in England (No. 6,171) for plumbing, heating and lighting equipment, etc.

An exclusive agency is desired in Johannesburg, South Africa (No. 6,149), for supplies for engineering and mechanical and kindred industries, such as electric lamps, grinders and machine tools.

## New Apparatus and Publications

DRY BATTERIES.—The National Carbon Company, Inc., Thompson Avenue and Orton Street, Long Island City, has added two new types to its steel case Columbia "Hot Shot" line of batteries.

FUSES.—Bulletin No. 200 issued by Schweitzer & Conrad, Inc., 4,435 Ravenswood Avenue, Chicago, covers the "S & C" extra high-potential fuse and other types of the "S & C" high-voltage fuses.

ELECTRIC DRILLS AND REAMERS.—The Hisey-Wolf Machine Company, Cincinnati, has issued bulletin No. 106, covering its "Hisey" portable electric drills and reamers.

INDUCTION VOLTAGE REGULATORS.—The General Electric Company, Schenectady, N. Y., has issued thirty-two leaflets giving construction details of its induction voltage regulators.

MOTOR.—Bulletin No. 132 issued by the Wagner Electric Corporation, St. Louis, describes and illustrates its "Pow-R-ful" motor.

BLUEPRINTING MACHINE.—The C. F. Pease Company, 813 North Franklin Street, Chicago, has developed the "Pease" sheet drier, which is designed for drying blue prints, negative prints and photographic prints.

WATER-TUBE BOILERS.—Bulletin No. 2 issued by the A. D. Granger Company, New York City, describes and illustrates the "Oswego" internally fired water-tube boiler.

ATTACHMENT FOR CONTROL SWITCHES.—A full automatic attachment that can be added to any type "CS" circuit-breaker control switch has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania.

FUSE BOX.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing leaflet No. 20,005, covering its type "OD" safety-first fuse box for use on circuits up to 100 amp. and 7,500 volts.

METERS.—The American Electrical Instrument Corporation, 147 Palisade Avenue, Union Hill, N. J., is distributing bulletins Nos. L-104, L-105 and L-107, entitled "'Aimco' Sliding Contact Tube Rheostat," "'Aimco' Vibrating Reed Tachometers" and "'Aimco' Vibrating Reed Frequency Meters" respectively.

PROTECTIVE RELAYS.—Bulletin No. 417-2 issued by the Condit Electrical Manufacturing Company, South Boston, Mass., covers its protective relays and accessories for electrically operating switchgear.

## New Incorporations

THE PUBLIC SERVICE ELECTRIC POWER CORPORATION OF NEW JERSEY, Newark, N. J., has been chartered to construct an electric superpower station on the Kearney Meadows. The officers are: Richard E. Danforth, president; Henry D. Whitcomb, vice-president; William H. Feller, secretary, and Frederick A. Neils, treasurer.

THE THORSBY (ALA.) LIGHT & DEVELOPMENT COMPANY has been chartered with a capital stock of $10,000 by A. E. Reagan, C. E. Lucas and Felix Elland.

THE MANN-FINK ELECTRIC COMPANY, Tacoma Park, D. C., has been incorporated by Leroy S. Mann, G. Ernest Fink and others. The company is capitalized at $10,000.

# Construction News

**Projects, Plans, Bids and Contracts; Contemplated or Under Way**

## New England States

AUGUSTA, ME.—The Maine Central Power Company has issued $600,000 in bonds, part of the proceeds to be used for extensions and improvements in its system.

RUMFORD, ME.—The Oxford Paper Company will install electric power equipment in connection with extensions, to cost about $300,000.

GORHAM, N. H.—The Twin State Gas & Electric Company, 160 State Street, Boston, has completed plans for a hydro-electric power plant to cost $275,000, for which a site has been acquired. R. J. Andrus is engineer.

LUNENBERG, VT.—The electric plant and system of the Lunenberg Manufacturing Company, which furnishes local commercial service, has been acquired by the Twin State Gas & Electric Company, 160 State Street, Boston. A transmission line will be erected to Lunenberg and extensions and improvements will be made to the local system.

LEE, MASS.—Plans, it is reported, are under consideration by the Smith Paper Company for the construction of an electric plant on the Housatonic River, between its Niagara and Centennial Mills.

WEYMOUTH, MASS.—The Edison Electric Illuminating Company, Boston, has awarded a general contract to Stone & Webster, Inc., 147 Milk Street, Boston, for the construction of the first unit of a steam-operated power plant, to cost about $5,000,000, with equipment.

NEW HAVEN, CONN.—The United Illuminating Company will build a transformer station at 34 Wallace Street.

## Middle Atlantic States

BUFFALO, N. Y.—Bids will be received by the Board of Education, Telephone Building, until May 2 for transformers, switches and other electrical apparatus for the vocational school on Elmwood Avenue.

NEW YORK, N. Y.—Bids will be received by the New York Central Railroad Company until May 4 for one 2,000-kw. rotary converter and one 2,100-kva. transformer, with switchboard and auxiliary apparatus. (Serial contract No. 13, 1923.) C. S. White, Room 344, 466 Lexington Avenue, is purchasing agent.

NEW YORK, N. Y.—Electric power equipment for general service, ice-manufacturing and refrigerating departments will be installed in the market building to be erected by the Department of Public Markets, Room 2337, Municipal Building, at Cromwell Avenue and the Harlem River, to cost about $6,000,000.

NEW YORK, N. Y.—Electric power equipment will be installed in the baking plant to be built by Cushman's Sons, Inc., 461 West 125th Street, on Lawrence Street, to cost about $150,000. L. S. Beardsley, 116 West Thirty-ninth Street, is architect.

SYRACUSE, N. Y.—The Syracuse Lighting Company contemplates extensions and improvements to its system during the next eighteen months, to cost about $4,000,000.

UTICA, N. Y.—The Utica Gas & Electric Company will erect a 110,000-volt transmission line to connect with the system of the Northern New York Utilities, Inc., Watertown, from which it will purchase hydro-electric power up to 25,000 kw., the service to begin in June. F. M. Tait is president and general manager.

FRANKLINVILLE, N. J.—Theodore Blank, Porchtown, plans to build a hydro-electric plant on lake property at Porchtown and Malaga. A transmission system will be erected to furnish commercial service at Franklinville and vicinity.

ALLENTOWN, PA.—The Amerag Corporation plans to build a power house in connection with its proposed plant at Greenawalds, a suburb, to cost about $500,000.

BROOKVILLE, PA.—The Jefferson Electric Company has been granted permission to acquire eight electric power companies

operating in this section and will merge the systems. Plans are under way for extensions and improvements.

EDGELY, PA.—The Margargee Paper Company, Modena, is preparing plans for a 4,000 kw. steam-operated electric generating plant in connection with its proposed new local mills. The cost of the project is estimated at $600,000.

HANOVER, PA.—The Metropolitan Edison Company, Reading, has acquired the properties of the Hanover Power Company and the Gettysburg (Pa.) Electric Company. The systems will be consolidated and extensions made.

HAWLEY, PA.—The Pennsylvania Power & Light Company, Allentown, plans to build a large local generating plant to furnish service to a number of distributing companies, now being organized as subsidiaries, to operate in parts of Carbon, Luzerne, Wayne, Lackawanna, Munroe and Pike Counties.

PHILADELPHIA, PA. — The Philadelphia & Reading Railroad Company, Reading Terminal, will build a power house at its proposed grain elevator (to cost about $3,000,000) in the Port Richmond section.

WILLIAMSPORT, PA. — The Keystone Glue Company is preparing plans for a power plant at its factory, to cost $200,000, including machinery.

ELKTON, MD.—The Northern Maryland Electric Company, Baltimore, plans extensions in its hydro-electric plant, in the vicinity of McCall's Ferry, on the Susquehanna River, increasing the capacity to 410,000 hp. The cost is estimated at $1,000,000.

LAUREL, MD. — The Annapolis Public Utilities Company has acquired the local municipal electric plant and will make extensions and improvements, including a transmission line.

MASON CITY, W. VA.—The Hutchison Coal Company contemplates rebuilding its power house, recently damaged by fire, causing a loss of about $40,000.

NORFOLK, VA. — The Norfolk Sugar Refining Company, recently organized, plans to build a power house in connection with a local sugar refinery, to cost about $750,000. J. B. Morgan and J. H. Caldwell, both of Norfolk, are interested in the company.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until May 3, for 2,093 connecting switchboard cords (Proposal 13488-A-2ACP).

## North Central States

TOLEDO, OHIO.—The Ajax Rubber Company, Trenton, N. J., plans to build a substation at its proposed local tire-manufacturing plant. The cost of the work is estimated at $200,000.

TOLEDO, OHIO. — The Toledo Edison Company is installing an additional 30,000-kw. turbo-generator unit at its Acme station. J. F. O'Connor is manager of the electric department.

TOLEDO, OHIO. — The Toledo Edison Company has issued $1,500,000 in capital stock, part of the proceeds to be used for extensions and improvements.

PINEVILLE, KY.—The Kentucky Utilities Company plans to erect a local power plant, to cost about $100,000, for which a site has been acquired.

CHANDLER, IND.—The Boonville (Ind.) Electric Light & Power Company is erecting a transmission line to Chandler (6 miles long) to supply electricity here and to the farmers and the coal mines along the route. K. H. Weyerbacher is manager.

INDIANAPOLIS, IND.—Plans are under way for equipping the plant of the Lavelle Foundry Company, Michigan Street, for electrical operation throughout.

LAFAYETTE, IND.—A power plant will be built at the Indiana State Soldiers' Home, for which bids will be called at once. W. M. Louden is commandant.

MARION, IND.—The Upland Flint Glass Company will install electric power equipment in connection with the rebuilding of its local plant, recently damaged by fire, causing a loss of about $100,000.

BAYFIELD, WIS.—Plans are under consideration to purchase electricity to operate the municipal system from a hydro-electric plant under construction at Port Wing, Orienta Falls, and to extend the lines to La Pointe and Madelaine Island, a distance of 3 miles, by a submarine cable. L. W. Barnes, is superintendent.

BELLEVILLE, WIS. — The Belleville Electric Light & Power Company contemplates extensions to its light and power lines, to cost about $10,000.

JOHNSON CREEK, WIS.—The installation of a new ornamental lighting system is under consideration. It is proposed to replace the three-lamp clusters with single-lamp posts.

OCONTO FALLS, WIS.—The Falls Manufacturing Company contemplates the construction of a power house in connection with a new paper mill, to cost about $160,000.

OSHKOSH, WIS.—The Wisconsin Public Service Corporation is planning to erect a 6,600-volt transmission line from Oshkosh to Pickett, which will also supply electricity to Fisk and Elo.

ST. CLOUD, MINN.—Expansion of the terminals of the Great Northern Railway Company at St. Cloud, to cost about $500,000, include a power house, roundhouse, machine shop, etc.

BROOKFIELD, MO.—At an election to be held April 30 the proposal to issue $95,000 in bonds to construct a municipal electric light plant will be submitted to the voters.

ST. JOSEPH, MO.—Plans for a proposed local cement-manufacturing plant to be erected by Claude H. Light, Garden Grove, Iowa, and associates, to cost about $250,000, include a power plant.

MERRIMAN, NEB. — Plans are under way to extend the electric transmission lines of the Cornell Hydro-Electric Company at Valentine to Gordon and Merriman.

WICHITA, KAN. — The Kansas Milling Company has authorized plans for a one-story power plant in connection with a new mill. The Benham Engineering Company, Gumbel Building, Kansas City, Mo., is consulting engineer.

## Southern States

ANDREWS, N. C.—Bonds to the amount of $350,000 have been authorized by the Board of Aldermen for the construction of a hydro-electric plant on the Hiawassee River, to develop about 1,500 hp. The Ludlow Engineers, Inc., Engineers, Winston-Salem, will have charge of the work.

AINSLIE, GA.—The Southeastern Portland Cement Company, Macon, recently organized, plans to erect a power house at its proposed local cement-manufacturing plant, to cost about $500,000. W. Jordon Massee is president.

AMERICUS, GA. — The South Georgia Public Service Company has purchased the system of the Americus Lighting Company. A transmission line will be erected from Albany, Ga.

DAYTONA, FLA.—The Daytona Public Service Company plans to install additional equipment in its plant.

GARY, FLA.—The Tampa Glass & Bottle Manufacturing Company, Tampa, plans to build a power house at its proposed new local plant.

MIAMI BEACH, FLA. — An improved street-lighting system will be installed to cost about $20,000, for which bonds have been voted.

BELLS, TENN.—The Bells Light & Water Company contemplates installing an ice plant in connection with its electric plant. A. T. Chronister is manager.

KNOXVILLE, TENN.—The Knoxville P. & M. Mortar Company plans to build a power house in connection with its proposed local works for cement plaster, fireclay, etc. W. B. Townsend is the president of the company.

BIRMINGHAM, ALA. — The Alabama Power Company contemplates building an additional hydro-electric power plant on the Warrior River, to cost about $1,000,000.

MONTGOMERY, ALA. — The Alabama Power Company has issued $4,000,000 in bonds, part of the proceeds to be used to acquire the properties of the Montgomery Light & Water Power Company, Montgomery Light & Traction Company, Power Transmission Company and the People's Electric Light & Ice Company, and for proposed extensions and improvements to the systems.

CANTON, MISS.—Bonds have been voted for extensions and improvements in the municipal lighting system and waterworks, to cost about $75,000.

POPLARVILLE, MISS. — The Southern Power & Manufacturing Company, New Orleans, plans extensions to the local electric plant, lately acquired. It is also proposed to install an ice-manufacturing and refrigerating plant.

GIBSLAND, LA.—A bond issue of $50,000 has been authorized for the installation of an electric system and improvements to waterworks.

SHREVEPORT, LA. — The Red River Refining Company plans to build a power house in connection with a new local oil-refining plant, to cost about $500,000.

ENID, OKLA.—Plans for the proposed terminal grain elevator, to be erected by the Enid Terminal Elevator Association, at a cost of about $500,000, include a power house.

MULDROW, OKLA.—The municipal electric plant has been acquired by the Oklahoma Gas & Electric Company, which will furnish service from a new transmission line. The local plant will be remodeled for a substation.

EDGEWOOD, TEX.—Bonds to the amount of $15,000 have been voted to establish a municipal electric light plant.

GRANBURY, TEX.—Bonds to the amount of $28,000 have been voted for the installation of an electric light and power system.

HULL, TEX.—The Gulf Production Company will build an electric power plant, with transmission lines for power service, at its oil properties, to cost about $1,000,000.

## Pacific and Mountain States

GRANITE FALLS, WASH.—The Puget Sound Light & Power Company, Seattle, plans to extend its transmission line from Granite Falls to Hartford.

MARBLE, WASH.—The Stevens County Power & Light Company will build a transmission line from Colville, through Echo Valley and Lake City, to Marble.

SEATTLE, WASH.—The City Lighting Department is considering plans for the installation of new lighting units on streets in the main business district.

TACOMA, WASH.—The Tacoma Harbor Lumber Company, recently organized, will build a power house at its proposed local mill. The cost of the project is estimated at $100,000.

VANCOUVER, WASH. — Contract has been awarded by the Columbia River Paper Mills Corporation to the Gilpin Construction Company, Portland, Ore., for the first unit of its proposed work,s to cost about $200,000. A power plant and machine shop will be built later. The entire plant, including other units, will cost about $1,200,000.

CORNING, CAL.—A hydro-electric development by utilizing water power secured from Trinity River in Trinity County is under consideration by W. H. Samson, Corning, and associates. The plans call for a development of 285,000 hp. and the use of the water later for irrigating 400,000 acres of land in Glenn, Colusa, Yolo and Tehama Counties. Two hydro-electric plants are planned, to cost about $30,000,000.

LONG BEACH, CAL. — Bonds to the amount of $80,000 have been voted for the installation of an electric fire-alarm system.

LOS ANGELES, CAL.—Bids will be received by the County Board of Supervisors until May 7 for furnishing and installing one steam-turbine-driven electric generator at the County Hospital.

LOS ANGELES, CAL.—Electric power equipment will be installed in the two-story ice-manufacturing and cold-storage plant to be erected by the Los Angeles Ice & Cold Storage Company on Mesquit Street, to cost about $50,000. John E. Kunst, 820 Higgins Building, is architect.

OAKLAND, CAL. — Bids will soon be called for the installation of an ornamental lighting system in the Lake Merritt district. Howard Gilkey is engineer.

ROSEVILLE, CAL.—Plans are under consideration for the installation of an ornamental lighting system on Church and Lincoln Streets.

SANTA ANA, CAL.—Plans are being prepared for the installation of an electric fire-alarm system, to cost $25,000, for which bonds have been voted.

WINKLEMAN, ARIZ. — The Arizona Portland Cement Company, Phoenix, will build a power house at its proposed cement-manufacturing plant. The cost of the project is estimated at $750,000.

## Canada

NELSON, B. C. — The Street Railway, Light and Power Departments contemplate extensions of transmission line (11 miles) to supply electricity for lighting and mines in the rural districts. G. T. McGuire is general superintendent.

ROSSLAND, B. C.—Plans to increase its hydro-electric developments at Bonnington

Falls on Kootenay River from 30,000 hp. to 60,000 hp. is under consideration by the West Kootenay Power & Light Company.

ST. JOHN, N. B.—The New Brunswick Electric Power Commission contemplates the erection of approximately 30 miles of additional low-tension rural feeder lines. G. A. Vandervoort is the general superintendent.

PARRY SOUND, ONT.—The Public Utilities Commission contemplates building two storage dams and also the installation of a 1,200-kva. generating unit and extensions to the distribution system. As yet nothing definite has been decided upon. W. F. Lockard is manager.

ESTEVAN, SASK.—The installation of a 300-kw. steam-engine-driven generator, three-phase, 60-cycle, 2,300 volts, and the erection of 1 mile of high-tension transmission line is under consideration by the Municipal Electric Light Department. J. B. Hamilton is manager.

MELVILLE, SASK. — The Light and Power Department is considering the installation of a lignite coal producers and tar-extracting machinery. James Anderson is superintendent.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued March 27, 1923)

1,450,156. Electrolytic Apparatus; J. N. Smith, Toronto, Ont., Canada. App. filed April 7, 1921. Electrolysis of saline solutions, production of oxygen and hydrogen or electrodeposition of metals.

(Issued April 3, 1923)

1,450,172. Swivel-Plug Connector; E. Dewald, Sr., Cincinnati, Ohio. App. filed March 8, 1920.

1,450,246. Piezo Electric Resonator; W. G. Cady, Middletown, Conn. App. filed Jan. 28, 1920.

1,450,253. Switching Device; H. A. Douglas, Bronson, Mich. App. filed Aug. 15, 1918. Switch for lamp socket such as is used on automobile instrument board.

1,450,254. Balancing Arrangement for Multiplex Carrier Circuits; L. Espenschied, Hollis, N. Y. App. filed Sept. 26, 1919. Balancing transmission circuit for several frequencies.

1,450,265. Hot-Cathode Tube; J. Slepian, Wilkinsburg, Pa. App. filed April 18, 1919. Used for rectification and in detector-bulb work.

1,450,275. Wireless Amplifier; C. T. Alcutt, Pittsburgh, Pa. App. filed Dec. 31, 1918. Cathode of a vacuum-tube amplifier, an electrode opposite cathode, a second electrode in plane parallel to cathode, and grid between the two electrodes.

1,450,276. Trolley Crossing; R. E. Andrew, Philadelphia, Pa. App. filed Feb. 21, 1922. Insures smooth passage of trolley wheel.

1,450,277. Waffle and Hot-Cake Iron; E. N. Brown and A. M. Lambert, San Francisco, Cal. App. filed Jan. 31, 1922. Reversible plates heated by variable-resistance elements.

1,450,294. Welding Tool; J. Jerry, Milwaukee, Wis. App. filed Dec. 29, 1920. For holding electrode or fusing strip.

1,450,305. Telephone Signaling System; W. A. Rhodes, New York, N. Y. App. filed Oct. 25, 1919. Means for providing "disconnect" and "busy" signals for telephone systems.

1,450,310. Lining for Conduit Outlet Boxes; W. M. Silliman, Syracuse, N. Y. App. filed Oct. 17, 1918. Lining or trim inserted which separates box into compartment.

1,450,321. Party-Line Revertive Ringing System; A. E. Lundell, Chicago, Ill. App. filed June 4, 1920. Full mechanical system of large capacity.

1,450,337. Automobile Signal; M. D. Shiverick, Albany, N. Y. App. filed March 14, 1921. Rear direction and stop signal.

1,450,339. Intermittingly Operating Motor System; R. S. Smith and J. L. Adams, Jr., Milwaukee, Wis. App. filed Oct. 20, 1919. Method of driving motor at varying speed in recurrent periods of rising and falling frequency.

1,450,347. Trolley and Feed-Wire Clamp; L. E. Armentrout, Borderland, W. Va. App. filed Jan. 3, 1923. Employed to suspend trolley and feed wires from mine roofs.

1,450,352. Selecting Switch for Use in Telephone Systems; K. Böhme, Berlin-Siemensstadt, Germany. App. filed Nov. 3, 1922. Decreased height of switch.

1,450,362. Electric Coil; P. Gilinson, Lowell, Mass. App. filed Feb. 10, 1919. Means for supporting and insulating various layers of windings of electric coils.

1,450,413. Vacuum Electric Dischagre Device; H. W. Edmundson and W. T. Munro, Rugby, England. App. filed March 10, 1919. Shield mounted in vacuum tube cuts off head radiated from anode.

1,450,415. Protective Device; H. G. French, Schenectady, N. Y. App. filed July 26, 1917. For protecting polyphase motors under unbalanced load conditions.

1,450,420. Sensitized Film Holder for X-Ray Photography; J. A. Heidbrink, Minneapolis, Minn. App. filed April 21, 1921. For dental work.

1,450,425. Protection of Alternating-Current Distributing Circuits; R. V. Bingay, Pittsburgh, Pa. App. filed Oct. 17, 1919. Protection of lines against high voltage of primary side of transformers.

1,450,439. Recording Phonograph; R. Hase, Berlin, Germany. App. filed Feb. 18, 1921. Speech recorded by aid of electromagnetic sound box.

1,450,464. Crystal Formation; E. Thomson, Swampscott, Mass. App. filed July 26, 1920. Alumina, beryllia, etc., made in electric furnace.

1,450,500. Flashlight; C. W. Harvey, New London, Conn. App. filed Jan. 17, 1922. Self-contained generator.

1,450,521. Armature for Dynamo-Electric Machines; A. Steinbach, Chicago, Ill. App. filed Dec. 31, 1921. Sectional armature core with coil on each section.

1,450,533. Storage Battery and Process of Producing the Same; A. H. Williams, Worcester, Mass. App. filed April 16, 1920. Relates to construction of plates.

1,450,543. Method and Device for the Heating of Material in Electric Furnaces; E. A. A. Grönwall, Stockholm, Sweden. App. filed Sept. 28, 1921. For the heattreating of metals.

1,450,563. Trouble-Locating Device; W. T. Powell, Rochester, N. Y. App. filed May 16, 1919. For locating apparatus trouble on telephone systems.

1,450,564. Telephone-Exchange System; F. M. Slough, Rochester, N. Y. App. filed Jan. 24, 1918. Exchange system in which calls are automatically extended by mechanical means to different idle call-receiving apparatus.

1,450,565. Secondary of Storage Battery; E. W. Smith, Philadelphia, Pa. App. filed Jan. 30, 1922. Plate consists of perforated tubes containing active material and metallic cores which act as conductors.

1,450,572. Reversing and Control Switch; O. Bahls, Long Island City, N. Y. App. filed Dec. 15, 1921. For electric vehicles.

1,450,589. Combined Heating and Cooling Device; G. Graff, New York, N. Y. App. filed Jan. 31, 1921. Ventilation system.

1,450,620. System for Regulating Frequency; H. E. Warren, Ashland, Mass. App. filed Dec. 13, 1918. Combined synchronous motor and clock indicates any change in frequency.

1,450,658. Oil-Well Heater; M. Warnick, Los Angeles, Cal. App. filed Dec. 6, 1921. Electric heater placed in bottom of well to facilitate pumping of oil.

1,450,668. Apparatus for Moving Furnace Electrodes; W. Dyrssen, New York, N. Y. App. filed Feb. 25, 1921. Automatically controls raising and lowering of electrodes.

1,450,725. Electrical Resistance Heating Element and Process of Making Same; F. Hodson, Philadelphia, Pa. App. filed May 22, 1922. Resistors of graphitic carbon.

1,450,749. Apparatus for and Method of Controlling Electric Currents; G. W. Pierce, Cambridge, Mass. App. filed March 11, 1914. Control of periodic current by another current or electromotive force the character of which it is desired to alter.

1,450,833. Steam-Heating Appliance; P. Bergeon, Grenoble, France. App. filed Oct. 6, 1921. Water vaporized by electrodes.

1,450,885. Trolley Construction; J. F. Healy, Chicago, Ill. App. filed May 25, 1921. Trolley pole operated by fluid-pressure cylinder.

1,450,898. Motor Controller; H. W. Cheney, Milwaukee, Wis. App. filed Dec. 6, 1919. Compensator for starting motors on low voltage.

1,450,902. Dynamo-Electric Machine; S. H. Mortensen, Milwaukee, Wis. App. filed Dec. 3, 1920. Flywheel for vertical waterwheel generators.

1,451,392. Electrode for Electric Arc Cutting or Reducing; C. J. Holslag, South Orange, N. J. App. filed Nov. 15, 1921. Electrode of rectangular cross-section.

1,451,426. Spark-Gap Apparatus; L. J. Lesh, New York, N. Y. App. filed April 9, 1918. Spark-gap apparatus of the multiple-unit gap type for use in radio transmitting and receiving sets.

1,451,427. Spark-Gap Apparatus; L. J. Lesh, New York, N. Y. App. filed June 5, 1918. Rotary gap for wirelss transmission.

1,451,465. Power-Transmission Apparatus; A. H. Neuland, San Francisco, Cal. App. filed May 13, 1916. Engine-generator-motor set for vehicles.

1,451,495. Audible Signal Device; J. L. Dinsmoor, Philadelphia, Pa. App. filed Aug. 7, 1917. Vibrating electric horns for automobiles.

1,451,500. Process and Means for Removing Corroded Terminals for Storage Batteries; G. E. Frohbeiter, Princeton, Ind. App. filed Sept. 11, 1922. By heating corrosion.

1,451,501. Speed-Regulating Apparatus; V. A. Fynn, St. Louis, Mo. App. filed July 5, 1919. Electromagnetic means for controlling supply of fuel to internal-combustion engines.

1,451,502. Speed-Regulating Apparatus; V. A. Fynn, St. Louis, Mo. App. filed July 5, 1919. Electromagnetic control for internal-combustion engines.

1,451,529. Resistor Element; Q. A. Brackett, Pittsburgh, Pa. App. filed Aug. 5, 1919. Grid leaks for vacuum-tube radio sets.

1,451,537. Electric Heater; M. D. Dominguez, New Orleans, La. App. filed May 1, 1922. Automatic water heater.

1,451,539. Electric Heating System for Ironing Machines; F. F. Forshee, Flint, Mich. App. filed Feb. 14, 1921. Method of maintaining constant temperature on heating surfaces.

1,451,543. Electroplating with Zinc; J. Haas, Jr., Muncie, Ind. App. filed Sept. 16, 1922. Electroplating of zinc or its alloys upon iron or steel in cyanide baths.

1,451,548. Contact Terminal; H. Kreisheld, Mansfield, Ohio. App. filed Nov. 20, 1919. Plug-and-socket contact for electrically heated apparatus.

1,451,550. Starting System for Automobiles; W. P. Loudon, Edgewood Park, Pa. App. filed April 14, 1920. Starting motor.

1,451,555. Arc-Welded Truss; W. Schenstrom, Brooklyn, N. Y. App. filed Oct. 11, 1920. Relates to framed-beam building construction.

1,451,556. Electric Percolator; F. Thornton, Jr., Wilkinsburg, Pa. App. filed June 29, 1922. Simple construction of vaporizing chamber.

1,451,558. Electropercussive Welding System; C. F. Wagner, Pittsburgh, Pa. App. filed May 14, 1921. Automatic control.

1,451,559. Section Insulator; N. A. Wahlberg, Wilkinsburg, Pa. App. filed June 3, 1921. For trolley wires.

1,451,577. Dynamo-Electric Machine; P. H. H. Jantzen, London, England. App. filed April 10, 1920. Means for cooling stator and rotor of dynamo-electric machines.

1,451,618. Flashlight; H. M. Koretzky, New York, N. Y. App. filed June 27, 1921. Accidental lighting prevented.

1,451,623. Soldering Iron; E. Millner, St. Louis, Mo. App. filed May 3, 1920. Electric heating element.

1,451,636. Electric Heater; R. Ullrich, Wels, Austria. App. filed Sept. 12, 1922. Cooking apparatus heated by electric energy, with automatic device for making and breaking circuit.

1,451,671. Electric Water Heater; W. G. Carter, Monrovia, and F. W. Thompson, Arcadia, Cal. App. filed Feb. 28, 1922. Tank heating system for hot-water-pipe lines.

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# Making Progress by Mingling Theory with Practice

THAT theory and practice can mix—and much to the advantage of the electrical industry—was strikingly shown at the spring convention of the American Institute of Electrical Engineers, held last week in Pittsburgh. Nearly twelve hundred electrical engineers were gathered there to take part in or listen to a program which contained both highly technical and highly practical papers, and the results showed conclusively that the practical or operating engineer and the technical specialist can meet jointly and discuss their problems and experiences to mutual advantage.

The story of the convention, with the details of its papers and discussions, is told elsewhere in these pages. It is enough to point out here that essentially the convention, in its technical aspects, was an exposition of some important operating problems of the light and power industry and that it was notable for the presentation of many papers filled with data obtained in the field. A judicious selection of theoretical and technical papers added vitality to the discussion, and there was thus formed a well-proportioned picture of the subjects under consideration. Agreement was expressed on the advantages of operating with a grounded-neutral system; the field for application of the neutral grounding reactor was defined, and a great deal of progress in relay design and application was shown. In addition, outstanding progress in illuminating engineering practice was evidenced, and a noteworthy revival of interest in the design and application of electric furnaces was evident.

BUT, while the details are of interest, most important is the fact that a general feeling of power to accomplish and of confidence and optimism concerning the future was quite evident. Many hitherto vexatious engineering problems have been solved. In fact, as M. H. Aylesworth observed in his banquet address, the status of electrical engineering has advanced so rapidly that the realization of an electrified America is delayed, not by lack of engineering knowledge and ability, but only by legal, economic, social and political handicaps. In other words, while there is real engineering work to do, yet from the viewpoint of engineering, superpower is an easy task.

Thus have the co-operative thinking and the personal contact of the electrical engineers made for progress. Engineers of groups from separate commercial divisions, with operating, manufacturing, or theoretical training and experience, meet together as unbiased professional men and discuss their problems in a friendly and constructive spirit. It is worth noting, too, that the younger engineers took an unusually prominent part in the meetings. More of the mingling of theory and practice would seem advisable to attain the maximum of progress in engineering work for the electrical industry.

# Otto Herbert Falk

*A manufacturing executive who adds to his commercial leadership by participating actively in public affairs*

AS CHIEF executive of the Allis-Chalmers Manufacturing Company since 1913 General Otto H. Falk has become an important factor in the electrical manufacturing field, where that company plays so prominent a part. Ten years ago the affairs of the company became involved, and the banking houses concerned turned to General Falk, who has large financial interests in Milwaukee, as a man eminently fitted to shoulder the responsibility of clearing up the situation. He became receiver of the company in 1912, and on its reorganization in 1913 he was made its president. It is to his ability in handling financial affairs that the Allis-Chalmers Manufacturing Company owes its present-day position as a producer of electrical, hydraulic and other machinery.

General Falk is a native of Wisconsin, having been born in Milwaukee in 1865. After receiving collegiate training in Northwestern College at Watertown, Wis., military tastes led him to become a pupil in the Allen Military Academy of Chicago, from which he was graduated as ranking captain in 1884. Ever since 1886 he has been an active factor in Wisconsin military affairs, stepping rapidly from grade to grade. In 1893 he was appointed adjutant general of the Wisconsin State militia. He was called into active service during the Spanish-American War, at which time he was commissioned as major and chief quartermaster. On his discharge he again became active in the Wisconsin National Guard, retiring with the rank of brigadier-general in 1911.

General Falk, in addition to his financial and military interests, is an important factor in Milwaukee's civic, social and business affairs. For a long time he was president of the Merchants & Manufacturers' Association of Milwaukee, serving on its legislative committee and becoming a member of the charter convention and chairman of the track elevation committee. He is a regent of Marquette University, and he has been fire and police commissioner of Milwaukee, vice-president of the public safety committee, and a delegate to national conferences on many important matters.

# Editorial Comment

Electrical World, May 5, 1923

Volume 81 Number 18



### Regulation Responsive to Public Opinion

A MOST interesting address was delivered by L. F. Loree, president of the Delaware & Hudson Company, at the centennial celebration of the chartering of that railroad. The vital part of the address comprised a peppery criticism of our system of regulation, which Mr. Loree stigmatizes as "repugnant to the genius of American political ideals and institutions." We do not so read history or interpret it. It may be that "railroading is no longer a business, it has become a calamity," but that view certainly does not hold for the electric light and power industry. Nor, indeed, would the railroads find it so if they took a more optimistic view of conditions and paid a little more attention to public relations. Every one recognizes that the railroads are vitally essential. No one seeks to destroy them or willingly wishes to cripple them. If they are maltreated, the fault rests with the railroads themselves. We have found regulation to be exceedingly responsive to public opinion, and that, properly enlightened, is constructive and not destructive. If the viewpoint of the railroads is otherwise, they should seek enlightenment and change their thought. Optimism and faith have been known to work miracles.

### Cost of Living and Price of Electricity

INDEX figures showing changes in the cost of living have been published for some years by the Labor Bureau in Washington and by special departments in various other countries of the world, as well as by private bureaus. The government's index figures are predicated on the normal household budget of the average workingman for food, clothing, housing, fuel, light, household goods, etc., compared with the cost of similar commodities in 1914, which year is used as a base. These serve a useful purpose and are employed principally in establishing wage scales. In the published tables and curves fuel and light are combined, and while the curve tells a true story, it does an injustice to the electric light and power industry, because, while the combination shows a large increase, the cost of electricity may have actually decreased. This, of course, is of no concern to the agitator or the yellow press, either or both of whom will, when it serves their purpose, quote the official figures as if they pertained to light only.

Fortunately, the Bureau of Labor Statistics is headed by a broad-gaged commissioner, Ethelbert Stewart. Mr. Stewart, when the matter was brought to his attention, recognized how unjust such a grouping was to a regulated industry. Accordingly he set about to right the wrong, and in the digest given to the daily press last week a note was added showing the percentage of increase or decrease in the price of electricity at specified dates compared with the price in December, 1914. The figures, which are based on simple averages of primary rates, show that while fuel and light cost 86.2 per cent more in March, 1923, than in December, 1914, electricity actually cost 2.4 per cent less. In fact, with the exception of the quarter ended December, 1920, which showed the slight increase of 1.2 per cent in the cost of electricity, all other quarterly periods since 1914 show a decrease ranging from 4.8 per cent to 1.2 per cent, the cost of fuel and light during that same period having increased from 24.1 per cent in December, 1917, to 86.2 per cent in March, 1923. The government's figures speak for themselves and the electrical industry takes commendable pride in them.

### Give Us the New Code—Now!

SOME very constructive changes have been made in the National Electrical Code, and a general revision in the phrasing and arrangement of the code is now in process. There is a question, however, as to how and when to put the new rules into effect. The authorized changes offer considerable advantage to the public in the wiring of private houses. Naturally, therefore, owners and contractors desire to apply them at once. Dana Pierce, chairman of the electrical committee of the National Board of Fire Underwriters, wrote a letter to the ELECTRICAL WORLD, which was published on April 14, to answer publicly the "numerous inquiries" he is receiving as to whether these changes were now operative. Mr. Pierce stated that the new code embodying the revision would be printed and made ready as soon as possible, but that he could not say when it would be issued. He gave it as his opinion, however, that it would be best if the 1920 code remained in effect until the 1923 edition is out.

R. S. Hale, in this issue, challenges the policy advocated by Mr. Pierce, asking whether the inspection department must wait upon the convenience of the printer without regard to the interests of the public. Should the inspector, he asks, "forbid certain forms of construction not because they are unsafe but merely because a certain book has not been printed"? It would seem that this point is well taken, and particularly in view of the fact, which Mr. Pierce himself stressed, that, anyway, each inspection department will "decide for itself" when it will begin to operate the new code after it is formally received.

Now, it so happens that the American people are at present engaged in the largest building program in history. About four billion dollars is to be spent, it is estimated, and of this at least 3 per cent, or $120,000,000, will be paid out for electrical construction. The important question is: Are the men and women who

will be investing their money in new buildings to have the benefits which the new changes in the code make possible to them or must it be withheld? The whole purpose of the code is, after all, to guide the owner, architect, contractor and insurance underwriter to safety in electrical construction, but the interests of the owner assuredly come first, by weight of numbers if for no other reason.

The issue should be decided, therefore, purely on the basis of safety. If the new accepted rules are safe, then in common justice they should apply to houses now building as well as to those other houses which will be building later on when the printer of the revised code book has finished his work. Meanwhile the principal revisions have been published in the ELECTRICAL WORLD (March 24) and other papers, so that they are not unknown to the inspectors and other concerns. Some additional means should be found to place the new rules in the hands of all inspectors immediately in temporary form pending the publication of the 1923 code, and they should be encouraged to apply them so that the American people may have the benefit of them now while they are most needed.

## Railroad Electrification Discussed on Higher Plane

RECENT discussions by electrical engineers on the subject of railroad electrification show that this question is at last being considered from the standpoint of those who operate the railroads. The most recent appearance of the subject was at the Pittsburgh A. I. E. E. convention last week, when a short discussion pointed directly to the fact that the transportation advantages and economies other than fuel economies were really the deciding factors.

A. H. Babcock's paper at the meeting was a worth-while contribution to the subject of relative fuel consumption by steam and electric locomotives, adding to the material presented a year or so ago at a joint meeting of the engineering societies. Although Dr. Cary T. Hutchinson questioned some of the conclusions from the results, yet the principal point finally made by W. J. Davis, and agreed to by R. S. Twogood, Mr. Babcock's representative, was that fuel economy would never be the determining factor, except as water power might enter as an element of conservation. The facts which will be considered by the railroad executives are those having to do with improvement of transportation, greater usage of tracks, reduced locomotive maintenance, reduced wages per train-mile and per ton-mile, reduced maintenance-of-way expenditures, etc., and greater dependability of continued safe and reliable service.

Not once was "A. C. versus D. C." mentioned. Engineers know that they can do the necessary engineering, make the necessary engineering decisions on any individual electrification problem. They are realizing that what really counts is the fact that electrification pays. There will doubtless be further discussion by engineers on the technical features of electrification —it would be too bad if there were none. But, whether or not present developments will lead to a common system, as they may, the future discussions of electrification should be, and doubtless will be, on a plane to promote it on its logical basis—improvement of transportation.

## Twelve Hundred Pounds Steam Pressure for Boston

THE expected use of steam pressures approximating 1,200 pounds per square inch in one of the boilers and in one small turbine in the new Weymouth station of the Boston Edison company marks another daring advance in engineering and serves again to focus attention upon the problems of boiler, turbine and fittings design which must be solved in order to reap the reward of this pioneer work in the field of generating-plant development. In the near future more particulars of this equipment will doubtless be available, but the outline printed in the news columns of this issue challenges one's interest because of the ingenious use of high-pressure and medium-pressure turbines, high-pressure and medium-pressure boilers and skillfully arranged superheaters that is proposed.

The thermodynamic analysis of these problems offers a fascinating and intensely practical field of study; the prospective economies of these units and the metallurgical progress which must be in reach to insure guarantees of commercial success in such a radically advanced development arouse the curiosity of the engineer and the utility executive alike, and the pioneering spirit of the Boston company, its consultants and the equipment builders deserve the commendation of the industry. The difficulties of so great a step forward appear very formidable, but the resources of American engineers are many and are seldom found more wanting in crises of equipment development than in emergencies of operation. The whole world of engineering will wish the fullest success to these laudable efforts to set a new standard of generating-plant design before the profession.

## Relativity and the Electrical Engineer

ACCORDING to recent press dispatches, the agreement between Einstein's theory of relativity and the actually observed astronomical facts is so close that no more money will be appropriated for costly expeditions to remote parts of the earth to test this theory. It is also well known that the motion of electrons in a vacuum tube checks well with the values deduced from the theory of relativity, and that this theory gives correct results for the propagation of electromagnetic waves in moving media.

The electrical engineer of a not far distant future will be directly concerned with the motion of electrons in all kinds of vacuum rectifiers, amplifiers, oscillators, etc.; in the ionization fields around extra-high-tension conductors, and in the study of liquid and solid dielectrics. And while it would be rather optimistic to expect many of the present generation of engineers to take up the study of relativity for the purpose of using it in their work, yet the oncoming generation of engineers, or at least its ablest theoretically inclined members, should be acquainted with the possibilities of this wonderful new analytical tool.

The motion of an electron is particularly interesting from the point of view of relativity. According to this theory, the values of the intensities of the electrostatic field and the magnetic field at a point depend entirely upon the velocity of the observer himself with respect to this point. Simple equations are available which connect these intensities as measured by a stationary

observer with those measured by a moving observer. Thus, in the case of a moving electron one needs only to imagine an observer moving with it and recording his measurements. But to such an observer the electron appears stationary; there is no magnetic field, and the electrostatic field is simply radial. Now, by means of the general equations it is possible to recompute these results in terms of a stationary observer and thus obtain the space distribution of the magnetic and electric fields due to a moving electron. The results check with those obtained in the old-fashioned way, and there is a considerable economy of mental effort and of formal mathematics.

Philosophers have taught for long centuries that space and time are but phenomenal concepts of our limited minds, the channels through which we perceive the universe. They have claimed that the Absolute Being needs no time or space because it sees the whole creation directly from minus infinity to plus infinity as one idea and its harmonious realization. Such a being needs no origin of co-ordinates and no zero time. At low velocities these two channels or modes of perception of phenomena—viz., space and time—have been found by humanity to be independent of each other. There is, however, no logical inconsistency in assuming space and time to be interdependent at high velocities, especially seeing that the results based on such an assumption agree with the observed facts.

Not long ago it was shown that the complicated phenomena in electrical machinery and lines can be represented by simple kinematic models. Perhaps some one will invent a combination of sticks and cogwheels which will show to the timid mind at a glance that the amounts of space and time involved in a given phenomenon depend entirely on the velocity of the observer who is describing the phenomenon.

## Where to Stop in Adding Refinements

IN THE desire to obtain low operating expense there is always danger of investing money for refinements that increase the fixed charges more than they reduce the operating expense. Furthermore, there is always the possibility that in adopting too many refinements the tail may some day wag the dog. A truth often expressed and well known by students of economy is that the best installation is the one which has fixed charges equal to the operating expense. Of course, this statement is subject to modification as conditions develop.

The point to be made is that the most economical plant is not necessarily the one which burns the smallest amount of coal per kilowatt-hour or generates a kilowatt-hour at the least operating expense exclusive of fixed charges. Still, this is the comparison often used. The only criterion of economy is how many kilowatt-hours can be got out of a plant, year in year out, per dollar of production expense, including fixed charges. With this in view, the real engineer, before copying other practices, makes it a point to study different plant arrangements, not in the aggregate but in parts, to determine whether changing this or that equipment or arrangement would reduce the sum of the operating expense and fixed charges. More extensive emulation of this practice might shorten the procession now playing "follow the leader."

## New Thoughts on Electric Furnaces

THE electric furnace has "made good" in the production of steel in competition with other methods, but recent investigations indicate that its full possibilities in the production of alloys have not been realized. Apparently there is ground for assuming that the electromagnetic effect of the electric current has a decided bearing on the metallurgical processes which occur during refining. How much the reaction of the field on the atomic constituents of the furnace charge can be utilized is a subject for further investigation. But if there is a possibility of obtaining new or better alloys by subjecting the charge to the influence of a strong field during cooling, a remarkable opportunity exists for further furnace applications.

Experimental evidence indicates that the electric furnace does things which cannot be explained on a thermal basis. For example, forced circulation by using the magnetic field has made the induction furnace a commercial possibility, and in many other applications the mixing of the constituents of the charge is best explained by the field effect on the atomic structures.

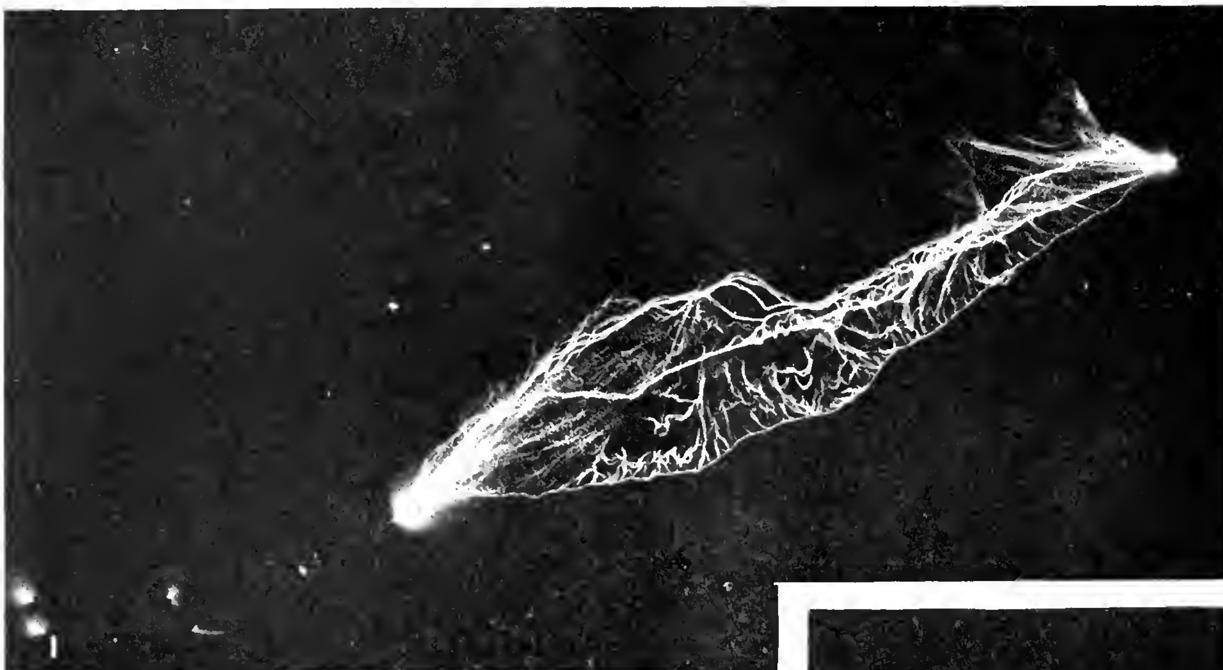
Although the subject is still rather speculative, it is quite fascinating to think that electricity may make possible the production of ferro-alloys without the use of tungsten, vanadium, manganese or other expensive constituents, and the electrical industry awaits with interest new data on the metallurgical effects which can be obtained by further work in the electric furnace.

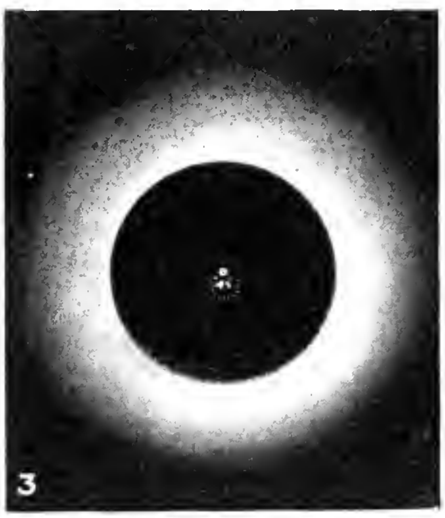
## Illinois Grading Its Utilities According to Service

A SYSTEM of grading the electric utilities of Illinois according to their service accomplishments has been adopted by the Commerce Commission of that state and affords an indication of the way in which public demands for good service are working out. Most of the state commissions have rules of some sort covering service standards, but in large degree these rules are a dead letter until insistent complaint stirs up the commission. The ceaseless inspection necessary to make them an always active force is too great a task. The Illinois grading system is intended to provide just such an active force and to forestall public complaint by removing the causes of criticism. The grading goes so far as to take into consideration the attitude of the public toward the utility and the willingness with which utilities meet complaints and remedy faults, as well as the attitude of the utility in dealing with its customers.

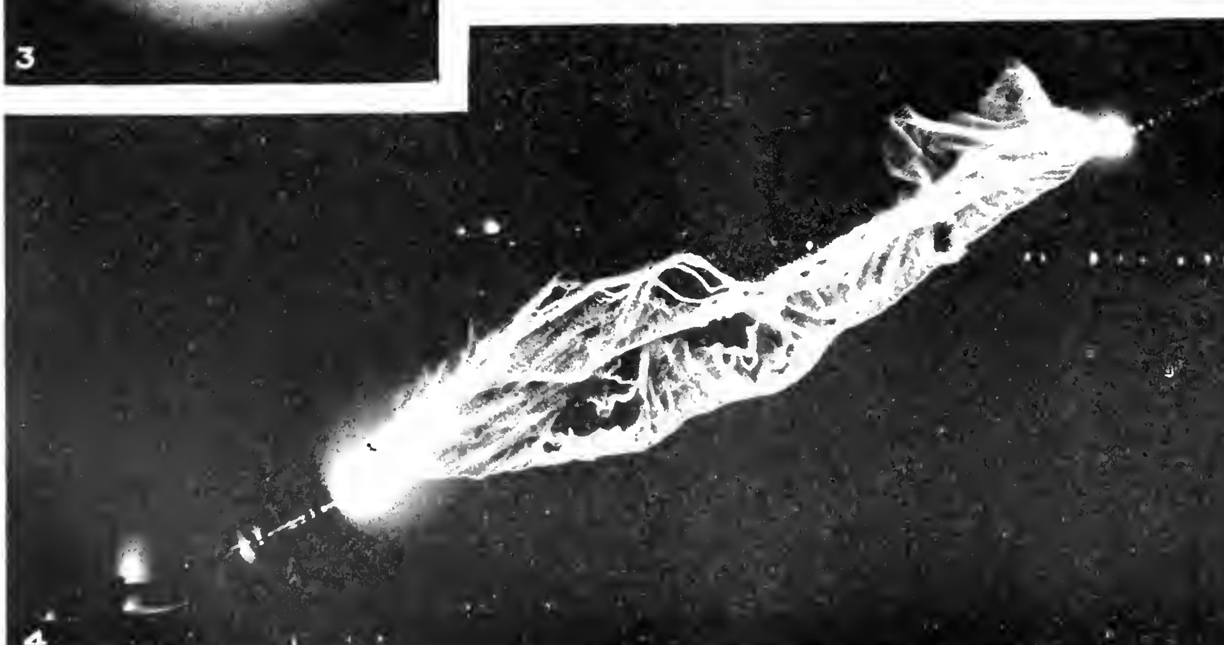
A great many utility men will criticise the system as an unwarranted interference with their affairs, but the impartial reader of the instructions under which the grading is carried on will be inclined to agree that a careful study of its results and appropriate action thereon will put any utility on a better footing with its own public. The instructions indicate a thoughtful and impartial effort to promote good service, and it would not be amiss if every central-station executive in the country were to have such a grading of his plant laid on his desk periodically. It would reveal surprising and disconcerting weaknesses as well as the strong and gratifying points in his organization. The Illinois grading system is not the last word in such matters, but it is worth a great deal of hard study.

# Corona Photography with Quartz Lens





THROUGH the use of quartz lenses it is now possible to study arc and corona formation much more thoroughly than heretofore. Some comparisons are made in the accompanying illustrations. Figs. 1 and 4 show simultaneous photographs of a 14-ft. 1,500,000-volt arc with a glass lens and a quartz lens. The first shows only a lace-like tracery, whereas the latter shows the ultra-violet light as well. Figs. 2 and 3 are fifteen-second exposures with glass and quartz lenses. The latter shows corona extending 27½ in. beyond the 36-in. circle, whereas the glass lens shows only brush discharge. These photographs were taken in the Pittsfield research laboratory of the General Electric Company.



# A.I.E.E. Convention
## *in Pittsburgh*

### Operating Experience Presented in Notable Papers — Grounding Devices, Relays, Furnaces, Insulators, Railroad Electrification and Illumination Discussed from Practical Standpoint

THE unprecedented expansion in the light and power industry was reflected in the atmosphere at the Pittsburgh meeting of the American Institute of Electrical Engineers on April 24-27. A spirit of optimism and expansion was current, and the successful program and skillfully conducted convention accented the feeling of confidence in the future of electric power. Nearly twelve hundred engineers assembled from widely separated properties and discussed the technical features of equipment and the practical features of operation associated with transmission, distribution and utilization of electric power.

The papers and the discussions clearly indicated the ability of the engineers in the light and power industry to meet the present and future engineering problems connected with a greater use of power on a national scale. Many heretofore controversial questions were recorded as answered, and the thoughts of the engineers were directed toward new problems and toward new equipment.

## *Operation of Grounded Systems*

The trend of present practice, as reported by the sub-committee on grounding of protective devices (E. C. Stone, chairman), is definitely toward the grounding of neutrals on large transmission systems. This conclusion was drawn from an analysis of thirty-six systems having an aggregate generating capacity of 6,371,850 kva. and a transmission mileage of 31,408. Increasing mileage and voltage have been the factors necessitating the practice described. On systems transmitting at generated voltage the neutral usually is grounded at each generating station with resistance of low value. On systems transmitting at higher than generated voltage the neutrals of the transformers are dead-grounded at each generating station and some or all substations. Where resistances are used they are generally made up of cast-iron grids with time ratings at maximum current of thirty seconds to sixty seconds.

On systems transmitting at generated voltage the relation between the voltage and value of neutral resistance is fairly consistent and is usually identical with the maximum ground fault current which could exist, assuming that the resistance and reactance of the return circuit from fault to ground connection was zero and that the voltage at the fault was held at normal. When ground relays are used the neutral resistance is generally higher than when using phase relays.

In the last few years there has been a fairly marked trend toward the use of higher resistance in grounded neutrals, especially in the higher-voltage systems. This has led to the development of a number of relay schemes in which selective operation of breakers is obtained with ground currents less than the full-load current of the line. Six companies are using schemes of this nature on parts of their system.

The most recent development in methods of ground-

ing of neutrals is the use of reactance instead of resistance. If for any given system the reactance is properly proportioned it will exactly neutralize the capacitance of the transmission system to ground, so that in case of a grounded phase no current will flow through the fault.

The use of arc suppressors has been very generally abandoned. That is not because such apparatus was without merit, since some fairly good results were obtained with its use, but rather because of the development of breakers of high interrupting capacity and selective relays, which are found to be a better solution of the problem.

In studying the effects of heavy ground currents on the operation of synchronous machinery a series of tests was made by one of the manufacturers under conditions approximating those of a certain transmission system. The results of this test indicate that the average voltage at the motor could not drop more than 30 per cent without interference with operation.

Grounding the neutral has proved successful to a very high degree in limiting trouble from excessive voltage on transmission systems. Case after case is on record where frequent and destructive insulation breakdowns on systems operating underground have been virtually eliminated after the neutral has been grounded.

General considerations in grounding the neutral of transmission systems were the subject of a paper by H. H. Dewey. The author pointed to the fact that in grounding overhead systems the tendency is toward the use of low resistance values, while in underground cable systems the trend is toward the use of resistance in the ground connection. The general conditions on the two systems are very similar, and the author thought there were no very good reasons for the differences in grounding practice.

Different types of resistance for the grounded neutral were considered, and the general conclusion was that on any large transmission system high-voltage strains are more to be feared than high-current strains.

SUMMARY OF GROUNDING PRACTICE

| | Systems at Generated Voltage | Systems at Higher Than Generated Voltage | All Systems |
|---|---|---|---|
| Number of companies | 20 | 32 | 36* |
| Number of systems: | | | |
| Ungrounded | 11 | 31 | 42 |
| Dead-grounded | 3 | 39 | 42 |
| Resistance-ground | 17 | 9 | 26 |
| Reactance ground | 0 | 1 | 1 |
| Total | 31 | 80 | 111 |
| Total mileage: | | | |
| Ungrounded | 1,008 | 5,377 | 6,385 |
| Dead-grounded | 3,797 | 14,678 | 18,475 |
| Resistanceground | 3,822 | 2,626 | 6,448 |
| Reactance ground | 0 | 100 | 100 |
| Total | 8,627 | 22,781 | 31,408 |
| Average mileage: | | | |
| Ungrounded | 92 | 176 | 152 |
| Dead-grounded | 1,270 | 377 | 441 |
| Resistance ground | 225 | 292 | 248 |
| Reactance ground | ... | 100 | 100 |
| Resistance factor $K$: | | | |
| Minimum | 0.008 | 0.022 | 0.008 |
| Average | 1.04 | 0.52 | 0.80 |
| Maximum | 3.55 | 2.00 | 3.55 |
| Maximum ground current: | | | |
| Minimum | 425 | 102 | 102 |
| Average | 2,300 | 2,000 | 2,080 |
| Maximum | 4,620 | 5,950 | 5,950 |
| Miles per ground: | | | |
| Dead ground | 24 | 32 | ........ |
| Resistance ground | 110 | 146 | ........ |
| Reactance ground | ........ | 100 | ........ |
| Total generating capacity | 2,387,500 | 3,984,350 | 6,371,850 |

* Some companies operate both types of system.

A descriptive performance of the Petersen coils installed on the system of the Alabama Power Company was embodied in a paper on "The Neutral Grounding Reactor" by W. W. Lewis. This paper discussed the theoretical features surrounding the use of a reactor on ungrounded systems and gave the results of tests made on the installations in Alabama at the time the reactor was installed. The reactor used has no core, is oil-immersed, water-cooled and designed to operate continuously at 795 kva. with 55 deg. C. rise. The total loss in the reactor at full voltage and maximum current is about 21 kw.

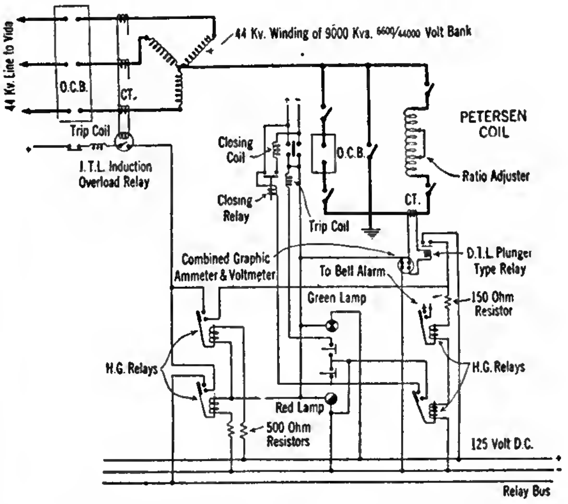
The resonance point of the circuit was determined in two ways—first, under normal conditions with no conductors grounded; second, when one conductor is grounded. Several series of arcing tests were made totaling about fifty arc-overs, and in this series of tests the arc was extinguished in from 5½ cycles to 14 cycles. Detailed data and oscillograms were made of the conditions under test which showed that the reactor functioned very well for the system upon which it was installed. Calculations showed that the current to ground when one conductor of a three-phase system is grounded is about one and a half times the normal three-phase charging current. Tests on the system showed that if the system had a ground wire the ground current was increased about 20 per cent. The arc-over test showed that the reactor would function to extinguish the arc with considerable tolerance in the setting. From the standpoint of voltage stresses the system with the reactor is more like an isolated neutral system than a grounded neutral system, except that the excessive voltage rises due to arcing grounds which occur on an isolated neutral system are eliminated. There is a possibility of overvoltage when the arc breaks, due to a difference between the resonant and supply frequencies, provided that the reactor serving is not in exact resonance. In the opinion of the author of the paper, the device will be limited to comparatively low-voltage lines of moderate length; that is, perhaps, up to 66,000 volts, or in a few cases up to 100,000 volts if the length of line is short. The reason given was that the current to the reactor is affected by the line reactance. Thus on long lines and high voltages it is probable that the residual current would maintain the arc. The author thought that the device appeared most applicable to those systems which are now operating isolated neutral and which for some reason connected with the operation or apparatus do not wish to go to a solidly grounded neutral.

### PETERSEN COIL REDUCES INTERRUPTIONS DUE TO INSULATOR FLASHOVERS

According to a log of Petersen coil operation kept by the Alabama Power Company since Nov. 16, 1921, the Petersen coil has considerably reduced the number of interruptions due to insulator flashovers during lightning storms. This assertion was made by J. M. Oliver and W. W. Eberhardt in their paper on the subject. For example, during 1921, before the Petersen coil was installed, there were forty-three interruptions due to lightning, which caused the line to be out of service a total of 230 minutes. In 1922, when the Petersen coil was in service, there were only seven cases of interruptions due to lightning, or a reduction of 83.5 per cent, with the line out of service only fourteen minutes, or a reduction of 94 per cent.

However, the use of the Petersen coil is attended by

the disadvantage that the taps have to be changed for virtually every switching operation, so that the inductive reactance of the coil will always be in resonance with the capacity reactance of the line to ground. Furthermore, several bus insulator flashovers occurred




PETERSEN COIL CONNECTIONS (OLIVER AND EBERHARDT)

A definite-time-limit overcurrent relay is connected in the secondary of a current transformer the primary of which is in series with the Petersen coil and ground. This relay is given a time setting of approximately two seconds. Normally the flashovers are cleared by the Petersen coil in five to fifteen cycles; consequently, when an abnormal current persists for several seconds, it is evident that the reactor is not functioning. At the end of two seconds the relay will close, thereby energizing two auxiliary relays, one of which causes the grounding switch to close and the other to ring an alarm bell. The grounding switch on closing short-circuits the reactor and the regular overcurrent relay scheme comes into action to clear the trouble.

when line switching was performed while the Petersen coil was in service. Whether the coil was in any way responsible for the flashovers is not known, but as a precaution against similar trouble in the future, the line relay has been electrically interlocked with the control circuit of the grounding switch to insure that the latter shall be closed before the line switch can open on relay action. However, this has the disadvantage of slowing up the relay operation when clearing a short circuit.

During the period covered by the log there were 168 operations of the Petersen coil, of which only two could be strictly classed as faulty. In these two cases the flashover held on long enough to close the grounding switch and cause the overcurrent relays to open the line. The line went back into service properly in each case, indicating that the trouble was not a solid ground but a flashover which the Petersen coil evidently failed to clear. There was a total of twenty-nine cases of solid grounds and phase-to-phase short circuits due to line, transformer and bus trouble, which are outside of the operating sphere of the Petersen coil. However, all these were successfully cleared by the line relays. In three of these cases, however, after the line switch opened, a string of the five suspension insulators on the 44-kv. bus between the transformer and the line switch flashed over, indicating the presence of an unusually high voltage. Since the insulators tested satisfactorily, it seems that some high-voltage transient was introduced by the disconnection of the line capacitance. It is proposed to make further tests to verify this point.

In seven operations the grounding switch closed but no line switch opened and no disturbance occurred on the system. This action indicated a solid ground on the system, which evidently held on long enough (two seconds) to cause the definite-time-limit overcurrent relay to operate, but cleared before the contacts of the grounding switch closed.

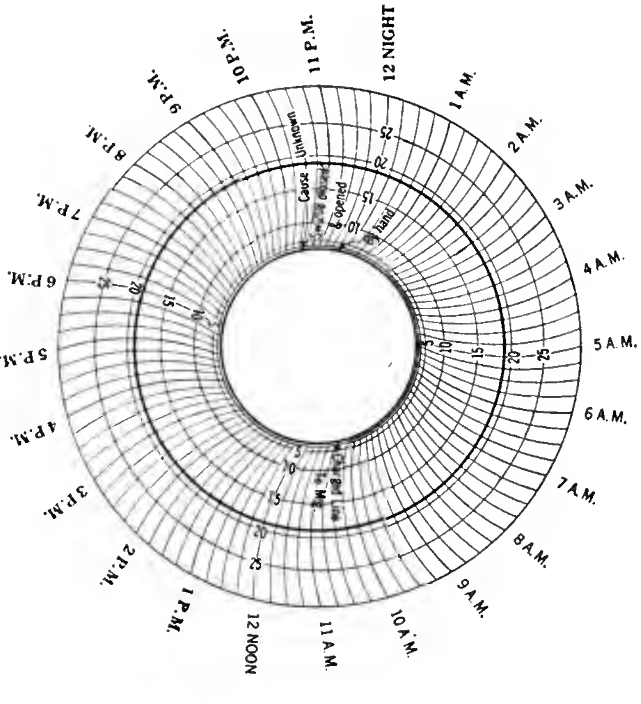
Twenty cases of reactor-current indications coincident with switching operations on the lines were observed when the neutral current must have been zero. These indications may have been due to the failure of all three poles of the oil-circuit breaker to open or close simultaneously, thereby causing a shift in the neutral.

While the experience of the Alabama Power Company indicates that the Petersen coil may prevent arcing grounds on grounded-phase operations, it is hardly safe to take the risk, as the imposition of full-line voltage to ground on the ungrounded phase for a considerable length of time will aggravate the trouble. With grounded-phase operation eliminated, the Petersen coil need have only a two-minute rating as compared with a continuous rating and would be less costly.

Other points which the experiences recited brought out were that all insulator pins should be grounded in order to insure the best positive action of the coil; that all switching, both hand and automatic, should be done with the Petersen coil out of service—viz., with the neutral solidly grounded—and that grounded phase operation is not advisable.

Considerable discussion arose at the Tuesday afternoon session regarding the relative merits of low and high resistance grounds, some advocating low resistance to secure enough current to operate selective relays and others favoring higher resistance to minimize disturbances. It appeared to be the consensus of opinion that the Petersen coil is limited to short branch lines.

Different problems are involved in grounding cables and overhead lines. R. W. Atkinson pointed out that it is feasible to insulate overhead lines for overvoltage,




GRAPHIC RECORD OF COIL OPERATIONS (OLIVER AND EBERHARDT)

but hardly so with cables. Furthermore, cable has greater electrostatic capacity than open wires. As indicating the success of the solidly grounded neutral, Mr. Atkinson referred to a 33,000-volt cable installation in Los Angeles which has operated two years.

F. C. Hanker pointed out that the Montana Power

Company reversed several years ago its opinion that the size of a grounded neutral system is limited. From the evidence presented it is very apparent, said Mr. Hanker, that the use of the Petersen coil is very limited.

The great diversity of opinion on grounding was dwelt upon by J. B. Taylor. In some cases large currents are allowed to avoid voltage surges, and sometimes vice versa. Besides, there are differences of opinion on the value of resistance to use. There is no virtue, he contended, in clearing a fault by allowing a great rush of current just because the equipment will withstand it. Such practice may in time weaken parts of the system. The most important factor in grounding is the calculation of the resistance; this should depend on the switch settings.

L. P. Ferris called attention to factors which should have serious consideration in grounding. For example, triple harmonics occur in grounded neutral systems which may disturb adjacent telephone lines. The possible bad effect of multiple grounds was also emphasized. Y-Y connections are very undesirable, but fortunately their number is limited. Mr. Ferris said that it is very gratifying to notice that the Petersen coil reduces interruptions, since otherwise the short-circuit currents developing from faults would produce acoustic shocks. Such shocks could be reduced still more if a resistance were connected in series with the breaker which is used to short-circuit the Petersen coil when it fails to function. The current experienced when the Petersen coil is set for resonance, he explained, is apparently due to the unbalanced voltage resulting from unbalanced arrangement of lines to ground. This condition can be corrected by balancing from neutral to lines.

H. W. Smith recommended rating ground resistors at 600 deg. since at this temperature they would have the safety factor which comes from change of resistance with temperature. As systems operating at generator voltage increase in size they must come to grounded neutrals, he contended, and hence should be laid out with this in view.

In explanation of the apparent voltage surges which occur when switching operations are carried on with the Petersen coil in circuit, H. M. Trueblood said: "If there is more reactance than necessary for resonance when three phases are connected, and if by chance one phase of a breaker fails to open simultaneously with the other phases, then voltage surges will occur. Hence care should be taken not to have more reactance connected in the Petersen coil than necessary."

The problem when using the Petersen coil, declared H. H. Dewey, is to secure the proper balance of inductance and capacitance, particularly on long high-voltage lines. Hence the Petersen coil is chiefly adapted to short branch-circuit lines.

R. D. Evans contended that the application of the Petersen coil is reaching its limit on the Alabama system, according to the data obtained. He warned against changing from a free neutral system to Petersen-coil protection without providing for the conditions imposed by grounded neutral operation.

There is more necessity of grounding frequently on high-voltage lines than on others, maintained C. L. Fortescue. Grounding reduces the cost of transformers, he explained.

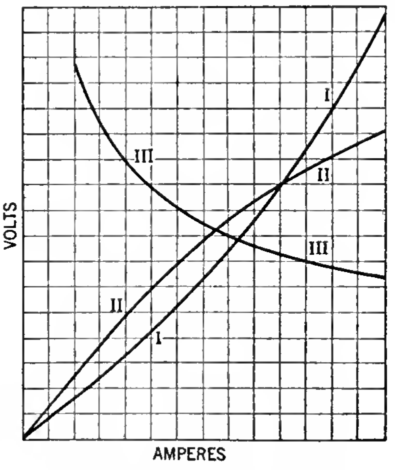
No one system of grounding is suitable for all conditions, J. Allen Johnson pointed out. Power lines with greatest exposures must use higher ground resistance to minimize interference. With induction-type selective relays, he explained, one cannot rely on their current settings as much as on their time characteristic when grounds occur. Just because a system can withstand short circuits is no reason for subjecting it to them in order to clear grounds. For protection against such faults he advocated ground relays.

L. F. Blum advocated transposing transmission lines, reducing power losses in Petersen coils and detuning to get the best protection from this system.

In closing, Mr. Dewey cited several examples where multiple grounds have not produced serious disturbances.

# *Technical Features of Surges and Arcing Grounds*

Dr. Charles P. Steinmetz, in a paper entitled "Frequency Conversion by Third-Class Conductors and Mechanism of the Arcing Ground and Other Cumulative Surges," discussed the building up of high-voltage oscillations in power circuits which differ from the typical transients of energy readjustments in that they do not gradually die out but increase in intensity until either destruction occurs or they finally limit themselves. These surges, of which the arcing ground is typical, derive their energy from the machine power of the system and so constitute a frequency transformation of which the mechanism has been little understood. Dr. Steinmetz derived the equations of the circuits of this character on the basis of a physical conception which considers a negative resistance in combination with the source of power which supplies the energy given out by the negative resistance. The so-called "third-class conductors" are those in which the voltage decreases with the increase of current, and the author showed that these conductors can be considered as a combination of the negative resistance with a source of power and as such are capable of transforming the low circuit frequency into a high oscillation frequency of alternating current. Their presence in an electric system may in this way produce cumulative oscillations.



CHARACTERISTICS OF CONDUCTORS

I—Metallic conductors. II—Electrolytic conductors. III—Arcs as conductors. (Steinmetz.)

The general equations in the paper were based on a system comprising a third-class conductor shunted by an inductive circuit containing capacity and supplied with voltage over an inductive circuit from an alternating low-frequency source, and the author showed that in such a system current and voltages of two distinct frequencies may continuously exist, of which one is the fundamental circuit frequency and the other a high oscillation frequency. The voltage at the high oscil-

lation frequency is limited only by the resistance of the oscillating circuit and may build up to very high values, particularly in the transformer. Thus the cumulative surge of the arcing ground in a transmission line does not reach such excessive values as that in the high-voltage coil of the power transformer, but may be of moderate intensity of the magnitude of the normal line voltage.

### EXPERIMENTAL OBSERVATIONS DETERMINE THEORY OF ARCING GROUNDS

Pointing out that the primary reason for operating transmission systems with a grounded neutral is to alleviate the destructive effects produced by arcing grounds, J. F. Peters and J. Slepian presented a paper on the arcing ground and the theory underlying its operation. The paper is based on laboratory experiments which duplicate arcing grounds. These elaborate experiments substantiate the theory which, when applied to a three-phase system, calls for displacement of neutral relative to ground and the development as a result of transient oscillations of maximum voltage three and one-half times normal voltage to neutral on the sound phases and two times normal voltage to neutral in the grounded phase. In a grounded neutral system with low impedance between neutral and ground the charge will be drained off before the next arc strikes and the maximum voltage which will be developed will be two and one-half times normal and one times normal at the same points stated previously. Thus the maximum voltages developed by arcing grounds on isolated neutral and grounded neutral systems respectively are in the ratio of three and one-half to two and one-half. This does not consider, however, the effect of sudden changes of voltage distribution in the interior of apparatus connected to a system in which the effect is much greater in the isolated neutral system. Thus the surges set up by the arcing grounds must be considered as a source of danger to the connected equipment.

Dr. J. Slepian, in the discussion of arcing grounds, took exception to the mathematical treatment of the arc and its negative resistance properties in Dr. Steinmetz's paper, saying that there was a lack of definite mathematical statement of the nature of the arc which made it necessary to go through the mathematical treatment and pick out the assumption. He said that the assumption for low-frequency arcs seems to be on the basis of straight-line characteristics, while for the high-frequency arcs a time lag assumption is brought in that gives the characteristic curve as an ellipse. With these deductions from the paper, Dr. Slepian questioned the reasonableness of the figures in the practical examples assumed by Dr. Steinmetz, saying that the negative resistance figures were too high. In place of the assumed value of 120 ohms he gave 20 ohms as a more reasonable assumption for the value of negative resistance. He claimed that the value used gave results that are impossible in any arc encountered in practical experience.

E. E. F. Creighton, using the analogy of a violin string, pointed out that many arcs over insulators or from conductors to ground might occur without serious consequences, but that an arc from a point on a line where the frequency of the disturbance corresponds with the natural frequency of the line or some piece of apparatus might cause a large amount of damage. He went on to illustrate by citing an example of a furnace installation that had operated successfully and had been enlarged by the addition of three transformers to the original three. It was then found impossible to keep all six transformers in sèrvice, owing, as was later discovered, to resonance between the frequency in the arc and the natural frequency of the transformer coils which resulted in small arcs forming between turns and ultimate serious breakdowns. Mr. Creighton also gave as the reason why the arcing ground suppressor had not proved successful, and why the Petersen coil would not, the close adjustment required of the apparatus to system conditions to enable either of them to function successfully. So close is this adjustment that it is impracticable to keep such devices adjusted to momentary changes in system conditions.

W. A. Hildebrand asserted that the voltage factor is not fundamental and that the high-frequency factor, which has no relation to 60-cycle characteristics, has been largely overlooked in the studies of arcing grounds.

C. L. Fortescue said that Dr. Steinmetz's ideas should be carried out to give more plausible values and that the papers presented show the need of more study, not under laboratory conditions but on a large scale.

H. R. Woodrow, in discussing the paper of Messrs. Peters and Slepian, said that maximum potentials were given but that system absorption had been neglected. Normally, he said, smaller values, particularly on underground cables, would be experienced.

That the figures of experts could not be checked by the experience of a Georgia company was asserted by E. P. Peck, and that one line 65 miles long operating at 60 kv. had developed surge voltages over 180 kv. was certain. The trouble had been cured by grounding the neutral through good grounds. Lately the same class of troubles have been cured on a Utica (N. Y.) property by solidly grounding the generator neutral.

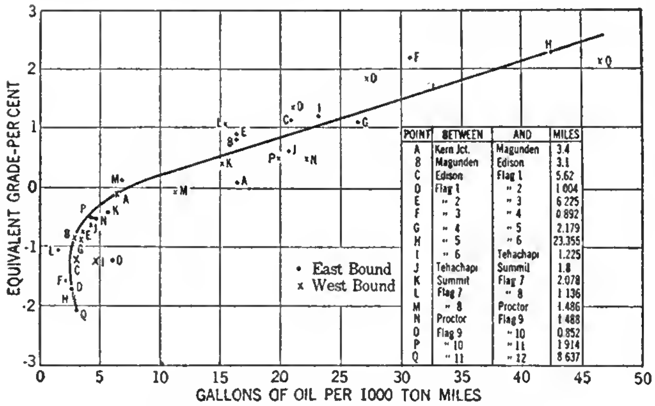
## *Furnace Operation and Electrification*

Test data on a representative mountain railway on the West Coast showing the fuel consumption of an average mountain-type locomotive burning oil were presented by A. H. Babcock in his paper on "Some Fuel Determinations on the Southern Pacific System." The paper contained a complete record of fuel consumption, beginning with firing up at the engine house and the standby consumption while the engine is waiting outside the house for the train, and including consumption while testing brakes, during acceleration, running up and down the various grades, holding the trains on sidings and finally running down hill over stretches of steep grade.

The over-all efficiency determined by the test was 5.57 per cent. It is the ratio of the integrated foot-pounds of work done by the engine whenever the draw-bar pull was positive to the total energy in the fuel used over the same time. From the test it is apparently constant for all grades greater than 0.5 per cent. The average operating efficiency rated on eastbound and westbound travel was 92.5 per cent, with an average thermal efficiency of less than 6 per cent. The ratio of the revenue freight weight to total train weight was 0.743, and in making comparisons this factor must be considered. The resultant data apply, in the opinion of the author, to the specific conditions, and should not be applied indiscriminately to all conditions of operation.

Dr. Cary T. Hutchinson, in an analytical discussion,

pointed out that Mr. Babcock's analysis was not general in scope but limited to the determination of the oil used on the particular section of the Southern Pacific under the conditions of service ruling there. Furthermore, no drawbar-pull measurements were made, so that figures for efficiency were based on calculations of work done from the profile of the section under the specific assumptions of the author.




FUEL CONSUMED PER 1,000 TON-MILES ON VARIOUS GRADES (BABCOCK)

Mr. Hutchinson then assumed to replace the steam locomotive with a four-axle, 110-ton electric locomotive for a 750-ton trailing weight and assumed an efficiency from power house to locomotive drivers of 63 per cent and then calculated the comparison between steam and electric operation, arriving at results given in Table I.

TABLE I—WORK DONE AT DRIVERS, STEAM DRIVE

| | Eastbound | | Westbound | |
|---|---|---|---|---|
| 1. Weight of train, tons | ...... | 1,000 | ... | 1,000 |
| 2. Work at drivers, kw.-hr.: | | | | |
| (a) Grade | 2,760 | | 985 | |
| (b) Curve | 250 | | 25 | |
| (c) Track | 690 | 3,700 | 240 | 1,250 |
| 3. Available for regeneration, (a) — (b+c) | | 1,820 | | 720 |
| 4. Delivered to contact system, 75 per cent | | 1,365 | | 540 |
| 5. Deliverable at driver, 80 per cent | | 1,090 | | 430 |
| 6. At driver as per cent of total work | | 29.4 | | 34.4 |
| 7. Same, for round trip, same tonnage both ways | | 30.6 | | |

He then assumed that 30 per cent of the total requirement is furnished by gravity and 70 per cent by power station, and concluded that the relative energy requirements for a round trip are as shown in Table II.

TABLE II—RELATIVE HEAT REQUIREMENTS, STEAM AND ELECTRIC, FOR SAME SERVICE

| | Steam | Electric |
|---|---|---|
| 1. Weight of train, tons | 1,000 | 860 |
| 2. Energy at driver, total kw.-hr | 4,950 | 4,250 |
| 3. Energy at driver, from oil, kw.-hr | 4,950 | 2,970 |
| 4. Energy at driver, from oil, per cent | 100 | 60 |
| 5. Heat required at drawbar per kw.-hr., B.t.u | 109,000 | 45,500 |
| 6. Total heat required, ($10^6$xB.t.u.) | 540 | 135 |
| 7. Total heat required, per cent | 100 | 25 |

Mr. Hutchinson then concluded as follows:

"This means that, in comparison with the author's test result, electric drive would reduce the fuel required by 75 per cent—a ratio of steam to electric of four. If allowance be made for the difference between tests and service conditions, this ratio will be even greater. These results are in practical agreement with the estimates of the superpower report."

N. W. Storer said that 7 lb. per ton was too high a train resistance for a whole run, so the work calculated was more than would be the case. He also questioned the accuracy of determination of locomotive resistance.

W. J. Davis pointed out that the results were better than could be expected from a coal-fired locomotive, stating that the cinder loss varied from 10 to 18 per cent in coal-fired locomotives with the rate of coal burning varying from 100 lb. per square foot per hour to 125 lb. per square foot per hour.

Mr. Davis' principal point was that, even though there were fuel savings, the fixed charges of electrification might easily offset them, but that the chief reason for electrification still existed in the advantages in conducting transportation. He cited increased capacity of tracks, reduction of overtime, very great savings in locomotive repairs per locomotive and reduction of number of locomotives—because the average steam locomotive was available for service only 25 per cent of the time, whereas the average electric locomotive was available 95 per cent. Mr. Davis concluded that because of greater serviceability and because electric locomotives could be made larger, one electric might actually replace four to five steam locomotives. Thus, said Mr. Davis, even with the fuel saving counterbalanced by fixed charges, by the saving in maintenance of locomotives, in maintenance of ways and structures and in wages total transportation economies of 25 to 50 per cent might be realized.

Mr. Twogood, in replying for Mr. Babcock, said that they had tried all sorts of mathematical analyses and could come to no other conclusion than the one given. He admitted that fuel was not the determining factor. He pointed out that operating officials were interested in the weight of the locomotive as well as of the train because eventually it was net revenue freight which paid the bill.

Through a large number of observations the author of the paper on "Some Problems in Electric Furnace Operation"—F. V. Andreae, chief engineer Southern Manganese Corporation—was led to believe that the transformation of electrical energy into heat energy in the furnace takes place in an arc passing through an atmosphere of vapors under pressure. The properties of the arc vary with the different materials. The current will increase when the arc is shortened under constant voltage and for constant currents, and the voltage

THEORETICAL ELECTRICAL CONDITIONS IN ELECTRODE LEADS OF VARIOUS TYPES FOR 4,000 KV-A. ELECTRIC FURNACE

| Electrical Propedies | | | | | | | | | Remarks Relative to Property |
|---|---|---|---|---|---|---|---|---|---|
| Size | 24-4 × ¼ per Phase Straps in Contact | 24-4 × ¼ per Phase Straps Spaced ¼" | 72 8 × ¼ Total Interlaced ¼" | 2 5" Tubes per Phase | 3-4½ Tubes per Phase | 3-4½" Tube, per Phase | 4 3" Tubes Interlaced | 4-3" Tubes Interlaced | |
| Remarks Ret Type | Middle Phase | Middle Phase | Phases Balanced | Middle Phase | Middle Phase | Phases Balanced | Phases Balanced | Phases Balanced | When unbalanced |
| D C Resistance | 0.000,027 1 Ω | 0.000,027 | 0.000,027 1 | 0.000,026 6 | 0.000,024 3 | 0.000,024 3 | 0.000,026.9 | 0.000,026.9 Ω | Phase 1 R.000,549 Ω |
| $\frac{R_{ac}}{R_{dc}}$ | 2.18 | 2.01 | 2.01 | 1.13 | 1.09 | 1.09 | 1.02 | 1.02 | Phase 2 R Ω |
| A.C Resistance | 0.000,059 Ω | 0.000,054,2 | 0.000,054,2 | 0.000,030,1 | 0.000,026 5 | 0.000,026.5 | 0.000,027.5 | 0.000,027 5 Ω | Phase 3 R.000,549 Ω |
| Inductance | 0.000,013,8 H | 0.000,013,4 | 0.000,001,3 | 0.000,013,4 | 0.000,012,3 | 0.000,012,3 | | | Phase 1 $X_L$.000,318 Ω |
| Ind. Reactance | 0.005,20 Ω | 0.005,060 | 0.000,490 | 0.005,060 | 0.004,65 | 0.004,65 | | | Phase 2 $X_L$ Ω |
| | | | | | | | | | Phase 3 $X_L$.000,318 Ω |
| IR Drop | 0.59 V. | 0.54 | 0.54 | 0.30 | 0.27 | 0.27 | 0.275 | 0.275 V. | |
| $IX_L$-Drop | 52.0 V. | 51.0 | 4.9 | 51.0 | 47.0 | 47.0 | 26.4 | 24.7 V. | |
| % IR-Drop | 0.465 % | 0.426 | 0.426 | 0.237 | 0.208 | 0.208 | 0.217 | 0.217 % | |
| % $IX_L$ Drop | 41.0 % | 39.8 | 3.85 | 39.8 | 36.5 | 36.5 | 20.8 | 19.5 % | at Unity Power Factor |
| % Volts Loss | 8.5 % | 8.0 % | 0.6 % | 7.8 % | 6.5 % | 6.5 % | 2.3 % | 2.0 % | Total Volts Lost |
| Watts Line Loss | 3 x 5900 W. | 3 x 5400 | 3 x 5400 | 3 x 3000 | 3 x 2700 | 3 x 2700 | 3 x 2750 | 3 x 2750 W. | on basis of $\frac{220}{\sqrt{3}}$ V. to |
| % Watts Loss | 0.44 % | 0.41 % | 0.41 % | 0.23 % | 0.20 % | 0.20 % | 0.206 % | 0.206 % | neutral |

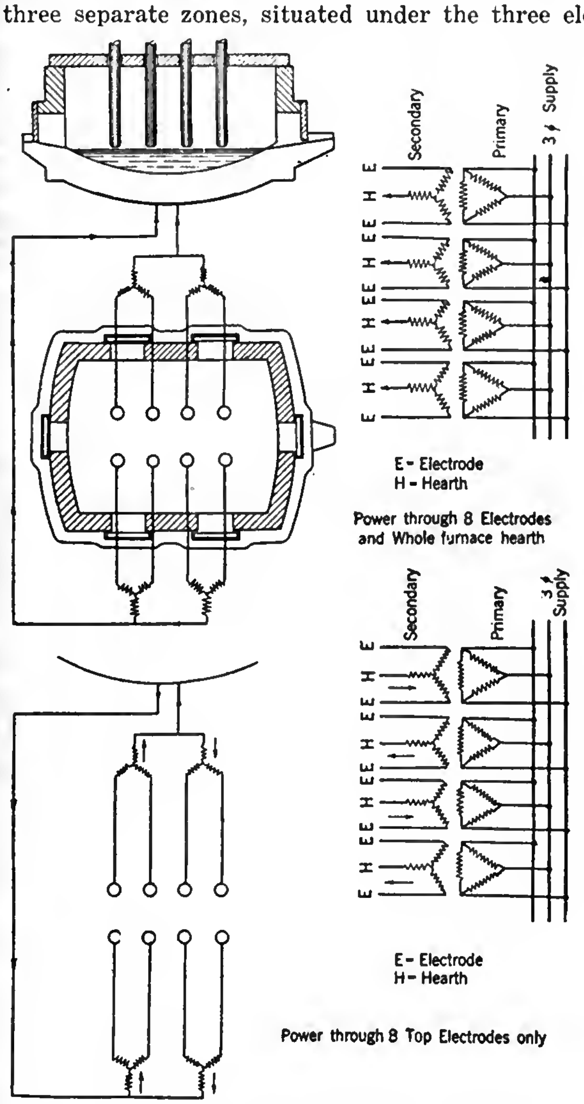
DATA

No. Electrodes-3-Y-Connected, bath is neutral
Transformer-1-3 Phase, V Connected
Primary Voltage-22,000
Secondary Voltage-220
Amperes per Phase 10,000
Kv-a. Rating 4,000
Current Density in Electrode Leads-800 Amp. per □"
Frequency = 60 ~ Values calculated for Conductors 20 Ft. Long Each

ANALYSIS OF ELECTRODE LEAD PERFORMANCE (SAKLATWALLA AND ANDERSON)

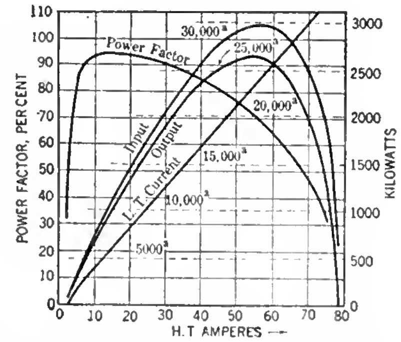
across the arc will increase with increasing length. Based on the theory that the reactance of a three-phase electric furnace does not depend on the load, but does depend on the arrangement of the conductors, the author derived a general equation for the furnace. He showed that, owing to the fact that the main conductors carrying the current from the interlaced busbars to the furnace are more or less in one plane, a transformer action is introduced between phase 1 and phase 3, taking power away from phase 1 and transporting it to phase 3, the phase rotation being 1 to 3. This power may be considerable. Moreover, when voltages between phases and currents are balanced the power delivered by the three electrodes is quite unbalanced, a fact that is very apparent in large furnaces, electrode 1 seeming dead while electrode 3 takes most of the power.

The load in the furnace is considered as connected in star, the bottom of the furnace being the neutral. The electrical energy is transformed into heat energy in three separate zones, situated under the three electrodes, and the load resistance is probably furnished by an arc in an atmosphere of the vapors under pressure. The author took up specific examples of the application of the general equation and showed how the unbalance can be taken care of in several ways. He reached the conclusion that the general performance of the three-phase furnace can be determined in advance with a large degree of accuracy by using the simple equations of the balanced three-phase system, where the only thing that is necessary is the previously determined reactance per phase, which is an important characteristic of the furnace.




60-TON TO 80-TON FURNACE DESIGNED FOR FORD MOTOR COMPANY (HODSON)

Electrical factors to be considered in the design of leads for ferro-alloy electric furnaces in order to achieve the highest input efficiency were discussed in the paper by B. D. Saklatwalla and A. N. Anderson. They also described a new system of electrode control which consists of Kelvin balance actuating relays which in turn control the operation and direction of rotation of the motors operating the electrodes. Information was also given on a new electrode holder to curtail the time of making changes.




PERFORMANCE CHARACTERISTICS FROM CIRCLE DIAGRAM (ANDREAE)

The authors reached the following conclusions:

1. The larger the cross-section of the conductor the larger the skin effect. This effect is appreciable at frequencies of 60 cycles for conductors greater than ½-in. diameter.

2. Skin effect is higher in straps than in tubes of equisectional area with subsequent higher power loss.

3. Distribution of the current over the sectional area is not affected by the inductive disposition of the conductor, since the internal inductance is unaffected by the mutual inductances.

4. Inductive reactance may cause considerable voltage drop in the electrode leads.

5. The larger the diameter of the conductors the less the inductance.

6. The farther apart the conductors the larger the inductance.

7. When inductive reactance expressed as per cent reactance drop amounts to 20 per cent or more, the actual volts drop in the line increases rapidly with decreased power factor.

The nearest approach to the tubular form of conductor for flexible leads is the familiar asbestos-cored extra-flexible cable developed expressly for furnace operation.

The development of the large electric melting furnace, the limitations of large electrode furnaces and the design and construction of the largest electric melting furnace ever built were subjects covered in a paper by Frank Hodson. He also discussed the advantages of correct heat application, the influence of the new Soderberg continuous electrode on furnace design and the possibility of using large electric furnaces as an intermediate process for the manufacture of cheap steel.

The Greaves-Etchells furnace as finally developed may be described as an arc-resistance furnace which on normal operation introduces two phases of the three-phase power supply through two or more top electrodes and the third phase through the whole of the furnace

hearth. On all recently installed furnaces of this type with four or more electrodes the system and design permit of the whole of the power being derived through the top electrodes or by change of position of an oil switch through the top electrodes and the furnace hearth, a balanced load being obtained with either method. This arrangement gives the furnace considerable flexibility of operation, as the top electrodes and high voltage can be used when melting down or when starting up the cold furnace, and the top and bottom contacts when a molten bath is obtained or for refining and superheating.

The new Soderberg electrode consists of a thin metallic casing the size of the electrode to be used, into which the electrode paste or mix is dropped. The actual baking of the electrode is done in the furnace.

A diagrammatic plan and elevation of the 60-ton to 80-ton furnace designed for the Ford Motor Company, Detroit, is shown in the accompanying illustration. It will be equipped with eight electrodes and transformers of 12,000-kva. capacity. The electrodes are arranged in two rows of four, and each pair and contact plate under the hearth of the furnace, which is common to all, form an electrical unit and are supplied by a 3,000-kva., three-phase transformer. By means of a switch power can, if desired, be derived entirely through the top electrodes. When this is done the bottom connections are thrown in series, and consequently no current can flow through the hearth.

### Furnaces Used in Making Alloys

The assertions regarding the sizes of arc furnaces in Frank Hodson's paper were questioned by W. E. Moore, who said that there was no reason why other types of arc furnaces should not be made in larger than 40-ton sizes. He characterized the ideal furnace as a one-electrode, single-phase type, but said that the power companies would not tolerate such a furnace. He said that 24-in. electrodes are not the largest available, as at least 32-in. electrodes are in use and 36-in. are made for the Soderberg type. Both Mr. Moore and F. W. Brooks criticised Mr. Hodson's advocacy of the conductive bottom, asserting that it is a weakness in furnace design. Mr. Brooks said that acid bottoms will not conduct current at voltages used in steel furnaces and that conductive bottoms can therefore be of basic material only, and these will not stand up under the heat involved. Mr. Moore questioned Mr. Hodson's statements regarding balance, stating that the variable resistance of the conductive bottom produces unbalance. He also characterized Mr. Hodson's statements regarding distributed heat as having a backward tendency, because it is necessary to keep electrodes as far away from the furnace refractory linings as possible in order to keep down temperatures.

E. T. Moore said that F. V. Andreae's paper had given undue attention to balanced loads between conductors and other parts of the apparatus and that the determining factor is the distance of the electrodes above the bath. Fluctuations, rather than load unbalances, he said, were detrimental to the central station. He also said that the Kelvin balance method described by Messrs. Saklatwalla and Anderson was not necessary in all types of furnaces. To this and a point about the effect of charging on load balance raised in the discussion Mr. Saklatwalla replied by outlining the continuous and uniform method of charging with finely divided and well-mixed material employed in the ferro-alloy processes in which the furnace is used. This, he said, made the wattage-input control method superior to voltage and amperage control. E. T. Moore took issue with the assertions of Mr. Hodson about the induction furnaces, expressing the opinion that with the advance of the art and availability of low-frequency current small induction furnaces have been developed and successfully used and large ones are within the realms of possibility.

### Heating a Cotton Weave Shed by Electricity

Electricity is used exclusively for heating the St. Croix mill of the Canadian Cottons Company, Ltd., Milltown, New Brunswick, Canada, which operates 56,880 spindles and 1,448 looms. The equipment used for heating this mill was described in a paper by C. T. Guildford, who also outlined the calculations made to estimate the quantity of heat required for buildings of this kind. Computations were presented to show the conditions under which electric heating in a textile mill may be used.

The method of heating adopted is the Sturtevant hot-air system with groups of electric heating units instead of steam coils in the fan room. The weave shed, which is a one-story building, 480 ft. long x 182 ft. wide, requires 1,600 kw. consumption at 15 deg. below zero, which with the equipment installed leaves a reserve capacity of 463 kw. for further drop in temperature. According to tests made, the room temperature can be quickly brought to any desired value by connecting additional heaters. The actual heat input checks very closely with the calculated requirements. The author concludes that electric heat should be purchased at an estimated cost of $0.0025 per kilowatt-hour to be on a parity with coal at $10.50 per ton where the average temperature is 22 deg. during the heating season. With coal at $5 per ton, as in parts of the South and where the average heating season temperature is 48 deg., electric heat should be purchased at $0.00156 per kilowatt-hour. Electric heat may be adopted with economy in mills where surplus hydro-electric power is available. In the case of the plant at Milltown a return of more than 37 per cent on the investment for the electrical equipment is shown, and in a plant in Georgia a return of over 18 per cent can be realized. The average heat required during the night for the Milltown installation was found to be 44 per cent greater than that required during the day, even after due allowances were made for the heat supplied by power and by the operators.

### Should Compare Steam and Electric Heating on Proper Basis

That electric and steam-heating systems are not comparable on the basis of heat units furnished for heating purposes was the opinion of Wirt S. Scott in discussing C. T. Guildford's paper on electric heating of a cotton-weave shed. He said that 50 per cent of the heat supplied from a steam-heating system is conducted out of a building because of the location of radiators near windows or similar openings. In the case discussed in the paper Mr. Scott said that for steam heat a change in air of four times per hour had been figured, while for electric heat only once in two hours had been provided for. He emphasized the importance of heat given off by motors and other power equipment in considering such a heating problem. In the case of the Canadian plant this amounts to 600 hp. in motors. During

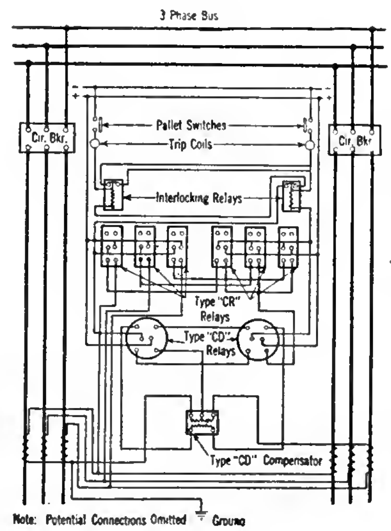
cold winter nights, with no motors running and with outside temperatures 20 deg. below zero, he said that the sixteen heating circuits with a capacity of 2,200 kw. may be required to keep the rooms at 70 deg. During the day, with somewhat higher temperatures outside, six of the main heating circuits usually keep up the room temperature. An adjustment of the automatic control of one circuit with a capacity of 137½ kw. usually suffices to keep the room temperatures within one degree of the 70 deg. for which the control is set, according to Mr. Scott.

## *New Relay Schemes and Illumination*

Relays and their operation formed the major subject treated in the technical session held Wednesday afternoon, at which N. W. Storer presided. The papers presented gave examples of recent relay practices, and a remarkable unanimity of opinion existed on the relay methods best suited for different systems.

The Duquesne Light Company has recently installed a new relay system on the 66-kv. ring surrounding Pittsburgh. H. P. Sleeper described the method of relaying employed and the results of tests made on the installation. The ring is made of parallel lines and is sectionalized at seven points, two of which are generating stations. The greater part of the load is industrial-motor and synchronous converters. A number of relay schemes were investigated, and a scheme using balanced directional relays for short-circuit protection and selective differential current relays for ground protection was chosen.

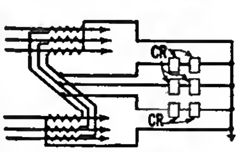
The short-circuit relays are of the CR type and the ground relays are rated at ⅓ amp. Interlocking relays are installed in the trip circuits of both lines to render the good line non-automatic for a few seconds after the relays have tripped out at one end of the defective line. This locks out the trip circuit of the good line until the relays at the opposite end of the section have had time to clear the line in trouble. On standard sections these relays are set at 0.4 second definite time. One 63-ohm, grounding resistor is used at each generating station, and the ground relays close contacts in 0.3 second. If the




CONNECTIONS OF BALANCE SCHEME USED (SLEEPER)

**SCHEME NO. 1**
Balanced Reverse Power Protection Only

Schematic Connections

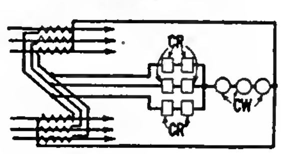



ADVANTAGES
1. Simplicity of wiring and equipment.
2. Directional single-line protection afforded.
3. No additional relays required for ground protection.
4. Requires dead grounded neutral.

DISADVANTAGES
1. Imposes severe voltage unbalance on line which will effect synchronous machines.
2. Severe damage may result as heavy ground current must pass to operate relays.

**SCHEME NO. 2**
Balanced Reverse Power Protection for Short Circuits and Watt Relay Protection for Grounds

Schematic Connections

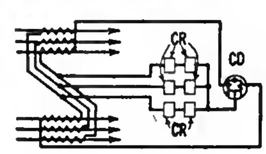



ADVANTAGES
1. Satisfied all conditions for short-circuit protection for both parallel and single-line operation.
2. Small ground current may be used which ensures the elimination of voltage disturbances.

DISADVANTAGES
1. Additional relays necessary for ground protection, at least one per circuit being required.
2. Wiring is complicated.
3. Extra grounding potential transformer required for one scheme using the watt ground relay.
4. Another scheme used three double contacting watt relays per pair of lines but this scheme does not have a dependable selectivity.

**SCHEME NO. 3**
Balanced Reverse Power Protection for Short Circuits and Balanced Current Relay Protection for Grounds

Schematic Connections

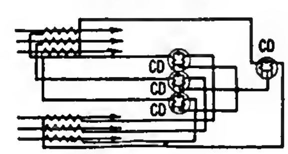



ADVANTAGES
1. Wiring and equipment simple, only one set of relays being required for ground protection of two parallel lines.
2. Satisfies all short-circuit conditions for both parallel and single-line operation.
3. Small ground current required to operate ground relays.
4. Ground relays very positive in action.

DISADVANTAGES
1. Ground protection is inoperative when ring is open.
2. Ground relays are non-directional for single-line operation.

**SCHEME NO. 4**
Balanced Current Relays for both Short Circuit and Ground Faults

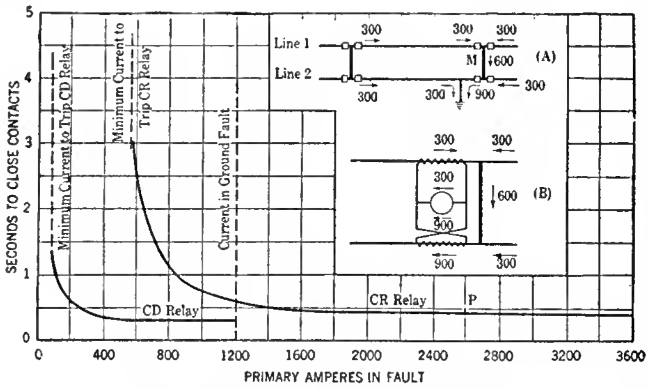
Schematic Connections



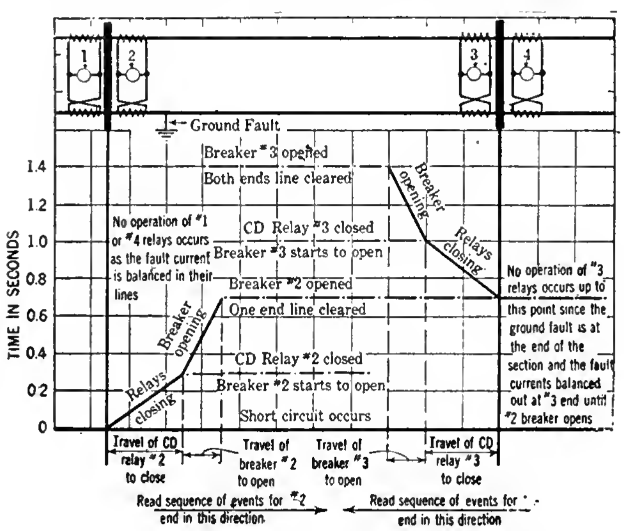

ADVANTAGES
1. Simple wiring and equipment.
2. Only one ground relay required for ground protection of two parallel lines.
3. No potential connections required.
4. Ground relays very positive in action.

DISADVANTAGES
1. Neither short circuit nor ground protection is operative if ring is open.
2. Single-line operation is not directionally selective.

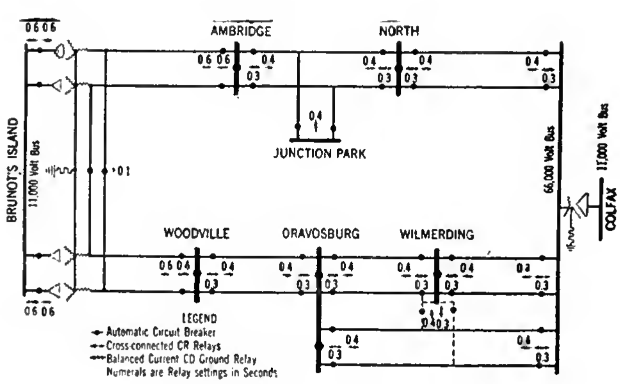
SEVERAL BALANCE SCHEMES WERE COMPARED AND NO. 3 CHOSEN (SLEEPER)




SETTINGS FOR SHORT-CIRCUIT AND GROUND RELAYS (SLEEPER)




TIME CURVES OF RELAY PERFORMANCE (SLEEPER)

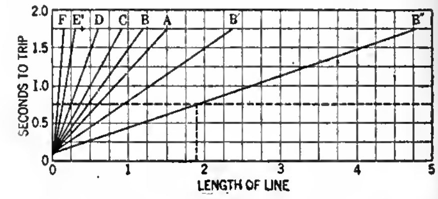



SYSTEM RELAY LAYOUT AND SETTINGS (SLEEPER)

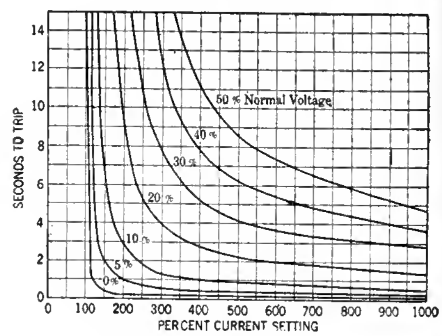
ground relays fail to respond to the ground fault, the grounding resistors are short-circuited after a period of ten seconds. This places a dead ground on the system and puts the short-circuit current in the CD relays, which causes them to operate.

A series of dead grounds were put on the ring to test the relaying. The dead ground was then replaced by a resistance ground, and that in turn by an arcing ground. A total of twenty-eight grounds was put on the system without damage, and the resultant relay operation was satisfactory.

A new device for accurately isolating trouble was described in a paper entitled "The Distance Relay for Automatically Sectionalizing Electrical Network," by Leslie N. Crichton. In determining the distance the relay makes use of the balance principle and bases its calculations upon the value of current and voltage existing at the time of the short circuit. In principle the relay has a current coil arranged to close contacts, while a voltage coil is so arranged that as long as voltage is applied it will tend to overpower the current coil and prevent the contacts from closing. The two coils are adjusted so that on a section of line the current coil will just overpower the voltage coil when a short circuit occurs at the far end of the section. The relay is so designed that when the trouble is close it will operate instantaneously, but when the trouble is some distance away it will operate slowly, so as to allow any relay which is nearer to the trouble to act. The induction-type relay has a disk which is rotated by the current coil whenever the current reaches sufficient magnitude, the movement of the disk being damped by the permanent magnet so that its speed is proportional to the current. The movement of this disk does not directly close the contacts, but instead it tightens a spiral spring. On the other end of this spring is fastened a lever which is pivoted at the center and which has the contacts on one end and the core of the voltage coil on the other. This voltage coil is so arranged that it opposes the closing of the contacts. When in the neutral position all parts of the relay are balanced, so that if there is no voltage on the voltage coil a very slight movement of the disk will close the contacts. Similarly, if the voltage is applied to the restraining coil, its unbalance will prevent the contacts from being closed until the spring has been tightened up sufficiently to overcome this, and since the motion of the disk is damped, this will require some time. The voltage coil will discriminate quite positively between zero voltage and 5 per cent of normal voltage. In addition to the distance-determining element, the relay has a directional element in order to locate definitely the direction of the trouble as well as its distance away. The directional contacts are in series with the distance contacts and act as a sort of check valve to prevent the relay from operating when power is flowing toward the busbars. The author claims for the relay that all dead short circuit will be cleared within one second and the majority of them in considerably less time, and trouble will be cleared with equal rapidity from all parts of the system. In effect, the well-known directional time-element overcurrent relay has been taken and sufficient "brains" given it to enable it to determine what time limit it should have in its particular location.

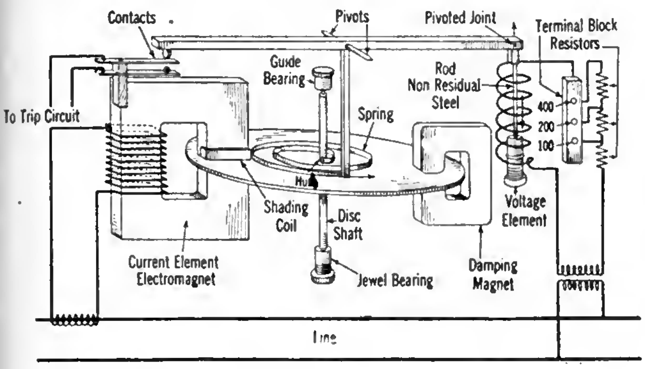



TIME-DISTANCE CURVE FOR THE DISTANCE RELAY (CRICHTON)



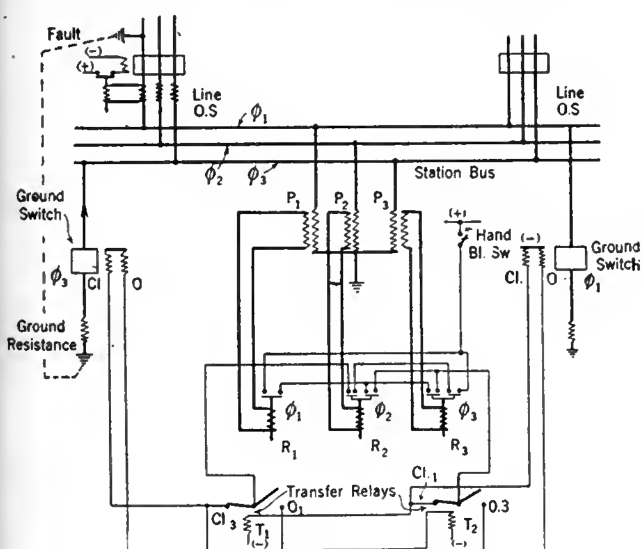

TIME-CURRENT CURVES AT VARIOUS VOLTAGES (CRICHTON)

In the opinion of P. Ackerman, who contributed a paper on "A Ground-Selector Relay Scheme," the adoption of a recently devised scheme of protection of the ground-selector type makes it possible for the ungrounded system of transmission to have all the advantages of the grounded system and some in addition. Operating results were given in the paper which, the author held, show conclusively that the ground selector




ELEMENTARY DIAGRAM OF DISTANCE RELAY WITH DIRECTIONAL ELEMENT (CRICHTON)

will bring the ungrounded system to the same state of perfection that is claimed for the grounded system without having to resort to artificial grounding methods; also that the ground selector prevents permanent secondary breakdowns and permits clearance of grounds and line trouble as effectively as the grounded system and retains besides the advantage of less numerous voltage disturbances and partial interruptions and the flexibility of permissible transformer connections. The author said that the ungrounded system, combined with ground selectors and equipped with an effective relay protection, should therefore prove advantageous com-




CONNECTIONS OF GROUND SELECTOR RELAY (ACKERMAN)

pared with the grounded system, at least as far as distributing systems are concerned and for voltages not exceeding 60,000.

The fundamental idea of the ground selector is, he pointed out, to produce intentionally a short circuit immediately after a ground develops on the system. This is accomplished by automatically grounding one of the sound phases at the main station bus by closing an oil switch immediately upon the occurrence of a ground. Thus a complete phase to phase short circuit is produced, and as a result overload current will flow into the faulty line as if the line were on short circuit. Accordingly the ordinary overload protection will enter into action and disconnect the faulty line. As soon as the trouble has cleared itself the ground switch will open automatically and thus restore the system to normal condition. Various other features had to be embodied to make the device practical, but no great difficulty was found in developing the scheme and installing it on two systems in Canada.

Operating records over a period of time were given in detail in the paper to show the efficiency of the device for the purposes intended. The author made rigid analyses and comparisons of the ungrounded and grounded systems based upon the use of the selector scheme.

### DISCUSSION SHOWS THAT PROGRESS HAS BEEN MADE IN RELAYING

R. N. Conwell suggested that many relay tests could be avoided and system operations improved if accurate records were kept of all relay operations. He also pointed out that the relay scheme developed by Mr. Ackerman was a modification of the arc suppressor and limited in its application because of complexity and cost. In his opinion, the newer relays described offered opportunity for greater developments in relay practice.

It was the opinion of P. Ackerman that an instantaneous relay placed in series with a definite time relay and connected on the balanced principle would give results similar to those derived from the relay described by Mr. Crichton. Mr. Ackerman thought great possibilities were opened by using the Crichton relay for certain applications.

W. V. Lovell stated that he could not find data to support the conclusions in the Ackerman paper to the effect that greater opportunity was offered for inductive interference under abnormal operations if the grounded neutral were used than under the scheme proposed by Mr. Ackerman.

L. P. Ferris stated that the amount of resistance in the grounded neutral will affect the amount of inductive interference appreciably and that the relative location of communication and power circuits would be a vital factor in considering the interference action if the schemes proposed by Mr. Ackerman were used.

E. A. Hester announced that a handbook on relays and protective schemes would be published in the fall under the auspices of the A. I. E. E. and N. E. L. A.

A voltage-restraining relay scheme was used for several years on the West Penn system, H. H. Langstaff stated, and gave good service in the original installation. Later this system was discontinued on account of the purchase of properties equipped with other relay schemes and because it is essential that relay applications be made quickly on every installation. He said that when using balanced protection it was essential to have a high setting to maintain the remaining line in service when one of two parallel lines is tripped on account of trouble. He also observed that it was often difficult to determine whether the ground relay or the overload relay tripped the circuit when trouble occurred. He advocated testing all relays in the laboratory before installation and said that the West Penn company had used twenty installations of 12-volt storage batteries with trickling chargers for control power and had experienced only one failure in two years.

C. M. Moss pointed out that one objection to the installation of balanced-relay schemes was the amount of control wiring and number of cross-connections required.

An interesting example of high-grade illuminating engineering design and practice was presented in a paper by F. A. Mott and L. A. Jones which described the installation for the Eastman Theater and School of Music at Rochester, N. Y. A great many experimental analyses were made previous to the installation to determine the limits for illumination and brightness. The problem was to get illumination without too much brightness so that the usual contrast between darkness and brightness in motion-picture theaters would be eliminated. At the same time, no loss of quality was desired in the pictures.

A successful solution was obtained and a detailed description was given in the paper of the equipment, controls and intensities used. Standard fixtures with ornamentation were largely used.

## *Reactors, Lightning Disturbance and Insulators*

The importance of low ground resistance in lightning-arrester installations and the current value to consider in designing and installing reactors were the chief subjects of discussion at the Thursday morning session.

A very elaborate investigation was made by Malcolm MacLaren, professor of electrical engineering at Princeton University, of the system of the Philadelphia Electric Company with regard to lightning disturbances on the low-tension distribution lines. The main primary distribution system has 2,300 volts and the high-tension system 13,200 volts. The lightning troubles on the low-tension system are of comparatively infrequent occurrence, the author reported in his paper, "Survey of Lightning Disturbances on a Distribution System," and much less serious in character than on the other parts of the system. The number of fuses blown in the houses was no indication of the effect of lightning, because of the large number blown by other causes. The number of injuries to house fixtures never reached 150 per month, and these injuries were irregularly distributed. There was, however, distinct evidence that a majority of the meter burn-outs were due to lightning as there was a large increase in the number of failures during the summer months. All the evidence pointed to the fact that the lightning disturbances in the secondary circuits are not transmitted from the primaries to the transformers, but originated in the secondaries themselves and are controlled largely by the length of these circuits. The losses occur indiscriminately upon meters connected to ungrounded circuits or circuits grounded outside the premises or directly at the meters. No true perspective upon the protective value of these methods of connection was obtained, however, as the relative number of meters using each type of connection was not known.

Experience with more than 230 current-limiting reactors of five different types of construction indicated to the Public Service Electric Company of New Jersey, according to the paper of N. L. Pollard, that most of the troubles to which they give rise can be attributed to poor mechanical construction and especially to insufficient consideration of thermal capacity. As a result of the experience gained on the New Jersey system greatly improved designs of reactors are now available.

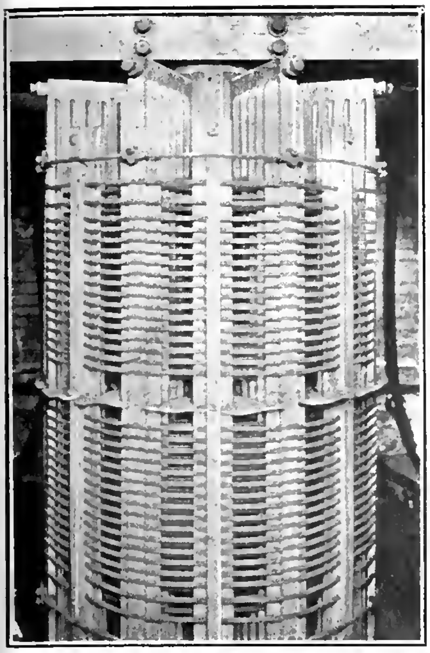
Some facts regarding these reactors and the performance they have given are shown in the table reproduced. While the number of instances in which these reactors functioned properly far exceeded the number of failures, it is in the causes of failures and the methods of overcoming them that the most valuable information lies. Only two cases of trouble developed in the type A reactors in ten years (see page 1031). The first was caused by water grounding one of the coils, and the second was caused by shrinkage of the wooden strips supporting the coils, thus allowing the windings to become slack and eventually short-circuited.

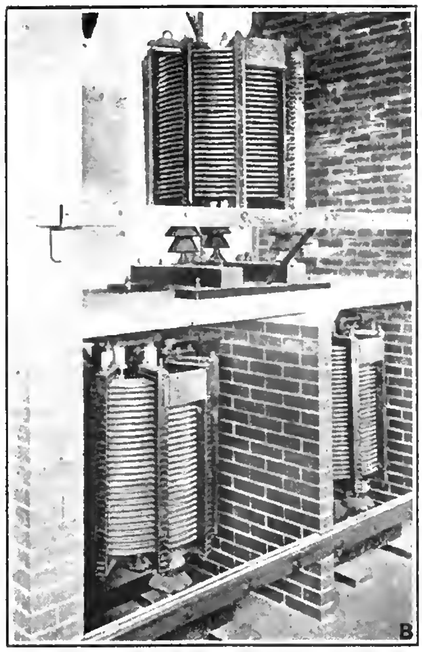
Numerous cases of short circuits and complete wreckage of type B coils indicated that they were not sufficiently braced and did not have sufficient clearance between layers and between coils and metal tie rods to withstand the severe operating conditions. In most cases failure occurred between the outer turn of either the top or bottom coil and one of the brass tie rods. Of the twenty-four failures experienced, two were due to short-circuiting of turns, six to arcing from top to bottom, three from lugs burning off, two from windings burning open and eleven were complete failures. This design was discontinued and an improved one developed giving greater space between layers, wood tie rods instead of brass, heavier supports, insulators of higher flashover, and terminals brought out one on top and one on bottom.

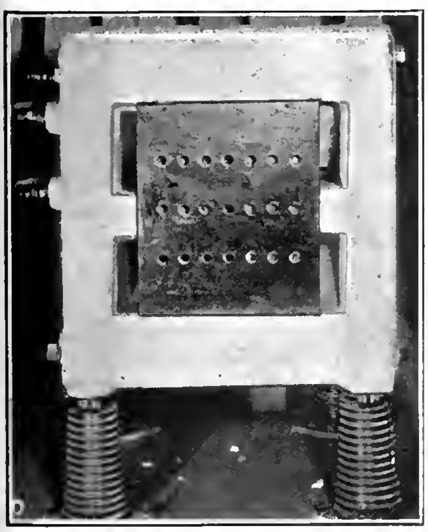
Only two failures were experienced with type C coils. The first occurred after two years of service, when one of the coils arced from top to bottom; the second oc-

COMPARISON OF REACTOR PERFORMANCE (POLLARD)

| Type | Number of Reactors (All Single-Phase) | Number of Sets | Amp. | Per Cent | Kva. | Year Installed | Nature of Failure: Turns Short-Circuited | Nature of Failure: Arced Over | Nature of Failure: Miscellaneous | Nature of Failure: Complete Failure | Total Number of Failures | Reactor-Years: Total | Reactor-Years: Per Failure | Reactor-Years: Per Complete Failure |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 6 | 2 | 220 | 3 | 50. | 1913 | 2 | .. | .. | .. | 2 | 120 | 60 | .... |
| .. | 6 | 2 | 395 | 3 | 90. | 1913 | .. | .. | .. | .. | . | .. | ... | .... |
| .. | 72 | 24 | 175 | 5 | 66.8 | 1914 | 2 | 6 | 5 | 11 | 24 | 676 | 28.1 | 61.4 |
| B | 12 | 4 | 250 | 5 | 95.3 | 1914 | . | .. | .. | . | | .. | ... | .... |
| .. | 3 | 1 | 350 | 5 | 133.3 | 1914 | | .. | | .. | | . | ... | .... |
| .. | 6 | 2 | 150 | 5 | 57.1 | 1915 | 2 | .. | .. | .. | 2 | 408 | 204 | .... |
| C | 9 | 3 | 175 | 5 | 66.8 | 1915 | .. | .. | .. | .. | | . | ... | .... |
| .. | 12 | 4 | 250 | 5 | 95.3 | 1915 | .. | .. | .. | .. | | . | ... | .... |
| .. | 21 | 7 | 350 | 5 | 133.3 | 1915 | .. | .. | .. | .. | | . | ... | .... |
| . | 6 | 2 | 550 | 2 | 83.9 | 1917 | 5 | 4 | 8 | 8 | 25 | 165 | 6.6 | 20.6 |
| D | 9 | 3 | 250 | 5 | 95.3 | 1917 | .. | .. | .. | .. | .. | ... | ... | .... |
| .. | 15 | 5 | 350 | 5 | 133.3 | 1917 | .. | .. | .. | .. | .. | ... | .. | .... |
| .. | 6 | 2 | 545 | 1.5 | 63 | 1917 | .. | .. | .. | .. | .. | | ... | .... |
| .. | 6 | 2 | 175 | 5 | 66.8 | 1919–20 | .. | .. | 3 | .. | 3 | 213 | 71 | .... |
| E | 3 | 1 | 765 | 1.5 | 88. | 1917 | .. | .. | .. | .. | .. | ... | ... | .... |
| .. | 9 | 3 | 250 | 5 | 95.3 | 1919–20 | .. | .. | .. | .. | .. | . | ... | .... |
| .. | 18 | 6 | 350 | 5 | 133.3 | 1919–21 | .. | .. | .. | .. | . | ... | ... | .... |
| .. | 12 | 4 | 300 | 8 | 183 | 1918 | | .. | .. | . | | . | ... | .... |

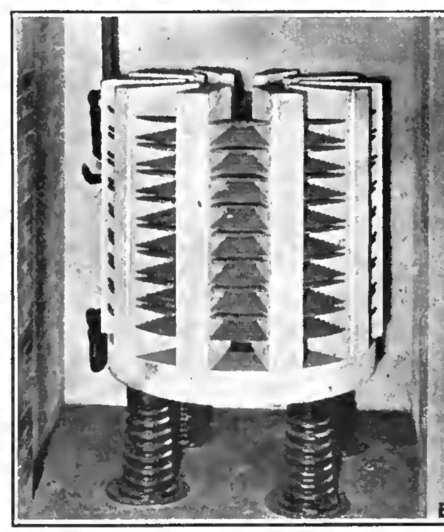






FIVE TYPES OF REACTORS WITH WHICH THE NEW JERSEY COMPANY HAS HAD EXPERIENCE (POLLARD)

Type A—Earliest type of reactor installed. Type B—Coils are made of stranded conductors wound in parallel layers with notched strips and specially prepared molded non-inflammable material between layers. Non-magnetic castings are placed at the top and bottom of the coils, and the different sections are held together by brass tie rods. All the terminals are at the top of the reactor. Type C—Series-wound, similar to type B except that insulated cable is used. The axis is vertical and the coils are partly inclosed by porcelain bricks with soapstone slabs at the top and bottom, held together by brass tie rods. Type D—These coils have two sections in series, each being made up of six pancake coils in parallel. One section has a diameter approximately 3 in. less than the other. The coils have a horizontal axis and are partly inclosed with porcelain bricks. Type E—In later units of this type the concrete supports are closer together.



curred when several turns short-circuited in another coil after three years of service. Both coils were repaired and neither has given any further trouble.

Within three months after the installation of type D reactors three total failures occurred. In each case the coil caught fire from arcing between a number of turns, and before the fire could be extinguished the coils were badly burned, loosened, distorted and partly wrecked. All of the coils were on two separate occasions returned to the manufacturer for rebuilding and reinforcing without successful results. Furthermore, attempts of the New Jersey company to rebuild them were ineffective in making them strong enough to withstand short-circuit conditions. At present whenever one of these coils becomes noisy it is taken out of service and scrapped.

About one year after the first installation of type E reactors there were two instances of trouble: The first occurred on a tie feeder and resulted in the short-circuiting of two reactors; the second occurred on another tie feeder and caused the concrete to crack on one of the coils. These demonstrations were sufficient to prove that the concrete supports were not close enough to prevent the conductors from pulling together. These coils were returned to the factory and additional concrete supports placed half way between the old ones.

In conclusion, the author of the paper urged that lightning arresters be installed on the feeder side of reactors when they feed underground cable to relieve the system of strain during disturbances.

R. E. Doherty and F. H. Kierstead, in their paper on "Short-Circuit Forces on Reactor Supports," discussed and worked out in a theoretical way the character of the force which is required to hold a reactor as a whole against short-circuit forces. The mechanical stress in the supporting members of the reactor is, they found, determined by the dimensions and the magnitude of the resultant force, but under accelerated motion the reaction of the mass enters, and if the supporting members are resilient, then this enters into the situation as another factor in determining the mechanical stress produced by a given impressed force. The paper showed that if any motion be permitted in the reactor supports the mass and resiliency factor become active and the maximum stress may be increased to the order of 25 per cent. On the other hand, if the motion of the reactor is prevented by sufficient initial bolt tension, then the maximum stress need be only as great as that corresponding to the maximum instantaneous peak of the electromagnetic force. Where the reactor is not

held rigidly against the motion, the maximum force on the holding device depends in a decisive way upon the ratio of the frequency of natural oscillation to the electrical circuit frequency. If, however, the reactor is held rigidly, then the maximum force on the holding device will be independent of the frequency ratios and need be only slightly in excess of the peak magnetic force. If the reactor is not held rigidly and the natural oscillation frequency is large compared with the circuit frequency, the maximum force will occur in the first cycle and will usually be as great as or greater than the maximum magnetic force.

More analytical papers are needed to permit the solving of operating problems, declared C. E. Stone, who pointed out that the requirements for lightning arresters are conflicting. He said that the solution of line protection for 4,000-11,000-volt systems is far from solved.

Low ground resistance is absolutely imperative to good lightning arrester operation, declared K. B. MacEachron, who said that attempts of manufacturers to reduce arrester resistance would be of little avail if this was not provided. High ground resistance will either decrease discharge capacity or subject apparatus to severe voltage surges.

In referring to tests of the New York Edison Company with reactors W. B. Kirk suggested that double the sustained short-circuit-current peak value should be used in calculating reactor tests. However, J. F. Peters said that 2.8 times the sustained value is more appropriate. H. O. Stevens recommended the use of the peak value of the displaced wave.

The insulator sub-committee of the A. I. E. E. standards committee presented a report on standardized insulator tests. For pin insulators a dry flashover test is specified in detail by having the insulator mounted according to specification and voltage applied at a uniform rate of 5,000 volts per second until flashover occurs. The wet-test equipment is the same as for the dry test, and a 45-deg. spray is applied at the rate of 0.2 in. per minute. The water resistance is specified at from 3,000 ohms to 6,000 ohms per inch cube at a nozzle pressure of between 35 lb. and 50 lb. per square inch. A puncture test on the insulator immersed in oil specifies an applied voltage of not more than three-fourths the dry flashover voltage and raised at 5,000 volts per minute for insulators having an average puncture voltage of 200,000 or less and at double this rate for those having a higher puncture voltage. A corona test calls for the application of voltage in a darkened room until streamers occur and a slow lowering until brush discharges disappear. The point of disappearance is the corona voltage. A test for mechanical strength is specified while the insulator has a voltage applied 15 per cent less than the dry flashover value. The load is increased at the rate of 2,000 lb. per minute until puncture occurs.

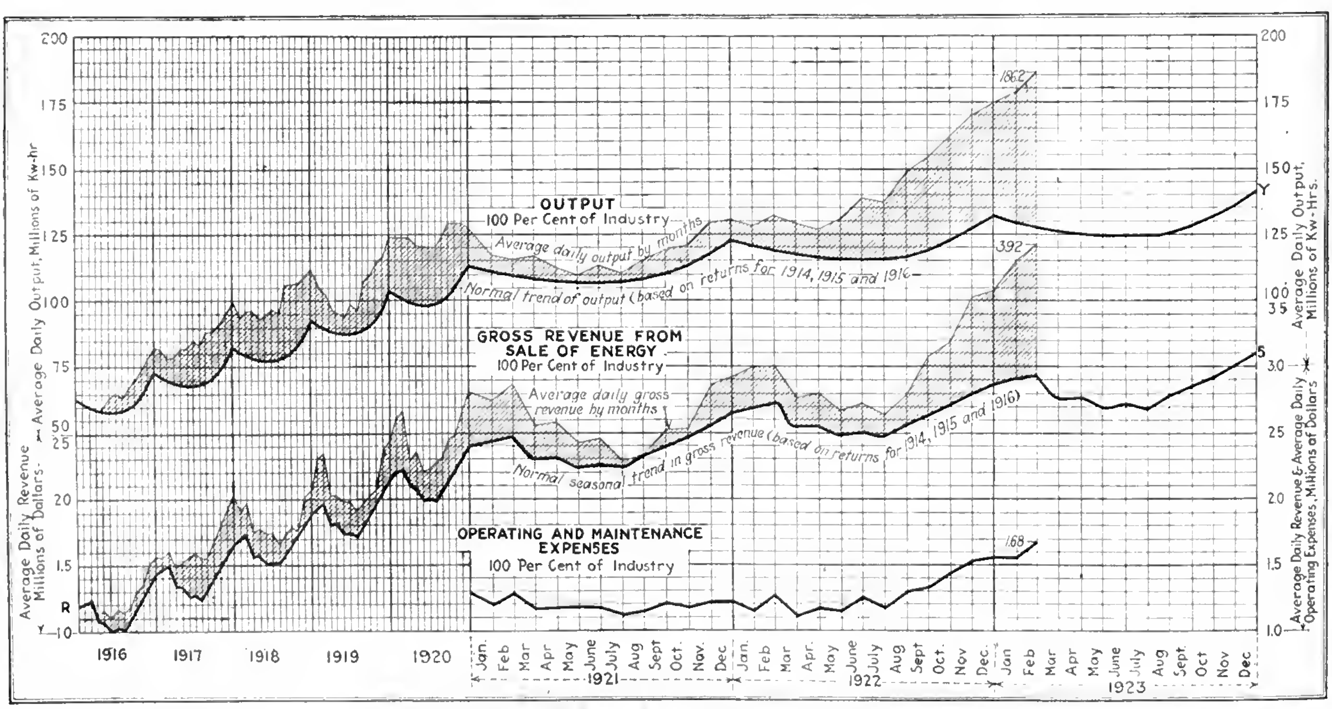
For suspension-type insulators the dry flashover test calls for the application of voltage at 5,000 volts per second until flashover occurs. All other details must conform to A. I. E. E. standards. The details of the wet flashover tests are very similar to those for the pin-insulator tests, and the same can be said of the puncture test specified by the committee. Data have been tabulated from twenty-seven operating companies in reply to a questionnaire, and specific recommendations for factory tests have been added to the former report.

# February Sets Record

### Unusual Energy Requirements of Central-Station Customers Reported from Every Section of the Country—Two Records Established

REPORTS received by the ELECTRICAL WORLD for the month of February from central generating and distributing companies representing 72 per cent of the installed generator rating of the country indicate that two new records were established by the industry during the month.

The average daily output during February was 186,-239,000 kw.-hr., which exceeded the previous record, made




OUTPUT AND REVENUE ON THE UP GRADE

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

| Mos. | Percentage of Installed Ratings Represented | Kw.-Hr. Output (Companies Reporting) 1922 Thousands | 1921 Thousands | Per Cent Increase | Percentage of Installed Ratings Represented | Revenue from Sale of Energy (Companies Reporting) 1922 Thousands | 1921 Thousands | Per Cent Increase | Mos. | Percentage of Installed Ratings Represented | Operating and Maintenance Expenses (Companies Reporting) 1922 Thousands | 1921 Thousands | Per Cent Increase | Operating Ratio: Steam Plants 1922 | Steam Plants 1921 | Hydro Plants 1922 | Hydro Plants 1921 | Combined Systems of Steam and Hydro Plants 1922 | Combined 1921 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mar.... | 78 | 3,154,993 | 2,781,731 | 13.4 | 72 | $61,148 | $56,047 | 9.1 | Mar.... | 55 | $19,199 | $19,897 | —3.5 | 48.3 | 54.6 | 27.1 | 21.0 | 40.7 | 42.8 |
| Apr.... | 82 | 3,121,346 | 2,769,100 | 12.7 | 75 | 62,784 | 58,484 | 7.4 | Apr.... | 61 | 21,402 | 21,657 | —1.2 | 48.3 | 53.9 | 25.3 | 27.6 | 34.8 | 47.7 |
| May.. | 83 | 3,380,602 | 2,804,535 | 20.2 | 76 | 62,295 | 57,789 | 7.8 | May.. | 62 | 22,785 | 22,378 | 1.8 | 53.7 | 58.1 | 25.1 | 22.4 | 43.3 | 46.0 |
| June.. | 82 | 3,402,467 | 2,809,183 | 21.1 | 75 | 61,314 | 55,288 | 10.8 | June.. | 62 | 22,770 | 21,848 | 4.2 | 54.2 | 56.9 | 26.4 | 28.1 | 44.9 | 48.5 |
| July.... | 80 | 3,401,789 | 2,823,231 | 20.4 | 74 | 60,392 | 54,442 | 10.9 | July.... | 61 | 23,006 | 21,556 | 6.7 | 55.3 | 56.8 | 27.9 | 28.5 | 46.1 | 48.1 |
| Aug.. | 79 | 3,648,755 | 2,998,719 | 21.6 | 73 | 62,821 | 55,499 | 13.2 | Aug.... | 60 | 24,932 | 22,435 | 11.1 | 56.6 | 54.2 | 26.8 | 31.4 | 48.8 | 50.7 |
| Sept... | 79 | 3,647,228 | 2,987,072 | 22.0 | 72 | 66,435 | 57,977 | 14.6 | Sept... | 59 | 24,559 | 22,353 | 9.8 | 53.4 | 53.2 | 26.4 | 25.8 | 46.9 | 48.3 |
| Oct.... | 78 | 3,922,493 | 3,171,675 | 23.6 | 72 | 70,710 | 61,024 | 15.8 | Oct. | 59 | 27,781 | 23,260 | 19.5 | 52.1 | 51.1 | 28.9 | 27.8 | 48.8 | 47.7 |
| Nov.. | 78 | 3,964,299 | 3,208,870 | 23.6 | 72 | 75,909 | 65,203 | 16.4 | Nov.. | 59 | 28,308 | 26,071 | 8.6 | 50.4 | 50.2 | 24.3 | 25.0 | 46.0 | 45.3 |
| Dec... | 74 | 4,010,374 | 3,202,431 | 25.2 | 69 | 76,344 | 65,624 | 16.3 | Dec... | 57 | 23,789 | 23,691 | 21.5 | 49.3 | 48.3 | 29.7 | 27.7 | 48.8 | 46.2 |
| | | 1923 | 1922 | | | 1923 | 1922 | | | | 1923 | 1922 | | 1923 | 1922 | 1923 | 1922 | 1923 | 1922 |
| Jan.... | 74 | 4,088,490 | 3,178,151 | 28.6 | 68 | 79,736 | 67,604 | 17.9 | Jan.... | 56 | 27,94[illegible] | 22,9[illegible]5 | 21.8 | 47.3 | 45.3 | 23.8 | 23.4 | 45.3 | 43.1 |
| Feb.. | 72 | 3,754,601 | 2,922,269 | 28.4 | 68 | 74,637 | 61,767 | 20.8 | Feb.... | 56 | 26,374 | 21,652 | 21.8 | 46.0 | 46.1 | 24.0 | 26.6 | 42.0 | 41.2 |

during January, by 8,000,000 kw.-hr. In addition, the average daily revenue from the sale of energy during the month was $3,917,000, which exceeded the former record, also made during January, by $137,000. This is the first instance in the recent history of the industry in which the operations during February have exceeded those of the previous December and January. The operations of the industry for the first two months of the year point unmistakably to one of the most prosperous years in the history of the central station.

Complete returns indicate that the total output of the central generating stations in the country for 1922 was 52,775,000,000 kw.-hr. The output in 1921 was 43,905,000,000 kw.-hr., indicating an increase over that year of industrial depression of 8,870,000,000 kw.-hr., or 20.1 per cent. The output in the past year was also 15.7 per cent over 1920, a year of great industrial activity.

The gross revenue from the sale of energy during 1922 was $1,084,000,000, indicating an increase of $139,640,000, or 14.9 per cent, over 1921. The total operating and maintenance expenses, exclusive of interest, taxes, depreciation or sinking funds, during 1922 were $481,570,000, against $432,400,000 in 1921 and $440,000,000 in 1920, a remarkable showing when the high cost of fuel is taken into consideration.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

| Month | Percentage of Installed Ratings Represented | New England States 1922 Thousands | New England States 1921 Thousands | Per Cent Increase | Percentage of Installed Ratings Represented | Atlantic States 1922 Thousands | Atlantic States 1921 Thousands | Per Cent Increase | Percentage of Installed Ratings Represented | North Central States 1922 Thousands | North Central States 1921 Thousands | Per Cent Increase | Percentage of Installed Ratings Represented | South Central States 1922 Thousands | South Central States 1921 Thousands | Per Cent Increase | Percentage of Installed Ratings Represented | Pacific and Mountain States 1922 Thousands | Pacific and Mountain States 1921 Thousands | Per Cent Increase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KW-HR. OUTPUT: | | | | | | | | | | | | | | | | | | | | |
| Mar..... | 82 | 258,142 | 210,107 | 22.9 | 81 | 1,177,876 | 1,024,161 | 15.0 | 70 | 968,229 | 862,240 | 12.2 | 60 | 160,656 | 145,320 | 10.6 | 94 | 590,090 | 539,903 | 9.3 |
| Apr...... | 81 | 232,294 | 205,100 | 13.2 | 82 | 1,129,200 | 979,666 | 15.3 | 80 | 1,019,170 | 910,482 | 11.9 | 63 | 158,524 | 137,240 | 15.5 | 94 | 582,400 | 536,612 | 8.5 |
| May.... | 80 | 241,879 | 200,030 | 20.1 | 83 | 1,207,306 | 984,646 | 22.5 | 82 | 1,108,924 | 935,268 | 18.5 | 60 | 166,171 | 138,576 | 19.9 | 95 | 656,322 | 546,015 | 20.1 |
| June.... | 77 | 242,700 | 200,343 | 21.2 | 83 | 1,194,012 | 978,178 | 22.1 | 82 | 1,113,428 | 917,708 | 21.3 | 58 | 167,420 | 140,425 | 19.2 | 93 | 684,907 | 572,529 | 19.6 |
| July..... | 74 | 227,799 | 193,144 | 17.9 | 83 | 1,180,488 | 970,398 | 21.7 | 80 | 1,114,357 | 911,543 | 22.3 | 58 | 166,374 | 142,407 | 16.8 | 91 | 712,771 | 605,739 | 17.7 |
| Aug..... | 72 | 260,666 | 214,944 | 21.4 | 83 | 1,275,186 | 1,026,388 | 24.3 | 79 | 1,176,589 | 972,551 | 21.0 | 58 | 179,325 | 150,412 | 19.3 | 90 | 752,345 | 621,586 | 21.0 |
| Sept..... | 69 | 261,523 | 225,408 | 16.1 | 82 | 1,307,413 | 1,037,644 | 26.0 | 78 | 1,170,148 | 976,556 | 19.7 | 57 | 194,866 | 158,373 | 23.0 | 91 | 713,248 | 589,091 | 21.0 |
| Oct...... | 69 | 297,362 | 251,833 | 14.1 | 80 | 1,408,629 | 1,128,973 | 24.8 | 78 | 1,305,808 | 1,058,870 | 23.4 | 57 | 201,756 | 160,261 | 25.8 | 91 | 706,346 | 571,738 | 23.5 |
| Nov..... | 70 | 312,949 | 248,370 | 25.8 | 78 | 1,438,270 | 1,160,878 | 23.9 | 77 | 1,318,588 | 1,073,114 | 23.6 | 56 | 212,739 | 159,917 | 33.1 | 90 | 681,753 | 566,591 | 20.3 |
| Dec..... | 73 | 338,613 | 255,769 | 32.3 | 76 | 1,505,165 | 1,214,589 | 23.9 | 70 | 1,251,660 | 998,398 | 25.3 | 55 | 210,897 | 165,922 | 27.0 | 89 | 704,039 | 567,753 | 24.0 |
| | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | |
| Jan...... | 73 | 327,962 | 252,291 | 29.9 | 75 | 1,551,514 | 1,197,086 | 29.5 | 69 | 1,304,478 | 1,008,910 | 29.2 | 55 | 205,108 | 153,903 | 33.2 | 88 | 699,428 | 565 961 | 23.5 |
| Feb...... | 72 | 295,874 | 227,309 | 30.1 | 75 | 1,418,743 | 1,094,574 | 29.6 | 70 | 1,187,205 | 924,856 | 28.3 | 55 | 190 749 | 135,285 | 40.8 | 87 | 662,030 | 540,245 | 22.5 |
| REVENUE | | | | | | | | | | | | | | | | | | | | |
| Mar..... | 82 | $6,366 | $5,947 | 7.0 | 75 | $23,798 | $21,617 | 10.1 | 57 | $17,411 | $15,726 | 11.0 | 60 | $4,214 | $4,048 | 4.1 | 94 | $9,359 | $8,709 | 7.5 |
| Apr...... | 81 | 6,132 | 5,808 | 5.6 | 76 | 23,809 | 21,847 | 9.0 | 67 | 19,534 | 18,017 | 8.4 | 62 | 4,123 | 3,928 | 5.0 | 94 | 9,186 | 8,880 | 3.5 |
| May.... | 80 | 5,787 | 5,508 | 5.1 | 76 | 22,579 | 21,204 | 6.5 | 69 | 20,237 | 18,175 | 11.3 | 60 | 4,131 | 3,782 | 9.2 | 95 | 9,561 | 9,120 | 4.8 |
| June.... | 77 | 5,791 | 5,422 | 6.8 | 76 | 22,351 | 20,437 | 9.5 | 68 | 19,018 | 16,763 | 13.5 | 58 | 4,138 | 3,806 | 8.7 | 93 | 10,016 | 8,860 | 13.0 |
| July..... | 74 | 5,729 | 5,301 | 8.1 | 76 | 21,867 | 19,903 | 9.8 | 67 | 18,709 | 16,411 | 13.9 | 58 | 4,036 | 3,716 | 8.6 | 91 | 10,051 | 9,111 | 10.3 |
| Aug..... | 72 | 5,968 | 5,415 | 10.2 | 76 | 22,586 | 19,991 | 13.0 | 66 | 19,702 | 16,760 | 17.6 | 58 | 4,201 | 3,881 | 8.2 | 90 | 10,412 | 9,440 | 10.3 |
| Sept..... | 69 | 6,335 | 5,754 | 10.1 | 76 | 24,478 | 20,973 | 16.7 | 66 | 20,516 | 17,592 | 16.6 | 57 | 4,495 | 4,029 | 11.5 | 91 | 10,612 | 9,629 | 10.2 |
| Oct...... | 69 | 7,055 | 6,370 | 10.7 | 74 | 26,361 | 22,453 | 17.4 | 66 | 22,130 | 18,716 | 18.3 | 57 | 4,652 | 4,136 | 12.5 | 91 | 10,512 | 9,319 | 12.8 |
| Nov..... | 70 | 7,744 | 6,875 | 12.6 | 73 | 28,579 | 24,363 | 17.3 | 66 | 23,659 | 20,037 | 18.2 | 55 | 5,022 | 4,330 | 16.0 | 90 | 10,905 | 9,598 | 13.6 |
| Dec..... | 73 | 8,440 | 7,099 | 18.9 | 71 | 29,433 | 25.766 | 14.3 | 59 | 22,192 | 18.530 | 19.8 | 55 | 5,129 | 4,378 | 17.2 | 89 | 11,150 | 9,851 | 13.2 |
| | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | |
| Jan...... | 73 | 8,509 | 7,284 | 16.8 | 70 | 31,619 | 26,785 | 18.1 | 58 | 23,272 | 18,874 | 23.3 | 55 | 5,193 | 4,489 | 15.7 | 88 | 11,143 | 10,172 | 9.5 |
| Feb...... | 72 | 7,954 | 6,715 | 18.4 | 70 | 29,137 | 24,264 | 20.0 | 59 | 22.222 | 17,674 | 25.8 | 55 | 5,192 | 4,399 | 18.1 | 87 | 10,132 | 8,715 | 16.2 |
| OPERATING EXPENSES: | | | | | | | | | | | | | | | | | | | | |
| Mar..... | 53 | $1,800 | $1,741 | 3.4 | 56 | $7,140 | $7,345 | -2.8 | 38 | $4,884 | $5,188 | -5.9 | 59 | $2,097 | $2,313 | -9.3 | 93 | $3,278 | $3,310 | -0.9 |
| Apr...... | 53 | 1,626 | 1,650 | -1.5 | 56 | 7,322 | 7,295 | 0.3 | 53 | 7,142 | 7,255 | -1.6 | 61 | 2,063 | 2,075 | -0.5 | 93 | 3,249 | 3,382 | -3.9 |
| May..... | 53 | 1,617 | 1,692 | -4.4 | 57 | 7,537 | 7,397 | 1.9 | 55 | 8,369 | 7,848 | 6.7 | 60 | 1,866 | 2,043 | -8.6 | 93 | 3,396 | 3,398 | -0.0 |
| June.... | 51 | 1,751 | 1,937 | -9.6 | 57 | 7,693 | 7,362 | 4.5 | 54 | 7,730 | 7,132 | 8.4 | 58 | 2,179 | 2,051 | 6.2 | 92 | 3,365 | 3,421 | -1.6 |
| July..... | 49 | 1,783 | 1,765 | 1.0 | 57 | 7,769 | 7,361 | 5.5 | 53 | 7,923 | 7,175 | 10.4 | 58 | 1,961 | 1,966 | -0.2 | 90 | 3,570 | 3,289 | 8.5 |
| Aug..... | 47 | 2,003 | 1,973 | 1.5 | 57 | 8,202 | 7,412 | 10.6 | 52 | 8,943 | 7,363 | 21.4 | 58 | 2,182 | 1,990 | 9.6 | 89 | 3,637 | 3,577 | 1.6 |
| Sept..... | 46 | 2,029 | 2,091 | -2.9 | 56 | 7,640 | 7,357 | 3.8 | 50 | 8,924 | 7,295 | 22.4 | 57 | 2,300 | 2,046 | 12.4 | 90 | 3,666 | 3,564 | 2.9 |
| Oct...... | 46 | 2,387 | 2,023 | 17.9 | 56 | 9,209 | 7,695 | 19.7 | 49 | 10,608 | 8,567 | 23.8 | 57 | 2,397 | 2,096 | 14.4 | 90 | 3,703 | 3,412 | 8.5 |
| Nov..... | 46 | 2,545 | 2,161 | 17.7 | 56 | 8,942 | 7,806 | 14.6 | 50 | 10,540 | 8,468 | 24.4 | 55 | 2,597 | 2,178 | 19.3 | 89 | 3,684 | 3,537 | 4.1 |
| Dec..... | 46 | 2,802 | 2,030 | 38.1 | 56 | 9,431 | 8,141 | 15.8 | 49 | 9,558 | 7,368 | 29.7 | 55 | 2,624 | 2,216 | 18.5 | 88 | 4,374 | 3,946 | 10.8 |
| | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | | | 1923 | 1922 | |
| Jan...... | 44 | 2,410 | 2,022 | 19.2 | 55 | 9,530 | 8,013 | 18.9 | 48 | 9,730 | 7,345 | 32.6 | 55 | 2,553 | 2,064 | 23.6 | 87 | 3,722 | 3,441 | 8.2 |
| Feb...... | 43 | 2,312 | 1,808 | 27.9 | 54 | 9.018 | 7,471 | 2.06 | 49 | 8,992 | 6,957 | 29.2 | 55 | 2,541 | 2.042 | 24.4 | 86 | 3,511 | 3,374 | 4.1 |

# Grading Utilities on Service

## Instructions Under Which Illinois Commerce Commission Inspectors Work in Drawing Up Their Classification—Technical, Business and Public Relations Factors Are All Taken Into Consideration

By J. HOWARD MATHEWS
*Service Engineer Illinois Commerce Commission*

"BY THEIR fruits shall ye know them" might be taken from its scriptural context and translated "By their service shall ye know them" for application to public utility activities. Given supervision over service as well as over other activities of the utilities, a public utility commission becomes the recipient of all sorts of complaints, some justified and many unjustified. For the purpose of bringing up the service averages of the utilities in the state, checking compliance with the service rules established by the commission, and above all forestalling as far as possible the complaints and controversies that do neither the utilities nor the public any good, the engineering section of the Illinois Commerce Commission has established a grading system under which Illinois utilities are being graded in the regular routine of inspection. Periodic reports are made, all the utilities in the state receiving copies of the grades assigned to the various localities. The first list was mailed on Aug. 10, 1922, to all electric utilities in the state, covering about seven hundred localities. The highest grade was 96.45 per cent and the lowest 56.5 per cent. Needless to say, the list attracted widespread interest. The reaction was favorable, only one organization expressing resentment, which was dispelled when the company became familiar with the detailed instructions under which the grading is done. The seriousness with which some of the utilities view the grading was shown recently when one of the larger companies desired emergency service from another large company. The latter was reluctant to furnish the service until assured by the service division of the commission that the poor voltage regulation, if any developed resulting from the abnormal load, would be overlooked in the grading.

TABLE I—TYPICAL GRADING OF AN ELECTRIC UTILITY AS SHOWN ON AN INSPECTOR'S REPORT

This form is used in grading service of electric utilities. Grades have been assumed for the various factors of service and computations made to determine the final grade.

| Condition of Service | Weight | Grade | Weighted Score |
|---|---|---|---|
| Continuity of service | 30 | 89 | 2,670 |
| Voltage regulation | 15 | 80 | 1,200 |
| Handling of complaints | 10 | 80 | 800 |
| Meter testing | 7 | 95 | 665 |
| Consumers' attitude | 5 | 80 | 400 |
| Provisions for emergency | 3 | 60 | 180 |
| Adequacy of capacity | 2 | 80 | 160 |
| Construction of distribution lines | 2 | 80 | 160 |
| Maintenance of distribution lines | 2 | 75 | 150 |
| Extension policy | 2 | 95 | 190 |
| Furnishing new service | 1 | 95 | 95 |
| Adjustment of bills | 1 | 100 | 100 |
| Billing | 1 | 90 | 90 |
| Grounding of secondaries | 1 | 60 | 60 |
| Total of service | 82 | ... | .... |
| Records: | | | |
| Record of interruptions | 5 | 60 | 300 |
| Voltage surveys and records | 5 | 20 | 100 |
| Records of meters and tests | 4 | 80 | 320 |
| Record of complaints | 4 | 0 | 000 |
| Total for records | 18 | ... | |
| Final grade, | | | 76.40 |

When any company is informed of the results of an inspection, a list showing the detailed grades given for each factor in service rating is also supplied. Some companies delegate individuals to visit the commission offices to study the grades in detail and learn how their standing may be improved, which means an improvement in service. Some have made an immediate study to remedy conditions that produced a low grading, and the engineering section of the commission has been asked in a number of cases to make another inspection so that the showing made would be better.

### Factors in Electric Utility Service

The most important factors entering into electric utility service are thirteen in number. They are: (1) Continuity of service, (2) voltage and frequency regulation, (3) accuracy of meter registration, (4) construction and maintenance, (5) adequacy of capacity, (6) provisions for emergency, (7) adjustment of bills, (8) billing, (9) extension policy, (10) promptness of furnishing new service, (11) handling of complaints, (12) courtesy of utility representatives, and (13) testing of service and keeping of records.

It is fairly obvious that such items as continuity of service, voltage regulation, meter accuracy, extension policies, handling of complaints and courtesy of utility representatives have a direct bearing on public relations. The others are perhaps not so direct in their relation but are of vital importance in maintaining the factors mentioned on a satisfactory basis.

Table I shows the various factors and the weight, typical grade and typical weighted score as well as the final grade recorded on an inspection sheet. Detailed instructions to inspectors have been prepared to insure uniformity of opinion and in so far as possible to eliminate the element of personal judgment.

These instructions are so specific that by their use any one would arrive at virtually the same final grade that a commission inspector would reach. It is apparent from a study of these instructions that the grading is not based on compliance with commission rules, but rather on service conditions and on records that any well-managed company would desire to keep. For this reason the operating companies could use these instructions to grade their own service, delegating some individual to study service conditions and to assign a grade on his knowledge obtained through inspections. Such a course would, in the opinion of the writer, be highly beneficial, and some of the most progressive utilities already have it under consideration.

The method as outlined in the inspectors' instructions for arriving at the values assigned to the various factors is as follows:

*Continuity of Service.*—Grades for continuity of service

depend upon the total duration of outages, number of interruptions per month and the time they occur. Table II shows grades to be given under different conditions. For the purpose of grading, the following classification of interruptions has been made, those falling in class A being least serious and those in class C most serious. Specifically, interruptions should be classified as follows:

**Class A**

1. Between 11 p.m. and morning.
2. When service is intentionally interrupted for the purpose of working on line, in stations, etc. (It is assumed that proper notice of such interruptions will be given consumers likely to be affected.)
3. During the daytime when the interruption does not come in class B or C.

**Class B**

(Usually applicable to power service in small and medium-size towns.)

Where interruptions affect power users having a combined connected load of 25 hp. or more, the use of such power being at least thirty hours per month. This class will usually include interruptions to grain elevators, mills, pumps, etc., operating short hours on indefinite schedules.

**Class C**

1. Between dusk and 11 p.m.
2. Interruptions in the daytime where they affect power used for industrial purposes, such as manufacturing and mining, where the service is usually used on a definite schedule of several hours daily and where the interruption may result in serious economic loss to the industries.

*Voltage Regulation.*—To determine the grade for voltage regulation during the lighting period the deductions given in Table III should be made. If the voltage is above the standard, or below the standard at other periods than during the lighting hours, the deduction from the grade shall be only one-third of that shown in the table.

*Handling of Complaints.*—Grading on this is to cover courtesy of employees, promptness and efficiency in disposing of complaints and success in satisfying complainants. To assist in determining the grade, the following apportionment of percentages is to be used:

| | Per Cent |
|---|---|
| 1. Efficiency and promptness of employees in eliminating condition complained of | 50 |
| 2. Courtesy and tact of employees | 30 |
| 3. Action of company to prevent recurrence of condition | 20 |
| Note.—If no records of complaints are kept, give no more than | 90 |

*Meter Testing.*—

| | Per Cent |
|---|---|
| (a) If initial tests are not made, deduct | 10 |
| (b) If installation tests are overdue (depending on per cent of tests and length of time overdue), deduct | 1 to 20 |
| (c) If periodic tests are overdue, deduct 1 to 4 per cent for each per cent of meters overdue in accordance with the following: | |
| If 1 to 6 months overdue, deduct | 1 |
| If 7 to 12 months overdue, deduct | 2 |
| If 13 to 18 months overdue, deduct | 3 |
| If 19 to 24 months overdue, deduct | 4 |
| (d) If proper testing facilities and equipment are not provided and checked (depending on seriousness of violation), deduct | 1 to 15 |
| (e) If testing is not done in accordance with standard practice, or where proper methods are not employed, deduct | 1 to 20 |
| (f) If request tests are not willingly and properly made, deduct | 10 |
| Note 1.—If initial tests only are made, allow not more than | 10 |
| If installation tests only are made, allow not more than | 20 |
| If periodic tests only are made, allow not more than | 70 |

Note 2.—Where installation meter tests or periodic meter tests are not yet overdue, but very nearly so, the grade given for meter testing should be determined by the judgment of the inspector and should depend upon the possibility or the likelihood that these tests will be completed within the required period in conformity with the rules.

*Consumers' Attitude.*—The following instructions serve as a guide in grading this particular factor of service:

| Class | Attitude | Grade | Instructions for Classification |
|---|---|---|---|
| A | Excellent | 95-100 | Practically everybody satisfied and commending company for its service. |
| B | Good | 85-95 | Where those interviewed have practically no complaint; neither do they have any particular commendation to make, showing a general spirit of indifference. |
| C | Fair | 70-85 | Some complaint. A general feeling that service is not quite what it ought to be. |
| D | Poor | 40-70 | Attitude generally unfavorable. A general criticism of service, but public tolerant. |
| E | Very unfavorable | 00-40 | Public critical and antagonistic with possible agitation for service from some other source. |

The grading is to cover the attitude toward the company, its employees and its service as this attitude has been developed through the furnishing of this particular class of service. Interviews should be held with at least two city

TABLE II—USED TO GRADE UTILITIES FOR CONTINUITY OF ELECTRIC SERVICE

| Hours of Interruptions per Month | | | Number of Interruptions per Month (Including Kick-offs) | | | | | |
|---|---|---|---|---|---|---|---|---|
| Class A | Class B | Class C | 0–8 | 9–16 | 17–24 | 25–32 | 33–40 | 41–50 |
| 0 | 0 | 0 | 100 | 98 | 96 | 94 | 92 | 90 |
| 0 35 | 0.25 | 0.20 | 99 | 97 | 95 | 93 | 91 | 89 |
| 0 70 | 0.50 | 0.40 | 98 | 96 | 94 | 92 | 90 | 88 |
| 1 00 | 0.75 | 0.60 | 97 | 95 | 93 | 91 | 89 | 87 |
| 1 50 | 1.00 | 0.80 | 96 | 94 | 92 | 90 | 88 | 86 |
| 2 00 | 1.40 | 1.00 | 95 | 93 | 91 | 89 | 87 | 85 |
| 2 50 | 1.60 | 1.25 | 94 | 92 | 90 | 88 | 86 | 84 |
| 3.00 | 2.00 | 1.50 | 93 | 91 | 89 | 87 | 85 | 83 |
| 3.50 | 2.35 | 1.75 | 92 | 90 | 88 | 86 | 84 | 82 |
| 4.00 | 2.65 | 2 00 | 91 | 89 | 87 | 85 | 83 | 81 |
| 4.50 | 3.00 | 2.25 | 90 | 88 | 86 | 84 | 82 | 80 |
| 5.00 | 3.40 | 2.50 | 89 | 87 | 85 | 83 | 81 | 79 |
| 5.50 | 3.75 | 2.75 | 88 | 86 | 84 | 82 | 80 | 78 |
| 6.00 | 4.10 | 3.00 | 87 | 85 | 83 | 81 | 79 | 77 |
| 6.50 | 4 50 | 3.30 | 86 | 84 | 82 | 80 | 78 | 76 |
| 7.00 | 4.85 | 3.60 | 85 | 83 | 81 | 79 | 77 | 75 |
| 7.50 | 5.25 | 3.90 | 84 | 82 | 80 | 78 | 76 | 74 |
| 8.00 | 5.65 | 4.20 | 83 | 81 | 79 | 77 | 75 | 73 |
| 8.50 | 6.00 | 4 50 | 82 | 80 | 78 | 76 | 74 | 72 |
| 9.00 | 6.40 | 4.75 | 81 | 79 | 77 | 75 | 73 | 71 |
| 9.50 | 6.80 | 5.00 | 80 | 78 | 76 | 74 | 72 | 70 |
| 10.00 | 7.20 | 5.30 | 79 | 77 | 75 | 73 | 71 | 69 |
| 10.65 | 7.60 | 5.60 | 78 | 76 | 74 | 72 | 70 | 68 |
| 11.35 | 8.00 | 5.90 | 77 | 75 | 73 | 71 | 69 | 67 |
| 12.00 | 8.40 | 6.25 | 76 | 74 | 72 | 70 | 68 | 66 |
| 12.65 | 8.80 | 6.50 | 75 | 73 | 71 | 69 | 67 | 65 |
| 13.35 | 9.20 | 6.85 | 74 | 72 | 70 | 68 | 66 | 64 |
| 14.00 | 9.60 | 7.20 | 73 | 71 | 69 | 67 | 65 | 63 |
| 14.65 | 10.00 | 7.50 | 72 | 70 | 68 | 66 | 64 | 62 |
| 15.35 | 10.50 | 7.80 | 71 | 69 | 67 | 65 | 63 | 61 |
| 16.00 | 11.00 | 8.10 | 70 | 68 | 66 | 64 | 62 | 60 |
| 16.65 | 11 50 | 8.40 | 69 | 67 | 65 | 63 | 61 | 59 |
| 17.35 | 12.00 | 8.75 | 68 | 66 | 64 | 62 | 60 | 58 |
| 18.00 | 12.50 | 9.10 | 67 | 65 | 63 | 61 | 59 | 57 |
| 18.65 | 13.00 | 9.40 | 66 | 64 | 62 | 60 | 58 | 56 |
| 19.35 | 13.50 | 9.70 | 65 | 63 | 61 | 59 | 57 | 55 |
| 20.00 | 14.00 | 10.00 | 64 | 62 | 60 | 58 | 56 | 54 |
| 21.25 | 14.50 | 10.25 | 63 | 61 | 59 | 57 | 55 | 53 |
| 22.50 | 15.00 | 10.50 | 62 | 60 | 58 | 56 | 54 | 52 |
| 23.75 | 15.65 | 11.15 | 61 | 59 | 57 | 55 | 53 | 51 |
| 25.00 | 16.35 | 11.40 | 60 | 58 | 56 | 54 | 52 | 50 |
| 26.25 | 17.00 | 12.05 | 59 | 57 | 55 | 53 | 51 | 49 |
| 27.50 | 17.65 | 12.30 | 58 | 56 | 54 | 52 | 50 | 48 |
| 28.75 | 18.35 | 12.55 | 57 | 55 | 53 | 51 | 49 | 47 |
| 30.00 | 19 00 | 13.20 | 56 | 54 | 52 | 50 | 48 | 46 |
| 31 25 | 19.65 | 13.45 | 55 | 53 | 51 | 49 | 47 | 45 |
| 32.50 | 20.35 | 14.10 | 54 | 52 | 50 | 48 | 46 | 44 |
| 33.75 | 21.00 | 14.35 | 53 | 51 | 49 | 47 | 45 | 43 |
| 35.00 | 22.60 | 15.00 | 52 | 50 | 48 | 46 | 44 | 42 |
| 36.25 | 24.20 | 15.65 | 51 | 49 | 47 | 45 | 43 | 41 |
| 37.50 | 25.80 | 16.35 | 50 | 48 | 46 | 44 | 42 | 40 |
| 38.75 | 27.40 | 17.00 | 49 | 47 | 45 | 43 | 41 | 39 |
| 40.00 | 29.00 | 17.65 | 48 | 46 | 44 | 42 | 40 | 38 |
| 41.25 | 30.60 | 18.35 | 47 | 45 | 43 | 41 | 39 | 37 |
| 42.50 | 32.00 | 19.00 | 46 | 44 | 42 | 40 | 38 | 36 |
| 43.75 | 33.80 | 19.65 | 45 | 43 | 41 | 39 | 37 | 35 |
| 45.00 | 35.40 | 20.35 | 44 | 44 | 40 | 38 | 36 | 34 |
| 46.00 | 37.00 | 22.00 | 43 | 41 | 39 | 37 | 35 | 33 |
| 47.50 | 38.50 | 24.00 | 42 | 40 | 38 | 36 | 34 | 32 |
| 48.75 | 40.00 | 26.00 | 41 | 39 | 37 | 35 | 33 | 31 |
| 50.00 | 41.50 | 28.00 | 40 | 38 | 36 | 34 | 32 | 30 |
| 51.25 | 43.00 | 30.00 | 39 | 37 | 35 | 33 | 31 | 29 |
| 52.50 | 44.50 | 32.00 | 38 | 36 | 34 | 32 | 30 | 28 |
| 53.75 | 46.00 | 34.00 | 37 | 35 | 33 | 31 | 29 | 27 |
| 55.00 | 47.75 | 36.00 | 36 | 34 | 32 | 30 | 28 | 26 |
| 56.25 | 49.50 | 38 00 | 35 | 33 | 31 | 29 | 27 | 25 |
| 57.50 | 51.00 | 40.00 | 34 | 32 | 30 | 28 | 26 | 24 |
| 58.75 | 52.50 | 42.00 | 33 | 31 | 29 | 27 | 25 | 23 |
| 60 00 | 54.00 | 44.00 | 32 | 30 | 28 | 26 | 24 | 22 |
| 62.50 | 55.50 | 46.00 | 31 | 29 | 27 | 25 | 23 | 21 |
| 65 00 | 57.00 | 48.00 | 30 | 28 | 26 | 24 | 22 | 20 |
| 67.50 | 58.50 | 50.00 | 29 | 27 | 25 | 23 | 21 | 19 |
| 70 00 | 60.00 | 52.00 | 28 | 26 | 24 | 22 | 20 | 18 |
| 72.50 | 63.00 | 54.00 | 27 | 25 | 23 | 21 | 19 | 17 |
| 75 00 | 66.00 | 56.00 | 26 | 24 | 22 | 20 | 18 | 16 |
| 77.50 | 69.00 | 58.00 | 25 | 23 | 21 | 19 | 17 | 15 |
| 80.00 | 72.00 | 60.00 | 24 | 22 | 20 | 18 | 16 | 14 |
| 82 50 | 75.00 | 63.00 | 23 | 21 | 19 | 17 | 15 | 13 |
| 83.00 | 78.00 | 66.00 | 22 | 20 | 18 | 16 | 14 | 12 |
| 87.50 | 81.00 | 69.00 | 21 | 19 | 17 | 15 | 13 | 11 |
| 90.00 | 84.00 | 72.00 | 20 | 18 | 16 | 14 | 12 | 10 |
| ..... | 87.00 | 75.00 | 19 | 17 | 15 | 13 | 11 | 9 |
| ..... | 90.00 | 78.00 | 18 | 16 | 14 | 12 | 10 | 8 |

*Use of Table*—Column A will be used when two-thirds or more of the total time of outages is in class A.

Column B will be used when most of the total time of outages occurs in class B or when about one-half of the total time falls in class A and one-half in class C.

Column C will be used when two-thirds or more of the total time of outages falls in class C. In certain cases interpolation between the curves is recommended. For instance, if 10 per cent should fall in class A, 45 per cent in class B, 45 per cent in class C, a compromise between the results secured from curves B and C should be used.

The table is based on interruptions per month covering the nine months' period previous to the inspection or the period since the last inspection. The object in using a nine months' period is to insure that part of the period will cover the months where transmission and distribution systems are usually affected by storms; also to insure the covering of certain months not usually affected by storms

In the case of partial interruptions, multiply the duration of interruptions by the per cent of the consumers affected and consider the resultant time as a total interruption to the entire community. To illustrate: An interruption of five hours to 20 per cent of the consumers should be considered equivalent to one hour's total interruption. Interruptions to street-lighting circuits shall be counted in determining the number of interruptions per month, but their duration shall not be considered in determining hours of interruptions.

officials if possible, representatives of civic organizations, representative business men and representative consumers. If it appears necessary to give a very low grade, greater care should be taken to determine accurately the public attitude.

*Provisions for Emergency.*—In grading provisions for emergency make the following deductions:

1. Subtract 5 per cent for each hour of interruption per month (counting only those interruptions of thirty minutes or more duration).
2. In addition to deductions for interruptions outlined under (1), make the following deductions:

| | Per Cent |
|---|---|
| (a) Two transmission lines and standby plant under steam, deduct | 0 to 10 |
| (b) One transmission line or local generating plant with reserve steam plant under steam, deduct | 0 to 15 |
| (c) Two transmission lines on different pole lines, deduct | 5 to 15 |
| (d) Two transmission lines on same pole line, deduct | 10 to 20 |
| (e) One transmission line reserve steam plant not under steam, deduct | 10 to 25 |
| (f) One transmission line—no reserve supply. Local generating plant—no reserve, deduct | 15 to 40 |

Whether the minimum or maximum deduction is made under the above rule will depend on the following:

(a)* Dependability of source of supply (including construction and maintenance of plant, transmission line and substation).
(b) Reserve plant equipment, transformers, etc.
(c) Availability of workmen in emergency at point of trouble, consideration being given to distance to be traveled, kinds of roads, transportation, etc.
(d) Lightning arrester equipment.

*Note.—This is the only place where consideration is given to construction and maintenance of supply sources. It may seem at first glance that any deduction where standby equipment is maintained is not exactly logical but the grade assigned will depend on the protection given; viz., it might be nearly 100 per cent where the standby equipment is so located that the likelihood of service interruptions is almost nil. In less favorable situations the grade would be lower.

*Adequacy of Capacity.*—The following table gives the possible deductions for inadequacy of facilities:

| When served entirely from local plant: | Per Cent |
|---|---|
| Generator capacity | 25 |
| Boiler capacity | 20 |
| Prime-mover capacity | 20 |
| Auxiliaries, wiring, piping, switchboards | 10 |
| Distribution system (including transformers, primaries and secondaries) | 25 |
| **When served entirely or in part from transmission line:** | |
| Source of supply capacity (including generating plant) | 45 |
| Substation capacity | 30 |
| Distribution system (including transformers, primaries and secondaries) | 25 |

*Construction of Distribution Lines.*—The following table gives the possible deductions for poor construction:

| Material: | Per Cent |
|---|---|
| Poles—kind, size, quality, treatment | 35 |
| Wires | 10 |
| Arms, pins, braces, insulators | 10 |
| Guys—kind and size of anchors and wire | 5 |

| Workmanship: | Per Cent |
|---|---|
| Pole setting (including regularity of spacing) | 20 |
| Wire installation (sags, ties, splices) | 10 |
| Cross-arm assembly (including insulators, pins, braces and double arms) | 5 |
| Guying | 5 |

*Maintenance of Distribution Lines.*—The following table gives the possible deductions for poor maintenance:

| | Per Cent |
|---|---|
| Poles | 30 |
| Arms, pins, insulators, braces | 25 |
| Clearance from trees and structures | 20 |
| Clearance from other wires and from ground | 15 |
| Transformers | 5 |
| Lightning arresters | 5 |

*Extension Policy.*—Grade to depend on degree of compliance with rule covering line extensions and on promptness in making extensions.

*Furnishing New Service.*—Grade to depend on promptness in furnishing new service where line extensions are not necessary.

*Adjustment of Bills.*—Grade to be based on company's policy of refunding on over-registering meters.

*Billing.*—Grade to depend on whether bills are sent, whether they are properly, accurately and completely made out, whether suitable form is used, and whether billing is in any other way unsatisfactory.

*Grounding of Secondaries.*—

| | Per Cent |
|---|---|
| 1. For each per cent up to 20 of transformers not grounded, deduct | 2.0 |
| For each per cent above 20, deduct | 0.75 |
| 2. If grounds are not properly installed, multiply grade arrived at under (1) by 0.5 to 1.0. | |

STATE OF ILLINOIS
**ILLINOIS COMMERCE COMMISSION**
ELECTRIC SERVICE INSPECTION

Utility City Pop.
Official Title Inspector District
Distribution Voltage Cycle Phase Date Inspection Last Inspected
Hours of Operation Consumers as of 192
Local Plant: Voltage Phase Transmission Line: Voltage Phase
Substation: Voltage Phase No., Size and Connection of Transformers
Nearest Office Extensions and Alterations
Provisions for Emergency
Is Capacity Adequate? Character of Construction
Is Force Sufficient? Is Force Qualified?
Important Changes in Staff Special Report
Interviews—City Officials Others
Attitude
1. Records and Reports
2. Meter Records
3. Meter Test Records
4. Station Records
5. Complaints
6. Interruptions (Make general statement. Attach detailed record): From to
Summary A B C
8. Testing Facilities
9. Meter Test Loads & Errors
10. Watt-hour Meter Accuracy
11. Demand Meter Accuracy
12. Initial Meter Tests
13. Installation Meter Tests
14. Periodic Meter Tests
15. Request Tests
17. Adjustment of Bills
18. Voltage Regulation Method

Voltage Charts

| Name | Address | Date on | Date off | Hours on | Std | Lighting Hours | | | Outside of Lighting Hours | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Max. | Min. | % Variation | Max. | Min. | % Variation |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

19. Voltage Surveys
20. Frequency
21. Groundings of Secondaries
22. Extension of Lines
23. Information to Consumers
Section 10—G. O. No. 28. Posting of Public Notices.
G. O. No. 30—Particularly rules 201, 203, 217, 220, 221, 225, 229, 305, 306:
*Mark with cross (X) rules violated and explain nature of violation, using opposite side where necessary.

FRONT OF REPORT FORM USED BY INSPECTORS IN ESTABLISHING GRADES

The reverse side, on which the final grades are recorded, is shown in Table I.

*Record of Interruptions.*—Grade to be determined by judgment of inspector.

| | Per Cent |
|---|---|
| If separate record is not kept, deduct | 20 |
| If duplicate record is not kept in local office, deduct | 15 |

*Voltage Surveys and Records.*—Grading to be largely determined by comprehensiveness of survey.

| | Per Cent |
|---|---|
| For failure to keep records, deduct | 1 to 20 |
| For failure to keep recording voltmeter in continuous use, deduct | 1 to 15 |
| If a recording voltmeter has been provided where required but no surveys have been made, give not more than | 15 |
| If duplicate records are not kept in the local office, deduct | 15 |

*Records of Meters and Tests.*—

| | Per Cent |
|---|---|
| If meter record is unsatisfactory as to form or completeness, deduct | 1 to 40 |
| If meter test record is unsatisfactory as to form or completeness, deduct | 1 to 60 |
| If duplicates of these records are not kept in the local office, deduct | 10 to 20 |

*Record of Complaints.*—The table following gives the possible deductions for failure to show on the complaint record the indicated information:

TABLE III—TABLE OF DEDUCTIONS IN PER CENT TO BE MADE FOR VOLTAGE REGULATION BELOW THE STANDARDS ESTABLISHED BY THE ILLINOIS COMMERCE COMMISSION

The deduction depends on the number of consumers affected as well as the voltage regulation.

Per Cent Below Standard (During Lighting Hours)

| Per Cent Customers Affected | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 |
| 3 | | | | | | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 4 | 4 | 5 | 6 | 7 | 7 | 8 | 9 | 10 |
| 4 | | | | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 6 | 8 | 9 | 9 | 10 | 11 | 13 |
| 5 | | | | 1 | 1 | 2 | 3 | 3 | 4 | 3 | 4 | 4 | 5 | 5 | 5 | 6 | 7 | 8 | 10 | 11 | 12 | 12 | 13 | 16 |
| 6 | | | | 1 | 1 | 2 | 4 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 6 | 8 | 9 | 10 | 12 | 13 | 14 | 15 | 16 | 18 |
| 7 | | | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 9 | 11 | 12 | 13 | 14 | 15 | 17 | 18 | 20 |
| 8 | | | 1 | 2 | 2 | 3 | 4 | 4 | 4 | 5 | 5 | 6 | 6 | 8 | 9 | 10 | 12 | 13 | 14 | 15 | 17 | 18 | 19 | 22 |
| 9 | | | 1 | 2 | 2 | 3 | 4 | 5 | 5 | 5 | 6 | 7 | 7 | 8 | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 21 | 24 |
| 10 | | | 1 | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 9 | 11 | 12 | 14 | 15 | 16 | 17 | 19 | 21 | 23 | 25 |
| 11–15 | | | 1 | 2 | 3 | 3 | 5 | 6 | 7 | 7 | 8 | 8 | 9 | 11 | 13 | 14 | 16 | 18 | 19 | 22 | 24 | 25 | 27 | 30 |
| 16–20 | | | 2 | 3 | 3 | 4 | 6 | 7 | 8 | 9 | 10 | 10 | 12 | 13 | 16 | 18 | 20 | 22 | 23 | 24 | 28 | 29 | 32 | 36 |
| 21–30 | | | 2 | 3 | 4 | 5 | 7 | 8 | 9 | 11 | 12 | 13 | 14 | 16 | 19 | 21 | 23 | 25 | 27 | 30 | 33 | 36 | 41 | 45 |
| 31–40 | | | 2 | 3 | 4 | 6 | 8 | 9 | 10 | 13 | 14 | 15 | 17 | 19 | 23 | 25 | 27 | 30 | 32 | 35 | 38 | 42 | 48 | 52 |
| 41–50 | | | 2 | 4 | 5 | 7 | 9 | 11 | 12 | 15 | 16 | 17 | 20 | 23 | 26 | 29 | 31 | 35 | 37 | 40 | 44 | 48 | 56 | 62 |
| 51–60 | | | 2 | 4 | 6 | 8 | 11 | 12 | 15 | 17 | 18 | 20 | 23 | 26 | 29 | 33 | 36 | 39 | 43 | 46 | 50 | 56 | 64 | 70 |
| 61–70 | | | 3 | 5 | 7 | 8 | 11 | 13 | 16 | 18 | 20 | 22 | 25 | 28 | 32 | 36 | 38 | 42 | 46 | 49 | 54 | 60 | 68 | 75 |
| 71–80 | | | 3 | 6 | 7 | 9 | 12 | 14 | 17 | 20 | 22 | 25 | 28 | 31 | 35 | 39 | 41 | 46 | 50 | 54 | 59 | 66 | 75 | 82 |
| 81–90 | | | 3 | 6 | 8 | 10 | 13 | 16 | 19 | 22 | 24 | 28 | 31 | 34 | 38 | 42 | 45 | 49 | 54 | 58 | 64 | 72 | 81 | 90 |
| 91–100 | | | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 31 | 35 | 38 | 42 | 46 | 50 | 55 | 60 | 65 | 72 | 80 | 89 | 100 |

Note—If no records of results of utilities' surveys are available, give not more than 90 per cent.

| | Per Cent |
|---|---|
| Final disposal | 25 |
| Result of investigation | 20 |
| Name and address | 15 |
| Date and receipt | 10 |
| Date completed | 10 |
| Time of receipt | 5 |
| Nature of complaint | 5 |
| Time of day completed | 5 |
| By whom conducted | 5 |
| If duplicate records are not kept at local office, deduct... | 15 |

# Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

## Safety Should Not Wait on the Printer

*To the Editors of the* ELECTRICAL WORLD:

I desire to answer the recent letter by Dana Pierce of the Underwriters' Laboratories and of the code committee in regard to the new code, since to my mind it either gives a wrong impression or indicates a very serious situation.

Mr. Pierce's letter seems to imply that, in spite of the action of the code committee in regard to changes in practice, these changes are not to be recognized until they shall have been printed and issued in some special or regular form. Does this mean that the insurance companies are not going to recognize the changes and that they intend for a time to charge the extra premiums called for by their schedules for installations that are made in violation of the 1920 code but in accordance with the recent action of the code committee? Legally an insurance company has the right to charge any premium it chooses, but I cannot believe that the insurance companies really mean to do this. I believe Mr. Pierce's letter gives the wrong impression and that the insurance companies, rather than charging extra premiums for installations made in accordance with the changes, will welcome the changes.

In the case of municipal inspection the case is somewhat different. The right of a municipal inspector to dictate the details of electric installation rests on the police power of the state to secure safety for the public. Under our constitution a municipal inspector may not do anything he chooses but must act in accordance with the law. He may reject an installation or prevent connection to it because he considers it unsafe, but may not do so to satisfy his personal prejudices.

If a municipal inspector undertakes to use his office and his power improperly, the courts have the power and right to order him to do otherwise. The municipal inspectors are not bound by any particular edition of the code, nor in fact are they bound by the code or any code.

As Mr. Pierce indicates in his letter, each inspection department has the power and right to decide for itself just when (if ever) it will adopt the changes. It has the power to adopt them when the new code is issued or at some later date. It also has the power and right to adopt them at any time, as immediately. This is fully within the right of the inspection departments, and properly so, since it is their duty to work at all times for the best construction. They are not required to wait for the printer.

A code that is revised only at periodic intervals will obviously not include the better methods that have been developed since its last revision; hence an inspection department that is working for the best construction would seem most certainly to have not only the power and right but the duty to be ahead of the last printed code. Mr. Pierce's letter, however, seems to suggest that the inspectors should for several months adopt a different policy and that they should forbid certain forms of construction, not because they are unsafe but merely because a certain book has not been printed.

If a case comes before the court, the inspector cannot testify that he rejects an installation that is safe merely because the new code has not been printed, or rather, if he should so testify, the judge will order him to approve the installation and issue the permits. In order to maintain his position, the inspector will have to testify that in his honest opinion the installation is really unsafe. Now, in regard to the changes under discussion, there may be inspectors who will honestly so testify, but the great majority of our inspectors are both honest and able, and when the situation arises will undoubtedly allow the new methods without waiting for the printing of the changes in a particular form.

We all of us realize the importance of standard rules. In many cases the advantage of such rules is sufficiently great to warrant slight departures from the best practice. The importance and advantage of standard rules is, however, by no means controlling in all cases. Some changes are best brought about gradually.

I wish to suggest the following procedure: That inspection departments should continue to allow con-

struction according to the 1920 code until the new code is printed and distributed, and also allow it for such further time as in their judgment will reasonably permit manufacturer and wiring contractor to adjust themselves to the new conditions.

That in addition the inspection departments should allow construction according to the proposed changes and also according to any other improved methods which in their opinion will result safely so far as either fire or life or other similar hazard is concerned.

That such departure from the 1920 code should in all cases be made under special inspection such that the records of any unusual happening shall be available.

There would seem to be no question that most inspection departments have the power and right to follow the above procedure, the only exception that I think of being the cases where there is a state or municipal ordinance specifying the methods of construction.

If inspection departments will continue to allow the 1920 code for a reasonable time and will also as soon as practicable allow, as alternatives and under special inspection, the better methods recently acted on by the code committee, then I believe the best results will be obtained for the public. R. S. HALE.

### Some Hints About Rural Service

*To the Editors of the* ELECTRICAL WORLD:

I should like to offer a few comments in answer to your question which appeared in the ELECTRICAL WORLD for March 17: "How shall our farms be served with electricity?"

We are serving approximately seven hundred farms in the north central part of Ohio, as well as ten small towns having no greater population than four hundred people. The lines constructed and in operation pass probably a thousand more farms, which will give our lines seventeen hundred farm meters when development is completed. This, we estimate, will be in five years. Our average customer's light bill is $3 per month, at $1 service charge and 12 cents per kilowatt-hour consumption charge, with a discount of 10 per cent on bills of more than $5 per month. The billing fluctuates considerably throughout the year, but not so much as some "rural authorities" believe.

Our construction is all overhead, with the exception of four miles of underground line which we have placed for experimental purposes with the thought in mind that eventually (probably in twenty-five years), after the farm business is thoroughly developed, all farm circuits will be under ground. This condition will be brought about by legislation due to public opinion, which will be worked up about that time against all cheap overhead construction. Some people might ask: "Why not put these circuits under ground at the start?" This would be impossible economically. It will take twenty-five years to develop the use of electricity for power even after all the farms are connected to the lines.

My conclusions during the short period that we have been engaged in this rural business can be summed up as follows in some rules for the central-station man:

Don't plan a line that is capable of taking care of large power requirements, because the energy cannot be sold at this time.

Don't make an agreement to use farmers to do the labor on such lines. Build all lines with your own organization.

Never change your proposal after it is once submitted unless the change is for the benefit of the farmer.

Don't make any investment of company funds in the line. Each and every farmer can well afford to spend as an initial investment $800 for line, transformer, house wiring and meter. If he says he is unable and he has the acreage, he is not sufficiently "sold" on the idea of electricity.

Don't construct lines of more than 4,600 volts or less than No. 6 copper. Don't build three-phase lines; single-phase is sufficient for many years.

Wherever possible tie your lines together, using disconnecting switches at these tie-ins. This assures maximum service and capacity with few interruptions.

Don't be alarmed at rumors from your territory before the current is turned on. We find that if there is any delay through waiting for material the farmers get worried and will listen to almost anything unfavorable, even to the extent of thinking the whole project fraudulent; but, however impatient they become, just as soon as the current is turned on they will be your friends.

Use the card system for reading your meters, having the customer mark his meter reading.

Examine the transformer, meter and lightning arresters every six months at the company's expense.

Send out a circular letter every two months stressing the point that larger consumption of energy will mean cheaper rates and better service. Advertise on your meter cards.

In closing, let me inform manufacturers and central-station men, as well as contractors or persons interested in rural development, socially or economically, that the solution of the problem does not rest with the National Electric Light Association, or the Farm Bureau, or any other agency, but with the farmer as an individual and with the central-station man who will advocate and work for the things that will make rural development easier, such as immigration and small farms. Rural service can be made profitable. J. M. HEPP,

Mead Utilities Service Company, Shelby, Ohio. Rural Division.

### Proper Connections for Meter-Test Set

*To the Editors of the* ELECTRICAL WORLD:

I note in the issue of the ELECTRICAL WORLD for March 17 a description of a meter-test set by H. S. Edwards of the Kentucky Utility Company, Pineville, Ky. The connections which Mr. Edwards shows will produce a considerable error in his results in that the meter under test will record the losses in his rotating standard. The effect of this will be that he will set his meters slower than they should be with correct connections, thus incurring a loss of income on every meter. Mr. Edwards should extend his potential wires from his rotating standard so that he can supply them with current from the service side of the meter. This can easily be done with snap connectors which may be attached to the service switch. LEON C. WHITE,

Twin State Gas & Electric Company, Bennington Division, Bennington, Vt. Manager.

### A Correction

In the article entitled "Design of Alternating-Current Substation," by R. A. Hentz, in the issue of March 3, page 513, owing to editorial errors the drawings contain the words "wrought iron" instead of "weight" when applied to the compartments and transformers in the substations.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of
Generation and Distribution Equipment, and Methods of Economically Utilizing
Electric Service in Large Industrial Plants

## Graphical Chart for Line Problems

**Charts Furnish a Convenient Means for Obtaining Voltage Drop in Distribution Layout Work—No Calculations Are Necessary When Using Charts**

IN DISTRIBUTION layout work it is desirable to know the line drop in advance, and yet it is inconvenient to have to perform the usual routine calculations, especially when many problems are handled each day. The charts described in this article were devised as a means of arriving at an accurate solution of line-drop problems quickly and without having to make any calculations whatever. In this respect they have proved very convenient to use in secondary and rural primary distribution layout work. They are flexible in so far as load, distance and power factor are concerned, but can be used only for the one voltage for which they are designed. However, this is not a serious obstacle as two charts would be sufficient for most companies, one for primary and one for secondary voltage.

The charts are based directly upon the solution of line drop by means of the vector diagram (Fig. 2):

Let $E_1$ = load voltage (assumed constant),

$\theta$ = angle of lag (or lead) of current at load,

$\phi$ = "wire angle" = arc tan $X/R$ and varies with the size and spacing of wires. The spacing is assumed to be constant for each chart, as usually standard construction will specify a certain spacing for each voltage class.

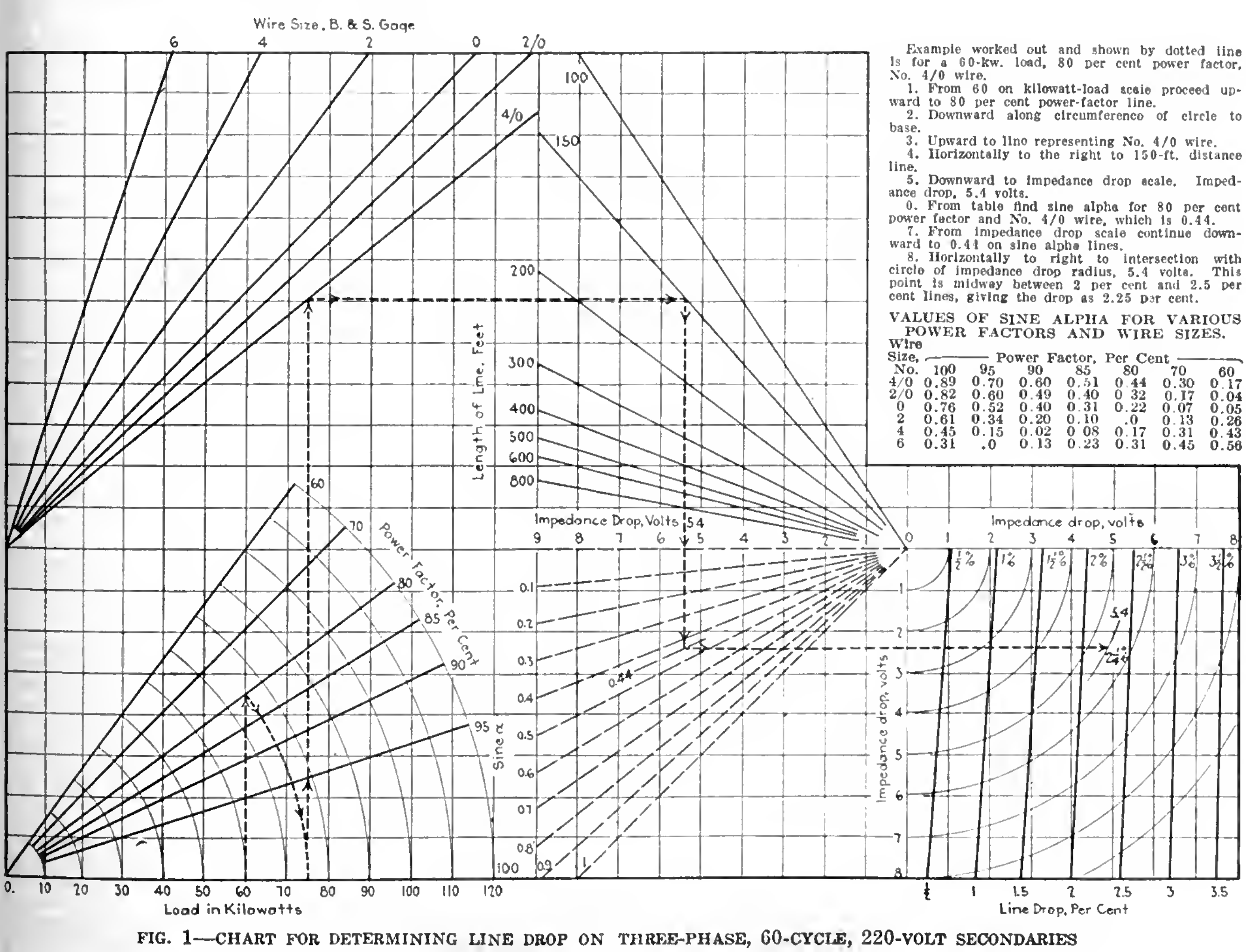
$E_g$ = voltage at source,

$E_d$ = impedance drop,

$E_g - E_1$ = line drop,

$HDI$ = locus of the impedance drop vector where the magnitude of the vector remains constant, but where the power factor or wire size (or spacing) varies (i.e., where $E_d$ remains constant in length and $\theta$ or $\phi$ vary);

$BE$ = locus of impedance drop where the value of the drop varies, but for a constant value of $\theta$ and $\phi$ (i.e., when the power factor, wire size and spacing remain constant, the impedance drop vector will be displaced from $E_1$ by the angle $\alpha$,




Example worked out and shown by dotted line is for a 60-kw. load, 80 per cent power factor, No. 4/0 wire.

1. From 60 on kilowatt-load scale proceed upward to 80 per cent power-factor line.
2. Downward along circumference of circle to base.
3. Upward to line representing No. 4/0 wire.
4. Horizontally to the right to 150-ft. distance line.
5. Downward to impedance drop scale. Impedance drop, 5.4 volts.
6. From table find sine alpha for 80 per cent power factor and No. 4/0 wire, which is 0.44.
7. From impedance drop scale continue downward to 0.44 on sine alpha lines.
8. Horizontally to right to intersection with circle of impedance drop radius, 5.4 volts. This point is midway between 2 per cent and 2.5 per cent lines, giving the drop as 2.25 per cent.

VALUES OF SINE ALPHA FOR VARIOUS POWER FACTORS AND WIRE SIZES.

| Wire Size, No. | Power Factor, Per Cent 100 | 95 | 90 | 85 | 80 | 70 | 60 |
|---|---|---|---|---|---|---|---|
| 4/0 | 0.89 | 0.70 | 0.60 | 0.51 | 0.44 | 0.30 | 0.17 |
| 2/0 | 0.82 | 0.60 | 0.49 | 0.40 | 0 32 | 0.17 | 0.04 |
| 0 | 0.76 | 0.52 | 0.40 | 0.31 | 0.22 | 0.07 | 0.05 |
| 2 | 0.61 | 0.34 | 0.20 | 0.10 | .0 | 0.13 | 0.26 |
| 4 | 0.45 | 0.15 | 0.02 | 0 08 | 0.17 | 0.31 | 0.43 |
| 6 | 0.31 | .0 | 0.13 | 0.23 | 0.31 | 0.45 | 0.56 |

FIG. 1—CHART FOR DETERMINING LINE DROP ON THREE-PHASE, 60-CYCLE, 220-VOLT SECONDARIES

regardless of the magnitude of the drop vector);

$\alpha = \phi - \theta$ for lagging power factor,

$\alpha = \phi + \theta$ for leading power factor,

$FCG$ = locus of $E_g$ when the line drop remains constant for different combinations of power factor, wire size, and loads.

The operation of the chart is shown by dotted lines in Fig. 1. From the load scale proceed vertically to the intersection with the desired power-factor line, then downward along the circumference of a circle (whose radius is the power factor line as intersected) to the base line. This gives the equivalent kilovolt-ampere load and hence is proportional to the current. Then proceed vertically to the line representing the desired wire size. The slope of this line is equal to the impedance per unit length, and the intersected vertical value gives the impedance drop per unit length for the particular case. Next proceed horizontally to the right to the desired distance line, then downward to the impedance drop scale. This determines the magnitude of the impedance drop vector ($E_d$ in Fig. 2) but not its direction.

Next find the factor corresponding to the wire size and the power factor from the table. This factor is the sine of the angle $\alpha$ (Fig. 2) and when multiplied by $E_d$, the impedance drop, gives $M$ (Fig. 2), the vertical component of the impedance drop vector with respect to the extended load voltage vector. It is evident then that the intersection on $HDI$ at a distance $M$ from the load voltage base will determine the position of the end of the impedance-drop vector and at the same time the line drop, as shown by concentric arcs similar to $FCG$. To accomplish this on the chart continue downward from the impedance-drop scale to the line representing the sine $\alpha$, then to the right to the intersection with the circle corresponding to the value of impedance drop as found above. This determines the position of the end of the impedance-drop vector ($E_d$) with respect to the concentric arcs which represent the various values of line drop and hence determines the line drop.

The arcs for scaling line drop may be constructed at equal increments of percentage drop or equal increments of voltage drop, whichever proves more convenient to use. Both the percentage drop and the voltage drop may be put on the arcs, but with most standard voltages this would involve fractional numbers, and for that reason only the percentage drop has been included on the chart shown. Likewise on charts for primary work it will be found more convenient to use some multiplier such as 20 or 50 in the impedance drop scale instead of using a scale of actual volts. This makes possible the use of small numbers

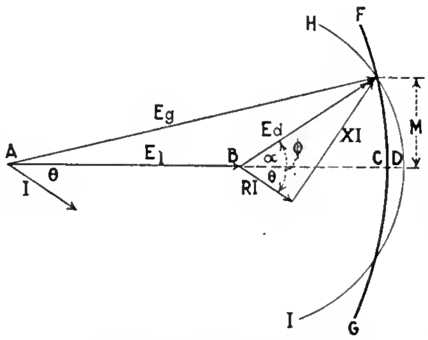



FIG. 2—LINE DROP CHART BASED ON ANALYSIS OF VECTOR DIAGRAM

and makes the chart somewhat easier to use.

If it is desired to construct a chart that can be used for both three-phase and single-phase, another scale may be added under the three-phase load scale to use for single-phase. Such a chart has been found very useful in rural distribution at 4,600 volts, where loads are handled on both single-phase and three-phase lines.

M. B. COVELL, JR.,
Distribution Engineers Department.
Detroit Edison Company,
Detroit, Mich.

## Safety Rules for Electric Crane Equipment

WHEN installing electric crane equipment the safety standards inaugurated by the Electrical Safety Conference* last fall should be kept in mind. The most important items covered are trolley conductors, overhead protection and disconnecting means, limit stops and brakes, phase reversal and low-voltage protection. The additions to the rules are given in part in the following paragraph:

### TROLLEY CONDUCTORS

*Location.*—Trolley conductors placed in the crane runway shall be located in such a position or so guarded that persons working on the crane or entering or leaving the crane cab are not likely to come into contact with live parts.

*Trolley Conductors on the Bridge.*—These conductors shall be so arranged or so guarded that hoisting cables cannot be brought into accidental contact with them and that persons cannot come into accidental contact with them. The installation of a light angle iron or its equivalent to prevent the hoisting cable from pulling against the bridge trolley of the conductors is considered sufficient protection.

*Monorail Conductors.*—Monorail runway conductors on I-beam or equivalent structural runways shall have a horizontal clearance from grounded metal parts of not less than 1½ in. if a wire is used for the conductor, or not less than 1 in. if rigid steel bars or shapes are used.

### OVERLOAD PROTECTION AND DISCONNECTING MEANS

*Main Fuses and Switch.*—Runway trolley wires for traveling cranes, or the feeder wires for other type of cranes, shall be protected by fuses or circuit breakers and controlled by a switch which can be locked in the open position. The fuses or circuit breaker and the switch shall be so located as to be easily accessible from the floor. If the circuit breaker opens all wires and is arranged so that it can be locked in the open position, the switch can be omitted.

*Bridge and Cab Switches.*—A switch shall be provided by which the operator can at all times and without leaving the cab disconnect all the equipment in the cab (except pilot lights) from its source of supply. There shall be a readily accessible switch by which all the bridge circuits and equipment (except pilot lights) can be disconnected from the runway trolley conductors or other source of supply. A single switch may in some cases serve both purposes provided it has means for locking in the open position.

*Individual Motor Protection.*—Where there is more than one motor on a single crane each motor shall be protected by fuses or by a circuit breaker or by overload relays controlling line contactors. If fuses are used, one fuse shall be provided in each conductor. If circuit breakers or overload relays are used, the number of trip coils shall not be less than that given in the following table:

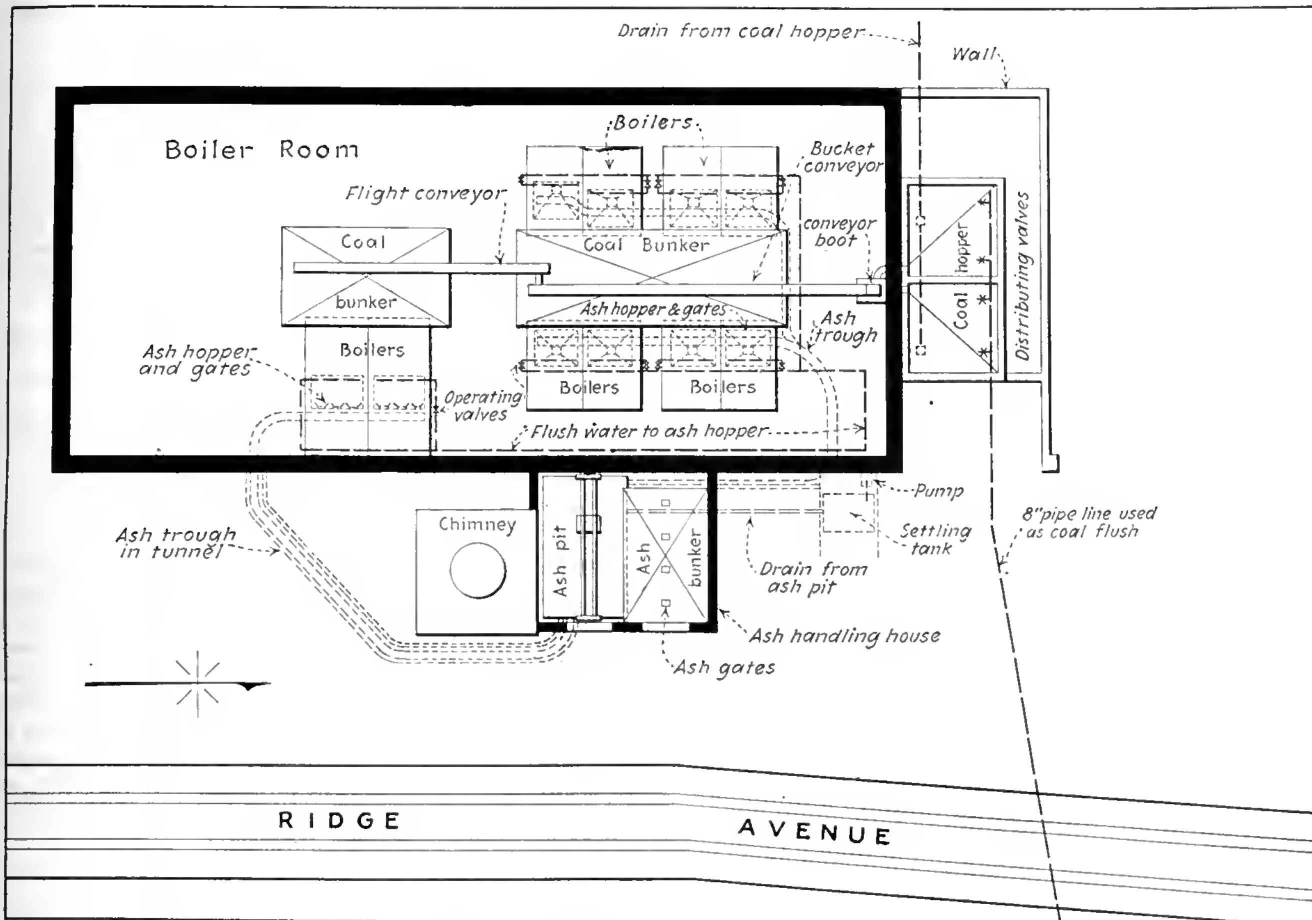
| System | Number of Trip Coils |
|---|---|
| Four-wire, two-phase, A.C. | Two (one in each phase). |
| Three-wire, two-phase, A.C. | Two (one in each outside conductor). |
| Three-wire, three-phase, A.C. | Two (one in each of two phases). |
| Two-wire, A.C. or D.C., ungrounded | One. |
| Two-wire, A.C. or D.C., grounded | One (in ungrounded conductor). |

### LIMIT STOPS AND BRAKES

*Limit Switch.*—Each hoist motor shall be equipped with a limit switch so placed and arranged as to disconnect the motor and apply the brake in time to stop the motor before the hook passes the highest point of safe travel. It is preferable to have the limit switch operated directly from the hook or block.

*Hoist Brakes.*—Each hoist motor shall be provided with a "magnet brake" so arranged that the brake will be applied when the power is cut off from the brake magnet. This brake shall have sufficient torque to sustain at least one and one-half times the full

*The Electrical Safety Conference is composed of five organizations, namely: the Associated Manufacturers of Electrical Supplies, the Electric Power Club, the National Workman's Compensation Service Bureau, the Bureau of Standards and the Underwriters' Laboratories. Its objects are the promotion by co-operative effort of the consistent development of manufacturing and installation practice with regard to accident hazards, the development of safety standards for construction and test and the interpretation and rendering uniform of electrical safety codes.




COAL AND ASHES ARE HANDLED BY WATER STREAMS IN THIS PLANT

rated load. Where a load brake is used, the "magnet brake" shall have sufficient torque to sustain at least full rated load.

*Additional Hoist Brake.*—All cranes which may handle hot metal or hazardous chemicals shall be provided with an additional brake on the intermediate shaft, which alone will meet the torque requirements of the foregoing paragraph. Cranes which have a cab on the trolley shall be provided with a brake for the trolley motion. The bridge travel shall be provided with a brake. The brakes specified for the last two cases shall be capable of producing a torque sufficient to retard at the rate of not less than one foot per second per second. When manually operated, this rate of retardation shall not require a force on the brake lever in excess of 100 lb.

*Phase Reversal.*—The runway feeders of electric cranes operated by polyphase alternating-current motors which have their direction of rotation dependent upon the proper phase relation shall be protected by a device such as a relay which will prevent starting of any of the motors on the crane if the phase rotation of these feeders is in the wrong direction.

*Low Voltage.*—Each crane shall be provided with a device which will disconnect all motors from the line on failure of power and will not permit any motor to be restarted until the controller handle is brought to the central position or a reset switch or button is operated. If a controller is arranged to return automatically to the "off" position when the operating handle is released, the low-voltage device may be omitted from that controller.

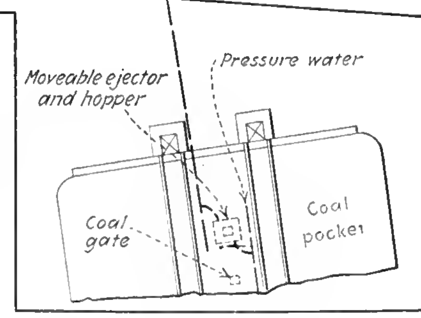
*Location of Controller.*—The control for the bridge and trolley travel shall be so located that the operator can readily face the direction of travel.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Water Employed to Handle Coal and Ashes

TWO innovations for the removing of ashes and the conveying of coal are to be introduced in Philadelphia in connection with that city's water supply. In each case water will play an important part in the operation, and both installations are expected to facilitate the work and also reduce labor cost of conveying coal and removing ashes to and from the station.

Under the former method of operation the coal was delivered by railroad to a bunker, located some distance from the pumping station, and from this point was transferred to the station by means of motor trucks. Under this method the cost to the city of transporting the coal from the bunkers to the pumping station averaged about 20 cents per ton.




Under the new method it is estimated that the cost will be not more than 5 cents per ton, and from this there will be a much more expeditious conveyance of coal and the coal itself will be in much better condition for use owing to the cleansing action of the water.

Under the new method the coal will run from a bunker into a hopper. Near the outlet of the hopper are two pipes so arranged that the outlet of one pipe is on one side of the mouth of the hopper and the entrance to the other pipe is directly opposite to this, as shown in the accompanying illustration. A stream of water under 100 lb. pressure is driven through the pipe across the base of the hopper. As the coal comes into the hopper it is caught by the water and carried across the mouth of the hopper.

Push-cars back of the boilers are under the existing system used to remove ashes. The hot ashes are placed in these cars and transported to a receptacle, to be finally taken away by motor trucks. This method is now to be entirely abolished and the ashes will be removed from the boiler room by means of water. As the ashes come from the grates they will be dropped into a trough in which a stream of water flows. The ashes will thus be cooled and all dust eliminated. The water will move with sufficient force to carry the ashes to a bin so equipped that they will be drained. They will then be lifted by buckets to a hopper, from which they will be loaded into motor vehicles and taken away. This system has been very satisfactory.

Philadelphia, Pa. J. S. CLARKE.

# Extracts from an Operating Code

By Field Editor Electrical World

New York, N. Y.

## Phase Converters with Voltage Balancers

A PHASE converter with voltage balancer is used to equalize the phase loads and voltages of an unbalanced polyphase system. It consists of an alternating-current generator with special windings, acting as a voltage balancer, directly connected to a synchronous motor. In operating phase converters it is necessary to regulate automatically the current in the component fields of the voltage balancer in order that the generated voltage shall be of the proper magnitude and phase position for balancing. This regulation is accomplished by means of a P12 system of automatic regulation, which employs for each component field an exciter whose field in turn is supplied from an auxiliary exciter. The field current of each auxiliary exciter can be varied in strength and direction like that of the booster exciter under the KR system of voltage regulation.

The strength and direction of each auxiliary exciter field is regulated by a Tirrill regulator, which has, in place of a counterweight as in the KR system, a pilot coil to balance the pull of the operating coil. The pilot coil of each regulator is connected to one phase of the system being balanced—for instance, phase A-B; then the operating coil of one regulator is connected to phase B-C and that of the other to phase A-C. The connections are such that with all three phases of equal voltage the regulator arms are balanced, while any voltage distortion causes the regulators to operate in the direction to correct it. The following instructions for starting and shutting down phase converters are abstracted from the operating code of the Philadelphia Electric Company and apply in particular to the phase converter installation at the Schuylkill No. 2 station of this company.

### Starting Phase Converters

1. Make certain that all switches are in normal position for starting, namely: Reversing switch closed on "Start"; exciter knife switch closed; phase converter field selector switch closed; main oil switch open; bus selector oil switches open; auxiliary exciter field switch open; starting resistance short circuiting switches open; balancer exciter circuit breaker open; phase converter field break switch open; compensator switch open; starting switch open.
2. Start the main and auxiliary balancer exciters.
3. Close the bus selector switch.
4. Close the compensator switch.
5. Close the starting switch.
6. Operate the starting resistance switch three times, pausing after each operation to allow the current on the phase-converter ammeters to decrease to a minimum.
7. When the machine has come up to speed close the field break switch on the converter.
8. See that the phase-converter field current is adjusted to approximately 53 amp.
9. Open the starting switch and close the main oil switch at the same time. These switches are interlocked so that the starting switch opens before the main oil switch closes thus preventing any accidents from occurring.
10. Open the compensator switch.
11. Close the balancer-exciter circuit breaker.
12. Operate the starting resistance switch once. This disconnects the starting resistance from the field and connects the field to the exciter. The red indicating lamp on this control switch should light when the starting resistance switch is operated once.
13. Close the reversing switch on "Run," holding the control switch on until the starting switch opens and running switch closes. Should the running switch fail to close, do not test it before opening the main oil switch on the converter.
14. Examine the regulator and see that the differential relay switch is closed.
15. Select alternating-current and direct-current potential with the selector switches.
16. Close the P-12 regulator switches.
17. Close the auxiliary exciter field switch in the "up" position.

### Shutting Down

1. Open the auxiliary exciter field switch.
2. Open the main oil switch.
3. Operate the starting resistance switch once. This should disconnect the field from the exciter, connect the starting resistance to the balancer field and open the starting resistance short-circuit switches. The green indicating lamp on this control switch should light at this point.
4. Open the balancer exciter circuit breaker.
5. Open the field break switch on the converter.
6. Close the reversing switch on "Start."

## Boiler-Feed Pumps of the Plunger Type

ACCORDING to the operating code of the Philadelphia Electric Company, it is important in the starting of plunger-type boiler-feed pumps that the discharge valves be open; otherwise the water in the pump will be compressed to such a degree that it may seriously damage the pump. The code referred to gives the following rules for starting and shutting down pumps.

### Starting

1. See that discharge valve is open.
2. Open the suction valve.
3. See that the exhaust valve is open.
4. Open the drains on the steam cylinder and exhaust line.
5. Open the throttle valve and start slowly.
6. Turn on the lubricator.
7. Bring up the pump speed for the desired pressure.
8. Close the drains.

### Shutting Down

1. Close the throttle valve.
2. Close the suction valve.
3. Turn off the lubricator.
4. Close the suction and discharge valves, if shutting down for dismantling.

## Voltage Limits of Instrument Circuits

A STANDARD has been adopted by the Electric Power Club that insures the protection of instrument, meter and relay circuits on alternating-current switchboards. In order to reduce the voltage on instrument wiring, on the back of switchboard panels, which must necessarily be closely grouped, the standard practice as adopted by the club shall be to use voltage and current transformers for all instruments, meters and relays connected to circuits over 150 volts. This rule does not apply to relays and contactors in unattended stations where 440 volts will be allowed.

Field Editor Electrical World.
Chicago, Ill.

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## Buffalo Company Opens Appliance Store in Substation

INTERIOR OF APPLIANCE SALESROOM

EXTENDING the use of electrical energy and the sale of appliances by intensive educational work led the Buffalo General Electric Company to add a complete and up-to-date appliance and equipment store to its substation No. 16, just completed in the northernmost section of the city of Buffalo. The company has a large appliance department in its main building in the business district of the city, but this is its first experiment in carrying the sale of apparatus and its educational work into the residential sections of the city.

Because, theoretically at least, there are many excellent reasons why it is practical to combine the service and appliance store with substations located in residential districts, central-station managers will watch results of the Buffalo experiment with interest. There is an apparent overhead economy in combining the substation and the merchandise store. Adding an attractive store front to the substation makes the latter a more attractive feature of the community. Besides being a convenience to nearby residents, such a store is a constant reminder of the adaptability of electricity to home uses. When educational work is combined with everyday merchandising, the results are almost sure to be beneficial to dealers in electrical supplies in the vicinity.

A feature of the new store is its large and well-lighted display windows. It is easily the best lighted and most attractive display in that part of the city, and this is likely to prove an incentive to merchants in the vicinity to provide themselves with better-lighted display windows.

The initial display used for the opening of the new station was one well calculated to give the public a better conception of the service of the company to the community. One window was devoted to the general idea that Buffalo is fortunate in having at its gates a wonderful source of hydro-electric power. On one side was a painting of Niagara Falls with a miniature reproduction of the generating plant of the Niagara Falls Power Company at the foot of the falls. Miniature high-tension lines were shown carrying the power from Niagara Falls to the distributing plant of the Buffalo General Electric Company at Buffalo. Then by means of miniature houses, parks and streets the display demonstrated how a modern community is electrically lighted.

WINDOW DISPLAY AT BUFFALO GENERAL ELECTRIC'S COMBINED SUBSTATION AND APPLIANCE STORE

## Maker-Utility "Tie-In" for Motor Advertising

AN EXPERIMENTAL newspaper advertising campaign was run for six weeks last fall by the Boston office of the General Electric Company to arouse the interest of business men in the electric motor drive. The number of inquiries received from these insertions has led to a broader development of publicity in the hope of obtaining the co-operation of utilities and local motor agencies in carrying forward the message of plant electrification. A second campaign, which is expected to run thirty-two weeks, was started March 27 in New England.


CO-OPERATIVE MOTOR ADVERTISEMENT

Representative daily papers in Boston, Springfield, Worcester and Portland will carry display advertisements, of which the one reproduced here is typical. The campaign will emphasize the economies of motor drive and invite the attention of manufacturing and central-station engineers to the problems of the "prospect." The Edison Electric Illuminating Company of Boston is co-operating in the local campaign. Similar developments are under way in Philadelphia and Chicago.

## Electrical Luncheons Prove Educational Value

IN THIS group of men are a hundred members of the Bloomington (Ill.) Rotary Club who were entertained by D. W. Snyder, Jr., general manager of the Bloomington & Normal Railway & Light Company at an electrical luncheon, which was followed by an inspection of the company's plant. The week previous a similar luncheon was given to the Young Men's Club of the city.

Commenting on the value of these contacts with local clubs, Mr. Snyder said: "I am very well pleased with the results obtained by the two luncheons. They have given these men, many of them leaders in their respective fields, an opportunity to see our problems from an operating standpoint. The interest they manifested in the machinery and equipment indicated that we operators often forget that our plant has a story which is very interesting to the public. Too often we see the apparatus merely as a physical machine and fail to capitalize its value from a publicity standpoint.

"The local newspapers gave us 48½ column-inches on these luncheons so I feel that we have done something which has helped us in getting our story across to the public."

## Twelve-Day Campaign Sells 140 Electric Washers

A HIGHLY successful sale of electric washing machines was recently conducted in Schenectady, N. Y., by W. M. Walsh, sales manager of that district of the Adirondack Power & Light Corporation. As a special inducement to buy during the twelve days of the sale a discount of $7.50 from the regular selling price was allowed, with a further discount of 5 per cent for cash. Deferred payments were also offered—$5 down and $12 per month.

After carefully outlining the advertising and selling program, the manufacturer's advertising department received an order for a big rush job.

### "Teaser Ads" Employed

Four days before the campaign opened a series of "teaser ads" appeared in the newspapers, increasing in size, reading matter and pulling power and exciting the curiosity of readers over the announcement to follow. Each of these "ads" declared, "You Need It in Your Home," and each day a line or two was added, increasing public curiosity and giving added hints of what was to come. As a result nearly every one read the six-column display "ad" on the opening day of the campaign, which answered the "teaser ads" by declaring that what the readers needed in their homes was a Western Electric washer and wringer, giving a full description of the service and opportunity being offered to the public.

The campaign slogan was used in all newspapers, truck and store advertising throughout the two weeks. Newspaper ads featured selling points of the washer with increased emphasis on the lapse of time and number of days remaining. During the campaign trucks carried banners

ROTARIANS READY TO INSPECT THE BLOOMINGTON COMPANY'S PLANT

advertising the slogan and selling terms, and the second week emphasized the closing date. The trucks decorated were those used in making deliveries and those used by the meter department, as they do the most traveling.

Tuesday and Wednesday of the first week the public address system of the Western Electric Company was brought to Schenectady to tie in with the campaign and help to put the story across. This was also used to good advantage in connection with the chamber of commerce membership drive.

A special display truck was put on the street which carried a message all its own. An old man was seen breaking his back and wearing out his knuckles over an old washtub and scrubbing board and turning an old-fashioned wringer. In the front a dainty young lady was reading while the electric washer did the washing. The moral was the subject of the principal banner: "Would you do this? Then don't let your wife do it. Buy her an electric washer and wringer, only $5 down." This amused and interested twenty thousand workers of the General Electric Company as they passed from work.

At night the feature truck gave its show on the main street at a busy corner and moved on to Schenectady's popular vaudeville house, where floodlights made it the center of attraction. A number of women mentioned the show when salesmen called on them, and people coming into the store to buy wanted to know where the Adirondack company found the clever old farmer, who was none other that L. E. Smith, one of the company's salesmen.

### Office Sales

Almost every one in Schenectady goes into the Adirondack office to pay his light and gas bill. Painted on the floor was a sign displaying the campaign slogan and terms, beyond which stood a washer mounted on a table in direct line of vision. Overhead, hanging between columns, were large signs driving home the campaign message.

The manufacturer furnished folders to accompany outgoing bills, lantern slides for use in motion-picture houses, newspaper illustrations and a quantity of window displays and placards.

The front window and three side windows contained displays in regard to the washer. The rest of the store display consisted of placards and washers placed at every conceivable advantage point on the sales floor.

The outside salesmen were backed by a competent inside selling and office sales force. During the campaign the inside selling force took the names and addresses, whenever possible, of "prospects" to whom they talked on the floor, and at each morning's sales conference these names were given to the outside salesmen, according to territory, for report in forty-eight hours. Good "prospects" were offered a free home trial, which generally resulted in a sale.

A campaign is always a strenuous affair, and there are always a thousand and one details to cover. Hence every one works at top speed under a high tension. When the day's sales are good every one is radiant and buoyant; when they are low the whole world is blue and despondent and every one else is to blame. Schenectady was no exception. The first day thirteen washers were sold; no doubt some had been held over for the opening by the outside salesmen. The next day brought five; Wednesday six. Things were not looking so bright. The first week closed with fifty sales, and every one was hopeful for another good Monday. The second week closed with ninety, twenty-seven sales being made Saturday, the last day—a total of 140 for twelve days.

The sales made by outside salesmen were seventy-nine, and sixty-one were made by the office sales force.

Campaign selling, Mr. Walsh believes, is best employed as intensive propaganda to stimulate interest and educate the public, and probably the greatest benefit is the business it brings in the future. The confidence and increase in capacity and vision accruing to a sales organization as a result of a job well done are factors having a direct bearing on increased business.

## The Potential Power Load on the Farm

A PROFITABLE field for devising new power applications is shown in the extent to which the farmer now uses power in his operations. Accurate data on the different types of farm power were recently presented by Prof. William Boss, chief of the division of agricultural engineering of the University of Minnesota, at the 1923 meeting of the Minnesota Engineering Society.

Of 3,611,325 hp. from animal, mechanical and electrical sources used in Minnesota alone, Professor Boss showed that only 6,000 hp., or one-sixth of 1 per cent, is from electrical sources. Farm automobiles and trucks form the biggest group, with animal power second. Professor Boss remarks that "very few people seem to realize the development that

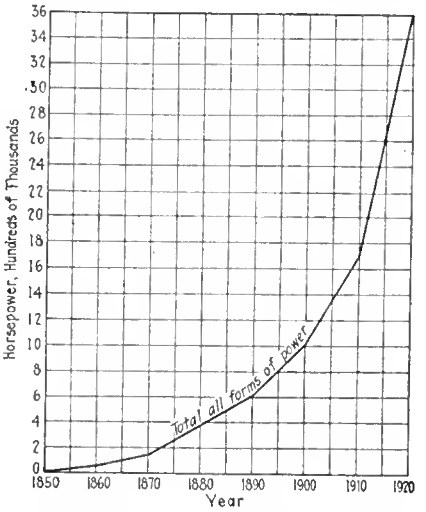



CHART SHOWING INCREASE IN USE OF POWER ON MINNESOTA FARMS

has taken place in the way of machinery and forms of power now available to the farmer. Minnesota is a comparatively young state, and it is interesting to study its development in the past twenty years and note what has taken place in the kind and amount of power used upon its farms."

The curve shows the development of the use of power on Minnesota farms and indicates the possibilities for the use of electrical energy if the proper equipment can be produced to do some of the draft work economically. The rapid growth of

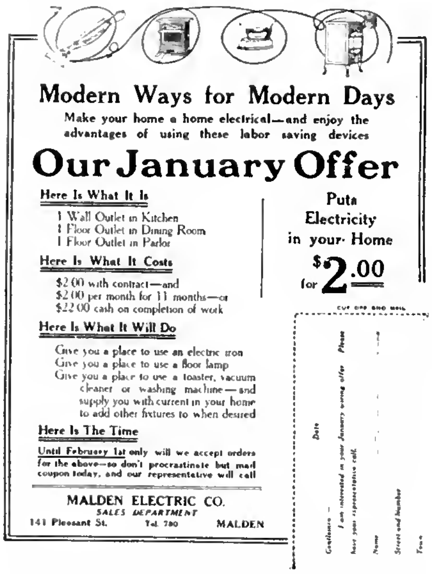
AVAILABLE FARM POWER IN MINNEOSTA IN 1920

| Type of Power | No. in Use | Hp. per Unit | Total Hp. | Per Cent of Total |
|---|---|---|---|---|
| Farm automobiles and trucks | 105,524 | 20 | 2,110,480 | 58.0 |
| Gas tractors | 14,799 | 12 | 177,488 | 5.0 |
| Gas engines | 61,039 | 2 | 122,078 | 3.5 |
| Windmills | 35,695 | 1 | 35,695 | 0.9 |
| Steam tractors | 6,300 | 25 | 157,500 | 4.5 |
| Horses and mules | 1,001,084 | 1 | 1,001,084 | 28.0 |
| Oxen | 1,000 | 1 | 1,000 | $\frac{1}{30}$ of 1 |
| Electric | | | 6,000 | $\frac{1}{6}$ of 1 |
| Total | 1,225,441 | | 3,611,325 | 100.0 |

the various forms of mechanical power and the relatively decreasing use of animal power is an indication of the trend. According to Professor Boss's figures, the use of electrical power did not begin until 1910 and has grown very slowly since then.

## Special Offer Brings 201 House-Wiring Contracts

RETURNS from the January campaign of the Malden (Mass.) Electric Company, which offered house owners an initial installation of three wired outlets for $22 as a base price and minimum installation, show that the company received 257




FOLDER GIVING DETAILS OF HOUSE WIRING OFFER WITH RETURN POST CARD

inquiries, which resulted in the obtaining of ninety-one contracts, representing $4,556 worth of work. Local contractors have reported to the company from their own accounts 110 installations, making a total of 201 meters added to the Malden company's service through the publicity material setting forth the above offer.

## Making Customer Owners of the Rising Generation

TO START the habit of customer partnership the Pine Bluff Company at Pine Bluff, Ark., is sending a certificate, as shown in the accompanying illustration, to each infant in its territory when the birth is recorded.

The certificate is good for $2.50 on the purchase of one or more shares of 7 per cent cumulative preferred stock of the company. In order to keep the company in the mind of the children as they grow up, an additional certificate will be sent to them on subsequent birthday anniversaries.

## Attractive Cottages for Station Operators

By E. A. Quinn

General Superintendent San Joaquin Light & Power Corporation, Fresno, Cal.

IT IS the aim of the San Joaquin Light & Power Corporation to obtain the services of operators at its Kerckhoff plant who can be relied upon to remain in the employ of the company for a reasonable length of time. To accomplish this the company has provided them with attractive and comfortable living quarters. The cottages at the Kerckhoff plant, one of which is shown in the accompanying illustration, were designed and the surrounding grounds were laid out with this thought always in mind.

The houses were built at a moderate cost, are electrically heated and are provided with electric ranges and water heaters. They are equal in every respect to modern city bungalows, and visitors to the plant upon seeing them, surrounded with lawn and shade trees, are almost willing to pay for the privilege of living in one and spending the delightful summer months in the picturesque Sierra Mountains.

The cost of making an attractive central camp for the operators and their families has been so small in proportion to the cost of the construction of dam, tunnel, power house, transmission lines, etc., that

OPERATOR'S COTTAGE AT KERCKHOFF PLANT OF SAN JOAQUIN LIGHT & POWER CORPORATION

it is really not noticeable in the total. The small sum thus spent makes for more reliable, efficient and contented employees.

## What Other Companies Are Doing

**Medford, Ore.**—The California-Oregon Power Company is organizing an entirely new department in central-station commercial activities. It is to be called the "new industries department" and it will be in charge of W. H. Crawford, formerly manager of the department of industries of the Portland (Ore.) Chamber of Commerce. The purpose of the new department will be to seek new industries and assist them in locating within the territory served by the power company in order to provide a greater sale of electrical energy.

**Milwaukee, Wis.** — Plans for a model electrical home, which will be a feature exhibit at the Home Building Exposition here, June 2 to 9, have been completed by the Architects' Small House Bureau. The house will be 44 ft. x 26 ft. in size and will have six rooms, bath and a model laundry. It has been designed to clear all trolley wires and low-hanging obstructions and will be specially constructed for moving, as it is to be given away on the last night of the exposition. The electrical and building industries have contributed all of the materials which enter into the construction of the house.

**Los Angeles, Cal.**—The first issue of "Edison Partners," an eight-page illustrated pamphlet sent quarterly to stockholders, employees and the general public by the Southern California Edison Company, has made its appearance. The purpose of the publication, according to President John B. Miller, is to acquaint all those interested in the welfare of the company with what it is doing to keep abreast of the rapidly increasing demands for electrical service in southern California.

$2.50 The Pine Bluff Company $2.50

Pine Bluff, Arkansas

This Certificate will entitle ______________________ to

Two Dollars and Fifty Cents ($2.50) to apply on First Payment of one or more Shares of 7% Cumulative Preferred Stock of The Pine Bluff Company

and make ______________________ a partner in the Electrical, Street Railway and Water Properties serving Pine Bluff, if presented within 30 days from date.

______________ 1923.

PRESIDENT

CERTIFICATE TO APPLY ON PURCHASE OF STOCK

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Remodeling Power Plant for Fuel-Oil Use.*—Owing to the cost of obtaining and storing its supply of coal for the power plant at Pittsfield, the Berkshire Street Railway is making extensive changes to permit the use of fuel oil. Six boilers are being changed over, using the steam-atomizing system. A 100,000-gal. oil tank, which is filled from tank cars by gravity, provides an ample reserve supply of fuel.—*Electric Railway Journal,* March 24, 1923.

*Generating Costs in 50,000-Kw. Plant Reduced 35 per Cent.*—D. E. DRUEN.—Changes in operating practices and the building up of an efficient personnel, with an intimate knowledge of daily performance, have resulted in an average saving of $1,000 a day in the 50,000-kw. station of the Kansas City Railways. Although twenty years old, the station performance now compares favorably with that of many modern plants. To insure continuity of service a careful analysis was made, supplemented by additional information gathered from the station operators, revealing the various sources of the troubles. The repairs to auxiliary equipment, the overhauling and adjusting of machine governors, oil switches, disconnecting switches, control wiring, feed lines, boiler-feed pumps, etc., have eliminated the faults. Rigid rules have been laid down for the regular inspection of every unit, and operating methods have been adopted that not only tend to minimize the possibility of a service interruption but also make possible the re-establishment of service with the least delay. In regard to the organization side, an operating force of 150 men now constitutes the force, whereas 360 men were used before the plant was overhauled.—*Power,* March 28, 1923.

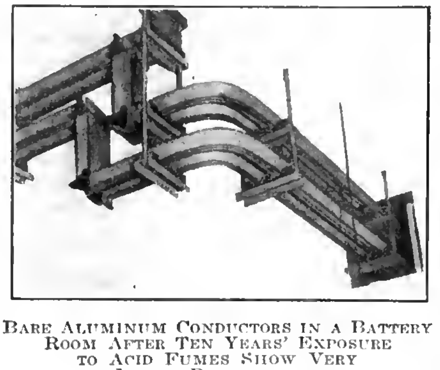
## Generation, Control, Switching and Protection

*Protection Against Overvoltages in the Iron and Steel Industries.*—H. M. TOWNE.—Overvoltages on electric circuits occur from four distinct causes. First is a direct stroke of lightning on the circuit itself; second, induced charge or stroke which may be caused by local or distant lightning flashes or which may exist in the nature of a bound charge caused by highly charged clouds above the circuit; third, gradual accumulation of static electricity by sand, sleet, hail and snow storms, and, fourth, internal disturbances—that is, overvoltages or surges originating from switching, sudden load fluctuations, resonant conditions, arcing grounds, etc. Some of the conditions found on the iron and steel electric systems and the relation of these conditions both to the possible hazard by overvoltages and to the class of protective equipment needed are briefly reviewed. The most important factors or requisites controlling the electrical behavior of arresters are analyzed.—*Proceedings of the Association of Iron and Steel Electrical Engineers,* March, 1923.

*Operating Alternating-Current Systems in Parallel.*—RALPH BROWN.—Conditions to be complied with when operating two power plants in parallel with and without transformers are pointed out. Parallel operation through frequency-changer sets is also considered—*Power,* April 10, 1923.

## Transmission, Substations and Distribution

*Bare Aluminum Conductors.*—An example is given of the usefulness of aluminum as material for heavy current busbars or for other bare station conductors. For such purposes aluminum can be used instead of copper with a very large cost saving. In addition, the weight to be supported by the insulators would be halved by such a substitution and other advantages are obtained in the direction of easier erection and better cooling. Data on the equivalent sizes of copper and aluminum bars, temperature rise, mechanical considerations and jointing are given.—*Electrician,* March 16, 1923.



BARE ALUMINUM CONDUCTORS IN A BATTERY ROOM AFTER TEN YEARS' EXPOSURE TO ACID FUMES SHOW VERY LITTLE DEPRECIATION

*Electric Oscillations in Transmission Circuits Caused by the Neutral Reactor.*—S. BEKKU. — The author treats the problem of electric oscillation in the transmission circuit where the neutral is grounded through the grounding reactor (in this case the Petersen coil) in a general manner, considering the line constants as concentrated. He first analyzes the single-phase system and then the three-phase system. Though a highly theoretical treatise the author visualizes the results by aid of numerical examples. The subject is considered under the following headings: Conventional representation of transmission lines, study of the steady-state phenomena, theory of symmetrical single-phase and three-phase transmission circuits, theory of faulty single-phase and three-phase transmission circuits, and miscellaneous disturbances in symmetrical three-phase transmission circuits.—*Researches of the Electrotechnical Laboratory, Tokyo, Japan,* No. 108.

## Units, Measurements and Instruments

*Well-Designed Hydraulic Testing Laboratory.*—A thoroughly modern test flume has been built at the Holyoke Water Power Company, in which any kind of draft tube or turbine setting can be tested out. A short description of the apparatus is given.—*Electrical News,* April 1, 1923.

*Teletachometer.* — C. WENDT. — An electric tachometer has been developed consisting of a direct-current generator with external excitation. It is made practically independent of the excitation voltage by using a highly saturated main field, a weak compensating field and a fixed magnetic shunt. Variations of as much as 50 per cent in the excitation voltage do not affect the constant field of the generator. It is claimed that short-circuits, external magnetic fields and heating do not influence the voltage. The voltage is directly proportional to the speed of the armature, so that any moving-coil voltmeter may be used to indicate the speed of the machine driving the tachometer dynamo. With its zero point in the middle of the scale of the voltmeter, forward and backward run can be remotely indicated and measured.—*A. E. G. Mitteilungen,* February, 1923.

## Illumination

*Color-Matching Units in the Industries.*—H. C. YOUNG.—A description is given of the proper lighting units to be used with the industries of lithographing, cotton, cigar and leather grading, dyeing and paint and chemical examination. It is pointed out that color-matching units are very desirable and practically a necessity in these industries.—*Central Station,* March, 1923.

*Electric Service in the Home.*—Electricity as an illuminant in the home has become such a necessity that few houses are now erected without wiring. The employment of electricity as a universal servant is, however, comparatively so recent a development that proper outlets have not been provided in the homes. This paper, which is a reprint of a booklet distributed by the Duquesne Light Company, should be of value in designing proper illumination for every room in the house. Diagrams for outlets are given for the front porch, lower hall, living room, dining room, library, kitchen, upper hall, bedroom, bathroom, sewing room, nursery, laundry, cellar, garage, pantry and sun parlor.—*National Electric Light Association Bulletin,* March, 1923.

## Motors and Control

*Three-Phase Motor Starter.* — H. FRANKEN. — Three-phase motors with wound rotors are started by closing the main switch for the stator and moving the starter for the rotor from the zero position slowly toward the full-run position. The paper deals with the question whether or not the starter should have an open circuit in its neutral position. Both constructions have their disadvantages, but it is found that a starter with an open-circuit zero position is liable to cause more severe trouble. The most satisfactory construction is an interlocked combination of main stator switch and rotor starter. An apparatus of this type, built like a drum-controller, is shown and explained. — *Elektrotechnische Zeitschrift*, March 8, 1923.

*Factors Influencing the Design of Woodworking Machinery.*—S. MADSEN. —Such factors as the adoption of high-speed steel, demands of greater economy, power and speed, the use of ball bearings and the direct application of the electric drive necessitate new standards for woodworking machinery. The author discusses these factors, summarizes the problems of driving and fitting cutter heads and tells how ball bearings and electric motors overcome many of them. The savings in power resulting from the use of ball bearings and motor-driven arbors are pointed out, and the paper includes tables of synchronous-motor speeds and other motor speeds.—*Mechanical Engineering*, March, 1923.

## Heat Applications and Material Handling

*Advantages of Basic Electric Furnace Iron for Castings to Resist Abrasion.*—L. J. BARTON.—Common white iron has many deficiencies, according to the author, inherent in the process of manufacture. The so-called synthetic iron, made in the electric furnace, has proved much more satisfactory for crusher jaws, ball-mill liners, roll shells and other parts. The characteristic properties of the common white iron made in the cupola and that made in the electric furnace are analyzed in order to show the superiority of basic electric furnace iron.—*Engineering & Mining Journal-Press*, April 7, 1923.

## Electrochemistry, Electrophysics and Batteries

*Some New Light on Electrolysis.*—E. R. SHEPARD.—The fundamentals of stray current distribution are considered in this article. Recent researches made with the earth-current meter have made possible the statement of these fundamentals in a way which was not possible before. Potential-difference measurements between underground piping systems and adjacent electric railway tracks or the earth's potential gradient are the main factor in determining electrolysis. It has been found that many of the assumptions heretofore made in regard to the flow of currents in pipes are erroneous. The author discusses the most important factors affecting electrolysis in order to modify or clarify the prevailing conceptions regarding the flow of earth currents in such a manner as will be helpful to those who are interested in this branch of engineering and research.—*Electric Railway Journal*, April 7, 1923.

*Generation of Suitable Voltages and Currents for Deep Therapy.*—C. H. HOLBEACH.—In the past few years considerable strides have been made in the improvement and simplification of X-ray equipment for both medical and industrial purposes. At the same time it is a noteworthy fact that the demands of X-ray workers are ever in advance of the apparatus at their disposal. It is for this reason that standardization is difficult, a design becoming obsolete almost as soon as perfection is approached. The comparatively sudden call for highly penetrative X-radiations of shorter wave length, involving the maintenance of 200,000 volts at the tube terminals for continuous running, has imposed many difficult problems on the designer and manufacturer. In the United States these difficulties have been solved to a great extent by the research laboratories of large electrical corporations.—*Journal of the Institution of (British) Electrical Engineers*, March, 1923.

## Traction

*All-Electric Passenger Service for New Haven.*—W. J. CLARDY.—Twelve new electric locomotives have been ordered by the New York, New Haven & Hartford Railway, and these will eliminate the steam locomotives for passenger service on the electrified section between New York and New Haven. These locomotives are of the 2-6-2 + 2-6-2 type equipped with six twin motors operating from an 11,000-volt, single-phase trolley or a 650-volt direct-current third rail. The motors have a combined rating of 2,016 hp. and will develop a tractive effort of 23,200 lb. at 32.6 miles per hour. The continuous rating is 15,800 lb. tractive effort at 39.4 miles per hour.—*Railway Age*, March 17, 1923.

*Further Accomplishments of Detroit Municipal Railway Systems.* — Three bulletins which deal with equipment, overhead and transportation are reviewed. How all of the practices of the Detroit United Railways have been changed under municipal operation should be of particular interest to railway men.—*Electric Railway Journal*, March 24, 1923.

## Telegraphy, Telephony, Radio and Signals

*The German Transcontinental Radio Station.*—E. QUACK.—A short and general description is given of the German sending and receiving stations for transcontinental radio-telegraph service. The two sending stations are at Nauen and Eilvese, the receiving posts at Geltow and Hagen. The corresponding American stations are at Riverhead and Rocky Point. A telegraphing speed of as high as 130 words per minute has been reached, which is contrasted against a maximum of thirty-five words through the Atlantic cable. A diagrammatic sketch shows the path a telegram takes from a sender in Germany to a receiver in America. — *Elektrotechnische Zeitschrift*, March 8, 1923.

*The Neutrodyne Receiver.*—A. RINGEL. — A new principle in radio-frequency reception for neutralizing capacity effects of tubes in which true radio-frequency amplification has been apparently obtained has been developed by L. A. Hazeltine. The equipment consists essentially of a tuned amplifier which is stable, neutralization being effected by small capacities connected from grid to grid of successive radio-frequency tubes. No potentiometer is necessary, and the tuning is quite simple.—*Wireless Age*, April, 1923.

*Radio Stations with Poulsen-Arc Generators.*—C. W. KOLLATZ. — This paper describes the latest navy and land radio stations with a Poulsen-arc oscillator for telegraph and telephone service. A 4-kw. Danish station and a modern 10-kw. German station are described in detail. By using the Pungs control an antenna output of as high as 50 kw. may be keyed directly with a very small key. The 10-kw. sender has a wave range of 2,600 m. to 9,000 m., an antenna current of 60 amp. for telegraphy and 35 amp. for telephony. The key current for the former is only 2 amp. — *Zeitschrift des Vereines Deutscher Ingenieure*, March 10, 1923.

## Miscellaneous

*High-Frequency Light Relay for Talking Motion Pictures.* — FRANZ AIGNER.—A perfect photo-electric cell or light relay must fulfill the three following conditions: (1) It must be inertialess, (2) it must be highly sensitive with a sufficiently large scale of sensitiveness, (3) it must utilize to the fullest extent the available wide gradation of a photographic emulsion. It has been suggested that the electromagnetic turning of the polarization plane of plane polarized light through either so-called "Faraday glass" or a cuvette containing carbon bisulphide be utilized, but the results obtained by this method have been found to be unsatisfactory on account of the distortion introduced by the self-induction of the controlling current coil. The author claims to have overcome this difficulty by using the same self-inductance as a means of tuning a high-frequency oscillating circuit and superimposing the acoustics according to well-known methods from radio telephony. The feasibility of this new method is explained mathematically. Theoretically the carbon - bisulphide would give better results, but for practical reasons the solid "Faraday glass" is preferable. A 200-cp. metal-filament lamp would give sufficient light and would obviate the disadvantages inherent in an arc lamp.—*Jahrbuch der Drahtlosen Telegraphie und Telephonie*, February, 1923.

# News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

## Floods in New England

**Public Utilities Escape Serious Damage Despite Unprecedented Overflow of Streams**

RECORD-BREAKING floods on the streams in northern New England early this week caused property damages estimated at millions of dollars, with widespread interruptions of railroad and highway transportation, especially in north central Maine, which were accompanied by temporary interruptions or curtailment of electric railway, lighting and power service. Advices by wire indicate that the water is subsiding in most of the affected districts and that the restoration of normal service will soon be accomplished.

President E. M. Graham of the Bangor (Me.) Railway & Electric Company says that the flow of the Penobscot River increased from a previous maximum record of 95,000 cu.ft. per second to 160,000 cu.ft. per second within a few days and that the hydro-electric stations of the company at Veazie and Milford had on Wednesday been out of commission for about three days. The Ellsworth plant of the affiliated Bar Harbor & Union River Power Company was shut down for about ten hours.

Nineteen out of twenty-one generators owned by these interests were under water. Trolley service was being run at about half schedule on Wednesday, and the company expected to restore electric service of all kinds to nearly normal by Friday night. Several weeks will be required to dry out the wet equipment on the system. Aside from minor washouts the dams and plants are in good condition. About three feet of water covered the operating floor at Veazie. No injuries to operators were reported on any of the Maine properties. On the Saco River high water caused inconvenience by backing up, necessitating considerable steam-plant operation.

The Central Maine Power Company sustained only moderate damage, according to late advices, although in some cases plants had to be shut down or operated at reduced rating for a time. A 110-ft. electric railway feeder tower at Augusta, Me., fell at a Kennebec River crossing Monday, but no one was seriously injured. Flood conditions in the Kennebec Valley were more troublesome than in the Androscoggin Valley, where excellent storage reservoir facilities helped in the control of excess flow.

At the New England Power Company's plant at Vernon, Vt., on the Connecticut River, output was cut down from 26,000 kw. to about 8,000 kw. on account of floodwater, and there was some reduction in capacity at other plants on the river. Little or no trouble was reported from the Deerfield River stations of this company, and J. Brodie Smith, vice-president Manchester (N. H.) Traction, Light & Power Company, wires the ELECTRICAL WORLD that high water on the Merrimac River resulted in no curtailment of service or damage to the generating stations of his company.

## High Pressure at Weymouth

**Turbine for Boston Edison's New Plant to Be Operated Under 1,200 Lb. of Steam**

WORK on the design of the new power station of the Edison Electric Illuminating Company of Boston, which is to be built on Fore River at Weymouth, about 8 miles from the company's L Street station, has now progressed sufficiently to permit an announcement of its more important characteristics.

The station will embody several new features in design—a 1,200-lb.-pressure boiler, a 2,000-kw., 1,200-lb. turbo-generator, the reheating of exhaust steam from the high-pressure unit and the use of house generators on the shafts of the main units.

A contract for two main units has been placed with the General Electric Company. Each turbine has a steam-end rating of 32,000 kw. at 350 lb. and has a direct connection to a generator rated at 30,000 kw. and a house generator rated at 2,000 kw. Negotiations are under way with the same company for a 2,000-kw., 1,200 lb. high-pressure turbine which will exhaust through a resuperheater into the main steam system at 375 lb. The way is left open for an ultimate installation of three of the high-pressure units, and the total exhaust of the three units will supply one main 32,000-kw. unit at 350 lb.

The four boilers are furnished by the Babcock & Wilcox Company and will operate with a total steam temperature of 700 deg. F. High-pressure economizers will be used with both the three 375-lb. boilers and the 1,200-lb. boiler.

The adoption of 1,200 lb. pressure for the initial stage requires the working out of many new problems in the design of the station. The work is under the supervision of I. E. Moultrop of the Edison Electric Illuminating Company of Boston, and Stone & Webster, Inc., have been engaged to design and build the plant.

## Water-Power Bill Fails Too

**Governor Smith's Niagara and St. Lawrence Measure Shares Fate of Utility Bills**

WITH the New York State Legislature speeding up to permit adjournment on Friday of this week, the water-power bill favored by Governor Smith, which provided for state development, distribution and control of power from the St. Lawrence and Niagara Rivers, went down to defeat by a majority of ten in the Assembly on Tuesday despite a special message from the Executive Mansion urging its passage. Thus the whole program of the Democratic administration on utility regulation and power development goes over for the verdict of the electors next fall, and its ultimate triumph or defeat will depend on which party gets a majority in the Assembly then to be elected. The Senate, which is Democratic, holds over for another year.

An important water-power measure has been introduced at Albany in the form of a constitutional amendment, presented by Senator Ferris, which provides in effect that not to exceed 3 per cent of the forest preserve may be used for the construction of power stations, the location of transmission lines, the building of dams and allied purposes.

Under present constitutional limitations, whether the state itself, private corporations or the United States government under the provisions of the water-power law were to develop hydro-electric energy at the St. Lawrence, it would be impossible to transmit it in a direct route to the capital district and New York City, because under the provisions of the New York State Constitution not a stick of timber could be cut on the Adirondack preserves for any purpose, and this would mean that transmission lines from the Long Sault Rapids would by force of necessity be carried either by way of Plattsburg and thence southerly or via Malone, Ogdensburg, Carthage and Utica around the present Adirondack reservation.

## Ford Accepts Conditions

Henry Ford has accepted the conditions imposed by the Federal Power Commission in connection with the extension of rights to generate power at the High Dam on the Mississippi between St. Paul and Minneapolis. The commission also has approved informally a contract wherein Mr. Ford agrees to sell all surplus power to the Northern States Power Company at 2½c. per kilowatt-hour.

## Steam Locomotives to Go

**Virginian Railway Places Contract with Westinghouse for 213 Miles of Single-Phase Electrification**

A CONTRACT for the electrification of 213 miles of its track, crossing the Alleghenies between Roanoke, Va., and Mullens, W. Va., has been placed with the Westinghouse Electric & Manufacturing Company by the Virginian Railway. This is nearly half the line. The order, which includes construction of electric locomotives, power house, transformer station and apparatus, involves an expenditure of $15,000,000. The alternating-current, single-phase system will be used at 11,000 volts. Power will be supplied by a 90,000-hp. generating plant to be erected on the New River, and the voltage of the main transmission line will be 88,000.

The Virginian, which was built by the late Henry H. Rogers, has long been known as a leading exponent of mass transportation, that is, the handling of traffic by the largest and heaviest trains instead of by the equivalent in smaller trains.

Frank H. Shepard, director of heavy traction for the Westinghouse company, said, in discussing the electrification, that although the Virginian is moving 7,000,000 tons of coal a year, this is not sufficient to meet the growing demands of the area served. The limit in power of steam locomotives has been reached, and after a thorough study it decided to electrify this mountain-grade division.

"The chief advantage of electric operation lies in the greater power that can be applied to each train," Mr. Shepard said. "Three of the largest steam locomotives in use on the Virginian, the articulated Mallet type, are used to haul 5,500-ton trains over the grades, but their combined power does not exceed 7,000 hp. and their speed on the grades is only 7 miles an hour. The new electric locomotives, developing 20,000 hp. per train, will haul 9,000-ton trains up the grades at a rate of 14 miles per hour, and it will be entirely practicable in future to increase this power so that 12,000-ton trains can be handled at the same speed.

"A feature of the electric locomotive," he added, "will be the use of regenerative braking on the down grades. This method of braking will not only reduce wear on the brakeshoes and wheels and improve operation, but will also save 15,000,000 kw.-hr. of electrical energy per year."

## Columbia River Investigation to Begin Soon

Definite steps to begin the investigation authorized by Congress of the Columbia River Basin in the State of Washington with respect to the reclamation of several million acres of lands included in it have been taken by the Interior Department. Much projected hydro-electric development is awaiting the outcome of this investigation.

Assistant Secretary of the Interior F. M. Goodwin, a member of the commission named by Secretary of the Interior Work to conduct the investigation, will join Director A. P. Davis of the Reclamation Service, another member of the commission, at Spokane in a few days for the purpose of outlining plans for the field work. Mr. Goodwin will make a short trip over some of the routes of the basin where it is proposed to construct diversion dams and other works, after which he will go to the Umatilla Rapids district in Oregon, Congress having appropriated the sum of $50,000 for the purpose of investigating its reclamation possibilities.

## Government Promotes Nitrate Manufacture

A campaign being launched by the Department of Commerce with the idea of freeing American consumers from the domination exerted by the Chilean nitrate producers is to be under the immediate direction of Harry A. Curtis, a chemical engineer who served with the nitrate division of the Ordnance Department during the war and was chief of the Sheffield Experiment Station, where work was done on the problems in connection with the Muscle Shoals nitrate plants. He is to be assisted by William H. Walker of the American Farm Bureau Federation.

This announcement, made on May 1 by Secretary Hoover, marks the opening of active work on the nitrate problem. The investigation resolves itself largely into a study of means whereby the fixation of atmospheric nitrogen can be undertaken in this country. While it will be necessary to learn as accurately as possible the minimum price at which Chilean nitrate could be laid down at American ports, it is believed probable that no extensive investigation of the Chilean industry will be undertaken. It is held that the situation is one which can be met best by establishing sources of nitrogen within our own borders. Every effort will be made, it is believed, to induce private enterprise to undertake the manufacture of atmospheric nitrogen. If that should fail, none would be surprised were a recommendation made for large-scale experiments to be undertaken by the federal government.

**E. F. W. Alexanderson of Schenectady, consulting engineer of the General Electric Company and chief engineer of the Radio Corporation of America, has appealed to the ELECTRICAL WORLD to help enlist the aid of men of the electrical fraternity in the search for his kidnapped son, Verner. He is described as a fair-haired, blue-eyed, chubby six-year-old boy. Possibly this message may reach some one whom the radio, the "movies" and the newspapers have failed to reach.**

**The boy was kidnapped April 30; but, in spite of nation-wide publicity, he has not, as the ELECTRICAL WORLD goes to press on May 3, been found.**

## Hetch Hetchy Distribution

**Power from San Francisco Plant May Be Sold to Private Companies and City Network Postponed**

TEMPORARY distribution by private corporations in San Francisco of the power that will be available upon the completion of the Hetch Hetchy project in about eighteen months has been suggested by City Engineer M. M. O'Shaughnessy in a report to the public utilities committee of the Board of Supervisors. Four proposals in all were made to the board in response to a request for recommendations to enable it to determine upon the best policy for the city to adopt.

Mr. O'Shaughnessy deferred making any definite recommendation, but emphasized the desirability of a temporary system of private distribution by pointing out the serious difficulties to be overcome before the city can own and operate its own distribution system. It was stated that officials of the Pacific Gas & Electric Company have signified a willingness to negotiate for the purchase of the power produced by the city's project.

An additional bond issue of $30,000,000 will be needed to complete the Hetch Hetchy work, and if arrangements for private distribution can be made, the city's financial and construction resources should be devoted to the completion of the major project. An expenditure of at least $17,000,000 would be involved in any municipal distribution system, and such an outlay at this time would virtually make impossible the thirty-million-dollar bond issue needed for additional construction. Under any plan of disposing of the power it is estimated that the city will be assured of a revenue of $1,500,000 to $2,000,000 a year for the 300,000,000 kw.-hr. that will be available for distribution to consumers when the plant is completed.

### FOUR ALTERNATIVE PROPOSALS

Following are the four alternative proposals as stated by Mr. O'Shaughnessy in his report to the Board of Supervisors:

1. That the city distribute the power by its own system, which would involve the building of transmission lines, construction of substations and tearing up of streets, with much expense in addition to the $17,000,000 that the system itself would cost.

2. That the city distribute the power itself, following purchase of the existing distribution system of the Pacific Gas & Electric Company.

3. That the city sell the entire Hetch Hetchy output to a private corporation, with an agreement for redelivery to the city of the 40,000,000 kw.-hr. that would be required of a total annual production estimated to reach 300,000,000 kw.-hr.

4. That the city distribute the power under an agreement with a private corporation by which the latter would act as agent of the city.

## Rulings by Power Board

**Rule Adopted for Permits to Municipality Hits Louisville—Expiration of Priorities**

PRELIMINARY permits for water-power developments may not be granted to municipalities until they can show legal authority for prosecuting the work. An opinion to that effect has been issued by the chief counsel of the Federal Power Commission and has been approved by the commission itself.

This ruling is certain to have a far-reaching effect. In many instances power developments have been delayed because of the action of municipalities in attempting to obtain the rights preferentially under the water-power act. In this opinion, however, it is held that "a municipality is not a competent applicant unless it is empowered by the laws of the state in which it is located to carry on the business of developing, transmitting, utilizing or distributing power, and that a city or other political subdivision is not competent if it is not empowered under the existing laws of its state to make the development applied for." The chief counsel pointed out that before an applicant for a license can receive a preliminary permit the applicant must be competent to receive a license. A preliminary permit, he holds, may not be given for the purpose of enabling an applicant to qualify as to competency.

This opinion was sought in connection with the application of the city of Louisville for a preliminary permit and license for the development of power at the government lock and dam in the Ohio River at Louisville. The municipality is proposing to undertake an enterprise which involves the distribution of power over a wide area in two states. As a result of the legal opinion it is anticipated that the commission will deny the application of Louisville.

The commission has approved an opinion by its chief counsel to the effect that "if a permittee within the time prescribed by his permit has filed an application for a license in proper form and accompanied by the required data, his priority will not expire with the end of the period of the permit, but will continue for such time as may be used by the commission in granting or denying the application; that the priority attaches to and inheres in the application for license and continues until the application is disposed of by withdrawal, denial or the grant of the license."

## Airplane Used to Map Route of New Coatesville Line

An airplane was called into use in a recent survey of a projected transmission line from the McCall's Ferry power plant of the Pennsylvania Water & Power Company at Holtwood, Pa., to Coatesville, Pa. The airplane flew in a bee line at a height of two miles and a photograph was taken every few seconds. After the flight was completed and the pictures had been developed they were pieced together and an absolutely accurate bird's-eye map of the route, showing a strip 5 miles wide and about 30 miles long, resulted. A great saving in time and effort was thus accomplished.

The new transmission line, which is to supply power to the Chester Valley Electric Company, will be operated first at 73,000 volts, but is designed for ultimate operation at 110,000 volts. It will be a double-circuit steel-tower system of the best type. A new substation is to be built by the Chester Valley company at Newlinville, near Coatesville and in proximity to the steel mills which are the company's largest power customers. The substation and the transmission line will together cost more than a million dollars. A long-term contract with the Pennsylvania Water & Power Company will, F. W. Harris, general manager of the Chester Valley Electric Company, announces, take care of the power requirements of Coatesville and its vicinity for many years to come. The plan is in accordance with the modern idea of superpower and will obviate the building of a new generating station by the Chester Valley company.

# How Alabama Company Can Use Lock 17

**Will Furnish Several Thousand Horsepower at Full Flow and Act as Voltage Booster in Low-Water Season—Tuscaloosa District Will Benefit—If License Is Granted, Work Will Be Pushed**

THE petition filed with the Federal Power Commission by the Alabama Power Company for a license to develop power at the government's navigation dam, Lock 17, on the Warrior River, about 20 miles above Tuscaloosa, Ala., and the similar petition filed with the Alabama Public Service Commission will, President Thomas W. Martin appears confident, be granted, although a petition has been filed with the commission against the project. This petition has been set for hearing on May 9. The sponsors are not known, but it is presumed to emanate from supporters of Henry Ford's scheme for exploiting Muscle Shoals.

Although the dam at Lock 17 is 63 ft. high and 1,200 ft. long, the flow of the Warrior is so varied that its use for the development of power has long been considered economically impracticable, and officials of the Alabama Power Company say that any power development of any kind at that point is possible only because of the company's ability to tie in the proposed plant at Lock 17 with its six other hydro-electric and steam generating stations. At certain seasons of the year the Warrior is a raging torrent, capable of generating several thousand horsepower of electricity, and at other seasons the stream flow is barely sufficient to turn the waterwheels. During the latter periods, however, it could do what is known as "float" the generators on the line, making the plant valuable as a voltage booster for the Tuscaloosa district, which is at the end of a single-circuit line. The proposed use of Lock 17 by the company is considered a boon to Tuscaloosa, as it will be the means of bettering the power service of that city.

One reason for the belief that the application will be granted is the fact that the Alabama Power Company is the sole agency in the state with sufficient reserve steam-plant capacity to make use of seasonal power such as that at Lock 17. It is pointed out that

LOCK 17, PROPOSED SITE OF PLANT TO BE ERECTED BY THE ALABAMA POWER COMPANY TO SERVE WESTERN ALABAMA

when the water is low in the Warrior the shortage could be supplied from the company's reserve steam plants at Gorgas or Gadsden or from the Muscle Shoals plant leased from the government, and that when there is sufficient water in the Warrior to operate the Lock 17 plant, its use would be the means of saving many tons of coal. In addition, the government would derive some revenue from the use of this power, which has been going to waste since the completion of the dam in 1915. A power house would have to be constructed by the company and waterwheels installed, calling for a large expenditure of money, giving employment to several hundred men and ultimately resulting in the payment of taxes to the state and county on the investment made.

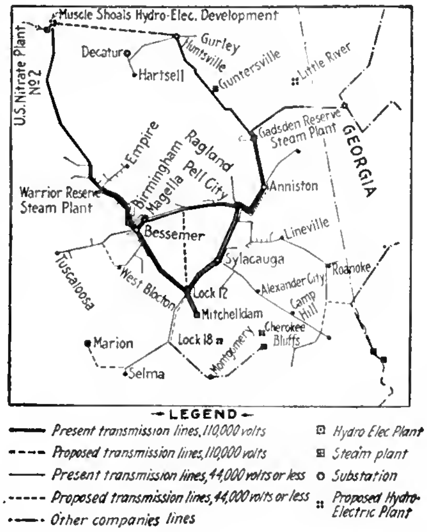
No details are available as to the size of the proposed development, it being necessary for the engineers of the company to work these out in conjunction with the Federal Power Commission. It is understood, however, that work will be undertaken as soon as after the granting of a license as is found to be possible.

## Fight on Alabama Link from Sheffield to Huntsville

A fight is brewing before the Alabama Public Service Commission on the petition of the Alabama Power Company to erect a transmission line from Huntsville to Sheffield, where it would connect with the Muscle Shoals steam plant and thus complete a "power loop" in Alabama. The petition was to have been heard last week, but was postponed until May 9 on the protest of the city of Sheffield and the Sheffield Chamber of Commerce. Objections to the new line were raised at Sheffield on the theory that its erection would prejudice the bid of Henry Ford for Muscle Shoals.

After Sheffield intervened in the case, cotton mills of Huntsville, Decatur and Albany, Ala., and the chambers of commerce of these cities sent telegrams to the commission protesting against postponement of the hearing on the ground that the new line is needed to supply in an adequate manner electrically operated industries in the Tennessee Valley.

According to the announcement by the Alabama Power Company, the line it proposes to build is simply a connecting link to make a complete circuit so that Huntsville and the "Tri-Cities" may receive power from either direc-




HOW LINK FROM MUSCLE SHOALS TO HUNTSVILLE WOULD COMPLETE RING

tion. Having a complete circuit insures continued service to customers in case there should be an accident to one of the lines.

## Wisconsin Advocates of Water Power Oppose Delay

Thousands of dollars would be lost and needless waste of thousands of tons of coal each year would be entailed by the passage of the water-power survey bill sponsored by E. J. Gross of Milwaukee, engineers asserted at the first hearing on the measure by a joint committee of the Wisconsin Senate and Assembly, which listened to arguments on April 25.

The opposition to the bill, which passed the Assembly by a vote of 54 to 7, waxed hottest over a provision which would prohibit further development of water-power sites for six years. No objection was voiced to that section, of the bill providing for a survey of water-power sites, though it was maintained that a thorough investigation would necessitate a much larger expenditure than the sum of $25,000 which the bill carries.

Prof. Daniel W. Mead, Madison, consulting engineer and a leading authority on water-power development in the United States, raised the principal objections to the bill, which, he said, could accomplish no useful purpose and meant a halt in the material development of the state. It would entail a loss of millions in money to the state and to its citizens in interest on moneys already invested, in consequential losses of taxes and in the unnecessary consumption in the proposed six-year period of at least a million tons of coal.

"It is to the interest of all citizens and all industries in the state," declared Professor Mead, "that the development of water powers be encouraged, not threatened. They conserve coal, withdraw coal traffic from the railroads, add to the local and state income, decrease the cost of light and power, induce manufacturing and add to the comfort and convenience of all the people. No man who has an intelligent knowledge of our natural resources would favor the passage of the bill."

## Cost of Electricity

### Government Figures Show It to Be the One Important Commodity to Decrease in Price

THE Bureau of Labor's last quarterly statistics on the changes in the cost of living in the United States as compared with basic prices in 1913 carry an interesting footnote. Hitherto "fuel and light" have been lumped together in the table and have shown a very large increase, comparable to that in other staple commodities. In the statistics just issued, which include the figures for March, 1923, this manifest injustice to the producers and distributors of electrical energy is remedied by a line added after the total and showing an actual decrease in the price of energy as compared with December, 1914. "Fuel and light" combined show an increase in the last quarter of 86.2 per cent, compared with 42 per cent for food and 74.4 per cent for clothing, but electricity not only shows a decrease of 2.4 per cent but has shown an increase only once in the last six years—one of 1.2 in December, 1920.

The information contained in the Bureau of Labor's statistics, which are a summarization of the figures for thirty-two cities computed on a 1913 basis, is derived from actual prices which have been obtained from merchants and dealers for each of the periods named.

CHANGES IN THE COST OF LIVING IN THE UNITED STATES, 1913 TO MARCH, 1923

| Item of Expenditure | Per Cent of Increase from 1913 (Average) to— Dec. 1917 | Dec. 1918 | Dec. 1919 | June 1920 | Dec. 1920 | May 1921 | Sept. 1921 | Dec. 1921 | Mar. 1922 | June 1922 | Sept. 1922 | Dec. 1922 | Mar. 1923 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Food | 57.0 | 87.0 | 97.0 | 119.0 | 78.0 | 44.7 | 53.1 | 49.9 | 38.7 | 41.0 | 39.8 | 46.6 | 42.0 |
| Clothing | 49.1 | 105.3 | 168.7 | 187.5 | 158.5 | 122.6 | 92.1 | 84.4 | 75.5 | 72.3 | 71.3 | 71.5 | 74.4 |
| Housing | .1 | 9.2 | 25.3 | 34.9 | 51.1 | 59.0 | 60.0 | 61.4 | 60.9 | 60.9 | 61.1 | 61.9 | 62.4 |
| Fuel and light | 24.1 | 47.9 | 56.8 | 71.9 | 94.9 | 81.6 | 80.7 | 81.1 | 75.8 | 74.4 | 83.8 | 86.4 | 86.2 |
| Furniture | 50.6 | 113.6 | 163.5 | 192.7 | 185.4 | 147.7 | 124.7 | 118.0 | 106.2 | 102.9 | 102.9 | 108.2 | 117.4 |
| Miscellaneous | 40.5 | 65.8 | 90.2 | 101.4 | 108.2 | 108.8 | 107.8 | 106.8 | 103.3 | 101.5 | 101.1 | 100.5 | 100.3 |
| Total | 42.4 | 74.4 | 99.3 | 116.5 | 100.4 | 80.4 | 77.3 | 74.3 | 66.9 | 66.6 | 66.3 | 69.5 | 68.8 |
| Electricity * | -4.8 | ** | ** | -2.4 | +1.2 | ** | ** | ** | -1.2 | -1.2 | -2.4 | -2.4 | -2.4 |

* This line shows the percent of increase (+) or decrease (-) in the price of electricity at dates mentioned as compared with price in December, 1914. These figures are based on simple averages of primary rates.
** Same as in December, 1914.

## Welding Men Meet

**Progress in the Electrical Process Is Shown in Report—Code Recommendations Made**

WELDING storage and pressure tanks, rail joints and structural work, cast-iron welding and resistance welding were the most interesting of the technical subjects discussed at the annual meeting of the American Welding Society, held in New York April 24 to 27. Past progress in the various branches of welding and plans for future investigation and developments were outlined by the different speakers, and the electric process was shown to be advancing rapidly.

A report of the committee on welded pressure vessels was made by H. L. Whittemore. This report told of tests and conclusions therefrom which will be submitted to the boiler code committee of the American Society of Mechanical Engineers as proposed rules for welded boilers. The committee found that double-V welds are at least 25 per cent stronger than single-V welds on longitudinal seams. The weakest double-V weld tested had a strength of over 90 per cent of the base-plate strength. The maximum was 113 per cent. This type of weld was suggested as mandatory for longitudinal seams. For welded boilers the committee recommended the use of low-carbon steel (not over 0.15 per cent) with a tensile strength not over 55,000 lb. To test welded vessels it was recommended that the pressure be raised to one and one-half times working pressure, and that after this the vessel be hammered and then the pressure be raised to three times working pressure. An exception was made for cases involving complicated attachments, when the final pressure need be raised to only twice working pressure.

### Electric Welding Reviewed

The committee on welded rail joints, of which Dr. G. K. Burgess, the newly appointed head of the Bureau of Standards, was chairman, reported that a program had been developed, financial support assured and experimental work well started.

A complete review of the present development of electric welding was contained in the talk of W. L. Warner. He touched on the high points in the various phases of welding practice and research. In addition, he gave a list of the latest reports and papers.

Higher welding currents, use of better material in electrodes, coated electrodes, forging and heat-treating the weld, welding cast iron, monel metal and brass were some of the advances in practice which were discussed. Application of welding to oil storage tanks and to pressure vessels was said to have many advantages over riveting.

In the field of resistance welding the trend is toward higher voltage and current, lighter pressure and shorter time for welding, according to Herman Lemp. This form of welding is used successfully over a large range of work. For instance, two 24-in. seams are welded on automobile rear-axle housings requiring 1,000 kw. Seam welds are made in 0.025-in. plates of low-carbon steel, tool steel or brass. The welded portions can subsequently be swaged and rolled. An application to very small parts is in welding together tungsten and copper wires for vacuum tubes.

T. F. Barton of the General Electric Company was elected president of the society for the ensuing term. An increase in membership from 595 to 684 was reported. C. A. Adams was re-elected director, H. M. Hobart first vice-director, A. S. Kinsey second vice-director, and W. Spraragen secretary of the American Bureau of Welding, the society's research department.

## Long-Distance Carrier-Current Record

**Radio-Telephone System Placed in Operation on 200-Mile Transmission Line Between Pit River No. 1 and Vaca Substation Will Use 220,000-Volt Lines**

ON APRIL 11 the Pacific Gas & Electric Company placed in operation a carrier radio-telephone system over its 202-mile transmission line between Pit River No. 1 plant and Vaca substation. The system utilizes the twin-circuit line between the two points built for 220,000-volt operation and will be used for directing the operation of the stations under both normal and emergency conditions. Wire communication has been carried on heretofore, but only by a very indirect route requiring five relays and necessarily subject to error and delay.

Uncompleted Carrier-Current Installation at the Pit River No. 1 Power House

The transmitting equipment is of the usual vacuum-tube telephone transmitting type similar to that used by high-power broadcasting stations. Four 250-watt and one 50-watt radiotron tube are used. Two of the tubes are used as oscillators and two as modulators, with the 50-watt tube as a speech amplifier. Wave lengths between 4,500 m. and 23,500 m. were tried and 9,200 m. was selected as the most satisfactory. At this wave length the radiation is 6 amp., and there is no interference from telegraph stations. The system is coupled to the transmission line through a single-wire antenna about 1,800 ft. long. This wire is attached to the twin vertical-circuit steel towers at a point on the center line of the tower and at the elevation of the middle arm.

The receiving equipment consists of a Colin B. Kennedy Corporation type 110 Universal receiver and a Western Electric No. 10-A loud speaker with two stages of audio-frequency amplification. Calling is accomplished by mounting a microphone in the horn of the loud speaker which when the calling circuit is completed will oscillate and "howl" in much the same manner as the ordinary telephone when the receiver is placed against the transmitter. This gives a loud note which is clearly audible in all parts of the station. Ordinarily this method of calling is not used as the operator is within hearing distance of the loud speaker. The system is arranged for simplex operation, and all that is necessary is to throw a small telephone switch which energizes a contactor to connect either the transmitting or receiving set to the antenna, thus permitting talking or listening.

The system, which was installed under the direction and supervision of Dr. Leonard Fuller, radio engineer, establishes a new record for distance for carrier radio-telephone communication. Operation has been very satisfactory, and tests indicate that normally one-half of the transmitting power of the set would be sufficient to carry on successful communication.

## A. I. and S. E. E. Discusses Mine Electrification

The factors entering into the proper selection of coal-mine hoists and methods for reducing power bills were discussed in a paper presented before the Association of Iron and Steel Electrical Engineers at Pittsburgh on April 27 by F. W. Cramer and A. W. MacDonald of the Cambria Steel Mill. Frequently in the selection of a hoist the initial cost has a direct bearing on the final decision, they asserted. The cost of power often influences the style and type of hoist drive purchased. In a mine completely electrified the authors thought that a 1,000-hp. hoist motor had no appreciable effect on the demand charge when central-station power was purchased. They also demonstrated that complete electrification means greater production and lowest cost per ton of coal mined.

The straight induction motor, the water-rheostat control and the Ward

Leonard motor-generator system are the typical hoist drives, the paper said. The induction motor represents the lowest investment cost, but the starting demand is high. With the second system the demand peak is reduced about 15 per cent, while with the motor-generator set the demand peak is cut to one-half or one-third that of the induction motor, but the cost of equipment is about two and one-half times as much. As the energy consumed per ton of coal by the induction motor is always the same for the same installation, this system is more efficient when the output of the mine is cut down by slumps, car shortage, etc. With the motor-generator set the energy consumed is variable, depending on the rate of use.

Graham Bright of the Westinghouse Company declared that the cost of power should not be considered as very important when selecting drives. He claimed that with flywheel equipment the starting demand should be cut down a great deal more than the paper indicated. An animated discussion arose in regard to buying power from central stations as against private plants. Mr. Bright pointed out that usually water conditions made the private plant out of the question. G. W. Quentin of the Duquesne Light Company said that his company usually supplied mines from two separate sources and sometimes three. He recited a case where one mine supplied with central-station energy suffered a total interruption of only six minutes in one year and defied the advocates of the private plants to compete with this figure. H. Goodwin, Jr., of the Sanderson & Porter Company, told of a very large company with plants in several cities which bought all of its power. This company's opinion, based on actual experience, was that it was far more efficient to buy power because in a private plant the costs usually go up with age while with a central station the costs go down.

L. C. Mosley of the General Electric Company thought that the Ward Leonard equipment gives the most accurate speed control of mine hoists. He also showed how the drum shape of a hoist motor was a very important factor to contend with. This problem, he asserted, lends itself to a definite mathematical solution.

## A. I. E. E. Summer Meeting

**Engineering Progress to Be Celebrated in Diversified Papers at Swampscott Convention**

NEW ENGLAND'S latchstring will hang outside the door for the American Institute of Electrical Engineers from June 25 to June 29, when the annual summer convention will be held at the New Ocean House, Swampscott, Mass., about 15 miles from Boston and on the famous North Shore of the Bay State. The local convention committee has been very active in its preparations and has organized an attractive program of work and play for visiting delegates and guests. Papers of large significance on both theoretical and practical phases of electrical activity will be presented. Local industrial plants, educational institutions and utilities are anticipating visits from the delegates, and trips to the numerous historic and scenic attractions of eastern Massachusetts will be made. There will be also an attractive program of sports. Headquarters will be at the New Ocean House, through which all reservations for accommodations should be made.

The keynote of the convention will be advances in equipment and plant design. Among the subjects to be covered will be modern developments in rectifiers, researches into the nature of insulation failures, artificial transmission lines, electric plants for commercial radio transmission and distribution, a new type of lightning arrester, lamp quality and street lighting, and a whole session will be devoted to the important subject of station economics as affected by the proposed use of 1,200-lb. steam pressure at the new Weymouth station of the Edison Electric Illuminating Company of Boston and by new methods of conducting away heat losses in generating machinery. Electric welding will be considered, and other papers which may be included in the schedule bear upon heat balance and plant economy, duplication of electrical equipment, instrument specifications and electrical instruments. At least one paper is planned expanding the ideas upon engineering education expressed at the Niagara Falls convention of the Institute in 1922.

In the main the afternoons will be devoted to the social and recreational sides of the convention, but if the program is crowded, one or two afternoon sessions may be held, as well as parallel sessions in the mornings.

## Stock Issues Prominent in April Financing

NEW financing in April by electric light and power companies was less vigorous than in March, but exceeded the total reached in April, 1922, by more than twenty-two million dollars. Attention is called to the prominent part taken by preferred-stock issues, they totaling $11,643,800 out of the month's total of $65,718,800. Although long-term securities continued to predominate, several short-term offerings appeared during April. The rate of return yielded the investor advanced to 6.38, and the largest single issue was the thirty-million-dollar offering of gold bonds of the Illinois Power & Light Corporation. Refunding was less active.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN APRIL

| Name of Company | Amount of Issue | Period, Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Illinois Power & Light Corp. | $30,000,000 | 30 | First and refunding mortgage gold bonds, series A | Refunding and to provide working capital | 6 | 98½ | 6.10 |
| Houghton County Electric Light Co. (Mich.) | 225,000 | 4 | First mortgage bonds | Refunding and to reduce floating debt | 5 | 95 | 6.35 |
| San Gorgonia Power Co. (Cal.) | 400,000 | 1–24* | First mortgage serial gold bonds | Capital expenditures | 7 | 100 | 7 |
| Dominion Power & Transmission Co., Ltd. (Ont.) | †400,000 | 9 | Gold bonds | Extensions | 5 | 91½ | 6 |
| Public Service Electric Power Co. (N. J.) | 14,000,000 | 25 | First mortgage sinking-fund gold bonds | Additions | 6 | 97½ | 6.20 |
| | 6,000,000 | .... | Cumulative preferred stock | Construction | 7 | 98¾ | 7.10 |
| Portland Railway Light & Power Co. (Ore.) | 2,000,000 | 24 | First lien and refunding mortgage gold bonds, series B | Construction | 6 | 94½ | 6.45 |
| Central Maine Power Co. | 600,000 | 3 | Gold coupon notes | To reduce floating debt and for other purposes | 6 | 99 | 6.38 |
| Houston Lighting & Power Co. (Tex.) | 2,000,000 | 30 | First and refunding mortgage gold bonds, series A | To reimburse for expenditures and for other purposes | 5 | 89½ | 5.75 |
| Iowa Southern Utilities Co. | 1,000,000 | 20 | First and refunding mortgage gold bonds, series 1923 | To reimburse for improvements and for other purposes | 6 | 93 | 6.63 |
| Sierra Pacific Electric Co. (Nev.) | 1,643,800 | .... | Cumulative preferred stock | General corporate purposes | 6 | 80 | 7.50 |
| West Penn Power Co. | 500,000 | .... | Cumulative preferred stock | Additions | 7 | (ex. div.) 100 | 7 |
| Indiana Power Co. | 1,000,000 | .... | Cumulative participating preferred stock | Additions | 7 | 89 | 7.87 |
| Long Island Lighting Co. | 1,000,000 | .... | Cumulative preferred stock | Reimburse for expenditures | 7 | 100 | 7 |
| Middle West Power Co. (Ill.) | 3,850,000 | 20 | First mortgage gold bonds, series A | Reimburse for expenditures and for additions | 6½ | 97¼ | 6.75 |
| Toledo Edison Co. | 1,500,000 | .... | Preference stock, cumulative series A | Extensions | 7 | 93½ | 7.50 |
| Total | $65,718,800 | | | | | | |

*Due serially Oct. 1, 1924-1947.

†Offered in March; not included in March tabulation.

## Halts Flaming Gorge Plan

**Federal Commission Also Imposes Delay for Flathead Lake—Pit River Permits Issued**

THE determination of the Federal Power Commission not to act on the Girand license applies with equal force to other Colorado River projects. Despite the very urgent plea made by Utah interests and by the state itself, the commission has declined to take action on the preliminary permit asked by the Utah Power & Light Company covering its Flaming Gorge project. The permit is essential to the work of exploring foundations and to the preparation of plans. The demand for power in Utah is growing at such a rate that a delay in the development of Flaming Gorge may make necessary the erection of a steam plant at Salt Lake City, an alternative which is strongly opposed both on account of the higher rates which consumers would have to pay and because of the aggravation of the smoke problem which would follow the erection of a large power plant.

The Flathead Lake power project also is apparently enmeshed in delay and uncertainty comparable with the Colorado River situation. The staff of the commission urged at its April 23 meeting that the Rocky Mountain Power Company should receive a preliminary permit, abundantly safeguarded to protect the interests of the State of Washington, so that it could do the preliminary work necessary to the 270,000-hp. development planned at the outlet of the lake. The commission decided, however, to withhold action until the special commission appointed by the Secretary of the Interior to investigate the Columbia Basin plan should report.

PERMITS FOR PIT RIVER NOS. 3 AND 4

A preliminary permit has been granted by the commission to the Mount Shasta Power Corporation, a subsidiary of the Pacific Gas & Electric Company, covering two projects on the Pit River. The projects are known as No. 3 and No. 4. A license also was authorized in connection with the No. 3 project. The company has completed one project which does not come within the jurisdiction of the federal government. Ultimately it expects to complete five large developments on the river.

The commission has authorized a modification in the license issued the Southern California Edison Company for the project on Big Creek at the headwaters of the San Joaquin River. The company is rearranging its program so as to complete certain units five years earlier than was planned at first. This necessitates the elimination of one reservoir. Instead a diversion dam and an enlarged conduit are to be built to carry flood waters into another reservoir.

A license has been granted to the Molybdenum Corporation of America for the development of a small project on the Red River in New Mexico. The power is to be used for mining purposes.

Application has been made by the Knoxville Power & Light Company, an Electric Bond & Share Company property, for a preliminary permit covering the development of 200,000 hp. at four sites on the Clinch River. The application is in conflict with one from the Tennessee Hydro-Electric Company.

Additional time has been granted to the Niagara Falls Power Company for the installation of its new units, the commission having agreed to extend the time from May 1 to Dec. 31 for the installation of one of these units, while the date for the installation of the other two has been extended from March 1, 1924, to Sept. 1 of that year.

## Water-Power Applications on Pacific Coast

Six applications for permits to appropriate water for power purposes were received by the Department of Public Works of the State of California during the month of March. The largest of the applications is that of Ray L. Allin, Sacramento, whose petition asks for a permit to appropriate 1,625 second-feet and 1,365,000 acre-feet per annum from Clear Lake and the North Fork of Cache Creek, all in Lake County. Mr. Allin proposes to develop 228,000 hp. and will construct 21 miles of conduit and 16 miles of pipe lines.

The Modesto Irrigation District has applied for a permit to appropriate 1,500 second-feet and 150,000 acre-feet per annum from the Tuolumne River in Stanislaus County. The district purposes to develop 17,000 hp. at an estimated cost of $360,000. The other applications are for small projects affecting only local areas.

During March the Division of Water Rights of the department issued three permits for the appropriation of water for power purposes. Roy H. Elliott, Hobart Building, San Francisco, has obtained a permit to appropriate 10,000 acre-feet per year from the North Yuba River in Yuba County. Mr. Elliott purposes to develop 20,682 hp. at an estimated cost of $1,500,000.

The Washington State Hydraulics Division recently received an application from Sterling B. Hill for a permit to divert 1,000 second-feet of water from the South Fork of the Nooksack River. Mr. Hill contemplates the erection of a large hydro-electric power plant and intends to spend in the neighborhood of $2,000,000. Mr. Hill has also made application for permission to divert 200 second-feet from Whatcom Creek, where he plans to erect a four-hundred-thousand-dollar hydro-electric plant. In addition to this the applicant intends to develop storage amounting to 65,000 acre-feet in Lake Whatcom. This water will also be used for power-generating purposes.

The Douglas Light & Power Company of Roseburg, Ore., has made application to the State of Oregon for a permit to appropriate 595 second-feet of water from the North Umqua River. The application asks for this amount of water for power purposes in addition to the 705 second-feet granted to the company under an old permit. The company plans to develop 2,289 hp. for light and power service in the adjacent territory.

## Maryland Utility Merger Plans Are Announced

Plans are nearing completion for the formation of the Maryland Public Service Company, a new subsidiary of the American Water Works & Electric Company, which is to include the Potomac Public Service Company and the Cumberland Edison Company, both now controlled by the American company.

The plan calls for the issue of $3,893,000 of 6½ per cent bonds, of which $1,275,000 will be used to retire the outstanding bonds of the Cumberland Edison Company. The rest will be used in repayment of advances for new construction and other purposes by the American Water Works Company.

The rest of the capitalization of the Maryland Public Service Company will consist of $514,300 of 7 per cent preferred stock, which will be exchanged for a like amount of Cumberland Edison stock, and 25,000 shares of no-par-value common stock to be held by the parent company. A public hearing on the merger plans and finances will be held in Baltimore before the Maryland Public Service Commission.

## Indiana Electric Utilities to Spend $50,000,000

New development work projected for this year or already under way by the electric light and power utility companies of Indiana will, it is estimated, entail an expenditure of $50,000,000, and the work planned, when completed, will place Indiana in the front rank of the states enjoying high-class utility service, according to Harry Reid of Indianapolis, president of the Indiana Electric Light Association and head of the Great Lakes Geographic Division of the National Electric Light Association, who added in a recent interview: "Indiana already has an investment of about $200 per capita in the public utility industry, which is about $40 per capita above the general state average."

Property additions, extensions of service, construction of transmission lines, building of power houses, connection of large populated areas, displacement of antiquated electrical equipment and expansion of generating facilities all form part of the year's new developments by Indiana light and power utilities. A large amount of this work centers in the Indianapolis area, although extensive construction programs are to be carried to completion in other of the larger cities of the state. Improvements and additions by the Indianapolis Light & Heat Company, planned prior to the explosion in the Mill Street plant two or three weeks ago, with the Terre Haute, Indianapolis & Eastern project and the Terre Haute

power development of the Central Indiana Power Company, are indicative of the general development of the electric power business, Mr. Reid said.

## California Railroad Commission On Valuations

Figures showing the reductions made by the California Railroad Commission in the valuations of public utilities for rate-making purposes as compared with the valuations submitted by the utilities themselves, with a corresponding saving in rates to the people of the state, have been submitted by President Clyde L. Seavey of the commission to the Legislature.

Reductions in the valuations of ten railroads and street railways, eight water companies, the Pacific Gas & Electric Company, the Southern Sierras Power Company, the Holton Power Company, the Western States Gas & Electric Company and the Great Western Power Company alone amounted to $128,922,688, with a corresponding saving in rates to the public of $10,227,000, according to the figures taken from the books of the commission. If rates as a whole had been augmented by even so slight an amount as 1 per cent, it would have added the sum of $4,000,000 to the amount paid by the ratepayers, the commission claims.

In the case of the Pacific Gas & Electric Company, the commission reports, the company claimed a valuation of $170,711,271 and the commission established a value of $109,723,695, a reduction of $60,987,576 and a saving to the ratepayers in one year of $4,800,000; in the case of the Southern Sierras Power Company and the Holton Power Company the companies claimed a valuation of $27,571,271 and the commission established a value of $14,026,126, a reduction of $13,545,145 and a saving to the ratepayers in one year of $1,080,000; in the case of the Western States Gas & Electric Company the company claimed a valuation of $8,793,063 and the commission established a value of $8,393,063, a reduction of $400,000 and a saving to the ratepayers in one year of $32,000, and in the case of the Great Western Power Company the company claimed a valuation of $69,516,725 and the commission established a value of $38,873,479, a reduction of $30,643,246 and a saving to the ratepayers in one year of $2,450,000.

The comparison between the transactions of the Railroad Commission in 1915 and in 1922 shows an increase of nearly 80 per cent. In 1915 the expenditures of the commission aggregated $349,235, while in 1922 they totaled $488,595, an increase of but 40 per cent. It is the object of the report submitted to the Legislature by President Seavey, he says, to place the facts clearly before that body so that the commission may be adequately provided with the funds necessary to continue its service to the people of California.

# Brief News Notes

**Introducing Electricity to the Pharaohs.**—Recent explorations in Egyptian tombs render timely this view of the oldest room in the world which contains a generating plant. It is the entrance chamber of the tomb of one of the Pharaohs who ruled the Egyptians between 1200 and 1100 B. C., and is near Luxor, the ancient Thebes. C. J. Hamilton, who has recently become sales manager, for the Buffalo office of the Vacuum Oil Company, was for three years sales manager for that company in Egypt. Mr. Hamilton tells of a visit to this plant, which consists of a

British-built generator and an internal combustion engine and is used for lighting the various tombs of the ancient kings of Egypt which have been opened. It will probably supply electricity for the tomb of Tut-ankh-Amen next fall when it is opened for public inspection. A native engineer has charge of the outfit.

**Arkansas Central Power Company Takes Over Little Rock Utility.**—The Little Rock Railway & Electric Company has been absorbed by the Arkansas Central Power Company, just incorporated under the "no-par-value" act of the recent Legislature. Operation will continue under the same management. H. C. Abell of New York was elected chairman of the board of directors.

**Chippewa May Take Over Central-Station Distributing System.**—As a means of reducing light and power expenses both to the city and to individual consumers the City Commission of Chippewa, Wis., has under consideration the advisability of taking over the local electric distributing system of the Wisconsin-Minnesota Light & Power Company. At present the city cannot distribute electricity to private consumers. If the company will not consent to sell the plant to the city, it is said to be the plan of the municipality to institute condemnation proceedings.

**Los Angeles Council Favors Survey of Utility with View to Condemnation Proceedings.**—Following a bitter fight in the City Council of Los Angeles, an ordinance was passed recently authorizing an appropriation for a survey to fix the price of the electric distributing system of the Los Angeles Gas & Electric Corporation. The survey is being made by the California Railroad Commission for the purpose of clearing the way to start condemnation proceedings to acquire the property. Recently when the city ordered the survey the company commenced a suit on the ground that the commission had no authorization to spend money for that purpose.

**Interstate Buys Four More Plants.**—Officials of the Interstate Public Service Company of Indianapolis announced recently that the company had bought the properties and franchises of the Jeffersonville Water, Light & Heat Company and the plants at Francisville, Monon and Medaryville in Indiana. The company paid $250,000 for the Jeffersonville property and $90,000 for the other plants. It already owned the utilities in New Albany, a few miles from Jeffersonville. Energy for light and power for Francisville, Monon and Medaryville will be supplied by the plant of the Indiana Hydro-Electric Company near Monticello, which will be operated by the Interstate Company.

**Insull Companies Buy More Coal Land.** — The Commonwealth Edison Company of Chicago and the Public Service Company of Northern Illinois will be further protected in their coal supply by the organization of the Industrial Coal Company, which has acquired 6,200 acres of valuable coal lands in Franklin County, Ill., and two modern well-equipped mines already in operation. These coal properties will augment mines already owned by these companies. The Edison company will receive one-third of the output of the new company's mines and the Public Service company one-sixth. The Peabody Coal Company will rceive one-half of the output.

**Providence Utility Company Increases Facilities.**—Dwight P. Robinson & Company, Inc., engineers and constructors, New York, have started work on the design and construction of the complete new switching plant which, as already announced, is to replace and extend the present facilities of the Narragansett Electric Lighting Company of Providence. The work includes a new four-story brick and concrete building and a smaller three-story extension to the present switch house. All power will be distributed from the new switching station to substations at 11,000 volts and 22,000 volts. In order to provide for future expansion all equipment will be designed for 22,000 volts.

**Westinghouse War Memorial Scholarships.** — The Westinghouse Electric & Manufacturing Company has announced that applications can be filed for its 1923 war memorial scholarships, open to employees of two years' continuous standing and not more than twenty-three years of age and to sons of

employees of five years' standing. Four scholarships are established annually by this company as a memorial to employees who served in the world war. Each scholarship carries with it an annual payment of $500 for a period not to exceed four years, such payment to be applied toward an engineering education in any technical school or college that the successful candidate may select with the approval of the committee.

**New Water Power in Quebec.**—Contracts for two important new water-power developments in the Province of Quebec have recently been let, says Consul E. H. Dennison in a report to the Department of Commerce, one of these being in connection with the rapids of the Grande Décharge of Lake St. John, while the other is a 15,000-hp. development on the Outarde River, on the north shore of the coast of that lake. It is predicted that within five years a minimum of 230,000 hp. will be developed at a cost of $12,000,000. There are said to be possibilities for developing 1,000,000 hp. from the stretch of rapids extending from Lake St. John to the head of navigation of the Saguenay.

**Hearing on Revaluation of Alabama Power Company Under Way.**—Revaluation of the properties of the Alabama Power Company, a matter which has been a football in Alabama politics for the last year, is provided for in an order issued recently by the Alabama Public Service Commission, and hearings started before the commission at Montgomery on May 1. The order for the revaluation is issued under the provisions of an act passed last February by the Legislature which authorized the commission to revalue public utilities in the state upon which valuations have already been fixed within three months after the approval of the act. The valuation made by the old commission, which went out of office in December, was attacked as too high and thereby permitting excessive rates to consumers.

**Electric Vehicle Schools for Salesmen.**—Under the direction of the Electric Truck and Car Bureau, supervised by the education committee of the Commercial National Section, N. E. L. A., two electric vehicle schools for salesmen are to be held in May and June—one in New York from May 15 to May 26 in the New York Edison Company building and the other in Chicago from June 19 to June 30 in the Commonwealth Edison Company building. The course of instruction will include transportation, engineering, trucks, motive equipment, batteries, garage equipment and operation, and truck operating and maintenance. The students will consist of representatives of electric light and power companies. Each school will be limited to fifty students, made up from the first fifty applications received. Only one application will be accepted from each company if a sufficient number from other companies apply to fill the class. There will be no charge for tuition. Applications should be made at once to E. S. Mansfield, chairman electric vehicle school committee, 39 Boylston Street, Boston.

**Fayetteville to Have New Central Station.** — A new power station for Fayetteville, N. C., to be constructed at a cost of approximately $750,000, has been announced by the Carolina Power & Light Company. The company has purchased 50 acres of land near a large manufacturing plant, and it is planned to erect the power station there. The power will be supplied from the Blewitt's Fall, Wateree and Yadkin River generating stations. To be used in cases of emergency, the company is also constructing a plant near Moncure, on Cape Fear River. This plant will supply cities in this territory with power in time of low water. More than a half million dollars has already been invested in the Fayetteville enterprise, according to a company representative. Work on the plant there will be started at once, and the company will be able to furnish the increased supply of energy immediately on the completion of the station and of a steel-tower line now being built from Laurinburg.

# Associations and Societies

**Electrical Supply Jobbers.**—The regular quarterly meeting of the Pacific Division, Electrical Supply Jobbers' Association, will be held at the Hotel Del Monte, Del Monte, Cal., on May 10, 11 and 12.

**National Association of Manufacturers.**—Some of the pressing subjects to be discussed at the convention of this association in New York on May 14-16 are transportation, construction, production, the open shop, immigration, taxation and the merchant marine.

**Chamber of Commerce to Take up Coal Problem.**—A plea for solution of of the coal problem by economic rather than legislative means will mark the session of the natural resources group at the eleventh annual meeting of the Chamber of Commerce of the United States, to be held in New York on May 7-10. The group will devote its time to coal entirely.

**Southwestern Public Service Association.**—The nineteenth annual convention of this association, to be held at the Texas Hotel, Fort Worth, on May 15-17, will bring together for the first time in several years all the utilities in the Southwest. Among the speakers expected from outside the state are H. C. Abell of New York, chairman of the committee on public utility information bureaus, N. E. L. A.; Labert St. Clair of New York, W. H. Sawyer of St. Louis, H. T. Edgar of Boston and Oscar Fogg of New York. Special entertainment features have been provided.

**Salt Lake Engineers Gather.**—At the regular weekly "All Engineers" luncheon held at the Salt Lake City Chamber of Commerce on April 9 R. A. Hart, drainage engineer of the Department of Agriculture, who has recently returned from a trip to Hawaii, said that electrically operated pumps are rapidly replacing the old apparatus used for pumping in the irrigated districts of that territory, which comprise 80 per cent of the agricultural land. These weekly luncheons, held every Monday, are well attended, bringing the engineering fraternity of the city together.

**Missouri Association Planning Program.**—For the seventeenth annual convention of the Missouri Association of Public Utilities, which will be held on the steamer Harry G. Drees from May 24 to 26, sailing up the Mississippi and Illinois Rivers from St. Louis to Peoria and return, with frequent stops, a good program of papers and addresses is being arranged. The entertainment features will comprise dancing and golf on courses adjacent to the river. Since the boat will accommodate not more than 200 persons, reservations should be made as soon as possible with F. W. Beardslee, 721 Locust Street, St. Louis.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Nebraska Section, N. E. L. A.—Omaha, May 10-11. Horace M. Davis, Lincoln.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Empire State Gas and Electric Association, Electric Section—Utica, N. Y., May 17-18. C. H. B. Chapin, Grand Central Terminal, New York.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Iowa Section, N. E. L. A. — Mason City, June 20-22.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Institute of Electrical Engineers—Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

## Recent Court Decisions

**Interpretation of Utah's Watercourse Laws.**—An attempted interpretation (in Caldwell vs. Erickson) of the phraseology referring to the authority of the State Engineer, "He shall have general administrative jurisdiction of the waters of the state," to mean waters owned by the state was overruled by the Utah Supreme Court, which held "of the state" in this instance clearly to mean the same as "in the state." (213 Pac. 182.)*

**Telephone Company Liable for Damages Caused by Contact of Its Lines with Electric Light Wires.**—Damages for loss from fire were confirmed against the Two States Telephone Company (plaintiff Hurley) by the Court of Civil Appeals of Texas, the court finding the company responsible because of the careless construction of its lines, which passed under the wires of the electric light company close to the building where the fire occurred and, it was alleged, came into contact with them, causing the fire. (248 S. W. 424.)

**Burden of Proof on Party Claiming Right to Raise Dam.**—Davenport vs. Centerville Water & Electric Company was a suit by landowners to enjoin the owner of a dam from raising water to a greater height than that to which it was raised by a former dam. The burden of proof was, the Supreme Court of Michigan held, on plaintiffs to establish by a preponderance of evidence that the crest of the dam, as limited by a decree of the trial court, was higher than that of the former dam. This evidence the Supreme Court did not find to be forthcoming. It added that a court may take judicial notice of wet and dry seasons which would affect the amount of water on lowlands. (192 N. W. 705.)

**Damages Refused Because of Failure of Electric Service Company to Provide Surplus Water for Irrigation.**—In Gause vs. Pacific Gas & Electric Company damages were sought because of the defendant's alleged failure to deliver water for irrigation purposes according to contract. In affirming judgment for the defendant, the California District Court of Appeal said: "The allegation of the breach of the water contract is insufficient. It is apparent that therein respondent agreed to furnish water upon certain conditions. It was expressly stipulated that it should first be used for the generation of electrical energy, which was declared to be its primary purpose. In fact, the fair interpretation of the covenants of the parties is that the company would furnish water if it had any left or was able to do so after using what was necessary for the development of the requisite electrical energy. That circumstance or contingency therefore became an inseparable part of the promise, and in order to state a cause of action it would be necessary to show that such water was not needed for that purpose. In view of the absence of any allegation to that effect, it will be presumed that respondent discontinued the delivery of the water for the reason that, in the opinion of its engineer, it was necessary to conserve it for the development of electric power." (212 Pac. 922.)

**Failure to Warn Carpenter of Possible Danger from Escaping Currents Is Negligence.**—In Jordan vs. Malden Electric Company damages were claimed because of the death of a carpenter who ascended to the roof of an electric power plant in company with the resident engineer and the foreman of the meter department to estimate on the work of building a projected platform, being plainly therefore lawfully upon the premises. The testimony tended to establish that he had not touched any of the equipment or wires, against doing which he had been warned, but had been killed by an arc-over from a lightning arrester near which he had been allowed to go. The Supreme Judicial Court of Massachusetts held that it could not be assumed as a matter of law that the victim knew or should have known of the peril in approaching the arrester and sustained the verdict for the plaintiff rendered in the trial court. (138 N. E. 536.)

**Regulation of Sale of Power Imported from Another State.**—In dismissing as "fragmentary and premature" an appeal of the Cannon Manufacturing Company and other cotton-mill operators against rates fixed by the North Carolina Corporation Commission for the Southern Power Company and remanding the case to the county court (see ELECTRICAL WORLD, March 3, page 533), the Supreme Court of North Carolina made observations to the following purport on the regulation of the sale of power imported from another state: Though the transportation into the state and sale of electrical energy therein directly to purchasers is interstate commerce, the regulation of the sale, including the fixing of rates at which it can be sold, is a matter within the power of the state where the sale is made, in the absence of any regulation by Congress. Evidence that a public utility whose rates were fixed by the Corporation Commission had made contracts with consumers in another state not affected by the decision, but that those contracts were made when the utility was first developing its plant and were less than the rates fixed by the commission within the state chiefly because the consumers thereunder took more power than those within the state, and that later contracts were at rates equal to those fixed by the commission, did not show that the rates fixed by the commission were unjust in contrast with the contract rates. (116 S. E. 178.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

## Commission Rulings

**Flat Rates Obsolete—Street Lighting Service.**—In authorizing new rates for the Fort Bragg Electric Company, the California Railroad Commission condemned flat rates as obsolete even in a small community and indorsed the meter rates which the company proposed to substitute. An electric utility, it said also, should own the entire street-lighting system except lamps and globes, which may be owned and maintained by the consumers. Rates for street lighting should be fixed on the basis of a fixed monthly charge varying with the size of lamp and number of annual burning hours.

**Company Ordered to Serve Customers of Municipal Plant.** — The Wisconsin Railroad Commission, on rehearing at the instance of the Lincoln Light Company, affirmed a previous order compelling that company to serve three extraterritorial customers of the Manitowoc municipal plant who, at the commission's instance, had been connected to the Lincoln Light Company's lines by the city, the line over which the city originally served them having been removed by a private individual who owned it. Under the commission's order the three customers thus served paid the legal rates to the city plus a rental charge of $6 a year each, and this revenue was turned over by the city to the company. The three customers were thus saved the expense of paying for connection. The company asked that these customers be placed upon the same footing as the other consumers whom it serves. (See ELECTRICAL WORLD, Sept. 23, 1922, page 683.)

**Unprofitable Rural Extensions**—A petition for an extension of electric service was denied by the Maine Public Utilities Commission in a case affecting the Cumberland County Power & Light Company on the ground that the extraordinary cost of rendering the service was so great and the resulting deficit would be so large that the company should not be required to make the extension without a guarantee of revenue approximating the cost of rendering the service. In the case at issue this was declared to be impracticable. The commission reiterated its view formerly expressed that rural service ought to be required whenever it can be given without placing an undue burden either on the company or on its other customers, even though the service must be rendered without profit; but it added: "If any particular section of the community is so situated by reason of its distance from the distribution line, its sparsely settled territory or any other reason that service to such community can be rendered only at additional or extraordinary cost, such additional or extraordinary cost must be borne by the particular community desiring the service."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

### Dr. Albert Hull Honored

Dr. Albert W. Hull, scientist in the research laboratory of the General Electric Company, has been awarded the Howard N. Potts gold medal for scientific research by the Franklin Institute, Philadelphia. The award was made for his studies in the crystalline structure of matter by means of X-rays and was based on a paper entitled "Crystal Structures of Common Elements" read before the Franklin Institute last year. Dr. Hull is also one of the foremost authorities on electron vacuum tubes and has been responsible for the development of some of the latest and most interesting types, such as the dynatron and magnetron, including a million-watt power tube. He has been active in the development of radio apparatus and last summer delivered a special course of lectures on X-rays and vacuum tubes at Columbia University.

The Potts medal was established in 1906 from a trust fund left by the will of H. N. Potts of Philadelphia. It is awarded only for "distinguished work in science or the mechanic arts."

### Ferguson Heads New England N. E. L. A. Division

Samuel Ferguson, vice-president of the Hartford (Conn.) Electric Light Company, was elected president of the New England Divison of the National Electric Light Association last week at the annual meeting of the organization at Providence, R. I. Mr. Ferguson is a nationally known central-station executive and has been vice-president of the Hartford company for eleven years. For twelve years previous to his association with the Hartford Electric Light Company he was connected with the research laboratories of the General Electric Company at Schenectady. Mr. Ferguson was born in Exeter, N. H., in 1874 and is a graduate of Trinity College, Hartford. Other officers chosen were: Fred H. Smith, Worcester, Mass., vice-president; Miss O. A. Bursiel, Boston, Mass., secretary; G. M. Guilford, Boston, treasurer. The new officers will take up their work after the annual convention of the division at Swampscott, Mass., Sept. 6-8.

### E. W. Rockafellow Joins National Pole Company

E. W. Rockafellow, known to all the industry as one of the elder statesmen of the electrical jobbing fraternity, has resigned from the Western Electric Company to become a vice-president of the National Pole Company in charge of sales. Mr. Rockafellow has been identified with the Western Electric Company since the very early days of the electrical industry, having grown up from office boy with that organization, and for many years he has borne the title of general supply sales manager. He has long been a prominent member of the Electrical Supply Jobbers' Association, and it will be exceedingly hard for electrical men to think of him as other than a jobber. As the Western Electric Company has been the principal distributor of the National Pole Company Mr. Rockafellow has long been in intimate association with the pole field, and he enters upon his new responsibilities with all the background of a pole man. He will have his office at 220 Broadway, New York.

### A. B. West Receives Promotion

A. B. West, vice-president and general manager of the Southern Sierras Power Company and the Nevada California Electric Company, has been named president of the Southern Sierras Power Company, to succeed the late Guilford S. Wood of Denver. After his graduation from Stanford University in 1899 Mr. West became junior member of the law firm of Potter & West in Denver. At that time this firm was acting as general counsel for the Nevada-California Power Company, and when the power company decided to enter the southern California field Mr. West was transferred to the operating end of the business and made vice-president and assistant to the president. During his association with the company it has experienced a remarkable growth and has been an important factor in the development of the southern part of California. He has been active in the Pacific Coast Electrical Association, having at one time served as its president. Fred O. Dolson, general superintendent, and E. B. Criddle, general agent, of the Southern Sierras Power Company were made vice-presidents of the company at the time of Mr. West's election to the presidency.

A. B. West

Th. G. Holmboe, editor *Teknisk Ukeblad*, Christiania, Norway, is in the United States on an eight weeks' visit, studying American engineering practice.

## Obituary

**Floyd Charles Furlow**, president of the Otis Elevator Company, died on April 26 at the Ritz-Carlton Hotel, New York, after an illness of six weeks. Mr. Furlow was educated at the Georgia Institute of Technology and later, while pursuing the profession of consulting engineer at Atlanta, lectured in experimental engineering there. He became chief engineer for the Otis Elevator Company in 1905, and soon after was made vice-president and then president. Mr. Furlow, in spite of his business activity, did extensive research work in electrical, hydraulic, and steam engineering and machine design.

**Frank E. Russell**, general manager of the Tucson (Ariz.) Gas, Electric Light & Power Company, died at his home in that city on April 15, at the age of sixty years. Mr. Russell suffered a breakdown in health in July, 1922, being taken with a severe attack of sciatic rheumatism, which finally developed into pneumonia, from which a complication of diseases resulted. Mr. Russell began his public utility career with the Western Union Telegraph Company, subsequently becoming active in the organization of the Tucson Gas, Electric Light & Power Company during the year 1892. Shortly after this he was appointed general manager, and he continued in that office until his death, a period of more than thirty-one years. In 1910 the Tucson company became a unit of the Federal Light & Traction Company of New York.

**Eugene Carpenter**, a pioneer New England central-station man, died on April 25 at the age of fifty-five. Mr. Carpenter was a native of Rowe, Mass., and among his earlier activities was the building of the central station at Gardner, Mass., and the pioneer three-phase hydro-electric installation for transmission of energy from Sewall's Falls to Concord, N. H. After engaging in construction work and subsequently in selling he became interested in the central-station properties on Martha's Vineyard and Cape Cod, developing these under the organization of the Boston Electric Associates, which also built up a number of small utility plants in the interior of Massachusetts and New Hampshire. Under Mr. Carpenter's guidance the Cape and Vineyard properties flourished, and to him more than to any other is due the development of electrical service in the sparsely settled area east and south of the Cape Cod Canal. He was active in the New England division of the N. E. L. A. and contributed much to its convention discussions.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Our Appliance Market—What It Needs *

### Sales Now Falling Behind Increase in Houses Connected—Four Fundamentals That Must Be Organized Into Our Selling


By Martin L. Pierce
Research and Promotion Manager Hoover Suction Sweeper Company
North Canton, Ohio


We have in the United States today approximately 8,500,000 homes wired for electricity. The normal increase of resident meters is 12½ per cent per year. During the investigations which I have made in the last few months I have not found a single community in which there are as many home demonstrations being made week by week for the three major appliances—washers, ironers and sweepers—as there are new home meters being connected. Of course, there may be such communities, but in my investigation I have failed to find one. In many of the larger cities, such as Cleveland, Ohio, I found that the home demonstrations did not equal more than 50 per cent of the new homes being electrified.

In other words, the merchandising of appliances is running approximately 50 per cent behind the electric development. The time has come when the electrical industry should establish for itself a definite sales responsibility for electric appliances.

#### What the Market Is

The electrical industry has been too modest in the past, both in its demands and in its expectation regarding the average investment of the typical home owner. While the plumber has been getting from 13 per cent to 15 per cent of the cost price of the average home or apartment, the electrical dealer has, for the most part, been satisfied to get from 1 per cent to 3 per cent. There is certainly no reason, however, why the electric industry should not be obtaining from the home owner an investment for electrical equipment that will at least equal that obtained by the plumber.

*From a paper read before the convention of the Southwestern Geographic Division, N. E. L. A., Oklahoma City, March 14-16, 1923.

The electrical industry in California, after a very thorough analysis, has come to the conclusion that every household should spend as much for electrical equipment as it spends for its automobile. The industry feels that the time has come for the installation of complete electrical equipment, and it is making a concerted drive for the realization of that end.

Recent investigation showed that for every ten wired homes in the United States there are nine automobiles, there are nine talking machines, but there are only one and a half electric cleaners and only one electric washing machine. Shall we not establish for ourselves a program that will comprehend the selling of as many of the major appliances as there are automobiles and talking machines in any given community?

#### Turnover Means Profit

To reach this possible market for electrical appliances the industry should universally make use of modern merchandising ideas and methods.

Above all else, these four things should be done:

First—The advertising of the industry should be built on facts, not "hunches." For instance, a Western central-station company operating in about thirty towns began a campaign on washing machines. These were advertised extensively in the newspapers. Their basic appeal was that of economy. The campaign did not go over. A washing machine was offered as a prize for the woman who would send in the best reason why a woman should have a washing machine. More than two thousand replies were received, and these are the reasons according to the women themselves: Thirty per cent wanted the machine because it saved time, twenty-five per cent because it saved strength, 14 per cent because it saved health, 12 per cent because it preserved youth and beauty, 8 per cent because it was more economical and 7 per cent because it contributed happiness to the home. The advertising campaign was changed to conform to the information gained from these prospective customers, and sales went over with a bang.

Second—The industry must appreciate the fact also that profit comes from turnover, not mark-up. The merchandising manager faces two kinds of expense, selling expense and carrying charge. In the large dry-goods store and the small department store, for example, the selling expense is 4 per cent and the carrying expense 20 per cent. An upholstered chair that cost $100 and is marked up 50 per cent would sell at $150. If the chair were sold the day it was put on the floor, there would be no expense except for selling, which would be $6. The firm would actually have made $44. If it remains on the floor for a year, it will have charged against it $5.25 for rent, $9 for supervision, $4.50 for advertising, $1.50 for heat and light, $1.80 for delivery, $1.80 for insurance and taxes, $3.75 for general expense and $2.40 for depreciation and bad debts.

If at the end of the year the chair is sold for $150, the firm does not make $44 profit, but $44 less $30, which is 20 per cent of $150, or $14. If the chair should remain in stock for two years and the firm should still sell it for a 50 per cent mark-up, the firm would actually lose $16. The small additional discount secured by buying in large quantities seldom equals the carrying charge that must be subtracted from the gross profit.

#### Standard Costs Needed

Third—Standard costs for doing business must be worked out and adopted if the business is to be established on the high plane of prosperity that must be achieved if the job is to be done. At a recent dinner in Canada I sat between two merchandising managers, each in charge

of an electrical department. One of them told me that the overhead charge against his department is 15 per cent. The other man told me that it was 22 per cent, and yet they were both doing business in the same town and under practically the same conditions. The indications were that possibly neither of them knew what the actual overhead charges should be. If either one did know them, the other was being discriminated against. The facts are that the electrical industry, to be successful in merchandising appliances, must be willing to adopt standard costs of doing business.

The costs of hardware stores, dry goods stores and department stores are no longer experiments. These retail firms are actually making money and some of them accumulating millions in reserve on the store costs that have been adopted. In 1921, 366 department stores doing $600,000,000 worth of business did it on an average gross mark-up of 28 per cent. Their net profit on this volume of business was 1.9 per cent. Millions of profits were accumulated because the stock was turned seven or more times on an average. This 1.9 per cent did not take into account the profit made from cash discounts.

Fourth—Our merchandising drive should be set up for twelve months in the year. There was a time when the electrical industry thought that appliances, such as cleaners, could not be successfully sold except at house-cleaning time.. We have learned, nevertheless, that there is no closed season for the selling of appliances.

A Southern central-station company recently put on a special campaign for electric ranges in the winter and sold more than it had ever sold during the same time in the middle of the summer. There are just as many sales arguments for electric cleaners, table appliances, washing machines and electric ranges for winter as there are for summer use.

Every industry that prospers has an ultimate ideal, an aim that cannot be realized in a year and possibly not in a century. With us it is without question the servantless home made possible through the development and use of public utilities. The appliance industry should plan to enter in 100 per cent to bring about the elimination of housekeeping drudgery in every American home.

# Contractors in Cut-Throat Competition

### Owners of Buildings Under Construction Should Have Some Protection in Inspection—Guiding Cost Statistics Are Greatly Needed

By a Manufacturer

I AM WONDERING whether in all our talk about cut-throat competition among contractors we know just what we mean. Most of us probably have in mind the fact that there are a vast number of "chip-basket contractors" who lack all practical knowledge of the rudiments of business and therefore carry on a destructive strife for jobs among themselves. The contractor must be educated, we say, so that he will do "quality" work for a good price and be prosperous. But, as a matter of fact, I believe that our biggest, most educated contractors are probably practicing the worst cut-throat competition in the whole game.

In my opinion, the most conspicuous cut-throat competition that the business is cursed with today comes from the "silk-stocking," college-bred electrical contractor, who terms himself an "engineering contractor" and claims that he has to practice the cut-throat variety of competition to stay in business. How is it done? There are two ways most popular. Poor-quality materials are substituted for those which are specified. That is one method. The other is to bid down the price of the job and then build it up on extras made possible by changing details in the job to differ from the specifications.

#### Selling Down the Job

I have been disappointed, discouraged and disgusted with some of the owners, and even the architects with whom we have got into touch, who have taken the word of some of these large cut-throat contractors as gospel truth and allowed themselves to accept material that was absolutely not in any way up to the standard of the specifications. There has been an epidemic of substituting the cheapest of material in the cheapest method of installation in the past two years, and we are not over it yet. I remember some time ago an engineer telling us how he had actually "sold" the owner on the idea that his job was worth $12,000, and behold, the job was let to a contractor of standing for $7,800. The engineer himself said, "How can they do it?" I suppose by this time he has found out that they substituted in every line of material and "skinned" the job down in workmanship.

As to the "chip-basket" contractor, nobody has ever given him even the credit of having business ability, and naturally when the owner and architect call him in because his price is 20 to 30 per cent lower than that of other contractors and tell him that their appropriation necessitates cutting the electric work still another 20 or 30 per cent, he takes it for granted that they mean exactly what they say, and he proceeds to "skin" the job some more and still further reduce its value.

#### Inspection Ignores Specifications

The result is that, regardless of what is shown or called for on the plans and specifications for a job, the inspection is not based on it. The inspection ordinance in no way recognizes the architects or owners or the engineer's plans and specifications as the basis of an inspection, but instead calls for the contractor to submit a list of the outlets and lights for which he is wiring. That, of course, means the skinned-down job that he has made his price on, so that he can well afford to do the job well for the outlets and capacities of switches that he figured on, and naturally the inspection will give him a clear bill of health and a wonderfully valuable certificate of inspection, which in no way recognizes the capacity or conditions that were called for under the plans of specifications.

#### Education Needed

Now as to the remedy. In the first place, we must educate the architect and engineer and the owner to recognize that there is a classification of value among contractors just as there is in dry-goods stores or any other line of business; that there are some contractors who have the reputation of being cheap, and there are others that have a reputation for responsibility and good installations. It is not fair to have both of these figure on the same job. If the owner wants a good job, he should get a first-class, reputable con-

tractor. If he wants a cheap job, he should not call on the good contractors, but get a man who puts in cheap work. He should know that the price regulates what he is going to get on the job, and, furthermore, he must understand that the inspection is simply on the work as installed.

### Guiding Statistics Needed

Moreover, the electrical industry could well inform the owner, architect and engineer as to the proper cost of the electric work as compared with the cost of the entire building. Let us tell them what a less-than-average installation should cost, an average installation and a better than average installation, and advertise this broadly so that the owner and architect and the engineer will have something fundamental with which to compare their bids. The "quality" contractor could use it as an argument that the statistics of the industry prove that his bid is within reason for a less-than-average or better-than-average job.

I have followed up the residential wiring in one city for a number of years and know of electrical work in jobs running $15,000 and under that ran only from three-tenths to five-tenths of 1 per cent. Just consider the crime of such an installation! On the other hand, I know that where the contract was let to reliable contractors, it began to run up into 2, 3 and 5 per cent, and we have done a number of jobs that ran as high as 7 and 8 per cent. Of course, these could be classed as better than average.

As a matter of fact, I have been told several times by architects that they have quit trying to figure on what the electrical work will cost, because they know it will always be cheap enough anyway. That's a fine reputation for the electrical business.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

TRADE continues vigorous, with well-sustained volume, although the demand upon jobbers last week was decidedly spotty as regards the geographical distribution of orders. Improved transportation conditions are making it easier for distributors to serve their customers, but in most lines the trend of deliveries out of the factory is toward longer datings after receipt of orders. Little complaint of shortages was heard the first of the week, although it is virtually impossible for jobbers to build up stocks in the face of the present demand.

Few price changes of importance were announced last week, the trend being upward in general with firm maintenance of quotations issued in the latest sheets to sales representatives. The upward pressure of labor toward higher wage levels continues, combined with a distinct scarcity of workers in many lines. Prices of Western red cedar poles, 30 ft. with 8-in. top to 90 ft., increased approximately 10 per cent in the early part of the week.

General business is unabated in volume. Building contracts in New England for the latest reported week totaled $8,858,600 against $12,924,400 a year ago, but the former figure exceeds all other corresponding weeks for twenty years. Rubber, textile, metal-working and paper industries are almost overwhelmed with orders. Central-station new-business departments are taking on extensive additional loads, house wiring is running at "full blast," and electrical apparatus manufacturers are working well up toward plant capacity in most lines. Here and there the reconstruction of distribution lines will be necessary as a result of flood conditions on interior rivers, and important interconnections and plant construction for utilities are keeping engineers and sales forces busy. Large telephone and railroad equipment and reconstruction budgets are announced for this section.

## General Business Shows Continued Gain

IN A review of general business and financial conditions the Federal Reserve Board says further increases in production of basic commodities, wholesale prices, employment, wage rates and wholesale and retail trade took place in March.

The board reported, however, that during the month prior to April 11 a more moderate growth in the demand for credit for member banks in leading cities resulted in an increase of about $48,000,000 in their loans, made largely for commercial purposes, as compared with an increase of $235,000,000 in the preceding month.

"Through withdrawal of funds from investments and a further inflow of gold," the board says, "member banks have been able to meet demands of their customers for increased credit and currency independently of the reserve banks. Consequently, the total volume of Federal Reserve Bank credit, measured by the total earning assets, has remained relatively constant during the last month and, in fact, since the seasonal liquidation at the turn of the year."

Production in basic industries, according to the board's index, increased 4 per cent in March to a level 8 per cent higher than at the 1920 peak and 67 per cent above the low point of 1921.

The output of pig iron, steel ingots, automobiles and crude petroleum and the mill consumption of cotton exceeded all previously reported monthly totals.

Building operations showed a further large expansion and the value of contracts let for residences in March was the highest on record. Railroad freight shipments have been larger every week this year than in the corresponding weeks of the last four years. Car shortage has been reduced to the lowest point since September, chiefly as the result of the addition of new equipment, a decrease in the number of locomotives and cars in bad order and a concerted effort to increase the average loadings.

## Case Involving Right to Exchange Trade Information

ARGUMENTS were presented April 25 and 26 before the United States Supreme Court in the case of the government against the American Linseed Oil Company and others, involving the right of business to exchange trade information through associations or through private bureaus acting as clearing houses for such data. The case is considered to be the most important to all trade associations since the hardwood-lumber case, but it involves different questions from those presented in the latter.

The federal government alleged that by exchanging various forms of information which was distributed as statistics by the Armstrong Bureau of Related Industries the defendant linseed-oil companies created a condition tending to prevent competition in prices of their product. The United States District Court for Northern Illinois, where the suit originally was instituted in 1921, held for the defendants and ordered the suit dismissed, the Government appealing.

In arguing before the Supreme Court, Special Assistant Attorney General James A. Fowler declared that daily and instantaneous price reports were sent the bureau by the linseed-oil members and relayed back to the members by the bureau, charging that each day each member knew the prices quoted by his competitors.

Thomas M. Debevoise appeared as attorney for the American Linseed Oil Company and John Walsh, formerly chief counsel for the Federal Trade Commission, appeared in behalf of the Armstrong bureau and other defendants. They argued that while various statistical information was exchanged through the bureau, there was no restriction of output and no combination or agreement as to price. Prices of the oil followed the flaxseed market, they

argued. The right of business corporations to compile statistics on which to base judgment was upheld, they contended, by the fact that the Department of Commerce gathers and distributes statistics of business.

### Says Promotion Work Is Needed to Get Business in Porto Rico

A MUCH larger volume of electrical equipment could be sold in Porto Rico were American salesmen sent to that island with the idea of doing some promotion work. Porto Rico already is a large customer and knows American electrical goods. The central stations on the island are efficient and progressive. The San Juan Railway, Light & Power Company has made active use of the demonstration idea, but much of the business in electrical equipment simply has gravitated to American markets. Very little effort has been expended by American manufacturers or jobbers in increasing the amount of electrical goods which the country will absorb.

To all intents and purposes Porto Rico is domestic territory. There are no duties on imports from the United States. The rather high internal-revenue taxes which are levied on many articles of luxury have not been applied to electrical accessories. These are observations made by R. A. Lundquist, chief of the electrical equipment division of the Department of Commerce, who has just returned from a visit to the island.

Twenty-three out of the thirty-five sugar centrals on the island are electrified. The present price of sugar is encouraging the owners of the remaining mills to consider electrification.

Additional hydro-electric development is certain to come. To be handled to greatest advantage, however, all of the water powers on the island should feed into a single system. The island is 100 miles long and 35 miles wide. Conditions are ideal for meeting the power requirements of the entire island with energy which is produced hydro-electrically.

### Chicago Business Active with Advancing Prices

BUSINESS in Chicago electrical circles still remains active. The most important announcements this week are an advance in conduit and switches and a reduction in the list price of incandescent lamps. Conduit advanced three points. Service entrance switches, externally operated, three-pole, advanced 2 per cent, two-pole 5 per cent, slate fuse blocks 10 per cent, single-pole slate fuse blocks 4 per cent, type C switches 6 per cent and snap switches have advanced 3 per cent.

There has been an approximate reduction of 10 per cent on the entire line of incandescent lamps, the reduction being from 2 cents to 25 cents per bulb on the entire line. This is the first reduction of the entire line in several years. Pole-line hardware demand is extremely active since numerous large orders have been placed for this material during the week. High-tension-equipment sales still remain up to their previous standard.

The demand for flatirons has been very good, and it is the belief that no increase in price of this commodity will occur for some time, inasmuch as irons are highly competitive. While initial orders are being placed for distributors' requirements of fans, the demand has not yet started on this class of material. Prices are firm. Storage batteries are holding their own, with no increase anticipated at this time.

### Motor Demand Well Sustained; Prices Expected to Increase

TAKING the country as a whole, the demand for motors of moderate size continues active, taxing current manufacturing facilities close to capacity. There is no present sign of a lower volume of business, but in some circles the curve of increased sales is expected to swing toward a smaller angle against time within a few months. In other words, there is some doubt if the present rate of sales gains can be sustained indefinitely.

Prices are firm and some advance appears almost inevitable if the cost of materials and current wage scales continue to stiffen. Not all the small-motor business of recent months is believed to have been booked at a satisfactory profit, some orders having been taken at figures chiefly attractive from the standpoint of keeping plants well occupied. There appears to be no general tendency to enlarge motor factories unduly against a heavy increase in business, and this conservative policy is reflected in present deliveries.

### Range Sales Improving as Season Develops

STEADY improvement in range sales continues as the season develops. Raw-material shortage is less troublesome, and some reserve capacity in plant facilities exists to meet an expanded demand. At present no serious labor shortage is reported in this branch of electrical manufacturing. Development work is making good progress toward the early marketing of a new moderate-priced range by a representative manufacturer, which will probably retail in the vicinity of $100. Central-station rates are being formed with closer regard to the commercial exploitation of ranges, and the outlook is good for the next few months' sales.

## The Metal Market

The extreme dullness which has characterized the metal markets in recent weeks continues in even more accentuated form, with no buying of consequence in any metal. That producers are feeling this lack of demand is indicated by further price reductions, though there is no disposition to force large tonnages on an unwilling market, and most producers are well sold up with current production. The lowering of prices would probably not amount to much were it not for the fact that prices have dropped considerably in London. The increased unwillingness to buy on the part of local consumers is without doubt caused by the feeling that prices are tending downward rather than up and that no more metal should be booked than is necessary for the needs of the immediate future.

Very few buyers have been interested in the offerings of producers, even at slight reductions in price. The larger interests are generally asking 17 cents delivered, but this price is admittedly a nominal one. A little copper was sold last week at 16⅞ cents delivered, and an occasional carload brought even as much as 17 cents, but later offers at these prices brought no response whatever. A fair tonnage was sold at 16.75 cents, largely for June and July delivery.

NEW YORK METAL MARKET PRICES

| | April 25, 1923 Cents per Pound | May 2, 1923 Cents per Pound |
|---|---|---|
| Copper, Electrolytic | 17.00 | 16.75 to 17.00 |
| Lead, Am. S. & R. price | 8.25 | 8.00 |
| Antimony | 8.37½ | 8.00 to 8.25 |
| Nickel, ingot | 28.00–30.00 | 28.00 to 30.00 |
| Zinc, spot | 7.37½ | 7.37½ |
| Tin, Straits | 46.62½ | 45.00 |
| Aluminum, 98 to 99 per cent | 26.00 | 26.00 |

The export market showed some signs of life last week, owing to favorable fluctuations in exchange, but it is again very weak. Sales during the week have netted producers on this side about 17⅝ cents for most of the business that has been done.

The official contract price of the American Smelting & Refining Company was reduced from 8.25 cents, New York, to 8 cents. This is the first reduction that has been made since June 22, 1921, when the price was established at 4.40 cents. The reduction was caused by the factors mentioned last week, namely, the decline in import costs, and the fact that lead was being offered by others at the 8-cent level.

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.0326 | $0.0322 | $0.0236 |
| Cold finished shafting, per lb. | 0.0406 | 0.0406 | 0.032 |
| Brass rods, per lb. | 0.1913 | 0.1904 | 0.15 |
| Solder (half and half), per lb. | 0.2987 | 0.314 | 0.21 |
| Cotton waste, per lb. | 0.1231 | 0.1231 | 0.104 |
| Washers, cast iron (½-in.), per 100 lb. | 4.66 | 4.50 | 4.00 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.11 |
| Machine oil, per gal. | 0.349 | 0.349 | 0.40 |
| Belting, leather, medium, off list | 42% | 42% | 48½% |
| Machine bolts, up to 1-in. x 30-in., off list | 44½% | 48½% | 62½% |

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Landers, Frary & Clark Announce Window-Display Contest

Announcement is made of the "Universal" electric iron window-display contest and national advertising campaign by Landers, Frary & Clark, New Britain, Conn.

Twelve cash prizes are offered for the twelve best window displays. The first prize is $100. The contest closes June 30 and is limited to dealers who have the company's "Universal" irons in stock or who had ordered them at the time this contest was first announced.

Every week for six consecutive weeks "Universal" advertisements will appear throughout the United States in more than fifty big metropolitan newspapers, reaching millions of people each issue.

## Century Electric to Reconstruct Six-Story Factory

The Century Electric Company, St. Louis, manufacturer of motors, has just contracted for the reconstruction of the six-story factory building at the southwest corner of Eighteenth and Pine Streets. The building adjoins the six-story building recently completed by this company on the south side of Pine Street opposite its main factory on the north side of Pine Street. A spacious tunnel has been constructed under Pine Street connecting the two factories on the opposite sides of the street.

The building to be reconstructed was built forty or fifty years ago as a carriage factory. With this addition the Century Electric Company will have a six-story factory on the south side of Pine Street, almost a block long. The additional building was made necessary by the tremendous increase in the Century company's business. Plans for the reconstruction work were prepared by L. Bayton Pendleton, architect, who will have entire supervision of the work.

## Commercial Truck Company Receives Order for 177 "Electrics"

The Commercial Truck Company, New York City, has received an order for 177 one-ton electric delivery wagons from the Wagner Pastry Company of Newark, N. J. This is one of the largest electric truck orders placed at one time.

Engineers of the Commercial Truck Company anticipate a saving to the pastry company of $100,000 a year at the Newark plant, where these "electrics" will replace an equal number of gasoline trucks and wagons. Before placing the order the company experimented on all of its seventy routes for a year.

The Commercial Truck Company has opened up a new garage at 542 East Nineteenth Street, New York City.

## E. W. Bliss Moves Sales Offices to South Brooklyn Plant

The E. W. Bliss Company, Brooklyn, N. Y., manufacturer of machinery, has moved its sales and executive offices to its South Brooklyn plant, at the foot of Fifty-third Street, on the east shore of the upper New York bay. This plant comprises a group of seventeen buildings covering a ground area of 18 acres and has a total floor area of 21 acres. It has a water frontage of 390 ft., on which there are two piers, one being 200 ft. long and 80 ft. wide and the other 575 ft. long and 60 ft. wide. There is ample water to accommodate the average-size steamship.

During the war many large additions were made to this plant to meet war requirements until it reached its present large proportions. At the termination of the hostilities a very considerable amount of space and equipment was available.

The Bliss company determined that consolidation of its two Brooklyn plants had decided advantages, and accordingly it has moved practically all the machine equipment from the Adams Street plant to the South Brooklyn plant, using the space made available by the dismantling of the special machinery which was necessary for war requirements.

## Apex Company's New Appointments

The Apex Electrical Distributing Company, Cleveland, home appliances, announces that Albert E. Richter, who has been Northwestern district sales manager of the company, with headquarters in Minneapolis, has been called back to the Cleveland factory as sales promotion manager. B. D. Schock, who formerly was Mr. Richter's assistant, has been appointed sales manager of the Northwestern district.

## Pure Carbon New Representative

Announcement is made by the Pure Carbon Company, Wellsville, N. Y., manufacturer of carbon motor brushes, of the recent establishment of a Minneapolis representative, the Charles A. Etem Company, 917-A Marquette Avenue.

## Anaconda's 1922 Business Was Largest in Its History

The Anaconda Copper Mining Company, for the year ended Dec. 31, 1922, reports gross revenue of $175,450,384, the largest for any year in the history of the company. The increase, however, was due to the acquisition of the properties of the American Brass Company in the early part of 1922. The total of $175,450,384 compares with a total of $33,113,231 in 1921. After payment of all operating expenses and reserves for federal taxes, the company reports net operating income of $11,432,044, against a net operating deficit of $6,257,042 the year before.

After providing for reserves for depreciation, bond interest and writing off of loss in connection with suspended mining operations during the first quarter of the year, the company reports a balance of $3,539,239 available for the 3,000,000 shares outstanding of capital stock of $50 a share par value, or the equivalent of almost $1.18 a share. In 1921, after all deductions for interest, reserves and other charges, the company reported a deficit of $17,061,189.

## National Carbon Sales Manager Praises Dealers as Stabilizers

James R. Crawford, general sales manager of the National Carbon Company, New York City, gave out the following interview during the recent joint convention of the Southern Hardware Jobbers' and the American Hardware Manufacturers' Association at Jacksonville, Fla.

"It is little short of marvelous," says Mr. Crawford, "the way in which the United States has recovered its stride after the disrupting march of the war. All of the dire predictions of the pessimists in regard to the difficulties we should experience in reabsorbing into our industrial life the great mass of discharged soldiers have proved false. All the wild and disquieting talk about the dangers of bolshevism and the spread of radical doctrines has likewise been shown to have had no foundation in fact.

"Particularly remarkable and gratifying is the brave 'comeback' from industrial depression that the South has made. I doubt if at any previous period the agricultural prospects of the Southern States were so promising. Aided by vast acreage reclaimed by draining and by intensive and scientific study of the soils, the Southern farmer and fruit grower is filling an ever larger space in the markets of the world. In industry also, especially in cotton weaving and kindred arts, the Southern States have entered into keen and healthy competition with the New England States. I am glad to note that Southern industries as well as those in other parts of the nation have apparently learned and taken to heart the lesson as to the value of advertising in the daily press. Very fine

barometers of business are the advertising columns of the daily paper, which, after all, is the best advertising medium in the world when backed up by the proper advertising to the jobber, wholesaler and retailer in the business trade press.

"One of the chief factors in bringing business back to normal has been the retail dealer. By co-operating with the jobber and manufacturer, the utilization of the most modern merchandising methods, the use of newspaper advertising, window displays and other advertising material, and by teaching his clerks salesmanship, he has speeded the wheels of commerce and aided in the task of re-establishing prosperity.

"Only a country as resilient, quick to sense new value and grasp new opportunities, a country with a spirit large enough to march alongside the splendid opportunities America offers, could have got back into a steady business step as quickly as our country has done. There has been no gulf created between capital and labor; instead there is a growing realization that the interests of capital and labor, so far from being opposed, are identical. Fearing a great influx of cheap labor from the distraught countries of Europe, our Congress passed a selective immigration law designed to keep our own American workmen from being swamped by cheap competition. Really such a law may not have been needed at all, for business and industry have taken on such sturdy, new vitality that there is actually a shortage of labor and there is no excuse for a man being without a job at good wages."

## Westinghouse Lamp Prices Cut

The Westinghouse Lamp Company, simultaneously with other lamp manufacturers, announces a reduction in prices of lamps amounting to from 8 to 10 per cent.

## Allis-Chalmers Sales in First Quarter Were $5,221,691

Sales billed by the Allis-Chalmers Manufacturing Company, Inc., Milwaukee, manufacturer of electrical machinery, amounted to $5,221,691.78 during the first quarter of 1923, with net profit of $468,689.62 after provision for federal taxes was made.

| | Sales Billed | Net Profit After Provision for Federal Taxes |
|---|---|---|
| January | $1,616,955.28 | $123,479.17 |
| February | 1,727,414.91 | 156,711.47 |
| March | 1,877,321.59 | 188,498.98 |
| | $5,221,691.78 | $468,689.62 |

## G. E. Turbine Generator Order

The General Electric Company has just received a contract for a 60,000-kw. cross-compound steam-turbine generator from the Commonwealth Edison Company of Chicago. This is the largest unit ever purchased by that company and will be installed in the new Crawford Avenue station. The ultimate capacity of the station will be from 500,000 kw. to 600,000 kw.

## Hessel Merges with Southern New England Company

The James T. Hessel Company, New Haven, Conn., and the Southern New England Electric Company, Waterbury, Conn., both electrical supply jobbers, have merged under the latter name, with headquarters at 19 Prout Street, New Haven. Branches have been established at Waterbury and Hartford, and another will be opened shortly at New London or Norwich. J. R. Spurr is president and James T. Hessel vice-president and general sales manager of the new organization.

**The Ohio Brass Company**, Mansfield, Ohio, will soon make additions to the plant of the Ohio Insulator Company, Barberton, Ohio, a subsidiary. Two buildings will be erected providing additional floor space of 16,000 sq.ft.

**The Sterling Insulated Wire Company** of Providence, was recently incorporated under the laws of Rhode Island to engage in the manufacture of insulated wire products, etc. The capital stock consists of 500 shares of common stock without par value, and the incorporators include William Shardlow of Pawtucket, R. I., and Francis J. Brady and Harold W. Thatcher, both of Providence.

**The Star Porcelain Company**, Trenton, N. J., manufacturer of electrical porcelain products, will establish a new branch at Annandale, N. J., to be used primarily for the production of steel dies. The present plant at Clinton, N. J., will be removed to the new location.

**The Tuska Electric Company**, Homestead Avenue, Hartford, Conn., manufacturer of electrical specialties, will construct a one-story plant addition, 30 ft. x 70 ft.

**Harry Alter & Company**, electrical jobbers, are moving to a new location at Ogden Boulevard and Carroll Avenue, Chicago. The company is to have a five-story building containing 51,000 sq.ft. of floor space.

**Schulz & Ingram, Inc.**, electrical engineers, 31 Broadway, New Haven, Conn., have been organized to specialize in maintenance and electrical repairs of equipment used in industrial plants. They also expect to manufacture special equipment. O. H. Schulz is president.

**The Universal Electric Stage Lighting Company**, 321 West Fiftieth Street, New York City, recently incorporated with capital stock of $400,000, is engaged in manufacturing lighting equipment and appliances. It takes over a business which has been established for about twenty-five years in making electric stage-lighting devices. The company occupies a four-story building which will later be increased to six stores. Incorporators are J. H., A. T. and L. Kliegel.

**The Ormor Sales & Supply Company**, recently organized by C. W. Orr and W. H. Moore, is the latest addition to the ranks of manufacturers' agents in Denver.

**Lewis B. Stillwell**, consulting engineer, on May 1 moved his offices to 90 West Street from 143 Liberty Street.

**Pelton Water Wheel Company.**—A new 8,500-hp. impulse wheel for the Pacific Gas & Electric Company has recently been shipped by the Pelton Water Wheel Company, San Francisco.

**The Campbell Transmission Company** announces the appointment of R. J. Dundon as sales manager, with headquarters in Watertown, N. Y.

**The Flexlume Corporation**, Buffalo, manufacturer of electric signs, now occupying the Curtiss airplane factory in Kail Street, has recently purchased the Ericsson plant in Military Road. The transaction involved approximately $500,000, and the corporation plans to move into the new quarters next September.

**The Blue Ridge Electric Company, Inc.**, 709 National Bank Building, Charlottesville, Va., recently capitalized with $10,000, will handle a complete line of equipment and supplies, acting as manufacturers' agents.

**The Chicago Mill & Lumber Company**, manufacturer of wooden boxes for electrical purposes, announces the removal of its offices to 510 North Dearborn Street, New Boyce Building, Chicago.

**W. J. Jeandron**, American representative of Le Carbone brushes, sailed for Europe last week for a six weeks' visit to the factory at Levallois-Perret.

**The Atwater Kent Manufacturing Company**, 5936 Stenton Avenue, Philadelphia, manufacturer of electric equipment, has purchased a tract of 15 acres of land at Abbotsford and Wissahickon Avenues and will use it as a site for a complete new plant. Plans for the initial unit have been authorized, estimated to cost approximately $225,000. The ultimate plant will comprise a number of units, estimated to cost approximately $1,000,000.

**The Connecticut Telephone & Electric Company**, Meriden, Conn., has acquired the plant formerly occupied by the Wilcox & White Company, defunct, heretofore used for the production of piano-player mechanisms, and will utilize the property for expansion. A main four-story building will be remodeled for a factory for the production of electrical insulating specialties. Other structures will be used for radio and electrical instrument manufacture. The power house will be increased in capacity with the installation of additional equipment. As a result of this acquisition the company will hold in abeyance the construction of its proposed new plant, for which plans recently were drawn and bids asked.

**The Gifford-Wood Company**, Hudson, N. Y., conveying equipment for power plants, has moved its office from Buffalo to Pittsburgh, where it is now established in the People's Bank Building, Fourth Avenue and Wood Street.

**John W. Hooley**, formerly of 45 Barclay Street, New York City, electrical engineer, moved on May 1 to 70 East Forty-fifth Street, Grand Central Terminal.

## Foreign Trade Notes

BILL PASSED BY THE FRENCH GOVERNMENT TO SUBSIDIZE ELECTRICAL ENTERPRISES.—A bill granting a subsidy of 600,000,000 francs to enterprises for the distribution and application of electricity has been passed by the French government.

PROPOSED HYDRO-ELECTRIC SCHEMES FOR ITALY.—Three decrees affecting hydro-electric schemes in the Province of Venice, Italy, have been approved by the Ministero dei Lavori Pubblici as follows: The granting of a concession to the Società Idroelettrica Veneta to utilize the waters of the River Paive, near Soverzene, Belluno, to generate electricity; the development of the water power of Longhella Falls, and the organization of the Consorzio di Bonifica di Dese Inferiore (trust for the development of the Lower Dese River). The Italian government has decided to organize an association of hydraulic experts, hydraulic power users and other specialists, etc., to be known as the Associazione Utenti Acque Pubbliche d'Italia, to survey, control and promote the utilization of water and water power in all its forms.

PROPOSED ELECTRICAL DISTRIBUTION SYSTEM IN FRANCE.—Application for a concession to distribute electricity in the departments of the Drôme Isère, Ardeche, Loire and Rhône has been made by the Société des Forces Motrices du Vercors. A concession has been applied for by the Société Electrique "La Lanterne," established at Conflans, to take in a large portion of the Haute-Saône department. A concession to furnish electricity in eleven communes in the department of Savoy has been asked by the Compagnie Savoisienne d'Electricité, and a similar application has been made by the Compagnie de Gaz et d'Electricité de Melun for the district of Melun (Seinet-et-Marne). The Société "Le Triphase" is seeking permission to erect a system to supply energy in thirteen communes in the Seine-et-Oise department.

PROPOSED ELECTRICAL SCHEME FOR CORSICA.—A project to supply electricity in Corsica is under consideration. The plans provide for four generating stations, one at Laucom of 1,600 hp., one at Tavignano of 1,250 hp., a third at Tarrano of 2,250 hp., and a fourth at Fiurmorbo of 3,200 hp. About 550 km. of 20,000-volt transmission lines, and 1,450 km. of 5,500-volt lines will be erected. The initial cost of the scheme is estimated at 45,850,000 francs.

HYDRO-ELECTRIC SCHEME ON RIVER ARDECHE PROPOSED.—Work will soon begin on the construction of a large hydro-electric scheme on the River Ardeche, France, to develop 42,000 kw. The cost of the project is placed at 75,000,000 francs, and it will require eight years to carry out the work.

HYDRO-ELECTRIC PROJECT IN FORMOSA.—Active work is expected to be resumed in the near future, according to *Commerce Reports,* on the Jitsugetsutan (Lake Candidius) hydro-electric project in Formosa.

## Foreign Trade Opportunities

The following inquiries have been received by the Philadelphia Commercial Museum, which will furnish names and addresses of the inquirers to any desiring them and mentioning the number given: Parties in Maracaibo, Venezuela (No. 40,649), would like to communicate with manufacturers of electrical supplies, etc. Parties in Turin, Italy (No. 40,653), would like to get in touch with manufacturers of filaments for incandescent lamps, carbon filaments, tungsten wire and rods, molybdenum wire and rods, borated copper-clad wire, discontinuous tungsten coils for half-watt lamps, which they wish to purchase and for which they also wish to act as sole agents. A party in St. Martin, French West Indies (No. 40,654), would like to receive catalogs and prices on telephone and telegraph material, ice-manufacturing and refrigerating machinery, surveying instruments, etc.

ALUMINUM STEEL-CORED CABLE FOR AUSTRALIA.—Tenders will be received by the Victorian Electricity Commission, Melbourne, Australia, until Aug. 31 for 500 miles of aluminum steel-cored cable.

ELECTRIC TRUCKS, MOTORS, ETC., FOR ARGENTINA.—Tenders will be received by the Department of Navigation and Ports, Buenos Aires, Argentina, until June 4 for electric motors and general machine shop equipment, electric battery trucks, ceiling, wall and table fans, machine tools, etc.

ELECTRIC MACHINERY FOR NAPIER, NEW ZEALAND.—Tenders will be received by the Borough Council of Napier, New Zealand, for one 500-kva. alternating-current generator and exciter set.

ELECTRIC PLANT FOR HONDURAN CITY.—Additional custom duties, *Commerce Reports* states, have been established by the Honduran Congress in order to raise the sum of $130,000 for the construction of a water system and electric light plant for the city of Comayagua. The Mayor (Alcalde) of Comayagua is president of a board to control the expenditure of the funds, including the making of all contracts for this construction work.

## New Apparatus and Publications

RADIO RECEIVING OUTFIT.—The Betts & Betts Corporation, 645 West Forty-third Street, New York City, is distributing radio bulletin No. 188, covering its various radio devices.

FREIGHT AND TRACK-HANDLING MACHINERY.—The Link Belt Company, Chicago, is distributing bulletin No. 375, describing its freight and track-handling equipment, together with labor-saving equipment.

LINEMEN'S BELTS AND SAFETY STRAPS.—Mathias Klein & Sons, 3,200 Belmont Avenue, Chicago, have issued a bulletin listing specifications covering their linemen's belts and safety straps.

TURBINES.—"Where Better Turbines Are Built" is the title of bulletin No. 103 issued by the Kerr Turbine Company, Wellsville, N. Y., which describes and illustrates its plant and gives some details regarding the manufacture of the "Kerr" turbines.

LIGHTING UNIT.—The F. W. Wakefield Brass Company, Vermilion, Ohio, has added a ceiling unit to its "Red Spot" lighting specialties. It is especially adaptable for kitchens and bath rooms.

STEAM ATOMIZER REGISTER.—The Engineer Company, 17 Battery Place, New York City, has issued an instruction book entitled "Enco S-A-R" (Steam Atomizer Register), which gives instructions for the care and operation of "Enco" oil-burning installations.

RETURN TUBULAR BOILERS.—"Uniflow Improved Return Tubular Boilers" is the title of a booklet issued by the Lebanon Boiler Works (J. K. Petty & Company, Inc., proprietors, Lebanon, Pa.) describing the "Uniflow" boiler.

PULVERIZED-COAL EQUIPMENT.—The Ground Coal Engineering Corporation, Worcester, Mass., is distributing bulletin No. 72, which describes and illustrates the "Multi-Mix" method of burning pulverized fuel. The company is represented by the Sanford Riley Stoker Company, Worcester, Mass.

VACUUM CLEANER.—An electric vacuum cleaner ("Magnetic") has been placed on the market by the Birtman Electric Company, 640 West Lake Street, Chicago.

CUTTING MACHINE.—A machine for cutting gaskets, display signs, etc., has recently been developed by the International Register Company, 15 South Throop Street, Chicago.

## New Incorporations

THE ARKANSAS CENTRAL POWER COMPANY, Little Rock, Ark., has been chartered to take over the property of the Little Rock Railway & Electric Company. The officers are: D. H. Cantrell, president; A. Brizzolara, vice-president and treasurer; W. J. Tharp, secretary and auditor, and C. J. Griffith, general manager.

THE LEGGETTS (N. C.) ELECTRIC COMPANY, post office Tarboro, has been incorporated with a capital stock of $15,000 by Theodore Fountain and others.

THE WALWORTH (N. Y.) Light & Power Company has been incorporated by E. J. Blythe, A. J. Esley, F. A. Boynton and G. R. Wignall, all of Walworth. The company is capitalized at $20,000 and proposes to supply electricity in the towns of Walworth, Macedon, Palmyra, Ontario and Williamson.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

UNION, ME.—The Central Maine Power Company, Augusta, is planning to build a 3,500-hp. power plant at Union to supply electricity in Knox County. A new transmission line will be erected from Union to Rockland. The cost is estimated from $300,000 to $350,000.

FALL RIVER, MASS.—Work will soon be commenced on the tidewater power plant to be erected for the Montaup Electric Company, to cost about $5,000,000, with transmission system. The initial installation will have a capacity of 30,000 kw. A second unit of same capacity will be installed at an early date. Stone & Webster, Inc., 127 Milk Street, Boston, are engineers.

SPRINGFIELD, MASS.—The United Electric Company will build a meter service station at Baxter and Wilbraham Streets, to cost about $65,000. H. L. Sprague, 310 Main Street, is architect.

NEW BRITAIN, CONN.—The State Board of Education, Hartford, plans to build a power plant at the camp school division of the State Normal School, to cost about $45,000.

## Middle Atlantic States

COLLEGE POINT, N. Y.—The Purvis Machine Company has filed plans for a one-story addition, 30 ft. x 45 ft., to its steam-power plant.

JAMESTOWN, N. Y.—Bids will be received by the Board of Water and Light Commissioners, City Hall, until May 10 for miscellaneous incandescent electric lamps.

LAWRENCE, N. Y.—The Long Island Lighting Company, 50 Church Street, New York, contemplates extensions and improvements in the power plant and system of the Queens Borough Gas & Electric Company, recently acquired.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 8 for furnishing and installing fire-alarm and watchman's call systems in the United States Veterans' Hospital, Webb Avenue and Kingsbridge Road, Bronx, N. Y.

NEW YORK, N. Y.—The American Smelting & Refining Company, 120 Broadway, contemplates the construction of a power plant in connection with a proposed copper and zinc smelting plant in Mexico. Electric power equipment will also be installed at the company's coal properties at Rosita, Mexico.

TOTTENVILLE, N. Y.—Electric power equipment will be installed in the plant to be erected by the Tottenville Copper Company to replace its works recently destroyed by fire, causing a loss of about $1,000,000.

CAMDEN, N. J.—The Philadelphia & Reading Railroad Company is preparing plans for a power plant to be built at its local terminal, now in course of erection, to cost about $150,000.

CAPE MAY, N. J.—The Atlantic City Light & Power Company has acquired the system of the Cape May Power & Light Company and will operate it in conjunction with its Wildwood plant. Extensions and improvements are planned. The installation of a lighting system on the Rio Grande Boulevard is under consideration.

MAYS LANDING, N. J.—The Atlantic Brick Company will rebuild its power house and plant, recently destroyed by fire, causing a loss of about $150,000.

NEWARK, N. J.—Electric power equipment will be installed in the printing plant to be constructed by the Newark *Evening News,* 215 Market Street, to cost about $200,000. Henry D. Scudder, Jr., 9 Clinton Street, is architect.

NEWARK, N. J.—The Public Service Electric Company will build an automatic substation on Norfolk Street. The equipment will include two 1,500-kw. motor-generator sets, six 2,000-kw. transformers, etc.

CHRISTIANA, PA.—The Christiana Planing Mills, Inc., will install electric

power equipment in connection with the rebuilding of its plant recently damaged by fire, causing a loss of about $100,000.

HARRISBURG, PA. — The Harrisburg Light & Power Company will build a two-story operating works at Walnut and Ninth Streets, to cost $30,000.

NORRISTOWN, PA.—Plans are under way by the Counties Gas & Electric Company for the construction of a 65,000-hp. power plant on Barbadoes Island, Schuylkill River, to cost about $400,000.

PHILADELPHIA, PA. — The Modern Laundry Company, 4089 Market Street, will build a one-story power house at Filbert and Forty-first Streets, to cost $25,000. William Lowenthal, 1208 Chestnut Street, is engineer.

PHILADELPHIA, PA. — The General Baking Company, Butler and Broad Streets, plans to build a one-story power house to supply power for its plant. C. B. Comstock, 110 West Fortieth Street, New York, is engineer.

PHILADELPHIA, PA. — Electric power equipment, refrigerating apparatus, etc., will be installed at the plant of the Abbotts Alderney Dairies, Inc., 222 Lombard Street, which will be enlarged and improved at a cost of $600,000.

WEST CHESTER, PA.—The West Chester Cold Storage & Ice Company will rebuild its power house and plant, recently damaged by fire, causing a loss of about $90,000.

CONOWINGO, MD. — The Susquehanna Power Company, a subsidiary of the United Gas & Electric Company, 61 Broadway, New York, contemplates the construction of a hydro-electric plant on the Susquehanna River at Conowingo, with ultimate capacity of 360,000 hp., to cost about $1,500,000. The plans include a transmission line.

CHARLESTON, W. VA.—The Virginia Power Company plans to build a 50,000-hp. generating plant at the mouth of Cabin Creek, to cost about $450,000.

HUNTINGTON, W. VA.—Electric power equipment will be installed at the plant of the West Virginia Rail Company, Second Avenue, in connection with additions to cost about $250,000.

ALTAVISTA, VA.—The Lane Company, Inc., has engaged Lockwood, Greene & Company, Charlotte, N. C., engineers, to prepare plans for a 600-hp. power plant at its cedar-chest manufacturing works.

## North Central States

GRAND RADIPS, MICH.—The Valley City Milling Company, 217 Michigan Street, contemplates the installation of a power house at its proposed flour mill on Turner Street, to cost about $600,000.

CLEVELAND, OHIO. — Two ornamental lighting systems, one to be installed on St. Clair Avenue and the other on East 105th Street, to cost about $100,000, have been approved by the City Board of Revisions and Assessments.

IRONTON, OHIO.—The Hecla Mining & Manufacturing Company, recently organized, is planning to erect a large electric plant to supply electricity for its properties and for commercial purposes.

JACKSON, OHIO.—The installation of gas engines in the municipal electric plant is under consideration. R. L. Lamb is director of public service.

SPRINGFIELD, OHIO. — Arrangements are being made by the Springfield Light, Heat & Power Company to place a large number of feed wires and cables underground in the downtown section of the city.

UPPER SANDUSKY, OHIO.—Arrangements are being made by the Council for the erection of a substation to distribute electricity to be supplied by the Ohio Power Company. Preparations are being made by the company to serve Carey, Sycamore and Alvada, as well as Upper Sandusky.

URBANA, OHIO. — The Northwestern Ohio Light Company contemplates the erection of a transmission line from its local plant to Kings Creek and also a line to Fremont City to supply electricity in those towns and to residences along the route.

MIDDLESBORO, KY.—The construction of a large hydro-electric plant on the Cumberland River in Bell County is under consideration by the Kentucky Utilities Company. An option has been obtained on a site near Pineville.

FORT WAYNE, IND.—Extension of the ornamental lighting system on Wayne Street is under consideration by the Board of Works.

FORT WAYNE, IND.—The International Harvester Company plans to build a one-story power house at its local motor-truck factory.

MUNCIE, IND.—Bids are being asked for the construction of a power house at the Indiana State Normal School and for furnishing two boilers with stokers, etc.

RICHMOND, IND.—The construction of a new power house, to cost about $70,000, is under consideration by the board of trustees of the Eastern Indiana Hospital.

RUSHVILLE, IND.—Improvements, it is reported, are contemplated to the municipal water and light plant, including an addition to the power house.

WHITEHALL, ILL.—Bonds to the amount of $54,000 have been voted for the installation of a municipal electric light plant.

EAU CLAIRE, WIS. — The Wisconsin-Minnesota Light & Power Company is considering plans for the construction of additional plants at Holcomb, Chippewa Falls and Dunnville.

EAU CLAIRE, WIS. — The Wisconsin-Minnesota Light & Power Company plans to erect a new transmission line from its Jim Falls hydro-electric plant on the Chippewa River to Hastings, Minn. The company also contemplates the erection of a high-tension transmission line from its Wissota Dam to Red Wing, Minn., a distance of 60 miles.

GREEN BAY, WIS.—The Wisconsin Public Service Corporation is considering the erection of a transmission line which will connect its Peshtigo and Oconto electric plants with its plants at High Falls, Menominee, Green Bay and Manitowoc.

HILLSBORO, WIS.—The Middle Wisconsin Power Company is reported to be negotiating for the purchase of the property of the Hillsboro Light & Power Company. Arrangements are being made by the Middle Wisconsin Power Company to extend its light and power lines from Union Center to this city.

KAUKAUNA, WIS.—The construction of a steam generating plant, to cost about $50,000, is under consideration by the Thilmany Pulp & Paper Company.

MILWAUKEE, WIS.—The installation of an improved street-lighting system on Center Street is under consideration by business men on that thoroughfare.

RHINELANDER, WIS.—The Rhinelander Light & Power Company is installing a 1,000-kva. generating unit, and waterwheel, and is also erecting an addition to power house and dam. E. W. Boyce is secretary and treasurer.

FOSSTON, MINN. — Arrangements have been made with the Northern States Power Company to extend its transmission line to Fosston this summer.

RED LAKE FALLS, MINN.—The Red River Power Company, Grand Forks, N. D., contemplates erecting a transmission line from Red Lake Falls to Terrebone, a distance of 28 miles, to cost about $32,000.

CHEROKEE, IOWA. — The Cherokee Electric Company plans to erect a new power house, 40 ft. x 100 ft., and will install new equipment.

FULTON, MO.—An election will be held May 8 to vote on the proposal to issue $50,000 in bonds for the erection of a transmission line and substation equipment for the municipal electric system and for waterworks expansion.

NEVADA, MO. — The National Asphalt Refining Company, recently organized, plans to build a power house at its proposed local refinery. The cost of the project is estimated at $450,000.

STOCKTON, MO.—The Stockton Electric Light Company contemplates the construction of a hydro-electric power plant on the Sac River, to cost about $90,000.

CHANUTE, KAN.—Bids will be received by C. G. Wood, city clerk, until May 8, for equipment for the municipal electric plant as follows: One 1,000-kw. turbo-generator, one surface condenser and pumps, one auxiliary exciter set, 30 kw., steam-driven, and two switchboards.

MEADE, KAN. — Extensions and improvements to the municipal electric light plant are under consideration.

## Southern States

BARNWELL, N. C.—Plans for the proposed local mill, to cost about $65,000, to be erected by the Barnwell Veneer Company include a power plant.

FAYETTEVILLE, N. C.—The Carolina Power Company is preparing plans for a local power plant, to cost about $750,000, including transmission line extensions.

GREENSBORO, N. C.—The Hill Flour Mills Company will install electric power equipment at its proposed milling plant, to cost about $200,000.

HIGH POINT, N. C.—The Lucas Lumber Company plans to build a power house in connection with a proposed local mill, to cost about $200,000.

SOUTHMONT, N. C.—C. M. Wall & Son plan to rebuild their mill and power house, recently destroyed by fire, causing a loss of about $150,000.

TRYON, N. C.—The Blue Ridge Power Company is preparing plans for a hydro-electric power plant to cost about $500 000. A steel-tower transmission line will be built, to cost $125,000. Mees & Mees, Charlotte, are engineers.

WACO, N. C.—The Rhodes Cotton Mills, Inc., plans to build a one-story power house in connection with a mill addition, to cost about $200,000.

ATLANTA, GA.—Additional plans of the Georgia Railway & Power Company include the construction of four new hydro-electric plants, substations and transmission lines, to cost about $11,568,000, work to be completed by the end of 1926. This, with the appropriation for 1923, will make more than $18,000,000 for new construction. Besides the Tugalo dam, work will be started on the Mathis-Tallulah power plants.

CLEVELAND, GA.—The Council is considering the construction of a municipal electric plant and a sewage and garbage disposal plant.

CLINTON, GA.—The Lydia Cotton Mills, Inc., plan to build a 1,500-hp. electric power plant in connection with a new local mill, to cost $130,000. Lockwood, Greene & Company, Charlotte, N. C., are engineers.

MOUNT DORA, FLA.—At an election to be held May 12 the proposal to issue $40,000 in bonds for an electric light plant will be submitted to the voters.

CEDAR SPRINGS, TENN.—The Wright & Pile Lumber Company will build a power house at its proposed local lumber mill, to cost about $90,000.

LAWRENCEBERG, TENN.—Plans are being prepared for the installation of a municipal power plant on Shoal Creek, to cost about $100,000.

BIRMINGHAM, ALA. — Electric power equipment will be installed in the new ice plant to be erected by the Birmingham Ice & Cold Storage Company, to cost about $400,000.

BIRMINGHAM, ALA. — The Alabama Power Company has petitioned the Public Service Commission for permission to erect a transmission line to connect the towns of Tuskegee, Union Springs, Childersburg, Waverly and Wetumpka, and to install electric distributing systems in each of the towns.

DOTHAN, ALA.—Bonds have been authorized by the city of Dothan for the construction of a hydro-electric plant on the Choctowhatchee River, about 20 miles from the city. The cost is estimated at from $800,000 to $900,000. The Ludlow Engineers, Inc., Winston-Salem, N. C., will have charge of the work.

HEFLIN, ALA.—W. M. Dodson, Wedowee, has been granted a local franchise and will erect a transmission system and substation, to cost about $30,000.

KREOLA, MISS.—The Southern Paper Company contemplates extensions to its mill at Moss Point, including a power plant and machine shop. The cost of the work is estimated at about $1,500,000.

PURVIS, MISS.—Bonds to the amount of $12,000 have been voted for the installation of an electric light and power system.

HOPKINSVILLE, ARK.—The local electric light plant and ice factory, owned by J. Dragoo, was recently destroyed by fire.

LITTLE ROCK, ARK.—The Arkansas Central Power Company, recently organized, has taken over the property and holdings of the Little Rock Railway & Electric Company, including local electric and traction systems. C. J. Griffith is general manager.

AGURES, LA.—Negotiations are under way for the establishment of an electric light plant in Agures.

SHREVEPORT, LA.—Preliminary plans are under consideration for a bond issue of $500,000 for the construction of a municipal electric plant.

GRANBURY, TEX.—Bids will be received by the Mayor and the City Council until May 9 for two crude-oil engines directly connected to alternators, two motor-driven centrifugal pumps, motor-driven air compressor, switchboard, etc. Proposals to be addressed to Mrs. Neil Hiner, City Secretary. The Municipal Engineering Company, Praetorian Building, Dallas, is engineer.

GREENVILLE, TEX. — The Greenville

Mill & Elevator Company contemplates the construction of a power house at its proposed local flour mill, to cost about $300,000.

TEXARKANA, TEX.—Electric power equipment will be installed in the ice-manufacturing and cold-storage plant, to be erected at Oak and West Broad Streets, at a cost of $100,000.

## Pacific and Mountain States

DEER PARK, WASH.—The Mount Spokane Power Company is planning to erect three rural transmission lines this summer.

KELSO, WASH.—Contract has been awarded by the Long-Bell Lumber Company for the construction of an electric plant. The ultimate capacity will be 16,000 hp., consisting of six units, three of which will be installed at once. The proposed plant will supply electricity for the town of Longview as well as for the mill. The cost is estimated at about $2,000,000.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has issued $2,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

REEDSPORT, ORE.—The Umpqua Mills & Timber Company will build a power house in connection with its proposed lumber mill, to cost about $100,000.

ST. HELENS, ORE.—The Columbia County Lumber Company plans to construct a power house and mill to replace its plant recently destroyed by fire, causing loss of about $300,000.

LOS ANGELES, CAL.—Bids will be received by the Board of Supervisors until May 14 for a 200-kw. motor-generator set and control equipment to be installed in the Hall of Records.

MARYSVILLE, CAL.—The Pacific Gas & Electric Company contemplates an addition to its local substation, to cost about $50,000.

MODESTO, CAL.—Bids will soon be called for the installation of a power distribution system. H. A. Storrs is consulting electrical engineer.

SAN BERNARDINO, CAL.—The Inland Oil Refining Company, recently organized, plans to build a substation in connection with a new refinery on West Rialto Avenue, to cost about $110,000.

LOGAN, UTAH.—A special election will be held on May 15 to vote on the proposal to issue $300,000 in bonds to rebuild the municipal power plant in Logan Canyon.

DENVER, COL.—A permit has been granted the Denver Tramway Company for the construction of a substation at 3,555 Gilpin Street.

WARD, COL.—Preliminary plans have been prepared by C. W. Thuringer, engineer, East Forty-second and Josephine Streets, Denver, for the construction of an electric smelter and a 40,00-hp. hydro-electric plant, to cost about $500,000. Owner's name withheld.

RENO, NEV.—The Sierra Pacific Electric Company has issued $1,643,800 in capital stock, part of the proceeds to be used for extensions and improvements.

## Canada

SOUTH VANCOUVER, B. C.—The British Columbia Electric Railway Company is planning to erect an automatic substation near Main Street. The cost of the equipment is estimated at $39,000.

CLIFFORD, ONT.—The installation of a municipal electric light plant is under consideration by the Town Council.

NORTH BAY, ONT.—Bids, it is understood, will soon be asked by the Temiskaming & Northern Ontario Railway Company for the construction of an electric branch line from either Dane or Swastika stations eastward to Lake Larder, 25 miles of single track. S. B. Clement is chief engineer.

NORTH BAY, ONT.—The Nipissing Central Railway Company contemplates building an electric railway eastward from New Liskeard into Quebec and then northward to Larder Lake from 60 to 80 miles, ultimately connecting with the Temiskaming & Northern Ontario Railway branch from Dane. The cost is estimated at about $3,000,000. S. B. Clement is chief engineer.

SARNIA, ONT.—The Hydro-Electric Power Commission of Ontario is preparing plans for extending the light and power lines from Sarnia to Corunna and Courtright, at a cost of about $42,000. E. R. Lawler, 190 University Avenue, Toronto, is engineer.

TORONTO, ONT.—Extensions will be made to the substation on Bay Street of the Toronto Hydro-Electric Commission, to cost about $90,000.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued April 10, 1923)

1,450,919. RHEOSTAT; P. Harris, New York, N. Y. App. filed July 15, 1922. Used in connection with storage batteries for wireless apparatus.

1,450,964. INCANDESCENT ELECTRIC LAMP; G. W. Turner, Cleveland, Ohio. App. filed Feb. 4, 1921. Method of renewing filaments.

1,450,966. SYNCHRONIZING SYSTEM; H. A. Affel, Brooklyn, N. Y. App. filed Sept. 30, 1919. For multiplex carrier-current communication systems.

1,450,969. RECEIVING CIRCUITS FOR WEAK SIGNAL CURRENTS; J. R. Carson, New York, N. Y. App. filed June 18, 1918. For long submarine cables.

1,450,970. TROLLEY HANGER; F. Chesszneky, Yukon, W. Va. App. filed Dec. 8, 1922. Clamping ear.

1,450,972. OUTLET BOX; L. H. Church, Roselle, and G. C. Thomas, Jr., Elizabeth, N. J. App. filed Aug. 19, 1921. Adjustable means for clamping cable or conduit therein.

1,450,998. HIGHWAY CROSSING SIGNAL; E. W. Vogel, Oak Park, Ill. App. filed March 3, 1920. Magnetically operated.

1,451,003. STORAGE BATTERY; W. H. Wood, South Euclid, Ohio. App. filed March 28, 1921. Separator of porous wood impregnated with magnesium sulphate.

1,451,024. COMBINED RHEOSTAT AND SOCKET; C. Klemmer and W. P. Koechel, Bogota, N. J. App. filed April 4, 1922. For radio apparatus.

1,451,051. WRAPPING AND UNWRAPPING MACHINE; F. M. Pierce, Chicago, Ill. App. filed Sept. 11, 1917. For the manufacture of tread-wrapped tires.

1,451,058. GRID PLATE FOR ELECTRIC CURRENT STORAGE BATTERIES; R. O. Shatzke, Denver, Col. App. filed Feb. 6, 1922. Allows for expansion and contraction.

1,451,166. SIGNAL DEVICE; D. J. McCarthy, Elgin, Ill. App. filed May 27, 1920. Polychromatic signal device from which shaft of light of selected color may be projected.

1,451,264. MOLD OR FORM; H. F. A. Kleinschmidt, Johnstown, Pa. App. filed June 4, 1921. For electrically uniting abutting ends of railway rails.

1,451,271. VAPOR-ARC LAMP; H. C. Rentschler, Wilkinsburg, Pa. App. filed Feb. 27, 1919. Concentrated-point light.

1,451,280. MILL; A. Sundh, Hastings-upon-Hudson, N. Y., and W. Westerman, Detroit, Mich. App. filed Oct. 8, 1920. Electrically operated device for indicating amount of material that is passing through mill.

1,451,281. INDICATOR; A. Sundh, Hastings-upon-Hudson, N. Y., and W. Westerman, Detroit, Mich. App. filed Oct. 8, 1920. Applied to mills for indicating the travel material through of mill.

1,451,283. THERMOCELL; J. L. Weatherwax, Wilkinsburg, Pa. App. filed Feb. 27, 1919. Means for varying pressure in thermocell tubes to change thermal electromotive force of couple.

1,451,328. ELECTRIC SIGNAL TRANSMITTER; D. Desplate, Buenos Aires, Argentina. App. filed Nov. 4, 1919. Push button type.

1,451,333. ART OF MAKING ELECTROLYTIC IRON; F. A. Eustis, Milton, C. R. Hayward, Quincy, and H. M. Schleicher and D. Belcher, Boston, Mass. App. filed Dec. 1, 1920. Electrolytic iron made by reducing ferric solution by electric current to ferrous state and then transferring ferrous solution to separate electrolytic cell.

1,451,347 and 1,451,348. STORAGE BATTERY; W. H. Thorpe, Mount Vernon, N. Y. App. filed Feb. 1, 1922. Automatic means for keeping proper amount of electrolyte in battery.

(Issued April 17, 1923)

1,451,678. VARIABLE-RESISTANCE UNIT; W. J. Cameron, Chicago, Ill. App. filed May 9, 1921. For controlling electric heating devices.

1,451,687. ELECTRICALLY HEATED BURNISHING MACHINE; H. E. Dow, Beverly, Mass. App. filed May 6, 1921. For burnishing sole edges of boots and shoes.

1,451,704. ATTACHMENT PLUG; S. McClatchie, Cambridge, Mass. App. filed Sept. 2, 1919. One-piece insulating body adapted to slip into a threaded socket shell.

1,451,746. MULTIPLEX SELECTING CIRCUITS; M. Sultzer, Brooklyn, N. Y. App. filed Dec. 23, 1921. Selective arrangements for multiplex signalling channel.

1,451,758. MANUFACTURE OF DRY-BATTERY CANS; F. G. Breyer and W. H. Finkeldey, Palmerton, Pa. App. filed Jan. 12, 1922. Uniform corrosion of zinc takes place in normal action of battery.

1,451,767. COMPOSITE RINGER FOR MULTIPLEX-TRANSMISSION SYSTEMS; L. Espenschied, Hollis, N. Y. App. filed Sept. 27, 1919. Interference between the various carrier currents eliminated.

1,451,801. PROCESS FOR HANDLING, DRYING AND FORMING PASTED BATTERY PLATES; C. M. Angell, Chicago, Ill. App. filed April 1, 1922.

1,451,847. ELECTRICALLY HEATED AND CONTROLLED STEAM BOILER; W. H. Rowe, Jacksonville, Fla. App. filed Feb. 10, 1922. Automatic control as to pressure and water content.

1,451,863. LIQUID HEATER; W. F. Clark, Warren, Pa. App. filed April 2, 1921. Water circulated through and around the heating element.

1,451,877. ADVERTISING DEVICE; J. E. Koehler and R. Paul, Chicago, Ill. App. filed Feb. 6, 1922. For doors or gates.

1,451,880. ELECTRIC HEATING APPLIANCE; E. N. Lightfoot, New York, N. Y. App. filed Feb. 28, 1921. Elongated electric heater arranged within a casing and embedded in metal contained therein.

1,451,885. PRIVATE-BRANCH-EXCHANGE SYSTEM; M. L. Nelson, Chicago, Ill. App. filed July 9, 1917. Subscribers establish connections by means of automatic switching mechanism.

1,451,886. SIGNALING APPARATUS FOR TELEPHONE SYSTEMS; M. L. Nelson, Chicago, Ill. App. filed June 13, 1921. Audible signaling equipment for automatic telephone systems.

1,451,894. ELECTRIC RIVETING MACHINE AND PROCESS; A. B. Rypinski, Laurelton, N. Y. App. filed Jan. 26, 1921.

1,451,896. TELEPHONY; H. S. Turner, San Diego, Cal. App. filed Feb. 27, 1915. Switchboard systems of the central-energy multiple type.

1,451,900. ELECTRICAL SIGNALING AND RECORDING SYSTEM; J. M. Diegel, Minneapolis, Minn. App. filed Dec. 6, 1920. For automatic journal and fire alarms, fire doors, etc.

1,451,912. TELEPHONE TRUNKING SYSTEM; A. E. Keith, Hinsdale, Ill. App. filed May 21, 1907. Automatic system in units of fifty subscribers' lines with ten first selectors.

1,451,968. INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed July 25, 1918. Strain insulator with heat-resisting covering.

1,451,969. INSULATED CONNECTOR; L. Steinberger, Brooklyn, N. Y. App. filed May 23, 1919. Connectors in which bodies of oil are utilized as insulating element.

1,451,979. ELECTRIC CONDUCTOR COUPLING; T. H. Penn, Cleveland, Ohio. App. filed May 17, 1921. Particularly designed for factory buildings, machine shops, etc.

1,452,032. OSCILLATING GENERATOR FOR SIGNALING SYSTEMS; J. F. Farrington, New York, N. Y. App. filed April 30, 1918. Vacuum-tube type with feed-back coupling.

1,452,064. RADIO TRANSMITTER; V. Bush, Chelsea, Mass. App. filed Nov. 22, 1918. Closed circuit of impact type in which a series of undirectional pulses are produced.

1,452,115. DIMMING MECHANISM; A. Herz, Chicago, Ill. App. filed July 24, 1918. Utilizes inductance coil.

1,452,143. DYNAMO FRAME AND METHOD OF FORMING THE SAME; J. Purke, Erie, Pa. App. filed Nov. 6, 1919.

1,452,157. INDICATOR MOTOR; C. J. Henschel, Brooklyn, N. Y. App. filed Sept. 18, 1820. Remote control of motors actuating indicators.

1,452,158. TRANSFORMERS; S. Horelick, Pittsburgh, Pa. App. filed July 21, 1921. Arrangement of coils for high-tension units.

1,452,163. CURLING-IRON HEATER; H. G. Levy, San Francisco, Cal. App. filed March 14, 1921.

1,452,169. SYSTEM OF ELECTRICAL CONSTRUCTION; A. T. Sampson, Lynn, Mass. App. filed May 7, 1917. Layout of conduit system.

1,452,194. ELECTRICAL TESTING CLIP; G. B. Dusinberre, Elmira, N. Y. App. filed June 22, 1921. Spring clip.

1,452,207. DEHYDRATOR; W. Meredith, Alameda, Cal. App. filed Oct. 28, 1920. Emulsion circulates in path of electrical discharge.

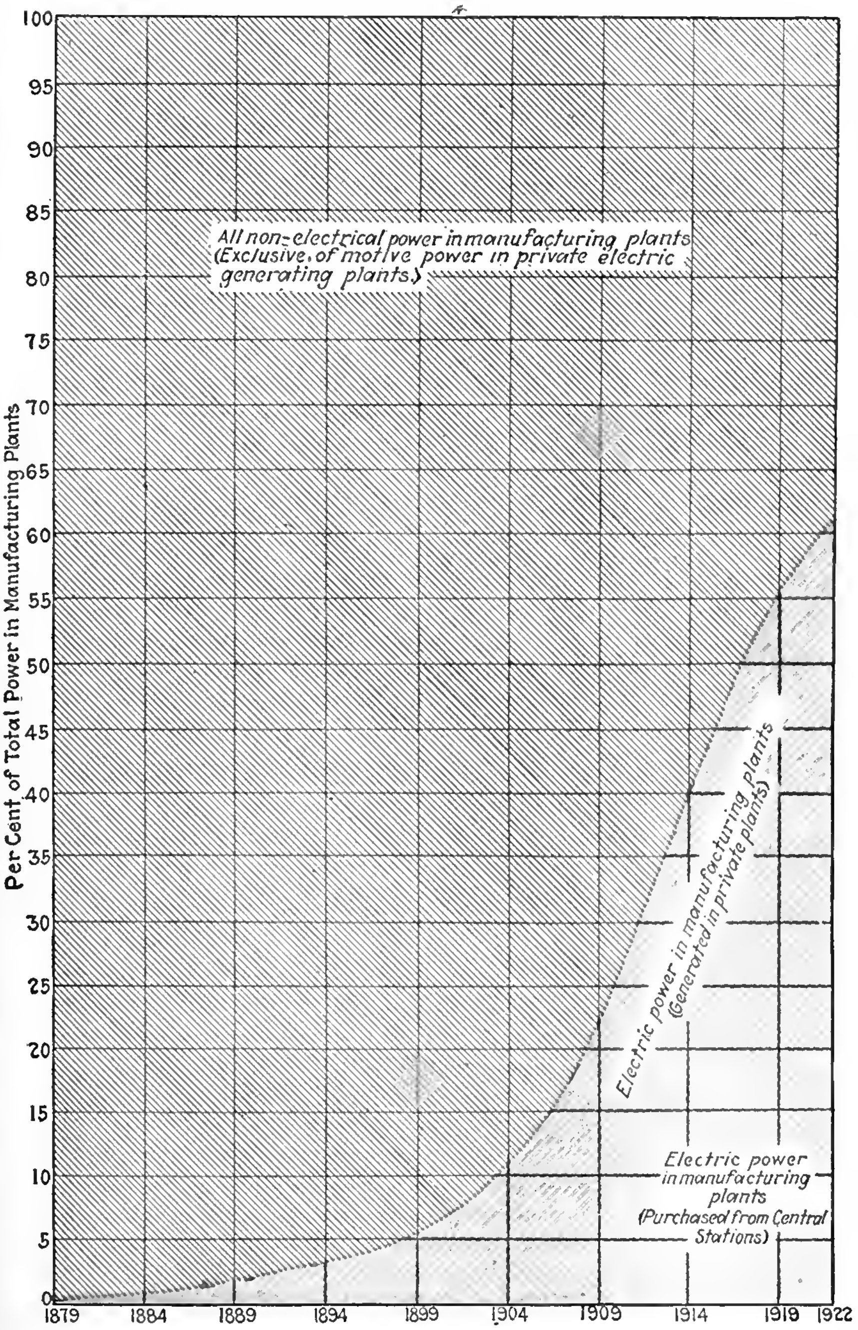
1,452,212. BRAKE-ACTUATING MECHANISM; R. A. Neal, Lexington, Ky. App. filed July 20, 1921. Electrically controlled brake for automobiles.

1,452,230. HIGH-POWER DRY BATTERY; A. A. Wells, Montclair, N. J. App. filed Jan. 2, 1918. Of Leclanché type.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

## Approximately 61 per Cent of the Primary Power in American Manufacturing Plants Is Now Electrical




Most of the data for statistics in the Electrical World are gathered by it from original sources. Privilege is freely given to readers of the Electrical World to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the Electrical World in obtaining and compiling further basic information if those using these statistics in any manner would credit the Electrical World.

## The Conquering Force in American Manufactures

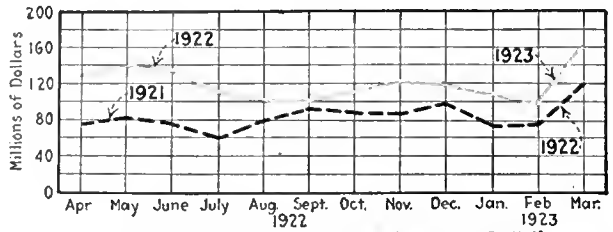
The wholesale adoption of electric drive by the manufacturing plants of the country during the past forty years reads like the story of the automobile. In fact, these two great servants of mankind, electrical energy and gas propulsion, have experienced much the same skyrocket type of growth, and yet a growth which has so intertwined these forces into the very economic being of the nation that they will endure as long as the nation itself. And yet there will probably always remain certain types of service which the horse can accomplish more efficiently and economically than the gas-driven machine, and the steam engine and water-wheel will probably always fill most effectively a certain niche in our industrial life.

The accompanying diagram, based on United States Census data and data collected by Electrical World through its four-year, nation-wide industrial survey, tells very effectively the story of the adoption of electric-drive by the manufacturing plants of the country, and the consequent decrease in steam, hydro and gas-driven machinery in the factories and mills of the land.

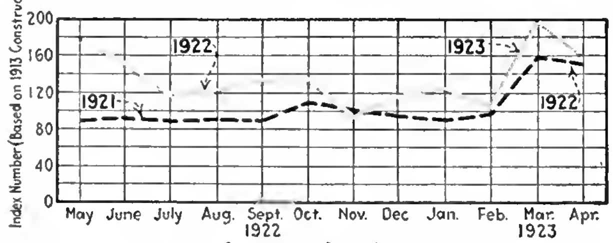
In 1879 steam and hydro power held full sway as the forces turning the wheels of industry. By 1922 electrical energy had pushed all other forms of machine-drive into the background, leaving the steam, hydro and gas-drive only 30 per cent of the total horsepower of the manufacturing establishments of the country. But the installation of electric motors in new plants and the conversion of steam drive to electric drive is still on the increase, with a consequent further decrease in the percentage of other forms of energy. The day does not seem far distant when three quarters of the motive power of the factories and mills as a whole will be electric.

Another very significant fact to be drawn from the diagram is the increasing proportion of electrical energy supplied by central stations as opposed to private plant generation. Back in 1904 more than 72 per cent of the electric motor load was carried by private generating plants. Today only about 30 per cent is carried by private plants and 61 per cent by central stations, and every year is witnessing the advance of the central station into the territory of the private plant.

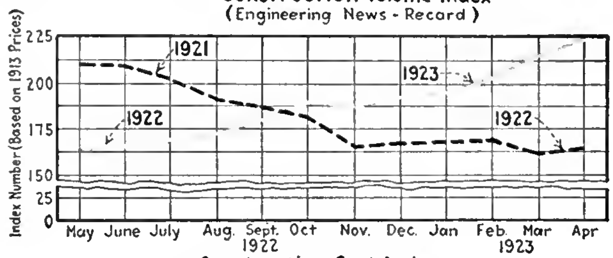
# How the Primary Industries Are Trending



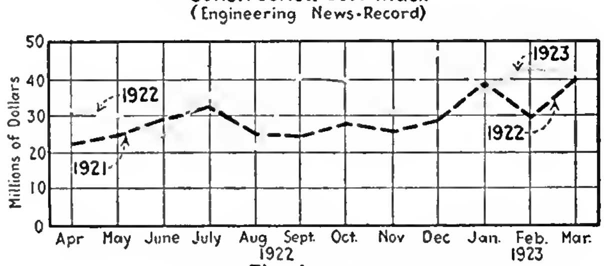

Contracts Awarded for Residential Buildings



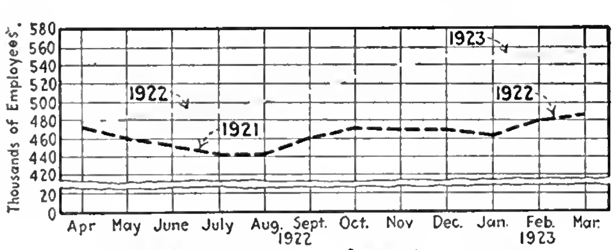

Construction Volume Index
(Engineering News-Record)



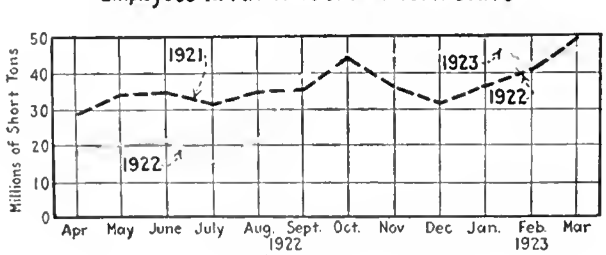

Construction Cost Index
(Engineering News-Record)



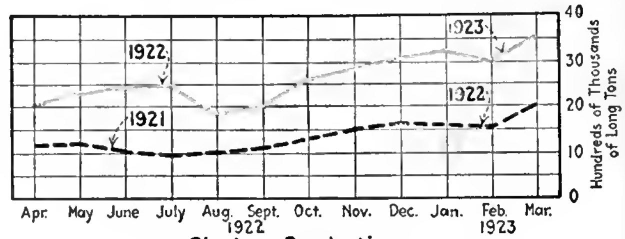

Fire Losses



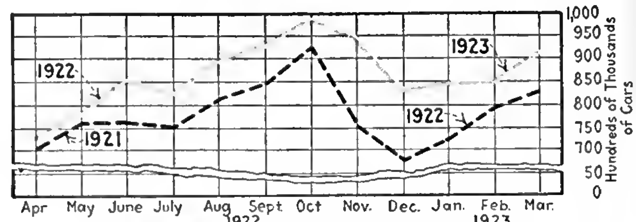

Employees in Factories of New York State



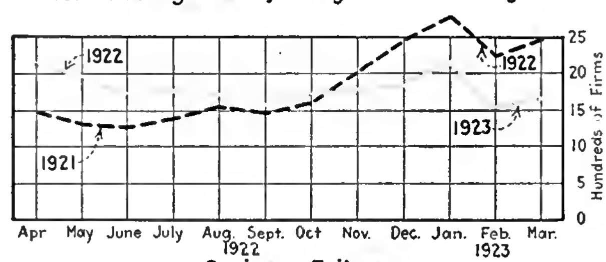

Bituminous Coal Production



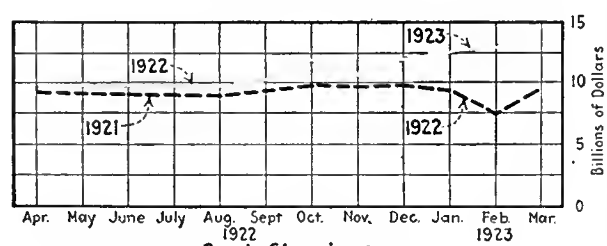

Pig-Iron Production



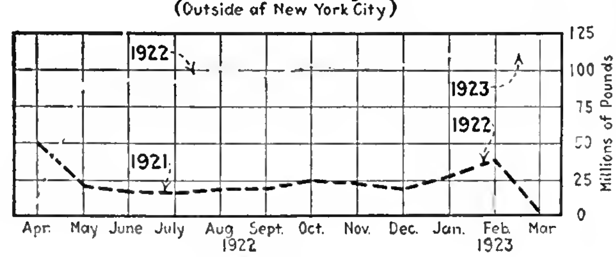

Total Average Weekly Freight-Car Loadings




Business Failures




Bank Clearings
(Outside of New York City)




Copper Production

## Bank Cash Exceeds Needs for Credit

THE present lending capacity of the country's banking system is now far in excess of the credit needs of the country's productive activity, according to the monthly review of the New York Federal Reserve District. The review also shows the following as among the increases that have taken place since July 1, 1921: Production, 67 per cent; employment, 28 per cent; wholesale trade, 23 per cent; retail trade, 15 per cent; prices, 15 per cent, and wages of unskilled labor, 22 per cent.

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# "Vice-President in Charge of Sales"

EXECUTIVES of central-station companies are beginning to appreciate more fully that their business, like any other, is built on the plan of a three-legged stool. The three legs which support it are finance, production and sales. Kick any one of these legs from under and the stool falls.

Since the beginning the attention of the executive has been closely, and naturally, focused on two legs mainly. He has been absorbed in the problems of engineering and operating—that is, production—and intent on financing—that is, raising money and meeting obligations. The sales leg—commercial management and public relations—has been a neglected, insecure one. But the stool has borne the weight upon it and the matter has had little thought.

Now comes a broader conception of the commercial opportunities and business obligations in the electrical industry. Bigger plans are forming. Greater expansion than ever is ahead. For the public *will* be served. And the development of a more general and intelligent equipment and electrification of buildings and industry, the development of a greater electrical merchandise market—in other words, the development of a more nearly universal application of electric service—presents an absorbing problem. More equipment and more appliances, which will use more energy and provide more service, are to be sold to industry, to agriculture and to the home. And naturally in each community the central station must lead in this work.

BUT this entire program means much more than just the selling of energy or appliances. The intelligent guidance and control of the expansion is the real issue. It is a problem of public relations, of community contacts. The need is thus for men rather than materials. And the important problem that confronts the president of the electric light and power company today is to strengthen the third leg of the stool by building up an adequate commercial organization that will go forward with the creative development of this greater market and service. Where he does not already exist in the president himself, the first need is for a commercial executive in every city who possesses the personality, the imagination and courage, the business experience and the commercial genius that will enable him to become the responsible head of this major activity of the business. In other words, the importance of the commercial division must be recognized, and it must be manned as effectively as are now the engineering and financial departments. The commercial executive of the central station is, moreover, the man who should make himself the head of the local electrical family, the leader and guide of all the electrical commercial activities in the town, working with a broad conception of the interest and service of the dealer, contractor, jobber and manufacturer as well as of his own company, to promote the expansion of the entire market for electric service and appliances. He should be a man of large caliber, a natural leader, able to win wide popularity without the sacrifice of proper dignity, amply qualified to take a prominent position among the influential business men of the community.

IT HAS long been customary for large and successful manufacturing enterprises to organize their personnel into these three departments of finance, production and sales. The problem of the central-station company is very similar, and the complete commercial function, embracing public and industry relations, customer contacts, publicity and selling, appears to be of sufficient magnitude to warrant its being headed, in the larger companies, by a "vice-president in charge of sales." In smaller organizations there should be a man no less appropriately titled and qualified to build sales and good will for the electrical industry.

Chief executives of central stations today can scarcely make any one move which will ultimately mean so much to the success of their business as to establish, where it has not already been done, commercial and public relations executives with the authority and support that will enable them enthusiastically and intelligently to develop the expansion of the industry. They will do this broadly in the public interest. Complete electric service will be brought into universal use, and the time to make adequate preparation is not some day—but now.

# George Edward Miller

*An exponent of the doctrine of a broad spirit of co-operation in business building for central stations.*

THE city of Cleveland has long been rated as one of the most advanced centers of electrical development. As the home of an exceptionally enterprising central-station company and a large and very active group of electrical manufacturers, it early became the source of much of the promotional activity of the electrical industry, a proving ground for many new ideas in electrical development. The Cleveland Electric Illuminating Company has been the moving spirit throughout this interesting evolution and finally itself withdrew from the sale of appliances, with the idea of encouraging the local electrical merchants.

For the last twelve years the executive direction of electrical development in Cleveland has been in the hands of George E. Miller, sales manager of the Illuminating company. Possessing rare business judgment and tact, he has functioned in an advisory and co-operative capacity, but in effect he has been placed in the position of an active sales manager for the local electrical family. He was the first president of the Cleveland Electrical League and has devoted much of his time and energy through these years to planning and making possible the broad advancement of the electrical idea in Cleveland and the development of a greater prosperity for the electrical business there.

Mr. Miller was born on a farm near Weldon Spring, Mo., in 1872. He was graduated from the State University at Rolla, Mo., in 1895 and for two years was assistant instructor in the civil engineering department of its School of Mines and Metallurgy. For a time he was engaged in consulting and designing electric light and waterworks plants in Middle West states.

But the problems of market development appealed to him very strongly, and in 1899 he became a sales engineer in the St. Louis office of the Westinghouse Electric & Manufacturing Company. A year later he was transferred to the Westinghouse headquarters at Pittsburgh, and for a period of seven years he engaged in sales work and confidential activities for the vice-president. He was assigned to the Cleveland district office in July, 1907. This brought him into close contact with the fascinating opportunities for market building that lie in the field of co-operation between the central-station company and the local electrical family of any community. He decided four years later to enter utility commercial work and joined the Cleveland Electric Illuminating Company, where he has won for himself a national reputation as one of the foremost utility sales managers of the day.

# Editorial Comment

Electrical World, May 12, 1923

Volume 81 Number 19

## Rendering Service a Business for Engineers

THROUGH his knowledge and training the engineer is particularly fitted to render service for the public welfare; but, being largely a creature of tradition, he is inclined to be exasperated by incompetence and ignorance and to fail to grasp the significance of facts not related to engineering. He looks upon commercial activities with distaste, not infrequently labeling business a "money-grabbing game." What the engineer fails to realize is that conditions now existing in our industrial civilization require his services, that he is under a heavy obligation to improve the civilization his engineering activities have produced, and that the only possible outlet for such services is through business channels. Engineering activities are really business activities, and the only touch with the public that can be maintained by the engineer is through the business contacts of his engineering operations.

The best salesman is the man who knows his product, and the engineers, therefore, should sell engineering service to the public if they are to develop and become an agency for the improvement of the national life. There is too much loose talking about water powers, transportation facilities, aviation, radio and other engineering subjects by politicians, lawyers, business men, economists and village gossips. If their imaginations are allowed to run wild, such men will hypnotize themselves into believing that their conjectures are facts. This is all wrong. Engineers must become publicists and must bring home the engineering side of these things to the public as business facts. Every engineering argument can be reduced to an economic fact or phrased in a popular manner which can be grasped by the public. If put forth by men who know whereof they speak and who are capable of stating it in a way dictated by business sense and a knowledge of mass psychology, these statements will carry conviction and belief.

## Petersen Coil Limited in Its Application

WIDELY different impressions have been left in the minds of engineers who attended the Pittsburgh convention of the American Institute of Electrical Engineers regarding the desirability of the Petersen grounding reactor. Some engineers, and possibly the majority, believe that the Petersen coil is a dead issue and has no application. Others quite as confidently believe that it can be adapted to any transmission system of moderate voltage.

The latter group are evidently impressed with the fact that the Petersen coil installation on the Alabama Power Company's system performed its function satisfactorily in 166 out of 168 cases of operation. While it was brought out in the discussion that the Petersen coil in this installation had to be short-circuited during switching operations to avoid producing severe voltage surges, it was not sufficiently emphasized that a still more practical disadvantage is the necessity of adjusting the reactor for every change in line conditions. If some simple scheme can be developed which will readily and quickly adjust the Petersen coil taps to the capacitance of the line which it is protecting, both these disadvantages will largely be eliminated and its field of application extended. Until that time it appears that the application of the Petersen coil will be limited to moderate-voltage branch lines.

## Why Not Centralize Experimentation in Station Design?

IT TAKES courage to be a pioneer in power-station design under existing conditions even though the economic prizes in prospect are unusually attractive. The rapid increase in the demand for power, the size of stations under consideration and the enormous investment required to build a modern station place a premium on conservatism and make reliability the governing element in design. Yet we find many stations under way which incorporate very radical departures in design principles, differ widely in their design details and involve experimentation and untried practice.

This fact is an indication of the courageous and forward-looking thinking prevalent in the central-station industry, which will surely achieve beneficial results. Yet a glance over the designs for contemplated stations shows a startling amount of variation in practice and a great amount of duplication in experimental work. Even though powdered fuel is adopted for many new stations, investigation shows that data for large boiler units are missing and that a great deal of experimentation will be necessary before the new stations operate satisfactorily. Even greater differences in practice and greater dearth of actual data are found in other contemplated practices. For example, one group of engineers enthusiastically plans several stations using reheated steam; another group advocates air preheating and cannot "find" economizers; still another group uses specially designed economizers and condensers and an unusual scheme for heat balancing. On top of all this stations are planned for the use of steam pressures of 375, 550, 1,200 and even 3,000 lb., with steam temperatures ranging up to 900 deg. F. No new basic theory has been developed which would prompt these designs; no great quantity of field data has been obtained, nor has there been any outstanding improvement in equipment recently. The wide adoption of new designs must therefore be largely a psychological reaction to the unprecedented demand for power, the good money market and the healthy state of the industry, coupled with a supreme confidence that the technical problems involved will be conquered.

While this general movement is fundamentally sound

and will prove its value, yet it does seem that there is a good opportunity to achieve the same results in a less expensive and less hazardous way. Why not centralize the equipment and personnel needed to determine experimentally the commercial limits of pressure and temperature and to obtain real data on preheating, economizers, steam reheating, condensers, burning of pulverized fuel and so forth? Would this not seem a logical way to approach an engineering problem of this importance and size? Most of these questions will have to be decided by getting data on installations of magnitude and by doing a great deal of research work, and the centralization plan would be the cheapest way to insure results, to say nothing of eliminating the duplication, false designs and operating hazards that may occur in the individual installations.

## Rating of Insulator Should Be Guide to Selection

FROM the user's standpoint the nominal line-voltage method of rating pin-type insulators has always been a source of confusion. One reason is that the ratings, as between different manufacturers, have not been uniform, and, what is more important, no rating of this character can take into consideration all the factors entering into the selection of insulators for any given situation. An insulator of a given nominal line-voltage rating may be good on one extreme for a line voltage of more than its rating. This condition occurs in some sections of the dry desert country of the West. On the other extreme a line operating at the same voltage may demand an insulator, rated on the same basis, at as high as eight or ten times the line voltage. This occurs where salt or chemical fogs or like conditions put a conducting deposit on the insulators. Between these two extremes lie the long list of system and climatic conditions which call for a selection that has little direct relation to the nominal voltage of the transmission line.

As a result of these conditions the more experienced designers have for a number of years been selecting pin-type insulators largely on dry-flashover voltages after careful consideration of the conditions under which the insulators are to be used. The less experienced designers have been placing dependence on the catalog ratings and then paying for the mistakes of selection in operating trouble and expense.

A demand, voiced by a few individual engineers, in addition to the action taken at the Pacific Coast convention of the American Institute of Electrical Engineers at Portland in 1920, was for a complete standard specification for insulators. When the committee came to examine the manufacturing situation, it was apparent that ceramic engineers have not yet had sufficient experience to write a standard specification for high-tension porcelain and that such a specification would be likely to prove a hindrance rather than a help. While the users were struggling with the rating situation, the manufacturers were struggling with a demand for tests and for compliance with specifications that were almost as numerous as the engineers responsible for the selection of insulators. Transmission-line designers were also embarrassed by the lack of specifications recognized as standards and the consequent uncertainty as to just how any two test voltages for different insulators could be compared. Some of the demands for acceptance tests were largely of the freak class, and the general result of the condition was an economic waste that could be obviated if a standard for design and factory testing could be devised. Since the standardization of the entire insulator specifications could not be undertaken, the committee devoted its attention to clearing up the two conditions which seemed the most embarrassing and that, from a practical standpoint, could most easily be met.

At the Pittsburgh meeting last month the committee presented a recommendation for the standardization of ratings on the basis of dry-flashover voltage, at the same time recommending a standard set of both dry and wet flashover tests. Any discussion of the proposed standards should proceed with a knowledge of the past work and should be devoted to determining constructively whether the committee has presented material that will really clear up the two conditions mentioned. On the one hand, will the designer be enabled, with the proposed rating, more intelligently to select the pin-type insulator he needs and, on the other hand, will the manufacturer be able to put his production processes on a more satisfactory basis and devote less energy to meeting half-baked ideas as to the proper tests to which pin-type and also suspension insulators are to be submitted for acceptance? If this can be done, he will receive more time to work out improvements in insulator design and manufacture. Complete standardization will have to be a step-by-step process based on the development of the art and the economics of insulator production.

## Non-Fading Light Needed to Preserve Colors

THERE are numberless examples of paintings which have faded beyond all semblance of their pristine selves. Very serious loss of color has taken place in many museum specimens which it was imperative to preserve as nearly as possible in their original state. In an endeavor to combat this deterioration Sir Sydney Harmer of the British Museum has within the last few years conducted a long series of experiments to determine the character of color changes produced by the exposure of pigments to sunlight or other light, the cause of these color changes in so far as it may be ascertainable, and particularly the possible remedies. The experiments were made by exposing pigmented and other objects under plain and tinted glasses with a control series under black glass, the exposure lasting for several years. The screening glasses covered a range from practically light window glass to a strongly absorbing glass similar to what used to be known as Euphos ordinary yellow green, cutting off all the ultraviolet and most of the violet and blue. This last-named glass had decidedly too strong a color to be a satisfactory permanent housing. Years before this same ground had been, for the same good purpose, pretty thoroughly explored by Dr. Russell and Sir William Abney.

The first fact which was clearly established was that, on the whole, fading from the action of light does not ordinarily take place in the absence of oxygen and moisture. This immunity probably does not extend to some of the very fugitive dyes like erythrosine, but the relation is generally true that where there is no oxygen and no water there is no fading. Moreover, as

might be anticipated from our general knowledge of photochemical reactions, the strongest fading effects were produced by direct sunlight, which was at least a score of times more injurious than the strong devised daylight. The control experiments, which freely let through a large part of the heat associated with the illumination, showed plainly that the effect of heat as such was substantially negligible.

Fading due to artificial electric light was much less than even with devised daylight—about one-sixth as much according to the experiments—the electric light used for the comparison being a powerful gas-filled incandescent lamp. Such a lamp is by no means free from ultra-violet radiation; hence there is the probability that a toning screen which would hold down the radiation on objects to something substantially within the limits of the visible spectrum would be of material assistance in still further preventing fading. Indeed, artificial daylight, when not abnormally rich in blue, gives promise of displaying colored objects as in a museum to better advantage in many respects than natural daylight. However, one must remember that while a great deal of photochemical activity has been charged up to the ultra-violet light, pretty nearly every part of the spectrum has under favorable circumstances a chemical effect upon something.

From a practical standpoint it would seem to be worth while to work out a source of non-fading light and then take up wherever possible the additional problem of preserving valuable objects with a still greater probability of success by sealing them from the air. There is probably no such thing as absolute prevention of all fading, but if the danger could be put far off down the centuries by means which now can be easily applied the end would seem well worth the effort.

## Modulated High-Frequency Telephony Over Transmission Systems

INTERCOMMUNICATION between substations and other strategic points on a transmission system and its distributing center or generating stations has always been more or less troublesome. In the early days, when transmission lines were short and the energy sent over the lines moderate, it was no difficult matter to string telephone lines as transposed metallic circuits below the power lines and to obtain reasonably good and reliable results. Sufficiently accurate transposition was, however, not always easy, and hearing was somewhat interfered with by the effect of leaks. Moreover, the line ran a risk of contact with the transmission circuits through a break in the latter. None the less, when most circuits were on wooden poles and the duty comparatively light the telephone line got on fairly well.

Today, with very long transmission lines carrying great amounts of energy and strung for the most part on steel poles or towers, the erection and maintenance of a first-class communication system is very far from easy. All sorts of protection have to be used both for the safety of operators and to guard against interruption of communications in case a surge starts on the power line. When everything is in order good results may be obtained over long distances, but abnormal operating conditions will very easily put the line out of service at just the time when it is most needed. In a few instances separate pole lines on the same right-of-way have been used for the telephonic communication, but this is such an outrageously expensive proposition both in first cost and maintenance that it is not likely to become popular.

Recently a good deal of interest has been excited in radio communication, particularly the variety of it somewhat loosely known as "wired wireless." In point of fact this is nothing but telephony by modulated high-frequency currents, which in this case have their locus on the transmission lines to which the oscillations are communicated instead of being in the free ether customarily employed for radio. A good many attempts have been made by central-station companies and others to utilize this particular variety of telephony on a considerable scale. Without wishing to be censorious of a new development just finding its application, considerable is still to be learned and accomplished before it can be adopted as an emergency means of communication with any assurance. It is encouraging, however, to see so many companies willing to do a little pioneering and experimenting in this connection. Out of experiences like those related in this issue and that for April 21 should come knowledge which will enable the manufacturers' development departments to put in installations of greater reliability.

Actual tests reported in the April 21 issue show what in fact might have been anticipated—that the efficiency of the power line as a carrier for extremely high-frequency oscillations depends in very large measure on the electromagnetic properties of the system considered as a high-frequency proposition. It is not surprising, therefore, to learn, first, that the frequencies desirable on the ordinary transmission system for wave telephony are comparatively low, and that there is a marked preference on any given system for certain groups of low frequencies. In one case which was well investigated the shortest wave length by which transmission was well effected was about 2,000 meters, with another useful range at say three times this wave length, and still another at about 18,000 meters. Near these points transmission was good, away from them bad and sometimes entirely ineffective. This may mean that there are resonant frequencies on the system which virtually form short circuits for oscillations of most wave lengths, or that impedances of equally bad effect may turn up.

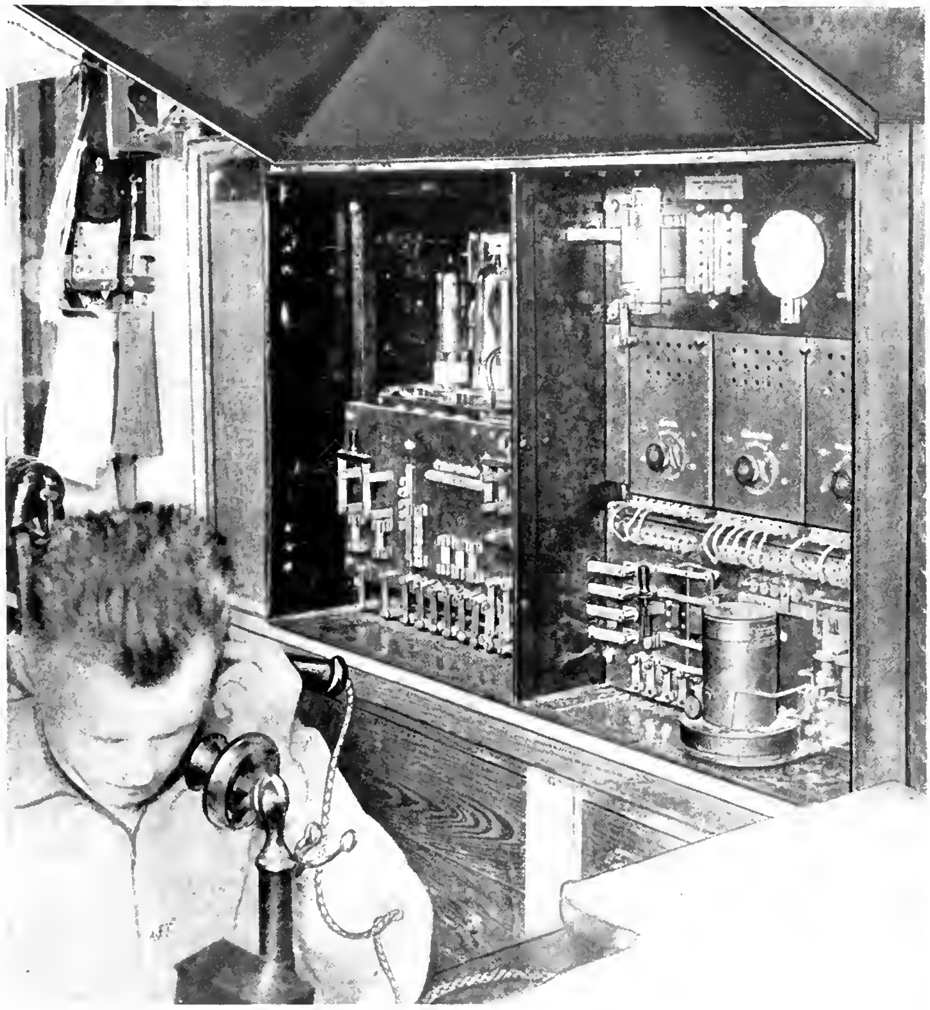
As might be expected, the scheme is interfered with by surges, short circuits and even the effect of switching. In fact, it should be easily seen that anything of this kind is likely greatly to upset the balance of the high-frequency system. Further trouble has been encountered from "spitting" insulators, which, of course, means variable leakage with all that that implies, and similarly electrolytic lightning arresters are likely to upset the successful operation of the system.

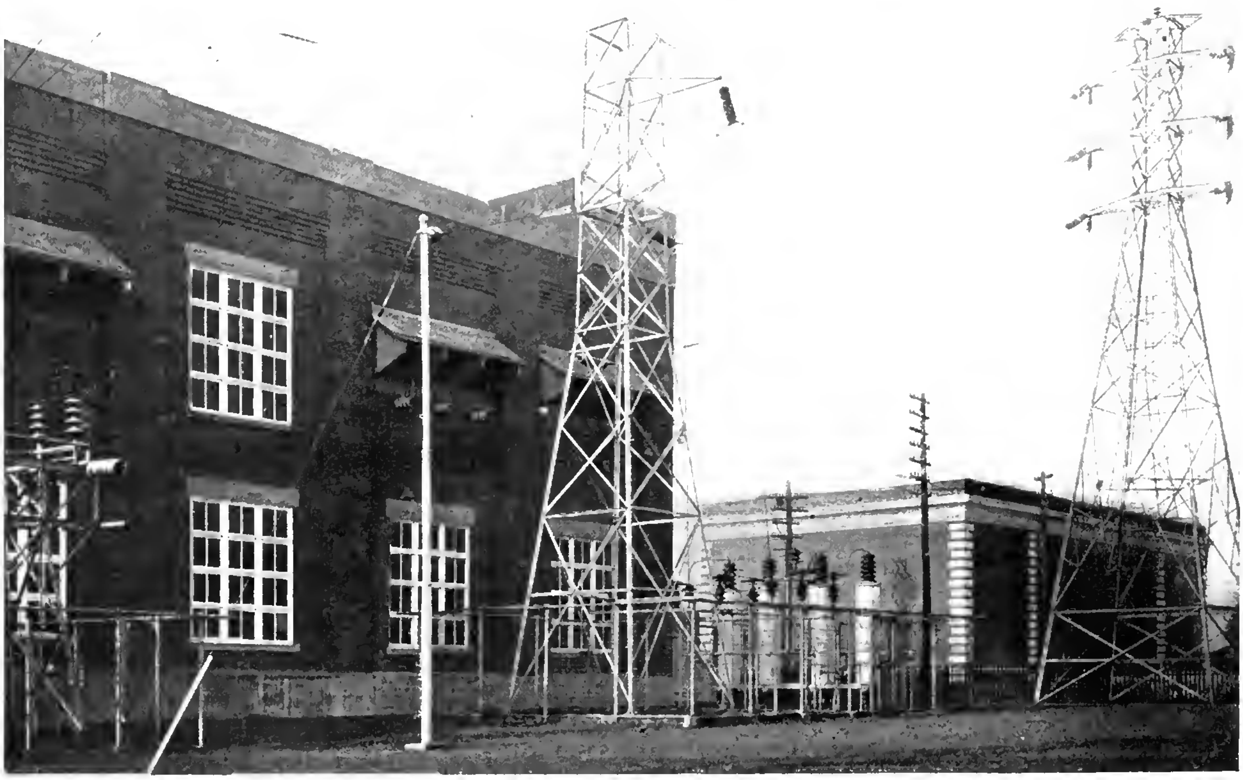
Doubtless, one factor in the successful operation of the Baltimore-Holtwood system, reported in this issue, is the simplicity of the transmission lines—that is, a single line without taps. This is in somewhat sharp contrast to the complicated system of the Duquesne Light Company, whose experiences were recorded in the April 21 issue.

It remains to be seen how far "wired wireless" can be used in a general way, although at present it may surely be said to be promising. Beyond all this comes the ordinary wave telephony, which has troubles of its own and plenty of them, but which may still "make good" over ordinary transmission system distances. It also seems likely that recent improvements may help the situation very materially so far as ordinary radio is concerned.

# Load Dispatching by Wired Wireless

IN ANY new development or application it is nothing unusual for various obstacles to arise. To a limited extent this has occurred with the application of carrier-current telephony to load dispatching and interstation communication. Remarkable strides have been made already by manufacturers in ironing out the obstacles, but further progress will be made in proportion as the operating companies exchange experiences with their fellow companies and manufacturers. Experiences of the Duquesne Light Company appeared in the April 21 issue of ELECTRICAL WORLD, and in this issue are presented those of the Pennsylvania Water & Power Company. One transmitting and receiving set is shown at the right and the line coupling below.





# Baltimore-Holtwood Carrier Current Giving Excellent Service

### Tested Under Service Conditions to Determine the Effect of Grounding Lines, Severity of Ground Currents, Charging Lightning Arresters, Nature of Coupling, Etc.—Three Months' Operation Entirely Successful

SEEKING some reliable means of assuring telephone communication between its Holtwood (Pa.) generating station and its main distributing substation at Baltimore,* the Pennsylvania Water & Power Company has installed and tested a carrier-current telephone outfit. It has been in operation since the beginning of the year and, according to tests and the experience of the operators, it is entirely successful—so much so that similar facilities for communication are contemplated between the generating station and the Lancaster (Pa.) substation.

In the past telephone communication between these points has been conducted solely over two physical wire circuits consisting of No. 9 B. & S. copper wires supported on wooden poles midway between the two tower lines connecting these points. These physical telephone circuits have provided good service except in cases of ground current and lightning surges. The need of supplementing these circuits by some other means of communication was emphasized, however, on July 25, 1921, when wire communication between Holtwood and Baltimore was totally interrupted for more than seven minutes owing to the failure of the telephone circuits. Prompted by this occurrence, General Electric carrier-current equipment was installed, using the high-voltage circuit as a guiding medium for transmission of speech. Tests were conducted to compare the operation and reliability of the carrier-current equipment with the physical-circuit telephones under service conditions involving grounds on the circuits at various points, ground current between stations, charging of lightning arresters and different degrees of carrier-current coupling.

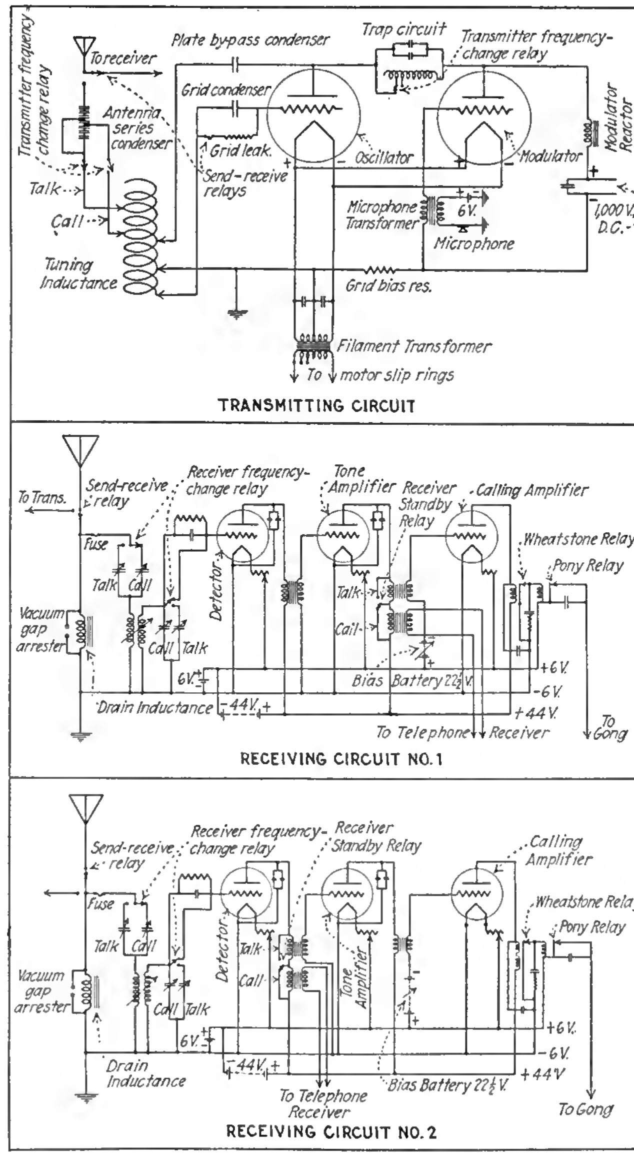
#### NATURE OF EQUIPMENT USED

The carrier-current equipment installed provides for calling and talking, but transmission of speech or call signals can be carried on in one direction only at a time. A carrier current provides means of transmitting speech and call signals, the calling and talking carrier frequencies being approximately 16,000 cycles and 12,000 cycles respectively

Modulation is accomplished by means of the well-known constant-current system. The calling and talking frequencies are separated by a frequency-change relay operated by a key on the telephone stand. This relay selects the taps on the tuning inductance, antenna series condenser and trap circuit corresponding to the talking or calling frequencies. Power for operating the small motor-generator set is received from the control battery at the station, and energy for lighting the filaments of the tubes is obtained from slip rings on the motor at 154 volts, 30 cycles, and is transformed to 10 volts, 6.5 amp. for the filaments.

As in the transmitting set, relays are employed to

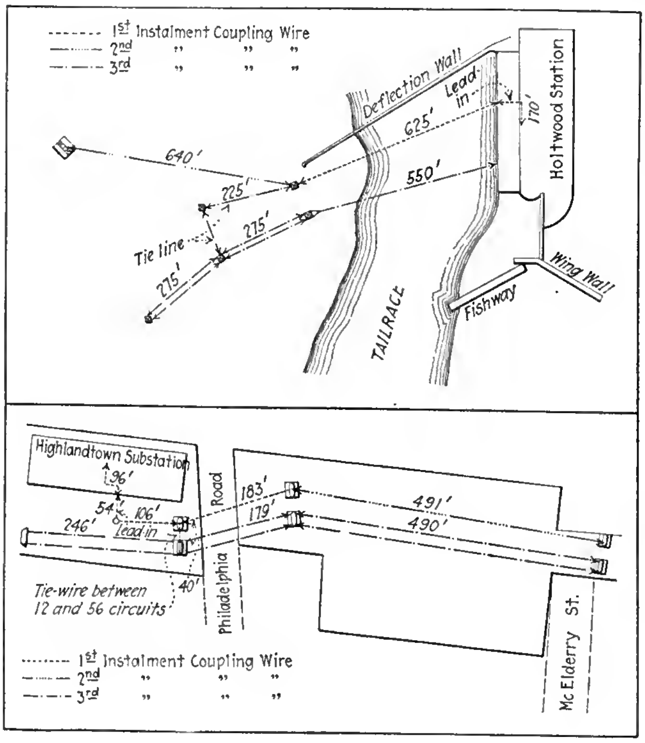
*Approximately 40 miles between stations.




TRANSMITTING-SET CIRCUITS AND TWO RECEIVING CIRCUITS WHICH WERE TRIED

tune the receiving set to the talking or calling frequencies, being operated by raising or lowering the telephone switch hook. The last tube is connected to a calling relay which operates a pony relay to ring a call bell. These call relays are disconnected from the circuit when the receiver is taken from the hook, and at the same time the receiver is automatically connected in the circuit.

Coupling of the transmitting and receiving sets with the transmission line is accomplished by utilizing the




LINE COUPLINGS AT HOLTWOOD AND HIGHLANDTOWN TERMINALS

existing ground wires over the circuit, sections thereof being insulated from the remainder of the ground wire and from the towers and brought to the sets by lead-in wires. The method of coupling is indicated in two of the accompanying illustrations. The coupling wire at the generating station and the wire at the substation end of the line differ in length and have been added to since the equipment was originally installed.

Tests were made under three different conditions: (1) With original coupling wires over circuits Nos. 1 and 2; these were 290 ft. at the Baltimore end and 625 ft. at the Holtwood end. (2) With lengthened coupling wires over circuits Nos. 1 and 2, consisting of 780 ft. at Baltimore and 1,265 ft. at Holtwood. (3) With the coupling wires of condition No. 2 in parallel with coupling wires over circuits Nos. 5 and 6.

The lead-in at Holtwood is 170 ft. in length and that at Baltimore is 150 ft. At Baltimore there are two ground wires on circuits Nos. 5 and 6, both of which are used as coupling wires, while at Holtwood the tailrace span now used as a coupling wire consists of a single wire. The wires are tied together between towers so that an H-shaped coupling is formed. The coupling wires consist of seven-strand $\frac{3}{8}$-in. steel cable.

Using the coupling wires as originally installed over circuits Nos. 1 and 2 (condition No. 1), the transmitters and receivers at Holtwood and Baltimore were adjusted to the best conditions for operation. Receiving condition No. 3 was used both at Holtwood and Baltimore. The quality of the speech was excellent. However, two limitations to the use of the short coupling wire became evident: (1) The talk and call frequencies could not be separated far enough to prevent the talk frequency from ringing the call bell, and (2) the frequency of the carrier could not be lowered to a value which would prevent interference from commercial long-wave radio stations.

Using the same coupling, a series of grounding tests were conducted on circuits Nos. 1 and 2. The procedure followed was to take the circuits out of service and ground a number of phases at Holtwood or Baltimore, or at both stations as desired, and to attempt conversation and ringing over the carrier.

The results from this test show that under the conditions employed, communication was impossible in either direction with circuits Nos. 1 and 2 grounded at both Holtwood and Baltimore. However, with one phase ungrounded entirely and the other five conductors grounded at both ends communication became possible. With one circuit ungrounded at both ends and the other circuit still grounded at both ends talking and calling became entirely normal.

### Coupling Increased

As a result of the difficulties previously mentioned, the coupling over circuits Nos. 1 and 2 was lengthened both at Holtwood and Baltimore. This necessitated a retuning of both sets to allow for the increased capacity

RESULTS OF GROUNDING TESTS ON CARRIER-CURRENT COMMUNICATION—CONDITION NO. 1—ORIGINAL COUPLING WIRE ON CIRCUITS NOS. 1 AND 2

Length at Highlandtown, 290 ft.
Length at Holtwood, 625 ft.
(Hn. = Highlandtown. Hd. = Holtwood.)

| Test No. | Location of Grounds | Result | Remarks |
|---|---|---|---|
| 1 | Hd. 1 2 Hn. | Hd. could not hear Hn. talk. Hn. could not hear Hd. except for one short interval—very faintly then. Could not call either direction. | Five and six circuits carrying load. |
| 2 | Hd. 1 2 Hn | Hd. could hear clearly but faintly. Hn. could hear faintly, but speech not understandable. Speech made understandable by changing receiver coupling. | Five and six circuits carrying load. |
| 3 | Hd. 1 2 Hn. | Hd. could hear at two-thirds normal intensity. Hn.—Not noted. | Five and six circuits carrying load. |
| 4 | Hd. 1 2 Hn. | Could call in both directions. Conversation about normal strength. | Five and six circuits carrying load. |
| 5 | Hd. 1 2 Hn. | Conversation approximately one-half normal at Hn., two-thirds normal at Hd. Could not ring either direction without adjusting Wheatstone relay. | Five and six circuits carrying load. |
| | Note | Code heard on call settings. | |

CONDITION NO. 2—LENGTHENED COUPLING WIRE ON CIRCUITS NOS. 1 AND 2

Length at Highlandtown, 780 ft.
Length at Holtwood, 1,265 ft.
(Hn. = Highlandtown. Hd. = Holtwood.)

| Test No. | Location of Grounds | Results | Remarks |
|---|---|---|---|
| 9 | No. 1 Hd. — Hn.<br>No. 2 Hd. — Hn. | Hd. could not ring Hn. Hn. could ring Hd. Speech faint from Hd. to Hn. and Hn. to Hd. Reception slightly better at Hd. Conversation could be understood. | Nos. 5 and 6 carrying load. |
| 10 | No. 1 Hd. — Hn.<br>No. 2 Hd. — Hn. | Calling satisfactory both ways. Reception of speech at Hn. one-half normal strength. Reception of speech at Hd. normal intensity but blurred. Quite understandable. | Nos. 5 and 6 carrying load. |
| 11 | No. 1 Hd. — Hn.<br>No. 2 Hd. — Hn. | Hd. could not ring Hn. Hn. could ring Hd. 80 per cent signal reception at Hn. 66 per cent signal reception at Hd., but understandable. Tried retuning to get call. Calling should be received by adding capacity or decreasing play on Wheatstone relay at Hn. | Nos. 5 and 6 carrying load. |
| 12 | No. 1 Hd. — Hn.<br>No. 2 Hd. — Hn. | Hd. could not call Hn. Hn. could call Hd. Signal reception 80 per cent at Hd. Signal reception 90 per cent at Hn. Best quality of speech yet obtained. | Nos. 5 and 6 carrying load. |
| 13 | No. 1 Hd. — Hn.<br>No. 2 Hd. — Hn. | Voice two-thirds normal both ways. Hn. could call Hd. Hd. could not call Hn. | Nos. 5 and 6 carrying load. |
| 14 | No. 1 Hd. — Hn.<br>No. 2 Hd. — Hn. | Calling impossible in both directions. Hd. could not hear Hn. Hn. heard Hd. very faintly. Not understandable. | Nos. 5 and 6 carrying load. |
| 15 | No. 1 Hd. — Hn.<br>No. 2 Hd. — Hn. | Calling impossible both directions. Hn. heard Hd. very poorly—mushy, not understandable. Hd. heard Hn. very faintly—not understandable. Time not available for retuning properly. | Nos. 5 and 6 carrying load. |
| 16 | No. 1 Hd. — Hn.<br>No. 2 Hd. — Hn.<br>Jarrettsville | Talking and ringing impossible both ways. | Nos. 5 and 6 carrying load. |
| 17 | No. 1 Hd. — Hn.<br>No. 2 Hd. — Hn.<br>Jarrettsville | Hd. could ring Hn., but Hn. could not ring Hd. Hd. cannot hear Hn. talk. Hn. can hear but cannot understand Hd. Voice very weak. | Nos. 5 and 6 carrying load |
| 18 | No. 1 Hd. — Hn.<br>No. 2 Hd. — Hn.<br>Jarrettsville | Could call both ways. Hn. speech reception, 85 per cent. Almost normal reception at Hd. A little blurred at times. | Nos. 5 and 6 carrying load. |

and inductance due to the additional wire. Receiving connection No. 3 was still used at both stations. With circuits Nos. 1 and 2 carrying load under normal conditions, reception was very loud and clear. The quality of speech, however, was not so good as with the shorter coupling wire, since the signal strength was increased beyond the limit of some of the apparatus. Furthermore, the 25-cycle hum was increased somewhat, as would be expected. With the longer coupling it was found possible to separate the call and talk frequencies so that there was no interference between the two, and in addition code interference was avoided. Frequency measurements with a wave meter at Baltimore determined the call frequency as 16,200 cycles and the talk frequency as 12,400 cycles (wave lengths, 18,500 m. and 24,200 m. respectively).

### Compare Line and Carrier Telephone

In an attempt to reproduce the conditions which caused total interruption of the physical telephone circuit on July 25, 1921, eight ground current tests were made and the behavior of the carrier-current equipment was carefully observed and compared with that of the physical lines. No. 1 generator and No. 1 transformer at Holtwood, with the transformer neutral grounded and the ground stack shunted, were connected to circuit No. 2. Phases B and C of this circuit were short-circuited and grounded at Baltimore, and phase A was left open. A separate exciter was used to control the generator voltage. Circuits Nos. 1, 5 and 6 were kept in service and carrying load.

The results of the tests with these conditions are arranged in condensed form in the accompanying table. With the neutral of the telephone-phantom transformers grounded at Holtwood and Baltimore, furnishing a metallic return for ground currents, the physical lines became useless as soon as the ground current reached an appreciable value. The arresters flashed over at both ends of the line, causing very loud clicking in the telephones, which continued until the fuses blew at Baltimore. The carrier equipment was less seriously affected. The chief disturbance seemed to come from the periodic flashing over of the physical-line arresters, causing a clicking in the carrier receiver. This clicking ceased as soon as the fuses blew on the physical lines. Switching conversation could be carried on successfully in spite of the noise.

With the "disconnects" opened on the telephone lines and the lines short-circuited and grounded at both ends, little or no noise could be noticed in the receiver of the carrier equipment. This indicates that the noise in the carrier was largely due to interference from protective apparatus on the telephone lines.

The most serious trouble occurred when the phantom neutral at Baltimore was opened while that at Holtwood remained grounded. The carrier actually became so noisy that communication was impossible for about twenty or thirty seconds. However, this was due to the same cause. The noise ceased after arresters had failed and fuses at Baltimore had functioned.

Two ringing tests were made. Holtwood called Baltimore successfully, but when Baltimore attempted to call

Holtwood the Holtwood bell rang continuously. The test was repeated with both equipments in position to receive calls (that is, receivers on the hooks), and while there was no effect at Baltimore, the Holtwood bell rang intermittently.

A second series of grounding tests, more comprehensive than those made under condition No. 1, were made with the longer coupling over circuits Nos. 1 and 2. In certain of these tests grounds were made between terminals of the transmission lines as well as at the ends.

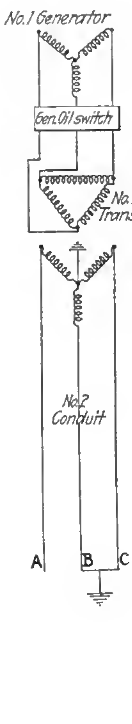
As in the previous grounding tests, satisfactory communication could not be obtained with circuits Nos. 1 and 2 grounded at both ends. Baltimore could consistently hear Holtwood, but the speech was too faint to be understandable. The test is of significance in showing that the longer coupling wire at Holtwood was a better transmitter than the shorter wire at Baltimore. With five phases grounded at both ends and one phase open throughout, talking was about two-thirds of normal strength in both directions. Ringing was possible in one direction only, but this was shown to be due to a slight misadjustment in tuning at Baltimore, since it was found that, after retuning, calls could be received in both directions satisfactorily. This test, together with a similar test made with the short coupling, pointed out the desirability of adding coupling wires over circuits Nos. 5 and 6 in addition to those over

COMPARISON OF WIRE AND CARRIER COMMUNICATION DURING GROUND CURRENT TESTS—LENGTHENED COUPLING WIRE CONDITION NO. 2 ON CIRCUITS NOS. 1 AND 2

Length at Highlandtown, 780 ft.
Length at Holtwood, 1,265 ft.

(Hn. = Highlandtown. Hd. = Holtwood.)

| Test No. | Test Connections Used | Current Readings, Final Built-up Value: Ground Amp. | No. 2 Circuit Amp.: BΦ | No. 2 Circuit Amp.: CΦ | Generator Field, Amp. | Method of Applying Short Circuit | Connection of A. & C. Telephone Lines | Method of Observations: Carrier | Method of Observations: Physical | Effect of Short-Circuit on Physical Lines | Effect of Short-Circuit on Carrier |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Hd. No. 1 Generator | 0 | 70 | 70 | | | Phantom—neutral grounded at Hd. and Hn. | Hd. talked continuously to Hn. | Hn. talked continuously over "A" line. | Hn. at maximum current continuous bum. Lines just usable and conversation could be carried on. Hd., no report. | Snap heard when generator switch was closed. Carrier intensity reduced slightly owing to grounds on B and C phases. No. 2 circuit. |
| 2 | | 130 | 80 | 100 | 120 | Built-up short held for half minute at normal generator load. Generator oil switch opened manually and immediately closed for another half-minute interval. | Phantom—neutral grounded at Hd. and Hn. | Hd. talked continuously to Hn. | Hn. talked continuously over "A" line. | Hn., both lines failed during sudden short. One fuse blew on "A" line. Two fuses blew on "C" line. Carbon vacuum arresters failed on both lines. Hd., phantom transformer heated and threw out compound. | Clicking in telephone of about same intensity as speech and frequency of approximately 5 cycles. Hd. could be understood. |
| 3 | | 125 | 70 | 85 | 130 | | Phantom—neutral grounded at Hd. and Hn. | Switching conversations carried on. | Hn. talked continuously over "A" line. | Hn., both lines failed during sudden short. Both fuses blew on both lines. Carbon vacuum arresters failed on both lines. Hd. arresters arced over, but nothing was damaged. | If unfamiliar conversation had been carried on, it probably could not have been repeated owing to clicking in receiver similar to previous test. |
| 4 | | 130 | 75 | 90 | 130 | | "Disconnects" opened. Lines short-circuited and grounded at Hd. and Hn. | Switching conversations carried on. | | | Little noise noticed. No clicking noticed. |
| 5 | | 130 | 80 | 100 | 130 | Full-load armature current thrown on suddenly and left on half minute. Short repeated immediately. | "Disconnects" opened. Lines short-circuited and grounded at Hd. and Hn. | Switching conversations carried on. | | | Test to determine if clicking was audible. Slight click heard when generator oil switch was closed. Carrier not noisy. |
| 6 | | 120 | 70 | 80 | 120 | See Tests Nos. 1, 2, 3 and 4. | In service, neutral open at Hn., neutral grounded at Hd. | Switching conversations carried on. | Hn. talked continuously over "A" line. | Hn., both lines failed during period of built-up short. Both fuses on both lines failed. Both carbon vacuum arresters failed. Hd., arresters flashed, but nothing was damaged. | Conversation became impossible when generator current ammeter read 200 amp. Remained too noisy for conversation until generator current reached 500 amp., when fuses probably blew on physical lines. |
| 7 | | .... | .... | .... | .... | See Tests Nos. 1, 2, 3 and 4. | See Test No. 1. | Ringing tried both direct. | No observations. | Hn., both lines failed, both fuses blew on both lines. Carbon vacuum arresters failed on both lines. Hd., vacuum gap arresters failed. | Hn. received rings satisfactorily, but Hd. bell rang continuously when receiver was on hook. |
| 8 | Circuits Nos. 1, 5 and 6 in service. | .... | .... | .... | .... | One built-up short and two successive sudden shorts for half-minute periods. | See Test No. 1. | Both sets in position to receive call. Receivers on hooks. | No observations. | Hn., "C" line failed second short. "A" line failed third short. One fuse blew on "A" line. Carbon vacuum arresters on both lines failed. Hd., no damage. | Hd. bell rang intermittently. Hn. bell did not ring. |




No ground current. Ground switch accidentally left open at Hd.
NOTE:—Telephone bells rang until physical lines failed.

circuits Nos. 1 and 2, so as further to insure there being always one clear phase in the event of trouble on the circuits. Accordingly, coupling wires were added over circuits Nos. 5 and 6 at Holtwood and Baltimore and tied in with the coupling wires over circuits Nos. 1 and 2, forming an H-shaped coupling wire.

After the addition of coupling wires over circuits Nos. 5 and 6, the set was again retuned. The output to the coupling wire at Baltimore was then 0.35 amp. at the talking frequency and 0.36 amp. at the calling frequency. The output at Holtwood after retuning was 0.29 amp. on the talking frequency and 0.25 amp. on the calling frequency. With the new adjustment the speech was very loud but not modulated quite so well as in the two previous conditions. The voice had to be pitched to a low tone or speech was unintelligible. Furthermore, the 25-cycle hum was very loud. An attempt was made to lower the speech intensity to a comfortable value by introducing a resistance in series with the high-voltage generator field, thus lowering the plate voltage. This cleared up the speech to some extent, but interfered with calling. Consequently the receiving-set connections were changed to connection No. 2 in the accompanying diagram. This made some improvement in modulation of speech and practically eliminated the 25-cycle hum. Calling was satisfactory.

Only one grounding test was completed with this connection. All phases of circuits Nos. 1 and 2 were grounded at Holtwood and Baltimore. There seemed to be no noticeable difference in transmission, talking and calling being normal in both directions.

With the receiving connections just named, a test was made to determine the effect of lowering the input voltage to the motor-generator set. It was found that conversation could be carried on with a voltage as low as 140, while calling required a minimum of 180 volts input to the motor.

### Effect of Arrester Charging

For the purpose of observing the operation of the carrier equipment during arrester charging, a series of tests were conducted during the regular daily charging period in order to obtain actual operating conditions. Each arrester at both Holtwood and Baltimore (circuit No. 2 arrester at Baltimore out of service) was charged in the normal manner. Observations consisted of talking and listening at both stations, thus enabling each station to compare the intensity of the disturbance caused by the local arresters with that from the arresters at the other end of the transmission system. In addition, the effect of arrester charging on the call bell was noted at each end.

While the arrester gaps were closed, no disturbing noises were noticed, but a loud static discharge was heard each time an arrester gap was opened or closed. The intensity of this discharge was about twice as great at the station at which the arrester was charging as it was at the other station. Throughout the test speech could be understood satisfactorily at both Holtwood and Baltimore on account of the short duration of the discharge. However, if the discharge had continued an appreciable time, reception would have been practically impossible at the station at which the arrester was charging.

Charging of arresters at either Holtwood or Baltimore did not affect the Holtwood equipment with both receivers on the hooks in position to receive calls. At Baltimore, however, during charging at either station the bell gave short clicks each time an arrester gap was opened or closed.

A number of tests similar to those conducted on the carrier equipment were made on the physical lines during arrester charging. As before, observations consisted of talking and listening at both ends. The results obtained showed that there were no disturbing noises when the gaps were actually closed, but when the operator opened or closed the gaps a faint static discharge followed by a louder click was heard in the receiver. The intensity of this discharge was at all times much less than that heard over the carrier.

Observations made on the carrier equipment during sleet runs on the transmission systems—that is, a practice adopted during sleet storms to melt the sleet from the wires by circulating sufficient current through them to melt the sleet—showed that these runs in no way affected communication. Conversation was carried on with each of the four circuits on a sleet run. The physical circuits were also not affected during sleet runs.

### Radiation Negligible

Little or no radiation is to be expected from the carrier wave because of the low frequency employed and the close coupling with the circuits. On one occasion, however, it was reported at Holtwood that conversation had been overheard from the Holtwood station by a Westinghouse "type RC" receiving set in the clubhouse. This occurred during the period of adjustment with the original coupling wire. Since then no report of any reception of this character has been received. An attempt was made later to repeat the above experience with the present adjustments, but no conversation could be picked up. An attempt was also made to pick up signals using a number of single-circuit amateur receiving sets installed near circuits Nos. 3 and 4 at Holtwood, but no reception was reported. However, in no case were the sets tuned to the wave length of the carrier, their range being limited to the broadcasting wave lengths.

### Carrier Current Meets Operating Requirements

As a result of these tests it was concluded that conversation and calling can be conducted in an entirely satisfactory manner over the carrier equipment for all conditions met in normal operation. With coupling on circuits Nos. 1, 2, 5 and 6 communication is practically unaffected by grounding circuits Nos. 1 and 2 at both ends. Previous tests (those made with one coupling wire over circuits Nos. 1 and 2) indicate that when using the present coupling wire over all four circuits conversation would be satisfactory with but one phase of the four circuits free from grounds. Conversation can be carried on with the carrier under conditions which render the physical lines totally inoperative as demonstrated by the ground-current tests.

No final conclusions can be drawn at this time as to the comparative operation under all conditions of the carrier equipment and the physical lines, because of the short time the former has been in service. Further observations will be made during heavy static and at times of electrical storms. A careful check is being made of day-to-day operation to determine the effect of variation in weather conditions.

The foregoing information is based on tests made by J. E. Allen, chief of tests for the Pennsylvania Water & Power Company.

# Lead Resistance for Current Transformers*

Advocates at Least 0.1 Ohm of Non-Reactive Resistance in Leads of All Current Transformers Subject to Precision Tests

By F. B. Silsbee
Physicist, Bureau of Standards, Washington, D. C.

FROM the time of the first introduction of current transformers the doctrine which has been preached continually by professors, engineers, manufacturers and every one else has been "keep the secondary burden small if you want to obtain accuracy." Like any other good thing, this idea can be carried too far; hence this plea from the testing laboratory for "moderation in all things."

In the precise testing of a current transformer the methods used in any laboratory require the insertion into the secondary circuit of a certain amount of impedance. In the use of the comparison methods, where one transformer is compared with a standard, this impedance can be fairly small (0.02 ohm), and can often be neglected. In the more precise "absolute" methods which test a single transformer, however, the impedance is necessarily large and is often from 0.1 ohm to 0.2 ohm.

## Problems in Precision Testing

If the user of the transformers requests a test with a burden consisting of, say, an ammeter, wattmeter and 0.1 ohm in leads, then all is well; for it is very easy for the laboratory to connect the instruments in the circuit with short, heavy leads and substitute the testing circuit in place of the 0.1-ohm leads. Even if the burden is specified as an instrument having 1 millihenry and 0.4 ohm with 0.01 ohm leads, the laboratory can still "beat the game" by substituting an inductor having the desired 1 millihenry and only 0.2 ohm, thus gaining a margin of 0.21 ohm for the testing circuit. This is not perfectly satisfactory, however, since (1) the impedance of the actual instruments may vary slightly from the values stated (which are usually obtained from the manufacturer as representative of the type), (2) the reactance of the instruments often changes somewhat from one point of the scale to another, and (3) if the magnetic circuit of the instrument contains iron, the reactance will vary with the current and hence the air-core coil of fixed value is not equivalent to the actual instrument.

The rub comes, however, when the user requests a burden of which the time constant (ratio of inductance to resistance) is greater than the value (0.005 second) which can be obtained with air-core coils of moderate size or in which the total resistance of the burden is less than 0.1 ohm. "One watt-hour meter with 3 ft. of No. 10 B. & S. gage (i.e., 0.003-ohm) leads" is a typical example of such a burden.

What can the laboratory do in such a case? It is theoretically possible to test a current transformer with zero burden, but to adapt the apparatus for such a method is very impracticable. Actually in such a case the laboratory now does double work. It first makes a test with the least resistance it can use—i.e., with a burden of "one watt-hour meter plus 0.10 ohm." It then repeats the test, using "one watt-hour meter plus 0.197 ohm." If the ratio and phase angle vary linearly with resistance in the secondary (which is roughly true), then an extrapolation gives the desired data.

The purpose of this article is to suggest that instead of doing this, the customer should always include a non-reactive resistance as great as 0.1 ohm, with transformers which are likely to be submitted for precise test.

A consideration of the objections that can be offered to the adoption of such a practice in various cases follows:

Current transformers submitted for laboratory tests may be classified according to the purpose for which they are used, thus:

A. *For special measurements of the highest precision.*—Here the transformer is always first tested with the actual burden with which it is to be used and the necessary corrections to its ratio and phase angle are applied in working up the results of the measurements made with it.

B. *For general use under conditions which cannot be foretold, but which may require high precision.*—Here the test is made with the burden which will most probably be used later and the corrections are often but not always applied in the actual use of the transformer later.

C. *For work of less precision.*—Here a test is needed to make sure that the performance does not depart excessively from the theoretical. Only the nominal value of the ratio is used in the future use of such transformers.

D. *For a type test.*—Here the test is desired to indicate the relative merit of the particular type of transformer relative to other types. The results of the test will probably not be utilized in actual measurements made with the transformer later.

Besides these four classes, there are the great body of transformers which have never been and never will be subjected to laboratory test and which need not be considered.

For transformers of class D there is obviously no objection to the insertion of an additional 0.1 ohm in the burden in all cases, since the comparison of types is not affected thereby. For class A also the presence of the 0.1 ohm will not increase the labor of observation or computation, except for the purely physical labor of seeing that the 0.1-ohm coil is correctly inserted. Any such difficulty is more than offset by the fact that, when desired, the transformer can be used with the same correction table when 50 ft. away from the instruments if connected to them by No. 10 wire.

In cases B and C, however, the question arises whether or not the insertion of the 0.1 ohm increases the ratio and phase-angle errors of the transformer. Such an increase in error might appear either as a greater departure from the ideal, nominal ratio and zero-phase angle or as an increase in the variation in ratio and phase on passing from one value of current or burden to another value of current or burden. An examination of the magnitude of such effects is next in order.

## Errors Not Proportional to Burden

It is very natural, though erroneous, to consider that the errors in a current transformer are, at any rate roughly, proportional to the external secondary burden and that if one reduces his burden from 0.15 ohm to 0.05 ohm by eliminating lead resistance, he will cut his errors to one-third. The fallacy of this appears when one considers that the secondary winding has a resistance of several tenths of an ohm, to say nothing of its leakage reactance. The secondary resistance of an assortment of twenty-five current transformers selected at random varied from 0.158 ohm to 0.55 ohm, the average being 0.35 ohm.

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The reduction of the burden from 0.15 ohm to 0.05 ohm, therefore, on the average reduces the total resistance from 0.50 to 0.40 and probably reduces the errors to 80 per cent of their former value instead of dividing them by 3.

Actual data on a number of transformers tested at the Bureau of Standards during the past few years show that the change in ratio when 0.1 ohm is inserted in the secondary was in the worst case only 0.1 per cent at 5 amp. and 0.2 per cent at 0.5 amp. In most other cases, however, the changes were decidedly less and seldom exceeded 0.02 per cent. The same poor transformer showed a phase-angle change of 25 minutes when 0.1 ohm was added, but no other showed more than 2 minutes at full current or 6 minutes at 0.5 amp.

It appears from this that the errors introduced by using the nominal instead of the actual ratio of the transformer are only very slightly greater when a lead resistance of 0.1 ohm is used. Furthermore, fully 50 per cent (an actual count of transformers tested at the bureau showed 66 per cent) of transformers have ratios less than nominal, so that the chances are about even that the ratio of a given transformer will be improved rather than impaired by the insertion of resistance.

Similar data show that the changes in ratio and phase angle with current at a given frequency and burden are only very slightly affected by the addition of 0.1 ohm. The increase in the change in ratio is only a few parts in 10,000, and the increase in the change in phase angle is only a few minutes in most of the transformers.

The conclusion is thus reached that the practice of allowing at least 0.1 ohm of non-reactive resistance in the burdens of all current transformers which are likely to be submitted to precise tests is at once highly desirable in the testing and perfectly harmless in the use of the transformer.

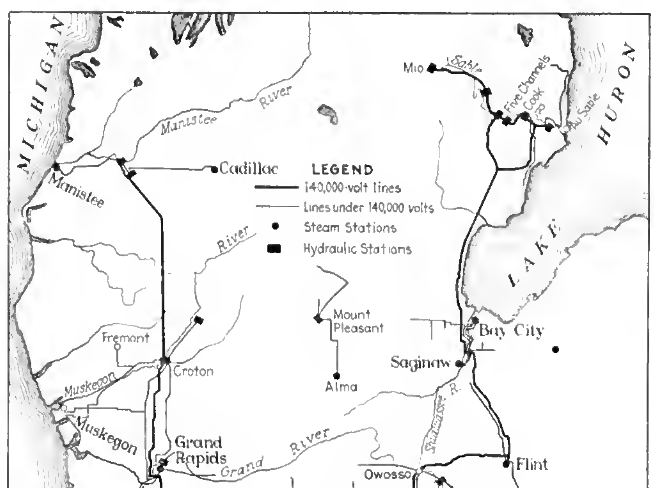
# Co-ordinating Steam and Hydro Operation

## Entire System Economy More Important than Individual Plant Economy—Must Keep Pace with Weather Conditions—Problem Is When to Use Steam and When to Use Hydro Equipment

By F. W. POLLOCK
*Consumers' Power Company, Jackson, Mich.*

OWING to the necessity of shifting loads on interconnected hydro-electric and steam plants in order to keep pace with weather conditions, to protect against line breakages and to improve power factor or voltage regulation, it is not always economical to operate stations at their highest individual efficiencies. If proper consideration be given to *system* economy, however, it may sometimes even pay to sacrifice individual plant economy.

The Consumers' system might be visualized in the shape of an enormous "U," formed by the 140-kv. transmission lines which convey energy from the Au Sable River on one side and the Manistee River on the other side of the state down to Battle Creek, which is the center of southern distribution. The principal sources of hydro-electric energy are at the extreme northern ends of the "U," while the large distribution centers are at the southern intersections of the two lines. This "U" is somewhat distorted as the transmission line connects with steam generating stations at Grand Rapids, Kalamazoo, Jackson, Flint, Saginaw and Bay City. Moreover, other hydraulic stations are connected by 40-kv., 70-kv. and 22-kv. transmission lines, which, along with the lower voltage circuits, complete the network for serving the people of Michigan.




THE "U" TRANSMISSION LINES OF THE CONSUMERS' POWER COMPANY

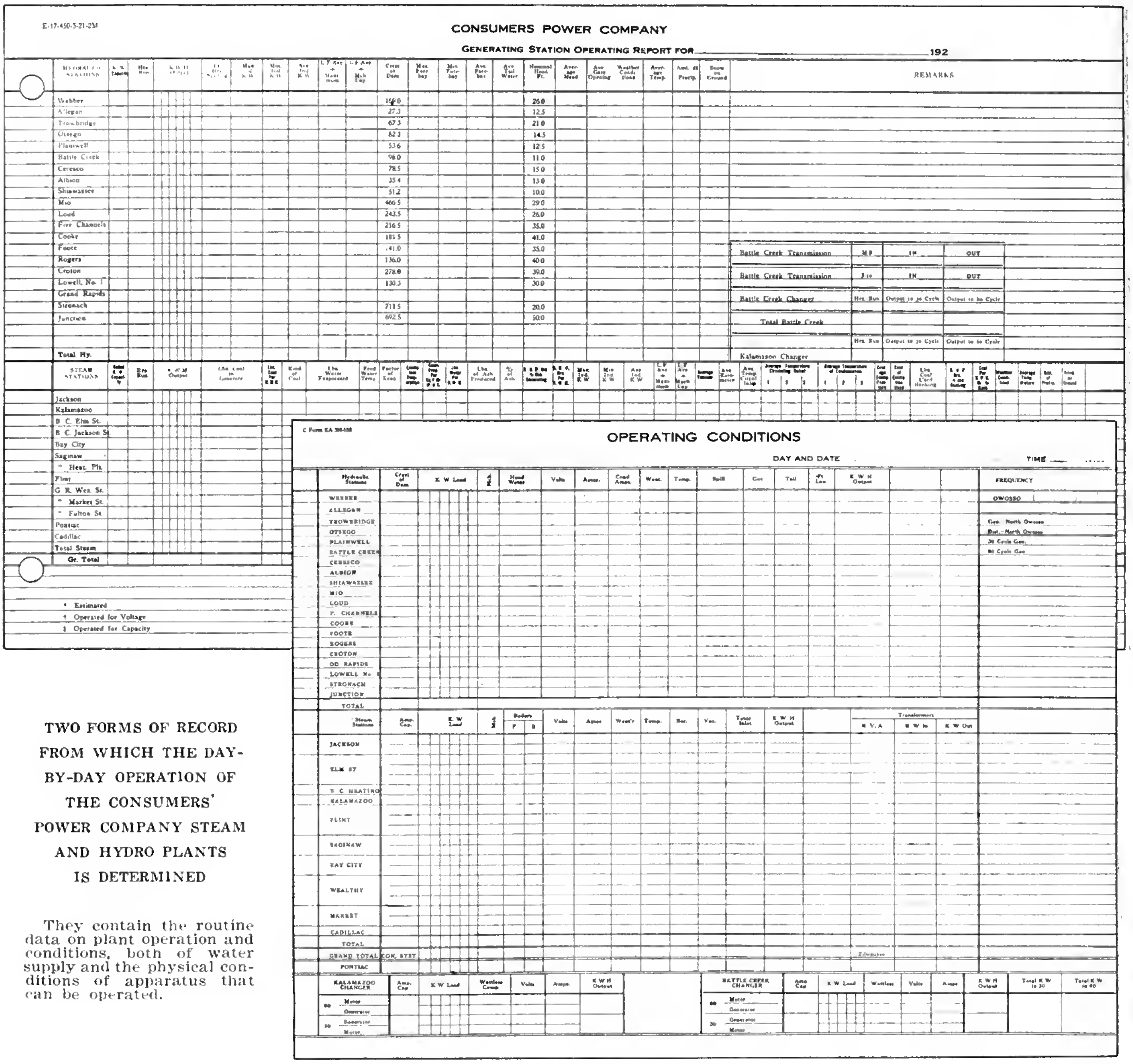
The maintaining of frequency and correct voltage, the question of power factor and the protection of service at different points are problems which become more complicated with long stretches of high-voltage transmission lines. Because of the fact that this system is a hydro-electric system and consequently somewhat dependent upon the ever-changing weather conditions, changes in methods of operation are often necessary over night. The yearly cycle of operation for the system is divided into four periods which follow the four seasons of the calendar year. This is indicated on the chart showing comparison of rainfall with hydraulic output. With the spring comes the break-up of the winter ice and snow, which, with the customary rains, results in a high-water period. Summer brings the hot, dry weather accompanied by drought, resulting in the low-water period of the system. The fall rains somewhat relieve the conditions of the summer, giving better water conditions. This allows the steam equipment of the system a breathing spell before the cold weather of the winter again freezes up the small creeks and river

tributaries, thereby cutting down the flow of water to a second low-water period.

But, one might ask, what has this to do with system efficiency? If the rivers of the state had an absolutely constant flow during the year, a scheme of operation could be devised which would attain to a high degree of efficiency, or at least one which would need little or no attention. This, however, is a dream of conditions which could exist only in an ideal climate. Plants must be designed to handle the largest possible percentage of water discharged during the high-water periods without having a great amount of capacity lying idle during the low-water periods. These plants must be operated on a basis which will give certain desired conditions at all points on the system, regardless of individual plant efficiency. The same holds true with steam-plant equipment. Sufficient installed capacity is necessary not only to handle the required portion of the load during the low-water periods, but enough to meet any emergency which might arise through the loss of a transmission artery from one of the northern rivers. Some steam plants are subjected to the same varying load conditions at times to obtain proper system conditions.

Some of the Consumers' Power Company steam and hydraulic plants are among the most efficient in operation. There are in all twenty-two hydro-electric plants supplying current for the system. These plants range in capacity from 150 kw. to 18,000 kw. and are tied into the transmission system at points greatly removed from each other. Many of these plants are operated at their most efficient point continuously throughout the year. They are operated at the most efficient governor-gate opening, and the headwater is not allowed to drop below certain limits. The length of operation on each unit varies with the river conditions, depending on the season of the year. With all units 100 per cent governor-gate opening is practiced during maximum water periods.

The Plainwell hydraulic station operates week after week during the low-water period on a governor-gate opening of 82 per cent. This is the most efficient point. The headwater does not fluctuate more than 0.2 ft. or 0.3 ft. from crest. There are three units of equal



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CONSUMERS POWER COMPANY

GENERATING STATION OPERATING REPORT FOR ______ 192

| Hydraulic Stations | Crest of Dam | Normal Head Ft. |
|---|---|---|
| Webber | 159.0 | 26.0 |
| Allegan | 27.3 | 12.5 |
| Trowbridge | 67.3 | 21.0 |
| Otsego | 82.3 | 14.5 |
| Plainwell | 53.6 | 12.5 |
| Battle Creek | 96.0 | 11.0 |
| Ceresco | 78.5 | 15.0 |
| Albion | 35.4 | 13.0 |
| Shiawassee | 51.2 | 10.0 |
| Mio | 466.5 | 29.0 |
| Loud | 243.5 | 26.0 |
| Five Channels | 216.5 | 35.0 |
| Cooke | 181.5 | 41.0 |
| Foote | 141.0 | 35.0 |
| Rogers | 136.0 | 40.0 |
| Croton | 278.0 | 39.0 |
| Lowell, No. 1 | 130.3 | 30.0 |
| Grand Rapids | | |
| Stronach | 711.5 | 20.0 |
| Junction | 692.5 | 50.0 |
| Total Hy. | | |

Steam Stations: Jackson; Kalamazoo; B. C. Elm St.; B. C. Jackson St.; Bay City; Saginaw; " Heat. Plt.; Flint; G. R. Wea. St.; " Market St.; " Fulton St.; Pontiac; Cadillac; Total Steam; Gr. Total

* Estimated
† Operated for Voltage
‡ Operated for Capacity

Battle Creek Transmission; Battle Creek Changer; Total Battle Creek; Kalamazoo Changer

REMARKS

C Form EA 300-558

OPERATING CONDITIONS

DAY AND DATE ______ TIME ______

Hydraulic Stations: Webber; Allegan; Trowbridge; Otsego; Plainwell; Battle Creek; Ceresco; Albion; Shiawassee; Mio; Loud; F. Channels; Cooke; Foote; Rogers; Croton; GD. Rapids; Lowell No. 1; Stronach; Junction; Total

Steam Stations: Jackson; Elm St; B. C. Heating; Kalamazoo; Flint; Saginaw; Bay City; Wealthy; Market; Cadillac; Total; Grand Total; Pontiac

Kalamazoo Changer; Battle Creek Changer

FREQUENCY: Owosso; Gen. North Owosso; Bus—North Owosso; 30 Cycle Gen.; 60 Cycle Gen.

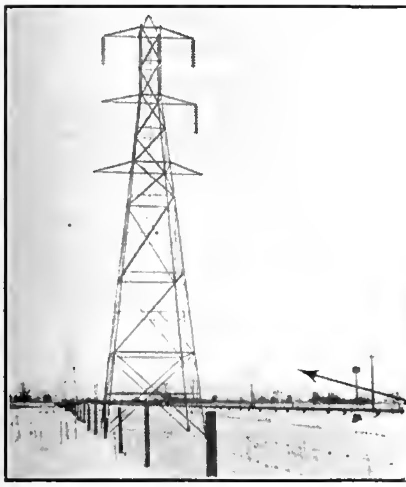
TWO FORMS OF RECORD FROM WHICH THE DAY-BY-DAY OPERATION OF THE CONSUMERS' POWER COMPANY STEAM AND HYDRO PLANTS IS DETERMINED

They contain the routine data on plant operation and conditions, both of water supply and the physical conditions of apparatus that can be operated.

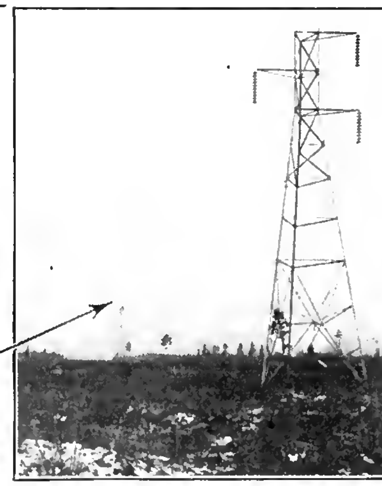
capacity in this plant. If the river flow is greater than one unit will handle, the headwater is allowed to gain with one unit in operation at 82 per cent governor until maximum elevation has been reached. A second unit is then placed on the line at 82 per cent governor opening and the headwater pulled down 0.3 ft. At this point one of the units is taken off and the headwater allowed to return to crest. The water is handled between these limits by the use of one, two or three machines, depending on the river conditions. In this way maximum efficiency is obtained.

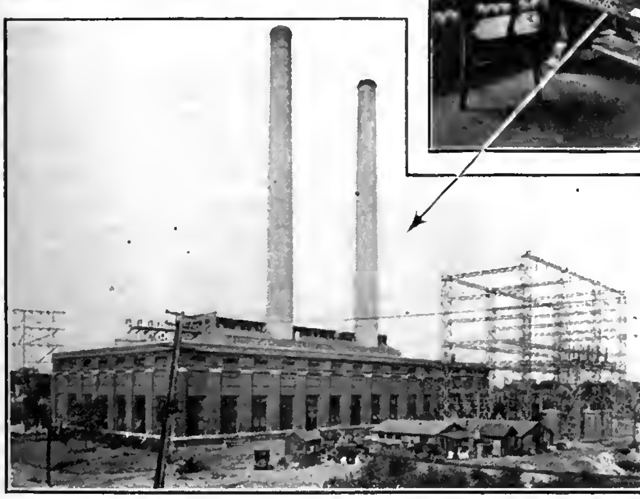
This scheme could not be applied throughout hydraulic operation, since it would necessitate an enlarged at crest, an excessive amount of fuel would be consumed at the steam plants during the day, making it necessary to waste water at night on the off-peak period.

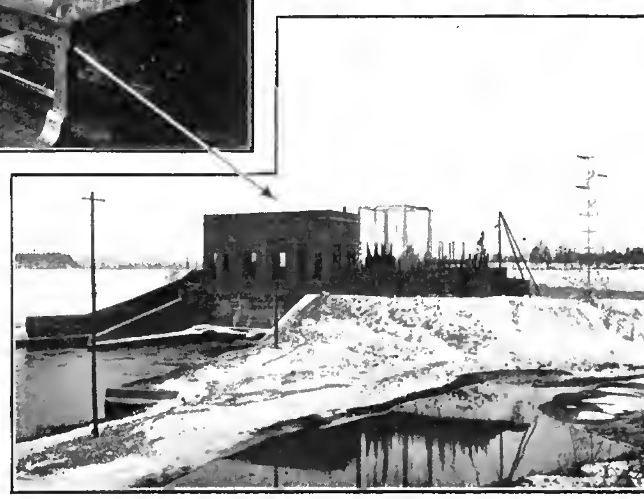
A compromise between these two possibilities results in better economy, which gives steam generation as near a constant daily load as possible for twenty-four hours. As the load comes on the system each morning it is picked up by the water stations, which are operated on efficient governor openings. One plant is known as a "regulating plant" and takes all the fluctuations in load. The load factor of this plant may be low at times since the load swings from no load to full plant capacity. The hydraulic stations accommodate the



STATION SWITCHING AND LINE CONTROL ARE SUPERVISED FROM THE SYSTEM OPERATOR'S DESK SHOWN IN THE CENTER







steam generation during the heavy-load period of the day and because there would not be sufficient load to accommodate the hydro plants during the off-peak period should several of them arrive at full head at the same time. The amount lost in fuel consumption and wasted water would prohibit this plan.

The ideal arrangement would be one which would give steam generation a straight-line curve twenty-four hours a day with a hydraulic plant operation on the plan mentioned above. As this is not possible because of the irregularity of the load, certain changes must be made affecting both steam and hydraulic stations. It must be decided what portion of the load will be carried on steam or water. If steam generation is reduced below a certain point, the system suffers by so lowering the headwater at the various hydraulic stations that inefficient operation results. On the other hand, if the headwater were continuously maintained load drop during the noon hour, and as fast as the power load drops off in the evening the hydraulic capacity is shut down, thereby allowing the ponds to fill up for the next day's operation.

During low-water periods when the river flow is very small it is primarily essential to keep the headwater of the various plants up to crest, since with low heads much additional steam is required to build the water level up again. If the plants are operated on low head, much is lost in efficiency. This problem is handled by the Consumers' Power Company as follows: Accurate records of each day's operation are kept both in the form of a summary of the day's operation and in hourly readings giving operating conditions at each generating plant. At midnight, when the total output figures are received from each plant by the load dispatcher on duty, a perusal of the headwater figures is made comparing them with those taken the previous night. This

shows at once whether there has been a loss or a gain in the headwater as a whole. It is then decided whether it is necessary to operate more or less steam on the coming day in order to bring the headwater back to its normal level.

Going further into the scheme of handling water conditions, the natural location of the hydraulic plants on the Au Sable River is also utilized. The Mio station is about 40 miles upstream from the other plants, which are closer together further down the river. This means that it takes approximately twenty hours for water discharged from the Mio plant to reach the other plants below. The water used one day at Mio is used the next day at the other four plants. Figures and charts have been devised so that it may be accurately determined at midnight from the previous day's output at Mio just what the value of water on the Au Sable River will be for the coming day and just what amount may be generated and full heads still be maintained.

As the total output on the system can be determined approximately, definite figures can be obtained on both steam and water. Thus there is no guesswork in cutting in boilers and placing steam units on the line.

Since certain boilers must be banked during the hours from 12 midnight to 5 a.m. in order to carry the daily maximum-demand load, the resulting steam plant efficiency is often decreased. Boiler operation at any steam plant on a poor load factor is seldom necessitated, with the exception of the operation of turbines at certain times as synchronous condensers to correct the power factor. This indicates one of the big problems in steam-plant operation. As an illustration of this point, during high-water periods it is often necessary to operate a steam plant with a large unit on a minimum load during the heavy-load period merely to maintain voltage. It is also true that an improved power factor would not entirely correct this condition since the capacity effect of the high-voltage line must be considered. But were the equipment such that a 100 per cent power factor might be obtained during the heavy load period, several units would still be required to operate as synchronous condensers during the off-peak period to compensate for transmission line capacity effect. This condition is not limited merely to one station on the transmission system, but involves great expense in order to keep conditions normal.

The operation of generating equipment for the correction of power factor is not limited to steam stations. Hydraulic capacity is sometimes operated during both heavy and light load periods daily in order to control voltage conditions at distribution centers. Several of the system hydraulic units are especially equipped for breaking the vacuum in order to be operated as synchronous condensers. Breaking the vacuum reduces the energy consumption, although approximately 200 kw. hourly is required to propel one of these units under such conditions.

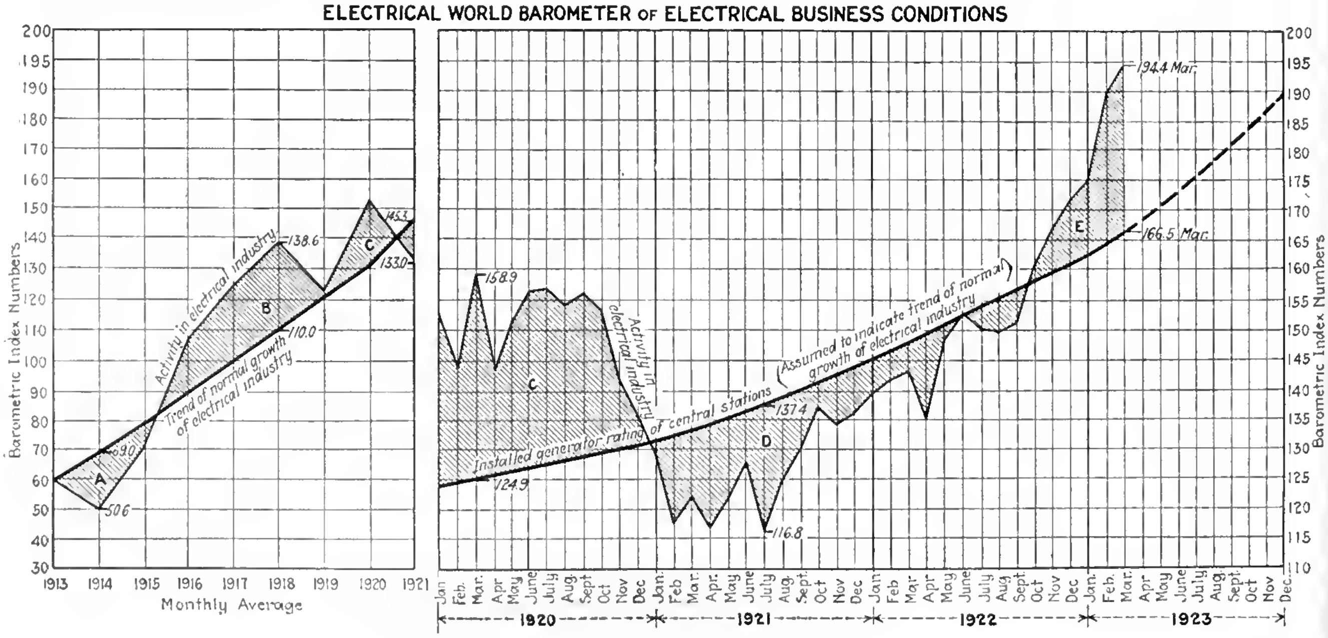
Protection to service or insurance against interruption is very important and sometimes causes inefficient plant operation. When the system is visited by electrical or sleet storms, steam generating equipment must be placed on the line with sufficient boiler capacity to handle the load, even though this means backing down on the hydraulic plants and wasting water. If the storm is severe, boiler capacity is increased at all plants and steam units are often operated over long periods on light and inefficient loads so that they will be ready if any emergency arises. This represents a necessary expenditure to insure continuity of service.

## Business Activity Continues to Increase

INDEX figures upon which the "Electrical World Barometer of Business Conditions in the Electrical Industry" is based indicate another record operation within the industry during March. Pig-iron production, generally regarded as the most accurate single indicator of productive activity, made a new high record in that month, exceeding even the war-time production of December, 1918.

The basic data upon which the "Electrical World Barometer" is based indicate an increase of 4.4 points on the barometer scale as compared with February activities. During this interval the industry had grown 2.2 points, leaving a net increase in activity of 2.2 points on the barometer scale as compared with February. The electrical industry as a whole was operating in March at 27.9 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In February it was operating at 25.7 points or per cent above the point of normal demand.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



# Industrial Electric Heat Applications—II*

## Types of Ovens and Their Field of Application—Limitations as Regards Duty and Temperature—Typical Installations Described and Operating Results Recorded—Advantages of Electric Heat Applications

By J. L. McK. YARDLEY
*General Engineer Westinghouse Electric & Manufacturing Company*

THERE are many types of ovens for industrial heating purposes and each has a well defined field for its application. In their use judgment must be exercised to secure best results and the proper type must be selected for the work under consideration. In order to bring out some of the commercial industrial ovens tabulations will be made with a brief comment on each type:

1. Electric range for the household. In connection with this application it is interesting to mention that over a test period of six months the average monthly power consumption for twenty-four families of four to six persons each was 100 kw.-hr.

2. Bread-baking ovens—reel type. One commercial size bakes 120 1-lb. loaves in a thirty-five-minute bake, which is equivalent to 175 loaves per hour. The input is 25 kw., or 7 lb. of bread are baked per kilowatt-hour. The loss to maintain the oven at the temperature required amounts to from 7 kw. to 8 kw. Larger and sectionalized types of ovens will be discussed later in their application to bread baking.

3. Enameling oven. These operate mostly at a temperature of 400 deg. to 500 deg. F., and there are many subdivisions: (a) The kiln type of oven, hand-operated, which produces 6 lb. to 8 lb. of work per kilowatt-hour; (b) the kiln type of oven, truck-operated, which produces 10 lb. to 12 lb. of work per kilowatt-hour; (c) the semi-continuous conveyor type, which produces 10 lb. to 12 lb. of work per kilowatt-hour; (d) the continuous conveyor type with air seal or exhaust fan, which produces 25 lb. to 30 lb. of work per kilowatt-hour.

In the making of bread, when the reel-type oven is used, the reel rotates and every loaf is baked equally by the heaters in the bottom of the oven. The oven, of course, is completely equipped with automatic control. In the continuous-conveyor type, which may make 1,200 loaves of bread per hour, the bread continually passes through the oven. The sectional type is made in several sizes, as from twenty to sixty loaves in a section. The idea is for the baker to buy one or two sections or hearths according to his needs and then add sections later as his bakery grows. Each section is heated from top and bottom and is provided with independent automatic control. The circuits are controlled by a motor-operated snap switch, which in turn is actuated by a small thermostat in the usual manner through the effect of furnace temperatures.

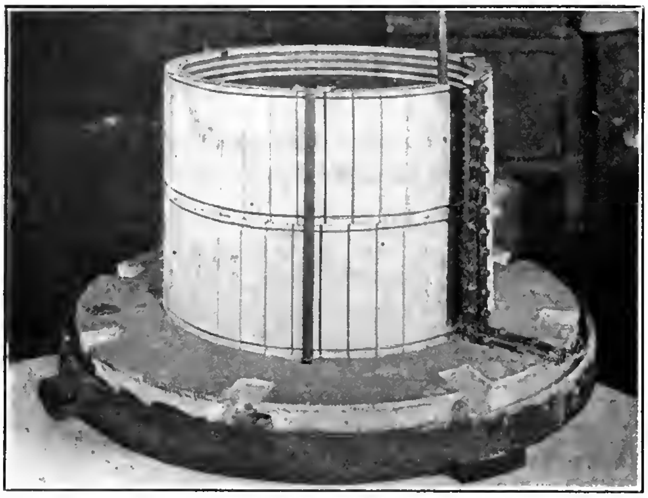
The heaters in the kiln-type oven are usually mounted in a vertical rather than in a horizontal position. The fresh air coming in at the top and passing through the heating elements at the side of the oven takes up the vapors which are heavier than air and is then exhausted from the bottom of the oven. This type of oven is largely used in the automobile industry and in furniture enameling. In some arrangements baffles with slits for admitting air to the interior of the oven are provided extending from the bottom to the top, and heaters are placed behind the baffles. The air inlets are placed beneath the heaters and the air passes up through the heaters and out through the slits into the baffles and into the oven. Fans for supplying the air are installed on the top of the oven.

A CONTINUOUS-CONVEYOR-TYPE OVEN FOR THE BUICK MOTOR COMPANY, DETROIT

Smaller ovens of the kiln type are made for hand operation. For example, a small oven with interior dimensions approximating 3 ft. x 3 ft. x 3 ft. is equipped with four 2½-kw. oven-type heaters and with the degree of heat insulation employed comes up to a temperature of 550 deg. F. in forty-five minutes. With power cut off, the temperature drops in two hours and ten minutes to 300 deg. F. Three kilowatts is required to maintain this temperature. The oven is designed to be operated with full automatic control at a temperature of 450 deg. F. The average thermal conductivity is approximately 0.8 B.t.u. per inch per square foot per degree Fahrenheit. Another size of hand-operated kiln type of oven in practical use has interior dimensions of approximately 4 ft. wide, 4 ft. high and 3 ft. deep.

Ovens of the semi-continuous conveyor type are being used extensively in the automobile industry, for example, at the Jordan Motor Company's plant, Cleveland. Here the work coming through the oven is allowed to

*This article is based on an address given by the author before the Toronto Section of the A. I. E. E. and the A. S. M. E.



ASSEMBLY OF HEATING ELEMENTS FOR 750-LB. SOLDER POT

hang on the conveyor over the drip tank. The work then passes into the oven and is baked while the conveyor over the drip tank is being filled again.

In the continuous-conveyor type, which is extensively used, the work goes through the oven continuously. One of the largest installations is at the Royal Typewriter Company's plant for the enameling of typewriter frames. Another large oven is installed at the works of the Buick Motor Car Company in Detroit. This oven has a capacity of 1,550 kw. The heating elements are all protected by screens. On the entering end they are mounted on the side walls and on the exit end on the floor. The reason for mounting them on the side walls at the entering end is that the work drips to some extent while passing through this part of the oven. Separate exhaust flues from the oven are brought outside to dissipate the noxious gases. This oven has been so satisfactory that it is now being practically duplicated in an extension of the same plant.

### SMALLER APPLICATIONS

The heating element in solder and babbitt pots is of considerably different construction from the others used. It may be operated up to a maximum of about 1,800 deg. F. and hence is applicable for work of 1,000 deg. F. or perhaps 1,200 deg. F. The 30-lb. preheat type of solder pot consists of a cast-iron shell lined with 1-in. molded insulation. The heating elements are directly underneath the cast-iron pot and are insulated by 1½ in. of "Nonpareil" brick. The brick is placed directly in contact with the heating elements and above the wire, so that all connections are amply protected. With terminals at the bottom it is well arranged for conduit attachment. About 1,300 watts is required to bring a 30-lb. charge to a temperature desired in fifty-five minutes; 650 watts is ample to keep the charge at temperature.

MOLTEN SALT IS USED IN THIS FURNACE AS THE RESISTOR ELEMENT; HEAT TREATMENT OF TOOLS TO 1,450 DEG. F. PRELIMINARY TO HARDENING

### HEAVY-DUTY-TYPE INDUSTRIAL FURNACES

The heavy-duty type of industrial furnace employs heating elements made of nickel chrome alloy. These elements are placed in grooved refractories or muffle plates of special composition which is a good dielectric and at the same time is a good conductor of heat. The heating elements, together with the grooved refractories, are held in position by T-shaped supports which fit loosely into recesses in the sides and roof of bricks. All terminals and connections between heating elements are made on the outside of the furnace. When operating on work the temperature of which is within 100 deg. or 200 deg. of that permissible for the elements, the intervening muffle plates are eliminated and the heating elements are arranged to radiate as directly as possible upon the work. It is obvious from the type of construction that there is no reasonable limit mechanically or electrically to the size to which this type of furnace may be built, and that it may have single or double doors. In the larger furnaces, of course, a substantial framework is required to carry the weight, and where heavy-duty work is involved the same attention to mechanical strength and ruggedness as in fuel-fired furnaces must be given.

The field for this type of furnace is very extended, being limited principally by the fact that the resistor itself cannot be operated for any appreciable length of time at more than 2,100 deg. F. An increasing number of these furnaces are being installed. Among others, arrangements have recently been made for the installation of the following, showing the variety of applications: A 60-kw. furnace for the treatment of wire, hardening at 1,650 deg. F., tempering at 900 deg. F.: a 210-kw. furnace for vitreous enameling at 1,800 deg. F.; a 33-kw. furnace for lead-bath treatment of steel saw blades at 1,600 deg. F.; a 220-kw. furnace of car-bottom type for the heat treatment of locomotive parts, piston rods, crankshafts, etc.; a 160-kw. pot and retort for the refining of sulphur, melting at 350 deg. F., distilling at 850 deg. F.

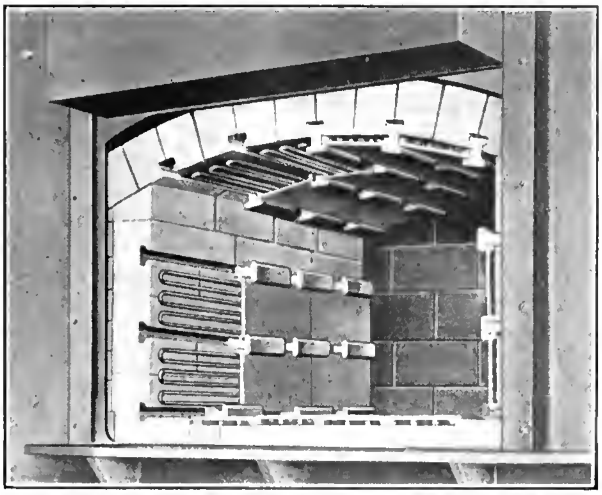
### FURNACE WITH MOLTEN-SALT RESISTOR ELEMENT

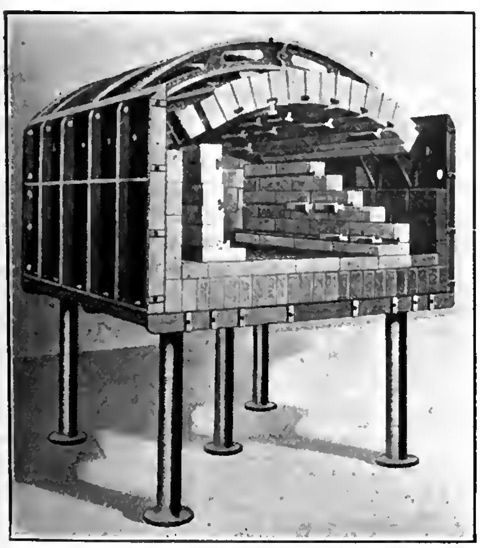
In the extensive search which led up to the development of the industrial heat-treating furnace of metallic resistor type, many other types of furnaces were, of course, tried out. It is of interest to refer to one or two of these which have given satisfactory results in practical operation.

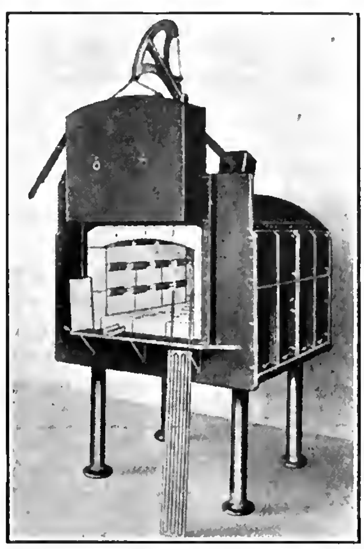
In one of these a molten salt is employed as the resistor element. The furnace is used for the heating of carbon-steel tools, reamers, etc., at a temperature of 1,450 deg. F. preliminary to hardening. It consists of a cast-iron cylinder 4 ft. high and 4 ft. in diameter,

open at the top and filled with firebrick, except for a well at the center 9 in. in diameter and 14 in. deep. Four blocks of carbon are built into the walls of the well, two on each side, and are connected to the electrical circuit. Power is supplied by a 24-kva., 30-volt to 60-volt transformer and switching panel. The furnace is started by connecting the carbon blocks by carbon rods. A mixture of dry barium chloride and sodium chloride is fed in and melted by the heat from the rods. The rods are then removed and the salts are kept molten at temperature by the passage of electric current through them. A number of advantages have been claimed for this type of furnace:

1. The temperature of heat treatment can be altered by varying the proportions of the salts employed.
2. For any given mixture of barium chloride and sodium chloride, or other salt, a practically uniform temperature is obtained.
3. The metal under treatment is in no danger of burning or scaling.
4. The cutting edge of a tool can be heated to any desired depth for hardening.







HEAVY-DUTY TYPES OF INDUSTRIAL FURNACE

Chromel-metal heating elements are placed in grooved refractories or muffle plates and are held in position by T-shaped supports fitting into recesses in the sides and roof, which are made of fire brick.

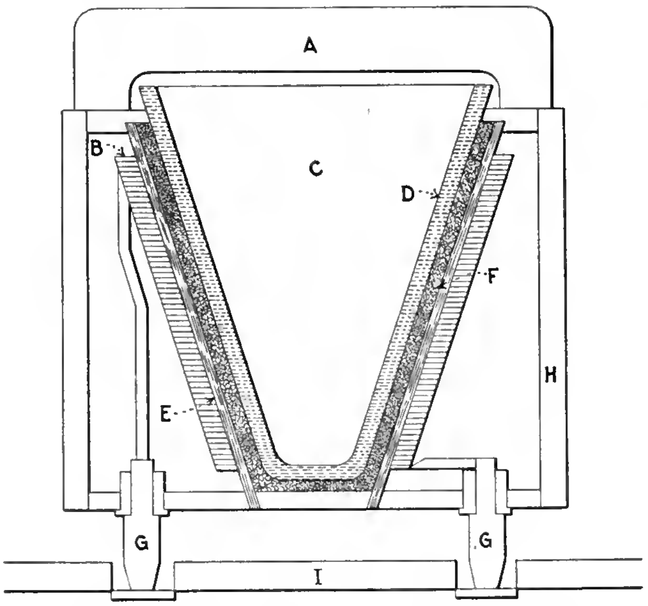
5. Labor cost in tool hardening is reduced and production increased.

As has been mentioned, the chromel resistor is not good for maximum working temperatures above approximately 2 100 deg. F. In searching for a resistor material which could be used in furnaces for applications requiring temperatures above 2,000 deg. F., and after a number of unsuccessful attempts had been made to use carborundum or silicon carbide for such work, a furnace was devised which shows considerable promise for the future. In this furnace the resistor element consists of a pile of carbon plates held together by spring pressure. An experimental furnace of this type has been kept at a forging temperature of 2,300 deg. F. for six weeks at a time and used in an extended operation, heading bolts. This furnace is 4 ft. long, 3 ft. deep and 4 ft. high over all and is mounted on 2½-ft. legs. The chamber is 30 in. long, 9 in. deep and 20 in. high. It takes from 16 kw. to 40 kw., 1,000 amp. to 1,200 amp., over a 20-volt to 60-volt range. In the operation of heading bolts the input was from 16 kw. to 22 kw. for small and medium-sized bars. The carbon resistor plates are 6 in. x 2½ in. x ¼ in. thick, and the pile of plates is held together by 200-lb. spring pressure. The heating element has been found to handle 100 kw. safely. Water-cooled bronze terminals are provided. The roof above the element consists of 4-in. x 4-in. carbon bars covered by from 6 in. to 8 in. of carbon dust and two layers of insulating brick. "Carbofrax" and firebrick are used in the side wall. It was found that the element must be protected by oil or gas flame from oxidization in order to have reasonable length of life. One gallon of oil or 100 cu.ft. of gas per day was sufficient. It was also found that the life of the element could be extended materially by changing the construction so as to seclude the element from the furnace chamber in a trough covered by "Carbofrax" brick or by a carbon plate protected by a covering of coke dust or granular carbon, and the earlier experimental construction is no longer used.

While the future for this type of furnace in forging work looks promising, the same principles have been employed in an experimental way in a muffle-type calcining furnace and also in a brass furnace, and the interesting results have been in the brass furnace, with an input of 50 kw., 100 lb. of metal in cold pigs has been melted in fifteen minutes.

A review of what has been done and the possibilities for the future in high-temperature work could be incomplete without reference to high-frequency inductive

heating, by which method temperatures above 2,550 deg. F. are readily obtained without carbon being essentially associated with the operation of the furnace. This type of furnace seems to have a multitude of applications. One of these is the melting of metal and alloys where low volatilization losses are essential, as in the case of molybdenum, platinum, gold and silver alloys. The furnace may also be used in graphitization work, when the carbon blocks to be graphitized are embedded in lampblack or carbon black, or in the heat treatment of knife blades and thin steel sheets. One of the miscellaneous applications which have been suggested is the manufacture of centrifugal castings.




HIGH-FREQUENCY INDUCTIVELY HEATED CRUCIBLE FOR MELTING PLATINUM, GOLD AND SILVER ALLOYS

A—Lid; prevents radiation and conduction of heat to the outside, confining heat to the crucible interior.
B—Electrical coil; carries the current, which produces the heat inside the crucible; coil itself is water cooled, making the furnace box cool and comfortable to work with.
C—Metal; where the heat is generated and left.
D—Crucible lining; holds the metal and helps keep the heat in the crucible.
E—Electrical insulation; for protection and to help keep the heat in the crucible.
F—Heat insulation; keeps the heat in the crucible where it is generated.
G—Terminals; where circuit is broken by lifting crucible to pour.
H—Box; for mechanical rigidity and ease of handling.
I—Table; supports the electric crucible and provides contact to the electrical power supply.

In order to provide the high-frequency power required for this type of heating, a frequency converter is employed for sizes up to 20 kw. per phase. This converter consists of an oil-cooled transformer with internal reactance, a set of static condensers and a metal discharge gap. For larger capacities it seems probable that a high-frequency alternating-current generator will be required. Such generators have been built and are obtainable. The electrical manufacturers appear to have no hesitancy about building this type of generator in larger sizes of, say, 200 kw. or 400 kw., at a frequency of 10,000/12,000 cycles, and it is probable that such capacities will take care of all the applications of this type of furnace.

The future will see a greater application of electric heat. Glass annealing will undoubtedly be done to a much greater extent by electricity. A total possible connected load of 60,000 kw. has been estimated. It is considered that the temperature gradients in the mass of homogeneous glass are solely responsible for the setting up of strains. Very accurate temperature control, such as is obtainable by electrical means, is therefore desirable. This should be within plus or minus 4½ deg. F., and the temperature required usually lies between 1 000 deg. and 1,450 deg. F.

An interesting account of the boiling of linseed oil with electric heat appeared in *Chemical and Metallurgical Engineering* for Nov. 2, 1921, page 844, and an account of the use of electric heat in the Western mining industry for the drying of fine concentrates, printed in the *Engineering and Mining Journal* of May 28, 1921, gave cost figures of from $5.66 to $6.86 per ton of water extracted with power at 0.65 cent per kilowatt-hour. Many other processes will be electrified, owing to the superior quality of product, even with high-priced power. Others will be electrified where power is cheap or where waste hydro-electric power is available.

In the textile industry in some localities the slashers, the tentering machines and the singeing machines will probably be electrified, as well as the dye vats and various other apparatus. In considering the extension of electric heating into this industry, the following advantages have been indicated: (1) More uniform heating of liquids, dyes and size; (2) more uniform consistency of liquids in dye vats, etc.; (3) elimination of steam piping and its losses; (4) higher temperature, taking the place of additional dry cans in increasing production; (5) higher temperatures in calender rolls and more uniform temperature throughout rolls than is obtainable with steam or gas heat.

In the paper industry, particularly where power is cheap or waste hydro-electric power available, there should be further use of electrical heat. This will probably be in the cylinders of the board machine, in the calenders and in the general steam requirements.

Even the time-honored limekiln is likely to be invaded by the metallic-resistor heating element some time when waste or cheap hydro-electric power is available. In the modern coal-fired limekiln 500 lb. to 1,000 lb. of coal is burned per ton of lime produced at a temperature between 1,100 deg. and 1,650 deg. F. Industrial engineers have recently projected an electric limekiln employing metallic-resistor heating elements in a locality where fuel for the fuel-fired kiln is difficult to obtain and some excess hydro-electric power is available, and they expect to obtain a ton of lime at an expenditure of about 3,400 kw.-hr.

## Germans Seek to Hasten Electrification

UNQUALIFIED public and professional interest is centered on the German government's present efforts to circumvent the coal shortage by the electrification of all state railways, says United States Consul B. S. Hayen, Leipzig, in a report to the Department of Commerce. By demonstrating the superiority in service and economic efficiency of electricity over steam it is hoped to offset the handicap to German railway transportation resulting from the occupation of the Ruhr coal fields and the deliveries previously made under the Versailles Treaty. Not only railways, but factories, will be compelled to use electric power. Lack of coal has forced the German State Railway Administration to withdraw a large number of trains. Even now the remaining trains run principally on imported English bituminous coal. Leipzig is already the terminus of several electrified lines.

# Man Development in Public Utility Companies*

## The Personnel Problem that Confronts Every Central-Station Manager—His Responsibility to Either Release or Build Up His Men

BY H. A. LEMMON
Personnel Department, Stone & Webster, Inc., Boston, Mass.

PROBABLY all central stations have men in their employ who are not equipped temperamentally or otherwise to gain success in this very exacting business, and yet who are gifted in many respects and still young enough to prosper in other lines. Perhaps many of these were employed at a time when of sheer necessity standards were somewhat relaxed. Presumably they have rendered the best service that they are capable of giving, and if so are clearly entitled to sympathetic consideration.

> THERE is no single problem of utility operation today more deserving of executive attention and guidance than that of the development of personnel. Whether the central-station staff number, twenty-five employees or five thousand, the importance of those individuals to that organization is equally vital. For here is a public service corporation, owned by the people through share holding, regulated by a popularly appointed commission, and dependent for its prosperity upon public sympathy and approval. Its employees are in constant contact with the people of the community it serves, and only by their representation is the company known. The kind of men and women who work for and speak for the light and power company make the character of the company in the mind of all its present and prospective customers. The question is how can the right kind of personnel be developed? It is this point which Mr. Lemmon discusses in this article.

Utility managers should frankly discuss the situation with all such, picture to them the probability of a greater measure of success in other lines, advise with them, and help them to become established in new activities. One may expect that within a reasonable time the industry as a whole will become more active. Men will then be in greater demand than now, and every effort should be made to assist "misfits" in obtaining employment with some other concern conducting a business more congenial to them. Even with present conditions, it is not clear that the industry is making as earnest an effort to accomplish this very desirable improvement as it can and should.

Any one can eliminate many applicants for positions as being ill trained or temperamentally unfit, but no man can and no system has yet been devised which will eliminate all of them. However, certainly two years' observation at most of a young man actually on the job and associating with his fellow employees and coming in contact with people outside should be a sufficient time in which to enable one to determine his fitness for public service. If there is any substantial doubt in the minds of his superiors, he should be carefully tested and considered, and if still found measuring up as anything less than desirable, he should be weeded out. Fairness to the man himself, if there were no other consideration, dictates this course. Yet we have not always so done, and the fact that we have not is responsible for the further fact that unfortunately there is much dead wood in many departments of most companies.

If we do not part company with the undesirable employee in the early stages of his employment, we are certain to wish to do so later, when perhaps so many years have elapsed that we are responsible for a conviction on his part that his position is permanent, and that, too, when he has passed the period of mental flexibility which would have enabled him to begin all over. We assume a tremendous responsibility by retaining in our service any newly made employee unless we are reasonably certain of his adaptability. It is no hardship to discharge a *young* man from the employ of an industry to which he does not belong, but it is nothing less than a tragedy to turn loose upon the world an old man whose long years of employment with us have robbed him of ability to adapt himself to other conditions. Our industry will avoid this crime against the man if it will be more ruthless at the beginning.

Promotion from time to time and increase in salary, however small, are official notice to the employee that he is making good. Except in rare circumstances, no such notice should be given unless it is a really significant one and will be interpreted by the employee.

In times gone by some utility managers have been guilty of recommending men for promotion for the sole purpose of getting rid of them. There is the typical case of a man who was recommended for, and received, five transfers to other companies and only after seventeen years' service was there found a manager with courage enough to proclaim him unsuited to the business, and yet in going back and interviewing fellow employees and superiors who had been with him at various parts of his career it was learned that he never had been desirable in any of his previous positions.

His first manager admitted this to be true and yet recommended him for transfer and promotion. It would have been easy to have corrected the mistake of his employment when his deficiencies were first discovered, inasmuch as he is a man of intelligence and industry and doubtless would have enjoyed a reasonable measure of success in some other line of business. Moreover, he was an unmarried man at the time when his faults should have been first discovered and was without serious financial responsibilities. Now he is the sole support of a mother, a stricken father, and has an invalid wife and two children, one of whom is feeble-minded. Lack of courage to face an unpleasant duty, or lack of interest, has robbed that man and his family of seventeen years of his life—more than that, it has robbed him of his chance for a future of reasonable contentment and progress.

We talk much of accident prevention. We might well interpret this to mean the exercise of our best efforts to prevent accident to the material welfare of our employees—a paralyzing disaster to the daily lives of the "misfits."

There appears to have grown up in the minds of some company officials a feeling that the young man sent to them from the headquarters office comes stamred with the parent organization's seal of approval. Such is not the case. Six to eight months in the home office, under supervisions, may or may not tell the story. Many a young man develops traits and characteristics in the field of which he gave no visible evidence while

*From a paper read recently before the Stone & Webster managers.

in the head office. These young men are on trial, and with precisely the same standing as the young men a local manager employs. Give them no favors. Judge them on their merits, and if found wanting, notify the department head from which they were sent.

No proper manager will recommend for promotion any man whom he would not like to keep in his own organization. Consciences in the past have sometimes been anesthetized by the thought that perhaps the man, though a failure with his present manager, would be successful if he might be transferred to a different environment. This actually occurs just frequently enough to prove that the theory is not without foundation in fact, but it is the exception rather than the rule, and in any event we can much better justify losing a few good men than we can justify becoming committed for the future of many indifferent ones.

Men are developed by having increased responsibilities placed upon them—ordinarily through promotion in the company with which they are connected or by transfer to a similar position in a larger company. Transfers are expensive to all parties concerned, but many years' experience of the Stone & Webster organization has demonstrated their efficiency and their desirability. They are rendered extremely difficult, however, in many instances by managers demanding a finished product to fill their open positions, instead of being content with a man who has had some experience but who, above all, can quickly grow into his new work. Unless the new job is actually a bit bigger than the man who is transferred to it, nothing whatever has been gained by the change except the filling of a position, while on the other hand an opportunity for man-development has been lost, perhaps for years. Every company must be a training school in continuous operation.

If we might take any given company and start fresh, selecting its new personnel from any and all available sources, the problem of building up that particular organization would be extremely simple. However, there is no such happy and easy solution. What we actually have to do in practice is to take such units as we now possess—inefficient and otherwise—working each over into the things he can do best and thereby shape all into a smooth-working machine. Some of our own companies present remarkable illustration of the possibilities of creating an unusually strong organization without any stars in the cast.

### Supervising and Graduating Men

Supervision is the magic formula for producing results in either man or property development, but as applied to men it doesn't mean sleuthing and, above all, it doesn't mean nagging. The failures of employees' associations, clubs and benefit societies, staff conferences, company spirit and cohesion and so on are almost invariably due to lack of the right sort of supervision. One cause of man failure in industry as a whole—and perhaps to a considerable extent in our own—is a natural tendency to set aside a considerable group of employees as occupying merely minor positions. In the public utility business—both from a standpoint of public relations and man development—there is no such thing as a minor position.

It has been said that if we very materially raise the standard of our personnel we cannot hold many of the best of our recruits—that they will not be able to advance as rapidly with us as their talents merit, and that therefore we shall find ourselves in the position of training men for other institutions. Even so, we can view many things with less equanimity than a situation in which our personnel shall be largely made up of brilliant young men who, having been trained in both the Stone & Webster spirit and ideals, will often enter into commanding positions with other great leaders in industry and still retain their affection and their regard for our organization. Promoting men out of our organization into better positions with others—under proper conditions—is not to be contemplated with alarm but with pleasurable anticipation.

## Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

### Relative Fields of Space Radio and Carrier Current

*To the Editors of the* ELECTRICAL WORLD:

I was very much interested indeed in the article by R. C. Denny of the San Joaquin Light & Power Corporation regarding its experience with radio telephones. The article is an excellent one and is timely.

In my opinion, a sufficiently strong case could have been made for the radiophone without putting arbitrary limitations on the carrier-current system. The carrier-current system will not, of course, meet all needs. However, we do not know its limitations even in the present first stage of development, and we should not therefore set up any limitations on its use at this time except the one limitation that there must be only conductors running between the two points between which we desire to communicate.

The article brings out the long distance over which broadcasting has been heard and the number of these long-distance receptions. It would be very interesting to know also how reliable the radio communication will be between the stations during the summer period when static is bad, and most particularly during lightning storms. Lightning is one of the major causes of transmission and station trouble in many districts, and a communication system which is put in with the idea of functioning at the time of electrical trouble when other means of communication have been interrupted should, of course, have very nearly 100 per cent reliability at these particular times.

The use of a loop receiving set with possibly some added features to improve selectivity works in the direction, of course, of reducing the effect of static. It is probably safe to say, however, that even the loop receiver will not permit completely reliable communication unless the received signal is exceptionally strong. It would seem that a 50-watt transmitter would not give a sufficiently strong signal over a distance of 135 miles to permit reliable communication during storms in that vicinity.

In this particular regard the carrier-current system appears to offer greater reliability than the radiophone system.

The radiophone will undoubtedly be used by a large number of companies operating over long distances, and the choice between a straight radio system and a carrier-current system can only be properly made after all elements that have a bearing on the case have been considered. We should not set up arbitrary limitations for either system and discard it on these assumptions.

The estimate of $1,000 per set, including transmitter

and receiver, is perhaps a little modest when all costs, including erection, are considered. However, the expense of $2,000 or $3,000 is small if it results in restoring service more quickly just a few times a year on a system of any magnitude.

The extension of the use of the carrier system can be made more rapid by continued reference to the installation of this means of communication as additional companies adopt it. This would be accomplished, of course, by each company submitting its experience in an article on the application of carrier current to its system when the system is installed.

E. P. PECK,
General Superintendent Electrical Department.
Utica Gas & Electric Company,
Utica, N. Y.

### The World's Greatest Reservoirs

*To the Editors of the* ELECTRICAL WORLD:

My attention has been called to a letter by Wilhelm Fleischer, supervising engineer for the Norwegian Hydro-Electric Nitrogen Company, Norway, which appears in your issue of April 21, 1923, page 922. Mr. Fleischer states that his company has in Telemarken, Norway, the second largest reservoir in the world, the capacity being given as 768,000,000 cu.m.

Let me point out that the Quebec Streams Commission completed in the year 1917 what it asserts to be the largest storage reservoir for power purposes in the world. The Gouin Storage Dam, in the upper part of the St. Maurice River watershed, in the Province of Quebec, Canada, assures the control of the water which is supplied from a drainage area of 3,650 square miles (9,456 sq.km.). The reservoir created by this dam has a capacity of 160,000,000,000 cu.ft. (4,500,000,000 cu.m.), and its area is 300 square miles (780 sq.km.).

The Gouin reservoir is twice as large as the Assuan reservoir.

O. LEFEBVRE,
Chief Engineer.
Quebec Streams Commission,
Montreal, P. Q.

[The following tabulation of the approximate capacities of the largest reservoirs in the world is of interest in this connection. It is possible that some large European reservoirs are not included. The capacities are stated in millions of gallons. The figures for the American dams were compiled by the *Engineering News-Record*. That for the Assuan Dam is derived from an article in the *Engineering News* for Sept. 30, 1909, by F. H. Fowler, who puts the storage capacity of the reservoir before its enlargement at 795,000 acre-feet. According to the *Encyclopædia Britannica*, the raising of the dam, completed about twelve years ago, increased the former capacity two and a half times. This factor applied to Mr. Fowler's estimate figures out as indicated below, making the Assuan basin rank fourth in size. The *Encyclopædia Britannica's* own figure for the entire 200-mile reservoir created in the Nile was 3,750,000 millions of cubic feet with the old dam. Multiplied by two and one-half and converted to gallons this gives the enormous figure of 70,312,500 millions. Obviously, estimated in this way the Assuan reservoir is not comparable with any other.

| | Millions of Gallons | | Millions of Gallons |
|---|---|---|---|
| Gatun (Panama) | 1,373,000 | Moosehead Lake (Maine) | 177,000 |
| Gouin (St. Maurice River, Quebec) | 1,200,000 | Ripogenus (Maine) | 157,000 |
| Elephant Butte (New Mexico) | 863,000 | Clear Lake Klamath (Oregon) | 150,000 |
| Assuan (Nile River) | 650 000 | Shoshone (Idaho) | 149,000 |
| Roosevelt (Arizona) | 425,000 | Ashokan (New York) | 132,000 |
| Pathfinder (Wyoming) | | Twin Lakes (Maine) | 123,000 |
| | 349,000 | Hebegen (Montana) | 115 000 |
| Lake Winnibigoshish (Minnesota) | 338,000 | Tirso, not completed (Sardegna, Italy) | 110,000 |
| Jackson Lake (Idaho) | 276,000 | Medina (Texas) | 98,000 |
| Burrinjuck (Australia) | 252,000 | Big Meadows (California) | 96,000 |
| Leech Lake (Minnesota) | 247,000 | Bridgewater (North Carolina) | 94,000 |
| Mosvand, Telemarken | | Lahontan (Nevada) | 94,000 |
| (Norway) | 203,000 | Arrowrock (Idaho) | 91,000 |

Of these dams the last-named, at Arrowrock, Idaho, is the highest. It measures 354 ft. to the top of the parapet wall.—EDITORS.]

### Underground Transmission at 150,000 Volts

*To the Editors of the* ELECTRICAL WORLD:

The Pacific Coast practice of joining distant power stations by a network of tie lines and operating them as a unit has gradually spread eastward until it has invaded the populous regions where electrical transmission must be of necessity by underground cables. The interest now being shown in "superpower systems" indicates that the near future will see an important demand for insulated cables of increasingly higher voltages.

The city of Paris has a 60,000-volt system using single-conductor cables, and a large system in the Middle West is now contemplating 132,000-volt underground transmission. The day when 150,000-volt underground systems will be required is not far distant.

A well-known professor of electrical engineering told his students that the problems he gave them differ from those they would encounter in practice in that the former were always capable of solution whereas the latter seldom were. Then, with a twinkle in his eye, he added that insoluble problems could generally be solved by eliminating certain unessential conditions which had been unconsciously assumed and thereby converting them into soluble problems. The insoluble problem of cable engineering is to make insulation of a fixed thickness and slowly improving quality carry greater and greater transmission voltages. The unessential condition in this case is the assumption that the transmission voltage cannot be raised without putting a greater stress on the insulation. Years ago, however, the invention of the three-phase system with grounded neutral enabled the transmission voltage to be raised 73 per cent without increasing the stresses in the insulation, proving this assumption to be unnecessary.

A. M. Taylor* has carried this idea further, first by conceiving of a six-phase instead of a three-phase system which would increase the ratio from 1.73 to 2.0. He then amplifies this scheme by resolving each phase of a three-phase star into six components 60 deg. apart by bringing the other two phases into play through special transformers. He thus obtains an eighteen-phase system for which six three-conductor cables are required. The transmission voltage then becomes three and one-third times the voltage between adjacent phases, so that 45,000-volt insulation may be used for 150,000-volt transmission.

Mr. Taylor proposes to use concentric three-conductor cables, but all the advantages of the scheme would not be lost if ordinary triplex cables were used, as its essence is to place conductors between which the diametric voltages are imposed in different cables and thus split the insulation into separate elements. Mr. Taylor's paper is largely devoted to an extended and somewhat complicated account of this idea. The details of his calculations may be questioned by American engineers who are prepared to operate their cables at higher temperatures and stresses than he assumes, but the general idea is well worth consideration where the complication of transformers and switching apparatus which is involved is not too serious a factor.

The real interest in the scheme is the idea of raising the transmission voltage to such a high value compared with the voltage between conductors. Perhaps other and simpler ways of doing this may be devised.

WILLIAM A. DEL MAR,
Chief Engineer.
Habirshaw Electric Cable Company, Inc.,
Yonkers, N. Y.

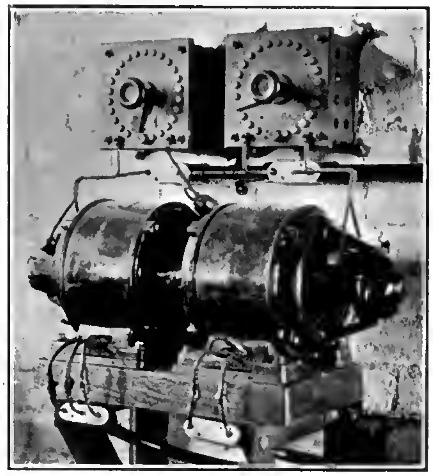
*Journal I. E. E., London, February, 1923.

# Central Station and Industrial Practice

**Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants**

## Protection for Frequency-Changer Sets

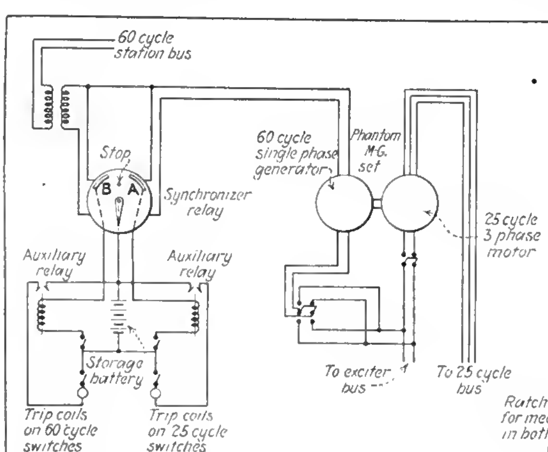
WHERE two systems of different frequencies are tied together through frequency changers it is difficult to provide relays which will protect the machines against overload and at the same time permit an interchange of power between the systems. The Central Arizona Light & Power Company has recently perfected a novel device for overcoming these difficulties. It consists of a small phantom synchronous motor-generator set and a contact-making synchroscope, shown in the accompanying illustrations.



PHANTOM MOTOR-GENERATOR SET WITH CONTACT-MAKING SYNCHROSCOPE PROTECTS FREQUENCY CHANGERS

The city of Phoenix, Ariz., is supplied with power from two sources, one source comprising a group of five hydro-electric plants, part of the reclamation system of that vicinity, which deliver energy over an 80-mile line. This system, with an aggregate rating of about 19,000 kw., operates at 25 cycles. The Phoenix company converts this 25-cycle power to 60 cycles for local distribution by synchronous motor-generator sets and rotary converters with a total rating of about 4,500 kw. Power is also obtained at 60 cycles from the hydro-electric and steam plants of the Arizona Power Company over an 85-mile line. This system has a total capacity of 12,000 kw. and is tied into the Phoenix buses. The motor-generator capacity at the Phoenix plant is in several units, so that at times less than 1,000 kw. is in service to hold in synchronism a 25-cycle system of 19,000 kw. and a 60-cycle system of 12,000 kw. Exchange of power is sometimes desired from one of these systems to the other through the motor-generator sets. When either system experiences severe transmission disturbances or develops a sufficient fluctuation of speed by reason of overload, the motor-generator sets, being of insufficient capacity to hold the other system in synchronism, are thrown out of step, subjecting the station apparatus to severe strains. These strains were such that the slot wedges of the generator stators have been pulled out and the cement grouting under the bedplates driven out for a distance of several feet. Reverse-current relays in both of the incoming line could not be employed to protect the frequency changers from these strains because of the desire at times to exchange power between the two systems. After ineffectual efforts to obtain a relay which would permit the flexible operation desired and at the same time protect the motor-generators, the apparatus described here was devised by H. L. Aller, vice-president of the company. A small synchronous motor-generator set was built, the 25-cycle motor of which is operated from the 25-cycle buses. The 60-cycle generator has but one phase winding, correctly placed to correspond with the windings of the large frequency changers. This winding is connected to one winding of an old synchroscope, the coils of which would permit of continuous excitation. The other winding of the synchroscope is connected to the corresponding phase of the 60-cycle station bus. The phantom generator is not paralleled with the 60-cycle system, and, being without load, the synchroscope shows at all times the difference in phase

FREQUENCY-CHANGER PANELBOARD



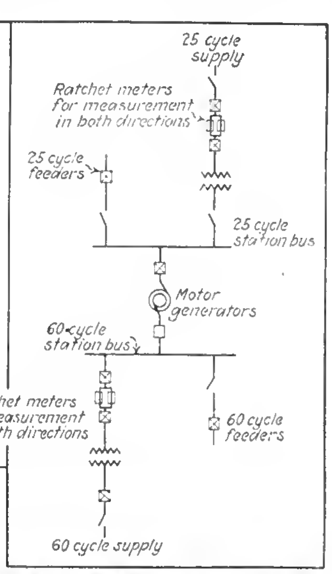




FIG. 1 (ABOVE)—SCHEMATIC DIAGRAM OF PHANTOM MOTOR-GENERATOR AND SYNCHROSCOPE RELAY CONNECTIONS. FIG. 2 (AT RIGHT)—DIAGRAM OF 25-CYCLE AND 60-CYCLE STATION CONNECTIONS

relation between the two generating systems. When either system begins to lag in speed, the synchroscope needle is deflected from its zero or normal position, the direction of deflection being dependent upon the relative speeds or frequency of the two systems. The exact position of the synchroscope needle when the frequency changers are pulled out of step was ascertained by trial, and contact-making plates were placed in the synchroscope face at these positions. When the needle touches plate *A* (Fig. 1) a positive acting relay, through the station storage battery, opens all of the switches connecting the Phoenix station to the 25-cycle system, leaving the Phoenix load connected to the 60-cycle system. The reverse action of the synchroscope makes contact with plate *B* and in like manner isolates the 60-cycle system, leaving Phoenix feeding from the 25-cycle system. An exchange of power can be effected from either system to the other up to the point when the motor-generators would pull out of step, at which point the system being fed is thrown off and entirely disconnected.

W. C. HORNBERGER,
Assistant General Manager.
Central Arizona Light & Power Company,
Phoenix, Ariz.

# Extracts from Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Operating Centrifugal Pumps for Boiler Feed

THE discharge and suction valves of boiler-feed pumps of the centrifugal type may be kept open because a check valve is placed on the outlet of all such pumps. The equalizing connection is placed on the pump to help balance the thrust along the shaft and thus relieve the thrust bearing of some of its work. The pressure regulator is not placed in service until the pump is delivering proper pressure to prevent erratic action while the pump is coming up to speed. When the regulator is cut in, the steam line is opened before the water line, to prevent an unbalanced water pressure in the regulator from closing off the steam in the turbine. Usually a cold-water spray line is tapped into the pump suction, the function of which is to admit cold water to the pump when it becomes vapor-bound from pumping hot water. The valve of this spray line should be kept closed except when it is needed, because, when open, the water going to the boiler is undesirable, lowered in temperature and is also not metered. The following instructions for starting and shutting down boiler-feed pumps of the centrifugal type are part of the operating code of the Philadelphia Electric Company, from which they have been abstracted:

STARTING

1. See that the pressure gage on the discharge side of the pump is operating.
2. See that the suction valve is open.
3. See that the discharge valve is open.
4. See that the pressure regulator valves are closed.
5. See that cooling water is on the bearings and seals.
6. Start the turbine or the motor and bring up to working pressure.
7. See that the proper pressure is on the equalizing pipes to balance the thrust.
8. Inspect the oil system.
9. Open the steam-line valve to the pressure regulator.
10. Open the water-line valve to the pressure regulator.
11. Adjust the regulator to give the proper differential between the feed pressure and the steam pressure. In case of running pumps in parallel, the load may be equalized by partially closing the suction and discharge valves on the pumps which are taking the most load.
12. Open the spray-line valve if the pump becomes steam bound.

SHUTTING DOWN

1. Close the spray-line valve, if open.
2. Shut down the turbine or motor.
3. Close the steam-line and water-line valves to the pressure regulator.
4. Shut off the cooling water from the bearings and seals.
5. Close the suction and discharge valves, if the pump is to be dismantled.

## Method of Paralleling Phase-Balancer Exciters

WHEN operating two or more phase converters with voltage balancers in parallel, it is also desirable to parallel their exciters and auxiliary exciters, so that the load will be equally divided among the converters. The following instructions have been abstracted from the operating code of the Philadelphia Electric Company and apply in particular to the phase-converter installation at the Schuylkill No. 2 station. Instructions for starting and shutting down phase converters were given in the last issue of the ELECTRICAL WORLD, under "Extracts from an Operating Code, page 1042.

Paralleling phase-balancer exciters and their auxiliary exciters:

1. Close the field switches for No. 1 and No. 2 auxiliary exciters in the "down" position. This is an interlock on the "close" control circuit for the equalizer breakers and the balance-exciter tie breaker.
2. Push the button-type control switch "in" and hold until both red indicating lamps show that the equalizer breakers and the balance-exciter tie breaker have closed.
3. See that all limiting resistance switches are open.
4. Close the two field switches for the auxiliary exciters (mentioned in No. 1) in the "up" position simultaneously. The phase-balancer exciters and their auxiliary exciters are now in parallel.

To "cut apart" phase-balancer exciters and their auxiliary exciters:

1. Pull the button-type control switch "out." The equalizer breakers will open simultaneously as indicated by both green lamps.
2. Either or both of the field switches for the auxiliary exciters may now be closed in the "down" position.

To feed No. 1 phase-balancer field from No. 2 balancer-exciter, or vice versa:

1. Close No. 2 balancer-exciter circuit breaker if starting No. 1 phase balancer, or vice versa.
2. Push the button-type control switch "in." The red lamp should indicate that the balancer-exciter tie breaker is closed.
3. Proceed according to Rules 12 to 17 inclusive of "Phase Converters with Voltage Balancers" (ELECTRICAL WORLD, May 5, page 1042). No. 2 balancer-exciter is now feeding No. 1 phase-balancer field, or vice versa. The interlock is so arranged that only one phase-balancer set can be fed with this connection.

Resuming normal operation, or shutting down with this connection:

1. Close the auxiliary exciter-field switch in the "down" position.
2. Proceed to shut down the phase balancer or to return to the normal method of operating.
3. Pull the button-type control switch "out." The green lamp should indicate that the balancer-exciter tie breaker is open.

## What Should Be the Proper Distribution Voltage?

FOUR-WIRE distribution at 4,000 volts is generally favored, and companies that are not now distributing at this voltage are rapidly adopting it, according to the opinions expressed at the recent meetings of the sub-committees of the Technical Section of the Pacific Coast Electrical Association. Greater capacity of existing circuits, better voltage regulation and the fact that 2,300-volt transformers on the lines can be

utilized by connecting between phase wires and neutral are the factors influencing this preference. Some engineers favor one three-phase regulator for four-wire, three-phase, 4,000-volt circuits, while others feel that satisfactory regulation can be obtained with one regulator.

The city of Los Angeles feels that 4,000 volts is not the answer to the city distribution problem and has adopted a 4,800-volt, three-phase, delta-connected system for its distribution, and transformers, regulators and other equipment are being purchased for this voltage. All transformers being purchased are insulated for 7,500 volts to ground so that the system may later be changed over to four-wire star operation if load conditions warrant.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

## Increased Coal Output by Better Mine Lighting

AS A RESULT of using six times the ordinary strength of illumination (the miners' standard electric lamp) the increase in coal output reached nearly 15 per cent, according to an investigation carried out in a Lancashire (England) coal mine on behalf of the Institute of Industrial Psychology. The more intense light was carried by men who had volunteered for the work. One of these carried the heavier lamp to the coal face during eight weeks with the following results: Average output per man per shift before use of big lamp, 2.47 tons; average output with new lamp, 2.83 tons, or an increase of 0.36 ton. The percentage improvement is 14.57 per cent. These figures refer to two men working together.

Deductions for dirt during the eight weeks' use of the big lamp decreased by 3.5 tons, equivalent to a reduction of 21.87 per cent. The man was now instructed to return to his ordinary lamp, and the following figures were obtained after a further eight weeks: Average output per man per shift during use of big lamp, 2.83 tons; average output per man per shift after use of big lamp, 2.57 tons, or a decrease of 0.26 ton, or 9.2 per cent. Deductions for dirt during this period increased by 5.95 tons, equivalent to an increase of 47.6 per cent.

As the workers in close proximity to these two men had no marked change of output, it seems reasonable to suppose that the cause of the increase was better illumination. It is suggested in the report of the investigation that the weight of the standard lamp might be doubled without proving a serious handicap to the miner. Such bright light would allow a margin of intensity which would permit diffusion of the light by means of a slightly opaque cylinder and thus add to the miners' comfort and powers of vision.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Radio Used to Locate Line Trouble

RADIO communication is destined to play a vitally important part in maintenance of continuity of service on high-tension power transmission lines in the future, in the opinion of operating officials of the Northern States Power Company. This newest form of communication already has been used successfully by the company in quickly locating "trouble" on its lines, and it has proved greatly superior to the wire telephone method previously used.

When the two St. Croix transmission lines tripped out at 1:55 p.m. on Jan. 30 both telephone lines to St. Croix were put out of commission. F. J. Gerlich, superintendent of the service department, lost no time in getting to the radio set and upon tuning in immediately heard the wireless operator at St. Croix calling Minneapolis. By means of radio-telephone communication the trouble on the transmission lines was quickly cleared up, and both lines were back in service by 2:05 p.m. (within ten minutes). Wire telephone communication was not reestablished until half an hour later.

### SEVERAL NEW STATIONS TO BE CONSTRUCTED SOON

Radio communication has been established between the St. Croix Falls hydro-electric plant and the Minneapolis office for several months, and a complete transmitting set now is ready for installation at the Coon Rapids hydro-electric station, 17 miles from the Minneapolis headquarters building. Plans are under way for installation of a high-powered station at Mankato, after which stations probably will be installed at Eau Claire, Wis.; Montevideo and Faribault, Minn., and eventually at Sioux Falls, S. D. It is expected to have the station at Eau Claire, and possibly the one at Montevideo, operating before the end of 1923.

The stations at Minneapolis and St. Croix are rated at 100 watts and use five 50-watt tubes—two tubes serving as oscillators, two as modulators and one as a speech amplifier. The circuit which is employed is known as a Colpit-Heising circuit, and the tubes are so arranged that one, two, three or five may be used, depending upon the power required for communication with the desired station. Motor-generator sets, rated at 750 watts and delivering 1,000 volts direct current, are used to deliver the required power to the sets.

These two stations are equipped for both telephone and telegraph communication, although they are designed primarily for the use of the telephone. Both sets are licensed for operation on a wave length of 525 m. and are in charge of licensed commercial operators.

The receiving sets are standard Westinghouse type RC single-circuit receivers. The Minneapolis station is equipped with a loud speaker and power amplifier, making it unnecessary for the operator to wear head telephones while operating the set.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Is Megger Insulation Test Too Exacting?

AFTER an experience with the use of a megger for testing the insulation of a direct-current exciter and its wiring, which was put out of commission by a flood, it is the writer's opinion that the test is too exacting.

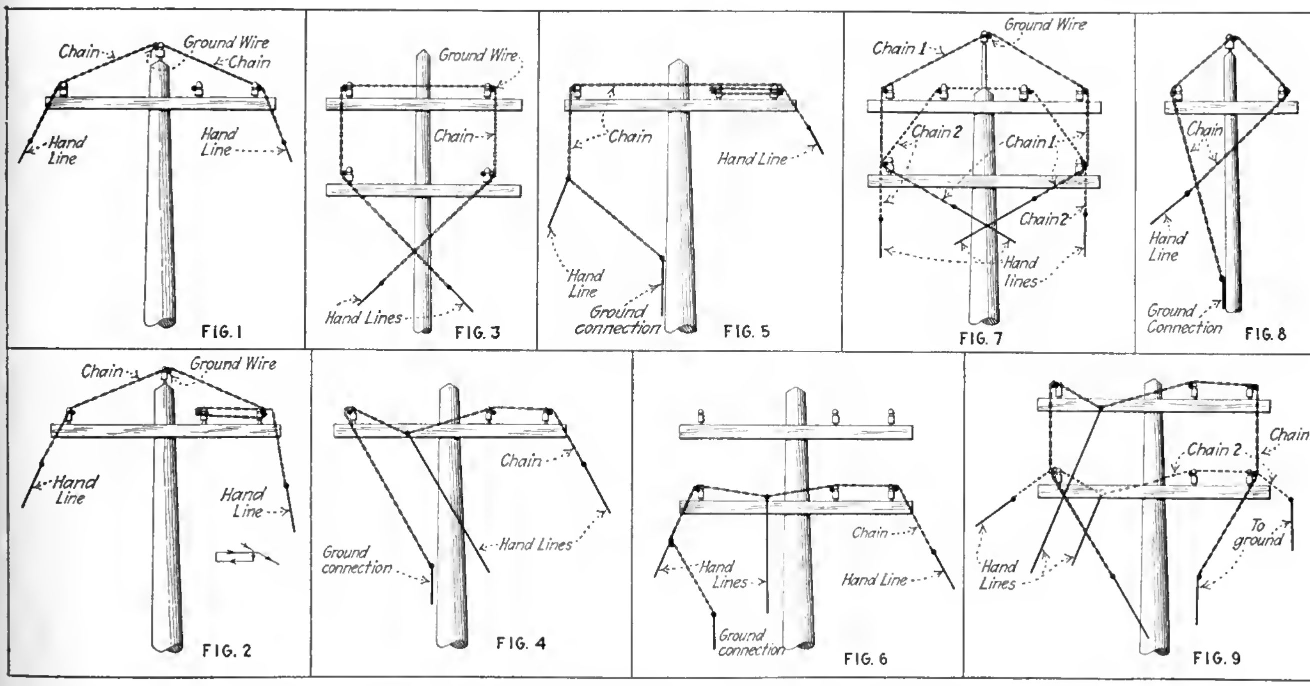
After the above accident occurred the exciters tested grounded both with megger and magneto. The armatures were removed and were prepared for a drying-out process with electric heaters, the field windings being subjected to the hot blast from the transformer core drier. The wiring from exciters to switchboard was installed in conduit and was also grounded. After seventy-two hours' drying the exciter armatures tested clear of grounds, but the field coils still showed a ground, although not a serious one. As the accident at this station crippled us considerably, it was decided to put the machines back in operation for a test run without removing the grounds. After a six-hour run the machines were put in operation under full load. After a twelve-hour run a megger test still showed a ground on the ex-

citer, although a test made two weeks thereafter failed to show a ground anywhere in the system. Had we waited until the megger tested clear we believe we should have been delayed for several days more. As you know, a central station man will take a chance to restore service that would be condemned by a factory service man.

S. G. HUNTER,
Operating Manager.
Malone Light & Power Company,
Malone, N. Y.

## Grounding Chain Practice Standardized

WITH the purpose of insuring uniform practice in the use of grounding chains by linemen, the Public Service Company of Northern Illinois has issued a set of rules accompanied by a diagram. These orders are the result of considerable experimental work by the testing department of the company to determine the most suitable method of grounding lines.




COMPLETE PROTECTION AGAINST ACCIDENTAL ENERGIZING OF LINES AFFORDED BY GROUNDING CHAINS

Various types of line construction used by the Public Service Company of Northern Illinois and the method of using chain to ground each one. All grounding methods shown are started from the left side of the pole excepting chain No. 1 in Fig. 7.

The instructions describe in detail and by blueprint just how chains are to be applied to the line under various types of construction with and without the overhead ground wire. If properly applied, full and complete protection against accidental energizing of lines from any cause while work is being performed on them is provided in the grounding chains. The instructions to linemen read as follows:

Whenever it is desired to take any transmission line out of service in order to repair or do any work on it, the recognized routine should be complied with. Furthermore:

If the line is reported dead by recognized authority, the party about to do the work will proceed to ground the line. Rubber gloves should always be worn when handling hand lines and chains while the latter are being placed on the transmission line. When the grounding is made by means of chains, the chains must be kept taut or no protection is afforded by them, and the following rules must be observed:

1 *Class A and B single-circuit construction with ground wire, with or without distribution lines on same poles.*

A single length of chain 25 ft. long with a hand line of suitable length, strength and insulation attached to each end appears to be the most suitable for grounding and shorting on these types of line construction. This is to be applied as follows:

One hand line will be thrown over all the wires, including the ground wire, and the chain pulled over these wires to make contact as shown in Fig. 1, a good strain being maintained on the chain and hand lines throughout this procedure. The first-mentioned hand line should then be thrown over the remaining wire and the chain pulled taut as shown in Fig. 2, or pulled into contact with the remaining wire while taut, as shown in Fig. 3. Precaution should be taken to keep the chain away from any distribution lines at any stage of the work. Care must also be taken not to come in contact with the chain or the line conductors until all the conductors and ground are in good contact with each other through the chain.

2. *Lines without ground wire.*

A chain of such length to reach across all conductors and extend to ground will be used. For this purpose a sufficient number of the 25-ft. lengths should be coupled together to furnish the necessary length. One end of this chain is to be clamped to an established ground and a hand line attached to the other end of the chain. The hand line will then be thrown over all the wires and the chain pulled into contact with at least the two outside conductors, as shown in Fig. 4. The hand line will then be thrown over the remaining wire by throwing the hand line up between the two line wires with the wide spacing and the chain pulled taut, as in Fig. 5.

3. *Other types of construction.*

Methods of grounding other types of construction in use in the Public Service Company territory are shown in Figs. 6, 7 and 8. Fig. 7 makes use of two separate grounding chains. If a distribution line is attached to the poles carrying a transmission line upon which it is intended to place a ground, it is necessary that the chain be kept clear of the distribution lines at all times.

When the line conductors are to be parted or are already separated, one chain should be placed on either side of the place where work is being done if there is the remotest possibility of either end of the line becoming energized from any source whatever. After the work is completed, chains must be removed from the line first, before being disconnected from ground, and line cleared and put under orders of the system operator.

ALFRED HERZ,
Engineer of Tests.
Public Service Company of Northern Illinois, Chicago, Ill.

Form No. 1026--2500--8-18--Premier Press

PAGE ______

____________ INTERRUPTION RECORD NAME ____________

PERIOD ______ TO ______ LOCATION ______ CAPACITY ______

DATE CUT IN ______ LINE ______

| DATE | TIME | Trouble On System | Trouble On Dist. Line | Trouble On Tap Line | Trouble On Sub-Sta. Eq. | Prearranged For Repairs | | | Lightning | Insulators | Conductors | Poles-Guys Cross Arms | Lightning Arrestor | H. T. Disc. Switch | H. T. Oil Switch | H. T. Fuse | Power Trans. | Instrument Trans. | Customers Equip. | Operators Mistakes | | Unknown | Prearranged For Re-Constr. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MINUTES | | | | | | | MINUTES | | | | | | | | | | | | | | | |
| Total Time | | | | | | | | | | | | | | | | | | | | | | | | Total Time Off |
| Total No. of Cases | | | | | | | | | | | | | | | | | | | | | | | | Total No. of Cases |
| Per Cent. Time | | | | | | | | | | | | | | | | | | | | | | | | |
| Per Cent. No. of Cases | | | | | | | | | | | | | | | | | | | | | | | | |

FIG. 1—PRESENT FORM OF RECORDING INTERRUPTIONS ON ALABAMA SYSTEM, ON WHICH DATA FOR EACH TRANSMISSION LINE ARE CLASSIFIED BY DATE, CAUSE AND DURATION

## Analyzing Causes of Interruptions

TO MINIMIZE interruptions of service the Alabama Power Company requires that very accurate records be kept of interruptions, their cause and duration, so that efforts can be made to prevent their repetition. Now the records are kept in the form shown in Fig. 1. This form is considered preferable because it tells at a glance what outage any customer on any line has suffered, its cause, duration, etc. Once a year this information is recapitulated in the form shown in Fig. 2 so that the most serious causes of interruption can be attacked and removed.

As indicated by the form in Fig. 1. now in use, records are kept for each line. Interruptions of service on the whole line are classified by date, time, cause and duration. Opposite each space are places for showing interruptions to individual customers' service, their cause and duration as well as any remarks pertaining to any unusual conditions encountered.

### Poles, Guys and Crossarms Most Vulnerable Parts

As may be seen from Fig. 2, which recapitulates the serious interruptions of the year 1920, the most serious interruptions on the 110,000-volt lines from the viewpoint of duration were due to poles, guys and crossarms. These were extremely unusual cases of trouble, however, as the two interruptions thus ascribed were both caused by a cyclone on April 20, 1920, which destroyed two structures on the Huntsville line and five structures on the Sheffield line, causing lines to go out for a total of 3,720 minutes as noted. In terms of number of interruptions, lightning was the most serious cause. On the 110,000-volt, 44,000-volt and 13,200-volt buses the most serious cause of interruptions from the viewpoint of duration and number was trouble on other sections of the system, as distinguished from trouble on the buses themselves. The same was true on the distribution system. The degree of seriousness of other causes is indicated.

From this analysis and the correction of weakness which it permitted the interruptions have been greatly reduced, because it has been possible to direct attention where it was most needed instead of aimlessly attacking all possible causes.

Field Editor Electrical World.
New York, N. Y.

INTERRUPTION RECORD
Jan. 1, 1920—Jan. 1, 1921

110-Kv. Transmission Lines

| | Trouble on System | Low Frequency | Lightning | Conductors | Insulators | Poles, Guys Crossarms | H. T. Oil Switch | Instrument Transformers | Customers' Equipment | Operators' Mistakes | Accidental | Unknown | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interruptions to 13-kv.—110-kv. Lines | | | | | | | | | | | | | |
| Time | 689 | | 958 | 4021 | 3407 | 3720 | 7 | | | 2 | 6 | 1059½ | 13869½ |
| Number of cases | 59 | | 130 | 10 | 47 | 2 | 3 | | | 1 | 2 | 62 | 316 |
| Per cent Time | 4.96 | | 6.91 | 29.00 | 24.57 | 26.80 | 0.07 | | | 0.01 | 0.04 | 7.64 | |
| Per cent Number of cases | 18.69 | | 41.12 | 3.16 | 14.88 | 0.64 | 0.95 | | | 0.32 | 0.64 | 19.60 | |
| Interruptions to 8-kv.—110-kv. Buses 8-kv.—44-kv. Buses 2-kv.—13.2-kv. Buses | | | | | | | | | | | | | |
| Time | 1620 | 3 | 32 | | 427 | | 4 | 88 | 4 | | 6 | 25 | 2209 |
| Number of cases | 236 | 1 | 13 | | 5 | | 2 | 4 | 2 | | 1 | 4 | 268 |
| Per cent Time | 73.32 | 0.14 | 1.45 | | 19.35 | | 0.18 | 3.98 | 0.18 | | 0.27 | 1.13 | |
| Per cent Number of cases | 88.02 | 0.38 | 4.15 | | 1.87 | | 0.75 | 1.50 | 0.75 | | 0.38 | 1.50 | |

Distribution Lines

| | Trouble on System | Low Frequency | Lightning | Insulators | Conductors | Poles, Guys, Crossarms | Lightning Arresters | H. T. Dis. Sw. | H. T. Oil Switch | H. T Fuse | Power Transformers | Instrument Transformers | Customers' Equipment | Operators' Mistakes | Switch and Testing Trouble | Unknown | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Interruptions to 22-kv.—44-kv. Distribution lines | | | | | | | | | | | | | | | | | |
| Time | 4161½ | 356½ | 1135½ | 3217 | 1343 | 32 | 119 | 70 | 136 | 37 | 732 | 17 | 8 | 53 | 657 | 688 | 12756½ |
| Number of cases | 480 | 21 | 212 | 54 | 27 | 4 | 2 | 5 | 7 | 4 | 27 | 1 | 4 | 7 | 25 | 76 | 956 |
| Per cent Time | 32.66 | 2.79 | 8.90 | 25.20 | 10.53 | 0.25 | 0.93 | 0.55 | 1.06 | 0.29 | 5.74 | 0.13 | 0.06 | 0.41 | 5.10 | 5.40 | |
| Per cent Number of cases | 50.20 | 2.20 | 22.18 | 5.65 | 2.82 | 0.42 | 0.21 | 0.52 | 0.73 | 0.42 | 2.82 | 0.11 | 0.42 | 0.73 | 2.62 | 7.95 | |

FIG. 2—CLASSIFICATION OF INTERRUPTIONS ACCORDING TO SERIOUSNESS AND CAUSE PERMITS INTELLIGENT CONCENTRATION UPON REMEDIAL MEASURES

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## A Well-Planned Merchandise Salesroom

**A Study of Ideas that Have Been Carried Out in the Arrangement of the New Display Room of the Kansas Gas & Electric Company in Wichita**

THE Kansas Gas & Electric Company in its new general office and salesroom in Wichita has given a most interesting demonstration of the value of careful planning in a central-station display room. The company's officials believe that an attractive merchandise display not only sells more appliances but raises the standing of the business of the company in the eyes of the public and therefore contributes to the development of energy sales as well.

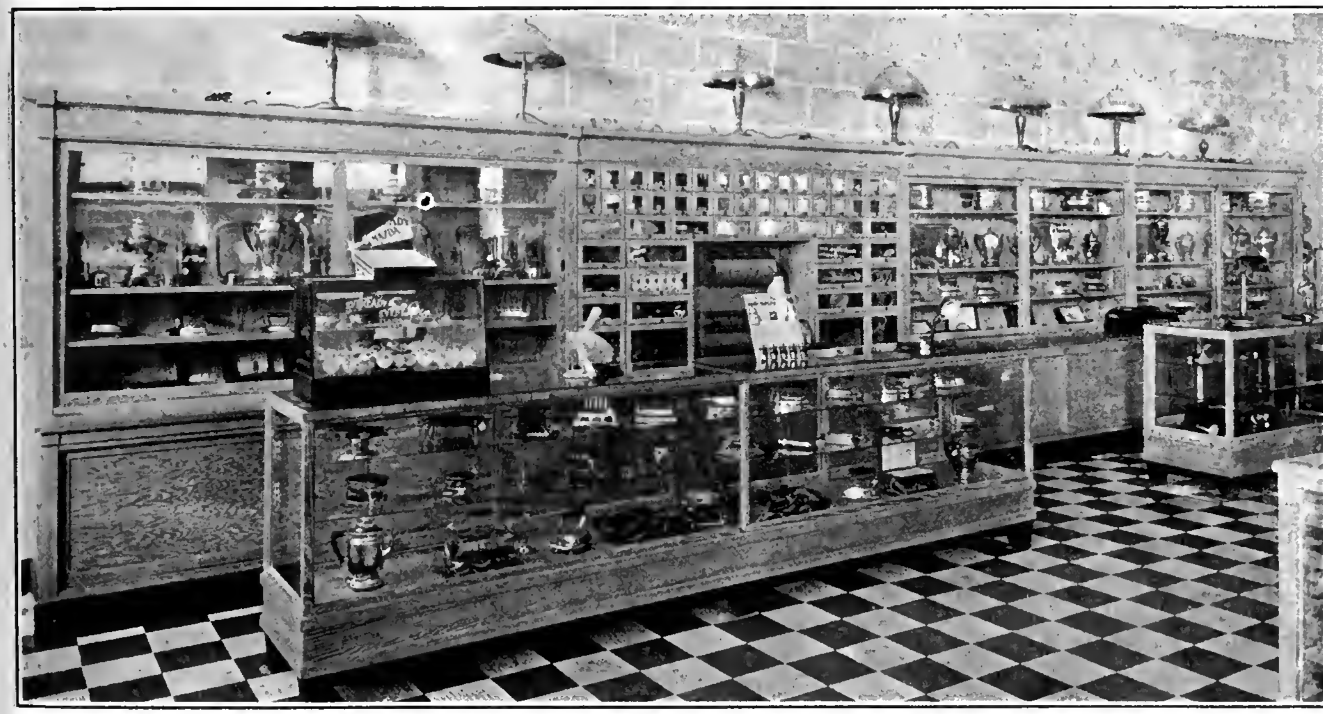
A consumer cannot pass through such a room to the cashier's window or the adjustment window without feeling the effect of the attractive display of merchandise and without gaining a higher respect for the company as a local business concern. Whether it is admitted or not, the feeling of pride in local enterprise is bound to be stirred. All this helps in maintaining public interest and good will for the company.

The primary object, of course, is the sale of merchandise. To accomplish this there is a definitely planned arrangement of the floor space and equipment so that the merchandise can be displayed to the best advantage as the seasons change.

The salesroom in this building, into which the Kansas company has just moved, is the headquarters from which it serves about thirty communities in central and southern Kansas and is an example of the most improved practice in central-station salesroom arrangement. Reference to the illustrations shows that, in place of the usual showcases in the center of the floor, almost the entire floor space has been left clear. The merchandise which is being pushed hardest, either for seasonal or other reasons, is placed in the most prominent positions. The customers' room, where all bills are paid, where troubles are adjusted and other business concerned with the sale of energy is transacted, is at the rear of the merchandise salesroom, and persons visiting the customers' room pass entirely through the display.

Particular thought has been given to the arrangement of the displays on the floor so that merchandise that requires especial educational or promotional support shall have a strong position and conspicuous display. On studying such merchandise it will be found that certain articles occupy a more staple place in the general demand than does the rest of the stock handled. Every effort is made to give this type of merchandise a prominent and permanent location on the floor so that the volume of sales can be maintained.

While the center of the floor in the Wichita display room has been



Here is a most ingenious innovation in the electric shop, adopted from hardware practice. Behind the glass counter-case is a display unit largely made up of drawers, each with a display compartment in the front where samples of the device carried inside are shown behind glass. Customers can easily select repair parts.

## Glimpses of the Kansas Gas & Electric Company's Wichita Salesroom


THE most interesting feature of this merchandise display room is the obvious fact that it is planned to promote sales: (1) The show windows are large and line two sides of the building. (2) A bright sign calls from afar. (3) The entrance is in the center on the corner. (4) A three-step, movable display platform presents the most seasonable appliance as the customers enter. (5) One aisle of the display floor, with the lamp counter in the rear, with lamps of all types and sizes connected for demonstration. (6) Another aisle and the main counter where small appliances are displayed and sold. (7) A view through the center of the salesroom, with the "customers' room," where bills are paid, in the rear.

left clear for the larger articles and the counters apparently occupy a secondary position in order to make the handling of merchandise displays more flexible, this lack of the usual large central counters has been compensated for by placing small counters for appliance display around four of the square columns that support the upper floors. This does not interfere with the use of the floor space for the heavier displays. The main counter has been placed at the extreme left side of the room, away from the main entrance, but convenient to any one coming in from the building hallway and passing on to elevator and building stairway.

Another idea in the arrangement of counters is the placing around one of the square building columns in the customers' room of a glass-top counter which serves the purpose of a writing desk and at the same time permits the display of one specimen of virtually every type of smaller appliance sold in the store, in direct view of the customer who may be writing a check or a memorandum.

Perhaps the most attractive element in the entire salesroom is the display equipment itself, which has been developed to an unusual degree. Back of the main counter, for instance, is a set of glass-inclosed shelves for small appliance display. On the same level is a section of drawers which contain the small devices and other repair parts that customers are apt to call for. The front of each drawer is glass, and a partition is set just back of the glass panel to form a narrow compartment into which one or two samples of the articles carried in the drawer can be placed, so that they can be seen through the glass panel. This enables the customer, who may not have the slightest idea as to the name of the repair parts he wants, to select them by sight. This display case is adapted from hardware-store practice. Underneath these display shelves and drawers is a row of large drawers for stock in storage,

GLASS DISPLAY COUNTERS SURROUND THE PILLARS NEAR THE CASHIER'S WINDOW AND ARE USED AS WRITING DESKS

and practically all this stock on hand is kept in the display room, where it it is readily accessible.

There is a lamp-sales counter at the rear of the salesroom directly back from the main entrance and in the aisle through which most of those on their way to the customers' room pass. As will be seen in the illustration, a number of lamps are mounted in a row at the front of an opening into the case well above the level line of vision. This opening is finished with black inside as a background, and on the counter directly in front of the customer are a number of flush switches corresponding in number and position with the lamps. A sample of each kind of lamp is connected with the sockets, and the customer is aided in making a quick selection by turning on the light.

Another feature which has been adopted from the hardware store is a stepped platform on which the medium-sized appliances are displayed. For example, electric or gas heaters occupy this space during cold weather, and electric fans will be placed on the same device when the hot weather comes on. The banked platform consists of three steps, rectangular in form, and is mounted on castors so that it can be moved.

Space has been provided for the demonstration of either electric or gas ranges in the rear of the room. It is proposed to use this not only in connection with demonstrations put on by the company but in connection with the work of the domestic science department of the public schools.

Naturally a considerable amount of small repair work is brought into the salesroom, and experience has shown that the plan of receiving this work in the office and then sending it out to a repair department some distance away is not satisfactory, because many of the repairs are the work of a few moments only and the customer would like to wait for their completion. A small room to the rear of the main display room has therefore been provided for small repair work brought into the office. In this way all small repair work is kept within reach of the display room.

The Kansas Gas & Electric Company operates branch salesrooms in a number of smaller communities, and,

BRANCH OFFICE SALESROOMS AT CHERRYVALE AND ARKANSAS CITY, SHOWING TYPICAL ARRANGEMENT USED IN SMALLER CITIES

SALESROOM AT MOLINE, A TOWN OF 1,000 POPULATION

of course, these stores do not offer the same chance for planning and arrangement that is offered in the spacious new quarters in Wichita. However, the same principles are carried out so far as possible and no possible effort is spared to make them attractive. The picture of the rooms at Moline (1,000 population), Cherryvale (5,000) and Arkansas City (11,500) show how these ideas are carried out. One thing that should be noted especially is the way in which the small staple items are arranged. The counter with the triangular-shaped top in the picture of the Cherryvale office is the clearest illustration. This contains a variety of small staple articles and is placed so that it is close to the point at which the customer pays his bills. With his change in hand his inclination is often to buy an inexpensive article, and the arrangement of these counters has been found very stimulating to sales.

## New York Edison Exhibits Electro-Medical Apparatus

FOLLOWING its policy of promoting and encouraging the use of electrical energy in every conceivable manner, the New York Edison Company during the week of April 23-28 held an exhibit of electro-medical apparatus in its Irving Place showroom, to which were invited all members of the medical and dental profession. The leading manufacturers of apparatus exhibited, their displays including everything from diagnostic lamps and sterilizers to the most elaborate X-ray equipment. The exhibit was held under the auspices of the Bureau of Electro-Therapeutics of the Edison Company, of which Miss Mabel Martin, a registered nurse, is manager.

## What Other Companies Are Doing

**Louisville, Ky.**—For some time the Kentucky Utilities Company has sold lighting fixtures under an agreement with the manufacturer by which fixtures were furnished on consignment. This business has been very successful, and a new contract provides, in addition to the consignment arrangement, for a fixture salesman to be furnished at the manufacturer's expense. In view of this additional co-operation, the Kentucky Utilities Company has placed its lighting fixture sales quota for this year at $50,000.

**Berlin, Wis.** — The Wisconsin Power, Light & Heat Company has made a definite step toward helping merchants to improve the appearance of the business district at night by reducing the rates for window and display lighting to about half the former rate. The proposal of the electric company follows a period of agitation by business men for a uniform and modern system of store-front illumination. The feeling has been crystallizing for some time that individuals and community alike would benefit by an improvement in the store-window and sign lighting of individual business houses. The policy of the company is to help advertise the community in which it is located, and it is the pursuance of this policy that prompted the company to offer a minimum charge of $1 per month and an energy charge of 7 cents gross and 6 cents net per kilowatt-hour for all window and display lighting. H. R. Smith is district superintendent of the company.

**Boston, Mass.** — Eight electric companies under the management of Charles H. Tenney & Company added to their lines 5,273 newly wired old houses during 1922, the total number of outlets involved being 82,834. The cost of this wiring was $551,798, or $6.66 per outlet. The work was financed by various plans, including loans by local banks, central-station credit, contractor-dealer credit and the Morris plan.

**Los Angeles, Cal.**—Plans of the commercial department of the Southern California Edison Company call for the connection during the year of thirty thousand new homes which will use Edison service. This does not include the many thousands of new consumers taking service from distributors who buy service from the company wholesale. On the customary ratio of five to one this means that 150,000 people will join the ranks of consumers in one year.

ELECTRO-THERAPEUTIC EQUIPMENT ON DISPLAY IN NEW YORK EDISON SHOWROOM

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Rebuilding of Boiler Plant Reduces Coal Consumption More Than One-Half.*—A modern boiler plant containing six water-tube boilers varying in size from 4,000 sq.ft. to 5,000 sq.ft. of heating surface was built on the site of an old overloaded plant containing fifteen boilers, without interruption to service. It was found that eight of the old boilers were in good condition, and these were rebuilt and enlarged by placing another deck of tubes below the old ones and connecting the headers by short nipples. Purchasing two new boilers made ten available, six of which have been installed, and room has been left in the plant for the installation of the remainder when they are needed.—*Power*, April 10, 1923.

*Interior Treatment of Boiler-Feed Water.*—A. J. Loppin.—Though it is generally best to treat hard make-up water before it is sent to the boilers, special conditions may warrant the use of treatment within the boiler. Whether the exterior or interior treatment should be used depends upon the conditions prevailing at the plant under consideration. It depends upon the amount and kind of scale-forming ingredients in the water, the amount of make-up, water used, the course of the water from its source to the boiler, the period of operation of the boiler, the use of the steam, comparative first cost and maintenance cost for each system, type of boiler, rate of evaporation, pressure, load maintained, etc. The effect of each one of these factors on the final selection is considered.—*Power*, April 3, 1923.

## Generation, Control, Switching and Protection

*Differential Relay for Protection of Three-Phase System.*—R. J. Jensen.—The author describes a system of relays designed by himself for the new power station in Copenhagen. The fundamental feature of the new relay is that the unbalance itself, and not the entire load, is used to actuate the relay. This gives uniform sensitiveness for all conditions of load. The two phases to be controlled are carried into the primary windings of a transformer. To one of these primary circuits are added a resistance and an inductance which are dimensioned so that the current in this phase is displaced 60 deg. with reference to the other phase. The secondary winding is connected to the relay. The voltage induced in this winding is dependent only on the unbalance between the two phases since the balanced parts are neutralized.—*Teknisk Tidsskrift*, Jan. 24, 1923.

*Magnetomotive Forces Produced by Single-Phase and Polyphase Windings.*—R. D. Archibald.—A description is given of a simple method of showing the variation in magnetomotive force of a single-phase alternator winding by the shadow of a vane attached to a rotating spindle. The application of the same principle to the case of polyphase windings and the method of arriving at the position and dimensions of the vanes are explained. An apparatus is described which is arranged to show the magnetomotive force produced in the air gap of an induction motor by the stator and rotor windings under load conditions, with the rotor either stalled or revolving.—*Journal of Institution of (British) Electrical Engineers*, March, 1923.

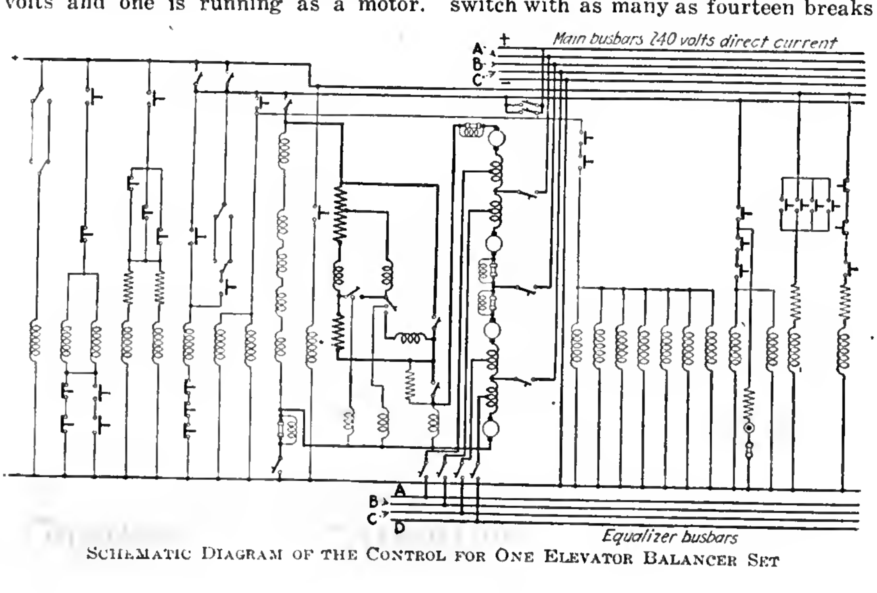
## Transmission, Substations and Distribution

*Automatic Balancer Substation for Elevator Service.*—M. A. Whiting.—In the multivoltage system power is supplied to the elevators from five main buses (see accompanying diagram) which provide four accelerating steps for the elevator motors of 60 volts per step. Voltages for the four-step buses are individually supplied by the four units of the balancer sets acting cumulatively in turn. Considering the acceleration of one motor only, on the first step, say the motor is connected from the plus to the A bus, then one unit of the balancer is supplying 60 volts to the multivoltage bus, and the three others are motoring. On the second step the elevator motor would be connected from the plus to the B bus. Under this condition two units are in series, generating 120 volts, and two are motoring. On the third step three units in series are generating 180 volts and one is running as a motor. When full elevator speed is reached the elevator motor is supplied directly by the 240-volt bus. When this condition obtains the balancers float across the line idle unless the current becomes unbalanced for any cause, in which case the set will make up the discrepancy. This arrangement takes care of the service while imposing the least practical load on the balancers.—*Power*, March 27, 1923.

*Grounding Cable on Overhead Lines.*—H. Behrend.—Investigations of the author on experiences with a grounding cable over an overhead line on systems of 50,000 volts or more indicate that the protective value claimed for such a cable is being considerably overestimated. In case of a ground on the line through a steel tower the danger of a high potential on this one tower is greatly diminished by a cable connecting all the towers. But this, the author claims, is the only positive advantage of a grounding cable, and it could be accomplished far better by laying out a bare underground cable connected to every one of the towers. The cost of the usual overhead grounding cable is about 10 per cent of the cost of the transmission line, an amount which is entirely too high to be paid just for the purpose of diminishing the ground resistance.—*Elektrotechnische Zeitschrift*, March 22, 1923.

## Units, Measurements and Instruments

*Tests on Oil Switches.*—G. Brühlmann.—In several large power stations where up to 32,000 kva. of energy was available short-circuit tests were made on oil switches and their performance was studied. The paper contains a very detailed report of these tests, including several oscillograms. The tests comprised investigations of the influence of multiple breaks, the generated gas pressure and the duration of the arc under oil. The tests seem to indicate that a division of the rupturing arc into a number of smaller arcs lessens the difficulties of the opening process, but that this benefit is not so pronounced in low-voltage switches as it is in types for very high voltages. A switch with as many as fourteen breaks




Schematic Diagram of the Control for One Elevator Balancer Set

per phase was tested and compared with one of only four breaks per phase. With three and one-half times as many contacts the duration of the rupturing arc was reduced only one-half, the sum of the arc lengths increased 25 per cent and the gas pressure generated rose from 4 atmospheres to 6 atmospheres. The excess cost of such a large number of contacts is therefore not warranted. Of considerable interest are tests made on a 35,000-volt oil switch with energy for the test delivered from a specially designed 12,000-kva. steam turbo-generator. Reaching a crest value of about 25,000 amp. short-circuit current, it was found from the oscillograms taken that the switch contacts opened and closed again three times before the intended opening. This was attributed to a lifting of the contacts due to the large dynamic forces acting upon them, and it resulted in a redesign of the contacts. A locomotive switch designed for 16⅔ cycles and 15,000 volts was tested with 16,000 volts and 3,250 amp., which would correspond to a three-phase rupturing capacity of 155,000 kva. After clearing the short circuit eight times at intervals of four minutes and one minute the breaker remained in perfect condition, it being the only breaker of several submitted for test by different manufacturers to stand up under the test. As a result the Federal Swiss Railways selected this type of switch as the standard equipment for its electric locomotives. The article contains a number of interesting photographs of modern Swiss oil switches designed for voltages up to 150,000. — *Brown-Boveri Mitteilungen*, April, 1923.

## Motors and Control

*Application of Electricity to the Printing Industry.* — Printing machinery is now almost exclusively driven by electric motors, and as a direct result of this development control apparatus has been highly developed. Raised-surface or typographic printing is the particular field covered in the article. This includes newspaper printing, magazine printing and the vast amount of work done by book and job publishing houses. The article pertains to the printing industry in Canada.—*Electrical News*, April 1, 1923.

SOURCES OF POWER FOR THE PRINTING INDUSTRY IN CANADA

Newspapers and Periodicals

| Kinds of Power | Number of Units | Hp. Actually Employed |
|---|---|---|
| Steam engines | 9 | 662 |
| Gas engines | 25 | 80 |
| Gasoline engines | 256 | 517 |
| Waterwheels | 14 | 33 |
| Water motors | 28 | 55 |
| Electric motors | 2,665 | 8,998 |
| Other power | 140 | 734 |
| Totals | 3,137 | 11,079 |

Printing and Bookbinding

| Kinds of Power | Number of Units | Hp. Actually Employed |
|---|---|---|
| Steam engines | 1 | 17 |
| Gas engines | 4 | 12 |
| Gasoline engines | 16 | 60 |
| Electric motors | 2,457 | 5,362 |
| Other power | 21 | 20 |
| Totals | 2,499 | 5,471 |

*Speed Control of Polyphase Motors.* —Gordon Fox. — An exhaustive and complete analysis of the factors involved in the operation of this type of motor is given. A classification of various systems of control and a description of each system are included. Three methods of speed control function through change of synchronous speed. These are the variable-frequency system, the multispeed motor and the cascade set. Three common control methods depending upon variation of the amount of slip are secondary resistance or rheostatic control, primary voltage control and dynamic control. Under "dynamic control" fall the Kramer, Scherbius and frequency-converter systems.—*Blast Furnace and Steel Plant*, March, 1923.

## Heat Applications and Material Handling

*Recent Developments in the Arc-Welding Field.*—W. L. Warner.—This is the annual report on electric arc welding presented before the American Welding Society at the annual meeting on April 25. The paper includes standard tests for welds, welding wire specifications, arc welding of cast iron, welding oil storage tanks, rail joints and various other applications, welding monel metals, manufacture of pure iron, arc-welding apparatus and suggested research activities.—*Journal of American Welding Society*, April, 1923.

*Methods of Handling Materials in the Electric Furnace and the Best Type of Furnace to Use.*—F. E. Brooke.—The author discusses the design of various electric furnaces, such as the plain box type, the special box type, the car type, the recuperative and continuous furnaces, and refers to their advantages and disadvantages. Attention is drawn to the method of handling materials for these furnaces so that a uniform temperature and high furnace efficiency may be maintained.—*Paper presented before the American Electrochemical Society, New York*, May 3-5, 1923.

## Illumination

*Influence of Paint on Interior Illumination.*—R. L. Hallett.—This paper briefly discusses the illumination of building interiors, particularly from the standpoint of secondary illumination or the illumination obtained by reflection of light from walls and ceilings. The effect of color and surface finish on reflection of light is discussed, and information is given concerning the reflection properties of paint made with various materials. Durability of paint films as affecting reflection of light is referred to, and the effect of the opacity of pigment as influencing reflection of light is brought out. The results of experiments showing the reflection factors of various kinds of paint and of the durability of paints of different composition are given.—*Transactions of the I. E. S.*, April, 1923.

## Electrophysics, Electrochemistry and Batteries

*Influence of the Base Metal on the Structure of Electrodeposits.* — W. Blum and H. S. Rawdon.—If copper is deposited electrolytically upon cast or rolled copper which has been cleaned with alkali, the structure of the base metal does not apparently affect that of the electrodeposit. If, however, the surface of the base metal has also been treated with nitric acid, the electrodeposited copper possesses both the crystal form and the orientation of the base metal.—*Paper presented before the American Electrochemical Society, New York*, May 3-5, 1923.

## Telegraphy, Telephony, Radio and Signals

*Magnetic Shunts in Telephone Receivers.*—H. Carsten.—The influence of a magnetic shunt across the pole pieces of the permanent magnet in a telephone receiver upon the sensitiveness of the telephone is investigated by experiments and calculation. It is found that the effect of the magnetic shunt depends largely upon the density of the field of the permanent magnet. An actual increase of sensitiveness can be obtained only with very high magnetic flux densities, for which the generally used magnets are insufficient. It is claimed that the addition of a shunt to magnets used today in modern telephone factories has therefore no advantage. — *Elektrotechnische Zeitschrift*, March 22, 1923.

*Tuned Radio-Frequency Amplification with Neutralization of Capacity Coupling.*—L. A. Hazeltine.—Tuned radio-frequency amplification is based on the general principle that electrostatic or capacity coupling between two circuits behaves like electromagnetic coupling in that it may be reversed and may be reduced to zero. This is accomplished by balancing one capacity against another. To attain the balance condition it is generally necessary to reverse the phase of a voltage, and this involves the use of a transformer in addition to the capacities. The circuit is a simplification of previous circuits and not an elaboration. It eliminates a previously existing disturbing feature and so gives pure relay amplification. —*Q.S.T.*, April, 1923.

## Miscellaneous

*Newer Aspects of Ionization Problems.*—H. S. Taylor.—A résumé is presented of some recent work by Born, Fajans, Haber and others on the problem of energy changes accompanying the conversion of some solid crystalline substances and of the hydrogen halides into dissolved ions. An outline is given of the concepts of lattice energy and of the electron affinity of halogens, the quantitative side of the problem receiving detailed consideration. Small modifications of the earlier calculations have been made whenever newer material of a more reliable nature seemed to be available.—*Paper presented before the American Electrochemical Society, New York*, May 3-5, 1923.

# New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

## English and Engineering

A Volume of Essays for English Classes in Engineering Schools. Edited by Frank Aydelotte, president of Swarthmore College. Second edition. New York: McGraw-Hill Book Company, Inc.

The function of English in technical education is, as President Aydelotte points out in his admirable introduction, twofold—"in the first place, to train students to express themselves in writing and speaking, not merely grammatically, but with order, force, sincerity and such charm as their natures will allow; in the second, to furnish something of the liberal, humanizing and broadening element which is more and more felt to be a necessary part of an engineering education." The two aims, the writer continues, are in reality closely connected and by them the outline and arrangement of his anthology have been dictated. The range from which material has been drawn, already a wide one in the first edition of six years ago, has been made even wider, embracing writings which extend from the works of John Ruskin, John Stuart Mill and Robert Louis Stevenson to those of living engineers and the advertisements of manufacturing companies. The book is divided into six parts, under each of which from two to nine essays or discourses are grouped without comment or notes. The first section, entitled "Writing and Thinking," is "an attempt to make the student see the dependence of writing on thinking, to impress upon him the first of all principles of good writing, that he must have something to say." The second and third sections deal with the profession of engineering and the demands which it makes on the engineering schools. The titles, "Pure Science and Applied," "Science and Literature" and "Literature and Life," epitomize the scope of the remaining sections.

President Aydelotte's collection, even though many refulgent masters of prose are necessarily unrepresented, is abundantly adapted to the classroom study of the engineering pupil who has heard and practiced correct speech from early childhood, who has an innate love of literature and who can feel the charm of words and delight in their nice uses and distinctions. Unfortunately, such students are comparatively few in our technical schools. Has the editor of this volume, one wonders, a plan by which the large majority of engineering undergraduates—boys of deficient elementary education, from homes where letters are little cultivated, who have turned to engineering just because they do *not* care for books or writing, but do love to use their hands and their wits in practical and productive arts—can be taught, not to compose treatises in masterly English, but, when occasion arises, to tell a plain, unvarnished tale of facts and experience in a clear, concise and grammatically correct manner? Will there come a day when a technical graduate as profoundly ignorant of rhetoric and as slovenly in syntax as hundreds of them are today will be as much a source of amazement as one ignorant of higher algebra or the use of logarithms?

## Die Technik der Elektrischen Messgerate

By Dr. George Keinath. Munich and Berlin: R. Oldenbourg. 448 pages, 372 illustrations.

Many authors keep abreast with the rapidly advancing art of instrument building by the frequent issue of new editions, so that there is really no lack of complete and up-to-date books on this subject. But all of them have one shortcoming in common in that they either surround a purely technical description of the construction of the instruments with too much theoretical matter, or else they neglect the constructive part of the instruments altogether. Dr. Keinath has written a book for the practical engineer and has introduced only such theoretical and mathematical explanations as are essential. The chapters on registering and "hot-wire" instruments contain details and test results found nowhere else in electrical literature. The author is connected with the Siemens & Halske company, which accounts for the fact that instruments and design of this firm are mentioned more frequently than others. By adding fifteen or twenty pages of details on the existing designs or oscillographs and apparatus for the measurement of the magnetic properties of iron the book could be made complete. A. PALME.

## The Essentials of Transformer Practice

By Emerson G. Reed. New York: D. Van Nostrand Company. 257 pages, illustrated.

A thoroughly readable and thoughtfully prepared treatment of the theory, operation and design of transformers. While meant primarily for the student and operating engineer, the treatment is fundamental and adequate for the specialist and designer. Much original material on transformer iron and insulation is contained in the text, the discussion of transformer heating being particularly good. The design element is subordinated to the fundamental physical phenomena and the use of mathematics is reduced to a minimum. General relations, polarity, reactors, losses, efficiency, transformations and regulation are discussed with a splendid perspective. The make-up, style and material combine to make this book a noteworthy addition to transformer literature.

## Advanced Laboratory Practice in Electricity and Magnetism

By E. M. Terry. New York: McGraw-Hill Book Company, Inc. 258 pages, illustrated.

A course in electrical measurements is given to electrical students in many schools, and for such courses this book of Dr. Terry is admirably adapted. It contains a carefully selected amount of material which is presented in teachable form. It recognizes the changes in the electrical art by adding to the usual measurements carefully prepared chapters on the discharge of electricity through gases, radio activity and thermionics. The fundamental principles of transient phenomena are treated in some detail. The arrangement of the book is good and well adapted to the laboratory method of teaching. Much of the material is new, and the work should be well received by the colleges and prove interesting to many engineers engaged in measurement work.

## Electric Toy Making

By T. O'Conor Sloane. New York: Norman W. Henley Publishing Company. 249 pages, illustrated.

Practically every type of amateur application of electricity is treated in the twenty-first edition of this book. It is the type of book that boys delight in having and has some very useful designs for more mature students.

# Books Received

**The Induction Voltage Regulator.** By E. F. Gehrkens. Schenectady, N. Y.: The General Electric Company. 516 pages, illustrated.

**Aide-Memoire et Schemas de l'Entrepreneur-Electricien.** By P. Maurer. Paris: Dunod. 620 pages, illustrated.

**Synthetic Resins and Their Plastics.** By Carleton Ellis. New York: The Chemical Catalog Company, Inc. 514 pages, illustrated.

**The "Electrician" Electrical Trades Directory and Handbook of the Electrical Engineering and Allied Trades, 1923.** Forty-first edition. London: Benn Brothers, Ltd. 1,364 pages.

**The Essentials of Transformer Practice.** By Emerson G. Reed. New York: D. Van Nostrand Company. 265 pages, illustrated.

**Advanced Laboratory Practice in Electricity and Magnetism.** By Earle Melvin Terry. New York: McGraw-Hill Book Company. 261 pages, illustrated.

**Business Cycles and Unemployment.** Report and recommendations of a committee of the President's Conference on Unemployment, including an investigation made under the auspices of the National Bureau of Economic Research. New York: McGraw-Hill Book Company. 405 pages, illustrated.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Engineer in Public Affairs

**Four Founder Societies in New York Hear Discussion of the Part He Should Play**

A MEETING under the auspices of the four founder societies of the United Engineering Society was held in the Engineering Societies Building, New York City, on Tuesday of this week to discuss "The Engineer in Public Affairs." Senator Stirling of South Dakota, who was to have made an address, was unavoidably absent. Gano Dunn, president of the J. G. White Engineering Corporation, who occupied the chair, declared that the engineer must be an all-around man before he can reach the heights of his profession. The increasingly essential relation of engineering works and structures, engineering operations, engineering conceptions and even engineering terms and habits to the daily life of the people of the United States has been so marked, he said, that engineering of itself has been taking a greater and greater part in public affairs, and if the engineer cannot keep pace with his subject, then certainly he is unworthy of the name. At the same time, Mr. Dunn recognized the possibility of overemphasizing the desirability of direct participation by engineers in public affairs. The proper line of demarcation was one of the things for consideration.

Admiral John K. Robison, engineer-in-chief of the United States Navy, told of engineering in the navy and made a strong plea for that branch of the nation's defense. The navy's problems, he said, are largely engineering ones.

President Frank B. Jewett of the American Institute of Electrical Engineers took Senator Stirling's place on the program and urged, as did Mr. Dunn, that all engineering bodies unite in support of the Federated American Engineering Societies, burying their individual points of view where these conflict.

## New York Legislature Passes Ferris Amendment

Before adjournment last week the New York State Legislature passed for the second time the Ferris amendment to the state constitution, referred to last week, which authorizes the use of not to exceed 3 per cent of the lands of the forest preserve for the building of transmission lines and the erection of power and generating stations for electrical development of state-owned water powers. The amendment will go to the people for ratification at the general election in November.

Five amendments to the Public Service Commission law were passed and are now in the Governor's hands. Two of these affect gas companies, one of them restoring "dollar gas" in New York City; two affect steam and electric railway companies, one of them ordering all steam tracks within New York City to be electrified by January, 1926, and the fifth amends sections of the law relative to the verification and filing of annual utility reports.

## Public Service of New Jersey Places Big Orders

Orders have been placed by the Public Service Corporation of New Jersey for the initial installation of 200,000 hp. for its new steam station at Kearney, N. J. The General Electric Company is to build three 40,000-kva. units for this plant, and the Westinghouse Electric & Manufacturing Company two units of the same rating. Ultimately ten units will be installed, giving the station a rating of 400,000 hp. Stoker-fired boilers will be used.

## Annual Business Meeting of A. I. E. E.

The annual business meeting of the American Institute of Electrical Engineers will be held at the Engineering Societies Building, New York, next Friday, May 18, at 4 p.m. Results of the annual election of officers will be announced and the report of the board of directors presented.

## Ford May Develop Many Michigan Power Sites

A bill permitting private corporations to condemn 25 per cent of the land necessary to develop water-power sites was passed by the State Legislature of Michigan last week and was reported to be likely to receive the Governor's signature and become law. Its passage may lead to development of water-power sites all over the state by Henry Ford. The Ford interests, it is said, exerted all the pressure at their disposal to get the bill through.

The bill as it passed the House carried an amendment introduced at the request of Governor Groesbeck which stipulates that the state shall retain title to all lands condemned and lease them to private corporations.

## Southern Power Halts Work

**Immediate Construction of Catawba River Project Abandoned—High Costs the Obstacle**

AS FORESHADOWED in the ELECTRICAL WORLD for April 28, page 995, the Southern Power Company has definitely abandoned its expansion program, for the present at least, on account of increased costs of labor and electrical equipment. Announcement to that effect was made at Charlotte, N. C., last Saturday by J. B. Duke, president of the company, who said that the company found it impossible to build at today's costs and earn a reasonable return at the rates allowed. For several weeks officials and engineers of the company have been going over building plans and consulting with equipment manufacturing concerns and contractors. Three weeks ago it was semi-officially announced that prices were so high that it seemed highly probable that the company would have to halt its building program. Further conferences only confirmed previous ones as to costs, and the definite announcement of abandonment of the program was made.

### Will Complete Projects Under Way

Following a period of inactivity during and immediately after the war, the power company last year began building again. Two large projects were started, one at Great Falls, S. C., developing 60,000 hp., and one at Mountain Island, N. C., developing 80,000 hp. The Great Falls plant is now complete and the Mountain Island plant will be completed this year. In addition to this hydro-electric construction, work was begun on two steam auxiliary plants, one of 40,000 hp. at Mount Holly, N. C., and one of 20,000 hp. at Eno, N. C. Work was also begun on 200 miles of transmission lines. This work will all be completed this year. As already announced in these columns, it was the purpose of the company to begin work on at least one more plant, and a site on the Catawba River, near Rhodhiss, N. C., was selected. The plans called for the development of 50,000 hp., and had a halt not been called this power would have been ready for industrial use by early next fall and would have taken care of present accumulated demands on the company, amounting to about 25,000 hp., and provided a surplus for future demands.

Rates in North Carolina are fixed by the State Corporation Commission. The present power rates were fixed three years ago and were based, it is

said, on original costs of the plants existing at that time. These plants were built when everything was much cheaper than now and were also built at the best sites; that is, where power could be developed at the least cost.

In addition to the increased labor and equipment costs, another item of expense to the company which, it is maintained, has more than tripled in the last few years is land, which the company has to acquire by the thousands of acres adjacent to and above its dams.

## Byllesby Acquires Oklahoma Utilities

Thirteen towns and cities in Oklahoma, with a combined population of 50,000, were added to the lines of the Oklahoma Gas & Electric Company this week upon the absorption by the H. M. Byllesby Company, Chicago, of the Shawnee Gas & Electric Company, the Oklahoma Light & Power Company, supplying electricity in Ada, Sulphur, Paul's Valley, Holdenville, Seminole, Maud, Harjo, Konawa, Francis, Roff and Maysville, and the Southern Oklahoma Power Company, which has a steam turbine station at Byng rated at 8,000 hp.

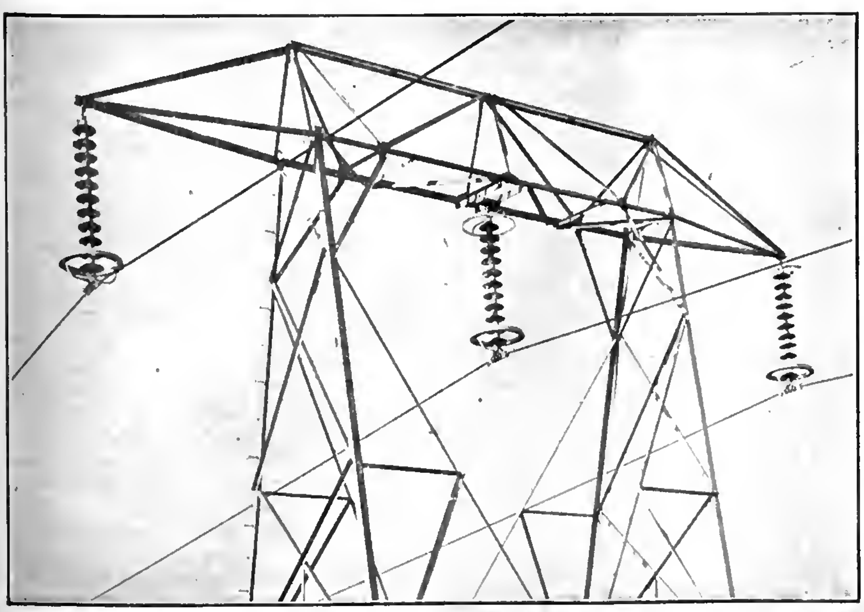
Most of these communities are interconnected by 123 miles of transmission lines, with 30 miles of new lines under construction. Eventually these properties may be connected with the 400-mile transmission system of the Oklahoma Gas & Electric Company, which now serves forty-nine cities and towns with a population of 277,000. The newly acquired properties serve 7,489 electric customers.

# Transmission at 220,000 Volts a Fact

### Big Creek Line Was Synchronized with Southern California Edison System Early Last Sunday Morning—A Triumph of Years of Research—No Hitch of Any Kind Is Experienced

At 6:12 O'CLOCK on the morning of May 6, 1923, the switches on the Big Creek lines of the Southern California Edison Company were closed and 220,000-volt transmission became an accomplished fact. Reports from California say that everything came off according to schedule with no hitch. The event marks the culmination of years of research, experiment and study of the problems of higher-voltage transmission by some of the most prominent electrical engineers in the profession, and to the electrical industry and the scientific world the day will go down in the annals of electrical progress as one of the important dates.

The photograph represents a suspension tower on one of the Big Creek transmission lines. These lines have been operating for some time at 150,000 volts. Before being changed over to 220,000-volt operation additional insulation units were added, making a total of eleven units on suspension and thirteen on dead-ends. Cast-aluminum shield rings having a diameter of 28 in. are used to distribute the electrostatic stress uniformly along the insulator strings. The conductors are 605,000-circ.mil aluminum, and each line has a capacity of 125,000 kw. at 220,000 volts. Auto-transformers forming a part of the line are used at each end except at Big Creek No. 8 power house, where 220,000-volt transformers were provided at the time the plant was built.



Cast-Aluminum Rings (28 In. Diameter) Make Electrostatic Distribution Across Disks Uniform

## Power Board Activities

### Competition for New River Rights in West Virginia—Alaskan Permits and Timber Purchases

Owing to the fact that the market for electric power in southern West Virginia and northeastern Virginia is growing at a compounded rate of more than 20 per cent per annum, a determined fight before the Federal Power Commission is in prospect for the power site near Hinton, W. Va., on New River. The contending applicants are the Virginian Power Company, which has headquarters at Charleston, W. Va., where it is operating a 60,000-hp. steam plant, and the Appalachian Power Company, whose activities center at Roanoke, Va. The latter company owns most of the flowage lands required and is now contemplating pushing a development which calls for the construction of six plants on New River. The two lower plants would be in direct conflict with the application of the Virginian Power Company.

The Home Power Company, a public utility operating in Skagway, Alaska, has received a preliminary permit from the commission for a small project on the North Fork of the Skagway River. This development is made necessary by the fact that the present source of power is interrupted before the end of winter by the freezing of the stream. A license has been authorized for L. H. Carvey covering a small project on Archangel Creek, 70 miles north of Valdez, and another to B. A. Garver of Seattle covering two minor projects on Big and Little Kanatak Creeks, near the town of Kanatak, Alaska.

#### Policy on Alaskan Permits

The Federal Power Commission and the Forest Service are about to agree upon a policy of co-ordination to apply in connection with combined power and pulp projects in Alaska. The power commission thus far has been granting preliminary permits in such cases with a requirement that the permittee shall purchase the necessary timber for his operations from the Forest Service. The effect of this plan is to limit competition for the sale of the wood, which led the Forest Service to propose that the timber be advertised for sale at the same time the power commission advertises the application. In this way the rights can be extended so as to safeguard better the public interest, it is contended. This plan may slow up initial action on the application, since timber sales must be advertised for four months, whereas applications for power rights need be advertised for only two months.

The license issued to the Wisconsin-Minnesota Light & Power Company, which required the stocking of its reservoir with muskellunge fish, has been amended to eliminate that provision.

Questions involved in the conflicting applications in the Little Falls-Pike Rapids case will be discussed at a public hearing to be conducted by the commission on June 7.

## Insull Dinner for Merz

### Visiting Engineer Expresses Views on Electric Developments and Tells of Progress in England

SAMUEL INSULL gave a dinner to Charles H. Merz of London at the Edison Restaurant, Chicago, on the evening of May 2, at which more than two hundred utility men and others were present. Mr. Merz is the head of the well-known engineering firm of Merz & McClellan, consulting engineers for the Commonwealth Edison Company, and, with some members of his staff, is in this country investigating the present status of electric power development in the United States. Mr. Insull, in introducing Mr. Merz, referred to him as having been connected with large electric power developments the world over and as an authority on the economical production and distribution of electrical energy as well as an engineer of great distinction and high ideals.

In responding, Mr. Merz spoke of the wonderful development attained by the electric power industry as shown by the fact that work is actually under way on a million-horsepower station. The reference, undoubtedly, was to the Crawford Avenue station of the Commonwealth Edison Company, for which Merz & McClellan are consulting engineers. Mr. Merz went on to sketch electric power conditions in Great Britain from the days of Joseph Chamberlain, the British statesman who had so much to do with the "municipalization" restrictions that have characterized this development. He described the present method of control by electricity commissioners in Great Britain and referred also to the modern and extensive electrical development in the Newcastle-on-Tyne region under private ownership. Recent electric power development undertakings in Australia and South Africa were mentioned, and Mr. Merz told how in the former country lignite or brown coal is being used for fuel.

In relation to railroad electrification the speaker brought the cheering news that the English companies favor centralized energy rather than the building of their own generating stations. On the general subject of massing the production and distribution of electrical energy Mr. Merz expressed himself in entire agreement with the ideas, promulgated many years ago, of Mr. Insull.

#### Underground Distribution Prevails

Underground distribution of electrical energy is highly developed in Great Britain, contrasted with the more usual distribution by overhead wires in this country. Even electric services to customers in small communities are underground. Thus distribution problems in Great Britain are rather different from those of the United States. The distribution is more likely to be regarded as a system separate from the production end. Outdoor switching stations are almost unknown. The 230-volt lamp is in almost universal use and has some advantages compared with the 115-volt lamp of this country.

The United States has seen one important advance in generating station practice which has no counterpart in Great Britain at present, the speaker said, and that is the use of very large steam boilers. For the future he believed that progress would be in the line of greater interconnection, more centralization, increase in the size of generating stations and higher steam pressures. With the large steam turbines, say of 50,000 hp. and upward, now in use, economies are obtained comparable with the highest efficiencies of internal-combustion engines. The latter at present cannot be made in very large sizes and are not to be had in units of more than 5,000 hp. This is not big enough for great modern generating stations, although in smaller plants the internal-combustion engine has obvious advantages, being economical in fuel and in labor. It should be watched by generating-station designers as it may be developed so that it will be available in larger sizes.

Mr. Merz concluded by declaring that while engineers must always work for the greatest economy in electric power production, they must never forget that to obtain this security and reliability must not be sacrificed.

## Consumers' Power 100,000-Kw. Plant

### Saginaw River Station to Use Cast-Iron Blocks in Place of Furnace Brickwork, Thereby Increasing Heat Absorption—Hydraulic Stokers—Water Sluicing of Ashes

THE Consumers' Power Company, Jackson, Mich., has started the construction of a 100,000-kw. steam generating station at Zilwaukee, on the Saginaw River, 3 miles north of Saginaw. The company has available an extensive acreage of land along the bank of this navigable river, so that in the future coal may be supplied to the plant by boat. At the present time, however, coal will be received by rail over the Grand Trunk and Michigan Central railroads. The initial installation will consist of two 25,000-kva. General Electric steam turbines. Operation is expected to start with the first unit about Dec. 1, and the second unit will, it is thought, be ready next March.

Each turbine unit will have two B. & W. boiler units, each having 8,870 sq.ft. of steam-heating surface and rated at 900 hp. These boilers will be fired by American Engineering Company type K underfeed stokers of a hydraulically driven type, using a Hele-Shaw pump system. The stokers will have a double row of clinker crushers. The steam pressure will be 375 lb. with 250 deg. F. superheat. A double bank of the Green Fuel Economizer Company's vertically baffled cast-iron economizers will be mounted directly above the boilers. They will have 8,500 sq.ft. of heating surface. Superheaters of the radiation type will be installed in the back walls of the furnaces by the Power Specialty Company.

The chief feature of the boilers will be the substitution of cast-iron blocks furnished by the Power Specialty Company for parts of the furnace lining. Through these cast-iron blocks water-cooled steel tubes will run which will circulate water at the same pressure as the boiler. It is expected that these water-cooled furnace linings will generate steam to correspond to a heat-absorption rate of 60,000 B.t.u. to 80,000 B.t.u. per square foot of exposed surface per hour. The building will be constructed of waterproof reinforced concrete up to any possible flood stage of the Saginaw River. Above that level the building will be a steel-supported brick structure. Steel stub stacks will be used, one for each boiler.

The coal-handling equipment will consist of a track hopper and an automatic vertical skip hoist, which will discharge the coal through crushing and weighing apparatus upon a shuttle belt conveyor, which will travel on a truck over steel-plate bunkers. Excess coal will be spouted by gravity from the skip-hoist tower back to the yard and spread out into storage by a drag scraper.

#### Ash Handling by Sluicing

Ash removal will be handled by means of a concrete sluiceway directly below the boilers supplied with water from the circulating system of the main condensers. As the ashes are ground through the clinker crushers of the stokers, they will drop to the secondary grates, from which they can be dumped by hand into the sluiceway. This sluiceway is to feed into a well so that the ashes may be raised by motor-operated manganese-steel-lined dredging pumps to a wooden launder which will carry the ashes mixed with water to the dumping grounds. These pumps will be capable of handling lumps of clinkers up to 8 in. in diameter. A grizzly will protect the pumps from clinkers larger than this size.

The make-up water will be purified by means of Griscom-Russell evaporators connected between the bleeders of the eighth and eleventh stages of the turbines. Each evaporator will have a maximum capacity of 10,000 lb. per hour. A condensate storage reservoir will be provided between the foundation walls under the boiler-room basement. This arrangement of evaporators eliminates a number of pumps and other auxiliaries generally found with a low-pressure evaporator plant. In this case the evaporator feed pump is also eliminated, as the water will feed to the evaporators by gravity from the cold-water house-service supply tanks. Deaëration of feed water will be accomplished by admitting all the con-

densate which has been exposed to the air in storage back into the system through the main condensers, which will have hot wells of special design. This will deliver the condensate practically free from dissolved air and at a much higher temperature than that corresponding to the pressure of the vapor in the condenser. Air for combustion will be admitted to the building through louvers and heaters in the top of the boiler room and drawn down through ducts, carrying with it waste heat from the boiler-room radiation losses into the forced-draft fan room. After passing through the fans on the way to the stoker wind boxes, the air will be preheated to a temperature of 250 deg. to 300 deg. F. by means of hot water and steam bled from the main units.

Since the power house will be nearly 800 ft. from the river, long intake and discharge circulating water ducts will be necessary. Two 22,000-g.p.m. pumps and one 35,000-g.p.m. pump will be built to operate the first two condensers. The Ingersoll-Rand condensers will be of the pear-shape type, being built for one pass only with ⅞-in. tubes, and each will have a surface of 14,250 sq.ft., excluding the coolers.

### NOVEL FAN CONTROL

What is believed to be an original arrangement of motors and controls for the forced-draft and induced-draft fans has been developed. Directly connected to each forced-draft fan there will be a 25-hp., 720-r.p.m. and a 100-hp., 1,200-r.p.m. motor. These are to be 440-volt alternating-current slip-ring motors with the 720-rp.m. motor designed for safe overspread at 1,200 r.p.m. Each motor will have its controller, of the motor-operated drum variety, and the controllers will be so connected and interlocked that by the mere operation of one push-and-pull switch on the boiler-control board any fan speed from 360 r.p.m. to 1,200 r.p.m. can be obtained. When the drum controller of the small motor has reached its top speed, a contactor will automatically cut this motor off the power circuit, and another contactor will connect the larger motor, whose controller will then accelerate up to the maximum speed with the small motor coasting. The reverse operation is similar. Flashing lights will indicate each step of each controller. Each induced-draft fan is driven by a 40-hp. and a 150-hp. motor operated similarly, the 40-hp. motor being connected by a chain drive while the large motor is directly connected to the fan shaft. Fan speeds of 225 r.p.m. to 900 r.p.m. are provided for. The small motors will furnish the necessary draft for 70 to 80 per cent of the running time, the large motors being called upon only when the boilers are operated at the very highest ratings.

The turbines will generate at 12,000 volts, which will be stepped up to 24,000 volts by means of auto-transformers directly connected to each turbo-generator. These auto-transformers will be installed in the outdoor substation with no switch between them and the generators. Differential relay protection will be provided around the entire unit of generator and auto-transformer, so that a failure in either the generator, the connecting cables or the auto-transformer will trip the switch connecting the unit to the 24,000-volt bus, open the generator field and close the throttle.

The generators are to have an entirely self-contained air-cooling system, which will circulate the air past water-cooling coils, the total volume of air in the system being extremely small. The volume of air, in fact, will be so small that in case of an incipient fire in the generator windings the oxygen would hardly support combustion for the small amount of dust which might be present in the windings. On this account no water, steam or other fire-fighting equipment is to be provided.

Each exciter is to be a 110-kw., 250-volt shunt unit directly connected to the turbine shaft. Bracketed and directly connected to the end of this exciter will be a small 2-kw., 125-volt machine to excite the field of the 110-kw. exciter. No main series-field rheostat is provided, nor will a Tirrill regulator be used. The exciter rheostat is to be motor-operated and consist of two sections, the first section cutting in resistance in the field of the main exciter and the second section cutting in resistance in the 2-kw. generator field. There is no spare excitation whatsoever provided, although in case of trouble with the 2-kw. machine the main exciter fields could be readily excited from the station control battery, which has a voltage of 125.

### OUTDOORS EQUIPMENT

Following the general practice of the company for the last ten years, all of the switching and transforming equipment will be installed in an outdoor substation erected adjacent to the steam plant. This will include the auto-transformers, the station power transformers, the step-up transformers for the 140,000-volt system and 24,000-volt and 140,000-volt buses and switching equipment. The 24,000-volt switches will be of the General Electric type KO-39B variety, rated at 50,000 volts.

The station power transformers are to be three 500-kva. self-cooled transformers stepping down from 24,000 volts to 480 volts, one bank supplying all the station auxiliaries for the first two units. Future units will obtain station auxiliaries from a second station power bank. To insure as much as possible against transformer failure, the station power transformers are to be built to 50,000-volt specifications.

The 140,000-volt substation will consist of a 45,000-kva. bank of transformers stepping up from 24,000 volts to 140,000 volts, together with switching equipment for the 140,000-volt lines. It is planned to install a duplicate 140,000-volt bus with electrically operated remote-control disconnecting switches connecting the line and transformer switches to either bus. In addition, there will be a bus-tie oil circuit breaker provided with electrostatic synchronizing equipment to enable the two buses to be synchronized. This outdoor substation will supersede the present indoor station at Zilwaukee, which is a portion of the original 140,000-volt system built in 1911. By means of this 140,000-volt system the energy of the new station will be available generally on the system, which already connects the Au Sable River dams with Flint, Owosso, Battle Creek, Jackson and, through frequency changers, with Grand Rapids and other cities served by the 140,000-volt, 30-cycle system.

The entire engineering and construction of the plant is being carried on by the engineering and construction departments of the Consumers' Power Company, H. F. Eddy, mechanical engineer, and J. H. Foote, electrical engineer, having direct charge of the design and engineering, and G. F. Stecker, assistant manager of construction, being in direct charge of building the station.

## No Change in Control of the Crocker-Wheeler Company

At the annual stockholders and directors' meeting of the Crocker-Wheeler Company, held in New York on Wednesday, May 9, new officers were elected, the selections proving that there will be no change in policy or management because of the death of President Schuyler S. Wheeler. Edmund Lang, who was previously vice-president and secretary, was made president. Arthur L. Doremus was continued as vice-president, and Clarence N. Wheeler, the former controller, was elected to fill the vice-presidential vacancy caused by Mr. Lang's promotion. Herbert C. Petty, formerly assistant sales manager, became secretary and sales manager; Theodore S. Fuller was continued as treasurer, and George W. Bower was made assistant secretary and assistant treasurer. The existing board of directors was re-elected, the vacancy caused by Mr. Wheeler's death being left unfilled for the present. Besides the president and vice-presidents named above, these directors are Edward W. Brown, Hampton D. Ewing, E. B. Humpstone, Frank H. Jones, and Dr. M. I. Pupin.

## F. A. E. S. Makes Appointments to Coal Committee

Appointment of four members of the committee to conduct an investigation into the storage of coal is announced by the Federated American Engineering Societies. They are P. F. Walker, dean of engineering, University of Kansas; S. W. Parr, professor of applied chemistry, University of Illinois; H. Foster Bain, director of the United States Bureau of Mines, and L. E. Young, Union Light & Power Company, St. Louis. The chairman is W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, Chicago.

## Commercial Men Meet

### Hoosier Association Devotes One-Day Session to Appliance Selling, Rural Rates and Refrigeration

SELLING appliances, rural extensions and electrical refrigeration received great attention at the Commercial Section meeting of the Indiana Electric Light Association at Indianapolis on May 3. A. W. Krueger, Edison Electric Appliance Company, answered the question as to whether a central-station company should merchandise appliances in the affirmative, basing his opinion on the experiences of central stations in many localities throughout the West. All electrical dealers, he thought, benefited by the pioneering work of the utility. Wallace O. Lee, Indianapolis, cautioned against price cutting if a utility desired the co-operation of the local contractor-dealers. T. Hatfield, a contractor-dealer, felt that since the utilities were virtually the backbone of the electrical industry, it was perfectly logical for them to handle merchandise, but unless prices were maintained dissatisfaction and jealousy on the part of other dealers would arise. R. Thurman chairman Commercial Section, and F. W. Buck thought that if the field was entered separate merchandising departments should be maintained.

#### New Rural Rates

The newly proposed rural service regulations for Indiana were discussed by Earl Carter, chief engineer of the Public Service Commission. These rules follow those adopted in Wisconsin in that the rural charge is determined by a certain percentage of the total investment. For Indiana this charge is 10 per cent of the total cost of the new general and local construction. Besides this, there are the regular urban minimum and energy charges. Construction is handled under the supervision of the utility that assumes title upon completion of the extensions.

John W. Brockman, Brookville, raised the question of how connection charges for additional customers should be handled once the line had been completed. Mr. Carter said this connection charge was determined by dividing the total cost of the general equipment by the number of customers, and if this charge was higher than the additional cost of the general equipment, the company would refund the difference to the consumers on that line, including the new users.

At the afternoon session D. M. Jones, Schenectady, N. Y., presented the economic side of poor power factor, explaining his subject by concrete examples. C. W. Johnson spoke on the value to central stations of increasing their load by the sale of refrigerators for private residences. By assuming an average residential yearly lighting bill of $19 against a 800-kw.-hr. consumption for a refrigerator which would give a return of $59, Mr. Johnson showed that the refrigerator load was a virgin field which would be an excellent revenue producer. H. E. Crane, Fort Wayne, however, cautioned against too much enthusiasm in selling these machines, thereby forgetting the necessary servicing. He estimated the average daily cost of his own refrigerator at 12 cents.

At the banquet on Thursday evening W. H. Morton, Sanborn Electric Company, Indianapolis, and C. C. Perry, president Indianapolis Light & Heat Company, spoke.

## Will Consider Illuminating Engineering Nomenclature

Thirteen men, consisting of six representatives of producers, three representatives of consumers and four representatives of general interests, constitute the personnel of the sectional committee on illuminating engineering nomenclature and photometric standards, one of the projects officially before the American Engineering Standards Committee. The Illuminating Engineering Society has been named sponsor for this project. The men who constitute this committee, and the organizations which they represent, follow:

American Gas Association, W. J. Serrill; American Institute of Electrical Engineers, A. E. Kennelly; Bureau of Standards, A. S. McAllister; Illuminating Engineering Society, Howard Lyon and G. H. Stickney; National Committee of International Commission on Illumination, Louis Bell; National Committee of International Electrotechnical Commission, C. O. Mailloux; National Council of Lighting Fixture Manufacturers, E. C. McKinnie; National Electric Light Association, C. H. Sharp; Optical Society of America, E. C. Crittenden; American Physical Society, E. P. Hyde; individuals, G. A. Hoadley and M. Luckiesh.

## Electrochemists Discuss Many Furnace Applications

The forty-third meeting of the American Electrochemical Society, held at New York on May 3, 4 and 5, was attended by 250 members and guests. The technical papers of the first day included symposiums on electrode potentials and electrodeposition. On Friday, among other subjects, "Heat-Insulating Material for Electrically Heated Apparatus" was discussed by J. C. Woodson, "Methods of Handling Materials in the Electric Furnace and the Best Type of Furnace to Use" by Frank W. Brooke, "Relation Between Current, Voltage and the Length of the Carbon Arcs" by A. E. R. Westman, and "Electric Furnace Detinning" by C. E. Williams, C. E. Sims and C. A. Newhall. Saturday was given over to papers on the production and application of the rarer metals.

J. W. Hinckley of the National Carbon Company was elected president of the society for the ensuing term. E. G. Acheson was elected an honorary member.

## Electric Truck Promotion

### Interested Bodies Unite for a Co-operative Program with Many Ramifications

NO LESS than twelve associations, groups of associations or groups of individuals are united in the "electric truck business development program" recently formulated in conference by representatives of these associations and to be put into effect through the Joint Committee for Business Development. These twelve bodies include, in addition to the committee just named, the Electric Motor Truck and Car Bureau, the Commercial Section and the geographic divisions and state associations of the National Electric Light Association; the Associated Manufacturers of Electrical Supplies, the Society for Electrical Development, the Electric Truck Association of New York, local electrical leagues and three groups of manufacturers directly concerned, namely, makers of electric trucks, of industrial trucks and of storage batteries.

The aims of the program are (1) to inform and interest the electrical industry generally regarding the possibilities and advantages of electric truck business; (2) to interest central-station companies generally regarding the possibilities and advantages to them in cultivating an electric truck load, and (3) to provide for the industry practical advertising and sales helps and concrete suggestions for developing electric truck business.

#### Work to Be Done

The work of those in charge of this program is to cover the obtaining of data needed by the society in connection with the compilation of literature, editorial assistance in the preparation of articles to be released to the electrical trade press, the appointment of an advisory committee to aid participating organizations, preparing and maintaining a mailing list, gathering and distributing statistics, preparing for not less than 500 daily newspapers articles on the advantage of electric trucking, preparing articles both for popular magazines and for the electrical trade press, forming local committees, supplying selling suggestions and advertising copy, preparing material for lectures to the industry and to the public, arranging for the mention of electric trucks at meetings within the industry, preparing material for broadcasting by radio, preparing suitable printed matter for use within the industry and for distribution to consumers, and promoting classes for electric truck salesmen as detailed in the ELECTRICAL WORLD for May 5, page 1057.

Charles R. Skinner, Jr., manager of the automobile bureau of the New York Edison Company, has been made chairman of the advisory committee, of which other members are O. R. Hogue, chairman Commercial Section, N. E. L. A., and W. L. Goodwin, representing the Society for Electrical Development.

## Joint Committee for Business Development at Work

At a recent meeting of the executive committee of the Joint Committee for Business Develoment W. E. Clement, commercial agent of the New Orleans Public Service, Inc., was elected a member, thus giving representation to the South and Southwest and making a direct point of contact with the sectional joint committee which has been formed in the Southwestern Geographic Division of the National Electric Light Association, of which Mr. Clement is general chairman.

It was announced at the meeting that there are now 641 accepted correspondents of the joint committee in various parts of the country, and that there is a total of 1,341 with whom correspondence is being carried on with a view to having them serve. The hearty support of the committee was pledged to the "Better Homes in America" movement.

A co-operative program is being worked out with the American Bakers' Association which will assume definite proportions at an early date, and it was announced that satisfactory progress had been made in the adoption of a minimum iring standard. A report concerning this will probably be made within sixty days.

An extensive campaign dealing with the electric range was outlined by Oliver R. Hogue, chairman of the Commercial National Section, N. E. L. A. Charles R. Skinner, Jr., reported progress upon contemplated electric vehicle activity. A. K. Baylor reported that he was at work on a consumer booklet to be known as "Better Outlets for the Home." The booklet being prepared by the electric heating and melting department, Chairman C. K. Nichols reported, will soon be ready for final approval. C. E. Greenwood, chairman of the domestic and industrial appliances department, stated that the monograph his department had prepared on the vacuum cleaner had been completed and was ready for distribution. He announced that his department contemplated publishing a booklet on electric refrigeration at an early date. The chairman of the electric lighting department, P. B. Zimmerman, reported that a very complete monograph on domestic lighting had been issued and was ready for distribution.

A comprehensive program of booklets covering various fields was reported by William L. Goodwin of the Society for Electrical Development as ready. Louis D. Gibbs, chairman of the publicity advisory council, announced that the council is working to secure representation from all the associations affiliated with the joint committee.

## Conference Takes up Problems of Apparatus Users

A conference of men interested in the use or the manufacture of scientific instruments and apparatus was held recently at the headquarters of the National Research Council in Washington. It was attended by members of government scientific bureaus, scientific societies, universities, the Association of Scientific Apparatus Makers and individual firms. Dr. Burgess, director of the Bureau of Standards, presided. It was resolved that a committee of apparatus makers and users should be formed under the Research Extension Division of the council. This committee is to consist of one representative from each of eleven technical societies and organizations, including the American Institute of Electrical Engineers; two representatives from the Bureau of Standards and the National Research Council and six repr -entatives from the Association of Scientific Apparatus Manufacturers, with members-at-large to be appointed by this committee.

The principal discussions at the conference ranged around apparatus supply, standardization of apparatus, information service and inspection service.

## New Electrical Safety Rules for Indiana

The State Fire Marshal of Indiana, Newman T. Miller, has, in the interest of safety, promulgated the following rules for all new electrical installations or alterations:

1. Service entrance wires, from point of contact with the building up to and including the switch, meter connections and main cut-out fuses, must be completely inclosed within steel.

2. Continuous rigid metallic conduit must be used from point of contact with the building to and terminating within the service entrance switch and affixed rigidly thereto.

3. Service entrance switches must be of the externally operated safety inclosed type and provide means for sealing the inclosure containing the main cut-out switch and fuses.

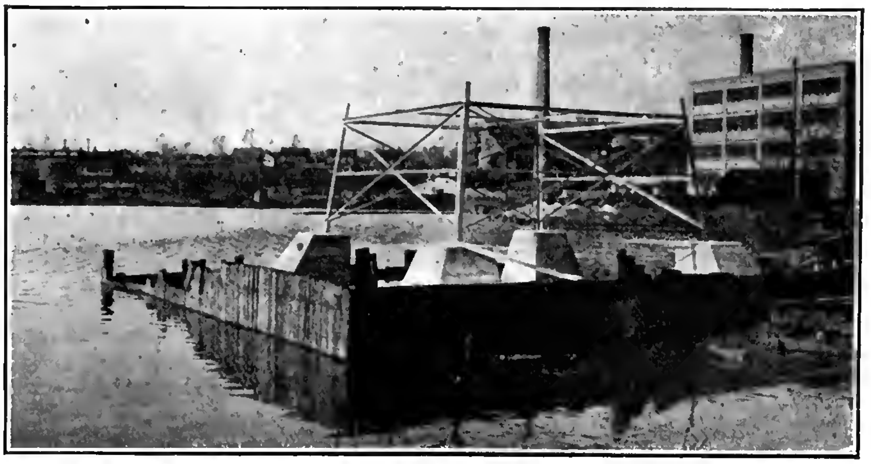
Switches must also provide means for entirely inclosing the meter connection wires within steel.

## Union Electric Light & Power Seeks to Expand

The Union Electric Light & Power Company of St. Louis has asked the Public Service Commission of Missouri for approval of its purchase of three properties which will give the company a string of electric utilities extending from St. Charles, Mo., on the north through southeastern Missouri to the northern boundary of Arkansas.

One group of properties which the company desires to purchase includes the St. Louis Light & Development Company, valued at $1,695,105; the Cape Girardeau & Jackson Interurban Railway, valued at $379,530; the St. Charles Electric Light & Power Company, valued at $106,591, and the Iron County Electric Light & Power Company, valued at $17,355. The second application asks permission to take over the Western Power & Light Company of St. Louis County, valued at $277,911, and the third application is for authority to purchase the lighting plants of the Missouri Public Utility Company at Bonne Terre, Cape Girardeau, Calfee, Charleston, East Prairie, Webb City, Sikeston and other smaller towns in southeastern Missouri.

## Building a Transmission Tower in a Lake



IN EXTENDING its new 110,000-volt line to Pittsfield, Mass., the Turners Falls Power Company was forced to build the abutments for one tower 50 ft. out from the shore of a small lake in the city limits, owing to the existence of a municipal ordinance making provision for a roadway along the shore of the lake to be built at some uncertain future date. It was at first planned to build a solid concrete pyramidal base, but so much difficulty was experienced in building and pumping out the necessary cofferdam that it became necessary to build individual piers for each leg of the tower. These are, however, tied together with arches of reinforced concrete. They extend 45 ft. down under water to bedrock. The work was done under trying winter conditions, and this one tower cost the power company nearly $35,000, or as much as forty similar towers constructed across open country.

## Brief News Notes

**Utica Rates Going Down.**—Officials of the Utica Gas & Electric Company have announced a reduction in rates for electricity used for lighting and power. The new schedule will represent a cut in cost to the consumer of about 10 per cent. The company says the new schedules will be operative by Oct. 1.

**San Diego Consolidated's Good Year.**—The San Diego Consolidated Gas & Electric Company reports that its electric operating revenue for the year 1922 was $2,169,025 and its electric operating expenses $1,541,470, giving a net operating electric revenue of $627,555. The company declared dividends of $528,843 during the year, leaving an accumulated surplus of $50,866.

**Eldora, Iowa, Is Connected with Transmission Line.** — A transmission line from the lines of the Iowa Falls Electric Company and the Iowa Railway & Light Company now furnishes service to Eldora, Iowa. The Iowa River Light & Power Company at Eldora has built this transmission line to Cleves and is receiving energy from the plants at Cedar Rapids, Iowa Falls and Marshalltown.

**Oxford, Ohio, Resolves to Keep Municipal Plant.** — Acquirement of new equipment for the municipal light and power plant at Oxford, Ohio, on a "lease-purchase" basis, was authorized by the City Council recently, after a proposal by the Ohio Gas & Electric Company to supply energy to the city on a wholesale basis on a ten-year contract had been rejected.

**Southern Indiana Gas & Electric Report.**—The Southern Indiana Gas & Electric Company of Evansville, which operates electric, gas, steam-heat, street-railway and interurban railway plants, had a combined net income for 1922 of $206,863, or $10,964.91 more than for 1921. The net income is the amount left after paying operating expenses, including taxes and depreciation, and after paying interest on debt. The company's surplus was $429,735.

**Municipal Ownership Wins in Red Wing, Minn.**—By large majorities the entire ticket favoring the construction of a municipal electric light and power plant has been elected in Red Wing, Minn., over the candidates advocating the purchase of energy from the Wisconsin-Minnesota Light & Power Company. The victory of municipal ownership comes after a bitter fight lasting over a period of many years.

**Southern Sierras Power Company's Report.**—The Southern Sierras Power Company, operating in Riverside, Hemet, San Bernadino and vicinity, reports to the California Railroad Commission for the year 1922 that its operating revenue was $2,010,744 and its operating expenses $814,075, giving a net operating revenue of $1,196,669. The net corporate income for the year was $79,053 and surplus $137,501.

**Oskaloosa Loses Permit.**—Failure to do the preliminary work required by the Federal Power Commission has resulted in the revocation of the preliminary permit granted the city of Oskaloosa, Iowa. The city had a plan for developing power on the Des Moines River.

**Geneva, Ill., Gives up Municipal Plant.**—The municipal generating plant of Geneva, Ill., has come to an end, and the city is henceforth to be served from the lines of the Chicago, Aurora & Elgin Railroad through its subsidiary, the Chicago Suburban Power & Light Company. The new rates will be lower than the cost of manufacture by the city, which will continue to distribute the electricity after transforming it from 30,000 volts to 2,300 volts.

**Study of California Rivers to Be Made.**—A study of the American River and of the proposed diversion of the Trinity into the Sacramento River is to be made by a board to be composed of a representative each of the War Department, of the Interior Department and of the Department of Agriculture. The study is to determine the best scheme of developing the power, irrigation, flood-control and navigation features of these rivers.

**Central Illinois Buys Athens Plant.**—The Central Illinois Public Service Company has purchased the Athens (Ill.) electric light plant and is now serving 195 communities with electric light and power. Business of the company is increasing rapidly. The average daily output of the Muddy power station has reached 220,000 kw.-hr., largely the result of the company's new contract with the Old Ben Coal Corporation, which it is serving with electrical energy for the operation of its coal mines.

**Lena (Ill.) Plant Serves Eighteen Communities.**—The Wisconsin Utilities Company of Monroe, Wis., a subsidiary of the United Utilities Company, Lena, Ill., announces the purchase of the plant and outside equipment of the Orangeville Electric Light & Power Company and its plan to supply that city with electricity. The Wisconsin Utilities Company has also signed an agreement with Clarno to furnish electricity there, making eighteen communities which will receive light and power from the Lena plant.

**California Oregon Power Company Busy.**—Three major construction jobs for the California Oregon Construction Company are under way. Work is progressing on the 20-mile extension of the 66,000-volt transmission system in Klamath County to the town of Chiloquin. This line will be completed in May. A suction dredge is being built to operate on Upper Klamath Lake in connection with the lake regulation project of the company. This will be ready for service this month. The transmission line from Fall Creek to Yreka, which was built in 1903, will be rebuilt and relocated.

**New Orleans Plant Must Have More Water.**—So much water has been used by the electric power plant of the New Orleans Public Service, Inc., at the foot of Market Street, since the installation of the new 20,000-kw. turbine-generator that it has been found necessary to augment the supply by building a new reinforced-concrete intake tunnel, 8 ft. x 10 ft., at a cost of about $500,000. Work will be started when the Mississippi River reaches a lower level. More water is consumed by the electric power plant than by the rest of the city combined, the power house requiring when operating at full capacity 11,570,000 gal. an hour.

**Missouri Pacific Abandons Steam Plant for Central-Station Service.**—The Missouri Pacific Railway Company has recently arranged to purchase electric service from the Union Electric Light & Power Company of St. Louis for the operation of all electric equipment at its shops in Dupo, Ill. The St. Louis company will deliver this service to the railroad company yards just south of St. Louis in the form of three-phase, 60-cycle, 13,200-volt energy, the Missouri Pacific Railway having installed a submarine cable across the Mississippi and constructed a 3-mile transmission line to Dupo and a 300-kva. substation. This contract means the abandonment of a steam plant which has been in operation at the Dupo shops for a number of years.

**San Francisco Holds Radio and Electrical Exposition.**—The National Radio and Electrical Exposition held in the Civic Auditorium, San Francisco, during the week of April 2 proved so successful that it has been decided to make it an annual event. It is estimated that twenty-five thousand persons visited the show during the six days it was in progress. The exposition was held primarily to demonstrate the progress that has been made in the art of radio communication, but electrical interests that had other displays capitalized on the public's interest in radio by showing the latest devices and appliances. Among the unique exhibits was a large illuminated map showing the power plants and the transmission system of the Pacific Gas & Electric Company.

**Government Engineers Continue Study of Snake River.**—The study of the power resources of Snake River begun in 1920 by an examination of the river between Huntington, Ore., and Lewiston, Idaho, by engineers of the United States Geological Survey was continued in 1921 by a similar examination of the river in southern Idaho, between Milner and Weiser, and manuscript copies of the report for that year are open for public inspection at the office of the Geological Survey in Washington and at the office of the district engineer at Boise. The report gives a history of the present development of power in southern Idaho and contains maps and descriptions of nineteen sites at which 250,000 hp. more could probably be developed even during times of low-water flow. It sets forth the amount of water available for power development and the schemes by which

the fullest use may be made of the water.

**Consummating Indiana Consolidation.**—The Wabash Valley Electric Company has petitioned the Indiana Public Service Commission for authority to buy the Putnam Electric Company, Cayuga Electric Company, Martinsville Gas & Electric Company, Spencer Light, Power & Water Company, Gosport Electric Company, Morgan County Light & Power Company and Roachdale Electric Company and to issue $1,561,700 of new securities to finance the deal. The petition says the properties are worth at least $2,073,000, against which there will be $1,811,700 in securities. The Central Indiana Power Company, which owns all the common stock of the Indiana Electric Corporation, owns the Wabash, Putnam and Cayuga companies, all of which were concerned in the hard-fought Indiana Electric Corporation case of 1921-1922. The whole system is to be provided with energy, in part at least, from the power plant which the Brewer interests are building near Terre Haute.

# Associations and Societies

**H. A. Lewis to Speak to New England Merchandising Bureau.**—H. A. Lewis of *Electrical Merchandising*, New York, is scheduled to address the Merchandising Bureau of the New England Division, N. E. L. A., upon "Compensation for Merchandising Salesmen," at the Congress Square Hotel, Portland, Me., at 1 p.m. Wednesday, May 16.

**American Welding Society's New President.**—In the ELECTRICAL WORLD'S report, on page 1053 last week, of the New York meeting of the American Welding Society it was erroneously stated that the president-elect, T. F. Barton, was "of the General Electric Company." Mr. Barton is master mechanic of the Delaware, Lackawanna & Western Railroad.

**Wenatchee Starts Electric Club.**—Power company representatives and electrical men of Wenatchee, Wash., met at an informal dinner recently for the purpose of organizing a local electric club. Ray U. Muffley, manager of the Washington Coast Utilities, was elected temporary chairman. The following officers were elected: President, Lewis Shreve; vice-president, V. R. Wright; secretary, W. A. Buttles; treasurer, H. L. Clark.

**Kansas Metermen Organize.**—At the close of the first annual meter school held by the department of electrical engineering of the Kansas State College at Manhattan, Kan., which was attended by fifty men, a permanent organization of Kansas metermen was effected. J. E. Brown of the Kansas Electric Power Company was elected president, and F. H. Pumphrey of Wichita and A. C. Krachy of Ellsworth committeemen.

**Power Development to Be a Topic at A. S. M. E. Convention.**—At the spring meeting of the American Society of Mechanical Engineers, to be held at Montreal on May 28-31, Julian C. Smith will discuss "Power Development in the Province of Quebec," Frederick A. Gaby "Development of Hydro-Electric Power Plants in Ontario," and H. G. Acres "Modern Hydraulic Turbines of Large Capacity."

**Empire State Gas and Electric Association.**—At the meeting of the electric section of this association on Thursday and Friday next week there will be reports from the following committee chairmen: Street lighting, K. V. Farmer, Syracuse; boiler-room operation, A. C. Jordon, Elmira; hydraulic power, H. G. Davis, Watertown; transmission lines, E. P. Peck, Utica; overhead distribution, H. W. Watt, Mount Vernon, and underground systems, R. A. Paine, Jr., Brooklyn.

**North Central, N. E. L. A., Convention Postponed.**—The convention of the North Central Geographic Division, N. E. L. A., originally scheduled to be held at the Curtis Hotel, Minneapolis, on June 13-15, will instead be held at the Radisson Hotel, in that city, on June 20-22. This postponement, the officers announce, has been necessitated by the mistake of the Curtis Hotel management in booking the convention for a week previously assigned by it to another gathering.

**May Section Meetings of A. I. E. E.**—Section meetings of the American Institute of Electrical Engineers still to be held this month are announced as follows: Baltimore, May 18, "Lighting of Factories and Office Buildings," Earl A. Anderson; Boston, May 15, annual entertainment; Cleveland, May 24, address by President Jewett; Erie, May 14, "Science of Musical Sounds," Dayton C. Miller; Philadelphia, May 14, C. J. Russell; Seattle, May 16, "Long-Distance Telephone Toll Cable;" Worcester, May 17, address by President Jewett.

**American Engineers Honor French Colleagues.**—A joint meeting of the four major engineering societies of America with the American Section of the Société des Ingénieurs Civils de France was held in New York on May 4, in honor of the seventy-fifth anniversary of the founding of the French society. Harrington Emerson, president of the American Section; Gaston Liebert, director of the French Bureau of Information; C. O. Mailloux, the president of the International Electrotechnical Commission; William Barclay Parsons, Arthur S. Dwight and Henri Vigneron spoke.

**Gerard Swope Addresses St. Louis Electrical Board.**—Gerard Swope, president of the General Electric Company, addressed the St. Louis Electrical Board of Trade on the subject of "The Future of the Electrical Industry" at its regular weekly luncheon at the Statler Hotel on May 1. Louis H. Egan, president of the Union Electric Light & Power Company, was chairman. Mr. Swope said that only about 30 per cent of the nation's industrial plants are operating with electric service. He also saw a great opportunity for steam railroad electrification, pointing to the strides that Italy has made along this line.

**Change of Meeting Place for Lighting Fixture Manufacturers.**—The place for holding the midsummer convention of the National Council Lighting Fixture Manufacturers has been changed from Hot Springs, Va., to Buffalo. The date, June 26-28, remains unchanged. On the first day there will be a design program under the direction of E. T. Caldwell, and the following questions will be taken up: (1) "Which is the more important, designing or merchandising?" (2) "Should the lighting-fixture industry follow period design as the furniture industry has done?" (3) "Are the designers asleep?" On the second day a publicity program will cover: (1) Value of a national publicity campaign to a trade association; (2) possible development of dealer contact in a publicity campaign; (3) merchandising possibilities for the individual manufacturer in an association publicity campaign. The last day will be given over to a business meeting.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Empire State Gas and Electric Association, Electric Section—Utica, N. Y., May 17-18. C. H. B. Chapin, Grand Central Terminal, New York.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 20-22. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Institute of Electrical Engineers—Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Iowa Section, N. E. L. A. — Mason City, June 26-29.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28.

# Recent Court Decisions

**Where Evidence Is Equally Consistent with Existence or Non-Existence of Negligence Jury Is Not Competent.**—In a suit brought by one Martin against the Louisville Gas & Electric Company the plaintiff claimed damages for injuries caused by a fall from a ladder lawfully placed by defendant to take the place of cellar stairs temporarily removed to facilitate the laying of conduit. The evidence was held by the Court of Appeals of Kentucky to be equally consistent with the theory of the ladder having slipped or the plaintiff herself having done so, and therefore the trial judge was held to have done right in withdrawing the case from the jury and finding for the defendant, in the absence of testimony to establish its negligence. (248 S. W. 868.)*

**Federal Court Possesses No Jurisdiction in Suit to Enjoin Forfeiture of Franchise Rights by Judicial Process.**—In dissolving an injunction granted to the St. Johns (Fla.) Electric Company against the city of St. Augustine, the United States Circuit Court of Appeals held that where an electric light and railway company was informed by the city that if it failed to comply with a resolution requiring it to make certain repairs the city would take steps to forfeit its right to use the streets in connection with its electric light business, as well as its railway business, and where it is the city's intention to do this by judicial proceeding, a suit to enjoin such proceedings involves no question under the United States Constitution giving jurisdiction to a federal court, even though there is not sufficient ground for forfeiture. (286 Fed. 474.)

**Public Must Have Opportunity for Hearing Before Commission Fixes Rates.**—Asserting, in Jones vs. Montpelier & Barre Light & Power Company, that the authority of the Public Service Commission of Vermont to make orders affecting rates depends on due notice to the parties interested, the Vermont Supreme Court has declared that where a public service corporation filed with the commission schedules showing rates for electricity which were in force and also a schedule of rates to become effective later, and where this additional schedule was protested and ordered discontinued, and no appeal was taken or request for a rehearing made within the statutory period, the company's motion for rehearing in which it requested the commission to fix a rate effective as of the date petitioned for in place of the one requested can be treated only as a petition to pass on a schedule not previously filed with the commission or made known to the public. (120 At. 103.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

**Erroneous Instruction on Insulation of Broken Wire.**—A steam-shovel operator who broke a transmission wire with the boom of his shovel got down from the machine, picked up one end of the wire and was instantly killed. In reversing for the second time a judgment for damages (Hollis vs. Kansas City Light & Power Company) the Kansas City Court of Appeals found the instructions given to the jury to have been in error because they disregarded how or why the wire fell and stated a case of liability beginning with the wire on the ground and its state of insulation after it had fallen regardless of whether the action that caused it to fall was also the cause of the defective insulation. Although negligence and contributory negligence were questions for the jury, the petition was not based on the company's action in maintaining an electric wire close to a coal yard where it was likely to be broken regardless of its insulation, but on the alleged long-continued maintenance of the wire without sufficient insulation, and instructions to the jury should have been in accordance with this fact. The case was therefore remanded for a third trial. (248 S. W. 634.)

**Deduction of Depreciation Fund from Rate Base Held to Have Been Error.**—The action of the New York Public Service Commission in deducting a depreciation fund from the rate base of a natural-gas utility was held to be error in People ex rel. Pennsylvania Gas Company vs. Commission. The State Supreme Court said: "The commission seems to have determined that all sums of money collected from consumers for depletion of capital and carried to depreciation account, less such sums as might be traceable into free investments, whether used for replacement or enhancement of capital, constituted a fund which, whatever its converted form, could not be included in reckoning the capital constituting a proper rate base. That this cannot be true is shown by a simple illustration. Assume that the relator were presently embarking in the natural-gas business; that it owned ten wells each having its own acreage of gas fields; that each well with its fields was fairly worth $10,000; that consumers would so deplete its gas supply that in ten years the ten wells and fields would be exhausted. It is plain that in such case the consumers should annually pay, in addition to a suitable charge for service, the value of one gas well and field, or the sum of $10,000. If the consumers paid such a charge for ten years, then the relator might each year buy a new gas well with new field, or at the end of ten years buy itself ten new wells with gas fields, and thus place itself, not in a better, but in the exact position occupied by it when it began business. Clearly in such case the relator should be allowed a continuance of its charges for gas based on the full value of its capital without deductions. If sums annually collected from consumers for depletion of capital and actually used for such replacement must be deducted from capital invested to determine a rate base, then it is not apparent why such collections are ever permitted. If the commission intended merely to determine that sums of money collected for depletion which added to capital should be deducted, then the commission was likewise in error when it made the deduction in question. This is true for the reason that there is no proof that the sum was collected from consumers for depletion and used to increase capital rather than to replace it." (198 N. Y. S. 193.)

# Commission Rulings

**Power Company Not Compelled to Incur Large Expense to Avoid Possibility of Inductive Interference.**—In passing on an application from the Blue River Power Company for permission to construct a transmission line in certain territory, the Nebraska State Railway Commission refused to compel it to incur a substantial cost in order to avoid one mile of additional parallel with metallicized telephone circuits. The route that appeared to afford the fewest natural obstacles and parallels to telephone lines was selected, and the commission said that where the telephone circuits were metallicized, as all the important ones in this territory were, the inductive interference from power lines operating under normal conditions at ordinary voltages would not materially affect communication over the telephone wires.

**Michigan Commission on Financing of Utilities.**—In refusing to the Sault Ste. Marie Gas & Electric Company authorization for additional stock issues and modifying an order relating to refunding bonds, the Michigan Public Utilities Commission made these pronouncements: A deficit resulting from the failure of a public utility to earn a 7 per cent return upon the rate base is no foundation upon which to base the issuance of common capital stock; a public utility should not be permitted to issue stock based on reorganization expenditures made seven years ago and prior to commission regulation; a public utility company should not be permitted to issue stock based on rate-case expenditures not charged to operating expenses, since these expenditures are properly amortized over a period of years; a public utility cannot and should not sell any preferred stock for less than par under the laws of Michigan. No commission, it was further decreed, should be paid for the sale of preferred stock of a public utility company when it appears that one individual is the owner of virtually all of the capital securities and that the issue of stock, together with other matters affecting capitalization passed on by the commission, amounts to a reorganization of the corporation.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## J. D. Andrew Vice-President of Stevens & Wood, Inc.

James D. Andrew has returned to the public utility engineering and construction fields by accepting the post of vice-president and district manager of Stevens & Wood, Inc., with offices at New York and Youngstown, Ohio. Mr. Andrew's headquarters will be at Youngstown, and one of his first activities will be charge of the construction of the 200,000-kw. superpower plant to be erected by his firm on the Ohio River. In returning to the public utility field, Mr. Andrew resigned as president of the American Balsa Company, a subsidiary of the American International Corporation, with which organization he became connected in war times, when, in 1917, he left his position as superintendent of station engineering for the Edison Illuminating Company of Boston to take a prominent part in the building of the great Hog Island plant.

Mr. Andrew was born in 1874 and was graduated from the Columbia School of Mines in 1897. He spent three years in erecting and testing engines for the E. P. Allis Company, Milwaukee, and the next three years as mechanical engineer of the Metropolitan Street Railway, New York. He then joined the New York Edison Company as chief engineer. Tempted by commercial activities, he next became general manager of the Virginia & Alberine Soapstone Company in charge of production and manufacture. The public utilities claimed him again when the Boston Elevated Railway made him superintendent of power, which position he relinquished to ally himself with the Edison Illuminating Company of Boston.

During 1916, however, he received leave of absence to go to South America for the Chili Copper Company to build and inaugurate a 40,000-kw. power plant.

**Frank L. Ostler** has been appointed secretary of the Public Utilities Commission of Utah, to succeed T. E. Banning, who resigned last February. Mr. Ostler has had considerable experience in rate work.

**R. E. Thompson** recently resigned as manager of the Deming (N. M.) Ice & Electric Company to become power superintendent for the Springfield (Mo.) Gas & Electric Company.

**H. S. Bastian**, assistant engineer of the Portland (Ore.) Railway, Light & Power Company, has resigned to take charge of the new district office of Charles C. Moore & Company. For a year before allying himself with the Portland Railway, Light & Power Company Mr. Bastian was engaged in private practice, chiefly mechanical and power-plant work. Previously he was associated with the Southern Pacific Company at San Francisco and also with the Oregon-Washington Railroad in Portland.

## W. H. Burke Goes to Iowa

Walter H. Burke, who has been transferred to Keokuk, Iowa, as manager of the railway, lighting, power and gas properties of the Keokuk Electric Company, as was announced in the April 21 issue of the ELECTRICAL WORLD, has been in the Boston office of Stone & Webster for some years and has in recent months been in charge of matters pertaining to the Southwestern group of properties under this management. Mr. Burke was graduated from the University of Maine in 1906. After serving for a time with the General Electric Company, he held various operating positions in the utility field, including that of assistant general superintendent of light and power for the Milwaukee Railway & Light Company and that of assistant to the manager of the railway, lighting and power property at Dallas, Tex. He has been a frequent contributor to the technical press, particularly on the economic phases of the public utility business. He assumed his new duties May 1.

W. H. BURKE

**M. C. Rypinski**, vice-president and general sales manager of C. Brandes, Inc., New York City, has started on a trip abroad. He will make his first stop in England, at the firm's London plant, to determine the advisability of its further expansion in order to keep up with the increasing demand for radio apparatus. He will then go to Paris and afterward into Germany. Mr. Rypinski will remain in Europe for a somewhat indefinite period.

**Rudolph P. Miller** of New York has been reappointed representative of the Federated American Engineering Societies on the National Board for Jurisdictional Awards.

**J. I. Searles**, who has been connected with the Menominee & Marinette Light & Traction Company since 1922, when he left the Wisconsin Railway, Light & Power Company at Winona, Minn., has severed his connection with the former company to ally himself with the Lake Superior District Power Company at Ironwood, Mich.

**Herbert L. Fisher** is now doing appraisal work with Stone & Webster, Boston. Mr. Fisher was formerly resident engineer with the Goodyear Tire & Rubber Company; then he joined the St. Croix Paper Company as assistant engineer of hydraulic construction, and later he was with the J. McCormick Construction Company, Philadelphia.

**William R. Bullard** has severed his connection with the United Electric Light & Power Company of New York, after seven years of service, to ally himself with the Electric Bond & Share Company, New York City, as assistant engineer in connection with the design and development of underground distribution systems.

**W. P. Strandborg** of the Portland (Ore.) Railway, Light & Power Company, president of the Public Utilities Section of the Associated Advertising Clubs of the World, has been appointed a member of the general reception committee to receive representative advertising and business men of the British Empire who will arrive in the United States the latter part of May for a tour of the Eastern and Middle Western sections of the country. The delegation will be composed of publishers, advertising specialists and representatives of large British industrial concerns. The party will attend the annual convention of the Associated Advertising Clubs of the World at Atlantic City early in June.

**William H. Crawford**, manager of the department of industries of the Portland (Ore.) Chamber of Commerce, has resigned to become affiliated with the California-Oregon Power Company. He has been appointed to organize a new service in the company, to be called the "new industries department," which will have for its purpose the encouragement of commercial development in the districts of southern Oregon and northern California served by the lines of the company. Before going to the Pacific Coast in 1902 Mr. Crawford spent two years in the Orient with Frazar & Company, importers, and several years on the Atlantic Coast selling railway appliances. Subsequently he was with Charles C. Moore & Company, engineers of San Francisco, for thirteen years, and he has also been associated with the Simmen Automatic Railway Signal Company of New York.

**H. W. Burmeister** has been made manager of the Flambeau Public Service Company's office at Phillips, Wis.

**R. H. McLain** recently resigned from the Maine Electric Company, Portland, Me., as sales manager and is now connected with the General Electric Company at its New York office.

**David Ross**, formerly connected with the Hydro-Electric Power Commission of Ontario, is now associated with the Electric Bond & Share Company, New York.

**John W. Carpenter**, vice-president and general manager of the Texas Power & Light Company of Dallas, has been made chairman of the public utilities committee of the Texas Chamber of Commerce.

**E. B. Powell**, consulting engineer, of Stone & Webster, Inc., Boston, has returned from France much improved in health. While abroad Mr. Powell was confined to the American Hospital at Neuilly for three months.

**W. F. Chadwick**, formerly assistant superintendent of gas and electric plants for the Connecticut Power Company, New London, Conn., has been transferred to the mechanical engineering division of Stone & Webster, Inc., at Boston.

**Fred Brown**, manager of the Mountain States Power Company in Eugene, Ore., for the last five years, has resigned. He has purchased an interest in the Buffelon Lumber Comnany and will have charge of the auditing and accounting for the firm.

**F. P. Nightingale**, who was formerly connected with the General Electric Company and who has just returned from a three years' stay in China in the interest of that company, is now connected with the Los Angeles office of the Pacific States Electric Company in the sales department.

**W. R. Marshall** has been made branch manager of the Buffalo sales office of the Westinghouse Electric & Manufacturing Company. Mr. Marshall has been a division manager connected with the New York office. C. W. Underwood, who was Buffalo branch manager, has been made Northern representative.

**Graeme Ross** has been appointed manager of the Kansas City branch office of the Westinghouse Electric & Manufacturing Company to succeed F. F. Rossman, who has resigned to accept the position of vice-president of the Mobile (Ala.) Light & Railway Company.

**Allen B. Coffman** has resigned as sales engineer for the Crouse-Hinds Company to become manager of the Philadelphia district of the Reliance Electric & Engineering Company, Cleveland, manufacturer of electric motors. In the past three years, while connected with the Crouse-Hinds Company, Mr. Coffman has made a study of different types of electrical installations in various industries from Pennsylvania to Florida. He will continue to make his headquarters in Philadelphia.

## C. J. Snyder Goes to Duluth

Carl J. Snyder has resigned as chief engineer of the Nebraska Power Company at Omaha to become manager of the commercial service department of the Duluth Edison Electric Company. Mr. Snyder was graduated in electrical engineering from the Iowa State College at Ames in 1909 and has been associated with the Nebraska Power Company in construction, operation and engineering work since that date. Under his direction the duties of the engineering department have been expanded to include phases of utility operation not usually handled by that department. This work includes the issuing of all plans, estimates and orders for all construction resulting from customers' applications for service and also all property accounting records. Mr. Snyder has taken an active part in the work of several of the technical committees of the National Electric Light Association and at present is vice-chairman of the Middle West Division Technical Section.

C. J. Snyder

**E. S. Fitz**, formerly general superintendent of the Houghton County Electric Light Company, Houghton, Mich., is now engineer in the power-station betterment division of Stone & Webster, Inc., Boston.

**Otto E. Huebner**, who had been associated with the New York & Queens Electric Light & Power Company for three and a half years, has resigned to manage the Exide Battery Service station in Flushing, L. I.

**A. L. Schieher**, formerly manager of the generator section of the power department of the Westinghouse Electric & Manufacturing Company, has been appointed to the recently created position of export representative of that department. Mr. Schieber is well fitted for the position, since in connection with his former duties he had considerable contact with foreign work. He will be succeeded as manager of the generator section by Willard Lofton, who for some time has been in active charge of the work of that section under Mr. Schieber's direction.

**O. H. Eschholz**, design and development engineer for the Westinghouse Electric & Manufacturing Company since 1910, has been appointed general manager of the Pittsburgh Chemical Company. Of late years Mr. Eschholz has devoted much time to research and the investigation of vapor arcs, electron emission, rectification, arc welding, precipitation, arc-rupture phenomena and breaker construction. He has also to his credit special achievement in the development of direct-current interpole generators, welding apparatus and processes and electrostatic precipitation apparatus and processes and has contributed widely to the electrical press.

**E. A. Hawkins**, vice-president and general manager of the Webster Electric Company, Racine, Wis., since 1919, has resigned his position and on May 1 assumed the duties of manager of the telephone and appliance departments in the general sales department of the Western Electric Company at its headquarters in New York City. Mr. Hawkins was with the Western Electric Company for nineteen years before going to Racine. He will direct the manufacture and sale of appliances manufactured by other concerns for the Western Electric Company and before going to New York will visit a number of factories in the Middle West which are under contract with the Western Electric Company. His successor at Racine has not been named.

# Obituary

**John Gilbert Ward**, treasurer of the Babcock & Wilcox Company, died in New York City on Sunday, April 22.

**Randolph Troy**, manager of transformer specialty sales of the merchandise department of the General Electric Company, died of pneumonia in the House of Mercy Hospital, Pittsfield, Mass., April 26, after an illness of three days. Mr. Troy had been associated with the General Electric Company since 1906, and when the merchandise department was organized last year he was assigned to the position he occupied at the time of his death.

**Donald Strode Barton**, formerly general manager of the Canadian Electric Light Company, Levis, and consulting engineer of the Quebec Railway, Light, Heat & Power Company, is dead. Mr. Barton was born in India and was educated in England. He went to Canada in 1900. He settled in Montreal and practiced his profession there for five years, when he accepted an appointment as general manager of the Canadian Electric Light Company and at the same time became consulting engineer of the Quebec Railway. When the Levis company was absorbed by the Quebec Railway he remained with the company in the capacity of consulting engineer.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Metric System in Electrical Industry

**Although Manufacturers Would Share Inconvenience of Change, They Would Share Also in Benefits—Present Conflict with Other Countries Over Measurements**


By Burt L. Newkirk

Research Laboratory, General Electric Company, Schenectady, N. Y.


The electrical industry now uses metric units for electrical quantities, but the dimensions of the motors, generators, turbines and other apparatus necessary to the production, control or utilization of electrical energy are designed and manufactured to inch and foot dimensions. The metric system of weights and measures is the fundamental standard in the United States. The law of 1866 legalized the use of the metric units and established a table of equivalents between metric and American measures of length, capacity, area and weight. In 1893 "the Superintendent of Weights and Measures, with the approval of the Secretary of the Treasury, decided that the international meter and kilogram would in the future be regarded as the fundamental standards of length and mass in the United States, both for metric and customary weights and measures." When the Bureau of Standards was established in July, 1901, this decision, made in 1893 by the Bureau of Weights and Measures, was accepted. Thus by law and by action of the Government bureaus the metric weights and measures have legal standing and authority as the fundamental units.

### Background of Metric System

These standards are made with great care, of materials that, to the best of our knowledge, will not change. They are so fortified by the existence of other copies of the international meter and kilogram, distributed throughout the world, that irreparable loss of the standards is not to be feared. The International Bureau of Weights and Measures is maintained by seventeen countries for the care and preservation of these standards and the periodic intercomparison of the same. I think no informed person would claim that any other standards compare with those of the metric system in satisfying the requirements of a fundamental standard.

The metric system was devised and adopted in France during the French Revolution, when radical reforms were the order of the day. It was adopted in Germany at the time of achievement of national unity and in Italy under similar circumstances. The countries of South America adopted the metric system in the early stages of their national development. Japan has recently taken similar action, and it is reported that Russia and the new nations which were formerly part of Russia have done likewise.

In the United States the avoirdupois pound and the inch are pretty well intrenched in industry and in the life of the people. These are defined by federal law and so are standard throughout the land. There is also practical agreement with the British Empire on these units. The measures of capacity—that is, gallons—are not identical, the British Imperial gallon being 20 per cent larger than the United States gallon of 231 cu.in. Much pressure is being brought to bear on both sides of the water in favor of a change to the metric system, but so far without entire success. The reasons are not far to seek. The chaos in the old standards that impelled the French, Germans and Italians to change does not exist here or in Britain, and our pound, foot and gallon are deeply rooted in our industrial and civil life.

### Alarm Is Unjustified

The alarm with which some manufacturers view the prospect of changing to the metric system seems unjustified. A few firms in this country are now doing their manufacturing essentially on a metric basis. Many firms are serving their export trade with goods made to metric dimensions. There is probably some embarrassment in getting stock, tools, etc., to metric dimensions, but if this entailed much loss of money it is not likely that these firms would continue their allegiance to the system.

The change can be made in the drafting room without delay or serious inconvenience. The fundamental gages are re-etched, but the product is not changed in any dimension; consequently the production gages are not changed. New designs are laid out to metric dimensions and the draftsmen, tool makers and shop foreman must know how to read blueprints and to measure lengths in millimeters, but even this is not required of the operator of a production machine. Either metric or American drills, taps, dies, etc., may be used. Gages become obsolete and tools wear out and these can be replaced to keep pace with any gradual process of change to a new system. That any considerable proportion of the machine tools now in operation in this country would be scrapped in changing to a metric basis does not seem to me to be at all probable.

### Ultimate Yield to System

If our manufacturers were persuaded of the desirability of changing, they would do it easily and without serious loss to themselves. In fact, many of them are now manufacturing to metric dimensions for the export trade, and no one has claimed, I think, that these metric goods cost much, if any, more to produce than the standard product. Various circumstances other than the demands of export trade are working to introduce the metric system into American industry. Among these may be mentioned the influence of science upon industry, the operation of international affiliations and the prospect of world standardization in particular manufacturing specialties.

In spite of the intrenchment of the

inch, pound and gallon in industry and in the common life of a very aggressive race, they must ultimately yield to the metric system. The latter is universally accepted and used in science; the electrical units are metric; new industries, as, for example, the manufacture of ball bearings, are building up on the metric basis, and apparently an overwhelming majority of the world's population is getting into line on the metric side. In Great Britain and the United States merchants, boards of trade, statesmen, educators and business men appreciate the advantages of the metric system and favor its adoption. The opposition centers about the difficulty of changing such fundamental things as screw-thread spacings and other dimensions that have become standard. In my opinion, however, the adoption of the metric system does not involve necessarily changing screw-thread spacings or shapes, wire gages, sheet-metal gages, etc.

We should undoubtedly continue to designate nails as sixpenny, tenpenny, etc., because at one time some nails sold six for a penny and others ten for a penny. In a similar way a metric world may accept our Brown & Sharpe wire gage or our United States standard screw threads, or it may choose to standardize wire sizes and screw threads devised on a basis of metric dimensions. But metricists, in my opinion, are under no obligation to convince the public that these things, deeply rooted in American industry, ought to be changed as part of a metric program. Their burden is to show that the metric system should be made the dominant one and to outline a program adequate to accomplish this with the minimum inconvenience and expense to the country. The extent to which present manufacturing practice should be modified to adjust itself most economically to the metric basis would then be worked out in detail with much care and study of each step, but future developments would build up naturally on the new basis. New industrial projects would reap the advantage of an interrelated set of units common throughout the world.

# The Insecurity of "High-Price" Business*

**Country's Progress Stops When Business Is Gained Too Easily—High Prices at Home Create Indifference Toward Exports**

By Edward N. Hurley
Chairman of the Board,
Hurley Washing Machine Company

What incentive or necessity do men have to decrease costs and increase their efficiency if their margin of profits is abnormally high? There is danger in war profits, danger in after-war profits, danger in the feeling that there is no competitor in the world worth fearing. Men say, "What is the use of trying to increase our profits by economy when we can get the prices we ask?"

The pioneers in American industry won their success by fighting hard for business. It was a sporting proposition and the best man won in obtaining the order. If, by a combination of circumstances, this American fighting spirit is to be allayed and we obtain business easily and at high prices, it is only a question of time before business executives become inefficient, and inefficient management produces inefficient workmen. This would seriously affect the progress of our country.

### Danger in Overconfidence

Sometimes I think we are too cocksure of our efficiency and think we know it all. Most of us have really been lucky instead of efficient, and we must not think that large profits are always an indication of efficiency.

Germany had the feeling in 1914 that she was 100 per cent efficient in all things, but the many lessons she learned during and since the war may be a great blessing to her future economic development. Our country, swinging into a constantly developing period of improvement in most of our principal industries, and with some very sharp lessons of our own gained during the post-war period, most certainly should not let slip her golden opportunity to build an enduring and all-inclusive prosperity.

Foreign trade also requires some of the old American clipper-ship fighting spirit, and the exporters and their salesmen who are blazing the trail, selling American goods in the markets of the world, should be on our country's roll of honor, particularly when they not only have the difficulty of obtaining business for export, but in addition have the hard task of keeping American manufacturers sufficiently interested to fill export orders.

### Lesson of Price Boycott

American orders at home are being obtained without very much effort and in many cases at high prices. These high prices on domestic orders frequently create indifference toward foreign trade, seriously affecting our merchant marine and our country at a period when we need exports to balance our increasing imports.

The American housewives bought and hoarded sugar in 1919, resulting in a great scarcity and causing abnormally high prices. Manufacturers and merchants did the same in 1920 in hoarding materials, thus creating a shortage and causing untold losses of millions to them and to the country. This lesson must not be forgotten, and the fact that prices are higher should not encourage us to borrow money to again selfishly hoard surplus materials.

I believe in the ability and the integrity of the American business man, but I do not think he is putting forth that effort to reduce the cost of manufacturing and selling his wares that he is capable of doing. What might be termed post-war necessity is now ignored by most of us. The war produced high prices and abnormal profits from the effect of which we have not recovered.

### Cost Reduction Vital

A reduction in costs of manufacturing and the employment of every inch of floor space in every factory were never so much needed. Some concerns, through a combination of circumstances, have been able to make profits without doing this. They must, however, soon fall into line. Industrial building should be kept at a minimum. Let the employees do the building, so that they may have their own homes—another feature of real prosperity.

War and war profits retarded the progress and natural development of our country. There must be a readjustment. While many of us urge

*An address given before the second general session of the Tenth National Foreign Trade Convention, New Orleans, May 3, 1923.

the readjustment of labor as a remedy, management must also be readjusted to meet new conditions. Labor can become more efficient—so can management. Unless we improve our methods so as to increase our profits by lowering our costs of manufacturing and selling and adding to our list of customers foreign purchasers, we are not working on a sound basis. Now is emphatically the time to avoid the errors of 1920, to keep a sane attitude toward industry, to be satisfied with a production schedule that fairly meets the demand but falls short of overproduction—and to increase profits not by increasing prices, but by reducing costs of the business we are already enjoying.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Chicago Business Generally Is Very Active

THE electrical trade again reports very good business for the past week. Several advances in price were also announced. Motors have advanced approximately 4 to 6 per cent. One company changed some of its slip-ring types from a 50-deg. to a 40-deg. rating. Control apparatus advanced ten per cent and a general revision of list prices was announced. In some cases these lists were reduced or equalized, while in others they were advanced. The same was true of motors. Western red-cedar poles advanced 10 to 18 per cent, while the condition of stocks has not changed at this time.

Building permits exceeded those issued last year by about thirty permits, while the amount of money involved exceeded that of last year by approximately a million dollars. Conduit stocks are still low.

## Prices of Lamps Are Now Below Pre-War Level

IN VIEW of the fact that incandescent lamps are the most frequent points of contact electrical stores have with their customers, and, particularly, since every user of electricity is a buyer of lamps, it is interesting to review here the trend of prices of incandescent lamps during the past few years.

Because of improvements in manufacturing methods, in spite of the rising costs of material and labor, increases in lamp prices during the wartime period were small compared with those that took place with other commodities. In the face of generally increasing prices in commodities at the present time, it is interesting to note that these recent changes bring the prices of lamps below the pre-war level on both vacuum and gas-filled types, and in the case of the gas-filled lamp these prices are the lowest in the history of the industry.

The reduction just made is the third since April 1, 1922, when there was a readjustment in which "Mazda C" lamps were reduced about 5 per cent and "Mazda B" lamps on an average 12½ per cent. On Oct. 1, 1922, a reduction was made in the prices of "Mazda C" lamps which averaged about 20 per cent.

| Size of Lamp (Watts) | Jan. 1, 1922 | April 1, 1922 | Oct. 1, 1922 | May 1, 1923 |
|---|---|---|---|---|
| | | "Mazda B" | | |
| 10-50 | $0.40 | $0 35 | $0 35 | $0.32 |
| 60 | 0.45 | 0.40 | 0 40 | 0 37 |
| | | "Mazda C" | | |
| 50 | .60 | 55 | 55 | .50 |
| 75 | .70 | .70 | .60 | .55 |
| 100 | 1.00 | .95 | .75 | .70 |
| 150 | 1.40 | 1 30 | 1 00 | 90 |
| 200 | 1.90 | 1 80 | 1 30 | 1.15 |
| 300 | 2.80 | 2.50 | 1.90 | 1.75 |
| 500 | 4 15 | 3.75 | 2 75 | 2 50 |
| 750 | 5.75 | 5.25 | 4 00 | 3.75 |
| 1,000 | 6.70 | 6.00 | 4 50 | 4 25 |

The accompanying table shows Mazda lamp prices at important points during the last few years.

## Business in New England Continues at Full Tide

BUSINESS continues at full tide, the pressure for wage inflation being the most active disturbing factor for the time being. The expansion of central-station plants continues to astonish investors, and the demand for service is reflected in the success of widespread house-wiring campaigns and increasing purchases of electrical material by industrial and mercantile establishments. Last week's falling prices of securities and the weakening tendency of some raw materials has caused slowing down of commitments to far-reaching projects, but on the whole the New England States are sharing in the great production volume common to other sections of the country.

Retail business is improving with better weather, but in northern New England trade has been much upset temporarily by floods now fast subsiding. An epochal announcement in generating-plant plans was made at Boston last week in connection with the proposed use of 1,200 lb. steam pressure at the Weymouth station of the Edison Electric Illuminating Company, and it is noteworthy that this same pressure is being considered for some other contemplated plant construction in Massachusetts.

The effect of such announcements upon the sale of plant engineering equipment is not easily measured as regards future marketing of boilers and accessory machinery, but this and new high-tension line and switch-house construction proposed or under way in Massachusetts have a trade reaction of considerable interest.

Building contracts in New England for the week ended May 1 were the largest for this week in twenty-three years, a total of $8,942,900. Jobbers of electrical material report some improvement in transportation conditions and also some shortening of deliveries. Lamp prices were reduced from list about 8 per cent last week, and cotton, copper, rubber, steel and lead display weakness on current quotations. Stocks of Boston jobbers were well-rounded Monday, buying being well sustained.

## Appliance Sales Respond to Improved Merchandising Methods

REPORTS of appliance sales from week to week indicate increasing interest on the part of the public in labor-saving devices for the home, the larger equipment being in unusually active demand. In some quarters sales of washers, cleaners and refrigerating apparatus during the last few weeks have picked up rapidly. One Eastern central-station company sold 100 washers during April, and in the same territory the demand for cleaners revived to a gross well above the preceding month.

Portable lamps are moving faster than is normal for this season. Stocks of fans are being laid in against the anticipated early summer demand. Popular appreciation of moderate-priced devices like waffle irons, toasters and small disk heaters is encouraging, and one central-station exhausted its stock of the former soon after the beginning of a special campaign which offered nine-dollar units on the basis of $1 down and easy time payments. The relation between appliance sales

## Comparative Priees of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.034 | $0.0322 | $0.0236 |
| Cold finished shafting, per lb. | 0.042 | 0.0406 | 0.032 |
| Brass rods, per lb. | 0.1913 | 0.1913 | 0.15 |
| Solder (half and half), per lb. | 0.2987 | 0.314 | 0.21 |
| Cotton waste, per lb. | 0.1231 | 0.1231 | 0.104 |
| Washers, cast iron (½-in.), per 100 lb. | 4.66 | 4.50 | 4.00 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.11 |
| Machine oil, per gal. | 0.349 | 0.349 | 0.40 |
| Belting, leather, medium, off list | 42% | 42% | 48¾% |
| Machine bolts, up to 1-in. x 30-in., off list | 44¼% | 48¾% | 62½% |

and prices is interesting managers of retail departments keenly at this time. The opinion was expressed to a representative of the ELECTRICAL WORLD recently that if manufacturers of appliances can build business on the basis of increased sales volume and a moderate profit per unit marketed, the public will "stay with" the industry as a continuous and expanding purchaser.

The point was made that appliance prices have in many cases been reduced materially during the past two or three years; that the public has responded to these reductions, and that the utmost effort to develop quantity business and to absorb cost increases if possible in expanding gross sales will prove the best policy. Some significance attaches to the fact that the upward pressure of costs has thus far been widely resisted by manufacturers. The outlook continues excellent for appliance sales throughout an immense range of types, designs and prices.

## Better Advertising Must Be Used to Get Foreign Trade

IN A COMPREHENSIVE survey of advertising for the electrical export field, G. Grenville Hunter of the International General Electric Company, Inc., told the tenth national foreign trade convention at New Orleans that there is no specter to intimidate or deter American traders from securing their share of profits from overseas markets, provided the right kind of publicity is used.

"You must remember," said Mr. Hunter, "that in foreign advertising you must take dealer representation as you find it—some of it good, most of it bad. You must direct your advertising toward making these dealers better merchants of your particular product through the medium of your advertising, which plays a definite part in making people want what your dealers sell; then selling them what they want in a way that will make them want more. Any advertising material which you send out will be of little value unless it is made of value by the dealers who use it. It will be of greatest value when these dealers are taught how to use it, and this is the first fundamental step in moving your goods from the dealer's shelf into the customer's hands.

"'Americanism' must be avoided at all costs because, while it is true that merchandising development in the United States has reached a stage in advance of many countries, nevertheless in using our experience as a cri-

## Exports of Wiring Devices, Meters, Motors, Rheostats, Fans, Motor-D

| | | Sockets, Outlets and Receptacles | | Other Wiring Supplies and Fixtures | | Watt-Hour and Other Measuring Meters | | Volt, Watt and Ampere Meters and Other Recording, Indicating and Testing Apparatus | | Motors Under 1 Hp. | | Stationary Motors 1 to 200 Hp. | | Stationary Motors Over 200 Hp. | | Ra Mo | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | Dollars | Pounds | Dollars | No. | Dollars | No. | Dollars | No. | Dollars | No. | Dollars | No. | Dollars | No. | D |
| 1 | Azores | 150 | 40 | ..... | ..... | ..... | ..... | 1 | 149 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | |
| 2 | Belgium | 80,935 | 15,303 | 7,803 | 7,705 | 203 | 4,741 | 2,185 | 10,895 | 127 | 2,159 | 285 | 30,727 | 64 | 31,599 | ..... | |
| 3 | France | 5,576 | 1,948 | 21,472 | 16,792 | 58 | 1,180 | 409 | 8,510 | 1,801 | 11,173 | 137 | 27,725 | 2 | 7,127 | ..... | |
| 4 | Denmark | 6,300 | 935 | 2,629 | 1,402 | 32 | 724 | 229 | 5,703 | 3 | 377 | ..... | ..... | ..... | ..... | ..... | |
| 5 | Greece | ..... | ..... | 267 | 252 | ..... | ..... | 2 | 142 | 4 | 329 | 17 | 1,185 | ..... | ..... | ..... | |
| 6 | Iceland & Faroe Islands | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 5 | 108 | ..... | ..... | ..... | ..... | ..... | |
| 7 | Netherlands | 8,343 | 3,032 | 5,450 | 2,679 | 51 | 1,273 | 437 | 7,617 | 1,088 | 19,639 | 74 | 1,934 | ..... | ..... | ..... | |
| 8 | Norway | 3,330 | 1,561 | 24,318 | 7,125 | 11 | 1,124 | 153 | 3,759 | 89 | 2,172 | 4 | 1,120 | ..... | ..... | ..... | |
| 9 | Spain | 82,871 | 10,014 | 9,402 | 5,077 | 1,145 | 9,267 | 175 | 7,758 | 1,134 | 30,333 | 344 | 57,941 | ..... | ..... | 6 | |
| 10 | Sweden | 536 | 620 | 672 | 1,489 | 102 | 463 | 95 | 2,878 | 18 | 1,291 | 22 | 1,440 | 1 | 620 | ..... | |
| 11 | Switzerland | 4,000 | 1,135 | 2,288 | 1,587 | ..... | ..... | 53 | 5,970 | 92 | 1,182 | 24 | 336 | ..... | ..... | ..... | |
| 12 | England | 45,746 | 10,674 | 101,261 | 96,193 | 999 | 22,124 | 9,496 | 63,835 | 2,489 | 55,473 | 1,179 | 76,990 | 2 | 3,600 | 10 | 1 |
| 13 | Scotland | 1,750 | 700 | 24 | 21 | 4 | 325 | 4 | 810 | 14,815 | 162,620 | 998 | 20,737 | ..... | ..... | ..... | |
| | Canada: | | | | | | | | | | | | | | | | |
| 14 | Maritime Provinces | 3,381 | 3,358 | 28,084 | 13,070 | 28 | 682 | 149 | 3,634 | 58 | 1,684 | 72 | 9,014 | 1 | 600 | 1 | |
| 15 | Quebec and Ontario | 335,096 | 90,416 | 1,116,660 | 448,235 | 9,710 | 58,518 | 29,920 | 105,157 | 14,909 | 223,122 | 4,346 | 392,588 | 20 | 6,700 | 46 | 7 |
| 16 | Prairie Provinces | 24,837 | 5,149 | 50,078 | 25,666 | 222 | 1,947 | 564 | 6,856 | 428 | 9,983 | 298 | 31,222 | ..... | ..... | ..... | |
| 17 | British Columbia and Yukon | 19,189 | 3,107 | 40,776 | 19,473 | 22 | 1,570 | 105 | 1,749 | 205 | 5,790 | 175 | 37,291 | 4 | 8,480 | ..... | |
| 18 | British Honduras | 1,382 | 451 | 7,235 | 1,788 | 152 | 1,729 | 28 | 61 | 5 | 313 | 18 | 3,072 | ..... | ..... | ..... | |
| 19 | Costa Rica | 3,532 | 1,038 | 2,139 | 884 | ..... | ..... | 4 | 254 | 41 | 1,166 | 2 | 661 | 1 | 1,400 | ..... | |
| 20 | Guatamela | 2,406 | 734 | 3,804 | 3,051 | 427 | 102 | 49 | 582 | 10 | 286 | 16 | 1,642 | ..... | ..... | ..... | |
| 21 | Honduras | 8,618 | 2,221 | 30,561 | 7,589 | 189 | 2,266 | 37 | 551 | 19 | 514 | 34 | 4,622 | ..... | ..... | ..... | |
| 22 | Nicaragua | 1,416 | 238 | 8,207 | 2,142 | 2 | 45 | 32 | 435 | ..... | ..... | 7 | 4,548 | ..... | ..... | ..... | |
| 23 | Panama | 10,699 | 2,225 | 16,324 | 10,450 | 2,017 | 18,673 | 247 | 1,402 | 34 | 1,140 | 24 | 3,043 | ..... | ..... | ..... | |
| 24 | Salvador | 3,939 | 1,194 | 2,764 | 1,564 | ..... | ..... | 30 | 807 | 45 | 832 | 20 | 1,811 | ..... | ..... | ..... | |
| 25 | Mexico | 239,921 | 33,608 | 188,604 | 90,530 | 11,375 | 92,696 | 2,224 | 35,968 | 884 | 20,775 | 1,087 | 138,165 | 39 | 24,943 | 39 | |
| 26 | Newfoundland & Labrador | 1,594 | 418 | 26,915 | 4,672 | 219 | 1,338 | 396 | 4,714 | 34 | 1,031 | 21 | 5,132 | ..... | ..... | ..... | |
| 27 | Bermuda | 175 | 40 | 27,560 | 12,075 | 63 | 4,416 | 37 | 2,800 | 32 | 1,272 | 4 | 202 | ..... | ..... | ..... | |
| 28 | Jamaica | 2,710 | 679 | 2,585 | 945 | 431 | 4,359 | 36 | 975 | 1 | 44 | 20 | 4,893 | ..... | ..... | ..... | |
| 29 | Trinidad and Tobago | 3,258 | 733 | 12,904 | 4,753 | 175 | 1,857 | 362 | 5,684 | 29 | 723 | 10 | 867 | 2 | 1,190 | ..... | |
| 30 | Other British West Indies | 4,484 | 519 | 27,608 | 15,751 | 27 | 670 | 110 | 1,227 | 33 | 1,991 | 52 | 16,877 | 2 | 1,190 | ..... | |
| 31 | Cuba | 107,173 | 19,554 | 193,796 | 77,249 | 5,241 | 51,701 | 1,156 | 16,984 | 470 | 14,994 | 311 | 95,999 | 12 | 13,826 | ..... | |
| 32 | Dominican Republic | 1,976 | 272 | 7,949 | 6,653 | 1,865 | 112 | 55 | 1,865 | 1 | 28 | 7 | 938 | ..... | ..... | 6 | |
| 33 | Dutch West Indies | 443 | 109 | 4,237 | 2,044 | ..... | ..... | 1 | 25 | 1 | 8 | ..... | ..... | ..... | ..... | ..... | |
| 34 | French West Indies | ..... | ..... | 28 | 31 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | |
| 35 | Haiti | 1,605 | 403 | 17,056 | 4,141 | 114 | 1,080 | 8 | 425 | 3 | 208 | 6 | 521 | ..... | ..... | ..... | |
| 36 | Argentina | 373,018 | 83,722 | 57,690 | 40,927 | 1,494 | 13,356 | 1,019 | 12,284 | 617 | 19,267 | 345 | 43,332 | 3 | 1,864 | ..... | |
| 37 | Brazil | 320,475 | 60,433 | 215,472 | 72,393 | 6,944 | 52,121 | 1,215 | 23,984 | 399 | 7,510 | 203 | 65,725 | 22 | 64,396 | 62 | 4 |
| 38 | Colombia | 31,600 | 6,600 | 24,508 | 9,717 | 191 | 2,668 | 327 | 2,566 | 73 | 2,332 | 129 | 21,992 | 3 | 2,450 | ..... | |
| 39 | Ecuador | 13,677 | 1,548 | 16,742 | 2,702 | 129 | 977 | 5 | 124 | 8 | 311 | 12 | 2,914 | 1 | 680 | ..... | |
| 40 | Bolivia | 1,000 | 300 | 2,308 | 1,247 | 7 | 290 | 37 | 2,361 | 2 | 38 | 16 | 11,331 | ..... | ..... | ..... | |
| 41 | Chile | 12,927 | 4,170 | 77,269 | 14,879 | 31 | 1,283 | 192 | 5,735 | 35 | 1,315 | 521 | 65,234 | 6 | 19,571 | 7 | |
| 42 | Peru | 13,298 | 3,780 | 12,904 | 7,555 | 75 | 1,724 | 55 | 1,592 | 107 | 2,806 | 65 | 16,036 | 4 | 29,001 | ..... | |
| 43 | Venezuela | 28,354 | 5,133 | 19,002 | 7,831 | 27 | 570 | 216 | 1,449 | 29 | 1,323 | 249 | 10,303 | ..... | ..... | ..... | |
| 44 | Hongkong | 750 | 220 | 6,579 | 2,452 | 3,216 | 22,680 | 722 | 4,934 | 5 | 280 | 109 | 10,242 | ..... | ..... | ..... | |
| 45 | Japan | 43,489 | 16,371 | 216,199 | 73,657 | 2,055 | 55,246 | 10,655 | 371,366 | 3,046 | 69,796 | 1,646 | 288,618 | 147 | 228,308 | 36 | 27 |
| 46 | British India | 3,939 | 1,419 | 45,087 | 12,649 | 294 | 4,833 | 1,196 | 7,484 | 240 | 7,003 | 221 | 39,754 | 54 | 80,964 | ..... | |
| 47 | China | 158,358 | 10,803 | 91,268 | 50,553 | 6,600 | 48,072 | 1,190 | 22,322 | 289 | 10,508 | 627 | 123,866 | 3 | 2,587 | ..... | |
| 48 | Philippine Islands | 40,488 | 12,503 | 32,880 | 22,344 | 1,923 | 18,186 | 917 | 16,010 | 58 | 2,247 | 278 | 43,164 | 4 | 20,449 | ..... | |
| 49 | Siam | 550 | 245 | 1,341 | 805 | ..... | ..... | 14 | 305 | 18 | 1,256 | 12 | 932 | ..... | ..... | ..... | |
| 50 | British West Africa | 560 | 97 | ..... | ..... | 300 | 2,730 | 16 | 171 | ..... | ..... | 1 | 78 | ..... | ..... | ..... | |
| 51 | British South Africa | 8,706 | 2,923 | 14,315 | 6,330 | 127 | 2,079 | 390 | 7,396 | 53 | 2,294 | 248 | 49,590 | 18 | 12,798 | ..... | |
| 52 | Australia | 125,039 | 46,216 | 114,019 | 69,914 | 465 | 9,266 | 3,697 | 39,177 | 1,467 | 46,140 | 1,905 | 163,869 | 63 | 83,095 | ..... | |
| 53 | Dutch Guiana | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | |
| 54 | Turkey in Europe | ..... | ..... | 2,266 | 961 | ..... | ..... | ..... | ..... | ..... | ..... | 1 | 110 | ..... | ..... | ..... | |
| 55 | New Zealand | 21,468 | 9,128 | 31,552 | 15,412 | 4,289 | 29,209 | 707 | 8,995 | 408 | 10,117 | 332 | 29,914 | 38 | 15,823 | ..... | |
| 56 | Italy | 1,800 | 1,257 | 29,195 | 8,865 | 110 | 1,099 | 1,125 | 7,043 | 198 | 3,369 | 20 | 1,281 | ..... | ..... | ..... | |

terion we must be exceedingly careful to show ourselves friends rather than shining examples of Yankee efficiency."

Referring to the participation of American shippers in fairs and exhibits abroad, Mr. Hunter stressed the importance of sending the right type of representative. Much damage has been done—and is still being done—to our foreign trade by the "fresh" type of Yankee salesman, with whom the foreigner will have nothing to do.

## The Ruhr Occupation and the Electric Industry

OCCUPATION of the Ruhr has not as yet made itself felt in the German electrotechnical industry, says Dr. Carl Friedrich von Siemens, chairman of the board of the Siemens & Halske Aktien-Gesellschaft, in his annual report under date of March 22. Extracts from the report, translated by the Department of Commerce, are as follows:

"No reduction in unproductive expenses was possible. Instead there was an increase. Prospects of improvement are poor at this time. Drafts of new laws and regulations promise to place further obstacles in the path of orderly economic development. One soon will be able to speak of Germany as a wonderfully well-organized country theoretically but one in which practical life is extremely difficult.

"New orders are decreasing considerably, largely because of the appreciation of the mark and the hope of further price reductions. This is the counter-movement in speculation. Reduction of prices for electrotechnical products is not prevented by a desire to sell at prices which will cover the costs of materials purchased at higher prices than those which obtain today, but is made impossible by the prevailing high costs of material, by high wages and by greatly increased overhead expense. If we do not succeed in bringing down these expenses to their former level and in increasing production, and, further, if we are unable to pay satisfactory returns upon invested capital and to bring down prices to the world level at least, it will be impossible longer to maintain German industry."

## The Metal Market

Demand for copper during the past week has been very slow. Sellers and consumers seemed to be sparring and waiting for developments during the greater part of the period, but in the

## sehold Devices, etc., from the United States During 1922

(Original data supplied by the Bureau of Foreign and Domestic Commerce.)

| (N. E. S.) | Rheostats, Controllers and Other Starting and Controlling Equipment | | Accessories and Parts for Motors | | Electric Fans | | Motor-Driven Household Devices | | Domestic Heating and Furnaces, Cooking Devices and Ovens | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dollars | Pounds | Dollars | Pounds | Dollars | No. | Dollars | No. | Dollars | No. | Dollars | No. | Dollars | | |
| ........ | ........ | ........ | 20 | 35 | ........ | ........ | ........ | ........ | 12 | 45 | ...... | ...... | Azores | 1 |
| 5,348 | 48,233 | 7,111 | 32,966 | 15,567 | 83 | 1,447 | 1,327 | 31,798 | 11 | 298 | 3 | 578 | Belgium | 2 |
| 6,737 | 89,927 | 61,033 | 102,013 | 72,770 | 402 | 2,531 | 1,482 | 20,729 | 218 | 1,334 | 5 | 672 | France | 3 |
| 21,292 | 184 | 245 | 174 | 427 | ........ | ........ | 113 | 3,807 | 83 | 1,160 | ...... | ...... | Denmark | 4 |
| ........ | ........ | ........ | 39,710 | 13,320 | 2 | 87 | 1 | 78 | 50 | 325 | ...... | ...... | Greece | 5 |
| ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ...... | ...... | Iceland & Faroe Islands | 6 |
| ........ | 467 | 168 | 688 | 738 | ........ | ........ | 3,813 | 97,891 | 604 | 5,102 | 2 | 695 | Netherlands | 7 |
| 94 | 62 | 47 | 3,429 | 2,731 | ........ | ........ | 184 | 5,438 | 4,882 | 4,910 | 1 | 46 | Norway | 8 |
| 3,538 | 60,454 | 30,044 | 40,320 | 17,255 | 7,263 | 7,263 | 1,767 | 3,340 | 1,840 | 6,745 | 1 | 11,000 | Spain | 9 |
| 445 | 822 | 1,480 | 1,062 | 1,488 | 1,228 | 1,228 | 9 | 955 | ........ | ........ | ...... | ...... | Sweden | 10 |
| 50 | ........ | ........ | 263 | 245 | ........ | ........ | 862 | 22,154 | 482 | 434 | ...... | ...... | Switzerland | 11 |
| 11,368 | 68,562 | 32,334 | 90,882 | 61,592 | 54,871 | 54,871 | 4,064 | 100,953 | 20,455 | 66,414 | 38 | 36,832 | England | 12 |
| 11,003 | 13 | 25 | 6,515 | 12,270 | 18,494 | 18,494 | 348 | 2,352 | 942 | 3,455 | 1 | 107 | Scotland | 13 |
| | | | | | | | | | | | | | Canada: | |
| 443 | 8,751 | 6,465 | 6,713 | 3,727 | 536 | 536 | 158 | 3,981 | 411 | 1,982 | 1 | 25 | Maritime Provinces | 14 |
| 116,829 | 316,089 | 191,850 | 239,420 | 124,476 | 113,460 | 113,460 | 39,516 | 1,250,802 | 58,493 | 99,020 | 189 | 9,949 | Quebec and Ontario | 15 |
| 3,269 | 11,655 | 7,206 | 25,301 | 14,256 | 15,695 | 15,695 | 1,482 | 30,152 | 3,780 | 12,272 | 12 | 452 | Prairie Provinces | 16 |
| 989 | 6,855 | 3,828 | 14,332 | 8,812 | 161 | 2,220 | 1,017 | 18,276 | 3,353 | 7,776 | 10 | 5,703 | British Columbia and Yukon | 17 |
| 5,041 | 61 | 29 | 2,160 | 4,004 | 59 | 1,298 | 4 | 109 | 151 | 934 | ...... | ...... | British Honduras | 18 |
| 55 | 390 | 253 | 8,574 | 6,084 | 9 | 208 | 4 | 198 | 43 | 566 | 1 | 11 | Costa Rica | 19 |
| 192 | 182 | 97 | 970 | 900 | 8 | 125 | 1 | ........ | 736 | 1,799 | 1 | 412 | Guatemala | 20 |
| 6,502 | 636 | 831 | 4,750 | 6,814 | 88 | 2,129 | 8 | 451 | 285 | 2,364 | ...... | ...... | Honduras | 21 |
| ........ | 1,046 | 290 | 909 | 1,205 | ........ | ........ | 2 | 16 | 17 | 45 | 5 | 250 | Nicaragua | 22 |
| 305 | 3,892 | 1,370 | 2,755 | 2,266 | 61 | 1,094 | 377 | 276 | 1,087 | 5,642 | 1 | 55 | Panama | 23 |
| ........ | 632 | 359 | 272 | 242 | 68 | 694 | 33 | 413 | 94 | 879 | ...... | ...... | Salvador | 24 |
| 25,133 | 96,540 | 40,027 | 130,713 | 72,161 | 2,015 | 36,840 | 373 | 6,607 | 8,638 | 42,538 | 25 | 18,024 | Mexico | 25 |
| 62 | 148 | 80 | 4,242 | 3,420 | 4 | 65 | 8 | 255 | 49,026 | 2,244 | ...... | ...... | Newfoundland & Labrador | 26 |
| 45 | 215 | 115 | 558 | 156 | 47 | 1,463 | 10 | 567 | 99 | 819 | 1 | 28 | Bermuda | 27 |
| 1,374 | 5,157 | 2,145 | 9,815 | 2,300 | 39 | 823 | 6 | 79 | 15 | 170 | ...... | ...... | Jamaica | 28 |
| 85 | 336 | 226 | 15,267 | 5,350 | 43 | 524 | 3 | 66 | 147 | 573 | ...... | ...... | Trinidad and Tobago | 29 |
| 220 | 626 | 221 | 660 | 695 | 26 | 924 | 7 | 72 | 25 | 1,247 | ...... | ...... | Other British West Indies | 30 |
| 4,659 | 106,285 | 47,538 | 134,036 | 83,611 | 410 | 7,465 | 114 | 2,269 | 2,324 | 12,890 | 15 | 793 | Cuba | 31 |
| ........ | 674 | 463 | 7,640 | 8,050 | 14 | 380 | 4 | 500 | 5 | 19 | ...... | ...... | Dominican Republic | 32 |
| ........ | ........ | ........ | 153 | 122 | ........ | ........ | ........ | ........ | ........ | ........ | 636 | 330 | Dutch West Indies | 33 |
| ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ........ | 1 | 6 | ...... | ...... | French West Indies | 34 |
| ........ | 187 | 117 | ........ | ........ | 28 | 276 | 1 | 68 | 12 | 99 | 1 | 8 | Haiti | 35 |
| 13,707 | 4,357 | 2,286 | 26,990 | 15,001 | 1,848 | 34,408 | 776 | 4,662 | 7,806 | 862,974 | 8 | 915 | Argentina | 36 |
| 13,822 | 46,213 | 13,315 | 117,946 | 48,627 | 367 | ........ | 5,811 | 1,206 | 1,861 | 6,160 | 7,384 | 2,600 | Brazil | 37 |
| 751 | 2,840 | 1,574 | 29,540 | 14,900 | 395 | 8,622 | 25 | 708 | 432 | 2,170 | ...... | ...... | Colombia | 38 |
| ........ | 1,420 | 505 | 2,181 | 803 | 30 | 1,293 | ........ | ........ | 41 | 271 | ...... | ...... | Ecuador | 39 |
| 741 | 114 | 48 | 8,855 | 7,157 | ........ | ........ | ........ | ........ | 2 | 35 | 2 | 137 | Bolivia | 40 |
| 320 | 24,725 | 12,160 | 81,662 | 35,312 | 113 | 1,754 | 18 | 748 | 291 | 1,638 | 6 | 1,078 | Chile | 41 |
| 304 | 6,179 | 3,648 | 38,107 | 24,736 | 19 | 619 | 113 | 1,853 | 538 | 2,141 | 2 | 2,341 | Peru | 42 |
| 1,420 | 2,192 | 966 | 6,941 | 3,661 | 185 | 2,226 | 47 | 644 | 570 | 2,654 | ...... | ...... | Venezuela | 43 |
| 81 | 1,761 | 961 | 975 | 842 | 1,417 | 29,384 | 144 | 1,001 | 1,100 | 4,790 | ...... | ...... | Hongkong | 44 |
| 12,165 | 425,777 | 169,703 | 149,829 | 69,855 | 3,176 | 47,642 | 753 | 40,864 | 9,479 | 60,345 | 508 | 63,828 | Japan | 45 |
| 40,915 | 114,858 | 42,800 | 223,806 | 74,339 | 6,622 | 144,665 | 77,016 | 4,644 | 1,225 | 4,088 | 927 | 2,860 | British India | 46 |
| 7,092 | 13,095 | 4,637 | 45,994 | 19,737 | 5,516 | 108,565 | 7,223 | 4,692 | 6,263 | 10,360 | 2,090 | 32,118 | China | 47 |
| 641 | 4,724 | 4,266 | 16,661 | 8,966 | 407 | 12,061 | 148 | 820 | 3,365 | 13,442 | 5 | 508 | Philippine Islands | 48 |
| ........ | ........ | ........ | 3,101 | 1,989 | 587 | 11,436 | ........ | ........ | 15 | 216 | ...... | ...... | Siam | 49 |
| ........ | ........ | ........ | 80 | 20 | ........ | ........ | ........ | ........ | ........ | ........ | ...... | ...... | British West Africa | 50 |
| ........ | 29,724 | 11,369 | 37,358 | 17,856 | 496 | 4,184 | 58 | 1,919 | 5,341 | 23,174 | 25 | 435 | British South Africa | 51 |
| 35,741 | 82,575 | 28,541 | 210,864 | 106,105 | 2,979 | 47,851 | 2,208 | 30,690 | 10,490 | 44,312 | 8,326 | 50,014 | Australia | 52 |
| ........ | ........ | ........ | 1,123 | 1,088 | ........ | ........ | ........ | ........ | ........ | ........ | ...... | ...... | Dutch Guiana | 53 |
| ........ | ........ | ........ | 2,501 | 504 | ........ | ........ | ........ | ........ | ........ | ........ | ...... | ...... | Turkey in Europe | 54 |
| 11,370 | 6,723 | 2,747 | 17,548 | 9,358 | 136 | 3,004 | 314 | 6,608 | 6,420 | 28,517 | 15 | 2,025 | New Zealand | 55 |
| 59 | 30,341 | 11,616 | 2,564 | 1,810 | 1,709 | 16,490 | 746 | 21,529 | 218 | 1,704 | 4 | 336 | Italy | 56 |

NEW YORK METAL MARKET PRICES

| | May 2, 1923 Cents per Pound | May 9, 1923 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 16.75 to 17.00 | 11.50 to 16.62½ |
| Lead, Am. S. & R. price | 8.00 | 8.00 |
| Antimony | 8.00 to 8.25 | 8.00 to 8.25 |
| Nickel, ingot | 28.00–30.00 | 28.00 to 30.00 |
| Zinc, spot | 7.37½ | 7.37½ |
| Tin, Straits | 45.00 | 45.00 |
| Aluminum, 98 to 99 per cent | 26.00 | 26.00 |

end it was stated that inquiries were slightly better.

Reports were circulated that one of the first hands had been offering copper at 16.37½ cents per pound, but this was emphatically denied in well-informed trade quarters, and an investigation among the sellers does not confirm the rumor. As a matter of fact, the big interests held for 16.62½ cents per pound, which appeared to be the low point on copper delivered at the plants of the consumer.

One or two sales actually were made at 16.50 cents per pound, but these transactions were exceptional, because they did not involve any delivery charges to speak of and were practically f.o.b. New York, or the equivalent of at least 16.62½ cents per pound delivered at the consuming point on ordinary transactions.

Second hands and those handling resales of the metal continued to shade prices and give concessions under the quotations of the big interests, but this is to be expected in a market such as has been experienced in the past few weeks. It is possible that one of these offered the metal at 16.37½ cents during the week, but even this could not be confirmed.

That there is a big demand for copper to come into the market is the popular opinion among the best posted authorities. Few of the sellers have been willing to dispose of the metal beyond July delivery, and as a result of that attitude the consumers have but small supplies of the metal on hand for their future needs.

# Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Plainville to Assemble Trumbull-Vanderpoel Inclosed Switch Parts

The growth of the inclosed-switch business of the Trumbull-Vanderpoel Company, Bantam, Conn., has led to an agreement with the Plainville (Conn.) Electrical Products Company whereby the latter will assemble and market this portion of the Bantam company's output. The Trumbull-Vanderpoel Company will continue to manufacture inclosed knife switches, safety switches, meter switches and the Mason safety switch for line service.

## Twenty-two Makers and Agents at New York Cleaner Show

Twenty - two manufacturers and agents of vacuum cleaners have accepted the New York Edison Company's invitation to exhibit standard makes and different types in the Irving Place showroom May 14 to 19. Electric scrubbing and polishing machines will be shown.

## Calorizing Company Formed by General Electric Interests

The Calorizing Company has been incorporated under the laws of Delaware to take over the assets and business of the Calorizing Company of Pittsburgh, which has developed commercially a heat-treating process originated by the General Electric Company, by which aluminum is driven into the surface of metals, thereby greatly increasing their resistance to high temperatures and to certain corrosive reactions. The new company, with headquarters in Pittsburgh, has an authorized capital of 30,000 shares of 8 per cent cumulative convertible stock at $25 par value and 100,000 shares of common stock at no par value. The General Electric Company owns 25 per cent of the common stock.

## Walker Electric Vehicle Opens Atlanta Branch Office

The Walker Vehicle Company, Chicago, manufacturer of Walker balance-drive electric trucks for city routes, has opened a branch office in Atlanta. P. C. Pomeroy, who has had extensive experience in trucking matters while representing the White and Packard organizations, has been appointed district manager, with offices at 926 Hurt Building, Atlanta.

## Brisk Fan Business for the Emerson Electric Company

The Emerson Electric Company, St. Louis, reports large orders for fans from the South and Southwest. Building activities in Texas are responsible for a number of very large orders for future delivery. There is every indication that this will be a banner fan season, notwithstanding the fact that it has been a rather cool spring. Jobbers and retail dealers in all parts of the country have had their stocks depleted and are ordering for immediate delivery. It is interesting to note the unusual number of orders that have recently been received for 32-volt fans for use with farm-lighting outfits, which is a natural reflection of the present activity in farm-lighting plants.

## Denver and Butte Jobbers Hold Joint Sales Convention

The Capital Electric Company, Salt Lake City, Western distributor of General Electric products, and the Butte Electric Supply Company of Butte, Mont., held a joint sales convention on May 3 and 4. H. D. Randall of the General Electric Company delivered a lecture on the outlook for the rest of 1923.

Forty salesmen attended the convention. Encouraging reports were brought from various points of the intermountain territory. J. A. Kahn, president of the Capital Electric Company, was in charge of the convention.

## Westinghouse Receives $1,000,000 Order from West Penn Power

The West Penn Power Company has placed with the Westinghouse Electric & Manufacturing Company an order amounting to more than $1,000,000. The contract includes seven 12,000-kva., three 10,000-kva., ten 6,000-kva., three 2,000-kva. and three 1,000-kva transformers for 60-cycle, single-phase service; one 5,000-kva., 4,000-volt synchronous condenser for three-phase, 60-cycle operation; 133 oil circuit breakers and seventeen lightning arresters. Most of this apparatus duplicates existing equipment and is to be used for making extensions in the system of the company.

## Johns-Pratt Company Establishes Export Division in New York

The Johns-Pratt Company, Hartford, Conn., manufacturer of "Noark" fuses, meter-service and protective devices, has established an export division with office at 30 Church Street, New York City. E. Wilhelm Droosten and W. L. Urquhart, who have had extensive experience in handling export business of electrical manufacturers, will be in charge of this division.

The company also announces that arrangements have recently been made with the Curtin Mill Supply Company, Houston; Globe Supply & Machinery Company, New Orleans; Hide, Leather & Belting Company, Indianapolis; Hardy & Dischinger, Toledo; Rathbun Company, El Paso; Miller Supply Company, Huntington; Walworth-Ohio Company, Cleveland, and the Wayne Belting & Supply Company, Fort Wayne, as distributors for its power-plant specialties.

## Starbuck Sprague Forms New Supply Jobbing House

A new electrical supply jobbing house has been organized at Waterbury, Conn., under the name of the Sprague Electrical Supply Company, quarters having been secured at 39 Spring Street, in the heart of the wholesale district. The company is a Connecticut corporation with an authorized capital of $112,500, and the officers are: President, Starbuck

Sprague; secretary, Weston M. Jenks; treasurer, R. G. Stewart; sales manager, Harry A. Squires.

The company has leased a three-story building with more than 4,000 sq.ft. on the main floor and over 2,000 sq.ft. on each of the two upper floors. The organization is launched to do a wholesale business without retail or contracting connections, and it will open with three men on the road, covering the Naugatuck Valley of Connecticut from Winsted to Ansonia and Derby, and from Danbury on the west to Southington and Cheshire on the east.

The company has been appointed distributor for Bryant, Johns-Pratt, Tubular Woven Fabric, Bryant-Marsh, Trumbull-Vanderpoel, Central Tube, Steel City, Federal Armored Cable and other products.

Mr. Sprague is widely known in New England electrical circles. He was graduated from Harvard College in 1907 and after two years in the electrical construction field spent seven years in the supply department of the General Electric Company and seven years as director and sales manager for the New England Engineering Company of Waterbury. Mr. Squires was graduated from Pratt Institute, Brooklyn, in 1916, and after two years with the Public Service Company of Northern Illinois spent five years with the New England Engineering Company.

## Northwestern Electric Equipment Now Is Distributor Only

The Northwestern Electric Equipment Company, 174 East Sixth Street, St. Paul, Minn., will in the future confine its commercial efforts to the wholesale distribution of electrical, radio and telephone supplies, appliances and apparatus, including motors, switchboards, panels and cabinets.

J. M. Whalen and A. S. Abbott, with other former employees of the Northwestern firm, have purchased the company's interest in the Commonwealth Electric Company, the company's former manufacturing and repair departments, and will operate under the name of the Commonwealth Electric Company at 417 Broadway, St. Paul.

The retail department of the former Commonwealth Electric Company has been sold to E. S. Talmadge and C. J. Otterholm, who will continue that business under the name of the Commonwealth Appliance Company at 373 Robert Street.

## Tungsten Light Manufacturer Buys Springfield Plant

The M. & W. Company, manufacturers of tungsten electric light bulbs, has bought a factory building from the Knox Motors Company, in Springfield, Mass., to which it will remove soon from its Taylor Street location. In place of paying four different rents in its present quarters, the concern will have a larger but more compact establishment comprising about 80,000 sq.ft. on four floors, enabling it to organize its business to good advantage and also expand to meet increased demands.

The new location is directly alongside the tracks of the New York, New Haven & Hartford's Highland division. The M. & W. Company is a licensee of the General Electric Company, and its production quota has of late been increased in a decided degree. C. F. Munder is president and treasurer of the company.

## Electric Storage Battery to Sell Stock to Employees

The Electric Storage Battery Company, Philadelphia, announces that it has recently made arrangements by which employees may purchase shares of common stock. The plan enables employees to become stockholders under advantageous terms, keeping the payments down to easy monthly installments.

Under the plan, if the present rate of dividends—viz., $1 per share per quarter—continues, stock subscribed for at $53 per share will be fully paid for after forty months—that is, $40 per share will be the amount paid by the purchaser and $13 per share will be the amount credited from dividends. Any increase in the dividend rate or any extra dividends will reduce this time and the number of payments accordingly, and any reduction in dividends will make a corresponding increase over forty months.

**The American Insulated Wire & Cable Company**, 954 West Twenty-first Street, Chicago, will erect a one-story copper rod and wire plant, 105 ft. x 300 ft., at South Kedzie Avenue and Drainage Canal, to cost $100,000. It is said that the equipment will involve an investment of $200,000.

**Stephen Hall & Company, Inc.**, formerly at 90 West Street, New York City, have moved to Seventh and Adams Streets, Hoboken, N. J., and the company has been incorporated to manufacture electrical machinery and equipment. Stephen M. Hall is president and Ross C. Pack is vice-president.

**The Ward Manufacturing Company**, 3047 Sheffield Avenue, Chicago, recently incorporated, announces that it will manufacture a line of electric toys, curling irons and grills. R. J. Rich is president of the company.

**The Phoenix Light Company**, 525 Market Street, Milwaukee, manufacturer of electric fixtures, has leased 20,000 sq.ft. of additional floor space at 529 Market Street. Joseph Sable is president and general manager of the company.

**The Rawlplug Company**, manufacturer of a special article for securing screws, has leased an entire floor at 66 West Broadway, New York City, where it will soon combine its general offices, now at 461 Eighth Avenue, and its sales office, now at 48 West Broadway. Stockroom facilities have been increased 600 per cent.

**The Electrical Jobbers' Club** announces the removal of its offices from 47 West Thirty-fourth Street, New York City, to 261 Broadway.

**Hammer & Schwarz**, engineers, announce the removal of their offices to 55 John Street, New York City.

**The Instant Electric Water Heater Company**, Bridgeport, Conn., recently formed, has leased property at Knowlton Street and East Washington Avenue for a new plant for the manufacture of electric water heaters. Equipment will be installed and operations commenced at an early date. The company is capitalized at $250,000 and will succeed to the business of the Bridgeport Manufacturing Company. H. E. Dineson is president.

**The French Battery & Carbon Company**, 2317 Winnebago Street, Madison, Wis., will soon have plans drawn for the rebuilding of the portion of its two-story-and-basement factory, recently destroyed by fire with loss approximating $30,000.

**The Pittsburgh Transformer Company**, Preble Avenue, Pittsburgh, Pa., has purchased property through its president, R. V. Bingay, at Metropolitan and Juniata Streets, at a price stated at $24,000. It is purposed to use the site for extensions.

**The Indiana Manufacturing & Electric Company**, Marion, Ind., recently organized, will manufacture electrical supplies, having taken possession of a plant at Twelfth and Race Streets.

**The Heine Boiler Company**, St. Louis, is enlarging its facilities to manufacture boilers of 2,000 hp. A tank-rolling machine and multiple drill have been ordered.

**The Rumsey Electric Company**, Philadelphia, electric supplies and machinery, announces the appointment of H. D. Baker in charge of its store at 1007 Arch Street.

**The Bakelite Corporation**, New York City, has acquired the plant formerly occupied by the Lake Erie Foundry & Vulcan Company, Painesville, Ohio, and will use it for the manufacture of phenol.

**The Electric Rotary Machine Company**, 40 South Clinton Street, Chicago, has purchased a two-story plant comprising 15,000 sq.ft. of floor space at 3825 West Lake Street.

**The Air-Way Electric Appliance Corporation**, Toledo, Ohio, announces the removal of its export sales department into larger quarters at 220 Broadway, New York City, where a complete array of its line has been arranged. N. M. Simons is the company's export manager.

**The Bartlett Hayward Company**, engineers, announces the removal of its New York office to 1607 Pershing Square Building, Forty-second Street and Park Avenue.

**The New York Electrical Credit Association**, New York City, announces the removal of its office from 47 West Thirty-fourth Street to 261 Broadway.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase or agency is desired in Morocco (No. 6,254) for electrical goods, etc.

An agency is desired in France (No. 6,256) for transformer oil, circuit-breaker oil, insulating tapes, mica-insulation substitutes and similar products.

Purchase is desired in Matanzas, Cuba (No. 6,300), of electric vacuum oven, medium size, voltage 220.

Purchase is desired in Chihuahua, Mexico (No. 6,309), of all machinery necessary to establish a modern bakery. Prices and illustrated catalogs are desired of gasoline or electrically heated ovens, kneeders, pans, etc.

Purchase is desired in Bilbao, Spain (No. 6,313), of an electric conveyor for iron ore, with a capacity of 1,000 tons per hour, over a distance of approximately 250 m.

SWITCHBOARD AND UNDERGROUND CABLE FOR AUSTRALIA.—Tenders will be received by the Postmaster-General's Department, Sydney, New South Wales, until June 21, for switchboard and multiple-twin underground cable and for telephone switchboard wire.

GENERATING UNIT FOR BULIMA, BRISBANE, AUSTRALIA. — Tenders will be received by the City Electric Light Company, Bulima, Brisbane, until Oct. 31 for one 12,500-kw. turbo-alternator unit at Bulima, Brisbane.

ELECTRIC LAMPS FOR MONTEVIDEO, URUGUAY.—Tenders will be received until June 12 by the State Electric Light Works, Montevideo, Uruguay, for 42,000 metal-filament electric lamps.

EXTENSION OF DISTRIBUTING SYSTEM OF THE MORWELL (AUSTRALIA) POWER SYSTEM.—The Victorian government has decided to appropriate £100,000 to enable the Victorian Electricity Commission, Melbourne, to extend the high-tension transmission lines and distribution lines to county centers desiring electricity from the Morwell plant. Applications have been received from sixteen rural municipalities desirous of taking advantage of the proposed service.

JAPANESE ELECTRIC COMPANY TO RESUME CONSTRUCTION. — The Japanese government, *Commerce Reports* states, is reported to have decided to provide the Taiwan Electric Power Company with funds to enable it to continue construction of the generating plant on which work has been temporarily suspended. The original plans called for a plant of 100,000-kw. capacity, to cost 40,000,000 yen (1 yen = $0.4985). These plans have been modified and it is now estimated that the total amount required will be 30,000,000 yen.

## New Apparatus and Publications

AUTOMATIC CUTTING MACHINE.—The Artos Engineering Company, 306 Milwaukee Street, Milwaukee, has added style "KN" No. 3 to its line of the "Artos" automatic measuring and cutting machines.

FUSE CUT-OUT.—Bulletin No. 201 issued by Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, covers its "S. & C." style "DP" fuse cut-out.

INSULATOR TESTER.—James G. Biddle, 1211-13 Arch Street, Philadelphia, has issued pocket manual No. 1010, entitled "Concerning Insulation Testing, with Special Reference to the Meg."

SLUICEGATES. — The Champion Engineering Company, Kenton, Ohio, is distributing five leaflets illustrating the "Caterpillar" type sluicegates manufactured by the company under "Broome" patents.

INSULATING MATERIALS.—The Mica Insulator Company, 68 Church Street, New York City, is distributing a revised price list and discount sheet covering its electrical insulating materials.

LIGHTNING ARRESTERS.—Bulletin No. 204 distributed by Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, covers the various types of the "S & C" lightning arresters.

LIQUID STARTERS FOR MOTORS.—The Brush Electrical Engineering Company, London, England, has recently brought out a liquid starter for electric motors. This new invention, it is claimed, diminishes resistance gradually and continuously and so eliminates the shocks and sudden variations of resistance characteristic of the usual metallic type of starters.

TRANSFORMER THERMAL INDICATOR.—A new device, known as the transformer thermal indicator, has been placed on the market by the Westinghouse Electric & Manufacturing Company to indicate the temperature of the hot oil in distribution transformers.

BATTERY TEST BOARD.—The Reliance Instrument Company, 1135 West Van Buren Avenue, Chicago, has placed on the market a portable high-rate discharge battery test board for bench use in service stations for testing automobile batteries.

CANOPY SWITCH.—The Arrow Electric Company, Hartford, Conn., has placed on the market a canopy switch with a ratchet handle which, it is stated, can be turned backword without injuring the mechanism.

LIGHTING FIXTURES.—A new lighting fixture, designed particularly for stores, known as "Magic-Lite," has been brought out by the Brascolite Company, St. Louis.

## New Incorporations

THE GROVELAND (FLA.) LIGHT, POWER & ICE COMPANY has been incorporated with a capital stock of $30,000. The officers are Harry Merck, president, and W. M. Cathrae, vice-president.

THE M. & F. POWER COMPANY has been chartered with a capital stock of $35,000 by W. S. Fant, S. Friend and O. H. Bright.

THE ROSCOE ELECTRIC COMPANY, Janesville, Wis., has been incorporated with a capital stock of $5,000 to generate and distribute electricity. The incorporators are William H. Daugherty, Stanley M. Ryan and Paul Grubb.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

AUGUSTA, ME. — The Maine Central Power Company will construct an addition to its substation, 30 ft. x 50 ft.

PORTLAND, ME.—A power house will be constructed at the high school to be built in the Deering district, to cost about $700,000.

MANCHESTER, N. H.—The Public Service Commission has granted the Manchester Traction, Light & Power Company permission to issue $676,700, the proceeds of $639,500 to be used to pay for extensions made prior to Jan. 1, 1923, the remainder to be used for further improvements.

EVERETT, MASS.—The Merrimac Chemical Company, Broadway, will build an addition to its power house.

HOLYOKE, MASS.—The Board of Aldermen has authorized an appropriation of $1,000,000 for a new municipal electric steam generating plant. An appropriation of $100,000 was also authorized by the Aldermen from money now available for the purchase of a site for the proposed new electric plant.

PAWTUCKET, R. I.—Negotiations are under way between the City Council and the officials of the Blackstone Valley Gas & Electric Company for the installation of an ornamental lighting system in the business district.

## Middle Atlantic States

ALEXANDRIA BAY, N. Y.—The installation of an ornamental lighting system, to cost about $50,000, is under consideration by the special lighting committee of the Thousand Island Yacht Club. Further information may be obtained of J. L. Kincaid, 643 West Onondaga Street, Syracuse.

AMSTERDAM, N. Y.—The Adirondack Power & Light Corporation contemplates building a dam and power house on East Canada Creek at Stewarts Landing, to cost about $175,000.

BROOKLYN, N. Y.—The Brooklyn Edison Company will build a substation, 52 x 79 ft., at 179 Hudson Avenue, to cost about $100,000.

BUFFALO, N. Y.—Electric power equipment will be installed in the proposed municipal market building, 50 ft. x 275 ft., to be constructed by the Department of Parks and Public Buildings, on Market Street. Howard L. Beck is architect for the department.

CHARLOTTE, N. Y. — Electric power equipment will be installed in the ice and cold-storage plant to be constructed by the Charlotte Cold Storage Company, to cost about $250,000. John Strobel, E. & B. Building, Rochester, is architect.

CORNWALL, N. Y.—The Cornwall Chemical Company plans to rebuild its power house and factory recently destroyed by fire with loss of about $100,000.

GLOVERSVILLE, N. Y.—The Board of Public Works contemplates the installation of an ornamental lighting system on several streets, to cost from $30,000 to $35,000.

NEW YORK, N. Y. — The Commercial Solvents Corporation, 17 East Forty-second Street, will build a power house in connection with a proposed plant, to cost about $750,000.

OGDENSBURG, N. Y.—The Ogdensburg Power & Light Company plans to erect a building for general operations at Caroline and Ford Streets, to cost about $150,000.

PEEKSKILL, N. Y.—The N. Dains Sons' Company plans to rebuild its power house and lumber plant, recently destroyed by fire, causing a loss of about $200,000.

ROCHESTER, N. Y.—The Rochester Gas & Electric Corporation plans to erect a transformer station at 26 Swan Street, to cost about $40,000.

ROME, N. Y.—The Manufacturers' Power Corporation is considering the construction of a power house on the barge canal and erecting high-tension transmission lines, to cost about $100,000.

TONAWANDA, N. Y.—The R. T. Jones Lumber Company contemplates the construction of a power house in connection with a new lumber plant to be erected on Tonawanda Island.

MILLVILLE, N. J.—The Whitall-Tatum Company will install electric power equipment in connection with the rebuilding of its local glass plant, recently damaged by fire. The loss is estimated at $400,000.

WEEHAWKEN, N. J. — The Cunard Steamship Company, Ltd., 25 Broadway, New York, plans to erect an electric power house in connection with building four 1,000-ft. piers on the Hudson River, to cost about $3,500,000.

BETHLEHEM, PA. — Bids will be received until May 15 for the construction of a power house at the new plant of the Confederated Home Abattoir Company on the Mauch Chunk Road. A refrigerating plant will also be installed. The cost of the entire work is estimated at $350,000. The Gorman-Brown Engineering Corporation, 40 Rector Street, New York City, is engineer.

HOLTWOOD, PA. — The Pennsylvania Water & Power Company is building a 60-cycle system to be completed in 1923. The work will include the installation of two I. P. Morris turbines of 20,000 hp. capacity each; two Westinghouse generators, each of 15,000 kva., 13,200 volts, three-phase; two General Electric frequency changers of 5,000 kw. capacity each; the erection of a double steel tower, 73,000-volt transmission line to York, designed ultimately for 110,000 volts, and a substation at York with an initial transformer capacity of 10,000 kw., where energy will be supplied to the Edison Light & Power Company; also a double-circuit steel-tower, 73,000-volt transmission line to Coatesville, where electricity will be supplied to the Chester Valley Electric Company, to be delivered at a substation to be erected by the latter. James L. Rintoul is treasurer.

MAHONOY CITY, PA.—The Ball Lumber Company plans to rebuild its power house and mill, recently destroyed by fire, with a loss of about $85,000.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 22 for miscellaneous motor-generator panels and auxiliary equipment. (Schedule 788.)

PHILADELPHIA, PA. — The Largman Gray Company, 3360 Frankford Street, will build a power house at its proposed textile mill on Kensington Avenue, to cost about $300,000.

PITTSBURGH, PA. — The West Penn Power Company has issued $500,000 in capital stock, the proceeds to be used for extensions and equipment in its generating plants.

BALTIMORE, MD.—The United States Industrial Alcohol Company, Curtis Bay, plans to install a power house in connection with a new plant to cost about $700,000.

BALTIMORE, Md.—Plans have been prepared by the Board of Works, for a central power plant for city service, to be built in conjunction with a police station at Lexington and Gay Streets, to cost about $500,000. Lawrence H. Fowler, 307 North Charles Street, is architect.

HAGERSTOWN, MD. — The Maryland Public Service Company was recently organized by officials of the American Water Works & Electric Company, New York, to take over the systems of the Potomac Public Service Company, Hagerstown, and the Cumberland (Md.) Edison Company. Bonds to the amount of $3,983,000 have been authorized to carry out the consolidation and for extensions and improvements to the systems.

CHARLESTON, W. VA.—Electric power equipment, refrigerating machinery, etc., will be installed in the new market building to be erected by the Charleston Market Company, to cost about $400,000.

MORGANTOWN, W. VA.—Preparations are being made by the West Virginia Power & Transmission Company, a subsidiary of the West Penn Power Company, for the construction of a hydro-electric plant on the Cheat River at State Line. Rights of way for a transmission line from the proposed dam to Morgantown and Fairmont are being purchased.

HOPEWELL, VA.—The Hopewell China Company contemplates rebuilding its power plant, recently destroyed by fire with loss of about $100,000.

SHENANDOAH, VA. — The Norfolk & Western Railway Company, Roanoke, plans to install a power house at its proposed local car and locomotive repair shops, to cost about $450,000.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until May 22 for 250 transformer coils and 100 mica condensers. (Schedule 787.)

## North Central States

CARO, MICH.—The Great Lakes Company, Bad Axe, has purchased the local electric plant, owned by the Consumers' Power Company, Jackson.

ERIE, MICH.—The Père Marquette Railroad Company, Detroit, will build a power house in connection with its proposed local car and locomotive shops, to cost about $1,000,000.

KALAMAZOO, MICH.—The El-Mora-Lee Paper Company, 839 Lake Boulevard, Kalamazoo, Mich., will build a power house in connection with its proposed paper mill in Howlandsburg, to cost about $100,000.

RED JACKET, MICH.—The installation of an ornamental lighting system on Fifth and Oaks Streets is under consideration.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until May 18 for cedar poles for the division of light and power. Separate bids will be received at the same time and place for electric meters, and also for fiber conduit, for the division of light and power.

FREMONT, OHIO.—A company has been organized by farmers along the Port Clinton road for the purpose of securing electric service from the Ohio Light & Power Company.

SHELBY, OHIO.—The Council has appropriated $6,500 for equipment for the municipal electric plant, including two boilers of 300 hp. capacity each.

FLEMINGSBURG, KY.—The Maysville Gas Company contemplates the erection of an electric transmission line to Flemingsburg and purchasing the local distribution system. The city at the present time is without street-lighting service.

WHITESBURG, KY. — The Blue Ridge Diamond Coal Company plans to install electric power equipment at its coal properties. A lumber mill with power house is under consideration.

CLINTON, IND. — The Wabash Valley Electric Company is negotiating for the purchase of the properties of the Martinsville Gas & Electric Company, Spencer Light, Power & Water Company, Putnam Electric Company, Cayuga Electric Company, Roachdale Electric Company, Gosport Electric Company and the Morgan County Light & Power Company. The systems will be merged and extensions and improvements made. Bonds to the amount of $1,561,700 have been authorized to carry out the consolidation and to provide funds for expansion.

INDIANAPOLIS, IND. — Arrangements are being made by the Lavelle Foundry Company, Michigan Street and the Belt Railway, for equipping its plant for electrical operation.

NEW HARMONY, IND.—Plans are being considered for improvements and extensions to the municipal light and power plant, to cost about $60,000.

VINCENNES, IND.—The Indiana Power Company has issued $1,000,000 in capital stock, the proceeds to be used for extensions and improvements, including a 10,000-kw. addition to the local plant.

BLOOMINGTON, ILL.—Bids, it is reported, will soon be asked for the installation of an ornamental lighting system on Washington Street, to cost $6,736.

EDWARDSVILLE, ILL. — Plans are under consideration to replace the arc lamps in the business district (covering about 2 miles) with an ornamental lighting system

LINCOLN, ILL. — Extensive improvements are contemplated by the Lincoln Water & Light Company involving an expenditure of about $143,000. Contracts have been placed for a 1,500-kva. turbo-generator and condenser.

ST. CROIX FALLS, WIS.—The Railroad Commission has granted the St. Croix Falls Improvement Company permission to raise and rebuild the Nevers Dam across the St. Croix River. The new dam, it is estimated, will develop about 30,000 hp.

SALEM, WIS. — The Carey Electric & Milling Company, Wilmot, will make extensions and improvements to its local system as suggested by the Railroad Commission.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company contemplates extensions and improvements to its local properties involving an expenditure of about $200,000. The plans include an addition to power house and installation of additional generating units.

WEST ALLIS, WIS.—The City Council has authorized the installation of an ornamental lighting system on Greenfield Avenue, to cost about $11,000.

FERGUS FALLS, MINN. — Among the improvements contemplated by the Ottertail Power Company this summer is the construction of two large power dams on the Otter Tail River at Fergus Falls and the erection of another large steam power plant. The cost of the work is estimated at about $500,000.

MINNEAPOLIS, MINN.—Plans are being considered by the Board of Park Commissioners for the erection of 244 electric lamp standards along Minnehaha Parkway, to cost about $35,000.

ST. PAUL, MINN.—Improvements contemplated by the St. Paul Gas Light Company during 1923 include replacing six rotaries of 1,500 kw. capacity with two motor-generator sets having a total capacity of 2,000 kw., installing three 300-kw. transformers and starting construction work on the first 25,000-kva. unit of its proposed new steam-driven generating plant. F. C. Hoffman is secretary.

SLAYTON, MINN.—The Slayton Power Company has contracted with the Northern States Power Company for electricity, the service to begin about June 1. F. H. Eddy is owner of the local system.

CENTERVILLE, IOWA. — The Iowa Southern Utilities has issued $1,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

RIVERSIDE, IOWA.—The Sioux (Iowa) City Brick & Tile Company plans to build a power plant at its proposed local factory, to cost about $100,000.

SIOUX CITY, IOWA. — Options have been obtained by the Sioux City Gas & Electric Company on about 15 acres of land in the North Riverside section of the city as a site for its proposed new plant.

HOPKINS, MO.—The Maryville Electric Light & Power Company is planning to extend its transmission line to Hopkins to furnish electrical service here. The local plant was recently burned down.

GREENFIELD, MO.—The South Missouri Power Company plans to erect a transmission line to Golden City to furnish electricity there. The company also contemplates extending its service to South Greenfield, Lockwood and Everton.

ORAN, MO.—At an election to be held May 15 the proposal to issue $23,000 in bonds for installation of an electric lighting system will be submitted to the voters.

SIOUX FALLS, S. D.—The Minnesota Electric Distributing Company and the Tri-State Utilities Company, Eldora, Iowa, are promoting the erection of a high-tension transmission line from Gayville, S. D., to Wynot, Neb., from which point two branch lines will be built. Practically every town in Cedar, Dixon and Knox Counties will be served by the new lines. Arrangements are being made to take over the electric plant now furnishing electricity in these localities.

## Southern States

GREENSBORO, N. C.—Plans are being prepared for a power plant for the Agricultural and Technical College to cost about $55,000. Harry Barton, Greensboro, is architect.

MARION, N. C.—The Marion Lake Club plans to install an electric light and power plant.

OAKBORO, N. C.—The Oakboro Cotton Mill plans to install a power plant in connection with a proposed local textile mill, to cost $225,000.

WALNUT COVE, N. C.—Plans are under consideration by the Council for the installation of a municipal electric light plant

WASHINGTON, N. C.—The J. M. Swindell Company will build a power house in connection with a proposed packing factory and ice plant, to cost about $100,000.

CLEARWATER, FLA.—Plans are being considered by the Clearwater Cooperage Company for the installation of a power plant in connection with a proposed local plant, to cost about $100,000. C. E. Murray is president.

CRESTVIEW, FLA.—Bids will be received by the Common Council until May 28 for a 40-kw. generator, exciter, switchboard and equipment for distributing system, etc., for a municipal electric plant. J. D. Carter, Geneva, Ala., is engineer.

GREENVILLE, FLA.—Bonds for $30,000 have been voted for extensions and improvements to the municipal lighting system and waterworks.

MIAMI BEACH, FLA.—Bonds to the amount of $20,000 have been voted for the installation of an ornamental lighting system.

MILAN, TENN.—Plans are under consideration for extensions and betterments to the municipal electric plant, to cost about $40,000.

HEFLIN, ALA.—W. M. Dobson, Wedowee, it is reported, contemplates installing an electric plant in Heflin. The local electric plant was recently destroyed by fire.

PELHAM, ALA.—The Superior Lime & Hydrate Company contemplates the construction of a power house at its local plant.

LITTLE ROCK, ARK.—The Arkansas Central Power Company, recently organized to take over the local properties of the Little Rock Railway & Electric Company, has issued $2,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

BATON ROUGE, LA.—The Baton Rouge Electric Company contemplates extensions and improvements during the next eighteen months, to cost about $1,000,000. The plans include an addition to the local power plant to cost approximately $300,000. New equipment, including a 3,000-kw. generator, will be installed.

LAFAYETTE, LA.—The Southern Pacific Railroad Company plans to build a power house at its new local shops now in course of erection.

KIEFER, OKLA.—The Oklahoma Gas & Electric Company is planning to erect a transmission line from Kiefer to Nuyaka, via Mounds, a distance of 20 miles.

McALESTER, OKLA. — The Choctaw Power & Light Company contemplates erecting a high-tension transmission line from McAlester to Savanna, Kiowa, Stringtown, and possibly to Atoka, a distance of about 50 miles.

AMARILLO, TEX.—The City Light & Water Company has contracted with the municipality for the installation of an ornamental lighting system in the business district.

DEWEYVILLE, TEX.—The Peavy-Moore Lumber Company plans to construct a power house in connection with a new lumber mill, to cost about $500,000.

URBANA, TEX.—The Urbana Sand & Gravel Company will install a power house at its plant. The equipment will include a 60-kw. generator.

## Pacific and Mountain States

TACOMA, WASH.—Plans are being prepared by J. L. Stannard, engineer, Balboa Building, San Francisco, for two power houses, one of 30,000 hp. capacity, the other of 45,000 hp., storage dam, etc., and transmission lines in connection with the Lake Cushman power project for the city of Tacoma.

VANCOUVER, WASH.—Work will soon begin by the Pudget Sound Power & Light Company, Seattle, on the erection of a high-tension transmission line between Woodland and Vancouver.

YARDLEY, WASH.—The Western Cedar Pole Preserving Company contemplates building a power plant in connection with its local plant, to cost about $100,000.

ASTORIA, ORE. — Surveys are being made by the Crown Willamette Paper Company with a view of developing the water power at Young's River Falls to operate its pulp mill there.

ASTORIA, ORE.—The installation of a new local heating and power plant is under considerataion by the Consumers' Central Heating Company, Tacoma, Wash.

BAKER, ORE. — The Eastern Oregon Light & Power Company plans to build a 1,500-hp. steam-driven electric plant in Baker, estimated to cost about $100,000.

MILTON, ORE. — Permission has been granted to K. C. Harlan, Walla Walla, Wash., to utilize the water power of the Walla Walla River above Milton. Mr. Harlan proposes to furnish water to irrigate 10,000 acres of land and to develop 4,000 hp.

EUGENE, ORE.—Plans have been prepared for the construction of a new power house for the University of Oregon, to cost about $75,000. Bids, it is understood, will soon be asked for the work.

NORTH BEND, ORE.—The City Council is considering the establishment of a municipal electric light plant and waterworks system.

ROSEBURG, ORE.—Plans are being prepared by the City Council for the installation of an ornamental lighting system in the business district, to cost about $10,000.

AUBURN, CAL.—The Bear River Water & Power Company has been granted permission to construct a hydro-electric generating plant on the Bear River.

MODESTO, CAL.—The Modesto Irrigation District has been granted permission by the State Water Board to construct and operate a 17,000-hp. hydro-electric power plant on the Tuolumne River, Stanislaus County, to cost about $360,000.

SAN FRANCISCO, CAL.—Bids will be received by the Board of Public Works of the city and county of San Francisco, San Francisco, until May 23 for furnishing and installing steel penstocks and accessories for the Moccasin Creek power plant, contract No. 91, Hetch Hetchy water supply. Specifications may be obtained at the office of M. M. O'Shaughnessy, city engineer, City Hall.

## Canada

VICTORIA, B. C.—The British Columbia Electric Company contemplates extending its transmission line from Bamberton to the Duncan, Cowichan and Ladysmith districts.

GLACE BAY, N. S.—The Town Council is considering an appropriation of $32,950 for extensions to the municipal electric system.

PORT ARTHUR, ONT.—The erection of a second transmission line from Cameron Falls to Port Arthur and the installation of an additional generating unit is under consideration by the Hydro-Electric Power Commission.

QUEBEC, QUE.—Plans have been submitted to the Provincial Cabinet by the Running Streams Commission for the construction of a dam on the Metis River in Matan County, to cost about $200,000. The Compagnie du Bas St. Laurent is interested in the project.

QUEBEC, QUE.—The Lower St. Lawrence Power Company has petitioned the Public Service Commission for permission to erect electric transmission lines in Rimouski and Matane Counties.

QUEBEC, QUE.—The Quebec Provincial Government has awarded the Des Quinze power lease to W. Alexander Fasken, Toronto, a director of the Northern Ontario Light & Power Company, Ltd., Cobalt, Ontario, at an annual rental of $80,100. The Des Quinze power project consists of fifteen rapids near the head of Lake Temiskaming and is capable, it is said, of developing 60,000 hp.

## Electrical Patents

**Announced by U. S. Patent Office**

(Issued April 17, 1923)

1,452,267. CONNECTING DEVICE FOR ELECTRIC CIRCUITS; S. M. Esler, Chicago, Ill. App. filed Aug. 7, 1919. Two-way adaptor for lamp sockets.

1,452,269. TELEPHONE-EXCHANGE SYSTEM; C. L. Goodrum, New York, N. Y. App. filed April 17, 1920. Machine-switching selecting means.

1,452,277. TELEPHONE SUBSTATION SET; K. S. Johnson, Jersey City, N. J. App. filed Oct. 8, 1917. Arranging elements of local battery set for maximum efficiency.

1,452,281. METALLIZING ARTICLES; Q. Marino, Hampstead, London, England. App. filed Sept. 10, 1921. Electrodepositing metallic coating on article.

1,452,304. COLLAPSIBLE ELECTRIC HEATER; E. J. McCormack, San Francisco, Cal. App. filed July 13, 1921. Of reflector type.

1,452,311. HEATING DEVICE FOR LIQUIDS; C. E. Parkhurst, Somerville, Mass. App. filed March 11, 1922. Automatic temperature control.

1,452,321. ADAPTER. L. Stendahl, Fairfield, Conn. App. filed March 31, 1922. For use in lamp sockets

1,452,323. TOLL TRUNKING CIRCUITS FOR MACHINE-SWITCHING TELEPHONE SYSTEMS; R. L. Stokely, Floral Park, N. Y. App. filed March 1, 1921. Method of collecting and returning coins to subscribers.

1,452,327. POWER-TRANSMISSION ARRANGEMENT; M. E. Thompson, Ridgway, Pa. App. filed Dec. 20, 1919. Magnetic coupling for engine and motor drive in submarines.

1,452,334. TELEPHONE RECEIVER; C. T. Baisley, North Edgecomb, Me. App. filed May 11, 1922. Watchcase type.

1,452,339. ELECTRICAL DISCHARGE DEVICE; R. A. Helsing, East Orange, N. J. App. filed May 28, 1918. Tubes of audion type which function as generators.

1,452,399. RADIO VARIABLE RHEOSTAT; H. W. Tompkins, Greensburg, Pa. App. filed Aug. 2, 1922.

1,452,472. CONTROLLER FOR MOTORS; C. W. Plehaty, White Plains, N. Y. App. filed Jan. 25, 1922. Manually operated starting box.

1,452,484. METHOD OF GUNFIRE CONTROL FOR BATTLESHIPS; E. A. Sperry, Brooklyn, N. Y. App. filed Sept. 30, 1916. Gyroscopic apparatus.

(Issued April 24, 1923)

15,584 (reissue). DIRECTION SIGNAL FOR AUTOMOBILES; W. W. Lincoln, Washington, D. C. App. filed Oct. 7, 1920.

1,452,500. BURGLAR-ALARM APPARATUS; B. Galerman, Philadelphia, Pa. App. filed Oct. 15, 1918.

1,452,511. 1,452,512 and 1,452,513. ELECTRIC RIVET HEATER; W. S. Johnson and J. W. Sheffer, Berwick, Pa. App. filed Aug. 17, 1920. Transformer for heating rivets and hood for protecting heater against elements.

1,452,527. TRANSMITTING APPARATUS FOR ELECTRIC TELEGRAPHS; L. M. Potts, Baltimore, Md. App. filed Dec. 14, 1915. Motor-driven telegraph transmitter.

1,452,528. BRAKE; J. M. Rohlfing, Plainfield, N. J. App. filed April 15, 1922. Electrically operated motor brake.

1,452,550. CIRCUIT INTERRUPTER; O. H. Eschholz, Wilkinsburg, Pa. App. filed Aug. 18, 1921. Water resistance inserted to reduce current.

1,452,573. ELECTRODEPOSITION OF TIN; L. D. Simpkins, Brooklyn, N. Y. App. filed Feb. 10, 1922. Electrolytic bath containing tin-salt solution, beta-naphthol and a colloid.

1,452,574. CIRCUIT INTERRUPTER; J. Slepian, Wilkinsburg, Pa. App. filed June 29, 1918. Resistance inserted to reduce current.

1,452,587. REGULATING AND CIRCUIT-CONTROLLING APPARATUS; E. J. Blake, Buffalo, N. Y. App. filed Oct. 14, 1920. For storage battery-generator lighting equipment.

1,452,589. ELECTROLYTIC CELL; D. A. Brading, Chicago, Ill. App. filed Sept. 23, 1922. For making hydrogen and oxygen gas.

1,452,590 and 1,452,591. ELECTRICAL MEASURING INSTRUMENT; I. W. Brogger, Newark, N. J. App. filed April 26, 1919. Ammeter of solenoid type.

1,452,610. ELECTRICAL CONDENSER; M. Klosner, New York, N. Y. App. filed Sept. 2, 1920. Variable plate condenser.

1,452,615. WIRE-ASSEMBLING MACHINE; E. A. Pigeon, Akron, Ohio, App. filed May 8, 1920. Machine cuts and assembles wires for various circuits in automobile.

1,452,651. TARGET FINDER FOR FIREARMS; C. H. Norrlin, New York, N. Y. App. filed Oct. 15, 1921. Flashlight attached to barrel.

1,452,666. DEVICE FOR THE COOLING OF ELECTRIC APPARATUS BY THE CIRCULATION OF LIQUID THROUGH THE CONDUCTORS; P. G. M. Toulon, Paris, France. App. filed May 2, 1922. Fluid-cooled secondary winding of a transformer so combined with fluid-cooled anodes of vapor rectifier that cooling of both is effected simultaneously.

1,452,678. APPARATUS FOR REMOVING THE DIVISION PLATES FROM ICE-CREAM RECEPTACLES; H. Dilas, Bay City, Mich. App. filed Jan. 12, 1922. Plates heated electrically.

1,452,681. AUTO SIGNAL; M. Fujimoto and T. Okawa, Portland, Ore. App. filed May 21, 1920. Rear-direction signal apparatus.

1,452,688. VOLTAGE-CONTROLLING DEVICE FOR DYNAMOS; G. C. Hubble, Bonners Ferry, Idaho. App. filed Dec. 2, 1921. Automatic or manual control of field current.

1,452,737. SIGNALING DEVICE; F. M. Hill, Chicago, Ill. App. filed Oct. 1, 1917. For railway crossings.

1,452,752. PANELBOARD CONSTRUCTION; E. A. Olley, Syracuse, N. Y. App. filed June 13, 1918. Circuit-carrying parts assembled as unit before attaching to panelboard base.

1,452,762. ELECTRIC SEAM-WELDING MACHINE; E. Schroder, Berlin, Germany. App. filed March 15, 1920. For welding longitudinal seams of tubes.

1,452,781. WELDING ROD; F. M. Becket, Niagara Falls, N. Y. App. filed June 28, 1921. Iron alloy containing carbon, manganese and silicon.

1,452,806. STORAGE-BATTERY VENT; N. M. Hopkins, New York, N. Y. App. filed May 31, 1921. Prevents leakage of electrolyte.

1,452,813. METHOD OF DECOMPOSING MIXED SALT SOLUTIONS; H. Pauling, Berlin-Grunewald, Germany. App. filed Aug. 3, 1921. By electrolysis.

1,452,814. INCLOSED-SWITCH CONSTRUCTION; C. F. Platt, Bridgeport, Conn. App. filed June 27, 1922. To facilitate installation and replacement of fuse plugs without opening box.

1,452,827. TELEPHONE DEVICE; L. de Forest, New York, N. Y. App. filed Nov. 22, 1919. Combined loud speaker and table lamp in which shade acts as diaphragm.

1,452,849. WIRELESS TRANSMITTING STATION; H. J. Round, London, England. App. filed Dec. 13, 1921. Sending different wave lengths simultaneously.

1,452,850. TELEPHONE APPARATUS; L. Schmidt, Brooklyn, N. Y. App. filed June 26, 1922. Loud-speaking receiver for wireless telephone.

1,452,851. HEAD RECEIVER FOR TELEPHONES; L. Schmidt, Brooklyn, N. Y. App. filed Sept. 30, 1922. Head band for two receivers.

1,452,857. SYSTEM OF VOLTAGE CONTROL; L. S. Uphoff, U. S. Army. App. filed June 26, 1919. For use with X-ray machines.

1,452,877. SYSTEM OF DISTRIBUTION; G. E. Hulse, Newark, N. J. App. filed Dec. 9, 1918. Railway-car battery-generator lighting equipment.

1,452,903. STATION SELECTOR; O. K. Bakken, Northwood, N. D. App. filed Jan. 30, 1920. Selective ringing device for party-line exchanges.

1,452,925. WIRELESS-TELEGRAPH CALLING DEVICE; W. H. Nottage and T. D. Parkin, Chelmsford, England. App. filed Dec. 18, 1920. Impulses transmitted at regular intervals and received by balance-wheel relay.

1,452,927. GATHERING REEL; G. W. Packer, Chicago, Ill. App. filed July 30, 1920. Adapted to mining locomotives.

1,452,933. SELECTIVE AMPLIFYING APPARATUS; M. I. Pupin, Norfolk, Conn. App. filed Oct. 10, 1918. Selective multi-step vacuum-tube amplifier.

1,452,934. ZINC SMELTING FURNACE; B. Raeder, Kykkelsrud, Askim Station, Norway. App. filed Feb. 5, 1920. Preliminary drying and heating before feeding reduction chamber.

1,452,936. METHOD OF AND APPARATUS FOR WELDING; F. J. Schuman, Cleveland Heights, Ohio. App. filed March 31, 1920. For repairing steel and iron castings.

1,452,939. COIL; C. Sparks, Oak Park, and W. G. Shull, Chicago, Ill. App. filed Jan. 9, 1920. Repeating coils for telephone apparatus.

1,452,942. CHAIN-LINK WELDING; E. Thomson, Swampscott, Mass. App. filed March 16, 1921. Done by machine.

1,452,954. PACK FOR ELECTRICAL HEATING ELEMENTS; W. A. Braun, Dover, Ohio. App. filed April 18, 1922. For embedding and insulating resistance wires and irons.

Electrical World

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# "Excess Varieties"

A WELL-KNOWN manufacturer of electrical supplies recently made the statement that 80 per cent of the articles produced by his firm were carried in its catalog for the purpose of "window dressing." The other 20 per cent, he said, represented practically 85 per cent of the entire volume of his sales. On the theory that this great array of varieties will discourage new competitors from entering the field, four out of every five devices that he makes and sells are forced on the market by the natural influence of their being listed as standard in his catalog.

Since these superfluous varieties are offered, it is no more than natural that central stations, contractors, dealers and industrial plants should order many of them. Jobbers carry them. And the manufacturer himself continues to produce them in small quantity to fill scattered orders that might just as well call for some other device of similar character.

AT THE present time American manufacturers in a wide range of industries are engaged in a broad program of simplification. It is their belief that duplication of product causes waste and that the elimination of dead wood in any line effects economy. Right down the line from the factory to the consumer the production of excess varieties lays a burden of extra cost upon every one who buys or sells or handles them. It means excess patterns, excess dies, excess operations in the making, excess stock for manufacturer, wholesaler and retailer, excess orders, excess bills, excess accounting; and in the case of electrical materials it adds to the cost of installations. It impedes the electrical business. Therefore as a principle and a policy it concerns the entire electrical industry.

It is, of course, quite natural that every manufacturer should desire to discourage newcomers from entering his field and unnecessarily increasing the competition for existing business. Excessive competition between manufacturers and wholesalers who produce and sell duplicate lines of too many varieties in too small quantities undoubtedly is one of the bad features of the present situation. But is there not a better way to go about it?

BY THE simplification of his line and by the mass production of more standardized staples a manufacturer can reduce his cost and his price and protect his business far more effectively than by endeavoring to frighten off new competitors by camouflage in the form of a catalog loaded down with obsolete, duplicate or other excess varieties. There is greater security for the manufacturer in following along economic lines and keeping costs down in the public interest than in any form of repellent "window dressing" that imposes added burdens of expense on the entire industry. Efficiency is the greatest armor in the world.

It is encouraging therefore to observe the amount of attention which this broad problem of simplification is right now receiving from both electrical manufacturers and jobbers. It will be a great service to the electrical business if together they can perfect a program that will relieve the market of the present glut of excess varieties in many of our important commodities.

# Lewis Taylor Robinson

*A leading exponent of standardization who is noted for his courtesy, common sense and understanding of human relations.*

STANDARDIZATION came into existence as a slogan and a fact only after unusually strenuous efforts to co-ordinate the opinions and practices of engineers and manufacturers had been made by a few farseeing leaders. In this work the outstanding requirements were persistency, perspective, enthusiasm and an understanding of psychology. Lewis T. Robinson proved to have these traits to an unusual degree, and his winning personality, his sound common sense and his broad perspective materially helped the work of standardization over many serious obstacles.

Born in Springfield, Mass., Oct. 20, 1869, he was educated at Reading and Lynn and then started his career in the electrical industry by taking charge of the standardizing laboratory of the Thomson-Houston Electric Company. In 1891 he became a member of the testing firm of Whitmore & Robinson and in 1896 took charge of the standardizing laboratory of the General Electric Company. Later he was promoted to his present position as engineer in charge of the general engineering laboratory. During this period he has contributed to the engineering development of instruments and machines and has exercised executive supervision with unusual success. Democratic, good-humored, witty and forbearing, he has encouraged and inspired his coworkers and "humanized" the engineering activities of the company.

He has found time to contribute valuable services to the industry as a whole and has held high offices in many engineering organizations. He served as a vice-president of the A. I. E. E. in 1916-18 and 1920-21 and is a past-chairman of the standards committee. His services were in demand at the founding of the Federated American Engineering Societies, and he maintains close contact with many committees working for the advancement of the industry. Mr. Robinson is the author of important papers and is active in the N. E. L. A. He is a member of the United States National Committee of the International Electrotechnical Commission and is on the committee on insulation of the National Research Council.

Untiring worker and self-made man, Lewis T. Robinson has a host of friends and a record of achievements that have made for him a secure position both as man and leader in the annals of the electrical industry.

# Editorial Comment

Electrical World, May 19, 1923

Volume 81 Number 20

## The Forthcoming Electric Light Convention

LIKE a banquet table fully set, the program for the convention of the National Electric Light Association is filled with delectable things. Statesmen, bankers, captains of industry, public service commissioners and others will address the various meetings in addition to representatives from the industry itself. Replete with all manner of reports and papers as these annual gatherings usually are, this year's program seems remarkably so. At no period of the association's history has interest in its affairs been keener or its work more productive, and naturally this condition is reflected in the annual convention. A record-breaking attendance is anticipated, for, aside from the attractions which New York affords, the wealth of material represented in this year's program provides an added incentive for electrical men from all parts of the country to be present. Certainly no phase of the electric light and power business has been overlooked, and all told the convention should go down in history as one of the greatest the industry has ever held.

## Is the Real Voice of Your Company Mute?

WHAT is the difference between advertising and publicity? Some central-station men may think that it doesn't matter much, that this is just a technicality. Not so. And the important difference is this, that advertising is a sales function, whereas publicity is in reality an executive function. Broadly, the distinction may be made that advertising is a message from the company to its customers about something that the company wants to sell, while publicity is a message from the company about itself. And the man who speaks thus for the company to the community should be an executive.

In too many utilities the president and the general manager retire into modest seclusion. They make no speeches to their townspeople. They write no personal letters to their customers. They express themselves directly in no printed messages. They forget that they head the most vital industry in the community, that they are the two men whom the public look upon as "the company." They keep their personalities out of the picture, whereas what the situation needs is a personal intimacy with the public. The words of the company they leave entirely to the articulation of the sales manager, whose costs they scrutinize, holding him strictly to account for sales. And so the company's speech is neither free nor frank. It does not express the thinking or the character of the executive, who is seen and met only in chance confidential conversations with individuals in his private office.

By contrast, those company executives who have taken the plunge and have appeared to their public in ways mentioned here have reaped the benefits manyfold and are enthusiastic supporters of such action.

Executives like frank opinion and plain speaking from the men of their own organizations that they may learn their measure and have the "feel" of their judgment and their self-reliance. By the same token does the community desire to hear and see and know these chief men who operate its central station and are therefore in an entirely real sense the employees of the public.

The voice of the chief executive should be recognized and listened to with confidence in the community and not habitually held to speak in secret to those alone who come to him. The rest of the people, for whom he is also working, are quite as interested and are entitled to hear no less.

## Putting Confidence in Young Blood

NO ARGUMENT is necessary to prove that unless the electrical industry attracts youthful workers to enter its service and embrace its opportunities from one year's end to another it will become moribund. Progressive executives act upon this fact when they open the doors of their plants and factories, stores and offices to ambitious young employees and so infuse new blood into established concerns. Not a little has been said of late about the importance of pecuniary compensation in keeping younger employees contented in the utility and other fields in which electricity plays a vital part. While the money reward, or at least the outlook in that direction, is undeniably important, yet to less mature workers there are other considerations quite as weighty and not seldom more prevailing than the question of present salary.

The rapid progress of virtually every phase of work in the electrical industry presents an appeal to younger employees which should be capitalized with insight by their superiors. In not a few cases the failure of executives to permit responsibility to remain upon qualified employees' shoulders has led to the loss of valuable and promising human material to other industries. The policy of taking away a particular job from a young man just as he reaches its thoroughly interesting stage is responsible for the departure of some workers into other fields, and the same remark applies to the policy of keeping employees in the dark as to the reasons for company practices, to a failure to give credit to the privates and non-commissioned workers of the industry for significant achievements, and to a lack of interest by executives of lower rank in the prospects and ambitions of their personnel. Even the dropping or irregular publication of an accepted company house organ is a blow to the morale.

Every modern business faces the problems hinted at, but surely in the electrical industry there is little

excuse for treating the ambitious employee as a mere cog in the wheel. Whenever he or she is doing significant work, let that significance be known to the doer. It may be a compilation of costs for presentation in a rate case or a computation of voltage drops in feeders as a part of an economic study of equipment development; it matters not which, but special effort may well be made to avoid submergence in a sea of routine too deep for getting a view of the bearings of the organizational craft as it moves forward into areas of greater service. Wise supervision is one thing in holding the employee's interest, but a policy of keeping him outside a proper knowledge of what is going on is quite another.

### Capitalize Maintenance Expense to Ascertain Value of Reliability

ALTHOUGH purchasing agents of some operating companies may be tempted to buy the cheapest equipment available so long as it is not notoriously inadequate, no operating engineer who has a voice in purchases will sacrifice reliability to a saving in first cost. Too many contingencies arise in practice, even when the greatest precautions are taken, to permit him to slight the factor of reliability. None the less, this factor is often looked upon as an intangible consideration, and hence the relative values of transformers are likewise assumed to be indefinite. Whatever truth there may be in this assumption, a very good basis for determining what can be paid for increased reliability can be obtained by keeping records of unit transformer repair and replacement expenses for different classes of equipment used. Capitalized and added to the first cost of the transformers, these expenses will permit the calculation of a more nearly true value of the relative cost of transformers than the initial cost would indicate.

### Standardization Rarely Attempted for Transmission Towers

APPARENTLY basic differences in design and operating conditions prohibit any great amount of standardization in line-tower construction. This fact is clearly brought out in the article in this issue by H. L. Sharp, there being a considerable difference in the towers which this one company recently installed on several different lines. One element in the situation which influences variety of design is a desire to determine the relative merits of different designs in view of the lack of field data regarding the use of steel towers over long periods of time.

The transmission structures built in recent years have usually been required to satisfy only some general conditions. It seems to be the practice that double-circuit tangent towers, for example, should stand where two of the six conductors are broken, angle towers should not fail when more than two of the six conductors are broken or a corner load is placed on them, and dead-end or anchor towers should carry the load accompanying the dead-ending of all line wires or unusual corner loads. From the article it is evident that the line described has, for its tangent towers, flexible frames with no longitudinal strength, instead of "intermediate" towers, and that the semi-anchor towers are equivalent in loading to the tangent towers used in the usual line. This installation serves to illustrate the lack of agreement among engineers in regard to the broken-wire condition of loading. Indeed, there is considerable doubt whether the assumption that all wires may be broken, at a crossing for example, is not in conflict with the assumptions on which the tower lines are designed.

Another interesting feature of the design is the use of double-double insulators at railroad crossings. Some designers prefer the type of construction used at the semi-anchor towers, but it may be that either a railroad specification or mechanical necessities caused the installation of the double-double insulators. Moreover, the ground wires are described as made of double-galvanized, high-strength crucible steel cable, and since, presumably, they are of greater strength than the conductors, a question arises as to whether a lower grade of steel would not have been easier to handle in the field. It would also be interesting to get a definition of the term "double-galvanized," as differences of opinion on this subject exist among transmission line engineers.

While it is not always feasible to carry a design from one line for use on another, yet surely the detailed record of design and construction practices used on the Niagara, Lockport & Ontario system should prove very valuable to engineers working on lines in other territories.

### Successful Automatic-Plant Operation in New England

NEARLY a year's experience with automatic operation at the Searsburg hydro-electric plant of the New England Power Company lies back of the article by E. B. Collins published elsewhere in this issue, and it is gratifying to record the success of the installation from both the labor-saving and the reliability standpoint. The plant is one of the largest automatic generating stations in the country; it is situated on a stream of unusually interesting characteristics and development, and it forms a part of a system noted for skilled engineering and up-to-date operating methods. Searsburg has been running more than 90 per cent of the time since last summer. No important changes have been required in its electrical equipment and only minor alterations in its mechanical features.

It is interesting to note how some of the problems in design which confronted the company's engineers and those of the manufacturers have been worked out in this station to insure maximum convenience and reliability of operation. These were outlined by Messrs. Conger and Dow of the New England company in a paper presented before the 1921 fall convention of the New England Division of the N. E. L. A., and not a little ability in anticipating requirements was then manifested. Some attendance was necessary at the plant in the past winter on account of its remoteness from populous centers and because of rack clearing and other factors not directly governed by equipment design, but full automatic operation has been generally practiced, with time-clock and float control and loading according to predetermined settings of governing equipment. Instrumental readings have been telephoned to other points, and the cost of providing for their automatic transmission has not yet been thought warranted.

Governor regulation operates within a range of about one-half cycle above and below normal, but since it is desirable that Searsburg shall carry a fairly uniform load while in operation the governor is designed to do

somewhat less than its proportional share of regulating. The speed of gate opening is cushioned by a dash-pot mechanism, and in starting about two and one-half minutes is required to reach full gate opening. The plant is provided with a surge tank capable of taking care of disturbances when full load is dropped instantaneously or when there is an instantaneous load increase of 50 per cent. The dash-pot mechanism is adjustable for a five-minute maximum opening period. The co-ordination of gate operation and brake service appears to have been carefully worked out, and the use of strained water instead of oil in the latter is giving good results. Other features include provision for cutting off water from the scroll case for inspection, repairs or shutdown; arrangement for automatic stopping of the unit in case of overheated bearings or insufficient governor pressure, and means of operating the generator as a motor for power-factor correction if desired, although its remote location with respect to the system load center renders this a rare necessity. No attempt has been made to use automatic flashboards, but as the headworks are provided with a power-driven submerged floodgate, the work required in connection with flashboards is greatly reduced.

By and large, the installation appears to be giving an excellent account of itself and it is safe to say that, young as the art of automatic control is, its usefulness is being demonstrated in practical service with increasing emphasis. A plant of the rating and head illustrated by Searsburg shows that the possibilities of automatic operation will not long be confined to stations of a few thousand kilowatts if the general conditions are favorable to the use of this new but highly developed type of apparatus.

## How Good Public Relations Are Not Built

A STORY known as the "bedbug story" is going the rounds among after-dinner speakers which has a good moral for utility public relations men. A man encountered bedbugs in a sleeping car, so the story runs, and wrote a very indignant and scathing letter to the proper official. A kindly, courteous letter of apology, with an explanation that the occurrence was most unusual and that every precaution was taken against it, was received, which made the indignant passenger feel that there were some real people in the world after all. Then he discovered his original letter attached to the reply, and across it was written in blue pencil: "Send this guy the bedbug letter." The complainant's state of feeling can be imagined better than described.

The "bedbug letter" type of public relations work, which has only been hung on the sleeping car as a convenient vehicle, is the reason why some men make a failure of winning the public. Good public relations are built only on sympathetic feeling, an ability to understand the other fellow's problems and an earnest effort to prevent the incidents that build ill will. The "send this guy" attitude strikes a note of insincerity which, when discovered, makes existing ill will twice as bitter. Form letters, set rules for pacifying a complaining public and all such devices are a failure. Personal contact and efforts to correct bad situations mean endless work and sometimes drudgery, as well as the most rigid personal honesty, but they are the important factors in keeping on good terms with the public.

## Problems Yet to Be Solved in Carrier-Current Telephony

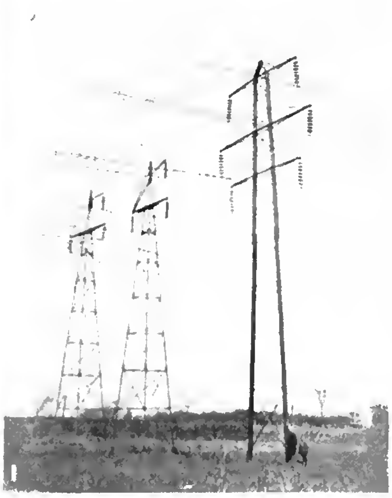
IN COMPARING experiences obtained with carrier-current telephony over power lines one should differentiate carefully between the operating conditions. Results do not depend alone on the sending and receiving sets. Line coupling, character of the power lines, number of branch circuits, neighboring exposures, condition of insulators, and any design or operating condition that will produce transients, will have their influence on performance. Thus, while some installations may be reported as "entirely successful" and others as less satisfactory, the blame should not be too quickly placed on the apparatus used.

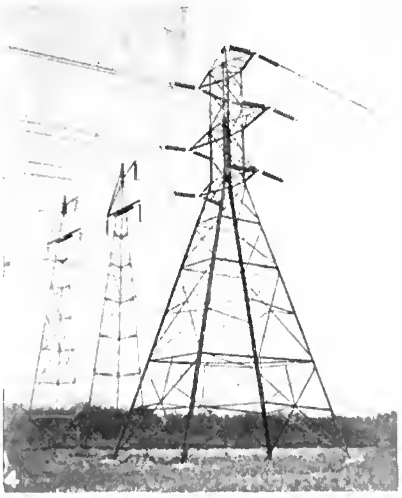
It was brought out in the description of the Baltimore-Holtwood installation in the ELECTRICAL WORLD for May 12 that the line coupling had to be changed several times before it was fairly satisfactory and is still not all that could be desired. Then, as pointed out in the discussion of the Duquesne Light Company's experience in the April 21 issue, there is the uncertainty of what determines the limits of the wave bands that are desirable for carrier-current communication. If resonant or impedance conditions are absorbing or choking the carrier current, the possible source of these obstacles must be known and fully understood in order to remove them. Another condition which arises in complicated transmission systems and affects communication is the cutting in or out of branch lines. Each line tap is known to have the effect of adding 15 or 20 miles to the length of transmission, and cables introduce still more complications. Harmonics inherent in the design of a system or disturbances caused by the charging of arresters or by "spitting" insulators, arcing grounds, switching and so forth are also factors which influence to no small degree the quality of carrier-current communication.

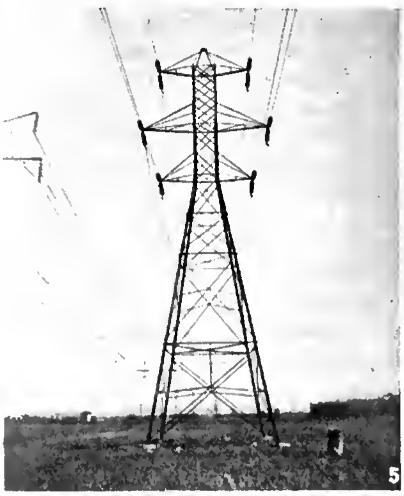
Despite all these difficulties, enough carrier-current installations are being made to afford a widespread field laboratory in which all the problems may be worked out if adequate records of performance and analyses are made. In seeking to overcome existing difficulties, however, it will be well to keep in mind the advisability of developing equipment for duplex operation. If this is not done, the user who is accustomed to the ordinary telephone may become confused in an emergency if he has to operate a button to allow two-way conversation. Another great advantage of wired telephones that must not be overlooked in developing the carrier-current telephone is that any patrolman can connect a portable instrument to the telephone line at any point. Some substitute arrangement that can be used with carrier-current telephony without too great expense must be worked out.

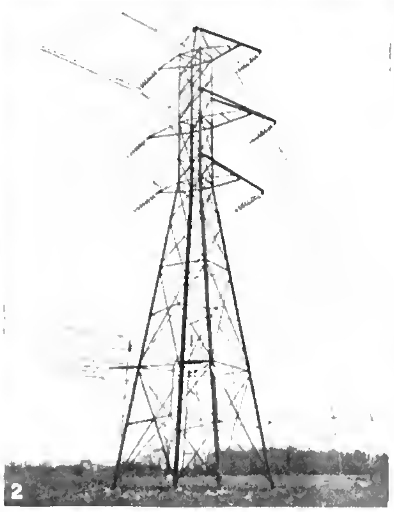
With full recognition of most of the difficulties and without any immediate prospects of profit in view, manufacturers are to be congratulated on their broad viewpoint in carrying on the work they are doing. They deserve every bit of support that operating companies can give them in solving the problems which still have to be faced before carrier-current telephony can be relied upon in emergencies. From the work that is now going on it is quite evident that operating companies foresee the possible benefit to themselves which will accrue from establishing a reliable means of communication in emergencies and that this support will be forthcoming without any pleading.

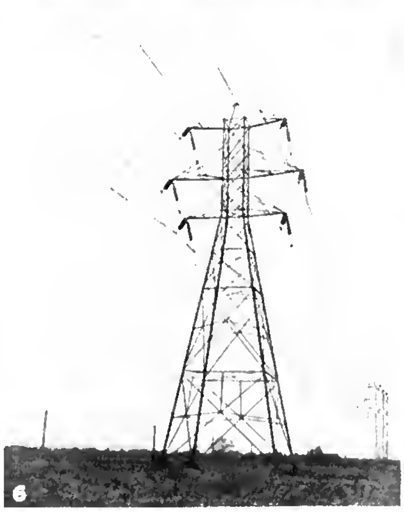
# Steel Towers for New Line

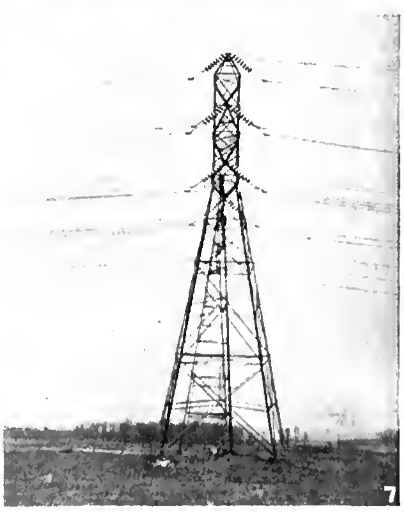


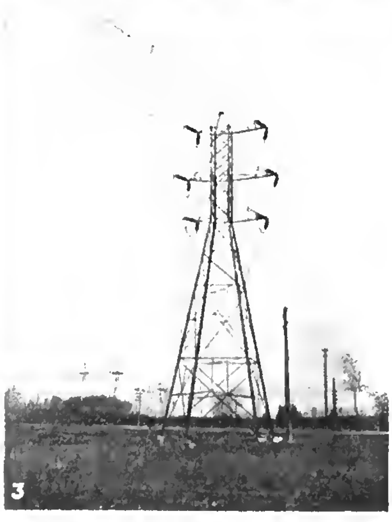


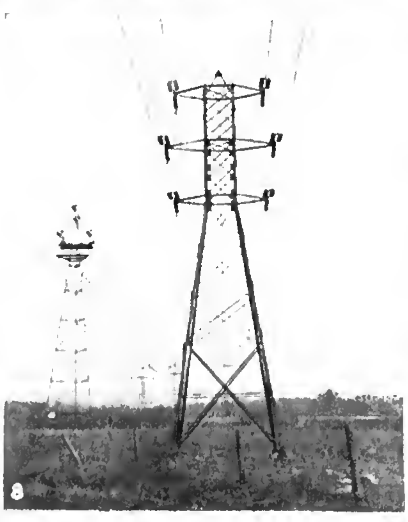


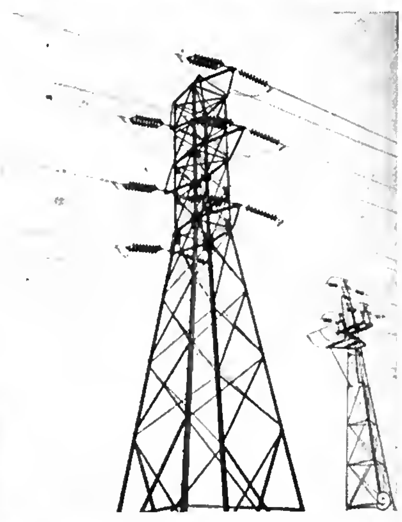













TYPICAL examples of the steel towers used on a 45-mile, 110,000-volt, double-circuit steel-tower line installed by the Niagara, Lockport & Ontario Power Company. A wind pressure of 13 lb. per sq.ft. on one and one-half times the projected area was assumed and a factor of safety of three was adopted. A double-galvanized extra-strength steel ground wire was used and a double-double insulator construction for crossings. Flexible towers are used for tangent lines and up to a 3-deg. angle. No. 1—Flexible tower type. No. 2—Thirty-degree angle tower. No. 3—Sixty-degree angle tower. Nos. 4 and 5—Dead-end towers. Nos. 6 and 7—Semi-anchor towers. Nos. 8 and 9—Railroad crossing towers.

# Double-Circuit Tower Construction

## Specifications, Design Details and Costs on New Steel-Tower Construction for 110,000-Volt Line—Foundation Arrangements and Methods for Installing Towers Discussed

By H. L. SHARP
*Engineering Department, Niagara, Lockport & Ontario Power Company*

STEEL-TOWER transmission lines offer opportunity for a great deal of engineering skill in design and installation. The type of structure is such that design formulas are difficult to use, and the variation in requirements for installation brought about by terrain conditions all add to the economic difficulty of satisfying requirements.

During the last year about 45 miles of new double-circuit steel-tower lines was erected in western New York as a part of the high-voltage system of the Niagara, Lockport & Ontario Power Company. This construction consists of two separate lines, one paralleling existing lines on right-of-way which the power company already owned and the other on an entirely new right-of-way which was recently purchased and on which no other lines existed. These lines were designed and built for 110,000-volt operation, but for the present they are being operated at 60,000 volts.

### Tower Types and Loading Specifications

The towers on these lines consist of several types. They were designed to sustain, with a factor of safety of three based on the ultimate strength, the loading given in Table I, together with their own weight and wind pressure of 13 lb. per square foot on one and one-half times the projected area of the steelwork.

The tower tops are provided with three cross-arms, so that the three conductors of one circuit are on one side of the tower and the three conductors of the other circuit on the opposite side of the tower. The top and bottom cross-arms are approximately 18 ft. long and the middle cross-arm is approximately 24 ft. long. Thus the wires on the middle cross-arm are 3 ft. beyond the vertical line through the other wires. The purpose of this arrangement is to reduce the chances for line trouble due to wire contacts with unequal ice loading on the various wires or other conditions which produce unequal sags in the wires.

These cross-arm lengths were determined by the insulation requirements. On all towers the clearance between the nearest live part and the steelwork of the tower, when the insulator string is in its normal position, is not less than 40 in. This refers to the distance between the end of the suspension clamp and the cross-arm or brace below the wire when the insulator string is vertical, or if there is an angle in the line so that the insulator string is deflected from the vertical, then it refers to the side of the tower or any other steelwork. When the suspension insulator string is momentarily deflected by wind to an angle of 45 deg. with the vertical, the clearance between nearest live parts and steelwork is not less than 36 in. The length of the insulator string from the surface which supports the insulator hook to the end of the cable clamp is 53 in.

On dead-end and 60-deg. angle towers the conductor loops between the strain clamps have a normal clearance of 44 in. to steelwork in all directions. This allows a slight swaying motion of the loop without reducing the clearance below the minimum specified value of 36 in. The 60-deg.-angle towers have cross-arms longer on one side of the tower than is the case on straight-line dead-end towers in order to maintain the loop clearances under all conditions.

The tower heights were determined by the condition that the distance from the surface of the ground to the lowest conductor should not be less than 25 ft. with maximum sag in the conductor. Thus the distance from the ground to the lowest cross-arm for level ground is 25 ft. plus maximum sag plus length of suspension insulator string. For strain towers the length of insulator string is not included. In order to maintain the desired clearances over uneven ground suitable extensions are provided for the various types of towers. These are added to the lower portion of the towers. Over highways the minimum clearance of 30 ft. is maintained.

TABLE I—LOADING FOR TOWER DESIGN

| | Power Wires | | | Ground Wire | | | Each Telephone Wire | | |
|---|---|---|---|---|---|---|---|---|---|
| Tower Type | Parallel-Line Load, Lb. | Cross-Line Load, Lb. | Vertical Load, Lb. | Parallel-Line Load, Lb. | Cross-Line Load, Lb | Vertical Load, Lb. | Parallel-Line Load, Lb | Cross-Line Load, Lb. | Vertical Load, Lb. |
| Flexible | 0 | 700 | 1,400 | 0 | 600 | 550 | 0 | 600 | 550 |
| Dead-end | *6,500 | 700 | 1,400 | 5 500 | 600 | 550 | 2,000 | 600 | 550 |
| Semi-anchor | †6,500 | 700 | 1,400 | †5,500 | 600 | 550 | 0 | 600 | 550 |
| 30-deg. angle | 0 | 700 | 1,400 | 0 | 600 | 550 | 0 | 600 | 550 |
| 60-deg. angla | *6,500 | 700 | 1,400 | 5,500 | 600 | 550 | 2,000 | 600 | 550 |

* Tower to austain unbalanced head pull of 6,500 lb. on all power wires.
† Semi-anchor tower is to austain the unbalanced head pull due to any two broken wires.

### Tower Types and Locations

On the right-of-way where the new line parallels the two existing 60,000-volt lines the new towers were erected opposite the towers on the old lines and at such a distance from the nearer line that the nearest adjacent wires are 15 ft. apart under normal conditions.

On the new right-of-way which was recently purchased in fee, there were no existing transmission lines to influence the location of the new towers. This right-of-way is 50 ft. wide and the towers are erected on a center line which is 20 ft. from one edge and 30 ft. from the other edge.

The location of the towers of the various types was determined as follows:

*Flexible Towers.*—Flexible towers are installed on straight portions of the line and on deflection angles up to 3 deg. On new right-of-way where no parallel line exists the normal spans are 600 ft. The anchors for

these towers consist of steel members buried in the earth without concrete. In order to provide a secure anchorage before the earth backfill has had time to become thoroughly compacted, this steelwork is installed according to Fig. 1, where the ground is suitable. This method provides a solid wall for the anchor legs to resist wind loads from either side and a considerable volume of undisturbed earth to resist uplift. The planks in the bottom of this footing help materially during the first year or two. The ground is not always such that straight walls can be cut or such that undercutting is possible. In that case the anchor is installed without undercutting the earth, and the earth is backfilled over the footing in the usual manner. In wet ground concrete is placed around the footing as shown in Fig. 2. Where solid rock is encountered the footings are installed according to Fig 3. If the rock is not perfectly solid, but has seams or is of a soft character, it is removed by blasting or otherwise so that a normal earth footing can be installed.

*Thirty-Degree-Angle Towers.*—These are square-base towers which are used with a single string of suspension insulators for each wire to support deflections in the line of 3 deg to 30 deg. Special cross-arms are used so that sufficient clearance is maintained between live parts and steelwork when the insulator strings are held in an oblique position due to the angle in the line. On angles up to 15 deg. earth footings are used, and on angles from 15 deg. to 30 deg. concrete footings are used.

*Sixty-Degree-Angle Towers.*—These are square-base towers which are used to support deflections in the line of 30 deg. to 60 deg. They serve the purpose of dead-end towers as well as angle towers. Insulators on these towers are used in the strain position. The cross-arms are unsymmetrical about the center line of the tower in order to maintain the necessary clearance between the conductor loop and the side of the tower. These towers have concrete footings.

*Dead-End Towers.*—Dead-end towers are erected approximately every two miles. They are suitable for dead-ending all wires under maximum loading conditions. Concrete foundations are used. In order to reduce the amount of concrete in the foundations necessary to sustain the overturning effect of the dead-end cables the bases of these towers were made 30 ft. long

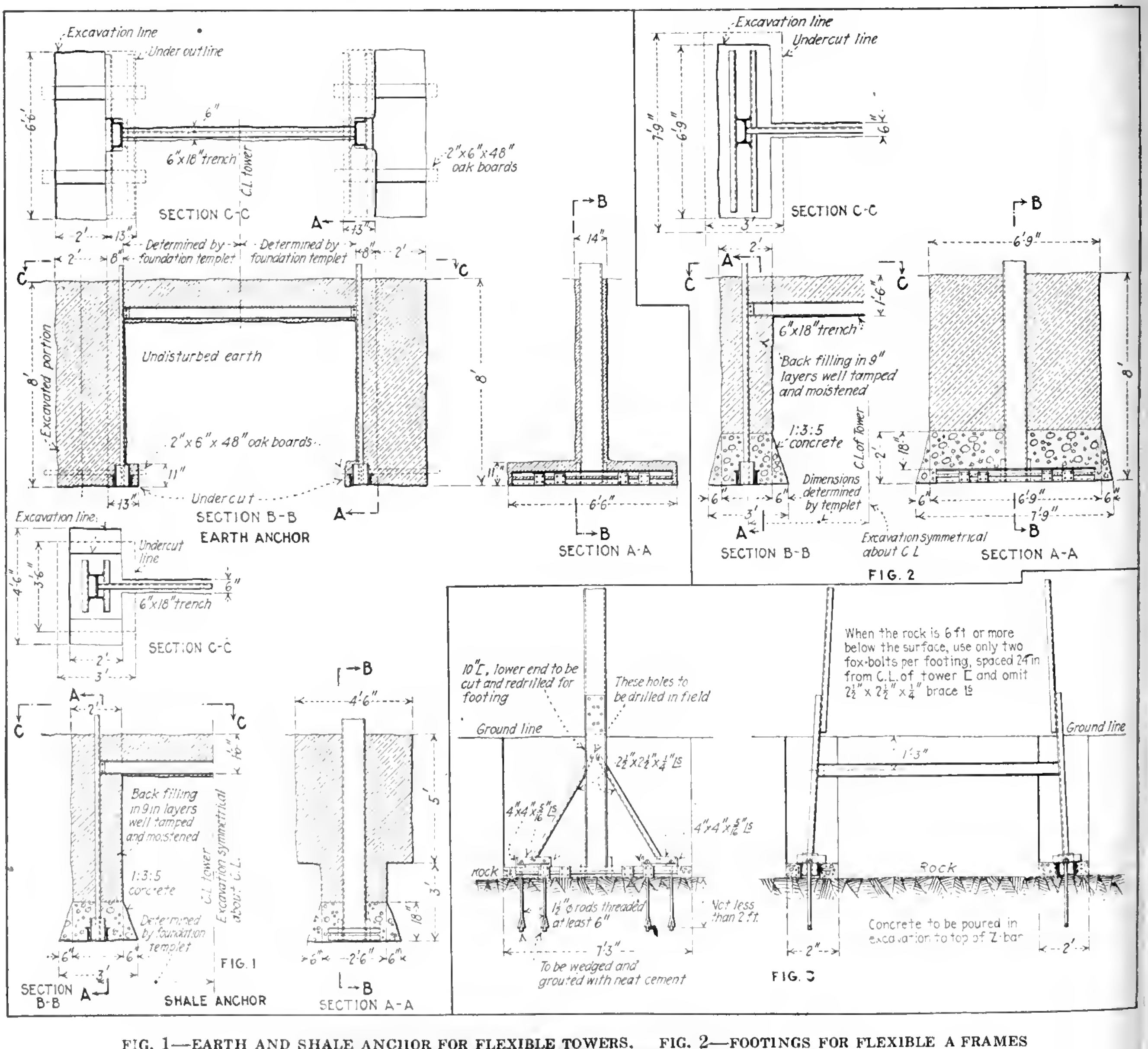



FIG. 1—EARTH AND SHALE ANCHOR FOR FLEXIBLE TOWERS. FIG. 2—FOOTINGS FOR FLEXIBLE A FRAMES IN WET GROUND. FIG. 3—ROCK FOOTINGS FOR FLEXIBLE TOWERS

in the direction of the line and 18 ft. wide across the line.

*Semi-Anchor Towers.*—Semi-anchor towers were installed so that two of them are at approximately equal intervals between dead-end towers; thus if dead-end towers are two miles apart a semi-anchor tower would be located two-thirds of a mile from each dead-end. Semi-anchor towers are designed to sustain the unbalanced load of any two broken wires. In good ground the footings are installed without concrete. If the ground is wet or otherwise unsuitable for earth footings concrete is added to give greater stability.

*Railroad Crossing Towers.*—Railroad crossing towers were of special design to meet the railroad companies' specifications. These towers are shown in the illustrations on page 1132.

The foundation members for all towers are held in place during installation by means of steel templets so designed as to hold the main members of the foundation in their proper relative positions.

### Insulators Are Standardized

On flexible, semi-anchor and 30-deg.-angle towers the insulator strings consist of seven units. On semi-anchor towers two insulator strings are used to support each conductor, the strings being arranged at 45 deg. to the vertical in the direction of the line. The conductor passes straight through as on a suspension tower and does not have a loop between clamps as on a dead-end tower. Long, flat steel links are used between the semi-anchor cable clamps and the insulators in order to place the conductors the same distance below the cross-arms as on the flexible towers. On dead-end and 60-deg.-angle towers the strain insulator strings consist of nine units. At railroad crossings double strings of nine units assembled in parallel, with steel yokes at each end, are used on the crossing spans.

TABLE 11—AVERAGE COSTS PER MILE FOR LABOR AND MATERIAL

*A*—Length of line, 14 5 miles; conductors, six 400,000-circ.mil copper; ground wire, one $\frac{1}{2}$-in. crucible steel; normal spans, 550 ft.

*B*—Length of line, 28.8 miles; conductors, six No. 4/0; A.C.S.R.; ground wire, one $\frac{3}{8}$-in. crucible steel; normal spans, 600 ft.

| | *A*—Cost per Mile | | | *B*—Cost per Mile | | |
|---|---|---|---|---|---|---|
| | Labor | Material | Total | Labor | Material | Total |
| Conductors, ground wire, insulators and hardware | $1,090 | $7,400 | $8,490 | $660 | $3,580 | $4,240 |
| Towers and foundations.. | 2,085 | 2,270 | 4,355 | 2,420 | 2,060 | 4,480 |
| Total................ | $3,175 | $9,670 | $12,845 | $3,080 | $5,640 | $8,720 |

### Use Galvanized Ground Wire

On one of the lines the conductors are 400,000-circ.mil medium-hard-drawn copper. They are strung with such sags that the maximum tension will be 6,000 lb. at 0 deg. F. with ice coating $\frac{1}{2}$ in. thick all around the cable and wind pressure of 8 lb. per square foot on the projected area of the ice-coated cable. Similarly the $\frac{1}{2}$-in. double-galvanized, high-strength crucible-steel ground wire will have a maximum tension of 5,500 lb. under the same conditions.

On the other line the conductors are No. 4/0 aluminum cables steel-reinforced. The maximum tension under conditions given above will be 4,000 lb. Similarly the $\frac{3}{8}$-in. double-galvanized, high-strength crucible-steel ground wire will have a maximum tension of 5,500 lb.

The ground wires are spliced by means of special copper McIntyre sleeves heavily tinned on the inside.

Some changes have been made in various features of tower designs and specifications for future lines of the same general type as described above. There will be under construction during the coming year about 175 miles of lines of this character. The principal modifications from the construction described consist in the use of structural-steel anchors for all towers except railroad-crossing towers and in the limitation of 5,000 lb. as maximum cable tension in the conductors instead of the 6,500 lb. in the original specifications.

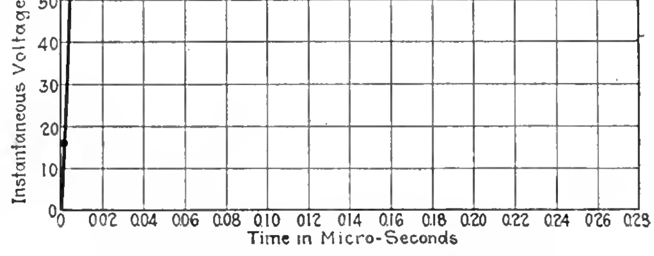
# Production of Lightning Voltage and Its Significance

## Impulse Generator Develops Voltage at the Rate of Fifty Million Million Volts per Second—Hazard of Omitting Shields

By F. W. Peek, Jr.
Consulting Engineer General Electric Company

In studying the effects of lightning on transmission lines and such apparatus as transformers, lightning arresters and so forth it is important to be able to produce lightning voltages in the laboratory closely approximating those occurring in practice.

An investigation of the lightning voltages induced on transmission lines has shown that during any storm many discharges take place on gaps set for lower voltages. The discharges become less and less frequent for the higher settings, and finally very few are found that exceed about 400 kv. However, higher voltages do occur occasionally. Another check on the voltage is the fact that insulator strings of seven or eight units rarely flash over during lightning storms. Lightning voltages or impulses are known to be of very steep wave front,




RATE AT WHICH THE VOLTAGE IS APPLIED BY IMPULSE GENERATOR

which has the effect of increasing the voltages across an insulator or other apparatus at the rate of millions of volts per second.

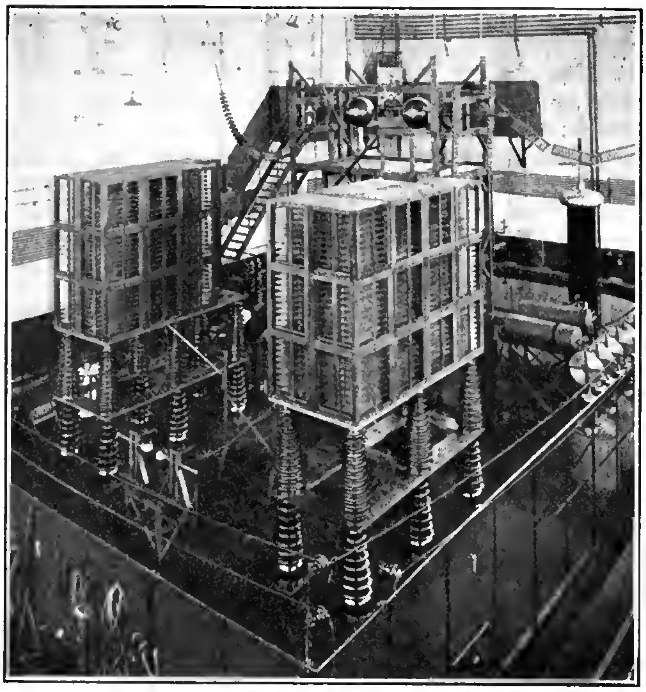
A few years ago a 200-kv. impulse or lightning generator was built to give lightning voltages of predetermined characteristics.* The time lag of various gaps was carefully measured and the term "impulse ratio"

*Peek, F. W., Jr., "The Effect of Transient Voltages on Dielectrics." *Transactions A. I. E. E.*, 1915, Vol. 34, page 1857.

resulted. This generator has been added to from time to time as higher exciting voltages have become available.

An increase to almost 750 kv. was made in 1916, while within the last year an increase to approximately two million volts has been made. It is not the intention to give details of the apparatus here, since these data as well as a description of the method of measuring voltage may be obtained from the paper mentioned above.

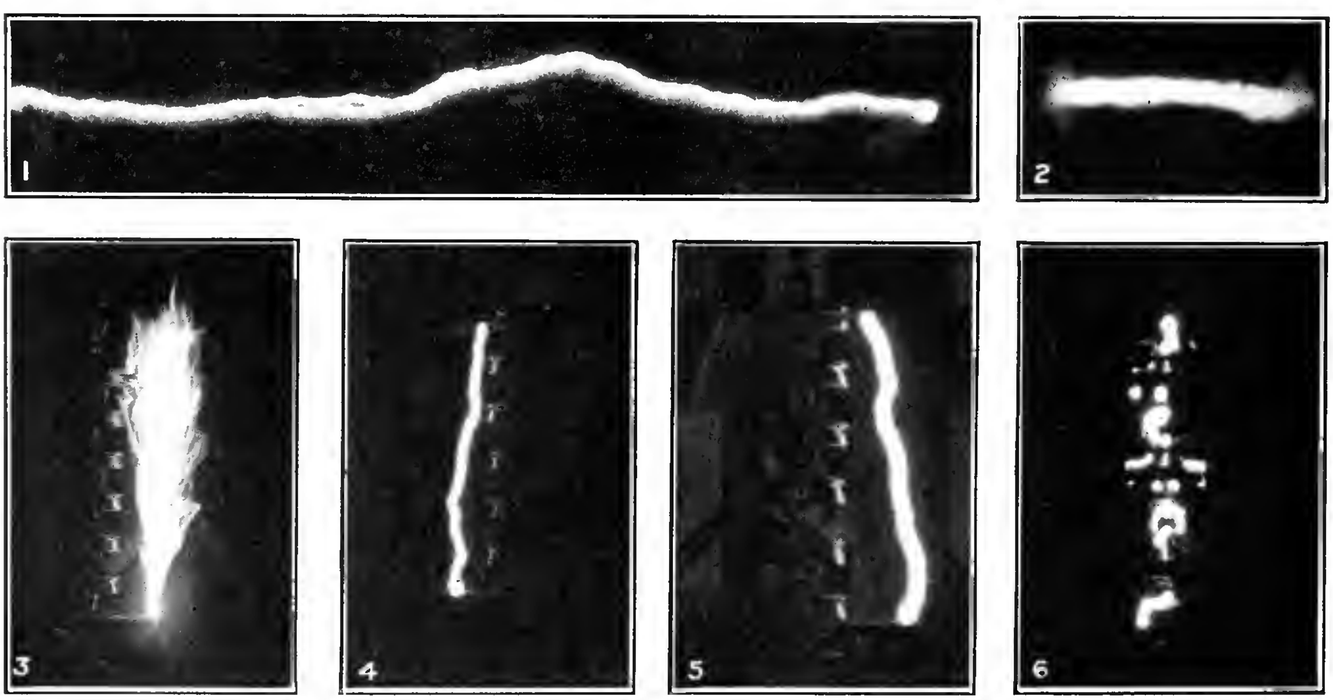
Briefly, the voltage is obtained by charging a large condenser to the desired voltage and discharging it through a known inductance and resistance. The result is a single lightning impulse of great power. In the lightning tests described in this article the voltages were applied at the rate of fifty million million volts per second. The power may be of the order of millions of kilowatts. The time of application is conveniently measured in micro-seconds (millionths of a second).



GENERAL CONSTRUCTION OF 2,000,000-VOLT IMPULSE GENERATOR

This type of discharge must not be confused with the high frequency obtained from an oscillator. In the lightning generator the discharge of energy is so rapid that the resultant spark is "explosive," and accompanied with a loud sharp report or crack.

Practical investigations similar to these illustrated are being carried on. Space will not permit details, but a few may be mentioned such as the propagation of lightning on transmission lines, protective value of lightning arresters, effect on insulations, value of ground wires, choke coils, etc. The generator is also of great value in theoretical work. It will permit the use of high energy discharges for studying steady and transient conditions on systems or equipment embodying new principles. Thus a new and exceedingly useful tool has been put at the disposal of the research worker which is bound to find ever-increasing applications of value.



TYPICAL DISCHARGES FROM THE IMPULSE GENERATOR. LOWER VIEWS SHOW FLASHOVERS ON INSULATORS

No. 1 — Million-and-a-half-volt lightning spark between needle points. Note that the discharge takes a zigzag path very similar to that of lightning.

No. 2—Lightning spark between spheres —the arc is about 3 in. in diameter; the current in the arc approximately 10,000 amp.

No. 3—Dry 60-cycle sparkover of a shielded insulator string. It is very important to know if lightning voltages will clear the string in the same way. Heretofore impulse voltages sufficiently high to spark over a string have not been available. Fig. 4 gives the desired information.

No. 4—1,200,000-volt stroke on dry shielded insulator string. The impulse goes to the shield and clears the string. This test was made in the dark. The photograph of the insulators was due to the spark lasting less than a millionth of a second. A still more important photograph is that shown in Fig. 5.

No. 5—1,200,000-volt stroke on shielded insulator string during heavy rain. The lightning spark clears the string in a heavy rain. The shield does not reduce the lightning sparkover voltages; neither does the rain. The display in the wet test is due to the reflection on the raindrops. Since the light producing this photograph lasted less than a millionth of a second, the illuminated drops appear stationary in space.

No. 6—Lightning sparkover (1,200,000 volts) of a dry non-shielded string. This is an undesirable condition since the skirts may be ripped off.

# Superpower Survey of Pacific Northwest

### Engineering Investigators Find that Existing Interconnected Power Systems Will, Through Natural Expansion, Prove Adequate for Many Years to the Needs of That Part of the Country

THE report of the engineers who, as representatives of various engineering organiations and chambers of commerce of Washington, Oregon and Idaho, undertook a two-year survey of electrical development in those states with reference to the desirability of a superpower system for the Pacific Northwest does not advocate taking any present steps in such a direction. As was stated in the ELECTRICAL WORLD of April 14, immediately after the report was made public, the engineers who made the survey are of the opinion that the vast and already interconnected systems of this great district will be sufficient, through natural expansion, to take care of future growth for many years to come without the need of developing a superpower system from which they would all alike derive energy.

The great water-power possibilities of the Pacific Northwest, says the report, and their relation to its general development can hardly be overestimated. In other parts of the United States the limitations of water-power development are being sensibly approached, because the cost of power from many undeveloped sources would be so great that it would not compare favorably with the cost of power produced by fuel. The Pacific Northwest is subject to no such limitation, and the abundance and reliability of its water powers is a vital factor in its commercial, agricultural and industrial expansion, which as yet has hardly begun.

In the early days of power generation, the report continues, interruption of service was a serious factor. With the growth of the power business this factor has become greatly minimized through interconnection of individual systems and the establishment of a network of transmission lines of sufficient capacity to perform emergency service in case of a local breakdown. It is these networks of lines of varied capacity which have permitted a division of the entire field considered into five groups. Within each group every reasonable precaution is being taken to avoid interruption of service. The assurance that now exists against such interruption would not be materially enhanced by the construction of superpower lines.

## EQUALITY OF EXISTING RATES AND CONDITIONS

General competitive conditions have brought reasonable equality in rates in the Pacific Northwest, the report continues. So far as any differences exist, they could not be eliminated by the construction of superpower lines, because the burden of their cost would fall upon the groups least favorably situated in this respect and would be reflected in the cost of the power delivered. A resultant lowering of rates in any one group, therefore, could be expected only if the difference in cost of group production were sufficiently great to exceed by a considerable amount the cost of providing superpower lines. This is not the case in any one instance. There is, however, an advantage in the exchange of power between groups in minor quantities which explains the construction now proceeding in various directions of group connections by ordinary transmission lines of moderate capacity such as do not come in the class of superpower lines.

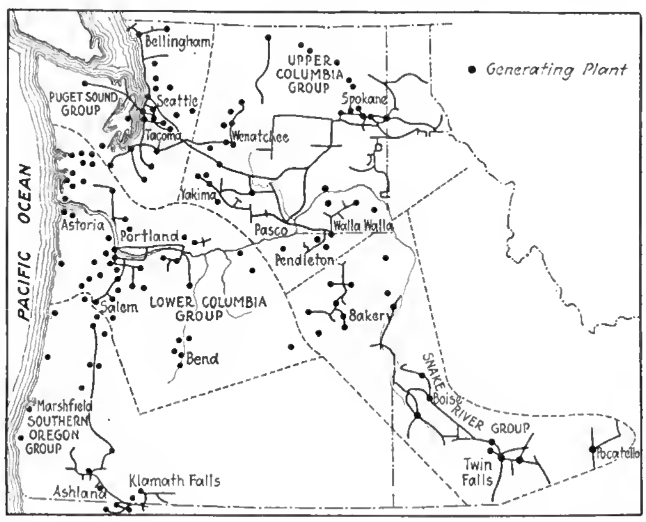



FIG. 1—GENERATING PLANTS AND TRANSMISSION SYSTEMS OF THE PACIFIC NORTHWEST AS OF MAY 1, 1923

A general benefit from superpower lines might be realized in all groups in case a seasonal excess of available hydro-electric power over market requirements in one or more groups coincided with a shortage in other groups, thus permitting wholesale seasonal interchange and resulting in an improved load factor for all. Climatic conditions in all groups so far as they control stream flow and seasonal excess over primary or all-year power are, however, in the main alike. There are some differences as to times when floods occur east and west of the Cascade Mountains, but these are differences of a minor character and are not such as to require or permit a large exchange of power were superpower lines built.

To those familiar with Northwestern power conditions it has long been apparent that the most valid

TABLE I—AVERAGE LOAD CONDITIONS BY GROUPS—1921

| Group | Average Load, Kw. | Peak Load, Kw. | Annual Load Factor, Per Cent |
|---|---|---|---|
| Puget Sound | 68,000 | 156,000 | 44 |
| Lower Columbia | 50,000 | 92,000 | 54 |
| Southern Oregon | 17,000 | 25,000 | 68 |
| Upper Columbia | 51,000 | 82,000 | 62 |
| Snake River | 24,000 | 37,000 | 65 |
| All groups | 210,000 | 392,000 | 54 |

TABLE II—TOTAL POWER GENERATED—1921

| Group | —Power Generated—Kilowatt-Hours— Steam | Hydro | Total | Steam Percentage Of Total |
|---|---|---|---|---|
| Puget Sound | 30,493,000 | 561,534,000 | 592,027,000 | 5.2 |
| Lower Columbia | 73,410,000 | 360,416,000 | 433,826,000 | 16.8 |
| Southern Oregon | 11,350,000 | 152,020,000 | 163,370,000 | 6.9 |
| Upper Columbia | 61,000 | 443,838,000 | 443,899,000 | .015 |
| Snake River | 1,260,000 | 202,018,000 | 203,278,000 | 1.6 |
| All groups | 116,574,000 | 1,719,826,000 | 1,836,400,000 | 6.3 |

reason for considering superpower connection at all must be sought in the variation throughout the year of power demands as compared with hydro-electric power supply, and it was this phase of the subject which received most careful consideration. The group load factors are, on the whole, favorable, and they can and will undoubtedly be improved by hydro-electric development within each group and by the use of storage. Superpower connection is not believed to be necessary for this purpose.

The question was considered whether in the future the number of possible power developments may not be reached in one group long before it is reached in other groups and whether at such a time a superpower connection may not be warranted or even essential to assure healthy expansion in all the groups. The investigators hold that water-power possibilities are so abundant and so evenly distributed over the entire territory, and that

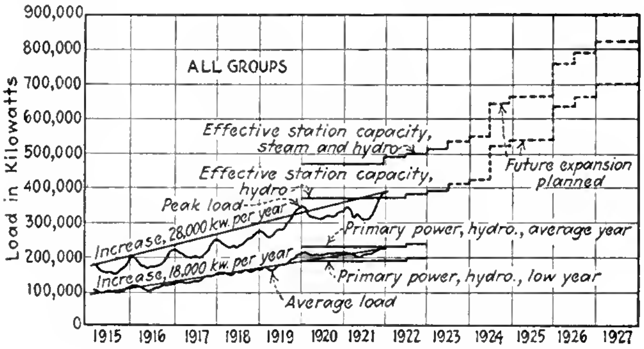



FIG. 2—DEVELOPMENT STEPS, PROVIDING FOR FUTURE EXPANSION, ARE DEFINITELY PLANNED FOR PACIFIC NORTHWEST

there is in each group such an enormous excess available that a group shortage of supply lies too far in the future to require consideration at the present time.

Fig. 2 gives the average load and the maximum load per month (one month) and the provisions planned to meet future demands of the entire Northwest. The terms which are used in Fig. 2 have the following significance:

"Effective station capacity" is the capacity of generation of the installed equipment in kilowatts. It is usually the capacity of the generators for a continuous run of one hour as limited by turbines or boilers, or the generators themselves, but not by water supply.

"Primary power, average year," is the effective station capacity of hydro-electric plants as limited by water supply during the average water year.

"Primary power, low year," is the effective station capacity of hydro-electric plants as limited by water supply during a low-water year.

The total average rate of generation in 1921 for all groups was 210,000 kw. and the peak load was 392,000 kw., giving an annual load factor of 54 per cent.

The committee's carefully studied conclusions are summarized in its report.

TABLE III—SUMMARY OF RATE OF GROWTH IN POWER DEMAND

| Group | Period | —Increase per Year, Kw.— Average Load | Peak Load |
|---|---|---|---|
| Puget Sound | 1915–1921 | 5,700 | 12,400 |
| Lower Columbia | 1915–1921 | 4,000 | 5,700 |
| Southern Oregon | 1915–1918 | 400 | 400 |
| Southern Oregon | 1919–1921 | 2,200 | 2,200 |
| Upper Columbia | 1915–1918 | 1,500 | 2,500 |
| Upper Columbia | 1919–1921 | 5,000 | 5,000 |
| Snake River | 1915–1921 | 2,500 | 2,800 |
| All groups | 1915–1921 | 18,000 | 28,000 |

"1. There is a healthy increase of power demand in all groups.

"2. Adequate provisions are under way in all groups to keep ahead of the estimated growing demand by the construction of hydro-electric plants and water storage. In the groups where steam power production is now an important element plans provide for reduction of the proportionate amount of power supplied by steam.

"3. The characteristics of the power load of each group are much the same, the maximum load occurring in the fall and winter, except in the Snake River group, where irrigation pumping produces a summer peak.

"4. The need of group connection by superpower lines is at present not sufficiently great to justify the expense even in the case of a line between the Snake River and Upper Columbia groups, where the advantage would be greatest.

"5. The power which can be economically exchanged between the several groups can be carried over ordinary transmission lines already built or likely to be built in the future.

"6. Existing networks of power systems will, through natural expansion, become more closely interconnected, but superpower lines are not likely to be needed unless economical development in one group reaches its limit while great excess of power exists in other groups. Such a condition is not likely to obtain for many years.

"7. Future large hydro-electric power development, in addition to that provided by existing systems normally expanding, is dependent upon the introduction of commercially feasible agricultural or industrial enterprises requiring large amounts of power.

"8. Such power development is of the highest importance to the Northwest. If wisely undertaken, it will come as a result of newly created markets, will tend to benefit other public utilities and stabilize rates, but will not in itself require superpower connection.

"9. Thirty-eight per cent of the water-power possibilities in the United States are situated in the area under discussion. The development work up to the present time has in the main been consistently carried along without unnecessary duplication. The expense of superpower construction, which must be incurred in other regions to save fuel or to equalize unbalanced power conditions, can be avoided for a long time in the Pacific Northwest. Superpower lines may, however, become of importance at an early date to carry power from our abundance to less favored regions to the south and east."

TABLE IV—PROBABLE EFFECTIVE STATION CAPACITY

| Group | Peak Load 1921 | Probable Future Effective Station Hydro and Steam Capacity in Thousands of Kilowatts at End of Year 1923 | 1924 | 1925 | 1926 | 1927 |
|---|---|---|---|---|---|---|
| Puget Sound | 156 | 192 | 248 | 248 | 332 | 332 |
| Lower Columbia | 92 | 115 | 154 | 154 | 179 | 204 |
| Southern Oregon | 25 | 33 | 33 | 43 | 45 | 45 |
| Upper Columbia | 82 | 135 | 143 | 143 | 156 | 156 |
| Snake River | 37 | 54 | 54 | 63 | 63 | 74 |
| All groups | 392 | 529 | 632 | 651 | 775 | 811 |

TABLE V—TOTAL RATING OF PLANTS IN OPERATION MAY 1, 1923

| Group | Number of Operating Companies | Number of Generating Plants | Installed Generator Rating in Hp. Steam Plants | Hydro Plants |
|---|---|---|---|---|
| Puget Sound | 12 | 24 | 102,560 | 202,250 |
| Lower Columbia | 28 | 50 | 81,500 | 109,600 |
| Southern Oregon | 12 | 20 | 12,570 | 58,290 |
| Upper Columbia | 20 | 34 | 9,940 | 198,690 |
| Snake River | 6 | 18 | 700 | 79,900 |
| All groups | 78 | 146 | 207,270 | 648,730 |

# Economies of Complete Electrification in Large Buildings

## In Closing Down Private Plants Auxiliary Steam Equipment Should Be Electrified to Afford Maximum Saving to Customer—This May Exceed All Other Loads—Value of Exhaust Steam Overestimated

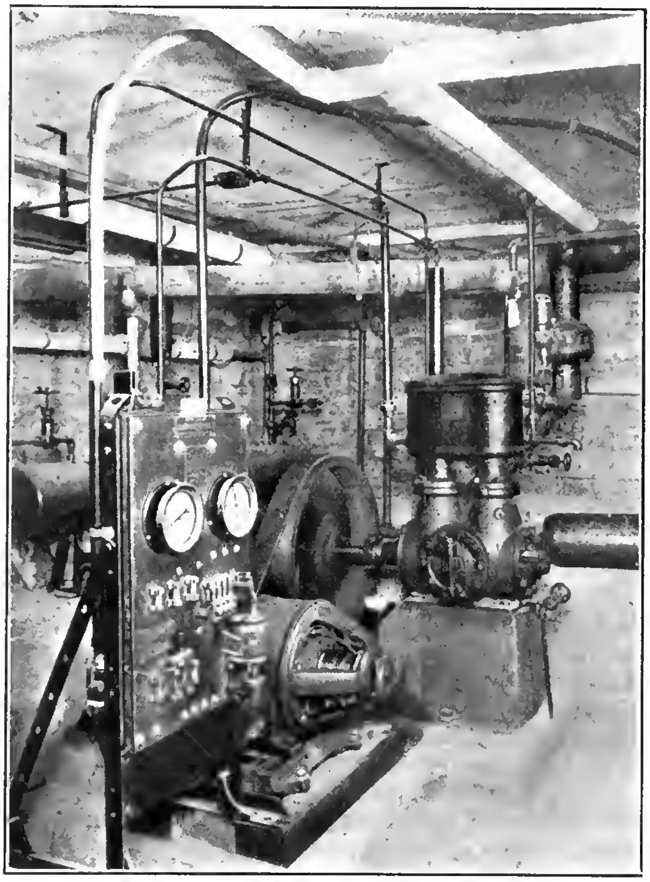
By W. H. WHITTON
*New York Edison Company*

A PRODUCTIVE field for extending the use of electricity, much to the advantage of both the supplying company and the consumer, exists in many large buildings which still have extensive equipments of steam apparatus, even though central-station service is used for other purposes. This condition is most commonly found where private generating plants have been superseded by purchased power, the substitution being unaccompanied, however, by any change to the attendant steam equipment.

It has been the experience of one large central-station company that a building which thus uses street service for its electrical requirements and at the same time produces steam for power to operate other equipment is run at needlessly great expense. The reason of this seems fairly obvious. Of the entire equipment of steam machinery found in the modern isolated plant, the engine-generators are usually by far the most efficient, and their discontinuance and the retention of other steam apparatus leaves in service the part of the equipment that not only is the most wasteful but that demands the greatest degree of attention.

The abandonment of generating units only, leaving other steam apparatus, such as elevators, pumps, compressors and auxiliary equipment, to be supplied from the building's boilers, usually has little effect, and sometimes none, on certain important items of expense, even though others are substantially reduced. Governed by local conditions, these reductions may or may not be sufficient to pay for the purchase of the electricity formerly generated locally, but it has been observed that the results are not nearly so satisfactory as where complete electrification is carried out, permitting wide-reaching economies in all directions. The fuel savings exceed those of the less complete change by much more than is represented merely by the former requirements of the steam machinery, the wastages in steam piping, traps and so forth in many plants with steam auxiliaries reaching as high as from 20 per cent to 25 per cent of the entire fuel consumption. The greater part of these wastages can by proper measures be eliminated.

From the central-station point of view, the complete electrification, as compared with the generator abandonment alone, presents very great advantages. It not only tends to add greatly to the satisfaction of the customer, but the income to the central station company is in many instances increased by a very material percentage, the exact amount, of course, depending on the extent of the former steam equipment. In hotels, where the changes from steam to electric drive may include elevators, house pumps, boiler-feed pumps, refrigerating machinery, brine pumps, air compressors, blowers, sump pumps, circulating pumps and kitchen machinery, the newly created electrical requirements may even exceed those formerly existing; that is, the consumption of electricity may be more than doubled.



ELECTRICALLY OPERATED REFRIGERATING MACHINE

TABLE I—CONSUMPTION OF ELECTRIFIED HOTEL EQUIPMENT AND ELECTRO-HYDRAULIC ELEVATORS

| | Kw.-Hr. One Year | Percentage of Total |
|---|---|---|
| Elevator pumps | 287,210 | 32.7 |
| House pumps | 66,925 | 7.7 |
| Boiler-feed pumps | 4,565 | .5 |
| Sump pumps | 1,344 | .2 |
| Refrigerating machine | 154,390 | 17.6 |
| Brine pumps | 56,206 | 6.4 |
| Light and miscellaneous | 306,400 | 34.9 |
| Total | 877,040 | 100.0 |

This is illustrated in Table I, which is an analysis of the electrical usages in a hotel in which the generators were shut down, electric pumps were installed to operate the hydraulic elevators, and electric machines substituted for the remainder of the steam apparatus.

TABLE II—CONSUMPTION OF ELECTRIFIED HOTEL EQUIPMENT AND STRAIGHT ELECTRIC ELEVATORS

| | Kw.-Hr. One Year | Percentage of Total |
|---|---|---|
| Elevator (passenger) | 10,456 | 4.5 |
| Elevator (passenger) | 11,933 | 5.2 |
| Elevator (freight) | 5,568 | 2.4 |
| House pumps | 2,878 | 1.3 |
| Refrigerating machine | 63,350 | 27.3 |
| Brine pump | 25,329 | 10.9 |
| Circulating pump | 4,246 | 1.8 |
| Light and miscellaneous | 107,990 | 46.6 |
| Total | 231,750 | 100.0 |

In this hotel the electrified apparatus consumes about 65 per cent of the total energy supplied and the original electrical equipment about 35 per cent. In other words, complete electrification rather than simple generator abandonment has almost tripled the value of the business to the central-station company, while a genuine service has been rendered to the building owner in securing to him better and more economical operating conditions.

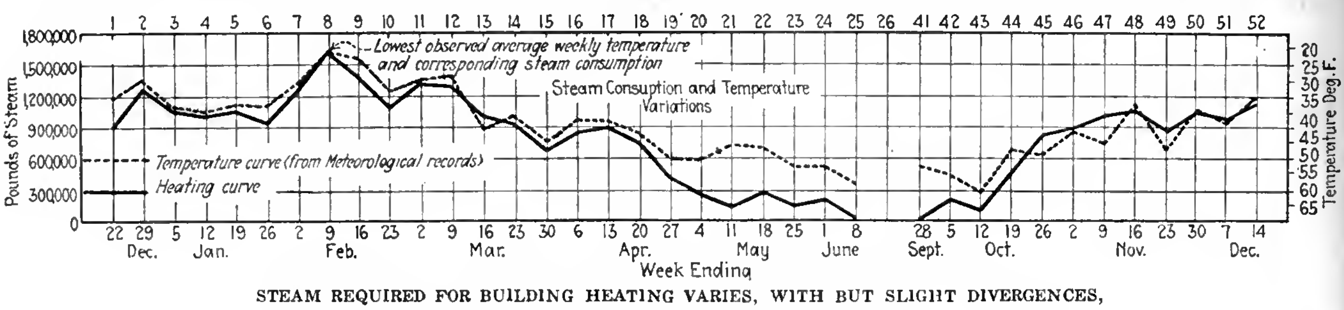
Table II shows values corresponding to those in Table I, the data, however, being obtained in a considerably smaller hotel with straight electric elevators. Owing to the fact that the elevators in this hotel were electric, the amount of new equipment and the energy consumed by it are relatively less than in the building shown in Table I. Of the total consumption, 41 per cent is used by the new equipment and 59 per cent by the old—a result which shows the importance of giving detailed attention to apparatus such as pumps and refrigerating machines, which, although less prominently in evidence than elevators, are in many cases of perhaps equal importance from both the property owner's and the central station's point of view—their electrification adding to the operating economy of the former and to the income of the latter.

Undoubtedly the installation of so much steam machinery in cities where the artificial heating of buildings is necessary during a substantial part of the year is due to the belief that this heat can be most economically furnished by the steam exhausted from the piston apparatus. The usefulness of exhaust steam for this purpose, as well as for water heating, has been greatly overestimated by many. Much of it is not available, and the rest can be utilized for building heating only during the winter months, and then but seldom to the full extent, as may be realized from observation of the wide range of temperatures occurring during the heating season. In the average building having a private plant the amount of exhaust steam made is fairly uniform from day to day, while the heating demands fluctuate widely, varying inversely as the outside temperature. This relation is shown clearly in the accompanying diagram, plotted from data obtained during the test of a large private plant in New York City.

Complete observations and measurements of the same plant, made over the period of an entire year, indicate how little, relatively, of the total steam produced could be utilized for building heating. The results are shown in Table III.

Here the exhaust steam used for heating was 39.3 per cent of the exhaust made, or 32 per cent of the total steam produced. Of the exhaust available for heating, only 52.3 per cent could be utilized for that purpose, the remainder being made at times when the supply exceeded the demand. Much of it was therefore wasted to the outer air, while a material percentage was lost in the foul drips, etc.

This test, during which the amount of steam distributed to each piece of apparatus was accurately measured during the year, will also serve to illustrate the relatively heavy steam requirements of the equipment other than the engines, a matter previously referred to. The values are shown in Table IV.




STEAM REQUIRED FOR BUILDING HEATING VARIES, WITH BUT SLIGHT DIVERGENCES, INVERSELY AS THE OUTSIDE TEMPERATURE

Analysis of these test results, which are fairly representative of a well-run plant, shows that the engines utilized about 44.4 per cent of the total steam produced and that 55.6 per cent was required for other equipment, for heating, or was wasted. The inadequacy of a policy which might simply contemplate the abandonment of the generating units, permitting the other apparatus to continue in operation, will be appreciated from these figures, which also convey some idea of the value of the field from the viewpoint of increased electrical sales.

The unsatisfactory results which may follow a partial change of the kind referred to, even though the steam equipment remaining in operation be small, may be realized from the example of a manufacturing building in which the abandonment of the generators was not accompanied by any readjustment of the other

TABLE III—UTILIZATION OF EXHAUST STEAM IN A PRIVATE PLANT AS DETERMINED BY ACTUAL TEST

| | | Lb. |
|---|---|---|
| Total steam produced | | 81,656,986 |
| Total exhaust steam made | | 69,116,887 |
| Exhaust steam not available: | | |
| Foul drip loss | 16,529,016 | |
| Condensed in house heater | 1,548,050 | |
| Drawn by ejectors | 252,014 | |
| Condensed by ice machine | 875,964 | |
| | | 19,205,044 |
| Exhaust steam available | | 49,911,843 |
| Exhaust to roof stack | | 23,852,060 |
| Exhaust steam used for heating | | 26,125,494 |
| Live steam used for heating | | 3,202,890 |
| Total steam used for heating | | 29,328,384 |

TABLE IV—DISTRIBUTION OF STEAM IN A PRIVATE PLANT AS DETERMINED BY ACTUAL TEST

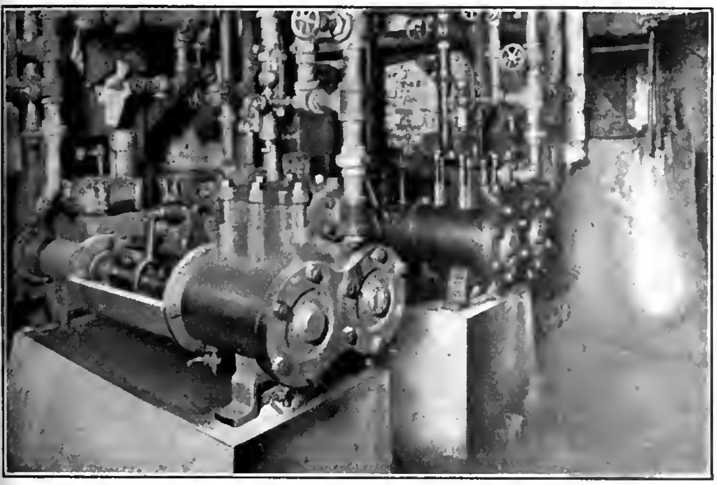
| Steam to | Lb. | Steam to | Lb. |
|---|---|---|---|
| Engines | 36,275,352 | Vacuum pumps | 2,375,711 |
| Auxiliary pumps | 8,416,425 | Ejectors | 1,225,421 |
| House pumps | 5,178,284 | House heater | 334,141 |
| Ice machine | 1,956,469 | Paul board | 266,936 |
| Elevator pumps | 12,509,868 | Clean drips | 8,736,125 |
| Return pumps | 1,179,357 | Reducing valves | 3,202,897 |
| Total steam made | | | 81,656,986 |

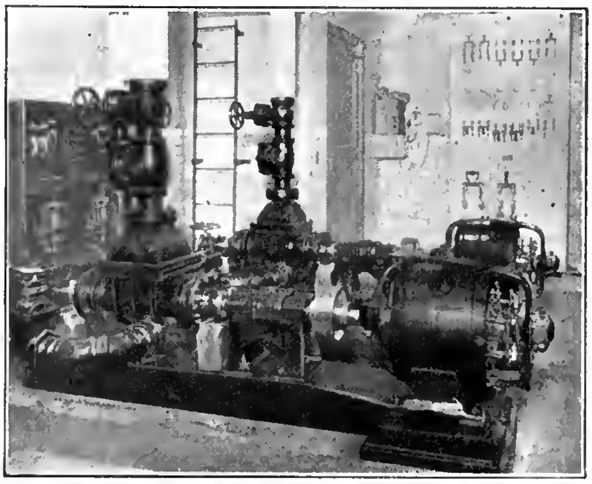
steam services. With the full plant in operation, the cost of producing light, power and heat had been about $33,000 yearly. With the generators closed down and electricity purchased, the cost was increased to about $35,000 yearly. A careful study of the causes of this unsatisfactory showing resulted in the substitution of several electric pumps for steam ones, increasing the electrical consumption by less than 4 per cent, and a complete rearrangement of the steam system which this change permitted. So extensive were the resultant economies that the operating costs were reduced to $23,000 yearly—a saving of $10,000 when compared with the plan of part central-station service and part locally produced power.

The results also call attention to the importance, if the full economies possible with central-station service are to be realized, of having expert steam engineering advice in planning the readjustment of the steam services. This is especially true in factories, where high-pressure steam may be required for industrial processes; in hotels, where cooking and perhaps laundry requirements are heavy, and in clubs and other buildings where similar conditions prevail. In the kitchen either gas or electricity, where the rate justifies it, can be substituted for steam, although in some instances it may be found advisable to adapt the kitchen equipment for operation with low-pressure steam. In the laundry the principal problem is the mangle; the smaller-sized machines can be successfully heated by gas, but for the larger sizes high-pressure steam seems a necessity.

Perhaps the best method of treatment is to install a small boiler, of the proper capacity and pressure, heated either by gas or coal as seems advisable. Under ordinary price conditions gas presents great advantages. Where the high-pressure steam requirements are sufficiently great, it may be found advisable, instead of installing a small new boiler, to devote one of the boilers formerly used for power purposes to the production of high-pressure steam, perhaps segregating the high-pressure system from the low-pressure system used for heating the building. A closed system of this kind reduces the heat losses to a minimum, eliminates many complications, and is both economical and convenient.

In the average building a complete steam and electrical changeover naturally involves a considerable outlay of money, one sufficiently great to explain the reluctance of many property owners to face the undertaking. The elevators usually constitute by far the largest item of expense — assuming that a complete change from hydraulic to electric power is made. In a building of substantial size having a number of elevators the investment may well run into thousands or even hundreds of thousands of dollars, a matter of very considerable concern to the property owner. Where the question of initial expenditure is an obstacle the installation of electric elevator pumps to replace those driven by steam may solve the problem. The cost of making the change is very much less, and while the consumption of energy may run from two to two and one-half times as much as with straight electric elevators, the saving in the fixed charges of interest, depreciation, and so forth may be sufficient not only to pay for the additional use of energy, but to compensate for the other items of expense which would be reduced if straight electric elevators were employed.





TYPICAL INSTALLATIONS OF STEAM PUMPS AND MOTOR-DRIVEN HOUSE PUMPS

There is probably no class of building equipment which suffers greater neglect and operates at poorer efficiency than steam pumps. The equipment shown was afterward superseded by an installation of motor-driven pumps.

Electric house pumps of 150-g.p.m. capacity, each operated by a 10-hp. motor. These units replaced the steam pumps in a large bank building when the private plant was abandoned and central station service installed.

The mileage and kilowatt-hour values obtained during elevator tests in three office buildings each with four hydraulic elevators the pumps for which were recently changed from steam to electric will serve to illustrate the requirements of electro-hydraulic equipment. The test results appear in Table V.

It may be of interest to compare with the foregoing the test results obtained on four typical elevators in one of the latest of New York's large office buildings. They appear in Table VI.

TABLE V—KILOWATT-HOURS PER CAR-MILE AS DETERMINED BY TESTS OF TWELVE ELECTRO-HYDRAULIC ELEVATORS

| | Building No. 1 | | | Building No. 2 | | | Building No. 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Week | Car-Miles | Kw.-Hr. | Kw.-Hr per Car-Mile | Car-Miles | Kw.-Hr. | Kw.-Hr. per Car-Mile | Car-Miles | Kw.-Hr. | Kw.-Hr. per Car-Mile |
| First. | 327.1 | 3,427 | 10.48 | 299.7 | 2,567 | 8.57 | 239.0 | 2,570 | 10.75 |
| Second. | 320.9 | 3,530 | 11.35 | 296.4 | 2,530 | 8.54 | 256.4 | 2,560 | 9.98 |
| Third. | 291.0 | 2,844 | 10.12 | 259.3 | 2,324 | 8.96 | 208.6 | 2,180 | 10.45 |
| Fourth. | 327.2 | 3,376 | 10.32 | 282.4 | 2,585 | 9.15 | 255.3 | 2,610 | 10 22 |
| Fifth. | 335.6 | 3,452 | 10.28 | 288.6 | 2,661 | 9.22 | 254.6 | 2,560 | 10.06 |
| Sixth.. | 347.8 | 3,593 | 10.32 | 286.9 | 2,678 | 9.32 | 239.9 | 2,500 | 10.41 |
| Seventh | 341.0 | 3,260 | 9.56 | 286.2 | 2,671 | 9.33 | 256.2 | 2,670 | 10.41 |
| Eighth. | 333 0 | 3,250 | 9 76 | 279.0 | 2,624 | 9.40 | 248.0 | 2,630 | 10.60 |
| Total... | 2,623.6 | 26,732 | 10.19 | 2,278.5 | 20,640 | 9.06 | 1,958.0 | 20,280 | 10.36 |

TABLE VI—KILOWATT-HOURS PER CAR-MILE AS DETERMINED BY TESTS OF FOUR GEARLESS TRACTION ELEVATORS

| Week | Elevator No. 1 Car-Miles | Elevator No. 1 Kw.-Hr. | Elevator No. 1 Kw.-Hr. per Car-Mile | Elevator No. 2 Car-Miles | Elevator No. 2 Kw.-Hr. | Elevator No. 2 Kw.-Hr. per Car-Mile | Elevator No. 3 Car-Miles | Elevator No. 3 Kw.-Hr. | Elevator No. 3 Kw.-Hr. per Car-Mile | Elevator No. 4 Car-Miles | Elevator No. 4 Kw.-Hr. | Elevator No. 4 Kw.-Hr. per Car-Mile |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| First.... | 101.0 | 450 | 4.46 | 117.9 | 390 | 3.31 | 132.8 | 530 | 3.99 | 153.8 | 488 | 3.17 |
| Second.. | 85.4 | 370 | 4.33 | 86.7 | 300 | 3.46 | 110.5 | 448 | 4.06 | 135.0 | 445 | 3.29 |
| Third .. | 82.7 | 360 | 4.35 | 114.0 | 370 | 3.24 | 128.0 | 542 | 4.24 | 153.0 | 484 | 3.17 |
| Fourth.. | 93.5 | 410 | 4.39 | 97.0 | 400 | 4.12 | 128.1 | 519 | 4.05 | 158.4 | 502 | 3.17 |
| Fifth.... | 95.3 | 420 | 4.39 | 67.9 | 400 | 5.89 | 127.5 | 539 | 4.23 | 161.6 | 507 | 3.14 |
| Sixth.... | 90.0 | 410 | 4.55 | 81.2 | 390 | 4.80 | 131.7 | 522 | 3.96 | 158.7 | 494 | 3.11 |
| Total.. | 547.9 | 2,420 | 4.42 | 564.7 | 2,250 | 3.98 | 758.6 | 3,100 | 4.09 | 920.5 | 2,920 | 3.17 |

The rate of progress to be made in the further establishment of the principle of 100 per cent electrification will largely depend upon the efforts put forth in this direction by central-station interests. There are no other agencies equally concerned, nor any others so well situated to demonstrate the merits of all-electric machinery operating in connection with low-pressure steam systems.

At frequent intervals there should be something of interest to tell to every owner of a building in which such changes might advantageously be made. He should be made to comprehend the nature of the problem and its solution and to understand that the central station stands ready to undertake any necessary tests and studies of operating costs, to have specifications prepared for both electrical and steam changes, and to co-operate in every possible way in determining the best course to follow. If during the period of readjustment that inevitably follows the execution of changes as complete as those discussed the central-station company will keep in touch with the situation and be prepared to make such tests, observations and suggestions as will be of assistance in bringing about the most satisfactory operating conditions, the complete success of the venture will be assured.

## Increased Logging Speeds with Electric Donkey Engines

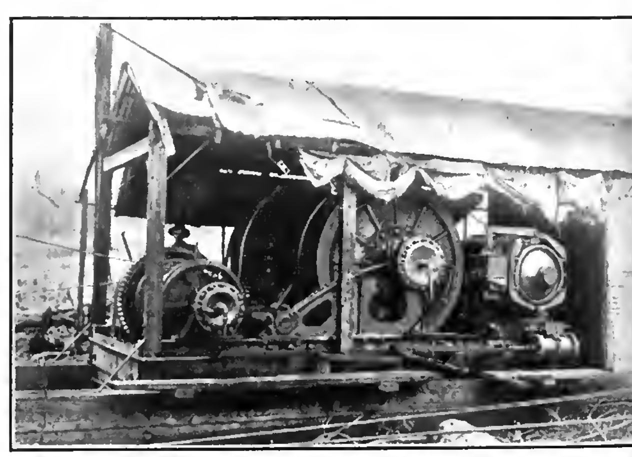
INCREASE in logging speed of 125 per cent and decrease in the cost of the operations have been accomplished together in the Pacific Northwest by the replacement of steam-driven donkey engines by electric motor-driven engines. In some instances—notably with the Snoqualmie Falls Lumber Company of Snoqualmie Falls, Wash.—combination yarding and loading units have been placed in operation and have proved far superior to steam-driven sets. Such a machine, having the yarder equipped with a 300-hp., 585-r.p.m., 550-volt motor and the loading machine equipped with two 75-hp., 580-r.p.m., 550-volt motors, has shown itself on test capable of handling 2,000,000 board feet of lumber per month.

In addition to the savings from the increased speed of operation, a great saving is made possible by doing away with the laying of pipes to supply water for the boilers of steam donkey engines. An additional saving in maintenance results from the elimination of the materials and labor for repairing the brickwork and tubes of the boilers.

TREES ARE USED IN YARDING OPERATIONS

Power for operating the electric units is distributed at 10,000 volts or 15,000 volts over inexpensive lines constructed with a realization of the temporary nature of the application. On the experience of the last few years' operating costs, electric drive can compete favorably with steam even with power costing $0.015 per kilowatt-hour and distributed as far as 7 to 10 miles through the woods.

Yarding and loading operations make up nearly 36 per cent of the total operating cost, neglecting stumpage, and these items are subdivided as shown in the table. This high proportion of the total expense indicates that the greatest economies in logging operations may be gained by electrification of the yarders and loaders.



ELECTRIC YARDERS MUST BE DESIGNED FOR RUGGED SERVICE

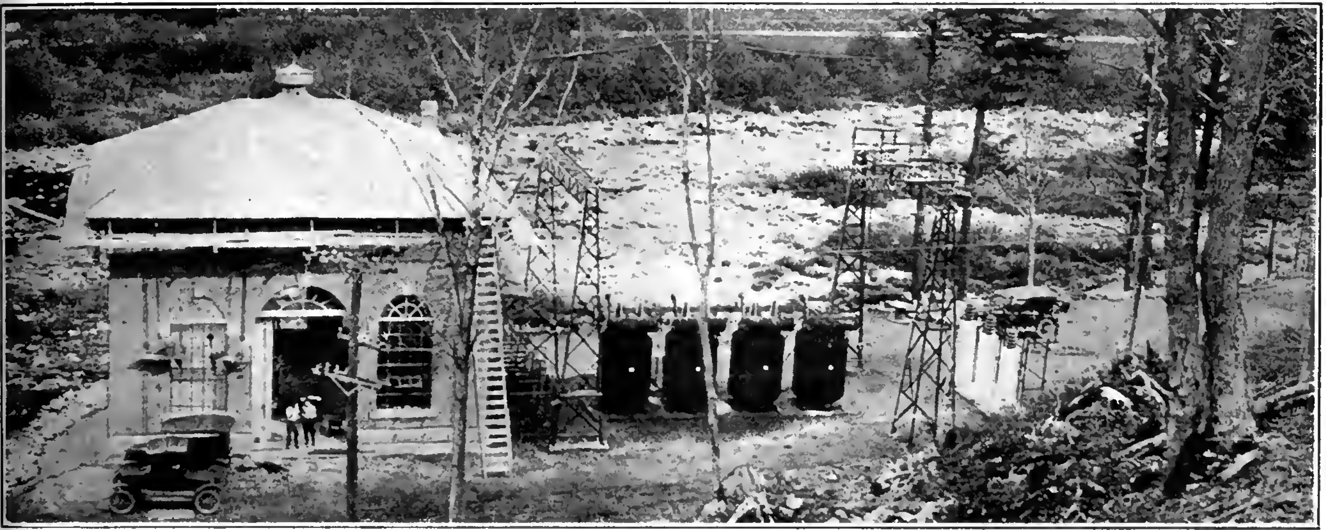
DIVISION OF YARDING AND LOADING OPERATIONS

| | Percentage of Total Costs | | Percentage of Total Costs |
|---|---|---|---|
| Labor............... | 16.6 | Haulage ropes....... | 4.9 |
| Repairs............ | 2.0 | Supplies.... ...... | 2.3 |
| Fuel................ | 1.2 | Fixed charges........ | 6.9 |
| Rigging trees........ | 2.0 | | |
| Percentage of total costs................ | | ................ | 35.9 |

# Full-Automatic Hydro-Electric Station

## Adopted by New England Power Company for Relatively Inaccessible Site on Deerfield River—Tied in with Other Stations—Functioning Under Different Conditions Explained

By E. B. COLLINS
*Assistant Electrical Engineer New England Power Company*



LARGEST FULLY AUTOMATIC GENERATING STATION JUST COMPLETED

THE 5,000-kva. automatic hydro-electric generating station recently installed by the New England Power Company represents a considerable stride in the application of full automatic control. It is situated at Searsburg, Vt., near the headwaters of the Deerfield River in a mountainous, unsettled region which is practically inaccessible during the winter months. Under these circumstances the expense and difficulties involved in maintaining the necessary personnel for the operation of a manual station would have been considerable. Therefore, in order to take the fullest advantage of the natural power site, the operating company decided to install an automatically controlled station.

The station utilizes natural run-off supplemented by water stored about 9 miles up stream. Three miles above the station the water is diverted into a wood-stave pipe, which affords an average operating head of 210 ft. Energy from this plant is fed through a 15-mile, 66,000-volt line into the high-tension bus of another station on the system, where it is metered.

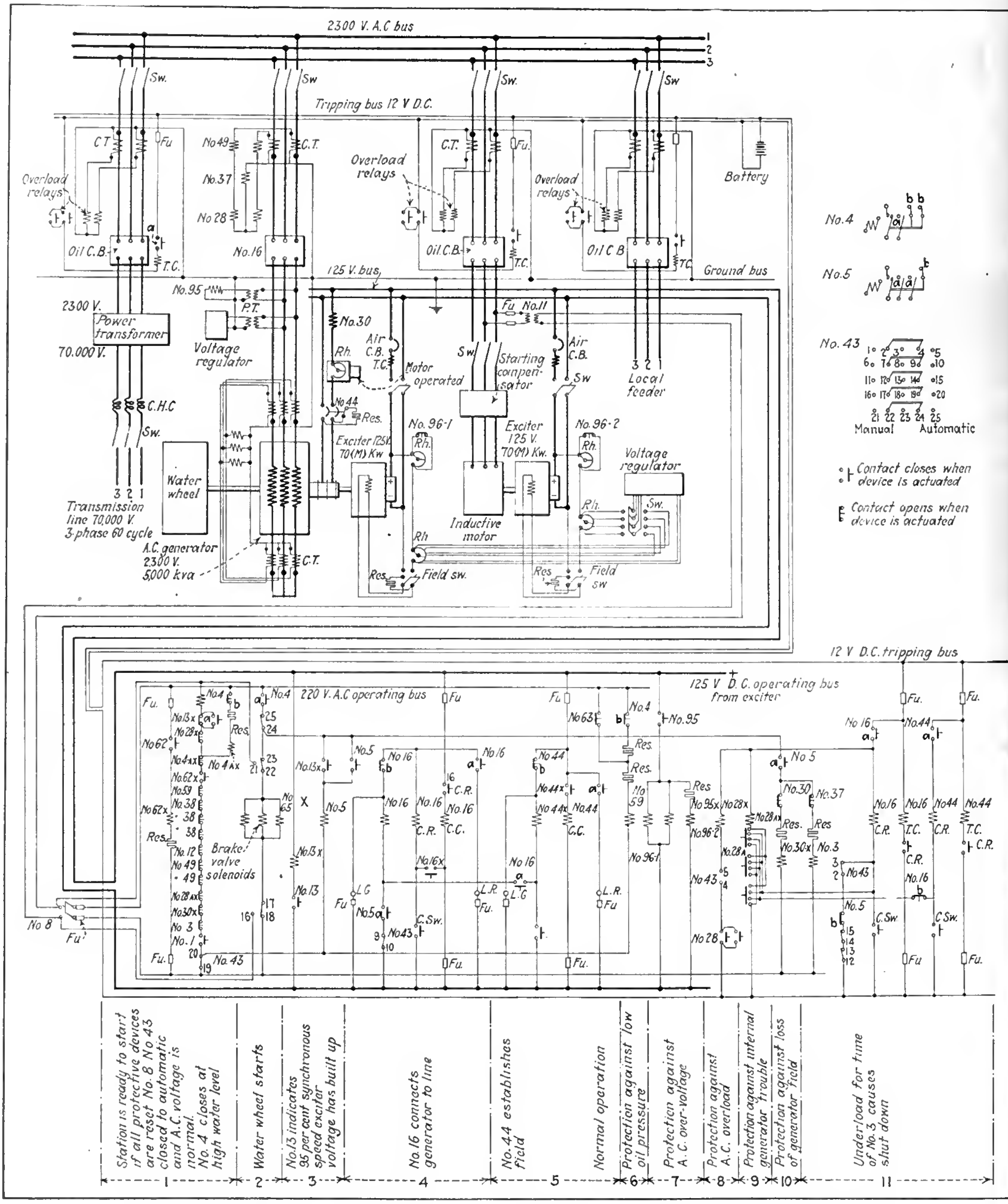
The equipment at the automatic station comprises one 5,000-kva., 2,300-volt, three-phase, 60-cycle vertical waterwheel generator, with directly connected exciter and automatic control equipment furnished by the General Electric Company. The generator is connected to an I. P. Morris waterwheel, which is controlled by a Woodward governor. The energy from the generator is stepped up by means of a 5,000-kva. bank of transformers to 66,000 volts and then transmitted to station No. 5 by means of the above line. The high-tension network is tied in at several points with other systems which serve a large part of New England. The control equipment is arranged for either full automatic or full manual control, the change-over being effected by a five-pole, double-throw knife switch installed on the control panel of the board.

The installation of this equipment was completed in March, 1922, but it so happened that before there was time fully to try out the automatic control, water conditions were such that it was necessary to start up the station at once. Consequently, the station commenced generation under manual operation and 4,800 kw. was placed upon the unit from the start and held there practically without change until tests on the automatic equipment could be made, which was not until the latter part of June. A better test of the abilities of a generating equipment to meet service demand could hardly be devised, and the results on this generating equipment were entirely satisfactory.

### FULL-AUTOMATIC FUNCTIONING

Since June the station has been operating under full-automatic control, carrying from one-fourth load to full load, depending on the varying water conditions which obtained on the river. As some of the features of the control and protective equipment are rather unusual, a description of the equipment and its operation should prove interesting. The power to operate the control devices is supplied by a control power transformer connected to the local 2,300-volt feeder, which is taken off the station bus and steps the energy down to 220 volts. The arrangement of the control circuits is shown on page 1144 and the operation is as follows:

With the connecting high-tension line alive from station No. 5 and the change-over switch No. 43 in the automatic position, the control power transformer No. 11 energizes the 220-volt control through the control power




## Schematic Wiring for Automatic Control of Searsburg (Vt.) Hydro-Electric Station

A.—Auxiliary switch, open when main switch is open.
B.—Auxiliary switch, closed when main switch is open.
C.B.—Circuit breaker.
C.C.—Closing coil.
C.R.—Control relay.
C.SW.—Control switch.
C.T.—Current transformer.
CH.C.—Choke coil.
Fu.—Fuse.
L.G.—Lamp green.
L.R.—Lamp red.
P.T.—Potential transformer.
Res.—Resistor.
RH.—Rheostat.
Sw.—Switch.
T.C.—Trip coil.

No.
96—Rheostat short-circuiting contactor.
95-X—Auxiliary relay for No. 95 hand reset.
95—Overvoltage relay.
65—Governor solenoid.
63—Oil pressure relay.
62-X—Auxiliary relay for No. 62.
62—Float switch.
59—Overvoltage relay hand reset.
49—A.C. machine temperature relay.
44-X—Hesitating control relay for No. 44.
44—Generator field circuit breaker.
43—Change-over switch, manual to automatic.
38—Bearing temperature relay hand reset.
37—Underload relay.
30-X—Auxiliary relay for No. 30 hand reset.
30—Field relay.

No.
28-AX—Auxiliary relay for No. 28A hand reset.
28-A—Overload relay for differential protection hand reset.
28-X—Auxiliary relay for No. 28 hand reset.
28—A.C. overload time delay relay.
16-X—Hesitating control relay for No. 16.
16—Running oil circuit breaker.
13-X—Auxiliary relay for No. 13.
13—Synchronous speed control switch.
12—Overspeed limit switch hand reset.
11—Control power transformer.
8—Control power switch.
5—Control current contactor.
4-AX—Notching auxiliary relay for No. 4.
4—Master control contactor.
3—Time delay stopping relay.
1—Master starting element.

switch No. 8. Sufficient oil pressure causes the oil-pressure relay No. 63 to remain open, leaving both steps of resistance in the circuit of the over-voltage relay No. 59, which remains closed if the voltage on the transmission line is not too high.

If the water level in the forebay is above a predetermined level, float switch No. 62 will also be closed. All other protective devices have their contacts in the normally closed position.

When the master control element No. 1 (in this case a time switch operating at a predetermined time) closes the coil of the master-control contactor, No. 4 is energized through the contacts of devices Nos. 43, 59, 3, 30x, 28x, 49, 12, 38 and 62. The closing of No. 4 energizes the governor solenoid No. 65, opening a pilot valve on the gate-operating mechanism, allowing the oil pressure to start opening the gate. At the same time the relief and inlet valves of the brake cylinders are operated by solenoids connected in multiple with No. 65, releasing the brake and allowing the generator to start. An auxiliary switch on No. 4 completes the circuit of a 12-volt battery through the coil of relay No. 28. This battery supplies power to the 12-volt direct-current control circuit, which is completed by the operation of either alternating-current overload relay No. 28 or differential overload relay No. 28a. This circuit supplies power to the trip coils on the generator oil circuit breaker No. 16.

### Bring Generator on Line as Induction Motor

When the generator comes up to about 95 per cent synchronous speed, synchronous-speed control switch No. 13 closes, energizing control current contactor No. 5, which thereupon closes. The closing of this contactor completes the circuit through the coil of auxiliary field relay No. 30x, which starts to close against a time delay through the contacts of field relay No. 30. The latter are closed until the generator field builds up. The closing of No. 5 also short-circuits No. 13, so that No. 5 is locked in against a momentary loss in speed. Contact is also made by No. 5 through underload relay No. 37 to the time-delay stopping relay No. 3.

Thus two conditions are guarded against, namely, failure of the field to build up and failure of the generator to take load. In the first case, if No. 30 does not open before No. 30x closes, the station will shut down, and in the second, if No. 3 opens, the coil circuit of No. 4 will be broken, de-energizing that contactor and shutting the station down. The first pole on contactor No. 5 completes the circuit through hesitating control relay No. 16x and the B switch on No. 16 to the 125-volt direct-current control bus, which is supplied by the generator exciter. Relay No. 16x closes, energizing control relay *CR*, which in turn energizes the coil of the generator oil circuit breaker No. 16, which thereupon closes.

The generator is now on the line without field and is acting as an induction motor.

### Synchronizing Generators

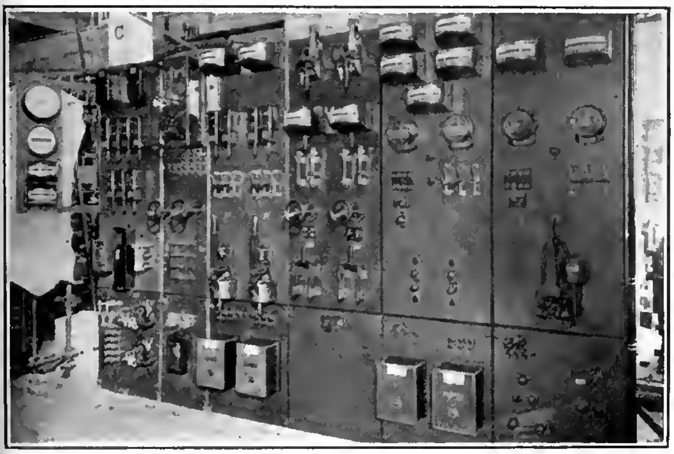
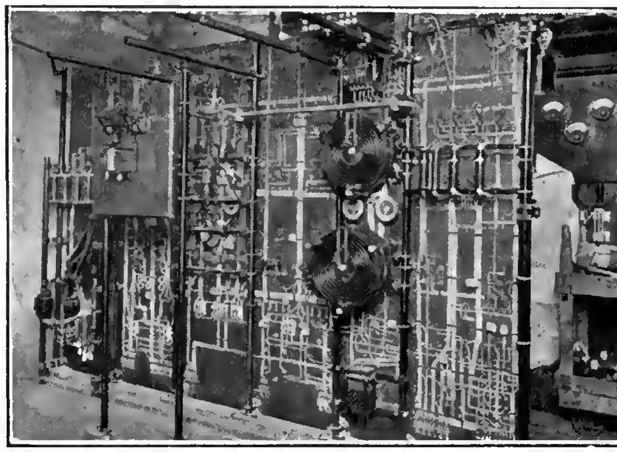
An A switch on No. 16 completes the circuit to hesitating control relay No. 44x. This energizes the coil of field circuit breaker No. 44, which closes, connecting the exciter to the generator field. This pulls the generator into synchronism, and it picks up load as the waterwheel gate continues to open to some predetermined gate opening controlled by means of a dial located on the governor. To the governor has been given a fairly drooping characteristic, so that the generator will not only carry approximately constant load but will do its share in holding the system to normal frequency.

It may be of interest to know that the total time taken by the automatic starting sequence from the closing of the time switch No. 1 to the point where the station is on the line, carrying full load, is approximately 35 seconds. Furthermore, the phasing of the generator is accomplished so smoothly by the automatic equipment that it is not noticeable at station No. 5 unless one happens to be looking at the line ammeters.

### Shutting Down

Shutting down normally may be accomplished in three ways, namely, by the operation of the master element No. 1 at a predetermined time, by the operation of the float switch No. 62 when the water level falls below the predetermined minimum, and by the opening of the oil circuit breaker at station No. 5.

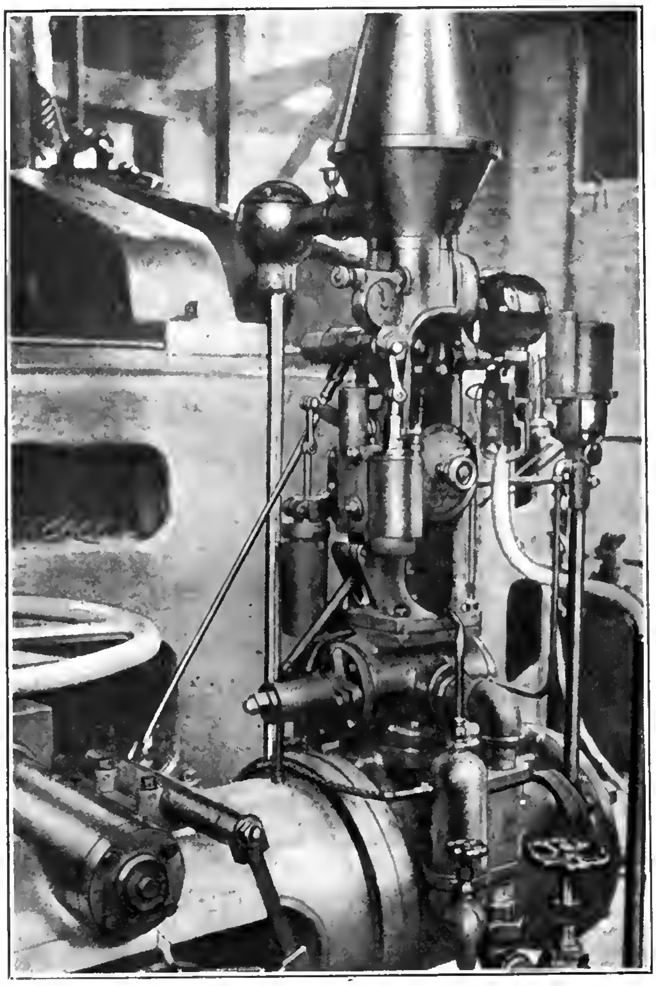
The sequences of operation in the various cases are as follows: When the time switch No. 1 opens its contacts, the coil circuit of No. 4 is broken and the contactor opens, de-energizing No. 65, which closes the gate. The brake-valve solenoids are also de-energized and returned to the position which allows the oil pressure to apply the brakes to the generator. Contactor No. 5 opens, and its B switch upon closing completes

FRONT AND REAR OF RELAY, INSTRUMENT AND AUXILIARY PANELS OF AUTOMATIC HYDRO-ELECTRIC PLANT AT SEARSBURG, VT.

the 12-volt battery circuit through a hesitating control relay. This actuates the trip coil of the generator oil circuit breaker No. 16, which thereupon opens. When No. 16 opens, its B switch completes the battery circuit through the control relay and energizes the trip coil of field circuit breaker No. 44, which also opens, thus disconnecting the exciter from the generator field. The station is now shut down with all of the devices in the starting position, waiting for No. 1 to close again to restart.

In the second case, that of low-water level, the float



GOVERNOR OF 5,000-KVA., 2,300-VOLT, THREE-PHASE, 60-CYCLE WATERWHEEL GENERATOR

switch No. 62 opens, thus opening the master control circuit and shutting down the station as described in the preceding explanation.

In the third instance, when the oil circuit breaker at station No. 5 is open, the load on the automatic station is removed and underload relay No. 37 closes its contacts. This energizes stopping relay No. 3, which, after a time delay, opens the master control circuit, shutting down the machine as above. The generator cannot start again on the operation of the time switch until the oil circuit breaker at station No. 5 is closed, thus energizing the control power transformer in the automatic station.

As to the matter of protection, every possible contingency has been foreseen and guarded against. Besides the protective features already mentioned incidental to the features of operation, there are about thirteen additional possible causes of trouble for which provision has been made. Among them are overspeed, in which case the speed-limit switch No. 12 on the generator shaft operates, breaking the circuit of No. 4 and shutting the unit down; overload or short circuit in the windings of the generator, which causes differential relays No. 28a and No. 28 to operate, tripping out generator oil circuit breaker No. 16 and field circuit breaker No. 44; underload, which actuates underload relay No. 37, energizing No. 3 and thereby opening the master control switch, which shuts down the generator. In this case, if the time switch is still in the closed position when underload conditions have ceased and the power line is still energized from station No. 5, the unit will start up again immediately.

### GUARD AGAINST EVERY CONTINGENCY

Overheated bearings cause bearing temperature relay No. 38 to open its contacts at a bearing temperature of about 90 deg. C., thus shutting the unit down. On trouble of this nature the unit cannot be restarted without inspection. Low oil pressure in the governor causes oil pressure relay No. 63 to close, energizing No. 59, which breaks the coil circuit of No. 4, shutting down the machine. No. 59 must also be reset by hand before the unit can again be started.

Creeping of the wheel when the gate is closed is prevented by the operation of the gate valves as follows: When contactor No. 4 opens, it de-energizes governor solenoid No. 65 and also the relief and inlet valve solenoids. The relief valve closes immediately, but the inlet valve, which is connected mechanically to the gate, will not close until the gate is practically closed. When the gate has closed, the oil pressure in the cylinder builds up and applies the brakes, which prevents creeping of the wheel due to the small amount of water which leaks through the gates.

Delay and trouble from a serious breakdown of the directly connected exciter are taken care of by the presence of a spare exciter driven by an induction motor. In case either one fails, the other is immediately available.

The station is also equipped with a voltage regulator for regulating the station voltage. The regulator controls a short circuit around a rheostat in the field circuit of the exciter, so that if the voltage rises, the rheostat is cut into the circuit and reduces the exciter voltage and consequently the generator voltage. If the generator voltage is low, the rheostat is short-circuited, causing higher exciter voltage and consequent higher generator voltage. There is also provided with the voltage-regulating equipment an auxiliary overvoltage contactor and auxiliary exciter field rheostats.

It often happens in stations which are provided with directly connected exciters that in case of sudden loss in load on the generating equipment the speed momentarily reaches a high value, which also momentarily causes excessive exciter voltage and consequent high generator voltage. This rises to such a value that the normal voltage regulator is unable to take care of it. The above overvoltage contactor is arranged so that should this condition occur the auxiliary rheostat in the exciter field is cut in, thus dropping the exciter voltage to a point where the regulator can take care of it. Upon generator and exciter speed coming down to normal, this auxiliary field rheostat is again short-cir-

cuited by means of the contactor, and the regulator again functions as under normal conditions.

Since the station has been in automatic operation, there has been very little trouble experienced with the automatic equipment. Regular inspection of the apparatus is maintained, and care is exercised that contacts shall be kept clean. The station is in a section of the country where lightning conditions are rather severe, and the connecting high-tension line has tripped out numerous times owing to lightning disturbances. The generating equipment has in every case promptly shut down and remained down until the line was again energized from station No. 5, whereupon the equipment has promptly started up and again come on the line and carried load.

Owing to the fact that the amount of oil required for the operation of the brakes is rather large in comparison with the oil system available at the station, it was decided to operate the brakes by means of water, which is supplied at penstock pressure by means of a small valve and through proper strainers. This seems to work out very satisfactorily and results in considerable reduction in the duty imposed upon the governor oil system.

## Bureau of Mines Comment on Powdered Fuel

MANUFACTURERS and operators of the larger coal-fired furnaces cannot afford to disregard the possible advantages of pulverizing their coal before burning it, John Blizard, fuel engineer of the Department of the Interior, says in Bulletin 217, just issued by the Bureau of Mines. The bulletin, which contains information regarding the preparation, transportation and combustion of powdered coal, is published through the courtesy of the Canadian Department of Mines, for which the bulletin was originally prepared. He says in part: "Since the coal has to be pulverized, it is generally better to purchase slack coal, which is usually cheaper and costs less to pulverize. The requisite composition of the coal depends upon many factors. Practically all coals from lignite to anthracite, and even coke breeze, have been pulverized and burned. But anthracite and coke breeze require more energy to pulverize them than softer coals, and low-volatile coals are difficult to ignite and must be burned in specially designed furnaces.

"One of the principal difficulties in burning powdered coal lies in the disposition of the ash, and for this reason it is desirable also to use a coal which contains little ash and that melts at a comparatively high temperature.

"The power used to pulverize and convey similar coals to the burner is approximately proportional to the weight of the coal pulverized, and it is clear that the pulverizing and conveying costs will therefore be greater per heat unit delivered the lower the calorific value of the coal.

"On the whole, powdered-coal plants cannot be said to be clean. There are fairly clean powdered-coal plants, but generally, though not universally, a plant using powdered coal is dirtier than a grate-fired plant. Powdered coal is better adapted for firing stationary water-tube boilers than other boilers. With these boilers furnaces of sufficient size and of the correct shape may be constructed, and the gases pass through no tubes wherein ash may settle to obstruct the draft and shield the heating surface.

"The possibility of a dangerous fire or explosion in a well-designed, well-managed powdered-coal plant is remote and should not influence the prospective user of powdered coal against installing it."

## Arc Welding as a Manufacturing Asset

### Structural Steel Can Often Be Substituted for Castings at a Material Saving — Riveting of Thin Metal Parts May Be Avoided

By J. F. Lincoln
Vice-President the Lincoln Electric Company

THE use of arc welding is usually limited, in the minds of the people who are not personally in touch with its application, to the repairing of broken parts or to the building up of friction surfaces that have been worn down. The average man remembers that the engines of the German ships in the harbors of the United States at the time of the late war were broken and left by the Germans as a total loss. He also remembers that by a new process of arc welding these engines were repaired in a few days and the ships put into operation, much to the chagrin of the Germans and much to the credit of arc welding. While this feat had a great effect in fixing in the minds of most people that arc welding is a wonderful thing with which to fix engines on German ships, it is doubtful if repair work is even a considerable part of its usefulness to mankind.

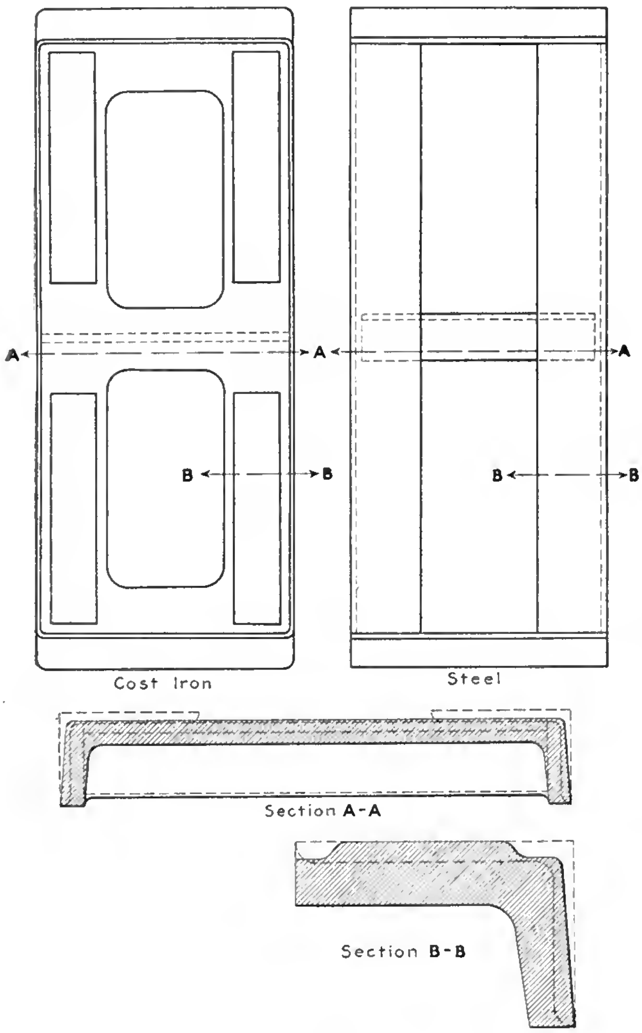
#### Arc Welding a Manufacturing Asset

Arc welding can be of the greatest service in the manufacture of parts which are usually made of cast iron. Its use there is not for repairing, but in the actual manufacture of these parts from standard structural steel shapes. The importance of this statement rests upon the fact that the cost of cast iron per pound compared with standard steel shapes is as three to one.

The strength of steel is as five to one compared with cast iron. This means that a part which is usually made from cast iron will if made of steel be equally strong at a cost of no more than one-fifteenth of the cost of the same piece if made of cast iron. This ratio, of course, will not always hold, because many other factors, such as appearance and inability to get the exact standard structural shape that is needed for the thing to be made, come into the problem. It does, however, show what the absolute cost ratio between the use of the two materials is when the tensile strength and cost only are considered. The cost of welding must be added to the cost indicated for steel, since the cost for cast iron on which this statement is based is for a completely molded casting, while the steel cost does not include welding. However, the welding cost is usually a small proportion of the steel cost and will vary according to the part to be made. Here lies the great opportunity of the designing engineer. He should be just as fully acquainted with the possibilities of arc welding as he is with the strength and possibilities of riveting.

The drawing shows details not because it is an extreme

case of the difference in cost between the two methods of making the same object, but because it is a part that all interested readers have seen and because the savings shown have been actually made. It is therefore a graphic illustration of what can be accomplished. The part shown is a motor-generator set base made by the two different methods. The one is a base made of structural steel parts and the other of cast iron.




EXAMPLE OF HOW STRUCTURAL SHAPES WELDED TOGETHER CAN REPLACE CASTINGS

The illustration at the left is a cast-iron base. That at the right is made of structural steel welded. Comparative cost:

| Cast-iron, weight 188 lb. | | Structural steel, weight 85 lb. | |
|---|---|---|---|
| Cost of casting | $13.16 | Cost of steel | $1.91 |
| Cost of machining | 2.50 | Cost of welding | .90 |
| Total | $15.66 | Total | $2.81 |

The resistance to bending is equal and the steel base is unbreakable. There is also the advantage with the steel base that no machining is necessary and the saving will more than make up for the cost of welding.

Other examples of this type that can be mentioned are:

1. Switch tanks for oil switches and compensators. Here the steel has an added advantage of being impervious to oil while cast iron is not.

2. The manufacture of motor-base rails. Here a drawn piece of channel section is made complete by welding on the tang which holds the adjusting screw.

3. The manufacture of motor and generator frames for automobile starting and lighting generators. Flat stock bent into a ring and welded will be enormously cheaper than pipe or castings such as are usually used. This also applies to frames for larger direct-current and alternating-current motors.

4. The manufacture of punch-press and drawing-press frames. Not only will the cost be not more than 10 per cent as great as for cast iron but broken frames are impossible. This would be a great boon to all users of such machines. In all these cases the saving is at least one-half of the cost of the same parts made of cast iron.

These examples can be multiplied by hundreds, and in all cases savings can be shown which range from 10 to 98 per cent of the cost of the same part made from cast iron.

### Chance for Increased Use

When the process is fully understood by the designing engineer, he will increase again the known applications as a result of his own experience.

At present the application of the arc is made usually to parts which were designed to be riveted or brazed. This often puts arc welding at a great disadvantage as the preparation of the part is entirely different for arc welding from what it is for riveting. Even in such cases the application of the arc has made great savings.

An example that may be cited is this: The usual range boiler, made by millions and used in almost every modern home for water heating, has, by custom, been riveted ever since it was first made. Rivets on thin metal do not make a job that is tight so the tank is galvanized after riveting. The galvanizing helps to fill up the gaps left by the rivets. After a time, however, the galvanizing disappears, leaks start and a new tank is necessary. To put off the evil day of leaks the manufacturer now rivets as of old and then welds the edges down. This eliminates the leaks on the edges but does not stop the leaks around the rivets. It is a better job than before because it stops up half of the places where leaks can occur. Sometime some manufacturer will weld the seams and forget to use rivets and the problem will be solved, saving about 80 per cent of the labor cost of doing the job and producing a boiler twice as strong.

### A Few Characteristics

The designer can rely on the following characteristics of a properly arc-welded joint:

1. One hundred per cent strength compared with the sheets welded.

2. A fraction of the cost compared with riveting, brazing or gas welding.

3. Automatic apparatus for welding duplicate work.

4. Possibilities of saving a large part of the present cost of making his product if arc welding is scientifically applied.

Arc welding in many ways is new, although the process itself is nearly as old as the discovery of the electric machine. Its progress is a revelation even to those closest to it, and new uses and methods are discovered almost daily. The engineer should look at the process as one which has wide application and one which should be first considered when the manufacture of any steel product is contemplated. Its use is tremendously more important than riveting, and its results can be almost universally depended on to be much cheaper, stronger and more satisfactory.

# Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

## Dr. Hutchinson Disputes Efficiency Percentage Given for Oil-Burning Locomotive

*To the Editors of the* ELECTRICAL WORLD:

The report in your issue of May 5 on the discussion of A. H. Babcock's paper on "Some Fuel Determinations on the Southern Pacific System," presented at the Pittsburgh meeting of the American Institute of Electrical Engineers, seems to call for some comment, particularly with reference to the report of my discussion.

The principal object of my discussion was to point out that the interpretation given by Mr. Babcock of his own tests is misleading. His statement that the "overall efficiency" is 5.57 per cent is not borne out by the tests themselves. This efficiency was obtained by considering only the oil used when drawbar pull was positive and is measured at the rim of the drivers, i.e., includes the work done in moving the locomotive itself.

My viewpoint is that this is entirely misleading—that all oil used should be included, and that efficiency should be measured at the drawbar for the same trailing load. Under these conditions the efficiency becomes 3.12 per cent—very different from 5.57 per cent. This, the most significant point of my discussion, is not referred to in your report, which, in effect, spreads abroad the statement that the efficiency found was 5.57 per cent.

It would have been interesting to discuss the general matter of railroad electrification as Mr. Davis seems to have done, but Mr. Babcock's paper did not touch upon this in any way, and I therefore confined myself to the subject of the paper.

CARY T. HUTCHINSON.

New York, N. Y.

## Reactive Kva., Prunes and Poems

*To the Editors of the* ELECTRICAL WORLD:

In regard to R. C. Fryer's letter in the ELECTRICAL WORLD for April 28 concerning the justice of billing power consumers for reactive kva. or reactive kva.-hours, I am inclined to agree with Mr. Fryer that it would be difficult to justify any rate applied to something delivered and returned 120 times per second, and which neither the central station nor the customer wants or can use.

If a grocer sells and delivers to a customer a pound of prunes, he should be entitled to the cost of the prunes delivered through his regular channels. If the customer orders the prunes sent up accompanied by an original poem on prunes, it is quite likely that the grocer would expect the customer to pay for the poem.

Reactive kva.-hours are fully as harmonious and beautiful as a poem, of a little less economic value, and their cost of production and delivery is indeterminate. They resemble the active kva.-hours very much as the poem resembles the prunes. On the other hand, it is true that in many localities cost of electric service is practically independent of the amount of energy used but is almost wholly dependent on demand, not in kw. but in kva. These considerations lead one to preserve a mind open to reason and conviction and to hesitate before condemning categorically the idea of charging for prunes on a conversion ratio of liters to poetic meters, or for electric service on a basis of reactive kva. In the early days central stations charged on the basis of lamps; later the charge was for ampere-hours. Here in Connecticut at the present time electric service is paid for on the basis of the number of square feet floor area, and consumers appear to be happy about it; moreover, in the main it is equitable.

Information on all points controlling the cost of electric service should be secured by the central-station company, and this includes, among other things, energy consumption and power factor. At least two instruments are necessary to obtain this information, and if active and reactive component watt-hour meters are used, other information may be derived, including kva.-hours. Local conditions will determine the most convenient and most equitable measurements to use.

H. J. BLAKESLEE,
Treasurer.

The States Company,
Hartford, Conn.

## The Central Station and Street Lighting

*To the Editors of the* ELECTRICAL WORLD:

The ELECTRICAL WORLD in its campaign for better street lighting is rendering a service to the industry worthy of the highest commendation. The editorial in the issue of Feb. 24 on "How a City Gains by Better Street Lighting" sums up the whole situation in a nutshell, and the last paragraph, "What does the operating company gain?" is of vital interest to the electric light and power companies.

Many of the operating companies have apparently failed to recognize that the rapid development in street-lighting practice during the past few years has created new conditions and that, in the interest of the industry, the central-station companies must take their place in their respective territories as leaders in the promotion of improved street lighting.

While it is true that, in spite of large advances in the cost of materials and labor, street-lighting rates have remained practically constant and that the street-lighting load has not generally been an attractive one for the central stations, there is no reason why the central stations should not undertake the sale of better street lighting on a business basis, charging a rate which would make it a profitable part of their service, interesting to the city as an economical improvement contributing to its safety and progress. Street lighting should not be looked upon as a political football, threatening municipal ownership. It is a civic improvement, affording the central station an opportunity for meeting municipal officials on a common ground, and should be the means of developing cordial relations between the central stations and the municipality.

The manufacturers of street-lighting equipment are doing their part in educating the public by extensive national advertising campaigns and by missionary work through trained street-lighting experts. Municipal officials are also showing their interest by giving a prominent place to discussions on street lighting at meetings of municipal associations and societies.

The real development in the street-lighting business will only come when the central stations themselves advocate improvements instead of holding aloof and awaiting the results of the efforts of the manufacturers of lighting equipment. If the municipal demand and the central-station ability can be co-ordinated, there is before us a tremendous prospect for more and better street lighting.

L. A. S. WOOD.
Manager Illuminating Section.
Westinghouse Electric & Manufacturing Company,
South Bend, Ind.

# Central Station and Industrial Practice

**Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants**

## Automatic Switch-Reclosing Apparatus

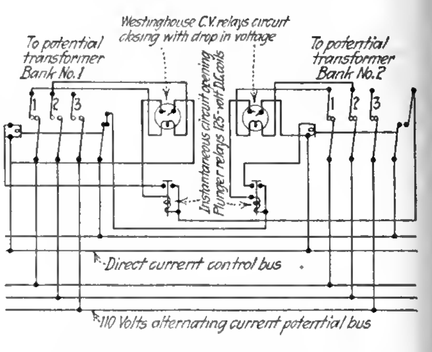
**Developed by Alabama Power Company and Successfully Used in Several of Its Substations—Has Extensive Application to All Classes of Apparatus**

FOR the automatic reclosing of switches which are opened because of trouble on the circuit or in apparatus connected thereto the Alabama Power Company has developed the apparatus described and illustrated herewith. At the Vida substation this reclosing equipment has been successfully used for more than a year to operate a 44,000-volt, 300-amp. G. E. "KO-26" oil switch. This station is operated by one man whose additional duties involve two days per week spent in patrol of lines in the district. The switch operated by the reclosing device controls an important circuit supplying Selma and other large customers. Continuity of service is of the utmost importance, and if during lightning storms, when the operator may be out on patrol or away from the station getting supplies, or during the night, when he may be asleep, the switch opens automatically because of flashovers or other troubles on the line, the reclosing device will, after a period of one minute, reclose the line switch. If trouble still exists, the switch will immediately open automatically the second time and close once more after a period of one minute. A continued fault will cause the switch to open again automatically, after which it will become inoperative until reset at some time by the operator after the trouble has been cleared.

The energy for operating the reclosing device may be either direct-current or alternating-current, and only 300 watts at the maximum is required. At Vida the source of supply is secured from a 44,000-volt potential transformer used to carry a few lamps about the station.

During the lightning season of last year the oil breaker at Vida automatically opened a number of times, and in each instance the reclosing device closed the breaker after the one-minute period. Recently line failures caused short circuits which remained until troubles were cleared on patrol, and the device reclosed the oil breaker twice and then became inoperative until the line foreman telephoned the Vida operator to test the circuit.

At the Dora substation four 2,300-volt feeder switches are connected for operation from a single reclosing device. Each switch has an individual contact switch closing the

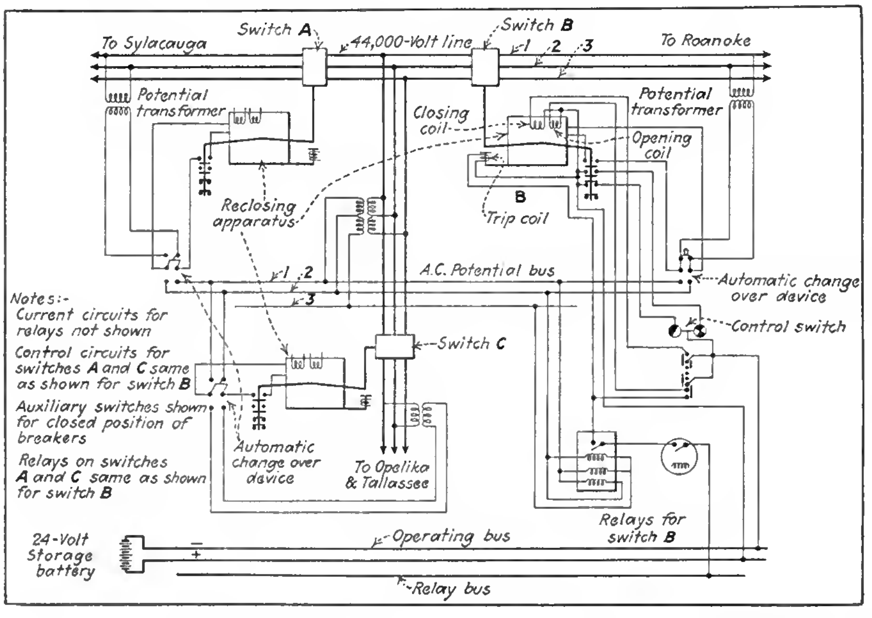



AUTOMATIC CHANGE-OVER DEVICE FOR POTENTIAL ON RECLOSING SWITCHES

motor circuit of the reclosing device. Should any breaker open automatically, the reclosing device will close it after a one-minute period without affecting the other breakers. Through this arrangement each feeder switch becomes automatically operated practically as though controlled by a separate reclosing device, thus reducing considerably the first cost.

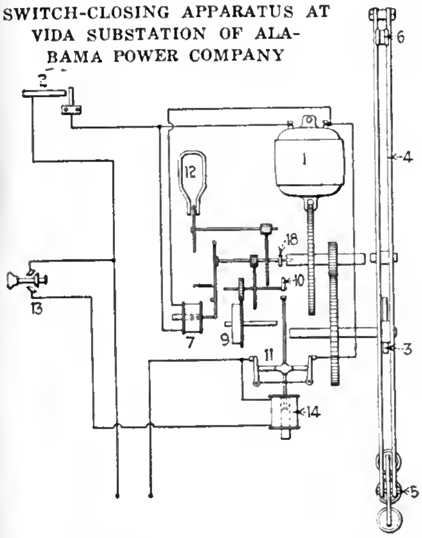
More recently the reclosing equipment provided with trip free attachment, trip coils and opening coils has been installed at Opelika substation, making this station almost fully automatic. The wiring of the control circuits is shown in one of the accompanying diagrams. The reclosing equipment on switches *A* and *B* takes its potentials from potential transformers on the respective lines. Switch *C* gets its potential from a contactor (shown in detail) which automatically makes connection to the transformer which is energized.

On the reclosing device furnished for the Opelika substation the trip-free attachment is a set of auxiliary levers working in between levers (4) on the schematic diagram of the reclosing equipment and arranged with latches and trip coil so that these




OPELIKA SUBSTATION MADE PRACTICALLY AUTOMATIC BY SWITCH RECLOSING DEVICE (AUTOMATIC CHANGE-OVER SWITCH SHOWN ABOVE)

SWITCH-CLOSING APPARATUS AT VIDA SUBSTATION OF ALABAMA POWER COMPANY

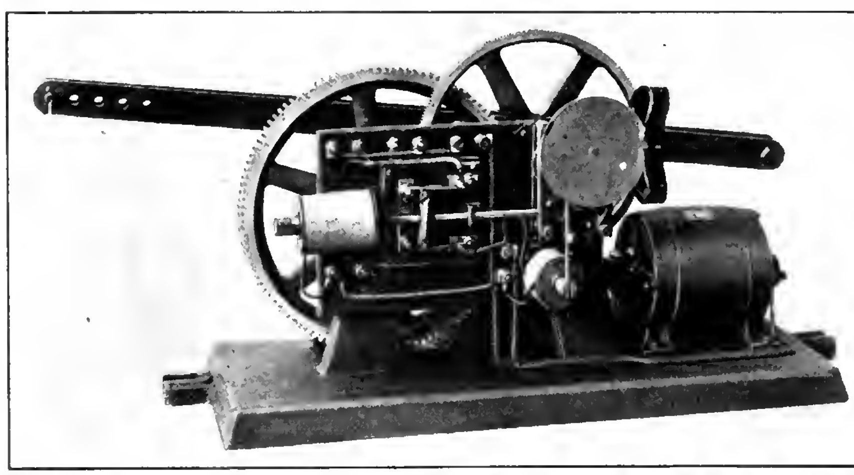


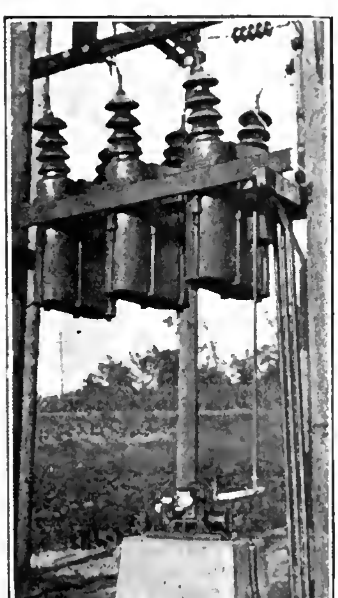

The small motor (1) for driving the gear train is designed for alternating current at 110 volts. The auxiliary switch (2) is so mounted on the oil breaker that when its blades are opened the contacts (2) are closed, thus establishing a current supply through cut-out switch (11) to the motor. The cam (3) attached to the main shaft of the large gear in revolving moves the lever (4) in such a way as to put the springs (5) under tension. When the rod (6) has reached the lowest point in its travel the mechanism of the switch to which the reclosing device is attached latches to close its contact when operating handle is moved in the opposite direction. As the cam (3) revolves further the tension of the springs is released for returning the lever (4) to its original position, thus closing the switch. When the circuit is closed through motor, potential across its terminals is applied directly to the clutch magnet (7) and the clutch (8) is made to engage with the revolving shaft. Movement of the gear train controlled through the clutch (8) winds up the spring on the larger gear (9). As the gear train continues to move the lever (10) revolves into contact with push rod controlling the cut-out switch (11) and finally the switch is opened, thus disconnecting the current supply to the motor (1) and stopping the operation of the device. The stop under lever (10) may be adjusted so that the motor is shut off when the cam revolves for closing switch once, twice, thrice or any predetermined number of times. As soon as the cut-out switch (11) opens the potential is removed from the clutch magnet and the clutch (8) disconnects the reset mechanism from the shaft. The spring (9) unwinds, reversing the movement of the gears, and returns the reset mechanism to its original position for another cycle of operation. The magnet and disk (12) retard rapidity of motion as gear train is reversing to original position after operation of device. Assuming stop is set under lever (10) for a cycle of two switch operations, then when closing contacts (2) are closed cam will close switch, say, after an interval of one minute. Trouble still being upon the circuit, the switch automatically reopens instantly, and then current supplied through contacts (2) is continued to motor until second closing operation, at which time the lever (10) operates cut-out switch and the device becomes inoperative until pull button (13) on switchboard is made to energize the reset solenoid (14) for reclosing the cut-out switch (11).

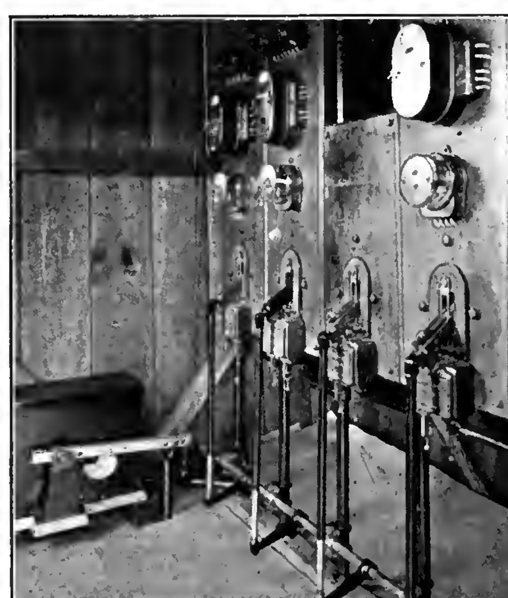
features become a part of the device instead of the oil switch itself. In other words, energizing the trip coils releases the auxiliary levers which are connected to the main breaker and permits the breaker to drop open. The reclosing device is immediately set into motion and the cam operates to lift the levers (4) to relatch the auxiliary levers at the upper end of the stroke and to bring both the auxiliary levers and levers (4) down together as the roller travels along the vertical face of the cam for closing the switch. The opening coil is attached to the present reset solenoid or closing coil and makes it possible to remotely control the opening of the cutout switch (11). This attachment eliminates the use of the Westinghouse KN-relay. Westinghouse control switch No. 271787 is easily applied for control of the device.

Reverse power relays on switches *A* and *B* and overload relays on switch *C* provide the necessary protection. The potentials for the reverse-power relays are taken from the potential transformers which actuate the reclosing devices. Phases 1 and 3 are wired through auxiliary contacts on switches *B* and *A* respectively, so that in case either incoming line is out of service for repair or maintenance work there will be no danger of a feed back from the "live" line.

In case of trouble on the Sylacauga line, switch *A* will open automatically and will reclose as soon as the line is energized from Sylacauga. If the potential coil for switch *C* is connected to the potential transformer on this line, it will automatically be switched over to the potential transformer on the Roanoke line by the device mentioned above, thus keeping the reclosing device on switch *C* operative. If the trouble occurs on the Roanoke line, the reverse operation takes place. In case of trouble on the Opelika feeder the device on switch *C* will operate to restore service. When trouble occurs on the two incoming lines and the Opelika feeder all three switches will open automatically. The switch on the incoming line which is first energized will close, and a fraction of a second later switch *C* will close and restore service to Opelika.







ALABAMA POWER COMPANY SUCCESSFULLY DEMONSTRATES THE USE OF RECLOSING SWITCHES

Top—Reclosing device that is shown elsewhere schematically. Left—44,000-volt, 300-amp. G. E. KO-26 oil switch operated for over a year with automatic device. Right—Four 2,300-volt feeder switches at Dora, operated by single reclosing device.

As soon as one incoming line switch has opened and remained so the reverse-power relay on the other incoming line is inoperative since the potential circuit has been opened as explained above. This will not matter, however, as switch *C* still has overload protection which will take care of trouble on the Opelika feeder, and in case of trouble on the incoming line service will be interrupted to Opelika anyway, so that automatic operation of either incoming line switch is not necessary when the other one is open.

It will be noted that the automatic devices are connected to the pull-button control switch, in such a manner that they can be operated from the board like regular electrically operated breakers.

This reclosing device, which is now being manufactured by the Southern States Equipment Company, has extensive application to all clases of automatic switching apparatus erected at isolated stations with or without regular attendance and where there are no large storage batteries installed or the available alternating-current capacity for operating such a device may be small. Should expense for the purchase of potential transformers to furnish alternating-current supply become prohibitive, the device may be altered to operate from the type of storage battery commonly used in automobiles. Typical installations include switches, controlling feeders at mines where overloads are frequent and attendance irregular, isolated substations on transmission lines supplying small distribution systems and feeder substations of a control-station system where automatic operation serves materially to reduce yearly costs. The simplicity of the apparatus makes for low manufacturing costs and minimum maintenance expenditures with very little attention except occasional oiling and inspection.

G. H. MIDDLEMISS,
Superintendent of Distribution.
Alabama Power Company,
Birmingham, Ala.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Instructions for Operating Feed-Water Heaters

ACCORDING to the operating code of the Philadelphia Electric Company, the three principal reasons for heating feed water are: (1) To utilize the heat of exhaust steam which would otherwise be wasted. One per cent of over-all efficiency is gained per 10 deg. F. increase in temperature of the feed water. (2) To prevent excessive stresses in the boiler caused by cold water striking heated surfaces. (3) Because dissolved air in the feed water is driven off by heating to 212 deg. F., and this decreases the amount of corrosion in the boiler and economizer.

In filling feed-water heaters, exhaust steam must be admitted slowly at first, to allow the water to heat uniformly, otherwise unequal expansion strains would be set up. The discharge valve is opened slowly to prevent the cool water of the incoming heater from reducing the temperature of the feed water from other heaters then in use. Vents on the heater must be kept open in order to allow air to escape which has been liberated by heating the water. The above code gives the following instructions for putting a heater on the line and for taking it off:

PUTTING A HEATER ON THE LINE

1. See that the drains are closed.
2. See that the vents on the heater are open and remain open.
3. See that the gage glasses are open and in operation.
4. See that the water valve on the seal is open and fill the seal, then cut down the water supply to a small amount.
5. Open the water-inlet valve and exhaust-steam valve slowly.
6. See that the float valves are operating freely.
7. When the heater has reached the operating level, partly open the discharge valve to the boiler-feed-pump suction line.
8. Open the exhaust-steam valve wide. When the operating temperature is reached, open the water-inlet and discharge valves wide.
9. See that the proper amount of pressure is obtained in the exhaust-steam header.
10. Open any trap discharge lines that lead to the heater.
11. See that the valve on the connection between the heater and float tank of the weir recording apparatus is open.
12. See that heaters divide the load equally and that the meter mechanism is operating properly.

TAKING A HEATER OFF THE LINE

1. Partly close the water-feed valve and allow the water to reach minimum level.
2. Close the exhaust valve.
3. Shut off all traps entering the heaters.
4. Close the feed-water valve.
5. Close the discharge valve to the pump suction line.
6. See that the vents are open.
7. Open the drain.
8. Before opening the heaters, close the vents.

## Using Induction Motor to Start Frequency Changer

IN ORDER to raise the rotor of frequency changers from the bearings by a film of oil, thereby requiring a much smaller starting motor than would be needed were the rotor not lifted, oil is supplied to the bearings under pressure. The following instructions for starting frequency changers with an induction motor and for shutting them down have been abstracted from the operating code of the Philadelphia Electric Company:

STARTING

1. When an oil pump is supplied, start it.
2. When the oil pressure reaches the proper value, open the valves admitting oil to bearings.
3. Adjust the valves on the pipes feeding the bearings so that the one farthest from the pump will be opened widest. If this does not lift the shaft from the bearing, open one valve at a time wide until the shaft does lift. Then adjust the valves as stated above.
4. See that the controller is in the starting, or "off," position.
5. Close the switch of the starting motor, observing the ammeter.
6. When the starting motor current falls to a specified value, cut in the next step of the controller, again allowing the current to fall in the specified value. Repeat until the proper controller point for synchronizing is reached. This point should be marked on the controller.
7. Shut down the oil pump.
8. Put on the fields of 60-cycle and 25-cycle machines and raise the voltage of the machine to be synchronized first to that of its bus.
9. When one or more sets are already in operation, plug in the synchronoscopes of both machines and bring the incoming set to approximately synchronous speed by varying the field of the machine to be synchronized last. When pointers of the synchronoscopes are in proper position with respect to each other (determined by a synchronizing calculator) close the oil switch of the machine to be synchronized first, when it is in synchronism.
10. Open the switch of the starting motor, place the controller in the "off" position, adjust the voltage of the machine to be synchronized last, and close its oil switch.

SHUTTING DOWN

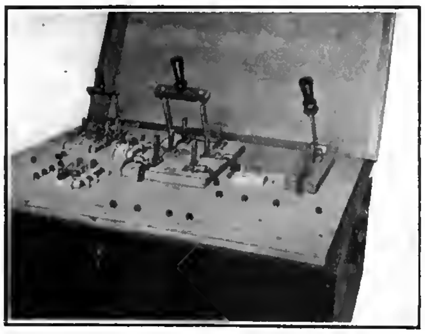
1. Adjust the power factor of the machine to be taken off first (either 25-cycle or 60-cycle) to unity.
2. Open oil switch of that machine.
3. Adjust the power factor of the other machine to unity and open its oil switch.
4. Cut in all resistance of both field rheostats.
5. Open the field switches.

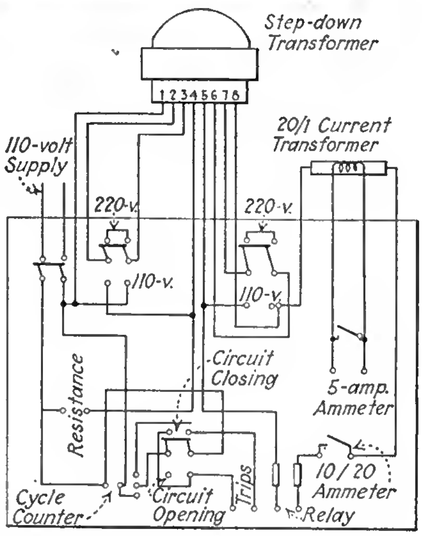
## Portable Set for Testing Relays

IN TESTING induction-type relays during the past it has been the practice of the Alabama Power Company to base all settings on a test curve showing relay characteristics when the 4-amp. tap is being used. This was done because it was impossible to pass more than 22 amp. through the relays with the portable test sets then available. It was found, however, that a test curve based on the higher-current taps would not pass through the same points as one based on the 4-amp. tap. A difference of 2 cycles to 10 cycles was observed between 150 and 400 per cent current setting.

Consequently the relay-testing set shown in the accompanying illustration was developed and is now being used in each station. All of the test equipment except the cycle counter, ammeter and adjustable resistor are contained in the test set. The test man carries these and also leads, contact parts, air valves for relays, oil and a folder containing curves and data on all relays on the system. The resistor is a Ward Leonard loading rheostat similar to the "RLR-120" except that it has a capacity of 10 amp. in steps of 0.1 amp.

A step-down transformer is used with the set to make it possible to obtain large current at low voltage without overloading the 110-volt supply. The windings of the primary and secondary may respectively be connected in series or parallel by means of the double-throw switches on the test set. This provision, together with the lower right-hand knife switch which cuts out a high reading ammeter when current values are such as to require the use of the current transformer shown above, enables the operator to obtain practically any current required for testing relays.






FIGS. 1 AND 2—EXTERIOR AND WIRING CONNECTIONS OF RELAY TEST SET

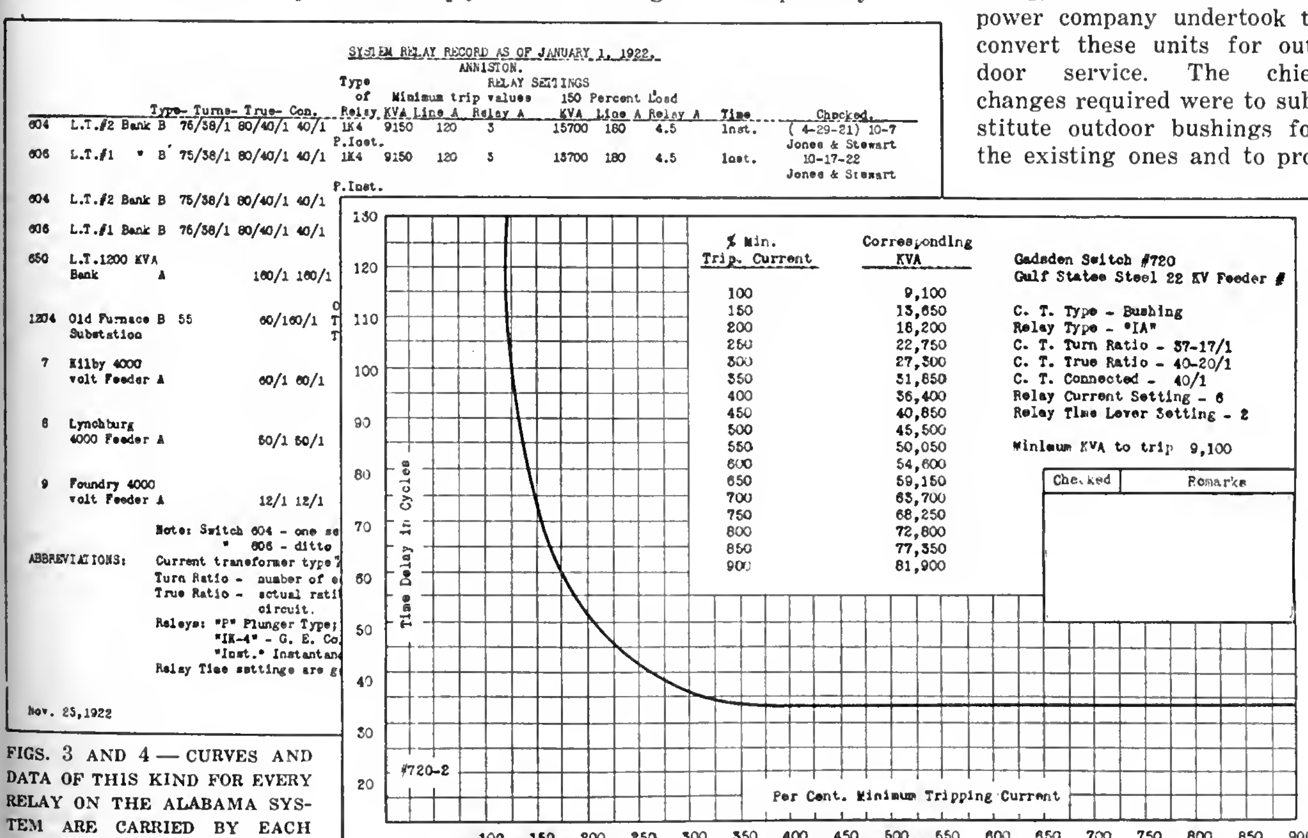
The coil and contact of the relay to be tested are connected across the four terminals at the bottom of the winding diagram. If the relay is of the circuit-closing type, the double-throw switch to the left is placed in the upper position. If the relay is of the circuit-opening type, the double-throw switch is placed in the lower position.

The resistance mentioned above is a variable resistance used to regulate the current in the step down transformer primary.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Indoor Breakers Converted to Outdoor in Need

BEING faced in an emergency with the immediate need for outdoor circuit breakers and having nothing but indoor units which had the desired rating, the one Southeastern power company undertook to convert these units for outdoor service. The chief changes required were to substitute outdoor bushings for the existing ones and to pro-




FIGS. 3 AND 4 — CURVES AND DATA OF THIS KIND FOR EVERY RELAY ON THE ALABAMA SYSTEM ARE CARRIED BY EACH TEST MAN

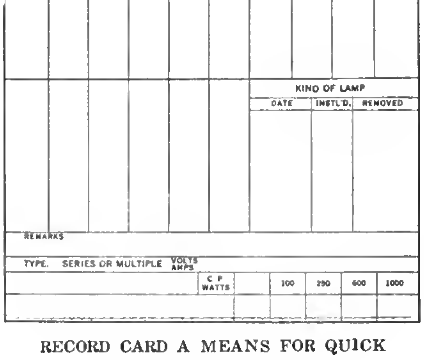
vide a weatherproof housing for the operating mechanism.

Consequently the old terminals were removed and outdoor bushings substituted without any change except to provide cork gaskets. Then a housing for the operating mechanism was improvised. This was done by bending angle irons, which were to serve as the attachment of the housing to the circuit-breaker cover, to conform to the contour of the breaker cover. Cork gaskets were then placed under the angle irons and drilled to receive cap screws in the breaker cover. At the corners the angle irons were welded together. The lower part of the housing (in two parts), which was made of ⅛-in. sheet metal, was riveted to the angle irons, while the top, made of thinner metal, was fastened to the lower part with wing nuts.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Keeping Street-Lighting Records

A CARD-INDEX file system has been found very satisfactory by the Detroit Edison Company for keeping records on street lamps. The 5-in. x 5-in. card shown in the accompanying illustration is used. It contains information showing the individual number of each lamp, the location of the lamp and the type of fixture in which the lamp is used, and it affords means for recording burn-outs and broken globes, so that the life of each lamp can be checked




RECORD CARD A MEANS FOR QUICK RECAPITULATION OF LAMPS AND FIXTURES

against the guarantee. In addition, the system affords a means for quick recapitulation of lamps and fixtures in service and permits billing against small towns to be made readily and accurately.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Industrial Trucks Effect Striking Economies

EACH industrial electric truck in a group located at Balboa, Canal Zone, replaces six laborers at $45.76 per month each, or $274.56 per truck, besides saving about 60 per

BULK LOADS CONVENIENTLY HANDLED

cent of the time formerly required in the handling of material, according to advices received from an operating chief at the Pacific terminal. The service performed consists principally in transferring incoming freight from cars to temporary and permanent storage sites and delivering supplies to steamships berthed at the various docks. An installation of Yale industrial trucks at this terminal is operated at an average monthly expenditure of $185.76 each. which includes the operator's wages, upkeep, depreciation and energy consumed in charging.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Boiler Paint Stops Corrosion of Turbine Disks

INTERNAL boiler paint has been successfully used for many years to prevent corrosion and adhesion of scale on internal surfaces of boiler drums. About a year ago engineers of the Southern California Edison Company conceived the idea of experimenting with internal boiler paint to prevent the trouble they were experiencing from corrosion of the wheel disks of their steam turbines. Some of the wheel disks of a 20,000-kw. vertical Curtis turbine were thoroughly cleaned and painted, while other disks in the same turbine were not painted.

About a year later this turbine was opened for inspection and the effect of painting the wheel disks noted. Practically no further corrosion was noticeable on the disks which had been painted, while those which had not been painted had corroded at about the former rate. Before adopting the use of boiler paint to prevent disk corrosion the depreciation of turbine-wheel disks due to corrosion was about $250 per disk per year.

J. W. ANDREE,
Engineer, Operating Department.
Southern California Edison Company,
Los Angeles, Cal.

## Cost of Building 3,000-Kva. Transformer Substation

THE accompanying itemized costs of a 3,000-kva. substation, exclusive of land, have recently become available in connection with a Massachusetts substation extension begun in 1917 and completed in 1919. Three 1,000-kva., 22,000/2,300-volt units were installed with complete substation equipment as listed.

SUBSTATION INSTALLED AT A COST OF $8.56 PER KVA.

| | |
|---|---|
| Three 1,000-kva. transformers | $9,103 |
| 100 lb. blotting paper for oil filtration | 22 |
| Two L-3V floodlighting units | 88 |
| One 22,000-volt lightning arrester | 745 |
| One No. 102,879 relay | 15 |
| Six L-224,644 overload relays | 127 |
| Two PP-St. circuit-breakers complete | 2,529 |
| Fifteen three-unit stud anchorages | 7 |
| Three 300-amp. air-break disconnecting switches | 484 |
| Two S-224,644 overload relays | 44 |
| Two oil switches complete | 867 |
| One tank-lifting device | 35 |
| One panel and fittings (1779, SOCR) | 32 |
| One storage battery complete | 946 |
| One motor generator, 2.25 kw. | 221 |
| One battery panel with instruments | 264 |
| 1,282 lb. electrolyte | 33 |
| 250 ft. 1¼-in. galvaduct | 52 |
| 75 ft. 1-in. Sheraduct | 13 |
| 80 ft. ½-in. Sheraduct | 7 |
| Two steel cabinets | 10 |
| Condulets and covers | 89 |
| Miscellaneous | 1,145 |
| Two 2,200-volt potential transformers | 40 |
| Two 1,000-amp. current transformers | 74 |
| One 5/1,000-amp. type H-2 ammeter | 27 |
| One 1,000/5-amp. 220/100-volt wattmeter | 22 |
| One 5-amp., 110-volt, 4,000-kw. wattmeter | 56 |
| One 175-volt voltmeter | 34 |
| 800-ft. fiber conduit | 52 |
| 275 3½-in. couplings | 26 |
| 26 3½-in. 90 deg. conduit bends | 52 |
| 54 2½-in. Sheraduct bends | 26 |
| 280 ft. 1,000,000-circ.mil lead cable, 5,000 volts w.p. | 588 |
| 200 ft. 1,000,000-circ.mil single conductor cable | 330 |
| 357 lb. ½-in. copper tubing | 171 |
| 194 lb. 1-in. copper tubing | 95 |
| 200 ft. ½ in. x 2-in. bar | 137 |
| Three type MS 220-volt, three-conductor potheads | 87 |
| Seven type TS 2,300-volt one-conductor potheads | 90 |
| 275 ft. No. 6 twin lead-covered wire | 66 |
| 280 ft. 124-conductor lead-covered cable | 80 |
| 282 ft. 123-conductor lead-covered cable | 72 |
| 100 ft. four-conductor stranded copper cable | 10 |
| 230 ft. three-conductor stranded copper cable | 18 |
| 100 ft. 1-in. galvaduct copper cable | 16 |
| 255 ft. solid "Sicimore" wire | 3 |
| 160 ft. No. 6 stranded double-braided rubber-covered wire | 9 |
| 250 ft. No. 10 stranded double-braided rubber-covered wire | 7 |
| 255 ft. No. 12 solid wire | 9 |
| 200 ft. ½-in. galvaduct | 16 |
| 100 ft. No. 10 twin rubber-covered wire | 5 |
| Insulators, fittings, clamps | 504 |
| Labor | 3,762 |
| Labor and material on vault in basement | 633 |
| Insurance | 74 |
| Engineering | 1,620 |
| Total | $25,698 |
| Cost per kva. | $8.56 |

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## A Merchandise Sales Code

**Fundamental Principles Which Should Be Observed by the Central Station Commercial Department in Selling Appliances**

By W. E. Clement

Commercial Manager New Orleans Public Service Inc.
General Chairman Sectional Joint Committee for Business Development of the Southwestern Geographic Division, N. E. L. A.

In going after new business the commercial manager of a central-station company should do so with a broad understanding of what will be profitable to the company as a whole—not merely what will make a good showing from a spectacular viewpoint. This is particularly true in the sale of appliances where the objective is twofold—first, to build up the connected load, and, second, to conduct this branch of the business so that it will at least be self-sustaining and preferably show an actual net profit. Though there is always a certain amount of this business which comes in of its own volition, it is only by carefully working out and following a definite plan that it can be made to produce a maximum volume of business and earn a profit.

W. E. CLEMENT

It sometimes happens that the sale of merchandise fails to pay its way not because of a lack of volume but because some of the cardinal principles of any successful retail business have been overlooked. Central-station merchandising does not differ greatly from other businesses, but there are certain broad principles which should be carefully adhered to if the department is to be successful and stand upon its own feet. Merchandise sales operations may be classed under six general headings — buying, stock keeping, sales floor and window displays, sales policy, sales advertising and the sales force. The organization and handling of these fundamental features may advantageously be carried out as follows:

*Buying.*—Buy the best appliances made. Stick to one manufacturer's complete line when all items are as good or better than similar items of any other line. Purchase so as to secure quantity discount, but bear in mind that slight differences in discounts are not usually a saving unless the additional merchandise can be moved quickly.

Always have at hand up-to-date stock sheets from your manufacturers and jobbers on all fast-moving merchandise, and know the time required to place this merchandise in your storeroom.

Grant all salesmen an interview. Let them wait for you, but make them comfortable while waiting. Don't let them waste their time or yours, but let them know that you also sell things, and that you like to make it easy for them to sell to you when possible. Not many new good things are missed if you are easy to approach.

*Stock Keeping.*—There should be no uncertainty or leaving to chance as regards the proper and accurate receiving, checking, pricing and storing of merchandise. A few months of uncertainty or carelessness may take high-priced help hours to straighten out. If $100 in currency is being received, it is accurately accounted for. If merchandise is being received for which $100 is to be paid, should it be any less accurately accounted and less properly cared for?

*Sales Floor and Window Displays.*—Equip your sales floor and windows with modern but not necessarily expensive store and window fixtures, including the best and most correct lighting installation in town. Arrange your merchandise so that a customer can locate without effort the kind of appliance she may be in search of and, at the same time, be aware of seeing distinctly several other kinds of appliances that she may not possess.

On the sales floor make groups of the different types and sizes of the same kind of appliances. As a rule, display one article only of each of the items of your complete line. Sell the articles on display. A shop-worn article should be offered at a big reduction in price to force a quick sale. These methods help to keep your merchandise appearing fresh and new.

The show windows are so valuable a sales medium that a special study of window trimming is necessary in order to get the return from them that you are justly entitled to expect. It is not necessary to mention that sales floors and windows can never be kept too clean and neat.

*Sales Policy.* — Form your sales policy from a definite knowledge of such important factors as the possibilities and limitations of the field you expect to cover and the amount of money that can be invested in stock and time-payment accounts. Consider the relation of short and long-time payments to gross sales; consider the manufacturer's guarantee on the merchandise to be handled; consider what arrangements are to be made with other departments of the utility, so that a merchandise sale may be handled as any other efficient retail store would handle a similar sale; consider whether it is intended to promote intensely, and perhaps at a loss, any or

all new but practical appliances; consider what percentage, if any, of net profits on merchandise sales as a whole is to be sacrificed for rapid increases in kilowatt-hour sales; consider the number and kind of campaigns to be run yearly; consider the relations you expect to maintain with the contractor-dealers, and consider the experience and ability of each individual in the sales force. After weighing such factors as these you are in a position to form a sales policy which will be in keeping with the sales service you expect to render.

*Sales Advertising.*—Consider carefully all possible advertising mediums and their relative value to you. Make use of, but not abuse of, all free advertising matter supplied by manufacturers—such as stickers for bills, descriptive pamphlets, counter stands, window cards, price tags, etc. Estimate the amount to be spent with each of such paid advertising mediums as you expect to use. Time all advertising so that you are featuring the merchandise your sales force is focusing on. Unusual methods and special attention are necessary when conducting a campaign. Adopt the slogan, "Tell it to them quickly, and tell it to them often." Housewives are the biggest and best buyers of electrical merchandise. They have been educated to certain styles of advertising—direct your advertising to them along the same general lines that the big successful retailers use. Study advertising. The biggest and most successful merchandisers personally direct their advertising.

*Sales Force.*—The sales manager must have first a thorough knowledge of the inside workings of a utility and the service it is expected to render. Next, he must understand merchandising as well as, and preferably better than, the average successful retailer. A low-priced man, if he really is a low-priced man, will not do, as the entire standard of the utility will be lowered and the investment will prove expensive.

A sales manager of ability should receive broad authority and be subjected only to the advice and regulation of the general manager or, in large holding companies, to the instructions of a sales manager in charge of all sales operations for the holding company. Selection of this man is vital to the promotion and best interests of the utility, including the profitable handling of merchandise.

Merchandise salesmen should be carefully selected, especially considering their natural or acquired ability to meet and please the public and to work without friction with their business associates.

### Morning Meetings Essential

The sales manager, when possible, and his assistant at all other times, should conduct a morning meeting, starting at a fixed time and ending ordinarily at a fixed time. This brings the sales manager in personal contact with his force and gives him an opportunity to issue instructions and discuss sales problems.

Merchandise salesmen may be assigned to sections of the territory served and maintain a perpetual canvass and "follow-up" of each user of electric service in this section, using any good method for keeping up-to-date records of this work. When organizing a campaign these records are of great value.

The territory salesmen will probably get the best results if paid a nominal salary plus a liberal commission, provided that a careful survey has been made of the possibilities for sales and that the man of average ability is then allowed to make the average income for similar work. This method weeds out the inefficient man and properly compensates the man of exceptional ability. A daily report of the sales of each individual salesman and a comparison of these reports establish a healthy condition of friendly competition in the department.

There should be constant help and training given the salesmen. Each individual should understand thoroughly the company's service and the merchandise he sells. Manufacturers' and jobbers' representatives can frequently be used as an aid to the instruction and training of salesmen.

As the sales force comes in daily contact with a great many of the company's customers who judge the utility by the promptness, courtesy and ability of these men, too much attention cannot be given to developing a truly representative organization of salesmen.

## Boston Electrical Home Opened

Under the auspices of the Boston Electric League, an electrical home was opened to the public on April 14 in the Wauwinet section of West Newton. Devices to be shown were selected by drawing lots, and the trademarks and makers' names were concealed in order to avoid any bias on the part of the visitor toward any particular type of equipment shown.

All branches of the local electrical industry co-operated in the work, together with a local real estate concern and a leading house furnisher who provided the setting for the electrical devices exhibited. About fifty appliances were shown, with adequate convenience outlets, in the seven rooms which compose the dwelling.

## Public Utilities as Community Builders

By Henry Bostwick

Manager San Francisco Division Pacific Gas & Electric Company

It has often been said that the prosperity of a community can well be judged by its public utilities, but I believe we should go a step further and say that all public utilities, particularly electric and gas companies, can and should be classed as community builders. However, the extent to which a utility assists in the upbuilding of a community and to what degree it merits being called a "community builder" depend in a large measure upon its public relations.

The Pacific Gas & Electric Company has given much thought and study to this matter of building and cementing better public relations. As an instance of what has been done along this line, it has been the practice of the company for some time to take parties of citizens on inspection tours through its various generating plants.

We feel that this has done more toward building better public relations than any other means that we could possibly have adopted. In the San Francisco division during the past year we have had the pleasure of a visit to our plants from the grade school teachers' association. There were 125 in this party, which visited the plants in the evening, and to use their own words: "It was an inspirational trip to all of us." Recently a women's organization known as the "See and Know San Francisco First Club" was conducted through the plants with the same result. In addition to personal visits to our plants representatives of the company are always glad to appear before any of the schools, mothers' clubs or other associations to tell about our industry. This practice

has always resulted in very favorable comment and appreciation from the members of these associations.

No branch of our service is receiving more constructive thought and application today than that of public relations. Not that we have been altogether neglectful of this important matter in the past, but conditions have arisen during the last three or four years which have brought it more forcibly to the attention of the managing heads of all institutions throughout the country, whether of a public or private nature. From our experience we believe that the central-station manager who is not taking advantage of such simple things as these inspection tours to foster and cement a better feeling toward and closer relations with his company in the community it serves is overlooking a valuable opportunity to build good will.

## Central Station Sells 1,120 Washers in Thirty-Day Campaign

THE Utah Power & Light Company, with general offices at Salt Lake City, continued its record-breaking pace in the sale of washing machines during March of this year, when a total of 1,120 machines were sold in a thirty-day campaign which has been an annual feature of the company's commercial program for several years past.

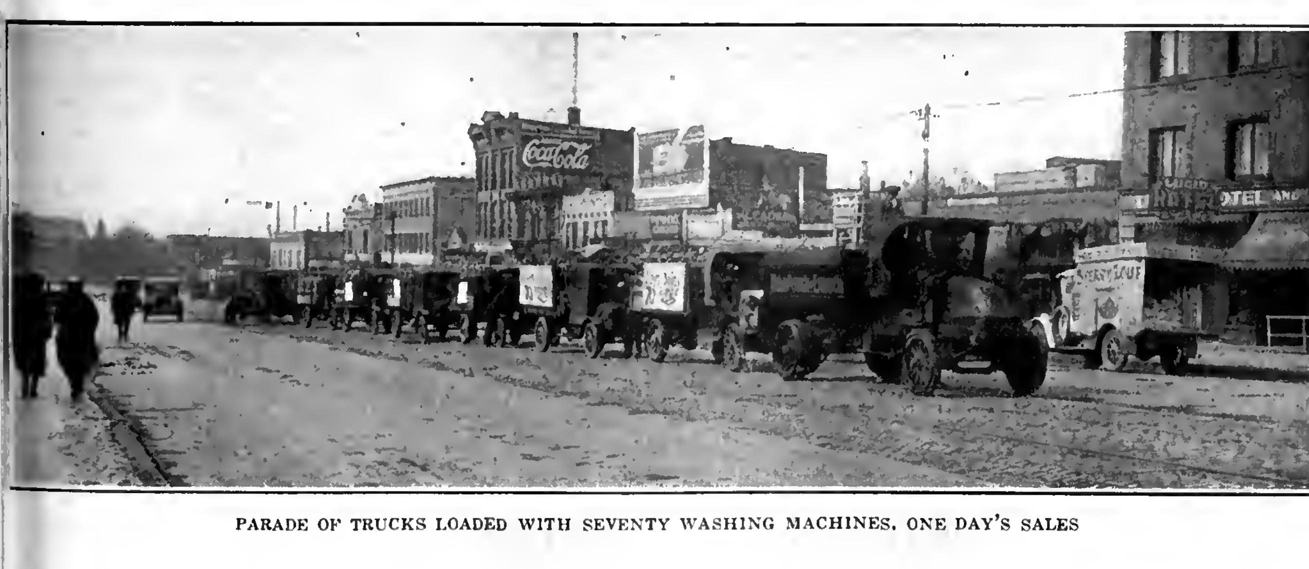
To dispose of this number of machines in that time in a widely scattered territory with a population of approximately 350,000 people distributed over a large part of Utah, southern Idaho and western Colorado is a splendid example of real central-station selling. The company serves in its entire territory 62,000 residence customers. At the start of the campaign a quota of 1,000 machines was set as the goal. This quota was divided proportionately among the eight divisions of the company's territory, and competition among these divisions was aroused by offering cash prizes for those which exceeded their quota, for the division which made its quota first and for the division which exceeded its quota by the greatest percentage. As in previous campaigns, this arrangement was a strong factor in the success of the drive.


TYPE OF ADVERTISEMENT USED IN WASHING MACHINE DRIVE

Easy terms of $1 down and $5 a month were offered and proved very attractive to customers. A liberal amount of newspaper advertising was used in all of the papers published throughout the company's territory. All the advertisements carried a slogan "A Copper Washer for a Silver Dollar," and the convenience, labor and money-saving features were also played up. A particularly interesting publicity stunt used to advertise the sale was a parade of several truckloads of washing machines on the main street of Salt Lake City, carrying a total of seventy washers representing one day's sales. Other features used to put the campaign over were banners on street cars, company automobiles and trucks; the delivering of washing machines from the front doors of some of the company's stores; distribution of 1,000 caps bearing the slogan "A Copper Washer for a Silver Dollar" to newsboys and others; placarding of freight cars loaded with machines; lettering of the sidewalk in front of stores, and the demonstration of machines in homes.

Daily sales reports were received by the general sales department at Salt Lake from the company's various divisions, and daily bulletins were forwarded to division managers and salespeople showing the relative standing of each division. This kept the enthusiasm and rivalry at a high pitch throughout the campaign. Daily sales letters were also sent out, encouraging those actively engaged to use their utmost energy in order that the quota might be reached or exceeded.

About thirty-five people were actively engaged in the selling of the machines, including some office employees who devoted part of their time to the work. These salespeople all worked on the outside, with the exception of about twelve inside salesmen. As in the past, the generous use of advertising, the selling of a thoroughly dependable piece of merchandise and the offering of terms within reach of every one were important factors in making the campaign a success and establishing what is believed to be another record.




PARADE OF TRUCKS LOADED WITH SEVENTY WASHING MACHINES, ONE DAY'S SALES

## Showing an Interest After Obtaining Business

MANY electric service companies will, when the question is raised, contend that they make every effort to show an interest in their customers after their application blank is signed, but the customers are not always so quick to agree with this contention. Actions speaks louder than words, and to make its service as near 100 per cent as possible the Georgia Railway & Power Company maintains a "greater service department." Four men are engaged in this department, which is really a field organization. They travel from customer to customer steadily, asking whether the service is satisfactory, if not why not, whether all equipment or apparatus is in service, and so forth. A record containing definite questions of this character is filled in for each customer and turned into the sales department promptly for immediate attention.

Minor repairs like mending of flatiron cord are made by the "greater service" representative, but major repairs necessarily are reported to the central office with other statements regarding service. The troubles are then adjusted by the electric service company or, if it is not the duty of the company to attend to them, the customer is informed how to get the work done.

In addition to the relatively detailed investigations of the greater service department representatives, the company has recently instituted a system of inquiry and investigation which is carried on coincidentally with the meter reading. As the reader enters the home he greets the lady-of-the-house with a "Good morning (or afternoon) Mrs. Blank" and makes inquiry as to whether the service is satisfactory and if not, in what respect it is deficient. When the reader reports back to the office in the afternoon he turns in reports of any complaints or requests for appliance adjustments. This innovation has served materially to improve customer relations and the time required for gathering the information has not appreciably increased the cost or time required for meter reading.

A great many prospects for gas and electric appliances are obtained in this way.

In the event apparatus, piping or wiring is found in a condition dangerous to life or property, or installed in such a manner as to be the cause of high consumption, a personal letter signed by the general sales manager is sent to the customer immediately after the visit, stating that the field man has reported that such and such a condition prevails and that same should be remedied.

The psychological effect of such methods alone, if no other advantage accrued, is worth the expense and time, says C. A. Collier, general sales manager. Furthermore, they prevent complaints accumulating and growing into general dissatisfaction that could only be eradicated with difficulty.

Form 2-616—20M—4-5-22

CUSTOMER REPORT

Date ..............................

Name .............................. Address ..............................

Service furnished: ELECTRIC LIGHTS, POWER, COOKING; GAS: COOKING, WATER HEATING.

Customer's statement of service, Electric .............................. Gas ..............................

Complaint of Servire, if any ..............................

..............................

Apparatus—Electric: Toaster, percolator, chafing dish, waffle iron, small stove, range, vacuum cleaner, sewing machine, washing machine, iron, ironing machine, dish washer.

Gas: Range, tank, heater, automatic heater, iron ..............................

Does customer wish broken apparatus repaired? ..............................

Attitude towards company ..............................

Remarks ..............................

..............................

..............................

Person interviewed .............................. Signed ..............................

A RECORD OF THE APPLIANCES IN SERVICE AND CUSTOMER'S ATTITUDE TOWARD THE COMPANY IS KEPT ON THIS FORM

## What Other Companies Are Doing

**Hartford, Conn.**—Following the offer of a limited number of shares of its stock to customers and their families on a cash or an installment basis, 1,075 shares were sold in the first four days by the Hartford Electric Light Company. The shares were sold to net 6 per cent to the purchaser. In a statement announcing this customer-ownership plan, Vice - President Samuel Ferguson pointed out that such a distribution represents a true and efficient "public ownership of utilities," in contrast to the form commonly advocated in socialistic circles, which should be more properly entitled "political ownership."

**El Paso, Tex.**—The employees of the El Paso Electric Ralway Company have formed a beneficial association to provide medical aid for employees who may be injured or become sick while in the services of the company. The monthly dues are $1 per month and the benefits include in addition to doctor and hospital service a death benefit of $1,000. All employees of the company, both men and women, whether in the railway or light and power departments, are eligible to membership upon meeting the entrance requirements.

**Montpelier, Vt.** — In a recent six months' house-wiring campaign by the Montpelier & Barre Light & Power Company 3,536 outlets were added, an average of sixteen outlets per house. Eighteen towns were canvassed and 210 meters added to the system. Of 6,664 homes in the territory, 5,416, or 84 per cent, are now wired and being served by the company.

**San Francisco, Cal.**—The annual report of the Pacific Gas & Electric Company was broadcasted on April 10 from the Mercantile Trust Company's radio station. Wiggington E. Creed, president of the power company, delivered the message. This is the first annual report to the stockholders of a public utility that has been sent over the radiophone on the Pacific Coast.

**Lowry City, Mo.**—The West Missouri Power Company has purchased the Osceola Light & Water Company of Osceola, Mo. A transmission line will be constructed from Lowry City to Osceola to supply the electric service in Osceola, and the water plant will be equipped with motors so that it can be operated electrically.

# Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Hydro-Electric Development in California.*—G. C. TENNEY.—In its Big Creek-San Joaquin River hydro-electric project, where approximately $300,000,000 is being spent to produce and market 1,400,000 hp. of electrical energy, the Southern California Edison Company is keeping abreast of the ever-increasing power demands of the rapidly growing territory to which its service extends. This ten-page, amply illustrated article deals with the general engineering features of this project. Tables give the capacity of present power houses, connected load in horsepower, miles of transmission lines, number of meters employed, uses to which electrical energy is being applied, summary of tunnel lines in the Big Creek-San Joaquin development, and growth in number of stockholders.—*Journal of Electricity and Western Industry*, April 1, 1923.

*Purification of Boiler Water.*—F. H. RHODES.—The selection of the proper method of water purification is one of the important problems in any steam-power plant installation. In this selection there are several factors to take into consideration. These include not only the nature and the amounts of the impurities in the raw feed water and the costs of construction, operation and maintenance of the water-purification plant, but also the amount of water to be treated daily, the daily and seasonal variations in the amounts of impurities, etc. The author treats mathematically several methods for purifying water and illustrates each with an actual example.—*Sibley Journal of Engineering*, April, 1923.

## Generation, Control, Switching and Protection

*Synchronizing Torque of Ljungstrom Turbo-Generator Set.*—T. KOMARU.—The author considers the power oscillation between synchronous machines of different frequency with special reference to the Ljungstrom turbo-generator set, discussing the circulating current between machines, exciters and generator characteristics.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1923.

*Transient Phenomena Arising in Transformers from Switching Operations.*—S. A. STIGANT.—The occurrence, effects and prevention of the transient disturbances arising as a result of switching are considered under the divisions of (a) switching-in current rushes, (b) switching-in pressure rises and (c) switching-out pressure rises. The initial value of the current taken on low load by the transformer at the instant of switching in is determined by the point of the pressure wave at which switching in occurs and is also dependent on the magnitude and polarity of the residual magnetism which may be left in the transformer core after previous switching out. The exact conditions encountered when switching in and out at various points on the wave and with various amounts of magnetism remaining in the transformer coil are considered.—*Electrical Times*, April 5, 1923.

*Developments in Auto-Valve Lightning Arresters in* 1922.—A. L. ATHERTON.—A four-page abstract of this paper, presented at the midwinter convention of the A. I. E. E., may be found in the ELECTRICAL WORLD for Feb. 17, 1923, on page 385.—*Journal of the A. I. E. E.*, May, 1923.

## Transmission, Substations and Distribution

*Characteristics, Operation and Maintenance of Underground Cables.*—A. I. TRACEY.—A page-and-a-half abstract of a paper presented before the Electrical Power Engineers Association (England). The author considers the general characteristics of a three-core transmission cable and how these characteristics function and discusses the operation and maintenance of such cables. The capacity of these three-core cables, their measurement and the determination of capacity current, self-induction characteristics, potential gradient, presence of moisture in the dielectric, relation of insulation thickness to working voltage, the concentration of stresses set up by local high-frequency current in cables, safe current with which a given cable can continuously stand and cable-jointing methods are other features covered.—*Electrical Times*, April 5, 1923.

*The Neutral Grounding Reactor.*—W. W. LEWIS.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1020.—*Journal of the A. I. E. E.*, May, 1923.

*Use of Single-Core Sheathed Cables for Alternating Currents.*—W. CRAMP.—It is frequently a matter of convenience to use single-core, lead-covered cables for transmitting power by means of alternating current, and in such cases the magnitude of the loss arising from the eddy currents induced in the lead sheath becomes a matter of importance. The eddy losses in the sheaths of these cables may be divided into two groups, called "sheath eddies" and "sheath-circuit eddies." The latter occur only when one or more cables have their sheaths connected at more than one place. The losses are analyzed for a single cable, a pair of single-phase cables and a set of three-phase cables. It is shown that the sheath eddies are in all cases negligible and that the sheath-circuit eddies may be kept within reasonable limits by proper regulations regarding the spacing of each cable in respect to the others.—*Journal of the Institution of (British) Engineers*, April, 1923.

## Units, Measurements and Instruments

*Measurements of Transients.*—F. E. TERMAN.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. midwinter convention, Feb. 24, 1923, on page 450.—*Journal of the A. I. E. E.*, May, 1923.

*Comparison of Performance of Oil Circuit Breakers.*—P. BENDMANN.—A number of oil switches, made by different concerns, are critically investigated as to their performance characteristics, such as ruggedness of contacts, depth of arc under the oil level, air space above the oil, churning of the oil and speed of opening. Two modern types of high-capacity switches are shown which embody most of the required characteristics for a dependable operation. Of special interest in these breakers are provisions to have the generated gas break up in small gas bubbles, contact knives arranged edgewise, a ventilated gas-accumulating chamber, arcing tips in a pressure-proof pot and compression air pockets to act as gas-pressure buffers. — *Elektrotechnische Zeitschrift*, March 15, 1923.

*Preparation of Platinum and of Platinum-Rhodium Alloy for Thermocouples.*—R. P. NEVILLE.—The Bureau of Standards has prepared in its laboratories thermo-element platinum and platinum-rhodium alloy for standard thermocouples, to determine what performance might justly be required of such instruments. The melting of the pure metal and of the alloy was carried out in an Ajax-Northrup high-frequency induction furnace in crucibles of lime and thoria. Platinum and platinum-rhodium alloy, superior in quality to the best material of this kind formerly in the possession of the bureau, was prepared. — *Paper presented before American Electrochemical Society, New York*, May 3-5, 1923

## Illumination

*Development of Electric Illumination of Railroad Cars.*—H. LÖWL.—After a short description of the different systems used on European railroads to illuminate their coaches, the author describes an automatic system which uses an axle-driven direct-current generator of 300 watts to 3,000 watts output connected over an electromagnetically operated mechanism to a battery of twelve cells. To insure uniform polarity at forward or backward run the brush yoke of the dynamo is automati-

cally shifted. Under most unfavorable conditions the voltage applied to the lamps in the car may vary between 24 and 27.6, or a variation of 15 per cent. —*Elektrotechnik und Maschinenbau*, April 1, 1923.

*Stage-Lighting Equipment and Its Application.*—A. L. POWELL.—A comprehensive discussion of the possibilities and limitations of the various standard devices for producing the multitude of light and color effects demanded on the stage, with particular reference to foot and border lights, bunch and spot lamps, "effect" apparatus and colored lamps, together with some brief notes on switchboards and wiring, is given. The article is well illustrated, showing various types of lamps and lighting equipment employed.—*Electrical Record*, April, 1923.

## Motors and Control

*Induction-Motor Developments.*—K. SACHS.—The author describes in this paper some of the latest designs of induction motors, selected from recent patent literature, with special centrifugally operated devices to start the motor with a wound armature and to short-circuit the winding at full speed. Such motors combine the easy start of the phase rotor with the desirable running characteristics of the squirrel-cage rotor. Some designers go even so far as to provide three steps of gradual short-circuiting, with a resistance mounted on and running with the shaft. Other models start with the rotor winding in "Y," then change it into delta, and finally short-circuit it. A motor with a centrifugal starting device, reliable and not too complicated, could be easily built as a totally inclosed type and would be a very useful machine in mines with explosive gases, doing away with starters having open or otherwise poorly inclosed contacts. *Bulletin de l'Association Suisse des Electriciens*, March, 1923.

*Graphically Designed Starting Apparatus.* — S. OGAWA. — The author describes a simple graphical method of designing a direct-current shunt and series-motor starter and starting compensator, taking into consideration the proper time elements.—*Journal of the Institute of Electrical Engineers of Japan*, March, 1923.

## Heat Applications and Material Handling

*Problems in Electric Furnace Operation.*—F. V. ANDREAE.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, May 5, 1923, on page 1024.—*Journal of the A. I. E. E.*, May, 1923.

*Relation Between Current, Voltage and the Length of Carbon Arcs.*—A. E. R. WESTMAN.—An account of the early work on the electric arc has been given by Mrs. Ayrton and a summary of present knowledge by Steinmetz. Each of these writers is the author of a formula connecting current, voltage and arc length; but in the experiments on which these formulas were based the currents ran up to only 30 amp. or so, and it seemed desirable to add to the experimental material. The paper under notice gives an account of measurements made with currents up to 770 amp.—*Paper presented before the American Electrochemical Society, New York*, May 3 to 5, 1923.

## Electrophysics, Electrochemistry and Batteries

*Battery Charging at the Chicago Mail Terminal.*—W. LANDESS.—Facilities are provided at the Chicago Union Station mail terminal for the charging of tractor batteries and of all batteries on mail cars in the terminal. Switching and charging panels, car-lighting charging panels, generating and switching of power and motor-generator sets are described.—*Railway Electrical Engineer*, April, 1923.

*Effect of Current Density on Overvoltage.*—M. KNOBEL, P. CAPLAN and M. EISEMAN.—There are numerous references in electrochemical literature on the effect of current density on overvoltage, but they set up in general more or less isolated values and for comparatively small current densities. The experimental conditions are so different also that it would be difficult to compile a comparable set of data. On account of the great technical importance of this phase of overvoltage, and also for the theoretical interpretation of overvoltage, it was thought desirable to have extensive and consistent data in this field. In this article the authors have attempted to include all the more common metals and alloys as cathodes and to determine oxygen and halogen overvoltages on as many electrodes as possible. While the overvoltage values obtained may not be acceptable as absolute values, they should at least be comparable as the experimental conditions were maintained alike in all cases.—*Paper presented before American Electrochemical Society, New York*, May 3-5, 1923.

## Telegraphy, Telephony, Radio and Signals

*Radio as Applied to Telephony.*—O. B. BLACKWELL.—The object of this paper is to give an idea of what radio is and what it means to the telephone business. The first part is intended to assist in forming a clear picture of the physical nature of both wire and radio transmission, while the latter part is a brief discussion of the fields of use for which radio has been developed or for which it has been considered.—*Electrical Communication* (published by the International Western Electric Company), February, 1923.

*A High-Voltage Mechanical Rectifier.*—S. T. WOODHULL.—A mechanical power rectifier for high-voltage direct-current production is described and its design and operation are discussed. This generator uses transformer action for the generation of the high voltage and a synchronous commutator for rectification.—*Proceedings of Institute of Radio Engineers*, April, 1923.

## Traction

*Roller-Bearing Tests on Railway Cars.*—During the past two years tests on two single-truck cars of the Wigan Corporation Tramways and on one double-truck car of the London County Council have been made to determine the characteristics of cars equipped with plain bearings and with roller bearings. The accompanying illustrations show the tractive resistance at various speeds and coasting-distance curves for both types of bearings. Comparison was also made between the two types as regards starting effort and retardation.—*Electric Railway Journal*, April 21, 1923.

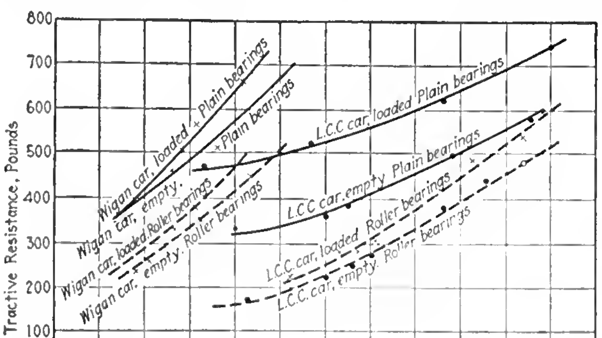



Fig. 1

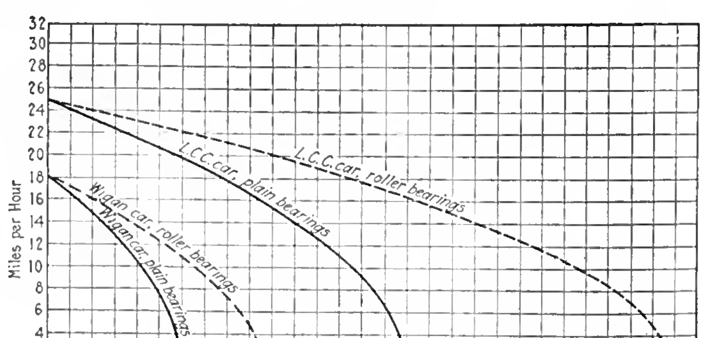



Fig. 2

RESULT OF TESTS ON CARS EQUIPPED WITH PLAIN BEARINGS AND ROLLER BEARINGS

Fig. 1—Tractive resistance at various speeds. Fig. 2—Coasting-distance curves.

# Sciehtific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

*Conducted by* PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

## Research Completed

### Cables, Lead, Protection Against Beetles

Beetles which bore through lead cables and which. nevertheless, do not or cannot penetrate pure gum rubber have proved a serious problem and pest in California and many other parts of the United States. Experiments indicate that the beetle is able to penetrate any lead alloy or any poison or repellent placed on it. Probably it is able to penetrate the poisons because it does not feed as it bores through. Beef tallow, when sufficiently soft, will stick to the beetle and suffocate it, and has been used with some success on the rings which suspend the cable. Layers of friction tape impede the boring, and thin sheets of copper, zinc, or steel prevent it.—*R. D. Hartman, H. E. Burke and T. E. Snyder, United States Department of Agriculture, Washington, D. C.*

### Lubricating Oils, Petroleum, Reclamation of

By means of simple apparatus already commercially available used lubricating oil can be reclaimed and made as good as new, or even better. An investigation has shown this to be true, judging by all the commonly accepted standards. Certain changes in the oil could be detected by special tests, but it is a matter for future investigators to decide whether or not these changes are detrimental.—*Bureau of Standards, Washington, D. C.*

### Phase Sequence Indicator

Various devices have been used for some years to indicate phase rotation on polyphase circuits. Arrangements of a more or less complicated nature have been made up and used locally by various operating companies, and during the past year a manufacturer has developed a phase-sequence indicator. This is a small portable device, consisting essentially of coils operating on a single lamp as an indicator. By two trials in connecting the binding post to a polyphase circuit the phase rotation can be determined. —*Instruments and Measurements Committee of the A. I. E. E.*

### Poles, Impregnation of

Comparative experiments have been carried on concerning the open-tank method of treatment with creosote oil, using what is known as the "B" treatment, the puncture method and the closed-tank pressure method. The results indicate that better penetration can be obtained where the sapwood has been punctured before the open-tank treatment is applied. Where the puncture treatment is applied without lacerating the fiber of the pole the increased penetration will more than compensate for any small decrease in strength due to rupture of some of the other fibers.—*Overhead Systems Committee of the N. E. L. A.*

### Solder for Aluminum

A study of the various solders for aluminum showed that the best results are obtained with compositions of zinc-tin and zinc-tin-aluminum. The tensile strength of a good aluminum solder is about 7,000 lb. per square inch, for those with higher tensile strength have, in general, their temperature of complete liquation too high for soldering purposes. Most of the metals commonly used in solders, except magnesium, are electropositive to aluminum, so that any metals used in making a soldered joint of aluminum act electrolytically in the presence of moisture as positive galvanic poles, accelerating the corrosion of the aluminum. Magnesium cannot be utilized advantageously even though it is electronegative to aluminum because the metal disintegrates rapidly in the presence of moisture. Soldered joints of aluminum which are to be exposed to moisture should be protected against corrosion by a paint or varnish.—*Bureau of Standards, Washington, D. C.*

### Transformer with Nitrogen Above Oil

When arcing sufficient to cause a breakdown of the oil occurs below the oil level, exceedingly rapid internal pressures may be created by the evolution of gas. The air space above the oil level acts as a cushion until the safety diaphragm has time to act. On the other hand, the air is undesirable because it may form an explosive mixture with liberated gases. Moreover, the air causes the oil to oxidize, producing a sludge. For these reasons means have been developed for replacing the air by an inert gas such as the atmospheric nitrogen. The transformer tank is made to "breathe" through a deoxidizing compound, so that most of the oxygen contained in the air is absorbed before it reaches the space above the oil. (For details see the *Electric Journal*, 1923, Vol. 20, page 53.)—*W. M. Dann, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

### Welding, Suitability of Various Materials for

Strips of various materials were created with vitreous enamel which was baked by the passage of an electric current through them. The materials tested were commercially pure-iron made in a basic open-hearth furnace, copper-bearing open-hearth iron, basic open-hearth mild steel, charcoal iron, Bessemer steel and silicon steel. In all cases except the open-hearth irons the enamel contained bubbles and blisters. The iron samples produced a perfectly smooth enamel surface free from any such defects. This indicates a freedom from gas or gas-forming constituents.—*J. H. Nead and R. L. Kenyon, American Bureau of Welding.*

## In Progress or Purposed

### Fuses for Potential Transformers

Some 13,200-volt potential transformers have such a high impedance that standard high-tension fuses do not always clear a dead short-circuit on the low-tension side, occasionally causing a transformer to blow up. It is almost impossible to obtain a fuse wire strong enough mechanically which would positively clear a secondary short-circuit. It is therefore recommended that the low-tension circuit of such a potential transformer be protected with a cartridge fuse of 15 amp. to 30 amp. rating.—*A. F. Bang, Pennsylvania Water & Power Company, Baltimore.*

### Generating Stations, Artificial

Work is being done upon the representation to a small scale of the effect of two independent generating stations feeding an artificial network. With more than one generating station some method of controlling the outputs must be obtained, and we are investigating the possibilities of using phase shifters with voltage control as artificial generators. At the same time work is proceeding on the possibility of making a synchronous motor, driven by a shunt direct-current motor, which will have the characteristics of a turbo-generator when reduced to the scale upon which the artificial lines are built.—*Vannevar Bush, Massachusetts Institute of Technology, Cambridge, Mass.*

### Insulator Troubles Due to Cement

The committee is continuing its studies on high-tension porcelain insulators, with special reference to the type of cement used between units. One of the difficulties which resulted in the failure of both pin-type and strain-type insulators has been the growth of cement. Where the design of the insulator does not allow for this growth the porcelain has in many cases been ruptured. Experiments show that the percentage of growth can be considerably reduced by the use of proper kinds of cement and by the proper curing. The trouble may also be eliminated by proper design of the cemented joint to allow for such growth.—*Overhead Systems Committee of the N. E. L. A.*

### Transmission Lines, Transient Phenomena in, Experimental Study of

A study was made last winter of direct-current transients upon a smooth single-phase line. We are now working upon alternating-current transients on both the single-phase and three-phase line. This will involve first a measurement in the simple case where the current is measured at the home end and the far end of the line, either open or short-circuited. After that, the transients will be measured at different parts of the line and with different terminal conditions. An oscillograph is used in conjunction with a vacuum-tube repeater where power drawn from the line will introduce distortion.—*Vannevar Bush and F. S. Dellenbaugh, Jr., Massachusetts Institute of Technology.*

## Suggestions for Research

### Cables, Thermal Problems in

In some tests it has been discovered that the variation in the thermal resistivity of the insulation and the emissivity of the lead on two samples of cable that were supposed to be exactly alike were sufficient to cause a difference of 10 per cent in the carrying capacity of the cable if this were determined by the maximum temperature of the copper. Some English engineers include in their cable specifications a clause which requires that the thermal resistivity of the insulation should not exceed a certain specified amount. In this country we do not have sufficient information regarding the thermal resistivity of the cables as made by the several manufacturers, nor for that matter do we know the range in the cables supposedly alike turned out by any one manufacturer. —*Cable Research Sub-Committee of the N. E. L. A.* [The University of Wisconsin and the Harvard Engineering School have signified their intention to co-operate with the sub-committee in problems of this kind. It is hoped that other engineering schools will also be willing and able to help in the elucidation of these important problems.—EDITOR.]

### Corona in Air Spaces, Preventing by Metallization

The problem of designing electrical machines and equipments for the high voltages which are now becoming common is mainly one of insulation. As important as the quality of the insulation are the configuration of it and of the electrodes and the combinations of the dielectrics of different permittivities so as not to lead to high or non-uniform dielectric flux densities. In a high-voltage generator, for instance, the mica insulation, on the part of the coil inserted in the slot, is in series with an air layer in which, owing to the low permittivity of air, corona may occur. To prevent it studies were made on coils covered with a conductor, as tinfoil, which when connected to the iron of the machine short-circuits the air space. This arrangement, however, is very delicate, since the tinfoil may be destroyed during the assembling of the coils. Better results could be obtained by the metallization process recently developed by Schoop for the galvanizing of structures. The same process may be advantageously used in other cases such as giving metallic coatings to parts of built-up insulators, so as to distribute the potential.

### Corona Loss, Theory of

Peek, Townsend, Whitehead, Kunz and others have investigated the laws of corona formation between a wire and a concentric cylinder, both theoretically and experimentally. The actually observed voltage at which corona begins, as a function of the air density, pressure and the dimensions of the electrodes, has been shown to be in good agreement with the general theory of ionization by collision and sparking between parallel plates. However, the theory has not been extended to include the actual energy loss due to corona, and Peek's emperical formula is being used. An extension of the theory of ionization by collision to account for the actually observed power loss is desired.

# News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

## New York State Officials Enlightened

### Those in Charge of Action Against Constitutionality of Federal Water-Power Law Meet Federal Power Commission and Some Misconceptions Are Cleared Up

A RECENT appearance of the Attorney-General and State Engineer of New York, along with other interested New York state officials, before the Federal Power Commission has given further color to the belief that the state administration is attempting to back out gracefully from under its bill of complaint attacking the constitutionality of the water-power act. The conference is understood to have resulted in making clear to the representatives of the New York administration that the Federal Power Commission does not interpret the water-power act as strictly as is alleged in the bill of complaint. It is understood that the New York delegation admitted that the bill was in error to that extent. It also was admitted, it is said, that many limitations on the commission had been entirely overlooked in the bill, which led to a wrong conclusion as to the scope of the commission's power.

The New York delegation made much of a ruling by Mr. Taft when he was Secretary of War to the effect that the federal government's interest in water-power development was limited to its effect in improving or injuring navigation. Apparently there was failure to take into account that Mr. Taft rendered his opinion when the only federal legislation on the statute book was the general dam act.

The recapture phase of the water-power act came in for extended discussion, it is understood. New York considers itself the proprietor of the bed and banks of streams and contends that the exercise of the recapture provision of the act by the Federal Power Commission would be taking away from New York property over which the federal government has no jurisdiction. The New York delegation was advised that under the recapture phase of the act the federal government merely sets up a means of determining how recapture is to be carried out provided the United States has the authority to take over the project.

#### No Danger to Barge Canal

It also was pointed out that in so far as the Barge Canal is concerned no license could be issued covering the use of that water until the applicant could show full compliance with the state law and that the commission never has entertained any application on the Mohawk River and never would attempt to take jurisdiction over a project which would affect the water supply of the canal.

New York takes exception to the action of the Federal Power Commission in giving a preliminary permit to the Lower Niagara River Power & Water Supply Company, covering the Niagara Gorge development. How did the commission know, it was asked, that the State of New York did not prefer that the preliminary permit be given the Niagara Gorge Railway Company, whose application the Federal Power Commission rejected? The answer in that case was that the preliminary permit was granted to the Lower Niagara company before New York had set up its Water Power Commission. The Lower Niagara company presented acts of the New York Legislature granting certain franchises to that company, evidently sufficient proof to convince the commission that it had the necessary state authority to go ahead with the development. Any preliminary permit is granted with the understanding that the applicant must secure state authorization for development before the license is issued, but in cases that are at all important it is the policy of the commission to confer with the state authorities directly to ascertain their feeling toward the project.

There is every reason to believe that the conference has resulted in a material clearing of the atmosphere. Practically the only point of difference which was not eliminated at the conference was that as to the scope of the federal authority over water power. The federal government bases its authority to control floods, further irrigation and regulate water-power development on the rights over navigation granted it by the Constitution, just as it bases many activities on the interstate commerce clause of the Constitution. Since the Supreme Court has upheld many apparently far-fetched activities related to commerce, it is believed that the water-power act will be upheld as the control exercised over power development is a contractual relationship incident to the protection of the navigability of streams.

## Savings in Fire Insurance

### Through Efforts of National Electric Light Association Committee Electric Light and Power Companies Receive Lower Premium Rates

DURING the last twelve months member companies of the National Electric Light Association have received reductions in premium rates for fire insurance on electric generating and substation property amounting in the aggregate to more than the total dues paid into the N. E. L. A. treasury by electric light and power companies.

In the opinion of Charles B. Scott, chairman of the insurance committee, and S. E. Wolff, vice-chairman, this is but the beginning, as the full benefits of the movement under way will not be realized until all companies have taken advantage of the work of the committee and asserted their right to a reinspection of their properties and a revision of their rating schedules. It is said, too, that a tremendous amount of detail work remains to be done before the greatest benefits will be obtained by the industry as a whole.

At the N. E. L. A. convention in Atlantic City last year the insurance committee reported that it had arranged with representatives of the fire insurance underwriters for a revision of rating schedules applying to electrical generating and substation properties. This arrangement was brought about through the adoption of a resolution by the underwriters authorizing a reduction of not to exceed 25 per cent on all premium rates on this class of property. This reduction was to apply to the business as a whole, with the understanding that schedules would be so arranged as to reward the reduction or elimination of fire hazard through good standards of construction, housekeeping, etc., while properties whose conditions did not reflect good standards of construction with a reduction of the fire hazard were to receive a lesser benefit. This agreement made necessary the devising of new forms of rating schedules and their subsequent adoption by the several insurance rating bureaus of the country. After the arrangement of these schedules and their adoption by

SAVINGS IN COST OF CENTRAL-STATION FIRE INSURANCE UNDER NEW RATINGS

| | Amount of Insurance Carried | New Rate per $100 Value (Cents) | Annual Savings Amount | Annual Savings Per Cent |
|---|---|---|---|---|
| Alabama Power Co. | $7,731,050 | 11.4 | $2,916.61 | 25.2 |
| Helena (Ark.) Gas & Electric Co. | 210,000 | 17.8 | 90.30 | 19.5 |
| Western States Gas & Electric Co. | 418,550 | 89.4 | 1,171.94 | 24 |
| Colorado Power Co. | 529,300 | 80 | 938.00 | 17.5 |
| Pensacola (Fla.) Electric Co. | 802,000 | 49.5 | 95.60 | 5.7 |
| Georgia Railway & Power Co. | 2,270,000 | 19.05 | 647.05 | 12.5 |
| Illinois Traction System | 629,975 | 25.9 | 497.69 | 23.4 |
| Wabash Valley Electric Co | 180,000 | 16.8 | 657.00 | 37.5 |
| Iowa Southern Utilities | 319,325 | 17.3 | 1,050.58 | 31 |
| Lexington (Ky.) Utilities Co. | 200,740 | 27.7 | 664.45 | 54.4 |
| Central Maine Power Co | 2,647,475 | 125* | 3,309.68 | 23.1 |
| Consolidated Gas, E. L & P. Co. | 8,915,000 | 9.741 | 4,471.16 | 33.9 |
| Springfield (Mass.) Electric Light Co. | 780,000 | 23.59 | 396.24 | 17.7 |
| Citizens' Light & Power Co., Adrian, Mich. | 58,200 | 104.8 | 96.61 | 32 |
| Duluth Edison Electric Co. | $300,000 | 56.1 | $750.00 | 30.8 |
| Ozark Power & Water Co., Branson, Mo. | 91,000 | 103.8 | 56.42 | 5.6 |
| Nebraska Power Co. | 2,500,000 | 11.41 | 2,028.79 | 41.7 |
| Electric Light & Power Co., Hightstown, N.J. | 9,000 | 66.85 | 10.80 | 15.2 |
| Santa Fé Water & Light Co. | 49,700 | 134 | 303.17 | 31.3 |
| Genesee L. & P. Co., Batavia, N. Y. | 126,000 | 112 | 516.60 | 26.8 |
| Fessenden (N. D.) Light & Power Co. | 13,000 | 174 | 35.10 | 13.4 |
| Northern Ohio Traction & Light Co. | 4,607,645 | 17.6 | 2,395.98 | 22.7 |
| Northwestern Elect. Service Co., Erie, | 137,400 | 20.75 | 218.[illegible] | 43.4 |
| Tennessee Electric Power Co. | 1,520,138 | 34.27 | 1,378.77 | 20.9 |
| Warrenton (Va.) Electric Light & Power Co. | 36,000 | 85.48 | 57.67 | 16 |
| Natrona Power Company, Casper, Wyo. | 105,000 | 84.67 | 675.46 | 44 |

* Three years' rate.

the bureaus, reinspection of properties to which they were to be applied was necessary before the benefits could be enjoyed.

Since May, 1922, revised schedules have been put into effect throughout the United States, except in the States of Kansas, Mississippi, Texas and parts of the New England States, and have been applied generally on the properties of member companies.

During April Chairman Scott requested member companies to report the progress of reinspection work and the results obtained. He requested that replies be made in time to reach him not later than May 10, and as of that date eighty-four companies had given complete information. Under the revised rating schedules the premium savings on this insurance amount to more than $96,000 annually, or 24.3 per cent of premiums paid under the old rating schedules.

Complete data are not available, but in order to give an idea of the results generally obtained, examples were chosen at random from the states where the schedules are in effect and are printed in the accompanying table.

The committee finds that a great many central-station companies have not had reinspections of their property and seem to be unaware of their right to demand such reinspections. In other cases central-station managers seem to take little interest in the proposition and are not co-operating with the insurance interests to get the best results. Thus, while the general results are fairly satisfactory to the committee, it will, as already said, require a great deal of attention to details to reap the full benef

## Contract Let for Ouachita River Dam

A contract for the construction of the Remmel Dam on the Ouachita River between Malvern and Hot Springs, Ark., has been awarded to Ford, Bacon & Davis by the Arkansas Power & Light Company of Pine Bluffs. This dam, from which 15,000 hp. will be developed, is the first of a series of three hydro-electric plants on the Ouachita River that will eventually develop 120,000 hp. The Remmel Dam will be 60 ft. in height and 900 ft. long at the crest. The lake formed back of the dam will cover about three thousand acres of ground. The new plant will tie into the transmission system of the Arkansas Power & Light Company, which already has transmission lines within a few miles of the plant site.

## Hot Springs Central Station Little Harmed by Flood

A telegram to the ELECTRICAL WORLD from S. E. Dillon, general manager of the Citizens' Electric Company, Hot Springs, Ark., says that service was suspended for only about three hours when a flood temporarily overwhelmed that city early this week. Fire destroyed sections of the company's lines, but the loss was nominal. The water came up to the pump station, forcing the shutting down of the plant for the length of time mentioned. Street-car service was discontinued for about twenty-four hours, but newspaper accounts of conditions in the city were, Mr. Dillon says, exaggerated.

## Residence Load Building

### This and Public Education in Matters Affecting Utilities Are Leading Topics at Fort Worth

RESIDENCE load building occupied a large share of the attention of the delegates to the annual convention of the Southwestern Public Service Association, held in Fort Worth, Tex., this week. At the Commercial Section meeting on Wednesday morning it was pointed out that in spite of the efforts devoted to appliance sales the average kilowatt-hour residential sales have not increased materially. A warm discussion of the possibilities of the electric range took place in which several took the position that electric ranges are not a desirable load because of the expense in distribution equipment required to carry them and the excess transformer capacity required.

J. H. Gill of the Dallas Power & Light Company said that fears as to the effect on transformer capacity were not well grounded and that the effect on the peak loads is merely to broaden them, as experience has shown that the range peak occurs fifteen to thirty-five minutes earlier than the peak due to other evening loads. Service difficulties, he said, should not be allowed to stand in the way of range-load development as these difficulties are no greater than those involved in developing the use of any load-building devices. Mr. Gill said that the way to successful load building involved a strict control of both the commercial man and the engineer responsible for distribution system building, so that the commercial man, on the one hand, will not be allowed to scatter ranges in such a way that individual distribution equipment for each range is required and the engineer, on the other, will not to be allowed to provide equipment to meet theoretical conditions that practical experience has shown do not exist.

Care in handling transformers during installation was urged in a discussion of transformer maintenance schedules, it being shown that if linemen are allowed to grasp the leads in handling distribution transformers the bushings are damaged and a breakdown may be the consequence. The use of slings that hook into either eyes or lugs provided for lifting purposes was urged.

H. C. Abell of the Electric Bond & Share Company, New York, recounted four processes that must be gone through in building public understanding of utility problems. Utility employees must be educated to understand utility problems so that they can talk intelligently and sympathetically of them to those with whom they come in contact. The people of the community must then be brought to an understanding of the utility problems. State education along these lines must be done through general bodies like the public utility information committees, and national education must be carried on through national associations.

Dr. E. B. Shurter of the University of Texas dwelt on the value of public speaking as a means of educating the public in utility problems and their relation to community welfare. H. B. Flowers of the New Orleans Public Sei ice Company deprecated any effort at concealing facts concerning the utilities.

The convention, which included sessions of the railway and gas associations, lasted from Tuesday to Thursday inclusive, with a banquet on Wednesday and a Texas barbecue on Thursday.

# N. E. L. A. 1923 Convention Program

*(Tentative Draft Subject to Revision)*

## General and Executive Sessions

TUESDAY, JUNE 5, 9:30 A. M.

"Greetings to the Industry," Thomas A. Edison.
Address of President Smith.
Report of Treasurer Neumuller.
Report of membership committee, H. K. Mohr.
Report of Executive Manager Aylesworth.
Report of committee on constitution and bylaws, W. C. L. Eglin.
National Section reports: Public Relations, H. T. Sands; Accounting, William Schmidt, Jr.; Commercial, O. R. Hogue; Technical, R. F. Schuchardt.

WEDNESDAY, JUNE 6, 9:30 A. M.

Report of company employees' organizations committee, R. B. Grove.
Report of rural-lines committee, G. C. Neff.
Address, O. E. Bradfute, president American Farm Bureau Federation.
Report of water-power development committee, F. T. Griffith.
Address, Gen. Guy E. Tripp.
Report of Joint Committee for Business Development, E. W. Lloyd.

THURSDAY, JUNE 7, 9:30 A. M.

Report of accident prevention committee, C. B. Scott.
Report of customer-ownership committee, M. R. Bump.
Address, Dwight N. Lewis.
Report of insurance committee, C. B. Scott.
Address, Julius H. Barnes, president U. S. Chamber of Commerce.
Address, Lewis E. Pierson, chairman of board Irving Bank-Columbia Trust Co.
Report of committee on electrical resources of the nation, M. S. Sloan.
Report of memorial committee, W. H. Onken, Jr.

FRIDAY, JUNE 8, 9:30 A. M.

Report of committee on Doherty and Billings prizes, A. S. Loizeaux.
Report of wiring committee, R. S. Hale.
Address, O. C. Merrill, executive secretary Federal Power Commission.
Report of joint fuel committee, J. W. Lieb.
Report of rate research committee, Alex Dow.
Report of public policy sub-committee on inductive co-ordination, R. F. Pack.
Report of merchandising policy committee, John F. Gilchrist.
Report of lamp committee, W. W. Freeman.
Report of committee on constitutional revision.
Report of resolutions committee, W. W. Freeman.
Election of officers and members national executive committee.
Installation of president-elect.

## Technical Sessions

MONDAY, JUNE 4, 2 P. M.

Session subject: "Problems of Electricity Generation"

Address, Chairman R. F. Schuchardt.
Report of prime movers committee, C. F. Hirshfeld.
Report of hydraulic power committee, O. G. Thurlow.
Report of electrical apparatus committee (generating station portion), R. H. Tapscott.

Symposium on Steam Plant Generation, High Steam Pressures and Temperatures.

Address, Charles H. Merz, London.
Address, Fred N. Bushnell.
Address, "Pulverized Fuel for Central Station," Prof. A. G. Christie.
Address, "Useful Life of Turbines," Peter Junkersfeld.
Address (speaker to be selected).
Address, "Comparison of American and European Practices of Waterwheel Construction and Water-Power Development," H. B. Taylor, Wm. Cramp & Sons.

TUESDAY, JUNE 5, 2:15 P. M.

Session subjects: "Problems of Conversion," "Problems of Metering."
Report of nominating committee, J. C. Martin.
Election of section officers and executive committee.
Address, "The Status of the Safety Code," Thomas Sproule.
Report of electrical apparatus committee (substation portion), R. H. Tapscott.

Symposium on Substation Equipment.

Address, "Power-Tube Possibilities" (speaker to be selected).
Address, "Storage Batteries on Metropolitan Systems," Philip Torchio.
Address, "Bulk Supply to Industries," Alex Dow.
Report of motor committee, W. L. Wadsworth.

Symposium on Metering.

Address, "The Place of the Meter in Industry," F. G. Vaughan.
Address, "The Education of Metermen," F. D. Paine.

WEDNESDAY, JUNE 6, 2:15 P. M.

Session subjects: "Problems of Transmission and Distribution," "Problems of Utilization."

Report of overhead-systems committee, L. M. Klauber.
Report of underground-systems committee, G. G. Post.
Report of electrical apparatus committee (motor rules and service voltages), R. H. Tapscott.

Symposium on Transmissions of the Future.

Address, Frank G. Baum.
Address, William S. Murray.

THURSDAY, JUNE 7, 2:15 P. M.

Session subject: "Interindustry Co-operation on Inductive Co-ordination."

Committee on inductive co-ordination will stage typical negotiations between a power company and a telephone company for the co-ordination of all power and signal lines.

## Commercial Sessions

MONDAY, JUNE 4, 2 P. M.

Address, Chairman Hogue.
Report of committee on electrically equipped furniture, Ralph Neumuller.
Report of Electric Truck and Car Bureau, Charles R. Skinner, Jr.
Report of electric vehicle school committee, E. S. Mansfield.
Address, "Lowering Transportation Costs by the Use of Electric Trucks in the Warehouse Industry," Charles S. Morris.
Address, "Supervision of the Motor-Truck Equipment of New York Utility Companies," John Stilwell.
Address, "The National Increase in the Use of Electric Trucks," William Van C. Brandt.
Report of committee on commercial service and relations with customers, Harold Wright.
Report of education committee, Fred R. Jenkins.

TUESDAY, JUNE 5, 2:15 P. M.

Report of Lighting Sales Bureau, G. Bertram Regar.
Report of division on commercial aspects of lamp equipment, G. H. Stickney.
Report of sign, display and billboard lighting division, H. H. Magdsick.
Report of division on lighting of large buildings, C. C. Munroe.
Report of street and highway lighting division, L. A. S. Wood.
Report of industrial lighting division, J. Carl Fisher.
Report of residence-lighting division, M. Luckiesh.
Report of store-lighting division, James Kirk.

WEDNESDAY, JUNE 6, 2:15 P. M.

Report of Power Sales Bureau, C. K. Nichols.
Report of competitive power division, H. H. Holding.
Address, William S. Murray.
Report of industrial-heating division, Wirt S. Scott.
Address, C. F. Hirshfeld.
Report of general power division, Ernest Pragst.
Address, D. B. Rushmore.

THURSDAY, JUNE 7, 2:15 P. M.

Report of Merchandise Sales Bureau, F. D. Pembleton.
Report of division on education and training of salespeople, E. A. Edkins.
Report of sales analysis division, W. R. Collier.
Report of standardizing and testing division, R. S. Hale.
Report of division on basis of paying salespeople, H. A. Lewis.
Report of electric cooking and heating division, C. O. Dunten.
Election of section officers and executive committee.

## Public Relations Sessions

MONDAY, JUNE 4, 2 P. M.

Address, Chairman Sands.
Report of committee on employee relations with public, L. B. Herrington.
Report of committee on co-operation with educational institutions, John C. Parker.
Report of committee on manufacturers' advertising, P. L. Thomson.
Report of committee on public speaking, A. C. Marshall.
Report of Information Bureau organization committee, H. C. Abell.
Report of committee on relations with financial institutions, M. S. Sloan.
Report of women's public information committee, Miss O. A. Bursiel.
Election of section officers and executive committee.

TUESDAY, JUNE 5, 2:15 P. M.

Session subject: "State Public Utility Information Bureaus."

Address, Frank A. Munsey.
Address, Bruce Barton.
Address, George E. Lewis.
Address, "The State Committee," W. W. Freeman.
Symposium by directors and members of the state public utility information committees.

WEDNESDAY, JUNE 6, 2:15 P. M.

Session subject: "Developing Public Relations—How? Why?"

Address, M. H. Aylesworth.

Symposium from Viewpoint of State Regulatory Authorities.

Six addresses by public service commissioners (names to be announced).
Symposium from Viewpoint of Member Company Executives.
Addresses by W. E. Creed, P. S. Arkwright, S. R. Inch, W. W. Freeman, Martin J. Insull, J. F. Owens, Dwight N. Lewis and Owen D. Young.

## Accounting Sessions

MONDAY, JUNE 4, 2:15 P. M.

Address, Chairman Schmidt.
Report of committee on purchasing and storeroom accounting, J. F. Torrence.
Report of committee on accounting education, Fred R. Jenkins.
Report of committee on preservation of records, Franklyn Heydecke.
Report of filing systems committee, E. W. Kells.

TUESDAY, JUNE 5, 2:15 P. M.

Report of committee on classification of accounts and annual reports, W. J. Meyers.
Paper, "Uniform Classification of Accounts," Fred W. Herbert.
Report of committee on accounts-payable records, E. A. Davis.
Report of committee on fixed capital records, C. M. Breitinger.

WEDNESDAY, JUNE 6, 2:15 P. M.

Report of committee on security holders' records, G. B. Thomas.
Report of committee on customers' records and billing methods, B. F. McGuire.
Report on budget, D. W. Harris.
Report of payroll standardization committee, A. B. McCoard.

THURSDAY, JUNE 7, 2:15 P. M.

Election of section officers and executive committee.
Address, Carl D. Jackson.
Report of merchandising accounting committee, P. H. Myers.
Report of committee on mortgage and trust agreements, Walter C. Lang.

## Program for Swampscott

**Arrangements for Summer Convention of A. I. E. E. Are Rapidly Taking Shape**

ARRANGEMENTS for the summer convention of the American Institute of Electrical Engineers, to be held at Swampscott, Mass., on June 25-29, have taken final shape, and an excellent program has been drawn up by the committee in charge. The technical sessions will be held in the mornings; in the afternoons there will be tennis, golf, bridge and trips to points of interest, electrical, historical and other, for the delegates and the ladies accompanying them, while entertainment, dancing and special features will fill the evenings. Monday will be devoted largely to registration, though there will be a meeting of section delegates from 10 a.m. to 12:30 p.m. as well as from 2 p.m. to 4 p.m.

The technical program prepared, subject to possible changes, is as follows:

TUESDAY MORNING, JUNE 26

Address of welcome, Governor Cox.
President's address, Frank B. Jewett.
"Cable Charge and Discharge," Dr. Charles P. Steinmetz.
"Dielectric Strength Ratio Between Alternating and Direct Voltages," J. L. R. Hayden and W. N. Eddy.
"Cable Geometry and Calculation of Current-Carrying Capacity," D. M. Simons.

WEDNESDAY MORNING, JUNE 27

(Parallel Session No. 1)

"The New Weymouth Station," J. Pope.
"Cooling of Electric Machines," G. E. Luke.
"Free and Forced Convection of Heat in Gases and Liquids," C. W. Rice.

(Parallel Session No. 2)

"Electric Plant for Transoceanic Radio Telegraphy," E. F. W. Alexanderson, A. E. Reoch and C. H. Taylor.
"Electric Plant for Transoceanic Radio Telephony," O. M. Arnold and Lloyd Espenschied.
"Measurement of Frequency Over the Communication Range," J. W. Horton, Messrs. Ricker and Morrison.
"Telephone Equipment for Long-Distance Cable Circuits," C. S. Demarest.
"Electrical Loud Speaker," A. Nyman.

THURSDAY MORNING, JUNE 28

"Transmission-Line Transients," V. Bush.
"Artificial Transmission Lines with Distributed Constants," F. S. Dellenbaugh.
"General Consideration of T and Pi Artificial Lines in Connection with a Proposed Compensated Pi Line," H. Nukiyama.
"Miniature Alternating-Current Transmission Systems," O. R. Schurig.
"Proximity Effect in Wires and Thin Tubes," H. B. Dwight.
"Simplified Method of Analyzing Short-Circuit Problems," R. E. Doherty.
"The Floating Neutral," L. S. Doggett.

FRIDAY MORNING, JUNE 29

(Parallel Session No. 1)

"Quality of Incandescent Lamps," J. W. Howell and H. Schroeder.
"Art of Sealing Base Metals Through Glass," W. G. Houskeeper.
"Measuring Instrument Standards," H. B. Brooks.
"Continuous-Current Generator for High Voltage," S. R. Bergman.
"Duplication of Electric Side of Power Stations," W. F. Sims.
"Pellet-Type Oxide-Film Arrester," N. A. Lougee.

(Parallel Session No. 2)

"Gaseous Ionization in Built-up Insulation," J. B. Whitehead.
"Effect of Transient Voltages on Dielectrics," F. W. Peek, Jr.
"The Axially Controlled Magnetron," A. W. Hull.
"Photographic Study of High-Voltage Discharges," K. B. McEachron.

Among the special features of the gathering will be the president's reception on Tuesday evening; an illustrated lecture by Prof. C. E. Magnusson on Wednesday afternoon; a lecture on the "North Sea Barrage" by Capt. R. R. Belknap, U. S. N., on Thursday evening; symphony concerts by radio, and special illumination of the building and grounds at 9 p.m. on Tuesday and Wednesday.

## Arizona Still Recalcitrant

**Governor Promotes the Policy of State Control and Ownership of Colorado Projects**

ARIZONA apparently still persists in her opposition to the seven-state treaty governing the development of the Colorado River, which, it will be recalled, was defeated in the Legislature of that state, all the other six states concerned accepting it. News comes from Phoenix that on May 9 more than thirty men met with Governor Hunt and indorsed a policy of state control and eventual state ownership of all power projects developed on the Colorado within the state boundaries. This policy has been christened the "Arizona plan," and to further it Governor Hunt appointed a committee of nine men to draw up development plans.

Two plans were presented, the McGregor plan and the Greenway plan. The former looks to the immediate ownership and control of any development that may be undertaken by a non-partisan commission, state ownership to be acquired by a bond issue tentatively set at $100,000,000. The Greenway plan looks first to the ratification of the Colorado River pact and the control by the state of development works constructed by private capital, with the privilege to the state of acquiring them by purchase when they shall be found to be profitable.

Still another plan is advocated by former State Engineer Maddock under which Arizona would settle its differences with the other states of the lower basin and, by reason of the close relation existing between Arizona and California because of the Imperial Valley, California would be asked to co-operate in and participate in the expense of any development undertaken.

At Santa Barbara, Cal., on June 7-9 the League of the Southwest will hold a meeting to discuss the Santa Fé pact. Governor Sweet of Colorado has, however, announced that he will not send a representative because to do so might be construed as "interference with the exercise of the sovereignty of a sister state."

# Will Cross Main Sierra Nevada Ridge

**First Transmission Line to Do So Has Been Authorized by the California Commission—Pacific Gas & Electric and Truckee River Power Companies to Be Interconnected.**

THE ten-year contract between the Pacific Gas & Electric Company and the Truckee River Power Company reported in the ELECTRICAL WORLD for March 24, page 709, providing for the construction of the first transmission line to cross the main ridge of the Sierra Nevada Mountains separating California from Nevada has been approved by the California Railroad Commission. The Pacific Gas & Electric Company will build a 60,000-volt line from its present system to a point at the top of the mountains near Summit, Placer County, and will deliver energy there to an amount not in excess of 5,000 kw.

At this point the line will connect with a line being built by the Truckee River Power Company, which supplies light and power to Reno, Sparks, Virginia City and contiguous points in Nevada. Increased demands for power in the mining districts and the development of pumping for irrigation purposes have forced the Truckee River Power Company to augment its supply. The energy delivered over the new line is to be charged for at the regularly filed rates of the Pacific Gas & Electric Company, the Truckee River Power Company making an advance payment of a portion of the cost of the transmission line, which will be refunded by an annual discount of 20 per cent upon future bills of the Truckee River Power Company, which guarantees a minimum annual bill of $20,000.

This enterprise will mark another step in the development of interconnected systems in the Pacific and Mountain States. As ELECTRICAL WORLD readers are aware, there now exists a continuous transmission line from Albany, Ore., to the Mexican border, formed by the connection of the lines of the Mountain States Power Company operating in central Oregon, the California Oregon Power Company in southern Oregon and northern California, the Pacific Gas & Electric Company in northern and central California, the San Joaquin Light & Power Corporation in the San Joaquin Valley, the Southern California Edison Company in southern California, the San Diego Consolidated Gas & Electric Company, whose lines reach to Tiajuana, and the Southern Sierras Power Company, whose lines reach the border of Mexicali.

More than thirty steam generating plants and almost one hundred hydro-electric plants feed into this system, and their combined output is available for the combined requirements of all.

Only four comparatively small gaps in the transmission systems of the northern states remain to interrupt a continuous line from Yuma north through California and Oregon to Puget Sound and easterly across Washington and Idaho to Billings, Mont.

## Nine-State Power Survey

**Committee of Great Lakes Section, N. E. L. A., Doing Its Work on Comprehensive Scale**

INTENSIVE work on the comprehensive electric power survey of the Great Lakes area, with the ultimate object of saving millions of tons of coal and bringing an uninterrupted flow of cheap electrical energy to cities, farms and industries in nine states, has been started, according to a report made by the power survey committee of the Great Lakes Section of the National Electric Light Association. The committee has determined to confine its first recommendation to the area covered by the southeast corner of Wisconsin, most of Illinois and Indiana and the northwest corner of Ohio. Its study is designed to show where it will be most economical and most advantageous to develop electric power up to 1950, to the end that all future extensions may be made in conformity with a definite plan. The entire region which will be studied includes Wisconsin, Michigan, Illinois, Indiana and parts of Minnesota, Iowa, Missouri, Ohio and Kentucky.

"The electric supply industry is no longer a purely local business," says the report. "Large generating stations and water powers are no longer merely local or state assets. They are the resources of the entire nation. It is now economically wrong to restrict the energy derived from them within any arbitrarily chosen limits. This energy must be so distributed that it will benefit the greatest possible number of people.

"'The outstanding feature of our future development plans is to provide a common reservoir from which electricity can be drawn at any point for any purpose, be it for lighting a home, operating a factory or providing power for railroads. Not until the power for the future is made only at the most economical points, and not until every available source of power that can be economically developed is put into use, will all the people derive the full benefits of electricity.

"In the earlier years little thought was given to the advantages of ultimate interconnection. We now will plan to base all future development on growth in population and industrial expansion, accessibility to coal fields and waterways and the labor market. The general location of large and small generating stations will be determined and reasons for such location given. The general run of transmission lines will be determined, with arrangements for lines radiating through rural districts."

R. F. Schuchardt, Chicago, is chairman of the committee, of which the other members are: From Wisconsin, Prof. Daniel W. Mead, P. D. Kline and G. G. Post; from Michigan, L. B. Andrus, J. C. Parker and B. E. Morrow; from Illinois, J. P. Clayton, G. W. Hamilton, J. L. Hecht, E. S. Hight and R. B. MacDonald; from Indiana, W. D. Carr and E. G. Ralston; from Minnesota, S. B. Hood; from Iowa, C. A. Sears, and from Kentucky, L. S. Strong. H. H. Field, Chicago, is engineer-secretary.

## Pulverized-Fuel Regulations Before N. F. P. A.

No action on the tentative pulverized-fuel regulations was adopted at the annual meeting of the National Fire Protection Association, held at Chicago May 8-10, other than that the committee on dust explosion hazards agreed to draw up improved specifications which could apply particularly to modern central stations. The committee felt that while the present proposed regulations were well suited for industrial and metallurgical plants, they would, from the standpoint of insurance, place a hardship upon central-station companies now using or installing pulverized-fuel systems. The regulations were printed in the ELECTRICAL WORLD for March 24, page 697. The hazards committee is to prepare a revised code consistent with modern practice to be presented at the next annual meeting of the association.

# Nebraska N. E. L. A. Has Successful Meeting

**Papers on Public Relation Policies, Rural-Line Specifications, Electrical Merchandising and Municipal Ownership Are Well Received—Service at Cost Frowned Upon**

IN A STIRRING plea for better re lations with the public, George A. Lee, Omaha, presented the story of the utilities' growth before the nineteenth annual convention of the Nebraska Section, N. E. L. A., at Omaha on May 10 and 11. Mr. Lee pointed out three direct results of the movement for improved policies—first, the comparatively few rate cases now up for settlement; second, a deeper appreciation by company managers of the wisdom of friendly relations, and third, the growth of better feeling toward the utilities. Quoting from a Supreme Court decision which held that rate questions were now judicial and not legislative, he declared that such a sentiment was a direct face-about from the feeling ten years ago, when rulings were sometimes upheld regardless of their confiscatory features. Mr. Lee urged strongly that utility managers should go directly to their customers and present their story. Although newspaper publicity served well, he felt that a speaker out on the firing line explaining utility problems was the best mouthpiece.

O. J. Shaw, Lincoln, told of the work of the Nebraska Public Utility Information Bureau, which is printing weekly a thousand circulars for distribution throughout the state.

### RURAL LINE PROCEDURE

John C. Hoge, Grand Island, in his report on rural lines listed nine factors affecting rural practices in Nebraska. Specifications adopted in other states had been largely followed, but provision had been made for farmers who prefer to build their own lines so that a better rate can be given them. Mr. Hoge advocated a high grade of construction despite initial high cost.

F. H. Brooks, Omaha, spoke of educating the farmer to the value of electrical service as the first step in selling the energy. To indicate the growth of the rural load T. H. Fritts, Grand Island, said that in January, 1922, there were 6,417 farm lighting plants in Nebraska, while in January, 1923, this number had risen to 7,978. Since rural-line distribution losses practically equal the energy consumption, the development of more day load was strongly advocated by other speakers.

Speaking on utility service at cost, Prof. V. L. Holister, State University Engineering College, outlined three possible roads for future regulation in Nebraska—first, the present competitive status with home rule; second, state regulation; third, profit-sharing co-operation between the local utility and the community. The consensus of opinion of the convention seemed to be that "service at cost" as applied was a misnomer and that regulation by the state was the best plan of the three. K. R. MacKinnon, Omaha, explaining the power costs of the Hydro-Electric Power Commission of Ontario, said that the Canadians did not want rates based on service at cost but on the value of the service rendered.

The report of the accident prevention committee was presented by W. O. Dunn, Nebraska City, who favored instructing utility operators through their foremen and also advocated that instruction in the prevention of accidents be given in the public schools.

### SELLING ELECTRICAL MERCHANDISE

Electrical merchandising was discussed by T. E. Roach, Omaha, who explained the system used by the Union Power & Light Company. He insisted that by the proper merchandising methods no central-station company need handle appliance business at a loss. Mr. Roach has increased his average residential consumer energy consumption to 24 kw.-hr. per month with a merchandising net profit last year of 10 per cent. J. E. Davidson, Omaha, attributed success in raising his company's income per residential consumer from $16 in 1919 to $25 in 1922 to intensive merchandising and the growing popularity of the high-wattage gas-filled lamps. Regarding the necessary reserve needed to be posted against bad debts, Mr. Davidson felt that in cities where the personal equation did not enter strongly 5 per cent was none too large.

On Friday morning C. H. Talmadge, St. Louis, presented the jobbers side of merchandising. A. J. Cole, Omaha, maintained that most utility operators had "gone to seed" on merchandising, whereas this should be their most active field. F. H. Brooks and J. E. Davidson favored the policy of the central station pioneering the sale of appliances through its own organization and not letting outsiders spoil the field for future development.

J. B. Hill, Lincoln, presented a paper on municipal ownership, dealing with its causes and results and the arguments against it. He thought the Legislature should insist that every municipal plant stand on its own feet, paying all the legitimate expenses required of privately owned plants, including state and local taxes.

A report on inductive co-ordination was read by A. J. Cole dealing with the year's work of the committee.

The annual banquet was given Thursday evening at the Hotel Fontenelle, when there was a gathering of jobbers, merchants and utility men.

H. G. Taylor, chairman of the Nebraska State Railway Commission, spoke of the relation between the utilities and the commission and urged that special attention be devoted to the rural-line problem. J. E. Davidson presented the romantic side of the story of electricity and pleaded that more of this phase of the industry be put before the public. A. J. Cole, G. W. Johnstone and John L. Kennedy also spoke.

The following officers were elected: President, T. H. Fritts, Grand Island; vice-president, A. J. Cole, Omaha; secretary and treasurer, Horace M. Davis, Lincoln. The members of the executive committee will be W. B. Roberts of Omaha, G. K. Pittinger of Albion, O. J. Shaw of Lincoln, G. A. Lee of Omaha and J. E. Davidson of Omaha.

## St. Louis Is Opposed to Union Electric's Expansion Plan

Opposition to the plan of the Union Electric Light & Power Company to expend $2,000,000 in the purchase of three groups of small power plants in Missouri has been manifested by the municipal government of St. Louis, which, in a petition to the Public Service Commission against granting the company the permission it seeks, expresses the view that if the company's surplus is not needed by it in the conduct of its St. Louis business, electric rates should be reduced to a figure which will not produce such a large surplus.

In connection with the proposal, the North American Company says:

"The Light & Development Company was acquired not only for the purpose of removing existing competitive situations in the interest of continuing the best possible service at the lowest rates, but also with the view of effecting operating economies under large scale production and distribution of electric power by combination of the Missouri properties with those of the Union Electric Light & Power Company. It is in furtherance of this plan that the Union Electric Light & Power Company has applied to the Public Service Commission of Missouri for authority to take over, at the cost to the North American Company's interests, all Missouri subsidiaries of the Light & Development Company."

## United Gas & Electric Corporation Readjustment

The stockholders' readjustment committee of the United Gas & Electric Corporation, which controls electric light and power companies and other public utilities in Pennsylvania, New York and several other states and which suffered a large impairment in capital account through the foreclosure of mortgages held against the International Traction Company and the American Cities Company, has proposed to its stockholders a plan of readjustment by which a consolidation with the Berkshire Corporation, recently organized in Connecticut to acquire three electrical properties in Lancaster County, Pa., where the United Gas & Electric Corporation also has subsidiaries, is effected. If the plan is approved by the stockholders, the consolidated corporation will issue its preferred stock (of the par value of $100 a share) and its common stock (of the par value of $10 a share) in exchange for the first preferred stock of the corporation on the basis of seven shares of preferred and seven shares of common stock of the consolidated corporation for ten shares of first preferred stock of the corporation.

The total authorized capital stock of the consolidated corporation will be $9,000,000, of which $6,499,360 will consist of preferred stock and $2,500,640 of common stock.

## Great Falls of Potomac and Cacapon River Projects

Since two years have passed during which the United States Congress has taken no action on the development of power at the Great Falls of the Potomac, the priority granted by the water-power act has expired. For that reason the Federal Power Commission has announced formally that it is particularly desirous of receiving applications for the development of the Great Falls project.

An application for a preliminary permit covering this development has been made by Stinemann & Quick of Baltimore, but these applicants have not convinced the commission of their ability to finance such a large undertaking. It is believed, however, that action will be taken on this application in the near future if no applications are forthcoming from interests considered better qualified to make the development.

The project of the Cacapon Power Company on the Cacapon River, near Martinsburg, W. Va., has been found to come within the jurisdiction of the Federal Power Commission. The project involves the erection of a dam 175 ft. in height, which will provide 150,000 acre-feet of live storage.

The interests behind the Cacapon Power Company are the same as those behind the Cheat River development. This Cacapon storage will be of great value in taking care of the peak loads. This is one of the free storage sites relied upon by Major Max Tyler in his plan for the development of the Great Falls of the Potomac.

## U. S. Chamber of Commerce for State Utility Regulation

The eleventh annual convention of the United States Chamber of Commerce, held at New York City last week, passed forward-looking resolutions on the regulation of public utilities, international economic policy, immigration, transportation, the merchant marine, federal taxation, waterways, the coal industry and a number of other subjects. On public utility regulation it declared for state as against municipal regulation.

Julius H. Barnes of New York was re-elected president of the chamber, and Elliot H. Goodwin, Washington, resident vice-president. Four regional vice-presidents were elected in accordance with the new plan of dividing the country into four districts with headquarters in each. They were as follows: A. C. Bedford of New York for the Eastern States, Thomas C. Wilson of Chicago for the North Central States, Harry A. Black of Galveston for the Southern Central States, and H. M. Robinson of Los Angeles for the Western States.

## National Manufacturers Draft Comprehensive Platform

Meeting in New York City this week for its annual convention, the National Association of Manufacturers, representing fifteen industrial states, adopted tentatively a preliminary draft of a platform which will be recommended to both the leading political parties for adoption in the presidential campaign next year. This platform, which will be amplified and put in definitive shape next month by a committee including three members from each industrial state, is comprehensive, covering government and industry, taxation, transportation, immigration, the merchant marine, coal mining, foreign trade and other issues.

The repeal of the excess-profits tax and the imposition of a tax on gross final sales are favored, as are permissive consolidation of existing railroad systems where this will promote efficiency and the encouragement of foreign trade by a tariff policy framed in the light of present-day commercial conditions and a scientific revision of taxation laws. Government ownership in any form is strongly opposed.

## Silk-Mill Lighting

### Illuminating Engineers Discuss Applications of Mercury-Vapor and Tungsten-Filament Lamps

RECENT applications of mercury-vapor and tungsten-filament lamps to silk-mill illumination were discussed before a well-attended meeting of the New York Section of the Illuminating Engineering Society at Paterson, N. J., on May 11. Two papers were presented, "Silk-Mill Illumination with Mercury-Vapor Lamps," by C. F. Strebig of the Cooper Hewitt Electric Company, and "Lighting the Silk Industry with 'Mazda' Lamps," by H. W. Desaix of the Watson-Flagg Engineering Company. Before the meeting members and guests were taken through the National Silk Throwing Company, where an interesting example of mercury-vapor lighting was inspected.

High visual acuity, low intrinsic brilliancy and high diffusion are the features of the mercury-vapor lamp, declared Mr. Strebig, whose paper was presented by W. J. Winninghoss. He went on to point out that fine details which can be discerned only with difficulty under continuous-spectra light are readily distinguishable under the simple light of the mercury-vapor lamp. Actual installations of the mercury-vapor lamp in the winding, spinning, warping and weaving rooms were described.

#### Requirements to Be Met

Mr. Desaix's paper was in the nature of a report of an investigation. It was pointed out that a satisfactory system of lighting must meet the following requirements: Higher intensity on the looms than over the drives and aisles, adequate intensity for all purposes, freedom from glare both direct and by contrast. The cost of installation and upkeep must be reasonable in comparison with results and must pay a return on the investment. For winding and quilling, "RLM" steel-dome reflectors with 200-watt "Mazda C" lamps spaced on 12-ft. centers and 12 ft. high will give a general illumination of about 8 foot-candles, the speaker said—an intensity sufficiently high for ordinary purposes. In warping rooms where horizontal warpers are used each warper should be treated as an individual unit, using the "spilled" lighting principle. The luminaires should be placed over the creel, over the reed and over the beam, all centered over the width of the machine and using the lamps named above. The intensity in this case will be about 30 foot-candles on the work. In the throwing process good results will be secured by using "RLM" steel-dome reflectors with 200-watt enameled-bowl lamps spaced on centers of 16 ft. to 18 ft. and hung 12 ft. to 14 ft. from the floor. This will provide about 4 or 5 foot-candles. For dyeing rooms a prismatic-glass vapor-proof reflector globe using a 150-watt type "C" clear "Mazda" lamp was recommended. The units should be spaced in bays 10 ft. x 10 ft. and mounted 10 ft. from the floor. The illumination in this case will be about 12 foot-candles.

## First Divisional Meeting of Contractors' Society

The first of the divisional conventions to be undertaken by President James R. Strong and Director Laurence W. Davis of the Association of Electragists International is to take place at Pittsfield, Mass., on Thursday, June 14. This will be an Eastern Division meeting, including the New England States, New York, New Jersey, Pennsylvania, Delaware, Maryland and the District of Columbia. The Hotel Maplewood will be headquarters.

The morning session will be devoted to meetings of the New York State Association of Electrical Contractors and Dealers. Chairman F. A. Mott will preside. At 2 o'clock the first session of the divisional convention will begin. President Strong's address will be followed by a speech on "Selling Electrical Service," by Charles L. Edgar, president Edison Electric Illuminating Company of Boston. "Service After the Sale" is the title of a talk to be given by Miss Alice Carroll of the Society for Electrical Development. Charles L. Eidlitz, New York commissioner, will speak on "Back to Quality, Sane Costs and Fair Dealing." "Estimating and Selling the Job" will be the topic of Laurence W. Davis, director of promotion and development of the association.

## Missouri Convention to Be Held Afloat

Electrical transmission problems in Missouri and the adaptation of oil engines for small central stations will be the subjects of papers to be presented at the seventeenth annual convention of the Missouri Association of Public Utilities, to be held on board the Steamer Harry G. Drees on May 24-26. This steamer will leave at the foot of Market Street, St. Louis, at 8 p. m. Wednesday, May 23, for a trip to Peoria, Ill., and back, with a stopover at Quiver Beach on Friday, when a picnic will be held. The tentative program is in part as follows:

THURSDAY, MAY 24

*Morning.* — Presidential address, E. R. Locke; Public Utility Information Bureau report, W. H. Henby; address, "Comparison of the Public Utility Industry for the Years 1915 and 1921," J. B. Sheridan, manager Missouri Committee on Public Utility Information.

*Afternoon.* — Address, Hugh McIndoe, member Missouri Public Service Commission; address, "Application of Oil Engines for Small Central Stations," Stanley Stokes, Union Electric Light & Power Company, St. Louis.

FRIDAY, MAY 25

*Morning.*—Address, "Public Utility Problems from a Manufacturer's Viewpoint," George A. Hughes, president Edison Electric Appliance Company, Chicago; address, "Some Electrical Transmission Problems in Missouri," L. W. Helmreich and N. C. Mann, Missouri Public Service Commission.

## Stone & Webster Men Meet

### President of Firm Tells Treasurers that Public Utility Securities Grow More Stable

A FUNDAMENTAL gain in the attitude of the public toward utility questions which tends to increase the stability of the industry has come since the war, Edwin S. Webster, president Stone & Webster, Inc., declared at a convention of resident treasurers representing sixty companies under this management which was held this week at the home offices in Boston. "Up to the time of the great war," said Mr. Webster, "the development of the art had been such that rates in electric light and power companies, gas companies and street-railway companies had had a continuing downward tendency. New methods and increased efficiency in operation had enabled the companies, in spite of increasing basic costs, to give their service at a decreasing cost.

"A short time before the war," he continued, "costs were gradually rising, with the result that many of the companies were in the embarrassing situation of selling their service for a fixed sum, with no provision for taking care of the increased cost of production. At that time it was almost impossible to make the moderate increase in rates necessary, partly on account of the fact that a large proportion of the utilities were owned by a comparatively small number of people, and it was impossible to get the sympathy of the public in general for any such increase. Then came the war with the tremendous increase of cost which made a revision of the public utility rates absolutely necessary. The economic changes at that time were so great that the companies had no difficulty in proving before any fair tribunal the absolute necessity of a revision of rates, and they were able to bring about a clearer appreciation that the development of any locality and the public utility are so closely associated that neither can succeed without the other.

#### Welcome Change of Attitude

"With this improved understanding of the utility situation by the public in general came an almost unlooked-for advantage. Investors in the localities where the utilities were located began to see that their securities were desirable investments. Companies all over the country have successfully offered stocks, notes and bonds to their customers and to local investors, which has had the most desirable result of getting customers interested in the companies selling them service and has also opened up a new source of capital for extensions."

The convention was the third the organization has held and was presided over by H. B. Sawyer, treasurer of companies under Stone & Webster management. The program included thirteen addresses by resident treasurers from all sections of the country.

## Power Board Activities

**Rio Grande Project Waits on the State Department—Ambitious Plan for Cheat River**

PENDING a report from the State Department, the Federal Power Commission will grant no rights in connection with the project on the Rio Grande near Laredo, Tex., which is intended to export power for public utility use in Mexico. The Mexican authorities are understood to be anxious to have the development proceed.

A preliminary permit has been issued to the West Virginia Power & Transmission Company covering an extensive project for the complete development of the Cheat River in West Virginia and Pennsylvania. The project contemplates the ultimate development of 600,000 hp.

A license is to be issued covering Pit River project No. 3 of the Mount Shasta Power Corporation and a preliminary permit to the same company covering Pit River project No. 4.

A preliminary permit is to be extended by the Federal Power Commission to the Murtaugh Irrigation District covering a project on Snake River near Auger Falls. It is proposed to develop 16,000 hp. to be used in pumping water to two levels where the lift is 92 ft. and 155 ft. respectively. The district to be irrigated is known as the Hansen-Butte project. Engineers express some doubt as to the feasibility of the higher lift and point out that it probably would be to the advantage of all concerned were the power purchased from the public utility company which is operating in that region.

Preliminary permits have been issued to P. B. Cross of San Francisco, covering a small project on Deer Creek in Tehama County, Cal.; to Kehoe, Hanson, Hummel & Sutherland, covering a 200-hp. mining project on Thumb Creek, near Hyder, Alaska, and to Blue & Traversy of Hyder, covering a small project on the Soule Glacier River.

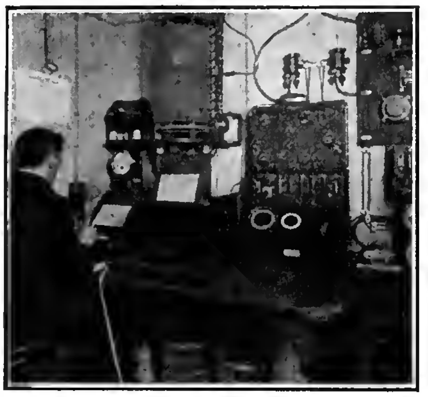
Preliminary permits extended to Maurice D. Leehey and to John H. Hughes have been revoked. In the case of the Hughes permit the provisions prescribed were not carried out. The Leehey permit, which covered an important project at Beaver Falls, near Ketchikan, Alaska, was revoked because the applicant declined to accept the terms under which the Forest Service will sell timber to be used in the manufacture of pulp.

## Predicts Reductions in Cost of Making Electricity

General reductions in the cost of the production of electricity were prophesied by C. C. Perry, president of the Indianapolis Light & Heat Company, in addressing the Commercial Section of the Indiana Electric Light Association in Indianapolis on May 3. "The keenest brains in the world are evolving intricate machines which ultimately will reduce the cost of the production of electrical energy to the minimum," declared Mr. Perry. "We must look forward to cheaper rates to the consumer. These machines will enable us to do just that. Although it may take many years, I have little doubt that we are steadily approaching the time when the consumer cannot claim he suffers the brunt of the cost of development."

## Brief News Notes

**Ocean Steamer Has Two-Way Radio.**—On the last voyage of the White Star liner Majestic radio messages were exchanged with shore stations of the Radio Corporation of America at speeds of more than eighty words per minute when the vessel was a thousand miles at sea. In order to effect two-way high-speed telegraphic service on the vessel



it was equipped by the Marconi Company with a high-speed receiver which worked most satisfactorily. High-speed signals were also received from Paris at a distance of 800 miles at a speed of eighty words per minute. The photograph showing part of the radio equipment of the steamer was supplied by the Radio Corporation of America.

**San Joaquin Corporation Has Profitable Year.**—The San Joaquin Light & Power Corporation, operating in Fresno, Bakersfield, Merced, Taft and vicinity, reports to the California Railroad Commission for the year 1922 that its electric operating revenue was $5,892,578 and electric operating expenses $3,062,172, giving a net electric operating revenue of $2,830,406. The company declared dividends of $766,800 during the year, leaving an accumulated surplus at the end of the year of $2,637,451.

**Industrial Teachers' Scholarships.**—The State of New York is offering twenty-five industrial teachers' scholarships of $1,000 each to qualified persons who have had at least five years of all-round experience of journeyman grade in one of twelve trade, industrial or technical occupations, including electrical constructing, repairing and operating and electrical drafting and design. Persons selected to hold these scholarships will spend one year at the Buffalo State Normal School preparing to teach their subjects in the public vocational schools of the state. The State Department of Education, Albany, will furnish detailed information.

**Survey of Uintah Basin.**—A survey of streams in the Uintah basin for the purpose of land classification and determination of power possibilities will be conducted about July 1 under the direction of Ralf R. Woolley, hydraulic engineer of the United States Geological Survey. Dam sites will be mapped, and final results will be included in the standard topographic map of the United States.

**Progress of Water-Power Development in Austria.**—At the present time about one thousand water-power stations are under way in Austria. In 1921 more water-power stations were under way than the entire country possessed previously. In 1922 ten stations with a combined capacity of 22,610 hp. were put in operation, while on twenty-nine plants with a combined capacity of 205,850 hp. work was continued and eight plants, rated together at 33,030 hp., were started. Altogether this came to forty-seven water-power stations with a combined capacity of 261,490 hp. To this must be added 895 smaller stations. A great saving in coal imports is hoped for when all these projects are completed.

**Progress on Wilson Dam.**—Work on the Wilson Dam at Muscle Shoals is 40 per cent complete. Progress is following the preliminary estimate closely. In March 34,586 cu.yd. of concrete was put in. Of that amount, 17,293 cu.yd. went into the dam and 17,097 cu.yd. into the power house. The remainder was put in the lock. Reports so far received for work in April indicate that the same rate was maintained. Working conditions throughout the season have been particularly favorable. There has been no trouble with high water, the only delay having been a few days when the rainfall was sufficiently heavy to interfere with work. There have been no troubles in securing labor or materials.

**Maplewood, Mo., Opens "White Way."**—The city of Maplewood, Mo., a suburb of St. Louis, opened a new "white way" on April 30 with a celebration which lasted for a whole week. This "white way" consists of 150 250-cp. series incandescent lamps mounted on ornamental iron standards placed from 50 ft. to 80 ft. apart on both sides of Manchester Avenue for a distance of three-fourths of a mile. The electric service is supplied by the Western Light & Power Company, and the lights are so arranged that 120 of them burn from dusk to midnight and thirty from dusk to daylight. The Maplewood Merchants' Association contracted for the "white way" for ten years, and the property owners have guaranteed payment of the bills.

**Largest and Fastest Cable.**—Plans for laying a new cable between New York and London by way of Nova Scotia and the Azores are announced by the Postal Telegraph-Commercial

Cables System. The new cable, contracts for the manufacture of which have already been completed, will be the largest and fastest ever laid in the Atlantic Ocean, President Clarence H. Mackay states. Engineers who designed the cable estimate that its speed will be about 600 letters per minute. The conductor will require an average of about 1,100 lb. copper per mile, as against an average of about 700 lb. per mile in the heaviest cable now in use. It will cost between $10,000,000 and $15,000,000 and is expected to be in place by Aug. 1.

**Boston Suburban Utilities Change Rate.**—Following protracted hearings before the Massachusetts Department of Public Utilities on petitions brought against the Malden Electric Company and the Suburban Gas & Electric Company, an agreement has been reached whereby the former service charges of these companies will be superseded by a three-part rate in which the first 15 kw.-hr. per month will be billed at 10½ cents net, all energy consumed above this at 8 cents per kilowatt-hour, and a minimum charge will be made ranging from 50 cents net per month for each 15-amp. meter or under to $1 net per month for each 600-amp. meter or over. The service charge under the old rate was 35 cents per month, with a 9-cent energy rate.

**Kelso-Wurdack Company Will Take Over Some Services of Light & Development Company.**—The Kelso-Wurdack Company, a Missouri corporation with offices in St. Louis, organized to manage, own and operate utility and other companies, will, it is announced, render all services that have been previously performed by the Light & Development Company of St. Louis in connection with the operating, engineering, management and current legal affairs of the following subsidiaries of the United States Public Service Company; Mitchell (S. D.) Power Company, Texas Utilities Company, Slaton (Tex.) Power & Light Company, Monmouth (Ill.) Public Service Company, Paris (Ky.) Gas & Electric Company, Danville (Ky.) Light, Power & Traction Company, and Carlisle (Ky.) Electric Light & Power Company.

**Plant to Develop 105,000 Hp. at Oak Grove, Ore.**—As plans of the Portland (Ore.) Railway, Light & Power Company develop for the construction of its Oak Grove hydro-electric project, it is foreseen that the ultimate power available will be 105,000 hp., instead of 100,000 hp., as originally figured. The total cost of the development will be $12,000,000, or $2,000,000 more than contemplated. With the approach of summer construction work is progressing rapidly on the first unit, which will develop 25,000 hp. Work is being rushed on a 25-mile extension of railroad in order that material may be transported to the dam and power-house sites. A force of 1,800 men is now engaged on the various phases of the work. It is expected that the first unit will be completed and in operation during the early part of 1924.

**Yadkin River Company Acquires Municipal Plants.**—The Yadkin River Power Company, a subsidiary of the Carolina Light & Power Company, with home office at Raleigh, N. C., has established service at Dillon, S. C., and has taken over the municipal plant. For several months the company has been engaged in the construction of a transmission line between Maxton, N. C., and Marion, S. C. This line has now been completed as far as Dillon. The municipal plant at Rowland, N. C., has already been taken over by the Yadkin company, and the municipal plant at Latta, S. C., will be acquired as soon as the transmission line is completed to that point.

**Rapid Growth of Sheboygan Plant.**—Extensive improvements and additions to cost in the neighborhood of $200,000 will be made in Sheboygan, Wis., by the Eastern Wisconsin Electric Company, operator of electric light and power and street-railway properties in that city. This expansion plan covers the purchase of additional ground and the erection of new units in its present steam generating plant which alone will cost about $180,000 and outstrip the capacity of any other steam generating plant in that part of the state. It is estimated by officials of the company that this equipment will be ready for service by Sept. 15. When completed this plant will transmit power clear across the state as far west as Fond du Lac and southwest into Illinois at Galena. The output of the Sheboygan plant for the year ended April 1, 1923, was 24,202,466 kw.-hr., an increase of 545 per cent in ten years.

# Associations and Societies

**New York Electrical League.**—Charles L. Eidlitz, commissioner for the electrical contractors' associations of Greater New York, will address the luncheon of the New York Electrical League at the Hotel Astor on Wednesday, May 23, at 12:30 p.m.

**Philadelphia Electrical Contractors' Association.**—Application for a charter has been made by this association, of which Charles E. Tull is president and M. G. Sellars secretary. The object of the association is to distribute technical electrical information, promote better trade relationships and advance the standing of electrical merchandise and workmanship.

**American Society for Testing Materials.**—The twenty-sixth annual meeting of this society will be held on June 25 to June 29, at Chalfonte-Haddon Hall, Atlantic City, N. J., with a very full program of committee reports and papers on tests, fatigue, corrosion, preservatives, magnetic analysis and so forth of various materials. F. M. Farmer, chief engineer Electrical Testing Laboratories, New York City, will report as chairman of the committee on electrical insulating materials, and there will be papers on electrical insulating varnishes, electrical slate and other topics of interest to the electrical industry.

**Public Utilities Advertising Association.**—This association, organized last fall, will hold its first session in connection with the annual convention of the Associated Advertising Clubs of the World at Atlantic City, June 3 to 7. The Public Utilities Advertising Association, which is rapidly growing, includes representatives of electric light and power, electric railway, gas and telephone companies in its membership. The sessions at Atlantic City will be devoted to public relations and utility advertising. On June 5 there will be addresses by J. C. McQuiston, manager publicity department Westinghouse Electric & Manufacturing Company, on "Why Advertise?" by Francis H. Sisson, vice-president Guaranty Trust Company, New York, on "Public Utilities and Public Relations," and by W. H. Hodge, manager advertising department, Byllesby Engineering & Management Corporation, Chicago, on "Customer Ownership Advertising."

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Westinghouse Agent-Jobbers' Association—Hot Springs, Va., May 28-June 2.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

North Central Division, N. E. L. A.—Minneapolis, June 20-22. H. E. Young, Minneapolis General Electric Company.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association—Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Institute of Electrical Engineers—Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Iowa Section, N. E. L. A.—Mason City, June 26-29.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association—Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

## Recent Court Decisions

**Telephone Company Permitted to Recover from Light Company Sum Paid Under Workmen's Compensation Act.**—The Appellate Court of Indiana has sustained a verdict permitting the Home Telephone Company to recover from the Wabash Water & Light Company sums paid and to be paid by the telephone company under the workmen's compensation act because of the death from electric shock of a lineman in its employ. The lineman while working on the telephone wires came into contact with a 2,300-volt wire maintained on the same pole by the electric service company and was killed. The telephone company, claiming that the wire with which the lineman came into contact was insufficiently insulated, sued to recover the amount it was legally bound to pay the victim's heirs, charging the defendant company with negligence. (138 N. E. 692.)*

**Kansas Court Affirms One-Dollar Service Charge.**—A service charge of $1 a month made for gas by the Leavenworth (Kan.) Light, Heat & Power Company was overruled as excessive by the Kansas Public Utilities Commission and a charge of 55 cents substituted. A temporary injunction against the enforcement of the reduction was obtained by the company, a fund being established by it for the reimbursement of its customers should the final decision sustain the commission. The Kansas Circuit Court of Appeals has sustained the company's contention that a charge of less than $1 would be non-compensatory as failing to cover the cost of installation and repairs of piping and meter, keeping accounts, rendering bills and the other items independent of general operating and maintenance expense.

**Damage to Land by Seepage from Reservoir Question for Jury.**—In Bijou Irrigation District vs. Cateran Land & Live Stock Company, an action to recover for damages to land caused by seepage from defendant's reservoir, the Supreme Court of Colorado held that where engineer witnesses for both sides testified that the source of some of the water on plaintiff's land was defendant's reservoir the question of damages was for the jury. The court found that it was improper to plead that damages were caused by high water in the river, heavy rains and seepage from a ditch other than defendant's, because such matters were merely evidential tending to show that the damage to plaintiff's land was not due to percolation or seepage from defendant's reservoir and so to support defendant's denials. Quotation of this plea was not, however, prejudicial where the court in addition stated the denials on which the defendant relied. Evidence that damages to plaintiff's land could have been averted by drainage was improperly stricken out on the ground that feasibility of drainage had not been pleaded, since the evidence went to negative the amount of damages, was not in confession and avoidance, and it would have been improper to plead it because it was mere evidence. Judgment for the plaintiff was reversed and a new trial ordered. (213 Pac. 999.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

## Commission Rulings

**Revaluation Figure for Alabama Power Company Placed at $29,000,000.**—The revaluation case of the Alabama Power Company (see ELECTRICAL WORLD, May 5, page 1057) has resulted in the Public Service Commission of that state establishing the value of the company's properties for rate-making purposes at $29,000,000, a reduction of $4,843,252 from the valuation of $33,843,252 placed by B. H. Cooper and S. P. Gaillard, associate commissioners, shortly before they retired from office. In reaching the new valuation the commission considered the evidence submitted in the original hearing and made new investigations into the various phases of the case. The valuation covers all property of the company as of June 30, 1920, the date involved in the original proceeding. To this value was added that of property acquired since that time, including the utilities of Montgomery, the utilities at Selma, the development at Mitchell Dam and other small plants. The new valuation is about $15,000,000 less than the final valuation placed by Hagenah & Erickson, engineers, who made an inventory and appraisal of the property for the commission after the valuation case was docketed in 1920. Hagenah & Erickson's original report placed the valuation at approximately $47,000,000, but conferences between them and I. F. McDonnell, engineer for the commission, caused a reduction of the valuation to approximately $44,000,444. Mr. McDonnell made a check of the valuation recommended by Hagenah & Erickson and of the valuation of Morris Knowles, who was employed by large consumers of power, and his recommendation to the commission was the establishment of the valuation at $29,000 000. Up to this time Mr. McDonnell had never made a recommendation, according to members of the commission. The total valuation includes $1,500,000 as working capital and $3,750,000 as going-concern value. Before the valuation can become final sixty days must elapse, and during these sixty days any citizen of Alabama may, under a law passed by the last Legislature, protest against the tentative valuation and may appear before the commission for the purpose of showing why the valuation should not become final. If no protest is filed within the sixty days, the tentative valuation will become final for rate-making purposes.

**Sale by Merged Corporation.**—A public utility company created by a merger is not authorized by the Pennsylvania statutes to sell and transfer to another company rights, franchises and privileges in the territory of the merged corporation which were formerly vested in a constituent company, according to a decision of the Pennsylvania Public Service Commission *in re* Topton Electric Light & Power Company.

**Bills for Separate Installations of Same Customer Must Not Be Added and Discounted.**—The Illinois Commerce Commission has overruled a rider in a rate schedule (*re* Produce Terminal Corporation) which provided that if any consumer owns several places of business in different locations and shall use electricity furnished by the company exclusively in all his places of business, he shall be entitled to a discount of 5 per cent from the total of the net monthly bills where two premises only are served and an additional 1 per cent for each additional place of business covered by the contract, the total discount not to exceed 20 per cent. Such a contract, the commission insists, is discriminatory, as for all practical purposes installations of the same customer in different localities are the same as installations of separate and individual customers.

**Going-Concern Value Should Be Shared with Public.**—The Public Utilities Commission of Connecticut in arriving at a valuation of the Ansonia Water Company made the following observations concerning going-concern value: "In determining the value of private property, such as mercantile or manufacturing establishments, the actual market value, what a willing or even anxious purchaser would be willing to pay, is an important factor and necessarily takes into consideration good will or going value of a successful business; but if market value should be considered as the measure of fair value of a utility company, upon which to base a return, many utility companies in operation today would be deprived of a fair return on the actual investment. Where a utility property is valued on the basis of cost to reproduce new, less depreciation, and the items of organization expenses, interest and taxes during construction, etc., are taken into consideration and included, and the subsequent business development cost charged to operating expenses, the intangible items of 'going value' or 'good will' should not then, in our opinion, be arbitrarily added as elements of value. . . . Whatever the intangible value of this element may be, it should, to some extent, accrue to the benefit of the public which assisted in creating it as well as to the company in increased volume of business."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## Dr. B. B. Brackett Leaves State College

Dr. B. B. Brackett, who has been the head of the electrical engineering department at South Dakota State College for the past fourteen years, has resigned from the faculty to become head of the electrical engineering department at the University of South Dakota. Before going to South Dakota Dr. Brackett was for some time private assistant at Johns Hopkins University to Prof. Henry W. Rowland, recognized as one of the greatest physicists America has ever produced. He also held chairs of electrical engineering at the Clarkson Institute of Technology at Potsdam, N. Y., and at Rutgers College. Heretofore Dr. L. E. Akeley has not only acted as dean of the College of Engineering of the University of South Dakota but has also performed the duties of professor of physics and electrical engineering. The need of assistance in his work has been apparent, and with the addition of Dr. Brackett to the faculty he will be relieved of the work in electrical engineering and enabled to give his entire time to his other duties.

**Harold F. Eastman,** who has been associated with the Connecticut Power Company, a Stone & Webster property, has been transferred to Boston in the division of construction and engineering.

**L. P. Perry,** vice-president and treasurer of the Central Connecticut Power & Light Company, has joined the organization of the Central Hudson Gas & Electric Company, with headquarters at Poughkeepsie, N. Y.

**Wilfred G. Parkinson** of the Carnegie Institution of Washington sailed on May 3 for Santa Teresa en route to Huancayo, Peru, where the institution has an observatory in which changes in the earth's magnetism and variations of atmospheric electricity are watched.

**John E. Loiseau,** for eight years secretary-treasurer of the Montgomery (Ala.) Light & Water Power Company, has been appointed secretary of the Denver Gas & Electric Light Company. Mr. Loiseau's appointment fills the vacancy created when Clare N. Stannard was promoted to the vice-presidency and general managership upon the death of William J. Barker.

**C. E. Oakes,** an electrical engineer who has been in the service of the Federal Power Commission, has resigned to accept a position with the Pennsylvania Power & Light Company. The vacancy created by his resignation has been filled by the appointment of N. B. Keeler. Mr. Keeler for many years has been an assistant engineer of the Corps of Engineers of the army. It was he who made a recent inventory for the Federal Power Commission of the properties of the Niagara Falls Power Company.

## L. O. Ripley Heads Middle West Division of N. E. L. A.

L. O. Ripley, vice-president of the Kansas Gas & Electric Company, was recently elected president of the Middle West Division of the National Electric Light Association. Mr. Ripley, though a native of New York, has been in Kansas since 1909, when he became associated with the American Power & Light Company and was immediately sent West as the field executive of the Kansas Gas & Electric Company, which is controlled by the American Power & Light Company. He entered the electrical industry during his high-school years, when he worked in the electric light plant at Cooperstown, N. Y., in the early mornings and afternoons. Following his graduation in 1900, from Union College, Schenectady, as an electrical engineer, he engaged in outside construction work until 1903, when he returned to Schenectady and joined the Schenectady Railway Company, which at that time also operated the electric light and power business as well as the gas business in Schenectady. This property was directly affiliated with the General Electric Company. Mr. Ripley was made superintendent of light and power, which included the interurban and city railway systems as well as light and power distribution in the city. When the railway systems were sold he became manager of the Schenectady Illuminating Company and remained there until he allied himself with the American Power & Light Company. Mr. Ripley has been an important factor in utility development in Kansas, both as an executive of the light and power company with which he is associated and as an active participator in the organization and work of the division of the National Electric Light Association which he is now called upon to head.

L. O. RIPLEY

**T. C. Martin** is now secretary of the New York Electrical Society, succeeding the late George H. Guy.

**Charles W. Tippy** of Jackson, Mich., general manager of the Consumers' Power Company, was recently elected president of the Great Lakes Geographical division of the National Electric Light Association. He succeeds Harry Reid of Indianapolis.

**Howard T. Spaulding,** who has been associated with the Nela Park laboratories at Cleveland for the past fourteen years, has been appointed illuminating engineer for the Bryan-Marsh Lamp Division with headquarters in Boston.

T. S. Saylor, formerly of the appliance department of the Salem (Mass.) Electric Lighting Company, has been appointed sales manager of the Rockland Light & Power Company, Nyack, N. Y., and of the Rockland Electric Company, Ramsey, N. J.

**L. F. Wiegand,** formerly executive in charge of the investment department of the Iowa Railway & Light Company, Cedar Rapids, has been appointed assistant vice-president in charge of investments of the Central Indiana Power Company, Indianapolis, and the Indiana Electric Corporation, which is controlled by the Central Indiana Power Company.

**Col. Eugene J. Spencer,** secretary of the St. Louis Electrical Board of Trade, was officially presented with the distinguished service medal, which was awarded to him about a month ago, by Major-General George B. Duncan, commander of the Seventh Corps area, at ceremonies held at Jefferson Barracks on Friday afternoon, May 11. Colonel Spencer received his award for "meritorious and distinguished services" while in command of the Engineer Corps in the southern area of France in 1918.

E. J. Steinberg, resident engineer in Milwaukee for the Wisconsin Railroad Commission for the past ten years, will resign June 1 to ally himself with the Milwaukee Electric Railway & Light Company. Mr. Steinberg joined the commission engineering force in 1910. Three years later he was transferred from Madison to Milwaukee as resident engineer. Since then he has had charge of street-car schedules for the Milwaukee Electric Railway & Light Company and has performed other administrative and regulatory duties, involving public utility properties in the Milwaukee district.

**Edgar M. Blessing** and **Glenn Vanauken** have been reappointed for four-year terms on the Indiana Public Service Commission.

**E. C. Davis**, formerly with the merchandising division of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., is now in the Los Angeles office of that company.

**Thomas F. McDonough** is now in charge of the Northwest territory of the Benjamin Electric Manufacturing Company. He will have supervision over the States of Montana, Idaho, Washington and Oregon.

**James W. Armour** has been appointed assistant general superintendent of the Murphy Iron Works plant of the Sanford Riley Stoker Company, at Detroit. Mr. Armour entered the plant in 1919 as inspector and later became production manager.

**E. L. Doty**, district service manager of the Buffalo branch office of the Westinghouse Electric & Manufacturing Company, has been appointed engineering assistant in the service department, with headquarters at East Pittsburgh. J. A. Atkinson has been appointed Buffalo service manager.

**Maurice Metcalf** of New York has been elected treasurer of the American Bosch Magneto Corporation of Springfield, Mass., and will soon assume the duties of the office. Mr. Metcalf succeeds George A. MacDonald of Springfield, who continues as a director and vice-president of the corporation.

**George F. Murphy**, formerly manager of the Pittsburgh office of the Heine Boiler Company, St. Louis, has been placed in charge of the New York territory of the company upon the retirement of Paul H. Brangs, who had been for many years in charge of the local office. Mr. Murphy will be assisted by J. L. Daly and G. A. Knowles.

**Rodney Q. Selby** of Des Moines has been appointed assistant director of the Iowa Committee on Public Utility Information. Mr. Selby goes to this committee from the Des Moines *Capital*, with which he has been associated for a number of years. He is a graduate of Drake University and has had many years' experience in the newspaper business.

**George Baily**, supervisor of distributing agents of the Westinghouse Electric & Manufacturing Company, has been elected president of the Varney Electrical Supply Company of Indianapolis, Ind. Mr. Baily became associated with the Westinghouse Electric & Manufacturing Company in 1914 as manager of the supply division of the Cincinnati office, where he remained until 1917, when he joined the Engineer Officers' Training Camp. On being mustered out of the military service in 1918 Major Baily returned to the Cincinnati office. In 1920 he was made assistant to the manager of the supply department and was transferred to the East Pittsburgh offices of the company. In 1922, when the merchandising department of the Westinghouse company was organized and the supply department reorganized, he was promoted to be supervisor of distributing agents, which position he held until his present appointment.

# Obituary

**John M. Egan**, formerly president of the Metropolitan Street Railway of Kansas City and the Kansas City Light & Power Company, dropped dead at Amboy, Ill., on May 9. He was seventy-five years of age and was born in Springfield, Mass. Mr. Egan retired from the presidency of the Kansas City companies in 1916.

**Prof. Louis Derr** of the Massachusetts Institute of Technology, Cambridge, died at Brookline, Mass., May 10, after a few weeks' illness. Professor Derr was well known in New England electrical engineering circles for his work in physics and photography. He was born in 1868 at Pottsville, Pa., and was educated at Amherst College and the Massachusetts Institute, becoming professor of physics at the latter in 1909. At the time of his death he was professor of applied optics and photography.

**William Shreeve Doran**, president of the Alberger Pump & Condenser Company and of Charles Cory & Son, Inc., New York, died on Saturday, May 12. Mr. Doran was born in Philadelphia and obtained his early training with the Southwark Foundry & Machine Company, in that city, and the United Gas Improvement Company. In 1887 he entered the employ of Henry R. Worthington and in 1900 became affiliated with the British Westinghouse interests in establishing their branch offices and supervising sales. He severed his connection with the Westinghouse company to join the Allis-Chalmers company as manager of the power department. Since 1905 he had been with the Alberger company, first in its sales department, later as vice-president and general manager and since 1918 as president. In 1920 he was elected president of Charles Cory & Son, Inc.

**Henry Woodland**, secretary and treasurer of the Allis-Chalmers Manufacturing Company and a widely known Milwaukee business man, died suddenly early on May 14. When the Gates Iron Works of Chicago was consolidated with the Allis-Chalmers Manufacturing Company, in 1901, Mr. Woodland, who was then treasurer of the Gates company, became assistant treasurer of the Allis-Chalmers company. Mr. Woodland went to Milwaukee in 1904, when the general offices of the Allis-Chalmers company were transferred there. Soon after he was made treasurer of the company and in 1916 was elected secretary and treasurer. He was also vice-president and a director of the Hanna Engineering Company, Chicago.

**Paul Preston Haynes**, a member of the Public Service Commission of Indiana under the Goodrich administration and since then an attorney specializing in utility matters in Indianapolis, died May 9 at Boston, after a brief illness, at the age of thirty-five. Mr. Haynes completed a two-year term on the commission and then was reappointed for another term by Governor Goodrich, but he resigned in March, 1921, after three years' service. Besides his work on the commission he was a member of the special war committee of the National Association of Utility Commissioners, which dealt with many important questions of railroad and utility regulation during the war.

**Rex C. Starr**, a prominent Pacific Coast engineer, was found dead on May 3 in a canal of the Merced (Cal.) Irrigation District. Mr. Starr was chief engineer and executive head of the Merced Irrigation District, a member of the firm of Thebo, Starr & Anderton consulting engineers of San Francisco, and consulting engineer for the San Joaquin Light & Power Corporation. Mr. Starr had been connected with many important power developments on the Pacific Coast during recent years. He was resident engineer for Stone & Webster on the construction of the Snoqualmie Falls plant of the Puget Sound Power & Light Company and later on the White River plant of the same company. He was assistant engineer on the construction of the Big Creek development of the Pacific Light & Power Corporation and chief engineer on the Kerckhoff and Kern River projects of the San Joaquin Light & Power Corporation. When he became associated with the Merced Irrigation District a year ago he was retained as consulting engineer by the San Joaquin Light & Power Corporation. Mr. Starr was thirty-eight years of age.

**Prof. Arthur Gordon Webster** of Clark University, an eminent physicist, died from self-inflicted bullet wounds on May 15. This tragic occurrence, which means a great loss to science, caused amazement among Professor Webster's friends and associates, for he had shown no signs of depression and must, it is believed, have taken his life as the result of a sudden impulse. He had attained great success in many scientific lines and was recognized as one of the world's greatest authorities on electricity and sound. He was born in Brookline, Mass., was graduated from Harvard in 1885 and later studied in Paris, Berlin and Stockholm. After spending a year as instructor at Harvard, he entered the service of Clark University, where he was successively docent in physics, assistant professor of physics, professor of physics and director of the physical laboratory, holding the last-named offices at the time of his death. Professor Webster was the author of several important works on electricity and dynamics and during the war was made a member of the Naval Advisory Board of Scientists, of which Thomas A. Edison was chairman. All who knew him will mourn the loss of a steadfast friend and a delightful personality, and the electrical industry will sadly miss the fruits of his brain and the enthusiasm he inspired for scientific research.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## The Reduction of the Jobbing Line

### The Position of the Manufacturer Toward Elimination of Excess Varieties—What the Jobber Can and Should Do to Help the Situation

By W. I. Bickford
Secretary and Treasurer Iron City Electric Company, Pittsburgh

THE Electrical Supply Jobbers' Association meets next week for its annual summer convention in Hot Springs, Va. One of the chief topics of discussion will be the need for the elimination of excess varieties in the jobbing line. Committees of the association have been studying this problem and will come to the meeting prepared to make definite recommendations for the practical simplification of the different commodity lines. With this in mind these expressions from one of the leading electrical jobbers are of interest.

ALTHOUGH one of the leading manufacturers has "taken the bull by the horns" and taken steps to eliminate the duplicate, slow-moving and obsolete items in the so-called schedule lines of his particular manufacture, there appears to be a lack of initiative on the part of other schedule manufacturers to take similar decisive action. These manufacturers acknowledge that many items now listed can be eliminated with resulting economy to all branches of the industry affected, but there seems to be more or less hesitation on the part of the individual manufacturer to reduce the number of items in his line for fear that he may lose business to competitors who do not take similar action.

#### A Legal Aspect

It has been suggested that such manufacturers get together and follow the suggestion of the United States Department of Commerce in other lines of industry for the simplification of their line. A study made by individual jobbers of the movement of specified lines in specified territories does not show the national demand for any article now listed. However, studies of sales of the different items by individual manufacturers and the comparison of such studies at a conference of such manufacturers would show beyond question what items now made which may be slow-moving or obsolete could be eliminated.

According to Judge Debevoise, there is a legal question as to whether these manufacturers can agree between themselves to eliminate such items. It would seem that if anything definite is to be accomplished it will be necessary to arrange a conference of the representatives with the authority of the leading schedule manufacturers and, under the proper legal advice, determine the proper course of procedure to accomplish the result desired.

I can recall the time when inclosed fuses were made not only in as many sizes as regards carrying capacity but in almost as many actual sizes and types. In those days before filling an order for inclosed fuses it was almost necessary in the majority of cases to obtain an actual sample of the fuse desired. With the adoption of the National Code standards of fuses, both as to type and dimensional size, the duplication and confusion was greatly reduced, although there is still opportunity for pruning as regards definite carrying capacities for which there is little or no necessary demand. The same condition existed in miniature lamps until the lamp manufacturers greatly reduced the large number of types, based on candlepower, size of bulb and base.

While the so-called schedule lines are the most conspicuous commodity lines in which duplication and obsolescence exist, and therefore the logical ones to start to cut, there are a number of other lines on which the same kind of constructive work can be done. I have in mind outlet boxes and covers, which could be materially reduced as regards the items cataloged, with no ill effects and many advantages to the industry; likewise pole-line hardware, under which come machine bolts, carriage bolts and lag screws, listed in almost innumerable lengths and diameters, with no indication by the manufacturer as to which are standard types and which are more or less special.

#### How the Jobber Can Help

Although the jobber can only use his influence on the manufacturers who are his main source of supply to work toward the end desired in the elimination of unnecessary items, he can do much in the management of his own business by adopting a policy of not stocking duplicate lines of manufacture. Instead of duplicating the slow-moving or even the fast-moving items of competing manufacturers, he should catalog and stock only the product of one manufacturer that will fulfill the individual requirements of his customers. This should be followed up by the salesmen selling this particular product instead of taking orders for any particular brand which the customer seems to favor.

We have endeavored to follow this policy for a number of years and as a result have been able to maintain a minimum stock and at the same time give improved service for products of this manufacturer on which we specialize. If more jobbers will adopt such a policy, the result will sooner or later be the development of the so-called "super-jobber" and a decreased cost of distribution. This is what all of us who are giving the matter any thought are aiming for.

#### Some Progress Made

In reviewing our figures for the past ten or twelve years it is gratifying to observe that the effort made in reducing the cost of distribution has not been in vain. Although our items of overhead have increased and our percentage of gross profit has decreased over this period, the average value of the order has increased, with the result that we have at least maintained our own as regards net

margin of profit. In other words, notwithstanding the increased actual cost of distribution, the percentage has decreased rather than increased, so that the jobber has been able to operate on a lower percentage of overhead. Of course, this does not apply during the periods of depression when with decreased volume the percentage of overhead has exceeded the percentage of gross profit.

The size of the jobbing line is a large factor in the situation, however, and presents an immediate practical opportunity to do something that actually affords relief. If one manufacturer can reduce his line, another can. If one jobber can reduce his line, so can his competitor. It all depends on whether or not they are willing to look economic laws in the face and do things that may be temporarily inconvenient, in order to help solve a problem for the entire industry.

## An Experience in Export Selling

**Success in Disposing of a Specialty Despite Restricted Market Makes Evident the Opportunity for American Electrical Appliances**

BY E. A. WIGHT

Export Manager Crescent Washing Machine Company, New Rochelle, N. Y.

WE ARE frank to admit that we are new in the export business. We have been selling our washing machines abroad for only about three years. But we are deeply interested in this field, and if we can continue for the remainder of the year the pace we have established, our export business will be from 10 to 15 per cent of our total yearly sales. Our largest markets are Great Britain, the Scandinavian countries, Australia, France, Spain, Switzerland, Italy and Belgium, in the order named.

### AGENTS WILLING TO INVEST

We are selling our own product only, although we are continually on the outlook for hotel and restaurant specialities that we can also handle through our agents. Because of the real effort that must be used to introduce our machines in any foreign market it has been our policy to favor exclusive representation. This we do not grant at once, but we put a company on probation for six or eight months. No concern abroad is going to attempt to handle machines like commercial dishwashers without a real hope for an exclusive agency.

Without exception, our agents have purchased the first machine outright. They have installed it on trial in some important restaurant or hotel in the city in which they live. If the machine should prove satisfactory, the restaurant was to pay for it; otherwise the agent would take it back. Thus you can see he was taking a chance in tying up money on the supposition that we, by our representatives and in our literature, were telling the truth about Crescent dishwashers. We are glad to say that without exception the foreign houses that have taken this chance have been successful in selling not only this first machine but many others.

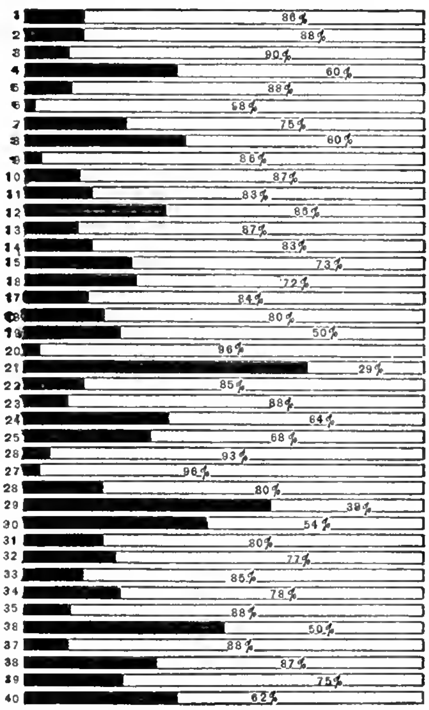
In England we have a condition of "no pressure" to overcome. While every restaurant and hotel that can use a machine has plenty of hot water, nevertheless the pressure is not sufficient to operate the "rinse" —really the most important part of any dishwasher. Therefore, we have had to develop a booster pump for this market. In France the people not only do not have pressure, but there are no hot-water-main supplies there. Even in the biggest restaurants the dishes are washed in sinks, under which gas burners are installed to keep the water hot. There is absolutely no hot-water-main supply, and our agent in that country, in order to sell a dishwasher, has usually to sell to begin with a hot-water system, costing three times as much as the dishwasher. Here again the machine and the entire hot-water system must be put in on trial. This means an outlay of close to $1,000 or more in the case of the larger dishwashers.

In Scandinavian countries the extremely hard water—particularly in Denmark—makes it hard to sell the Crescent against German tank machines. In Australia we no sooner had a good volume of business started than the duty was raised from 35 to 45 per cent ad valorem, and two concerns immediately started copying our larger models bolt for bolt and nut for nut. Our machines had been patented in this country long before we thought of exporting. Therefore, they could not be patented abroad, at any rate in Australia. Such conditions as I have named are typical the world over, and, combined with the relative cheapness of native labor, they necessitate the most up-to-date selling methods on the part of our agents.

### BROADENING THE LINE

We feel that we have been extremely fortunate in our selection of distributors. Every one of them is financially sound and pays for machines either by cash in advance or through a letter of credit in New York. Our agent in France, for instance, whenever a customer of his pays him in dollars, immediately forwards the check to us, and as a rule he keeps a substantial credit

## Elimination Progress in Industries




| Article | Reduction |
|---|---|
| 1. Baskets | 78—11 |
| 2. Bed springs | 206—28 |
| 3. Bottles, glass | 210—20 |
| 4. Bread | 15—6 |
| 5. Canned goods | 200—22 |
| 6. Car wheels | 175—4 |
| 7. Ceramic tile | ...... |
| 8. Chain, malleable | 2,044—820 |
| 9. Cigars | 150—6 |
| 10. Clocks | 600—80 |
| 11. Collars | 150—25 |
| 12. Dry cells | 17—6 |
| 13. Farm implements | 1,092—137 |
| 14. Fertilizer | 100—17 |
| 15. Flashlight batteries | 30—8 |
| 16. Hammers, axes, etc. | 2,752—761 |
| 17. Interior tile | 735—115 |
| 18. Kitchen cabinets | 20—4 |
| 19. Laboratory apparatus | 2,800—1,400 |
| 20. Lamp bases | 179—6 |
| 21. Leather belting | 63—45 |
| 22. Paper | 377—56 |
| 23. Paving brick | 66—7 |
| 24. Pencils | 700—250 |
| 25. Piano benches | 34—11 |
| 26. Piano stools | 15—1 |
| 27. Pipe fittings | 17,000—610 |
| 28. Pocket knives | 1,500—300 |
| 29. Reed furniture | 400—250 |
| 30. Reinforcing bars | 24—11 |
| 31. Rubber goods | 145—29 |
| 32. Shafting | 60—14 |
| 33. Shotgun shells | ...... |
| 34. Steel lockers | 37—9 |
| 35. Stove parts | 2,982—364 |
| 36. Taps and dies | ...... |
| 37. Tires | 287—32 |
| 38. Toilet goods | 425—140 |
| 39. Water bottles | 20—5 |
| 40. Wheelbarrows | 42—16 |

balance here. The fact that we allow an extra 5 per cent discount for payment in New York is, of course, the reason why payment is made in this manner. Five per cent amounts to from $12 to $40 on each machine, so you can see it is well worth the expense of establishing a letter of credit in New York.

Every trade has its own difficulties to overcome, and I have enumerated a few of ours. I believe that we have overcome them, and I am sure that the next two years are going to see a steady increase of orders. Within the next two or three months we are going to start to introduce certain other specialties that we have permission from manufacturers in this country to handle. We did not immediately write to our agents the minute we secured representation for a certain article, but we have held off until our representatives were fully acquainted with and familiar with our own product before asking them to turn their attention to something else. We have wanted them to think and talk nothing but dishwashers for two or three years, without diverting their minds to some other new piece of equipment that they might sell. Now that our machines are fairly well established in various markets, sales resistance will be greatly reduced, and local advertising that we are doing will help to ease the hitherto heavy burden on the distributor.

### Specialty Handicapped

I do not believe that we have accomplished anything that has not been accomplished by every American manufacturer who has attempted to build up an export business. I have tried to point out, however, the real difference between our product and domestic electrical appliances and the method that must be used in marketing them both here and abroad. Perhaps one incident will better illustrate this point than further discussion. I have just been reading a trade information bulletin published by the Bureau of Foreign and Domestic Commerce on British India. In this bulletin I note the increased sales of electrical instruments, apparatus, etc., and I find that American sales are increasing in volume and dollar value, which would seem to indicate increasing sales possibilities for all electrical appliances. Yet in all British India there are not twenty "prospects"—even possible purchasers — of Crescent electric dishwashers.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

## Eastern Business Shows Little Change Over Last Week

BUSINESS in the Eastern territory shows little change over last week's volume. Prices are firm in current quotations of most commodities, and little scarcity of supplies is reported, barring a temporary uneven stock of rigid conduit. The larger sizes are most difficult to obtain in quantity at present. Jobbers' sales are well distributed among different classes of buyers. Interior wiring is absorbing great quantities of material and appliances are moving freely, sales of socket devices being particularly good.

Transportation conditions are improving rapidly as regards motor-truck service, and the railroad and steamship lines are doing their part to improve shipments. The expansion of central-station generating plants continues the chief feature of interest in utility construction, although a relaxation of regulations in regard to line extensions of moderate cost is apparent in this territory.

A comfortable money market prevails, and recent notes of caution appear to have made some headway in checking inflation tendencies. Some Fall River cotton mills have dropped to a four-day week in production as an offset to recent forced wage increases. Collections are improving.

Conditions in the shoe, metal-working, paper-making and wire factories reflect intense activity. The public is getting restive over the demands of labor in the building trades, and unquestionably much home building is being postponed until more favorable conditions arise.

## Evidences of "Easier Buying" in Industries Are Seen

IN CONNECTION with efforts of the electrical industry to avoid inflation of businesses supplying materials for new construction, developments in the building industry indicate that over-ordering of cement, which recently was made the subject of complaint by producers, is being taken up directly between the producers and with good prospects that orders will be pared to actual necessities, according to information received in official circles in Washington. It appears probable therefore that there will be no conference held with federal officials on this subject, as had been suggested at one time there would be.

Evidences of a "buyers' strike" in the construction industry, as reported in newspaper dispatches from various cities where temporary withdrawal of projects has been announced on account of high costs, are being watched closely by Washington officials. While a reasonable let-up in new construction projects would be welcomed as tending to relieve pressure upon material and supply houses and upon the labor supply, there is some fear that the psychological effect may extend to other lines of industry. Conditions in the building industry have been recognized as abnormal, and in considering possible inflation of business this industry has been set aside in a class by itself by government economists.

A general easing of business conditions since the middle of April has been noted in Washington, and it is considered by prominent government officials that the caution now being displayed has averted the possibility of a period of inflation.

## Fifty-four Opportunities for Elimination in Electrical Industry

MORE than one thousand outstanding opportunities for the elimination of economic waste through the simplification of varieties and sizes of products are presented in the first analysis of findings in the survey of simplification opportunities which has been carried on during recent months by the American Engineering Standards Committee at the request of Secretary Hoover of the Department of Commerce.

This is in the form of a summary of answers to a questionnaire sent out by the American Society of Mechanical Engineers, one of the member bodies of the A. E. S. C., to selected lists of its membership, which includes all members of its professional division. It shows 54 opportunities among electrical appliances and supplies; 123 suggestions of important standardization opportunities in the automotive and aircraft industries; 115 opportunities in building-material industries; 291 opportunities in tools and other machine-shop equipment; 64 opportunities in paper, catalogs, books and printing; 200 opportunities in boilers, valves, pumps, pipe supplies and kindred products; 37 opportunities in the railroad field, and 191 opportunities in miscellaneous industries.

Among the electrical materials simplification of which was suggested in the answers to the A. S. M. E. questionnaire, are the following: Electrical attachment plugs, diaphragms on radio head sets, electrical fixtures and boxes, lighting fixtures, electrical wiring fittings, panelboards and switches, electric fuses, electrical motors, motor bases and frames, electrical sockets, electrical vacuum cleaners, transformer oil, washing machines and insulated electrical wires.

Other developments in this activity by the committee are expected in the near future.

## Reduced Freight Rates Forgotten in Prosperity

THOSE Senators and Representatives who have been planning to make a drive at the next session of Congress for reduced freight rates are perturbed by the prospect that such agitation will not arouse any popular enthusiasm. When prices are good the average shipper is more interested in service than he is in the rate. On most electrical commodities the freight rate really represents a small percentage of the selling price.

When prices are hovering around the cost of production the freight charge looks big. For that reason the agitation of railroad legislation in 1921 and early in 1922 struck a popular chord. It appealed particularly to the demagogues of Congress. It is believed, however, that in prosperous times there will be no general support for any legislation which would instruct the Interstate Commerce Commission to regard an amount less than 6 per cent as a fair return or to take into account other factors which would have the effect of lowering rates.

Transportation specialists in Washington agree that more efficient service is being rendered by the railroads at this time than ever before has been the case. The proportion of unfilled car orders to the total loadings is very small. This has been made possible through closer co-operation and more friendly relationships with the shippers, through the reduction to the minimum of bad-order equipment, and through the placing in service of increasing numbers of new cars.

## Chicago Business Continues at Normal Stride

CHICAGO business continues normal. Jobbers report steady demand for electrical merchandise, although no exceptional activity is noticeable. Price advances were announced this week on single-phase fractional-horsepower motors and high-tension equipment of a certain class, and the former policy with reference to jobbers purchasing wiring devices was revised.

Single-phase, 1,725-r.p.m. motors ranging from ¼ hp. to ½ hp. advanced 10 per cent. Motors rated at ¼- ⅓- ½-hp., 1,140 r.p.m., advanced 7½ per cent. High-tension equipment of one class advanced approximately 5 per cent.

One manufacturer of wiring devices adopted the policy of selling only in standard-package quantities of twenty cartons. While this may appear as a hardship to the jobber, he will really benefit by this system ultimately. It is expected that other manufacturers will follow suit.

The demand for storage batteries has apparently decreased during the first part of May. This is attributed mainly to the fact that many consumers have had taxes to meet at this time and have held off their individual purchases accordingly, while throughout the country districts the farmer has been busy in his fields. The summer season coming on also brings a slowing up of radio-battery purchases. The situation on flatirons remains the same, while there is the normal demand for fans for this season of the year.

## Street Lighting Business Healthy in Various Parts of Country

SLOW but substantial growth of business with a steady interest in ornamental illumination characterizes present street-lighting equipment sales in various parts of the country. Although the close of the war opened the door for larger expenditures for street illumination, municipalities in many quarters have moved rather slowly in assigning marked increases in budgets for new development work in this field, and a good deal of skillful sales engineering has been necessary to spread the idea of improved service.

One manufacturing company found it helpful in showing representatives of municipal governments the latest progress in highway illumination to construct a working model built accurately to scale and equipped for varied demonstrations of unit spacing, variations in road surface, effect of miniature automobile headlight rays, etc., all arranged in a large darkened room and flexibly wired to facilitate quick and complete changes in apparatus.

Visits to the factory have been productive and a great deal of time has been saved in studying various layouts. So far as reported, there appears to be no difficulty of moment in making deliveries of either arc or incandescent street-lighting equipment. About this time of year municipal appropriations tend to keep manufacturing plants busier, and the general improvement of trade throughout the country is reflected in many additional orders, scattered to be sure, but effective in the rising volume of national sales.

## March Electrical Exports Show $1,344,544 Increase

TOTAL exports of electrical machinery, apparatus and appurtenances for March were $6,344,842, a gain of $1,344,544 over March, 1922, when the total amounted to $5,000,298. In February, 1923, total electrical exports amounted to $4,839,738. The following figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR MARCH, 1923, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

| Articles | Value — March 1922 | 1923 |
|---|---|---|
| Turbines | $23,759 | $7,570 |
| Generators: | | |
| Direct-current— | | |
| Under 500 kw. | 36,835 | 67,830 |
| 500 kw. and over | 52,607 | 92,049 |
| Alternating-current— | | |
| Under 2,000 kva | 23,081 | 10,960 |
| 2,000-kva. and over | 143,866 | 131,022 |
| Accessories and parts for generators | 22,148 | 38,695 |
| Self-contained lighting outfits | 25,165 | 57,514 |
| Batteries: | | |
| Primary | 111,620 | 123,388 |
| Storage | 117,147 | 176,669 |
| Transforming and converting apparatus: | | |
| Transformers— | | |
| Power | 298,379 | 362,707 |
| Other | 19,607 | 59,167 |
| Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters | 47,486 | 250,844 |
| Transmission and distribution apparatus: | | |
| Switchboard panels, except telephone | 65,125 | 138,588 |
| Switches and circuit breakers above 10 amp. | 150,212 | 166,180 |
| Fuse and fuse blocks | 11,187 | 21,551 |
| Meters and measuring instruments: | | |
| Watt-hour and other measuring instruments | 51,954 | 49,022 |
| Volt, watt and ampere meters and other recording indicating and testing apparatus | 61,316 | 103,206 |
| Lightning arresters, choke coils, reactors and other protective devices | 20,628 | 42,254 |
| Motors, starters and controllers: | | |
| Motors under 1 hp. | 71,171 | 128,276 |
| Stationary motors 1 to 200 hp. | 181,394 | 217,155 |
| Stationary motors over 200 hp. | 65,880 | 65,295 |
| Railway motors | 5,000 | ..... |
| Electric locomotives— | | |
| Railway | | 474,098 |
| Mining and industrial | 14,553 | 18,780 |
| Other motors | 19,738 | 13,183 |
| Rheostats, controllers and other starting and controlling equipment | 52,216 | 137,373 |
| Accessories and parts for motors | 112,242 | 112,470 |
| Electric fans | 112,302 | 159,184 |
| Electric lamps: | | |
| Incandescent— | | |
| Carbon-filament | 5,402 | 3,471 |
| Metal-filament | 164,721 | 117,489 |
| Other electric lamps | 13,858 | 19,027 |
| Flashlights | 22,602 | 43,284 |
| Searchlights and projectors | 12,403 | 14,641 |
| Motor-driven household devices | 49,877 | 72,294 |
| Domestic heating and cooking devices | 48,123 | 97,567 |
| Industrial electric furnaces and ovens | 25,536 | 13,719 |
| Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc. | 47,480 | 64,680 |
| Signal and communication devices: | | |
| Radio and wireless apparatus | 21,180 | 213,094 |
| Telegraph apparatus | 12,582 | 16,643 |
| Magneto telephones | * | 7,399 |
| Other telephones | 519,442 | 31,327 |
| Magneto switchboards | * | 2,964 |
| Other telephone switchboards | * | 34,718 |
| Railway signals, switches and attachments | 43,857 | 33,623 |
| Bells, buzzers, annunciators and alarms | 3,554 | 12,582 |
| Other electrical apparatus and appurtenances: | | |
| Spark plugs, magnetos and other ignition apparatus | 94,413 | 111,978 |
| Insulating material | 80,139 | 129,986 |
| Metal conduit, outlet and switch boxes | 16,832 | 51,784 |
| Sockets, receptacles and lighting switches | 16,079 | 90,673 |
| Other wiring supplies and fixtures | 77,357 | 204,647 |
| Other electrical apparatus not elsewhere specified | 11,080,188 | 644,170 |
| Globes and shades for lighting fixtures | 29,787 | 39,561 |
| Electrical glassware, except for lighting | 16,043 | 24,301 |
| Electrical porcelain | 176,323 | 169,662 |
| Electrical carbons, carbon brushes and electrodes | 54,451 | 184,956 |
| Insulated wire and cable (iron or steel) | 27,692 | 83,103 |
| Other manufactures of aluminum | 86,096 | 66,062 |
| Copper: | | |
| Bare wire | 208,661 | 111,033 |
| Insulated wire and cable | 129,002 | 408,374 |
| Total electrical exports | $5,000,298 | $6,344,842 |

*Not separately stated prior to Jan. 1, 1923.

## New England Appliance Sales Show Marked Increases

SALES of socket appliances in New England reflect a remarkable increase in buying power on the part of the public compared with last year. The demand for washers and cleaners has reached a point where substantially full plant capacity must be utilized to meet the needs of the national market. One large manufacturing plant in this section is now working at night on production. Prices are holding firm on the better-grade products.

One representative distributor of socket devices said recently that his sales are double those of last year to date. Transportation embargoes are being gradually done away with, but rail shipments are still slow and unsatisfactory in this section, especially on freight handled through New England gateways. Retail buying of appliances is greatly stimulated by the growing use of national advertising, accompanied by intensive local sales campaigns.

## English Electrical Exports £165,129 in March

THE following are official values of electrical machinery, apparatus and material exported from England (*a*) during March, 1923, and (*b*) the aggregate figures from Jan. 1 to March 31, with increase or decrease compared with corresponding periods in the year 1922.

The total exports of electrical machinery, material and apparatus, other than insulated wire, were £949,457 for March, which was a decrease of £165,129 from those exports during the month of February, 1922:

Electrical machinery (*a*) £296,524 (decrease £188,591), (*b*) £1,015,716 (decrease £420,678); including railway and tramway motors, (*a*) £21,663 (decrease £891), (*b*) £66,654 (increase £13,044); other generators and motors, (*a*) £140,922 (decrease £136,529), (*b*) £526,949 (decrease £272,241); and other electrical machinery, (*a*) £133,939 (decrease £51,171), (*b*) £422,113 (decrease £161,481); telegraph and telephone cables, submarine, (*a*) £47,281 (increase £29,508), (*b*) £149,676 (increase £69,425); other than submarine (*a*) £98,476 (increase £68,637), (*b*) £220,385 (increase £74,649); telegraph and telephone apparatus, (*a*) £116,557 (decrease £63,709), (*b*) £462,213 (decrease £78,856); other electrical wires and cables, rubber insulated (*a*) £82,964 (increase £34,437), (*b*) £296,526 (increase £150,953); with other insulations, (*a*) £92,610 (decrease £5,900), (*b*) £269,398 (decrease £68,069); carbons, (*a*) £7,183 (increase £3,681); (*b*) £17,342 (increase £4,734); glow lamps, (*a*) £20,795 (decrease £17,554), (*b*) £76,033 (decrease £20,909); arc lamps and searchlights, (*a*) £943 (decrease £810), (*b*) £1,689 (decrease £1,156); parts of arc lamps and searchlights (other than carbons) (*a*) £162 (decrease £449), (*b*) £246 (decrease £1,146); batteries, (*a*) £48,934 (increase £1,414), (*b*) £143,457 (increase £37,544); electrical instruments (commercial and scientific) and electricity meters, (*a*) £21,324 (decrease £12,423), (*b*) £78,317 (decrease £27,624); switchboards, (*a*) £3,934 (decrease £11,567), (*b*) £26,980 (decrease £98,885); other electrical goods and apparatus, (*a*) £111,770 (decrease £1,803), (*b*) £324,051 (decrease £12,798). Total of electrical machinery, material and apparatus other than insulated wire, (*a*) £949,457 (decrease £165,129), (*b*) £3,082,029 (decrease £394,808).

## The Metal Market

Conditions are little different in the non-ferrous metal market from those that have existed during recent weeks. The international situation still dominates the market, and so long as London prices exhibit almost continuous declines from day to day buyers on this side are likely to hold off. The time must soon come, however, when supplies will be needed for nearby consumption, and there is then likely to be a scramble for early deliveries. Germany is not taking anywhere near her normal requirements of metal, and as she is the most important consumer in Europe, her withdrawal from the market has had a bad effect.

The Ruhr difficulty seems to be no less unsettled than last week, and there seems to be little hope of an immediate improvement. Without a stronger feeling in the London metal market, prices cannot advance here until buying in substantial volume appears. The bright spot is that consumption has not fallen away to any great extent and buyers must soon come into the market for at least small tonnages to meet current requirements.

NEW YORK METAL MARKET PRICES

| | May 9, 1923 Cents per Pound | May 16, 1923 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 16.62½ | 15.75 |
| Lead, Am. S. & R. price | 8.00 | 7.75 |
| Antimony | 8.00 to 8.25 | 8.00 |
| Nickel, ingot | 28.00–30.00 | 28.00 to 30.00 |
| Zinc, spot | 7.37½ | 7.15 |
| Tin, Straits | 45.00 | 45.00 |
| Aluminum, 98 to 99 per cent | 26 00 | 26.00 |

The last government report shows March exports of copper to have been 61,531,000 lb., exclusive of shipments to Canada. This figure includes finished as well as unwrought copper and makes the total for the first quarter approximately 185,000,000 lb. With April estimated at 80,000,000 lb., total for first four months is 265,000,000 lb.

# Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Electric Storage Battery Reports Largest Year in Its History

The Electric Storage Battery Company, Philadelphia, reports the largest year in its history, according to Herbert Lloyd, president. Mr. Lloyd said the demand for automobile, radio and telephone accessories continues unabated and that a shortage of skilled labor would be the only factor that might serve to restrict production.

"Orders are coming in in considerable volume," he continued. "The Crescentville plant is operating at two-thirds capacity and the remainder will be equipped and ready in the near future. That part of the new plant that has been in operation for six months has demonstrated its efficiency. We are now employing four thousand men and women, more than ever before were on the payroll."

## Link-Belt Moves Pittsburgh Office

Notice has recently been received of the removal of the Link-Belt Company's Pittsburgh branch office from its old quarters at 1501 Park Building to its new and more commodious offices at 335 Fifth Avenue. T. F. Webster, manager of the Pittsburgh office, says that larger space and the more convenient location were imperative because of the large volume of business transacted during the past year, which promises to remain in full swing at least for the coming fiscal year.

## Pelton Water Wheel Order

The Western States Gas & Electric Company has awarded a contract for building a 72-in. butterfly valve to the Pelton Water Wheel Company. This valve will operate under a head of 65 ft. and will be installed at the head of the penstock at the power company's new Eldorado plant near Placerville, Cal. It will be designed for both direct and remote control and for electric motor and hand operation.

## Westinghouse, Except Radio, Is Filled to Limit with Orders

The Westinghouse Electric & Manufacturing Company is working at full capacity in every department excepting the radio division. The production of small motors is nearly 300 per cent greater than a year ago.

A. B. Reynders, works manager at Springfield, predicts that radio is due for a revival. He says: "Production in our radio department has fallen off since January, chiefly because we have suspended operations to a certain extent while disposing of enormous accu-

mulated stock of apparatus completed last year.

"The demand has been so large that our surplus stocks have nearly been absorbed, and we shall resume production in this department at the normal rate soon. The outlook for industry in the electrical field is very favorable. If the radio demand continues, we expect to be more busy during the next four than during the past four months."

### Square D Appointments

The Square D Company, safety-switch manufacturer, Detroit, announces the following recent additions to its sales force:

H. R. Thornburgh, formerly of the Western Electric Company, and W. F. Clarke of the M. W. Duncan Company, manufacturer of "Nokorode" paste, Providence, R. I., have been added to the New York branch organization. R. W. Coblentz has taken over the Northwest Pacific Coast territory and has established himself at Portland, Ore., under the direction of E. S. Conrad of the San Francisco branch. E. J. Burke will help handle the Philadelphia territory.

H. N. Foster, recently with the W. J. Fisher Company, manufacturers' agent, Detroit, has joined the Detroit sales force.

### Rome Wire Offering New Issue of $3,000,000 Gold Notes

A new issue of $3,000,000 three-year 6 per cent sinking-fund gold notes, due May 1, 1926, is being offered by the Rome Wire Company, manufacturer of copper rods, wire and cables.

The Rome Wire Company, incorporated in New York in 1905, has its main plant at Rome, N. Y. Plants are situated on 45 acres of land and have 669,000 sq.ft. of floor space. Output in 1922 was more than 76,000,000 lb. of copper rods, copper wire and copper-wire products. Sales in 1922 were in excess of $10,000,000.

Total net assets, upon completion of the present financing, amount to $8,404,562, or 280 per cent of this $3,000,000 issue, constituting the company's total funded debt. These net assets include all securities of the Buffalo subsidiary, except $500,000 notes which the company has guaranteed. Fixed assets are carried on the books at $2,667,221, considerably less than value based upon outside appraisal in 1920 and additions since that time. Net current assets alone are $5,674,488.

### E. C. Butler Now Associated with American Electric Equipment Firm

Edwin C. Butler has discontinued the electrical contracting business under the name of E. C. Butler Electric Corporation, 1402 Broadway, New York City. He is now associated with the engineering and sales division of the American Electric Equipment Company, subsidiaries of which are the Localized Lighting Corporation and the Home Lighting Equipment Corporation. This company makes a line of lighting fixtures for the factory, office and home, the operating principle of which is covered by the well-known patents of the Anderson adjustable arm, namely friction disks and interior disk wiring. The office is in the Longacre Building, 151 West Forty-second Street.

### Copper Export Directors Chosen When Guggenheims Quit

Directors of the Copper Export Association were re-elected last week. Murry and Simon Guggenheim resigned as directors and Stephen Birch, president of the Kennecott Copper Corporation, and John K. MacGowan, vice-president of the Braden Copper Company, took their places to fill the remainder of their unexpired terms.

The retirement of the Guggenheims is said to have no significance other than that they felt it would be better to have two of their executives upon the board dealing with technical matters.

### Riley Stoker Sales Abroad and at Home

The Sanford Riley Stoker Company, Worcester, Mass., has received a contract for four 1,600-hp. automatic stokers from the Nippon Power Company for installation in a plant in Tokyo, Japan. About ten cars will be required to transport the parts across the United States for Oriental shipment.

The company has recently shipped five carloads of stokers to Sydney, Australia, for the generating station of the municipal council. An order for four large stokers has been received from the Public Service Electric Company, Newark, N. J., and also four for the municipal generating plant at Lansing, Mich.

**The Westland Engineering Supply Company**, 760 Monadnock Block, Chicago, recently capitalized at $5,000, will manufacture and deal in power plant parts and appliances. Benjamin E. Seaman, Harry M. Everson and Lillian Everson are incorporators.

**The Pittsburgh Transformer Company**, Columbus and Preble Avenues, Pittsburgh, manufacturer of electrical equipment, has acquired property at Juniata and Metropolitan Streets for extensions. R. V. Bingay is president.

**The United States Electrical Tool Company**, Cincinnati, announces that it has established a branch at 430 North High Street, Columbus, Ohio, E. W. Beeler in charge, and another at 412 First National-Soo Line Building, Minneapolis, Thomas H. Caley in charge.

**The Instant Electric Water Heater Company**, Bridgeport, Conn., recently organized with capital stock of $250,000, will succeed to the business of the Bridgeport Manufacturing Company. A plant has been leased at Knowlton Street and East Washington Avenue. H. E. Dineson is president.

**The Appliance Manufacturing Company**, 10 Hoadley Place, Hartford, Conn., is a recent incorporation to make and deal in electrical appliances, etc. The firm will have a capital stock of $50,000, and the officers chosen the past week include F. E. Wolcott of Hartford, president and treasurer; J. S. Wolcott, vice-president, and G. H. Anthony, secretary. The concern has established a plant at the address mentioned above.

**Harvey Hubbell, Inc.**, of Bridgeport, Conn., manufacturer of electrical switches, sockets, etc., has increased its capital stock from $300,000 to $2,000,000, consisting of 15,000 preferred and 5,000 common shares of stock, par value $100.

**The Bryant Electric Co.**, Bridgeport, Conn., large manufacturers of electric switches, etc., recently increased its capital stock from $2,000,000 to $3,000,000, the increase consisting of 40,000 shares of common stock with a par value of $25. The firm completed several large building additions to its plant in the last two years, and the plant is very busy at the present time.

**The Robertson-Cataract Company**, Buffalo, N. Y., plans to open a distributing branch in Watertown, N. Y.

**Stovel & Brinkerhoff**, electrical engineers, 136 Liberty Street New York City, announce the addition of H. M. Van Gelder as a partner and a change of name to Stovel, Brinkerhoff & Van Gelder. Mr. Van Gelder, member A. I. E. E., has had an active experience of over twenty years in electrical engineering and construction.

**C. Brandes, Inc.**, manufacturer of radio head sets, 237 Lafayette Street, New York City, has recently added another 5,000 sq.ft. of floor space and much new equipment to its assembly plant in order to increase production.

**The Fay Mendenhall Electric Company**, 44 West South Street, Indianapolis, Ind., is planning for an addition to its plant and the installation of equipment.

**E. D. & A. F. Cronk, Inc.**, Hotel Street, Utica, N. Y., has plans for the construction of a two-story addition to its electric motor and equipment manufacturing plant. T. H. Williams, Devereaux Block, Utica, is architect.

**The Crescent Truck Company**, Lebanon, Pa., manufacturer of electric trucks and tractors, is building a one-story addition, 40 ft. x 100 ft., to its factory in order to enlarge production facilities.

**The Ace Electric Cord Adjuster Company**, Twenty-fifth Street and Park Avenue, New York City, is the name of a recent incorporation for $20,000 to manufacture electrical equipment. The incorporators are G. F. Brown, A. Helfat and W. H. Oakes.

**Ross, Inc.**, 5414 Rainier Avenue, Seattle, Wash., recently organized to manufacture electric ovens and heating appliances, has obtained a factory and purchased equipment. A. R. Ross heads the company.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Turin, Italy (No. 6,362), for electrical novelties for household use.

An agency is desired in Vienna, Austria (No. 6,382), for air compressors of small dimensions which can be easily attached to the automobile or air compressors which are operated by electric motors from a battery in the car.

An agency is desired in Marseilles, France (No. 6,407), for light, strong, easily conducted electric or gasoline tractors, capable of being used in shipyards, railway stations, factories and on farms.

An agency is desired in Cairo, Egypt (No. 6,413), for railway engines, telephone equipment, Diesel and semi-Diesel engines, ice-making machines, etc.

An agency is desired in London, England (No. 6,430), for intercommunicating telephone equipment.

AUTOMATIC TELEPHONES PROPOSED FOR RIGA.—A new automatic telephone system to replace the present system in Riga, according to *Commerce Reports*, has been proposed by the General Director of the Latvian Post and Telegraph Bureau of the Ministry of Communication. The plans call for a machine-switching telephone exchange capable of caring for 10,000 lines, with a maximum of 20,000 lines. It is proposed to install the new system in the building erected for that purpose in 1914. The installation will be extended over a period of about four years. The cost is estimated at about $600,000.

DEMAND FOR ELECTRICAL GOODS INCREASING IN INDIA.—Owing to extensions of electric power facilities and the popularity of electric drive in Indian mills, *Commerce Reports* states, the demand for electrical goods is increasing in India.

PROPOSED ELECTRIC PLANT FOR PENANG.—Tenders are being called, *Commerce Reports* states, through the crown agents for an electric light plant for the city of Penang and the new Prai docks, Straits Settlements. The crown agents, it is reported, are also calling for bids for new telephone equipment for Penang.

DEMAND FOR POWER-PLANT EQUIPMENT IN NORWAY.—Power-plant equipment and supplies, according to *Commerce Reports*, are in good demand in the district around Bergen, Norway. In the districts of More, Sogn og Fjordene and Hordaland there are 664 power stations with a total capacity of 279,885 kw. A list of Bergen commission agents interested in electrical equipment may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, by referring to file No. 91,960.

# New Apparatus and Publications

ELECTRIC LIGHTING FIXTURES—The Louisville Composition Products Company, 840 East Jefferson Street, Louisville, Ky., has issued catalog "C," which describes and illustrates its various types of lighting fixtures.

POWER HACKSAW.—A power hacksaw designed for precision work when sawing materials has been placed on the market by E. C. Atkins & Company, Indianapolis, known as the "Kwik-Kut."

HEATING PAD.—The Edison Electric Appliance Company, Inc., 5660 West Taylor Street, Chicago, has brought out a new flexible cloth heating pad.

SWITCH PANEL.—A master switch panel has been placed on the market by the Palmer Electric & Manufacturing Company, 175 Fifth Street, Cambridge, Mass.

MINING MACHINE.—An improved model of the "Arcwell" mining machine, used particularly for low seams of coal, has been brought out by the Jeffrey Manufacturing Company, Columbus, Ohio.

BATTERY TERMINAL PULLER.—A battery terminal puller which can be used without pliers, screwdrivers or other tools has been brought out by the Bird Manufacturing Company, Marshalltown, Iowa.

ELECTRIC HOISTS.—The Link-Belt Company, 910 South Michigan Avenue, Chicago, has issued a book on "Electric Hoists and Overhead Cranes" which contains illustrations showing some of the most recent "Link-Belt" electric hoist applications, with line and wash drawings. The publication is known as "Book No. 480."

BLUEPRINTING MACHINE.—Wickes Brothers, Saginaw, Mich., have placed on the market a blueprinting machine for printing continuous rolls or separately cut sheets.

ELECTRIC RANGE.—An electric range with two electric units in an insulated oven has been brought out by the Magee Furnace Company, 38 Union Street, Boston.

ELECTRIC WASHING MACHINE.—The Station-Airy Company, Pitt Building, Cleveland, has brought out an electric washing machine, known as "Station-Airy."

FLOOD LIGHT.—The Pyle National Company, 1334 North Kostner Avenue, Chicago, has developed a new flood light, known as the "Pyle-O-Light."

# New Incorporations

THE MONTAUP ELECTRIC COMPANY, Fall River, Mass., has been incorporated with a capital stock of $7,500,000 to generate, transmit and sell electricity to the Blackstone Valley Gas & Electric Company, the Fall River Electric Company and the Edison Electric Illuminating Company of Brockton. The officers are: Simeon B. Chase, president; Henry B. Sawyer, treasurer; Roy F. Whitney, A. Stuart Pratt and Victor D. Vickery, directors.

THE KELSO-WURDACK COMPANY, 2169 Railway Exchange Building, St. Louis, has been organized to manage, own and operate utility plants and other companies. The company will take over the control of the companies previously operated by the Light & Development Company of St. Louis. It is also prepared to render engineering, managerial, financial and other services usually furnished to utility properties. The officers are: Hugo Wurdack, president; J. A. Porter, vice-president; I. R. Kelso, secretary; E. Strauss, treasurer, and E. S. Billings, chief engineer.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

DANBURY, N. H.—The Ford Motor Company, Highland Park, Mich., contemplates the installation of a power plant at its proposed local garnet powder works, to be used in connection with manufacture of glass, to cost about $150,000.

DORCHESTER, MASS.—The Boston Insulated Wire & Cable Company, 65 Bay Street, has filed plans for an addition, 40 x 40 ft., to its power house.

HOLYOKE, MASS.—Rights-of-way have been secured by the Turners Falls (Mass.) Power & Electric Company for a transmission line to Holyoke and also a site on the North Chicopee bank for a substation.

PLYMOUTH, MASS.—The Plymouth Electric Light Company has awarded contract to the Fred Ley Company, Boston, for the erection of 10 miles of high-tension transmission line, to cost about $35,000.

PAWTUCKET, R. I.—Extensive improvements are contemplated by the Blackstone Valley Gas & Electric Company to its systems in Woonsocket and Pawtucket, involving an expenditure of about $2,500,000. The plans for 1923 include the erection of additional tie lines to provide additional supply of energy to the Woonsocket division, the completion of the line between Woonsocket and Pawtucket, which will enable it to obtain power from either the Rhode Island Power Transmission Company or its own power station, the erection of an outdoor substation at Riverside and the complete rehabilitation of the distribution in Woonsocket. The work will be in charge of the Stone & Webster Engineering Corporation, Inc., Boston.

SOUTH NORWALK, CONN.—Contract has been awarded by the Crofut & Knapp Company for the construction of a power house, 50 ft. x 100 ft., in connection with its new hat factory. The cost of the entire plant is estimated at about $1,000,000.

## Middle Atlantic States

BUFFALO, N. Y.—The Buffalo General Electric Company will erect a one-story building, 103 x 180 ft., near its power plant on Niagara Street, for general operating service.

NEW YORK, N. Y.—Bids will be received by S. B. Wight, agent, Room 338, 466 Lexington Avenue, New York City, until May 25 for incandescent lamp bulbs required by following companies for one year, to be covered by serial contract No. 16-1923: New York Central Railroad Company, Boston & Albany Railroad, Grand Central Terminal, Troy Union Railroad, New York & Harlem Railroad, New York State Railways, Rochester (N. Y.) Gas & Electric Corporation, Cleveland, Cincinnati, Chicago & St. Louis Railway, Indiana Harbor Belt Railroad Company, Union Passenger Depot Association, Cleveland; Schenectady (N. Y.) Railway Company, Rutland Railroad Company, Michigan Central Railroad Company, Pittsburgh & Lake Erie Railroad Company, Monongahela Railway, Trunk Line Association, Cincinnati Northern Railroad, Peoria & Eastern Railway Company, Chicago River & Indiana Railroad Company.

OGDENSBURG, N. Y.—The Ogdensburg Power & Light Company plans to erect a building for general operations at Caroline and Ford Streets, to cost about $150,000.

WATERTOWN, N. Y.—Bids will be received by Walter Ackerman, city manager, until May 25 for all work in connection with the construction of a hydro-electric plant in the city of Watertown. Paul B. Sutton is city engineer.

ELIZABETH, N. J.—Plans for the proposed plant to be erected on West Grand Avenue by the American Type Founders' Company, Communipaw Avenue, Jersey City, for the manufacture of printing presses, include a power station. The cost of the works is estimated at $500,000.

NEW LISBON, N. J.—Bids, it is understood, will soon be asked by the Department of Charities and Correction, Trenton, for the construction of a power house and ice-manufacturing plant at the Colony for Feeble-Minded, New Lisbon, to cost about $35,000. A. B. Mills, State Office Building, Trenton, is engineer.

CARLISLE, PA.—The West Pennsboro-Carlisle Electric Company, recently organized, plans to erect a transmission line and system for commercial service in this district. George M. Hays is interested in the company.

CONNEAUTVILLE, PA.—The Council has secured permission to acquire the local system of the United Electric Company, to be operated by the municipality. Extensions and improvements will be made.

EBENSBURG, PA.—Plans for the new hospital to be established at Ebensburg by the Commissioners of Cambria County and the Johnstown Society for the Prevention of Tuberculosis, both of Johnstown, to cost about $300,000, include a power plant. W. R. Myton, Johnstown, is architect.

LANCASTER, PA.—The United Gas & Electric Company, 61 Broadway, New York City, has acquired a number of electric companies in this section and will merge the systems, to be operated in conjunction with the Harrisburg (Pa.) Light & Power Company. The transmission lines will be extended and additional equipment installed.

LYKENS, PA.—The American Briquette Company plans to rebuild its power plant, recently damaged by fire, causing a loss of about $200,000.

SLATINGTON, PA.—The American Slate Company contemplates rebuilding its power plant, recently damaged by fire, causing a loss of about $100,000.

TUNKHANNOCK, PA.—The Sullivan County Electric Company has acquired the property of the Tunkhannock Electric Company and will merge the systems. Extensions and improvements will be made; a transmission line is planned.

WARREN, PA.—Electric power equipment will be installed by the Conewango Refining Company, in connection with the rebuilding of its oil refinery, recently damaged by fire, causing a loss of about $600,000.

HAVRE DE GRACE, MD.—The Tiger Tire Company, Toronto, Ontario, Canada, will build a power plant in connection with a proposed local plant, to cost about $200,000.

BRISTOL, VA.—The Bristol Gas & Electric Company plans extensions and improvements to its system, to cost about $50,000.

HERNDON, VA.—Bids will be received by the Fairfax & Loudoun Light and Power Company until May 22 for erecting 13½ miles of 22,000-volt, three-phase wood-pole line, the material for same to be furnished by the company.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until June 4, for electrical equipment for towing locomotives. (Circular 1529.)

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, United States Army, until June 15, for two Diesel engine-generating sets, with auxiliary apparatus, 150 kw. and 300 kw. capacity; also for miscellaneous spare parts for engines and generators.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until May 26, for switchboard supplies, including line jacks, relay assemblies, lamps, etc. (Circular PR-14773- 1CP); until May 28, for ten telephone battery charging rectifiers (Circular PR-14123-14CP); until May 25, for 120 dynamotors (Circular PR-14600- 6CP); until May 26, for thirty-six terminal boxes (Circular 14732- 1CP).

## North Central States

DETROIT, MICH. — The Detroit Steel Corporation will build a power house at its proposed plant in the Oakwood section to cost about $250,000.

DETROIT, MICH. — The Ford Motor Company has awarded a contract to Stone & Webster, Inc., 147 Milk Street, Boston, for the construction of a 10,000-hp. hydro-electric plant on the Menominee River, near Iron Mountain. Stone & Webster, Inc., is now starting work on a large combined hydro-electric and steam power plant at the High Dam at St. Paul. Plans are also being prepared for a large manufacturing plant for the Ford Motor Company adjacent to the High Dam by Stone & Webster, Inc.

IRON MOUNTAIN, MICH.—The Michigan Iron, Land & Lumber Company is having plans prepared for a hydro-electric power plant, to cost about $1,000,000. Mead & Seastone, Journal Building, Madison, Wis., are engineers.

ZILWAUKEE, MICH.—The Consumers' Power Company, Jackson, has authorized plans for a 54,000-hp. steam-driven generating plant to cost about $3,000,000. Plans previously prepared for a power plant of about one-half this size will be abandoned.

CLEVELAND, OHIO—Separate bids will be received at the office of the commissioner of purchase and supplies, City Hall, Cleveland, until May 25 for lead-covered cable, steam boilers and superheaters, and for weatherproof copper wire for the division of light and power.

COLUMBUS, OHIO.—The City Council is considering an ordinance providing for an issue of $235,000 in bonds for the purchase of new equipment for the municipal electric light plant, including a 7,500-kw. generating unit and condenser, etc. The installation of a new street-lighting system in the business district is also under consideration by the Council.

LIMA, OHIO.—Arrangements are being made by the Ohio Power Company to increase its service in Lima. A substation will be built in the southern part of the city (the factory district), and transmission lines will be erected to tie the Lima plants with power units in Toledo, Cleveland, Youngstown, Fort Wayne, St. Mary's and Delphos.

UPPER SANDUSKY, OHIO.—The City Council has passed an ordinance authorizing an issue of $80,000 in bonds for the erection of an electric distributing system in Upper Sandusky. Electricity will be purchased from the Ohio Power Company.

LOUISVILLE, KY.—Plans are being prepared by H. M. Byllesby & Company, 208 South La Salle Street, Chicago, for extensions to the steam-power plant of the Louisville Gas & Electric Company on the River Road, to cost about $150,000.

PADUCAH, KY.—The Paducah Electric Company will enlarge its power house and install additional equipment, including a 2,500-kw. turbo-generator, boilers, coal and ash-handling machinery and auxiliary equipment, to cost about $300,000.

FORT WAYNE, IND.—The Board of County Commissioners will build a power house in connection with the proposed court house building, to cost about $500,000.

LAFAYETTE, IND.—The construction of a new heating and power plant this summer for the Purdue University has been approved by the board of trustees. The cost is estimated at $300,000.

ATHENS, ILL.—The Public Service Commission has granted the Central Illinois Public Service Company permission to purchase the local electric plant. The transmission line from Athens to Petersburg will be rebuilt.

LUCK, WIS.—The Luck Light & Power Company has applied to the Railroad Commission for authority to issue $5,000 in capital stock for extensions and improvements to its plant.

MILWAUKEE, WIS.—Contract has been awarded by the Milwaukee Electric Railway & Light Company for the construction of a turbine and boiler house at Lakeside, to cost about $1,000,000.

WAUKESHA, WIS.—The Board of Public Works is receiving bids for extending the ornamental lighting system on Broadway, Madison, Grand, Main, Clinton and South Streets, to cost about $25,000. A. P. Kuranz is city engineer.

MINNEAPOLIS, MINN.—Plans are being prepared by the Minneapolis General Electric Company for the construction of a terminal station at First and Aldrich Avenues, to cost about $75,000.

CHEROKEE, IOWA. — The Cherokee Electric Company contemplates erecting an addition to its power station and installing new equipment. Contract, it is understood, has been placed for a 250-hp. engine.

DUNBAR, IOWA.—The Dunbar Light & Power Company, recently organized, plans to supply electricity in Dunbar and vicinity. John Ingebritson is president.

SHENANDOAH, IOWA.—Bids will soon be called for an ornamental lighting system in the business section. The Henningson Engineering Company, Twelfth and Harney Streets, Omaha, Neb., is consulting engineer.

WATERLOO, IOWA. — Electric power equipment will be installed in the five-story ice manufacturing and cold-storage plant, 90 ft. x 100 ft., to be built by the Rath Packing Company, Elm and Sycamore Streets, to cost about $150,000.

KANSAS CITY, MO.—The Kansas City Power & Light Company plans to build an addition to its building at Twenty-fifth Street and Pennsylvania Avenue for general operating and mechanical service.

LUDLOW, MO.—The citizens have authorized the installation of an electric lighting system. The service will be supplied by the Northwest Missouri Power & Light Company, Excelsior Springs.

MOBERLY, MO.—Electric power equipment will be installed in the local ice-manufacturing and cold storage plant to be erected by the Polar Wave Ice & Fuel Company, 3626 Olive Street, St. Louis, to cost about $250,000.

POTOSI, MO.—Steps have been taken by the Chamber of Commerce to establish an electric plant in Potosi.

ST. LOUIS, MO.—The Missouri Pacific Railroad Company plans to build a power house in connection with its proposed local grain elevator, to cost about $1,000,000.

ST. LOUIS, MO.—Electric power equipment will be installed in the ice-manufacturing and refrigerating plant to be erected by the St. Louis Dairy Company at Twentieth and Pine Streets, estimated to cost $100,000.

FARGO, N. D.—The Union Light, Heat & Power Company contemplates installing an additional generating unit, condenser type, to double the output of its plant. The cost is estimated at about $300,000.

BERESFORD, S. D.—Investigations are being made with a view of extending the service of the municipal electric light plant to Alsens and also to furnish electricity to residences along the line.

PIERRE, S. D.—Bids will soon be called for the installation of an electric distributing system. The Charles L. Pillsbury Company, 1200 Second Avenue, South, Minneapolis, is engineer.

ADAMS, NEB.—Improvements to the municipal electric light plant, to cost about $6,000, are under consideration.

AINSWORTH, NEB.—The electric plant of the Ainsworth Light & Power Company was recently damaged by fire, causing a loss of about $20,000.

SILVER CREEK, NEB.—Plans are under consideration to rebuild the distribution system of the municipal electric plant.

SEVERY, KAN.—The City Council is negotiating with the officials of the Eastern Kansas Electric Company to erect a high-tension transmission line to Severy to supply electricity to operate the local system. The company offers to erect the line to the municipal plant and erect a substation. The city is to pay $12,500 toward the construction of the line.

## Southern States

CONCORD, N. C.—The Concord Knitting Company will build an electric power plant in connection with a proposed cotton mill.

LEXINGTON, N. C.—C. M. Wall & Son plan to rebuild their power house and wood-working mill, recently destroyed by fire.

RIDGEWAY, S. C.—Bonds to the amount of $58,000 have been sold, part of the proceeds to be used for an electric lighting system.

COLUMBUS, GA. — Extensive improvements, to cost about $100,000, are under consideration by the Columbus Electric & Power Company. The work will include the erection of a substation on Second Avenue and the installation of three large transformers at the Goat Rock station. Connection has been made with the system of the Georgia Railway & Power Company, which has increased the voltage from 66,000 to 110,000.

ST. PETERSBURG, FLA.—The St. Petersburg Power & Lighting Company is reported to have purchased a site in Pasedena on which it will erect a substation.

BRICEVILLE, TENN. — The Cambria Coal Mining Company, Knoxville, plans to rebuild the power plant at its local properties, recently destroyed by fire.

CLINTON, TENN.—The Knoxville Power & Light Company has petitioned the Federal Power Commission for permission to build a large hydro-electric development on the Clinch River in Scott and Lee Counties, Virginia. The plans call for the construction of four dams on the Clinch River in Tennessee and Virginia.

LAFOLLETTE, TENN.—The Lafollette Water, Light & Telephone Company contemplates extensions and improvements to its hydro-electric plant.

SPRINGFIELD, TENN. — Preparations are being made to enlarge the municipal electric light and water plant. New equipment including a turbine will be installed.

ALBANY, ALA.—Plans are being considered by the Alabama Water Company for the installation of electrically operated pumping machinery, to cost with other extensions about $100,000.

BIRMINGHAM, ALA. — The Alabama Power Company has petitioned the Public Service Commission for permission to extend its electric transmission lines to Waverly, Wetumpka, Centerville and Union Springs.

RUSSELLVILLE, ALA. — Plans have been authorized for a municipal electric light and power plant, to cost about $40,000.

BLYTHEVILLE, ARK.—The Waggoner-Gage Corporation plans to install a power plant in connection with a proposed cotton-oil mill, to cost about $250,000.

LITTLE ROCK, ARK.—The installation of an improved lighting system on Main Street is under consideration by the Merchants' Bureau of the Board of Commerce.

NEW ORLEANS, LA.—The installation of an ornamental lighting system on Magazine Street is under consideration by the Business Men's Associations.

CHICHASHA, OKLA. — The Chichasha Gas & Electric Company plans to erect a high-tension transmission line from Chichasha to Minnekah and Rush Springs.

SAPULPA, OKLA.—Negotiations are under way between the Oklahoma Union Railway Company and the Southwestern Railway Company for the construction of an electric railway from Sapulpa through Keifer to Nuyaka, connecting with the line of the Southwestern out of Bristow, with later extension to Okmulgee and Okemah.

ABILENE, TEX.—Under the terms of a contract between the city of Abilene and the West Texas Utilities Company, an entire new street-lighting system will be installed, including ornamental lamps in the business district and also along the full length of seven residential streets. The cost is estimated at $75,000.

CLEBURNE, TEX.—The installation of an ornamental lighting system is under consideration by the Council.

DALLAS, TEX.—The Dallas Textile Mills Company plans to build a power house in connection with a new cotton mill to be erected in the Love Field industrial district, to cost about $1,000,000. Robert & Company, Atlanta, Ga., are engineers.

DECATUR, TEX.—The Decatur Light & Water Company has installed a 250-hp.

gas-engine-driven generating unit and contemplates extending its high-tension transmission line to the towns of Boyd and Paradise. C. P. Dodson is manager.

FORT WORTH, TEX.—The Transcontinental Oil Company contemplates the installation of electric power equipment in connection with an addition to its local oil refining plant, to cost about $500,000.

TIOGA, TEX.—C. P. Dodson, Decatur, who has recently acquired the local electric plant, plans to rebuild the distribution system and to erect a three-phase transmission line to the Pilot Point plant, which will supply electricity for the system in Tioga.

WACO, TEX.—The Missouri, Kansas & Texas Railway Company has prepared plans for the electrification of its Bellmead car and locomotive shops.

## Pacific and Mountain States

CONCRETE, WASH.—The Superior Portland Cement Company, Seattle, has applied for permission to build a hydro-electric power plant for service at its mills, to cost about $175,000.

MILLWOOD, WASH.—The Inland Empire Paper Company, Spokane, has acquired a power site on the Spokane River for a hydro-electric power plant.

TACOMA, WASH.—The City Council has authorized the installation of an ornamental lighting system on North J Street.

MERCED, CAL.—The Yosemite Cement Company, care of the Hunt Engineering Company, Kansas City, Mo., plans to build a power house in connection with its proposed cement manufacturing plant on the Merced River, to cost about $1,000,000.

MODESTO, CAL.—Bids will be asked at once by the Modesto Irrigation District for the construction of a transmission line to the boundary line of the Turlock Irrigation District. A new substation will be erected at Modesto. R. J. O'Connell is electrical engineer.

ROSEVILLE, CAL.—Work will soon begin on the erection of an ice-manufacturing plant and precooling plant at Roseville by the Pacific Fruit Express Company. The cost of the machinery is estimated at $200,000.

SAN BERNARDINO, CAL.—The Cajon Lime Products Company, recently organized, contemplates the construction of a power house at its proposed lime works near Camp Cajon, to cost about $200,000. W. F. Warner, Riverside, heads the company.

SAN FRANCISCO, CAL.—Plans for the proposed new plant of the Continental Furniture Manufacturing Company, to be erected at Slauson Avenue and Fifty-ninth Street, include a power plant. S. Heiman, 57 Post Street, is architect.

SAN FRANCISCO, CAL.—The California Railroad Commission has approved the contract of the Pacific Gas & Electric Company with the Truckee River General Electric Company, Reno, for the erection by the former of an electric transmission line to the summit of the Sierras, where it will connect with the line of the Truckee company now under construction.

SOUTH PASADENA, CAL.—Steps have been taken for the installation of an ornamental lighting system on portions of Camden and Court Avenues and Huntington Drive.

PAROWAN, UTAH. — Bonds to the amount of $72,000 have been sold, the proceeds of $65,000 to be used for the installation of a new municipal electric light plant.

DILLON, MONT.—The Union Electric Company is erecting a transmission line from Sheridan to Dillon and to erect a substation on Kentucky Avenue, just outside of the city limits.

## Canada

BRANTFORD, ONT. — Extensions and improvements to the street-railway system, to cost about $40,000, are under consideration by the City Council.

BROCKVILLE, ONT.—The Hydro-Electric Power Commission of Ontario is negotiating for the purchase of the Ragged Chute water power on the Mississippi River above High Falls, where electricity is now generated for the Rideau system.

WALKERVILLE, ONT.—The City Council has approved a by-law authorizing an issue of $50,000 in debentures for extensions in the Hydro-Electric system this year.

WALLACEBURG, ONT. — The Hydro-Electric Power Commission of Ontario contemplates the erection of a transmission line from the local substation to Sombra, via Whitebread and Port Lambton, a distance of 16 miles.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued April 24, 1923)

1,452,960. Wireless Transmitter; W. T. Ditcham, Twickenham, England. App. filed Dec. 18, 1920. Inductively coupled type.

1,452,972. Signal System and Transmitter Therefor; R. M. Hopkins, Rutherford, N. J. App. filed Aug. 12, 1918. Fire-signal-transmitting mechanism employed with water-sprinkling system.

1,452,989. Heating Element; N. F. Strauss, Milwaukee, Wis. App. filed April 26, 1921. Liquid acts as conductor between electrodes.

1,453,017. Wall Bridge for Switches; G. H. Lindelof, De Kalb, Ill. App. filed March 22, 1922. Building wall for supporting switches, outlet boxes, etc.

1,453,025. Apparatus for Electric Arc Welding; R. S. Smith, Milwaukee, Wis. App. filed Dec. 6, 1918. Welding of sheet material.

1,453,026. Apparatus for Arc Welding; R. S. Smith, Milwaukee, Wis. App. filed Dec. 6, 1918. Welding of sheet material.

1,453,030. Means for Establishing a Voltaic Arc Between Electrodes not in Contact; F. C. Uear, Madrid, Spain. App. filed July 6, 1915.

1,453,073. Safety Mechanism for Elevator-Shaft Doors; G. G. Laureyns, Newark, N. J. App. filed Dec. 3, 1919. Lock on door magnetically operated by elevator as it comes to floor level.

1,453,083. Electric Machine; M. Schuler, Neumuhlen, near Kiel, Germany. App. filed Oct. 25, 1916. Hydrogen gas used to ventilate that placed in inclosed-tank machine.

1,453,097. Multiple-Unit Induction Furnace; C. B. Foley, Bristol, Conn. App. filed Dec. 28, 1916. Induced secondary formed by metal within crucible.

1,453,132. Process for the Recovery of Pure Alkalies from Impure Lyes; K. Heinemann, Heldenau, Germany. App. filed Nov. 8, 1920. By electrolysis.

1,453,159. Cooling of Dynamo-Electric Machines; P. A. H. Mossay and H. C. E. Jacoby, London, England. App. filed Jan. 16, 1919. Cooling system for totally inclosed motors.

1,453,166. Rotary Electric Machine; K. Nobuhara, Muko-Gun, Hyogo-Ken, Japan. App. filed Oct. 23, 1919. Machine filled with liquid, air being used to force liquid from gap.

1,453,173. Electric Wire Clamp; P. Pairard, Paris, France. App. filed June 13, 1918. For fastening wires to pin insulators.

1,453,194. Dental-Film Holder; A. E. Shaw, Columbia, S. C. App. filed April 26, 1922. For X-ray machines.

1,453,195. Signaling Mechanism; J. C. Sims, Maynard, Mass. App. filed Nov. 6, 1919. Electrically operated visual and sounding signal.

1,453,201. Strain Insulator; L. Steinberger, Brooklyn, N. Y. App. filed Nov. 30, 1918. Exposed bridge portions insulated from leg portions.

(Issued May 1, 1923)

15,594 (reissue). Signal for Vehicles; T. B. Powers, Brooklyn, N. Y. App. filed Aug. 11, 1919. Rear direction signal.

1,453,267. Electron Emitting Cathode and Method of Making the Same; J. L. Bradford, New York, N. Y. App. filed Nov. 29, 1918. For electron tubes.

1,453,314. Current Regulator for X-Ray Systems; C. Fayer, New York, N. Y. App. filed April 2, 1918. Employed with Coolidge tubes.

1,453,316. Acoustic Method and Apparatus; R. A. Fessenden, Brookline, Mass. App. filed April 28, 1919. Submarine signaling.

1,453,321. Call-Distributing System; W. S. Paca, Oil City, Pa. App. filed Sept. 4, 1919. Applied to the operation of manual telephone exchange.

1,453,328. System of Ventilation; J. Smillie, Stretford, Manchester, England. App. filed Nov. 12, 1920. Closed-circuit system of generators.

1,453,333. System of Ventilation; K. Baumann, Urmston, England. App. filed Oct. 9, 1920. Closed-circuit system for generators.

1,453,343. Welded Joint; J. W. Fay, Milwaukee, Wis. App. filed Dec. 19, 1921. Method of making reinforced joint between two plates.

1,453,347. Electric Furnace; A. W. Gregg Chicago, Ill. App. filed July 11, 1921. For melting small quantities of material by electric arc.

1,453,349. Lighting Fixture; E. F. Guth, St. Louis, Mo. App. filed May 29, 1920. Indirect fixture for high-powdered lamps.

1,453,357. System of Ventilation; J. E. Jolly, Stretford, Manchester, England. App. filed Oct. 6, 1920. Closed-circuit system for generators.

1,453,358. Process of Joining Metals; C. F. Kettering, Dayton, Ohio. App. filed Dec. 15, 1920. Attachment of non-ferrous metal-cooling elements (such as copper fins) to cylinders of internal-combustion engines.

1,453,359. Telegraph Sounder; J. H. Kinsley, Clinton, Mass. App. filed March 27, 1920.

1,453,368 and 1,453,369. Speed Regulator for Automobiles; F. W. Teves, East Elmhurst, N. Y. App. filed Jan. 25, 1922. Automobile cannot exceed predetermined speed limit.

1,453,387. System for Communicating with Moving Vehicles; L. Espenschied, Hollis, and H. A. Affel, Brooklyn, N. Y. App. filed Sept. 30, 1919. High-frequency current line from which signals are taken parallels tracks.

1,453,388. Electrolytic Condenser; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Nov. 3, 1919. Insure maximum area of heat radiation.

1,453,389. Arc-Welding Dynamo Electric Machine; K. L. Hansen, Wilkinsburg, Pa. App. filed Sept. 25, 1919. Constant-current generator employed in direct-current welding systems.

1,453,391. Alternating-Current Commutator Generator; R. E. Hellmund, Swissvale, Pa. App. filed Aug. 10, 1918. Stabilizing commutator motor for regeneration.

1,453,397. Protection of Resistors of Electric Furnaces; G. M. Little, Pittsburgh, Pa. App. filed April 21, 1921. Sooty oil flame deposits protection coating on resistors.

1,453,398. Self-Tightening Water-Cooled Terminal; G. M. Little, Pittsburgh, Pa. App. filed April 21, 1921. For electric resistance furnaces.

1,453,399. Means for Protecting Resistors in Electric Furnaces; G. M. Little, Pittsburgh, Pa. App. filed April 25, 1921. Oil forced into furnace deposits sooty coating on resistors and furnace walls.

1,453,410. Dynamo-Electric Machine; J. Slepian, Wilkinsburg, Pa. App. filed Dec. 17, 1919. Elimination of transformer and rotational electromotive forces of armature coils undergoing commutation.

1,453,412. System of Control; G. F. Smith, Wilkinsburg, Pa. App. filed Sept. 25, 1919. Regenerative braking of electric railway motors.

1,453,419. Electroplating Apparatus; W. Thompson and W. R. Jameson, Niagara Falls, N. Y. App. filed Sept. 12, 1921. For manufacture of knives, forks, spoons, etc.

1,453,430. Voice-Operated Relay; O. B. Blackwell, Garden City, N. Y. App. filed Nov. 22, 1919. Two-way repeater communication system.

1,453,435. Method and Apparatus for Nitrogen Fixation; C. H. Buettner, Cincinnati, Ohio. App. filed Nov. 17, 1921. Calcium or potassium nitrate made at place where they are to be applied to soil.

1,453,441. Excess-Demand Meter; G. A. Cheetham, Manchester, England. App. filed Oct. 6, 1920. Method of releasing indicating lever periodically.

1,453,442. Marking Machine; W. E. Choate, Westerly, R. I. App. filed April 26, 1921. Machine adapted to make impressions from electrically heated typed members or dies.

1,453,443. Lighting Fixture; W. E. Cochran, Cleveland, Ohio. App. filed June 1, 1920. Indirect lighting type.

1,453,453. Notifying or Call Device for Telephones; G. Forster, Philadelphia, Pa. App. July 24, 1920.

1,453,473. X-Ray Plate Changer; R. J. McKenna, Denver, Col. App. filed Feb. 23, 1922. Tunnel type.

1,453,491. Voltage-Regulating System; F. J. Champlin, Pittsfield, Mass. App. filed March 22, 1921. Induction regulator.

1,453,492. Overload Circuit Controller; C. B. Connely, Scotia, N. Y. App. filed Aug. 2, 1921. Overload relay.

1,453,498. Maximum-Demand Meter; W. L. Hamilton, Holyoke, Mass. App. filed Aug. 25, 1919. Curve-drawing type.

1,453,522. Control of Dynamo-Electric Machines; H. W. Rogers, Schenectady, N. Y. App. filed Oct. 6, 1922. Control of Ward Leonard motor-generator sets.

1,453,524. Wire Splicer; F. A. Ropp, Smithton, Pa. App. filed June 16, 1922. Clamping device for connecting ends of trolley wires.

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# Pre-eminence of New York in Use of Electricity

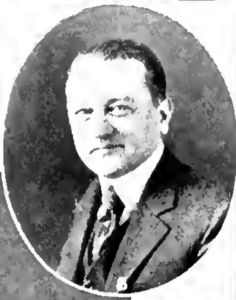
THE pre-eminence of New York City in the Western Hemisphere is beyond all cavil or question. Faith, learning, character and competence in business have brought her this distinction. Among all the cities of the world also she fills a role peculiarly hers. This applies to her harbor, her towering buildings, her public works and also to her system of electrical supply. Not that the latter exceeds in efficiency other large systems, for no city has a mortgage on all science, initiative, genius or brains; but by reason of its teeming population and restricted area more electricity is used in New York City than in any other city in the world.

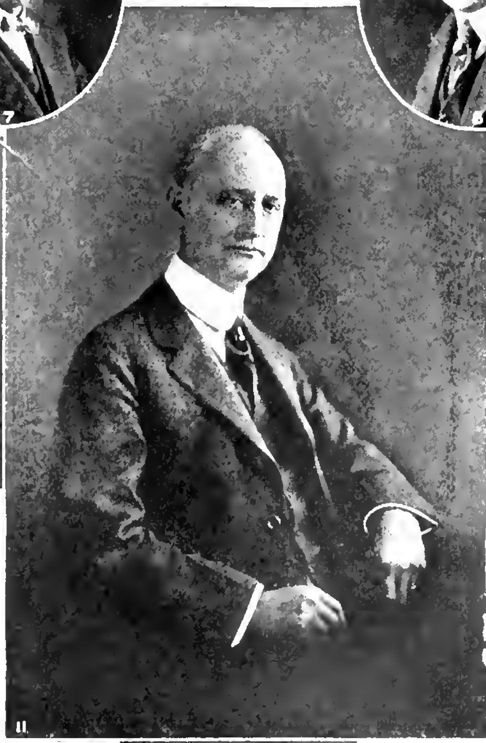
Those who attend the convention of the National Electric Light Association, if they seek, will find hidden treasures of applied electricity on all sides. Outwardly the manifestations are scarcely visible except at night, for there are no wires to be seen overhead and, indeed, there is hardly enough space to spare for them underground, so encumbered is the earth with subways, water pipes, gas mains, sewers and the myriad cables of the telegraph, telephone and electricity supply companies.

The accounts given in this issue of the features of the various generating systems are necessarily brief. A volume could be written about the precautions taken to guarantee service alone, for the railroads, the street railways and even the isolated plants in every emergency caused by mishap to their own systems cast their loads on the mains of the central-station companies. And the wonderful thing about it is that the latter have never failed them. But there are other phases of the electricity supply business just as exacting and just as interesting to both engineers and executives which will repay investigation.

As for growth, the new building program of New York is so immense that the electric light and power companies are hard pressed in extending their mains and installing the service. Few companies can show larger increases in new meters connected or in accretions to gross revenue, and there are no signs of let-up. Clear perception of the facts is necessary for a just appreciation of the work of the electric light and power companies in the metropolitan district. Bigness is one chief characteristic; the unostentatious self-confidence and apparent ease with which great results are accomplished is another.


# Leading Central Station Men of New York






1. N.F.Brady, Pres., N. Y. Edison Co.
2. J.W.Lieb, V.-Pres., N. Y. Edison Co.
3. P Torchio, E. E., N. Y. Edison Co.
4. H.M.Edwards, Audt., N. Y. Edison Co.
5. Arthur Williams, Gen. Com. Mgr., N. Y. Edison Co.
6. A.H Kehoe, E.E., U.E.L.&P Co.
7. W.J.Meyers, Sec., U.E.L.&P.Co.
8. L.A.Coleman, Treas., U.E.L.&P.Co.
9. J F.Becker, Sales Mgr., U.E.L.&P.Co.
10. M.S.Sloan, Pres., Bklyn. Edison Co.
11. FrankW.Smith, Pres., N.E.L.A., and V.-Pres., U.E.L.&P.Co.
12. Thos. N. McCarter, Pres., Public Service Corp. of N. J.
13. L.C. Parker, E.E., Bklyn. Edison Co.
14. W.P. Holcombe, Pur.Agt., Bklyn. Edison Co.
15. T.I.Jones, Com.Agt., Bklyn. Edison Co.
16. W.F.Wells, V.-Pres. & Gen.Mgr. Bklyn. Edison Co.
17. Dudley Farrand, V.-Pres., Public Service Corp. of N. J.
18. Farley Osgood, V.-Pres., & Gen.Mgr., Public Service Elec. Co.
19. W.K.Vanderpoel, Supt. of Dist., Public Service Elec. Co.
20. R.R.Young, New-Bus. Agt., Public Service Elec. Co.
21. Ray Palmer, Pres. & Gen.Mgr., N.Y. & Queens Elec. Lt. & Pw. Co.
22. C.A.Barton, Gen. Sales Mgr., N.Y. & Queens Elec. Lt. & Pw. Co.

# Editorial Comment

Electrical World, May 26, 1923

Volume 81 Number 21


## Progress Unimpeded, Growth Prodigious

THE N. E. L. A. convention of 1923 will long be remembered because it fell in a year which saw the beginning or the completion of so many great electric power houses. Readers of this paper are familiar with the tale of Crawford Avenue piled on Calumet, of Trenton Channel doubling Connors Creek, of Hudson Avenue added to Gold Street, of Kearney o'ertowering Essex, of Devon and Weymouth, Delaware and Saxton, Cahokia and Philo, High Bridge and Zilwaukee, Peoria and Wabash, of Niagara and Pit River, St. Croix and Boulder and Mitchell Dam—the list of familiar names could be extended almost indefinitely.

As estimated in a tabulation appearing in News of the Industry this week, the largest steam and hydro-electric stations under way or just completed, together with extensions to existing stations, reach a total rating of 3,500,000 kva. and a total cost of approximately half a billion dollars—and the innumerable small stations all over the land are not included.

The convention of such an industry as this in such a year as this cannot but be full of interest, of enthusiasm and of profit. With such prodigious growth, such unimpeded progress, there are problems worthy of the best of men to solve. The annual convention of the N. E. L. A. assists in no small measure not only the individual's own accomplishments but the collective or group action so necessary in the proper progress of the industry. The convention this year cannot help but be memorable. Every one who can should attend.

## Reproduction Cost as an Element in Valuation

ONCE again the United States Supreme Court has declared that no adequate determination of fair value can be arrived at without due consideration being given to reproduction cost on the basis of present-day prices. The latest pronouncement of the court in this regard is embodied in a decision in the case of the Southwestern Bell Telephone Company of Missouri handed down on Monday of this week. But it should also be noted that the Supreme Court does not hold that reproduction cost alone is the measure. In fact, the words of the court—"An honest and intelligent forecast of probable future values, made upon a view of all the relevant circumstances, is essential"—sound in tone much like those used in the famous case of Smythe vs. Ames, when the court said:

> . . . The basis of all calculations . . . must be the fair value of the property. . . . The original cost of construction, the amount expended in permanent improvements, the amount and market value of its bonds and stock, the present as compared with the original cost of construction, the probable earning capacity of the property under the particular rates prescribed by statute, and the sum required to meet operating expenses, are all matters for consideration and are to be given such weight as may be just and right in each case. We do not say that there may not be other matters to be regarded in estimating the value of the property.

Justice Brandeis, in a separate opinion, urges the money invested in the enterprise as a preferable basis, asserting that advocates of reproduction cost will find its application harmful when wages and costs are lower. The important element in the majority decision, however, is that "all relevant circumstances" must be considered, and important among these is "reproduction cost on the basis of present prices," which must not be neglected. This latest decision is another encouraging pronouncement in the long string of Supreme Court findings which uphold the rewards of private initiative and guard against confiscation.

## Again the Question "How Do You Find Business?"

IT IS not hard to think back just a few short years to the days when business men on every side were asking each other the question "How do you find business?" Then the country was just pulling out of the valley of depression into the cheerful prospect of returning prosperity. Each one sought to bolster up his returning confidence with the courage of his fellows. Now again comes the query—repeated on every side. But the reason is somewhat different today. Prosperity and expansion have rolled up a wondrous record of late, and men are asking each other if it will continue.

The matter lies surely in the hands of those who themselves are asking the question. Blinded with greed for still greater profits, capitalists, manufacturers and merchants in the post-war boom kept on raising prices until the people would endure no longer, and a buyers' strike and the disastrous slump in business followed. Whether this bit of history is to repeat itself will depend much on whether the American business man will remember the lesson that he learned so painfully and refrain from imposing on the public.

The prosperity of the electrical industry depends upon the prosperity of industry in general, and all prosperity naturally is the sum of the success of individuals. The responsibility for protecting general business against a setback similar to that of recent memory devolves upon business men, merchants and manufacturers as individuals. If they too long forget their duty to the public, crowd on the profits and force up prices, reaction will inevitably come. If they temper their zeal with caution and with prudence, there need be no disappointment. The central-station business is one in which no such danger or, indeed, opportunity of pyramided prices exists. But central-station men as well as other electrical men can exert a sobering influence and help strengthen public sentiment for moderation in profit making in every community.

### Wet-Flashover Tests Not Susceptible of Close Control

A GOOD many engineers who comment on the standard pin-type insulator ratings proposed by the American Institute of Electrical Engineers ask why dry-flashover voltages should be used as the basis and wet-flashover voltages ignored. The selection is based on the very practical fact that the wet-flashover test under any known test conditions is not susceptible of close enough control to make its use feasible for such a purpose. The area over which water must be distributed in making such a test is small, but experiments to determine the uniformity of distribution of moisture show that even in such a small area, with the best means of spraying that can be designed, the distribution is surprisingly bad. There seems to be little hope of devising a practical method of keeping this factor under better control. Another important reason for the decision is the resistance of the water used in the tests. Large quantities are required. As an economic proposition it is impracticable to use water that has been treated to bring it to a standard condition of resistance and to maintain it in that condition for an indefinite time. As a result of these two difficulties wet tests made under apparently identical conditions vary too widely to permit their use as a basis of rating.

The dry test has been proved capable of close control as to conditions and results. Consequently it was selected as the basis for pin-type insulator ratings. The wet-flashover test, however, has a very definite value as a design check test, and the committee has presented a proposed standard for consideration.

### Why Not Take a Hint from Nature?

THE fierce sleet storms which overwhelmed forests and overhead lines in some parts of the country a year and a half ago left a shaky feeling in the minds of system operators lest even worse trouble come upon them. The sleet question is a queer one, not easy to reduce to formulas. Sleet seems to flourish especially in the climate of the northern United States—it is almost unknown in continental Europe—and the vital problem for designers of lines, poles and towers is to find out how, if at all, designs can be modified to gain comparative immunity from failure while still keeping within the limits of practical expense.

It would be interesting to know how many transmission-line operators have taken full cognizance of what happened to trees. The story of their destruction and successful defense ought to bring home a lesson to those who are building artificial structures to meet the same kind of stresses. In the worst of the devastated area the appalling combined effect of sleet and wind was evident everywhere. Big oaks and hickories snapped like pipestems under the load and branches were ripped off from the treetops down; maples and elms and other supposedly sturdy trees went to wreck at a moment's notice. But with it all the conifers escaped material damage. Thick though their foliage was, carrying the load of tons of ice, these great trees, engineered by nature on the principle of flexibility rather than stiffness, simply folded up their overburdened branches like the ribs of an umbrella and waited for the thaw to come. Then they shook off their icy burden and returned substantially unharmed to their original straightness and dignity.

Could something of this lesson be more often applied to overhead lines, particularly those which do not have outrageously severe loads of copper to carry? A little thought and study of how to obtain the maximum of elastic strength rather than the maximum stiffness would go far toward making a line of greater utility, although perhaps less attractive to the eye than many of the forms now in use. It is, after all, merely a matter of distributing the load so that it shall in a measure equalize itself before disaster comes.

### Power-Factor Correction a Commercial Problem

IT TOOK considerable time to convince central-station executives that a power factor meant decreased ability to serve and increased cost of operation. The growth of systems and the increased demands for power, however, presented specific facts that were sufficient to prove the case. For example, when voltage drop determines line loading and a specific line can carry double the load at unity power factor that it can at 70 per cent power factor, this fact becomes important financially if corrective equipment can be used more cheaply than duplicate circuits can be built. Thus an array of facts and figures proved to central-station executives that a low power factor makes overhead costs higher, increases production costs, limits the return from existing installations and reduces the general efficiency of the service.

Once convinced of the economic advantages of a good power factor, the executives called in the operating and commercial departments and ordered them to improve the power factor on the system. Easily said and easily analyzed on a theoretical basis, but difficult to accomplish commercially. Rate clauses containing penalty or bonus features, some ill-judged selling of corrective equipment to customers, new metering devices and accounting methods were some of the steps taken. But the fundamental thought was not emphasized that the customer must be "sold" on the benefits *he* would derive from power-factor improvement, and the results on the whole were not very satisfactory. Only recently has some new thinking been done to obtain real results with power-factor correction.

In the first place, the attention of the customer must be taken from power-factor rate clauses and focused on the real advantages of power-factor correction which will result in financial saving for his installation. In the second place, a thorough study and analysis of every proposed installation must be made to gather data on motors, circuits, operating requirements and energy consumption. Frequently these data will permit of rearrangement of the motors or rewiring to an extent that will be very beneficial both from an operating and an improved power-factor standpoint. In all cases the data are needed to show the decrease in circuit losses, the increase in motor efficiencies and the greater reliability of production and greater speed that can be obtained with a higher power factor. Once these items are capitalized to the customer in dollars and cents, he is willing to go further in considering power-factor corrective devices. Then the problem is to use the proper corrective equipment and the proper rate clause to obtain the results desired both by the central station and the customer. This problem is becoming increasingly less difficult because of the developments occurring in the industry. Thus power-factor correction is best obtained by properly "selling" the customers and by

getting away from the tradition long held by both manufacturers and central stations that a low power factor is inherent in the alternating-current system.

### Liberal as Well as Technical Training

DISCUSSION as to the most advantageous forms of educational training for the profession of engineering has for a long time indicated a realization on the part of educators, engineers and industrial employers that for many types of engineering problems far more is requisite in the way of formal training than is possible in the usual four years' undergraduate course. The additional needs are twofold, one in the direction of a wider general education, fitting for prominent participation in the economic and political phases of engineering discussion, and the other for more extensive training in special engineering fields, with a knowledge of pure science fitting for experimental research.

In response, first thought and suggestion have indicated the addition of the graduate school to the usual undergraduate curriculum. Several of the more prominent schools have for a long time announced and conducted graduate courses leading to advanced degrees. Apparently, however, attendance in these graduate courses has not been large, and it appears difficult to induce the four years' undergraduate to go on. In spite of scholarships and fellowships of steadily increasing value, the call of the industrial field, with a good living wage at the start, is more attractive than the prospect of two or three years more of intensive mental effort and, usually, rigid personal economy. Another reason, it is to be feared, is the lack of vision and inspiration of the average teacher of engineering subjects. Too often he is himself a four-year man, and his conception of the sphere of the engineer is limited to the normal processes of operation, routine design and industrial production. He is often incapable of holding up to the student the wide opportunities open to the engineer as a participant and agent in the large enterprises of social, civic and political life, as well as in the great field of engineering research. Apparently, the young man entering the usual four years' course somehow acquires at an early stage an idea that the highest aim and greatest rewards of the profession are open to him when he takes the bachelor's degree and receives an invitation to a beginner's job from a manufacturer's scout.

This is not to say that any large proportion of these four-year men should be encouraged to go further in formal training. The industries need them by the thousand each year, and not many of them are fitted for the advanced field. But a select few, and more than at present, should advance through the discipline of graduate study to the rank of the highly educated man, as well as that of the thoroughly trained engineer. Or, equally desirable, the prospective student of engineering should first take the liberal courses leading to the degree of bachelor of arts and then begin his professional studies. Some years ago Harvard adopted this plan for all students of engineering, but abandoned it after a few years; the plan was well conceived but too long a step in advance. For several years Columbia has been trying an intermediate plan in requiring two years of general college work for admission to her three-year courses in engineering, and the experiment is being watched with interest. A somewhat different method is found in the recent announcement by Johns Hopkins of combined courses in the liberal arts and engineering, in which certain fundamental courses necessary for engineering, such as applied mechanics and the like, are accepted as electives for the degree in arts and the combined time for both degrees, in the arts and in engineering, is shortened to five or six years. This type, of course, has been available for several years in a few Middle Western schools, yet only a few young men availed themselves of the opportunity offered. The plan seems to have the advantage of an easy transfer to the study of engineering, without wasted effort, by a student who is well advanced in courses in the liberal arts, and so has more of the desirable broad and fundamental education. These steps are indications that a few individual institutions are convinced of the importance of more liberal training for certain types of engineers and are willing to make the effort to train them. Perhaps only a few such courses are needed.

### Inspectors May Take Advantage of 1923 Code Changes

IT SEEMS unfortunate if, for a simple matter of expediency, the benefits of the recent revisions of the National Electrical Code are to be officially withheld from the public for several months. As pointed out in the ELECTRICAL WORLD in its issue of May 5, there are many reasons why the changes in the code should be made available for application at the earliest possible moment. They were worked out after long and thorough consideration and represent an advance in the code of no small importance and value.

It is, of course, easy to understand that the rearrangement and rephrasing of the code on account of the changes involved is not a small matter and is necessarily a somewhat slow process; but if the previous practice of the electrical committee is followed in this case, namely, to discourage the application of code changes until the revised edition can be printed, a delay of some consequence is involved. Some of the revisions are less restricted, some are more restricted, but all are in the public interest, and those who are building should have the advantage of the changes while building is going on.

It should be understood, however, that the actual final authority to place the changes into effect rests with the inspectors of the various districts. The code and its changes are essentially recommendations. The committee feels that it would exceed its authority if it sent out advance digests of the changes in the code, but its chairman, Dana Pierce, suggests that the ELECTRICAL WORLD reprint its statement of the code changes originally printed in the March 24 issue and furnish it to all inspectors who may desire copies. Such inspectors would then be in a position to use their admitted right to apply the new code.

Under the circumstances this seems an advisable move to make, and the ELECTRICAL WORLD will be glad to send without charge to any inspection authority who may desire them copies of the condensed statement of the 1923 code changes approved by Mr. Pierce at the time it was published as giving in essence the principal alterations. This at least provides a means for inspectors to have the code changes available now and to put them into practice in their districts at their discretion.

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The Metropolitan District of New York, Showing the Financial Center of the World and New York Harbor

# Character of Metropolitan Service

## Enormous Output of Electrical Energy in the New York District and Precautions Taken to Safeguard the Supply—Cities and Industries Depend on Central-Station Service—Tremendous Loads Thrown on System Suddenly

THE metropolitan district of New York includes not only the area within the corporate limits of the central city but also parts of the surrounding territory which are closely associated with the development of the metropolis. The city itself has an area of 183,555 acres and a population of 5,620,000, or 5.31 per cent of the entire population of the United States. Outside and within the metropolitan area are the counties of Nassau and Westchester in New York and the counties of Bergen, Essex, Hudson, Middlesex and Union in New Jersey. These have a combined population of approximately 2,500,000, giving to the metropolitan district almost 8 per cent of the entire population of the country. This district ranks first among the metropolitan districts of the United States in the value of its products.

The quantity of electricity generated in the New York district for all purposes in 1922 was fully six thousand million kilowatt-hours, with a peak load of approximately 1,500,000 kw. and a load factor hovering around 40 per cent. Of this amount the isolated plants in the hotels and some of the office buildings of New York City and those in the large industrial districts of New Jersey contribute over a thousand million kilowatt-hours yearly. The outputs and peaks of the public utility companies in 1922 are shown in Table I, in which no account has been taken of the outputs of the smaller generating companies in the boroughs of Richmond, Brooklyn and Queens or in the New Jersey districts.

TABLE I—OUTPUTS AND PEAKS OF METROPOLITAN UTILITY COMPANIES

| Name of Utility Company | Output in Kw.-hr. | Peak Load in Kw. |
|---|---|---|
| New York Edison Co. and United Electric Light & Power Co. | 1,659,269,781 | 497,577 |
| Public Serviee Electric Co. | 958,407,194 | 249,778 |
| Brooklyn Edison Co. | 516,987,870 | 164,495 |
| New York & Queens Electric Light & Power Co. | 120,011,093 | 35,300 |
| Interborough Rapid Transit Co. | 886,223,920 | 246,770 |
| Brooklyn Rapid Transit Co. | 413,992,125 | 118,800 |
| Pennsylvania Railroad Co. | 214,906,725 | 72,000 |
| New York Central Railroad Co. | 157,450,819 | 48,470 |

### Leading Industries of New York

While it is universally known that New York is the largest city in the Western Hemisphere, it is not generally appreciated that its population is almost as large as that of the State of Ohio, the fourth most populous state in the Union. Brooklyn, for instance, has a larger population than the city of Philadelphia; Manhattan and Queens exceed Chicago by 40,000; the Bronx is as big as Baltimore, and Richmond is more populous than Nashville or Salt Lake City.

Industrially the city also leads. The essential facts concerning New York's manufacturing industries are shown in Table II.

New York leads the country in the production of many items in common use and manufactures a very large proportion of many others. This is particularly true of outfitting and apparel. For the women who make their own clothes, for instance, New York produces 95 per cent of all the paper patterns made in this country, and for the women who wear ready-made clothes New York produces nearly three-quarters of the country's entire output. The same is true of fur goods. New York also makes about one-half of the country's output of millinery and lace goods. In the city are cut and polished 90 per cent of the diamonds and other precious stones which are manufactured in this country. One-third of the country's jewelry is manufactured in New York and about 30 per cent of the nation's production of pianos.

For men New York makes four out of every ten ready-made suits of clothes, 46 per cent of furnishing goods, 40 per cent of the shirts and a quarter of the hats. It also supplies them with four out of every five tobacco pipes made in the country. New York is the greatest printing and publishing center of the country. It makes 29 per cent of the toys and games, a third of the mirrors, a quarter of the buttons, chewing gum and scientific instruments, and a large percentage of the patent medicines and compounds manufactured in the United States. In addition to all these is the fact that New York is now the financial center of the world.

### Problem to Find Space for Wires

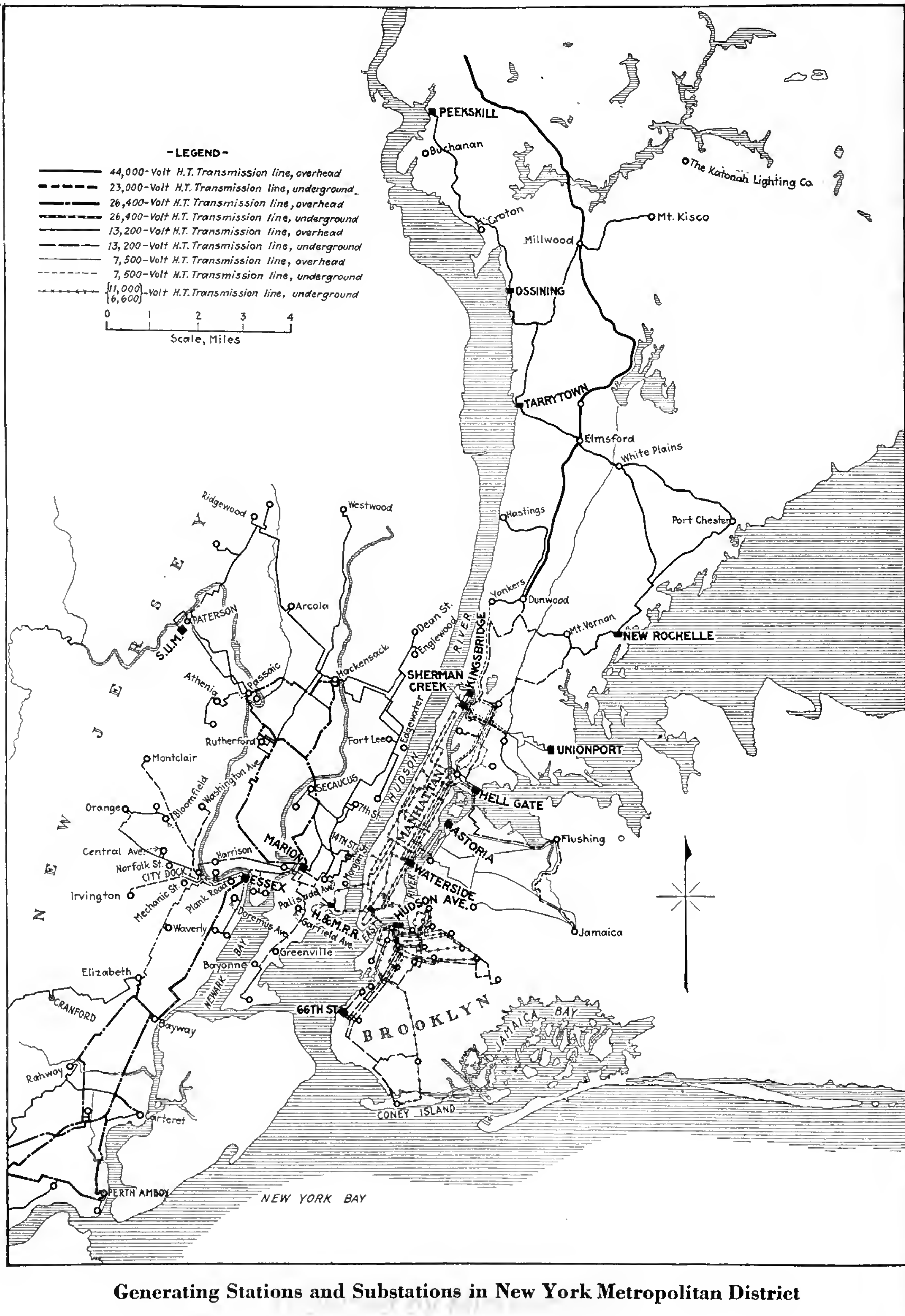
In a district the size of New York, with so many diversified and varied industries and with such a compact population working in skyscrapers and living in huge apartment houses, naturally electricity plays a very important part, more important than in any other city in the world. Without it the immense subway system of passenger transportation would be impossible, skyscrapers and large apartment houses and hotels would be largely uninhabitable, Broadway would become a village street, and a large part of industry would have to move elsewhere.

Having such a vital part in the life of the city, every precaution is taken to safeguard the supply of electricity and to provide for continuity of service. No overhead wires are permitted in the Borough of Manhattan, so that distribution of all electric service there is underground. So intensive is the use of electricity in many of the districts of Manhattan and so occupied are the streets with subways, pipes and ducts that the limit of capacity of many of the substations is fixed by the space available for underground cables in the streets. In the congested districts the situation is causing the operating companies much concern.

TABLE II—MANUFACTURING DATA FOR NEW YORK CITY

| | |
|---|---|
| Number of establishments | 32,590 |
| Persons engaged in manufacturing industries | 825,056 |
| Capital | $3,038,557,492 |
| Salaries and wages | 1,131,994,192 |
| Value of products | 5,260,707,577 |
| Value of raw material used in manufacture | 2,801,619,388 |
| Value added by manufacture | 2,399,231,459 |

All of the generating stations in New York are interconnected, and the practice in Manhattan is to feed the substations from independent generating sources. More equipment could be installed in the generating stations of The New York Edison Company if sufficient space




Generating Stations and Substations in New York Metropolitan District

could be found in the streets for the copper feeders. As it is, lack of street space has limited the interconnections between generating stations and between generating stations and substations even though the distribution voltage has been raised from 6,600 to 11,000 and tie feeders between stations are being operated at 40,000 volts.

### IMPORTANCE OF ELECTRIC SERVICE

The reasons why continuous electric service is imperative in the Borough of Manhattan will be apparent from the following considerations: The high-pressure pumping stations of the fire-protection system are absolutely dependent on central-station service for their operation not only in the Borough of Manhattan but in the Borough of Brooklyn as well. Any interruption lasting over three minutes is penalized at the rate of $400 a minute, but no penalty has so far been collected in either borough. The police and fire-alarm signaling systems, the ticker system, the telephone and telegraph systems of the Bell, Western Union and Postal companies, the trans-Atlantic cable companies, the newspapers, the garment and needle trades, 95 per cent of the passenger and freight elevators of the borough and the entire street-lighting system depend solely on the electric service of The New York Edison Company.

In order to provide a service which shall be at all times available great precautions must be taken. Coal shortage because of strikes or other reasons is guarded against by storage at Shadyside, N. J., and at the Hell Gate station, in addition to the overhead bunkers in the generating stations themselves in the case of the New York Edison and United companies. Space is available for more than 300,000 tons of coal, and during the recent coal crisis large cargoes of coal were imported from England. Taking into consideration the cost of the real estate and equipment and the cost of the coal in storage, the amount of working capital tied up in coal storage alone is not far short of $5,000,000 for the Edison company. In addition, to guard against any emergency or failure of generating equipment The New York Edison Company has electric storage batteries whose one-hour discharge rate is 471,000 amp. and from which 250,000 kw. can be pumped into the system for fifteen minutes.

The downtown section of New York is built skyward. There structures unequaled in height in any other section of the world are built wall to wall as compactly as possible. Each is a city in itself, with its vertical traction system in the shape of elevators, with a complete water supply and sewerage system and with power and lighting loads exceeding those furnished by many towns of like population. So high are these buildings that the streets resemble canyons more than thoroughfares, and electricity must be used for lighting the lower offices even during the day.

Such a condition is not without its effect on the electric light and power company, particularly when sudden storms sweep over the city. Every precaution is taken to have the power houses ready for such emergencies, and warnings are telephoned to operators when lowering clouds appear. The peaks thrown on the system are oftentimes of short duration, but to meet them means eternal vigilance and tremendous cost.

One such peak occurred at 4 p.m. on March 2, 1911, when an extra 52,000 kw. came on the system, which in five minutes was carrying a load of 75,000 kw., the extra load disappearing during the following ten minutes. The cause was a snow squall from the Northwest. On June 20, 1919, about 3 p.m., when the system was carrying 180,000 kw., a thunderstorm added 133,000 kw. to the load in about thirty minutes, and this extra load did not entirely disappear until 5 p.m. The total load overtopped the winter peak by 15,000 kw. In this case about 40,000 kw. was carried by the storage batteries for a few minutes. Similar in its effects to the thunderstorm peak, but not so troublesome, is the dark day. On Feb. 28, 1923, the load on the system increased from 120,000 kw. to 435,000 kw. in two and one-half hours, an increase of nearly 3,000 kw. per minute, and this load persisted for more than eight hours. One can readily appreciate the great reserve capacity required in an electric supply system capable of handling such tremendous loads on such short notice without any indication of distress.

### MORE THAN A MILLION METERS INSTALLED IN CITY

The practice of selling electricity in New York differs somewhat from that which obtains in other cities in that dwellers in huge apartment houses are customers of the landlord rather than customers of the company. Thus the number of meters actually owned and installed by the utility companies represents less than the total number of users of electric service. There are in the Borough of Manhattan alone more than 150,000 sub-meters in apartment houses, service to which is supplied by the public utilities through a master meter.

The total number of meters connected to the circuits of the utility companies in the greater city was, at the end of March, 889,946, which, plus the sub-meters installed in apartment houses, brings the total number of electric meters in use to considerably over one million. As all of the distribution circuits on Manhattan are underground, and underground construction on Manhattan means blasting from solid rock, it will be appreciated that the cost of servicing a customer is high. Notwithstanding this fact, there is no minimum service charge for energy in Manhattan and the Bronx, and The New York Edison Company has on its circuits more than 50,000 customers whose annual bills for electrical energy are less than $10 a year.

The number of new meters which are being added to the circuits of the companies in Brooklyn, Queens and in the New Jersey district is very great. The Public Service Electric Company of New Jersey, for instance, connected 63,901 meters to its system last year, as compared with 45,912 in 1921, and of these 83 per cent were small meters for domestic service. The Brooklyn Edison Company in a smaller district during the same period added 63,657 new meters, a gain of 26 per cent over 1921. The ratio of growth in the Borough of Queens is even larger, the New York and Queens Electric Light & Power Company, which has almost 100,000 meters on its circuits, having increased their number during the last ten years 1,400 per cent.

### EXPENDITURES FOR EXTENSIONS AND ADDITIONS

Of course, enormous expenditures have been made and are being made by the electric public utility companies to keep abreast of the demands made upon them for service. Since 1916 The New York Edison Company and its subsidiary, The United Elec'ric Light & Power Company, have expended more than $70,000,000 for additions and betterments to the system. This company, which has the largest gross income of all of the purely electric light and power companies of the country, will, at the present ratio of increase, which is

over 16 per cent, have a gross income of more than $60,000,000 this year. The Brooklyn Edison Company has increased its gross revenue in five years 135 per cent, and the gross earnings of the company for the four months ended April 30, 1923, showed an increase of $2,000,000 over the same period last year, or an annual rate of increase of $8,000 000. The gross earnings last year amounted to $19,129,000 against $16,000,000 in 1921. Since 1921 the capital of the company has been increased from $19,000,000 to $50,000,000.

The large increase in business reflects the fact that new construction in Brooklyn is going ahead at a pace equaled by few cities in the United States. During the first four months of the year the Brooklyn Edison Company added 22,000 new customers, and May showed no diminution in the rate at which new names were being added to the books. At the first of this year the expansion program of the Brooklyn Edison Company, to meet increasing demands for service, called for an expenditure of about $15,000,000, while $7,000,000 had been expended out of earnings for this purpose during the previous year. The expansion program includes a new 400,000-kw. steam station on the East River at Hudson Avenue. This station when completed will be one of the largest in the country.

Other features of the generating systems in the metropolitan district are given elsewhere in this issue.

# Edison and United Companies' System

## Manhattan Island Has the Most Concentrated Load of Diversified Character to Be Found in the United States—Service in the Bronx and Westchester and Connections with Railroads and with Brooklyn

By JOHN W. LIEB
*Vice-President The New York Edison Company*

THE starting of the historic Pearl Street station on Sept. 4, 1882, initiated the service of The New York Edison Company, as well as central-station electric service in the world as it is thought of today. Contemporary scientists predicted the failure of the undertaking, designating it as an absolute "ignis fatuus," but it proved to be a forerunner and established the basis of the highest type of central-station supply as it is now known. In the short period since the starting of the old Pearl Street station in New York the tremendous accomplishments of The New York Edison Company and The United Electric Light & Power Company have been recorded.

The territory directly served by these companies covers Manhattan and, together with its affiliated distributing company, the Borough of the Bronx. The electrical energy required in the city of Yonkers, served through the Yonkers Electric Light & Power Company, is also provided from the generating stations of the companies, as is a part of the energy required in the Borough of Queens and in Westchester County, which are served through allied companies, the New York & Queens Electric Light & Power Company and the Westchester Lighting Company. Thus the energy generated by the allied companies serves a territory extending from the southern tip of Manhattan Island to the Putnam County line, a distance of about 50 miles, and includes Yonkers, Westchester County and the Boroughs of Manhattan, Bronx and Queens as shown on the map of the metropolitan district.

The area of the territory served directly by The New York Edison Company and The United Electric Light & Power Company is approximately 40 square miles, with about 3,000,000 inhabitants, while the corresponding figures for the entire territory referred to are 550 square miles and about 3,800,000 inhabitants.

### Five Generating Stations

The generating stations of the two companies comprise five stations of a total rated capacity of 635,000 kw., of which 405,700 kw. is 25-cycle alternating-current and 221,500 kw. is 60-cycle, with 7,800 kw. of direct-current generation. In order to care for the load of the coming winter there will be added a 35,000-kw., 25-cycle turbo-generator, making the total capacity of the stations 670,000 kw. Including the stations of the Third Avenue Railroad and the Hudson and Manhattan Railroad, which are operated by the companies under lease and are rated at 60,000 kw., there is in 1923 a total generating capacity, operated as a unit under the combined auspices, of 730,000 kw.

Waterside generating stations Nos. 1 and 2 are adjacent to each other on the East River between Thirty-eighth and Fortieth Streets. Waterside No. 1 commenced operation with large engine generator units, which have all been replaced by steam-turbine generator units, and it now has a total installation of ten units with an aggregate capacity of 174,000 kw. Two of the units are of 35,000 kw. capacity each, and all of them are 25-cycle except two small 60-cycle units aggregating 16,500 kw. The generating equipment of Waterside No. 2 comprises ten steam-turbine generator units of an aggregate capacity of 152,200 kw., of which all are 25-cycle except one 60-cycle unit of 14,000 kw. capacity. The Sherman Creek generating station of the United company, in Manhattan on the Harlem River at Two Hundred and First Street, contains eight steam-turbine generator units with an aggregate capacity of 151,000 kw., of which 40,000 kw. is 25-cycle and the remainder is 60-cycle. The Hell Gate generating station of the United company, on Long Island Sound at the foot of One Hundred and Thirty-fourth Street in the Bronx, with an ultimate capacity of 300,000 kw., has now installed two 35,000-kw., 25-cycle steam-turbine generators and two 40,000-kw., 60-cycle units. The original Duane Street generating station of 7,800 kw. capacity supplies direct current feeding into the Edison network in the business district near the southern end of Manhattan.

The Hell Gate generating station receives most of its coal from oceangoing ships and is equipped to unload such boats rapidly. Thus, during the recent extreme

shortage of coal, coal-laden boats from England went directly to the Hell Gate dock for unloading. This station is also equipped to receive coal by rail as well as by water. The other generating stations receive their coal by barge, the coal being brought to New York tidewater by rail, supplemented by the supply for the Shadyside storage yard.

The fuel supply for the generating stations is fortified by the large Shadyside coal storage yard, with a capacity of 240,000 tons, on the west bank of the Hudson River opposite Ninety-sixth Street, local storage capacity at the Hell Gate Station amounting to 60,000 tons, a total of 300,000 tons exclusive of the coal in process of utilization in the bunkers over the boilers of the several generating stations. In addition to this adequate provision for emergencies, the companies further participate in the storage facilities provided at the Consolidated Gas Company's plant at Astoria, with a capacity of 700,000 tons, located immediately opposite the Hell Gate station.

All of the generating stations are interconnected by tie cables of sufficient capacity to supply the loss in emergency of the largest unit in any station. Ties are also maintained through all substations to provide for the loss of at least one transmission cable.

The load dispatching of the entire system is supervised and directed by a system operator at the Waterside station. The system operator's room is equipped with a pilot board automatically indicating the position of all switches in all generating stations and all switches controlling high-tension feeders to substations and customers. A special telephone switchboard is installed with direct lines to all substations and generating stations and with trunks to several telephone exchanges. A Gamewell fire-alarm system is also provided for simultaneous instantaneous signaling between all substations and generating stations. All city fire alarms from the district supplied by the high-pressure pumping stations are also recorded at the system operator's room, and storm warnings are received by a "wireless detector."

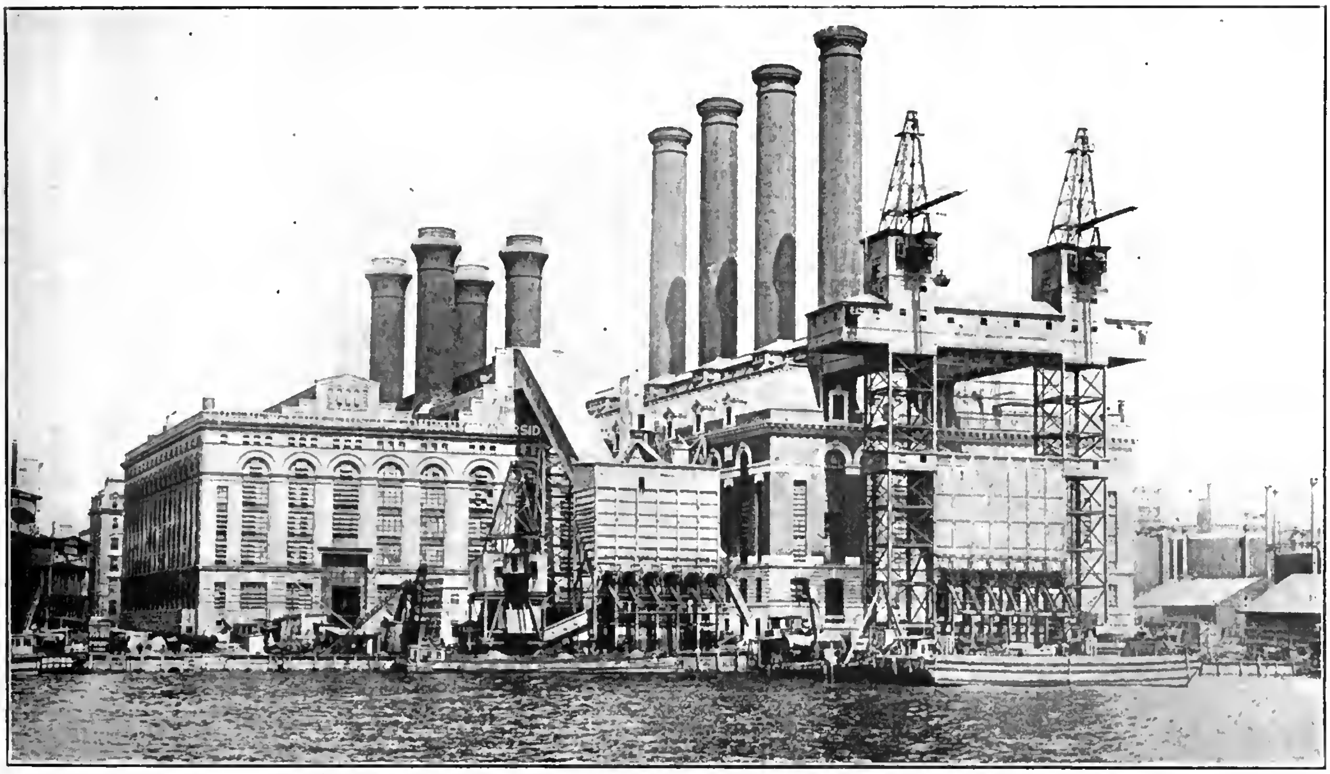
The total demand on the Edison and United generating stations in 1922 was 525,000 kw., and the total output for that year was 1,665,000,000 kw.-hr.

It is interesting to note that in Manhattan sudden thunderstorms are sometimes accompanied by inky darkness, causing the midsummer load to rise to an amount almost equal to the previous winter's maximum. Thus the spare peak capacity usually found in central stations during the summer months is not available, a condition singular to Manhattan Island.

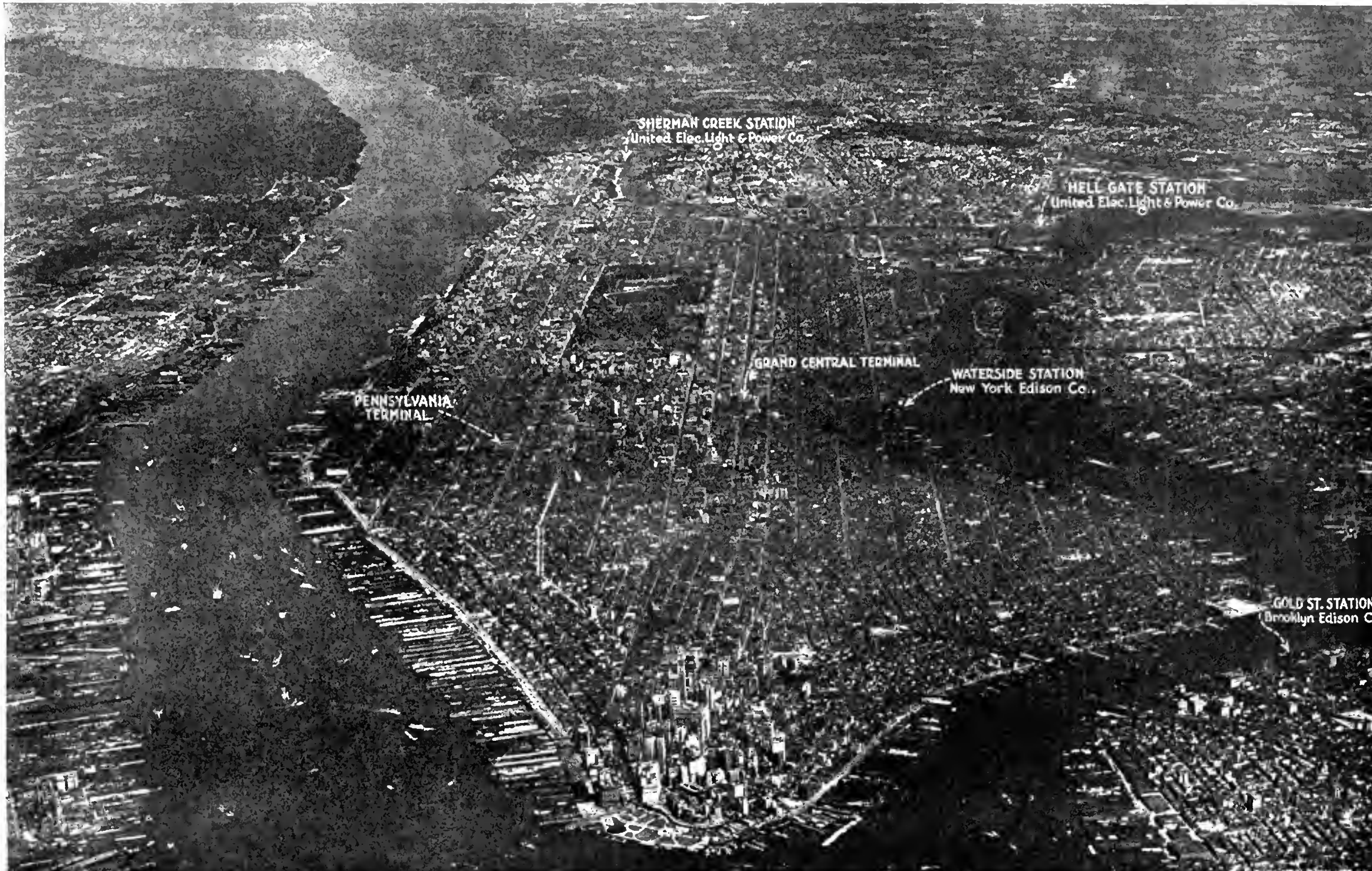
Energy is supplied to 25-cycle substations over radial feeders at 6,600 and 11,000 volts and to 60-cycle substations through parallel feeders at 7,800 and 13,200 volts. All transmission feeders operated by the Edison and United companies are carried underground. The supply to the Westchester Lighting Company is through two 45,000-volt underground feeders at 60 cycles (six single-conductor cables) from the Sherman Creek generating station to the New Rochelle substation, at which this energy is transformed to 13,200 volts for supply to other substations.

The northern end of Westchester County is also supplied from the Dunwoodie Avenue substation of the Yonkers Electric Light & Power Company via 45,000-volt overhead lines to the Elmsford substation. The New York, New Haven & Hartford Railroad Company is supplied by three-conductor, 25,000-volt underground cables at 25 cycles which tie in with the railroad's generating station at Cos Cob.

Tie connections for interchange of power are also maintained with the Interborough Rapid Transit Company at 11,000 volts, 25 cycles; with the Pennsylvania Railroad at the same voltage and frequency through the Jersey City Station of the Hudson & Manhattan Company; with the Brooklyn Rapid Transit Company at



WATERSIDE STATION OF THE NEW YORK EDISON COMPANY

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Aerial Photograph of New York, Showing Location of Electric Generating Stations

6,600 volts, 25 cycles, and with the Brooklyn Edison Company at the same voltage and frequency and also at 13,200 volts, 60 cycles. The last-named connection is now being changed to operate at 26,000 volts.

High-tension energy is supplied in bulk to certain large customers, such as ice manufacturing companies, mostly at 7,800 volts or 13,200 volts, 60 cycles, through single or multiple loop feeders, with automatic switches in the customers' premises. This service is in all cases stepped down to not more than 440 volts by the customers' transformers. In the case of the pumping stations for supplying high-pressure water for city fire protection the energy is fed at 6,600 volts, 25 cycles, with two direct feeders from separate generating stations and two feeders from separate substations to each pumping station, the pump motors being operated direct at the 6,600-volt feeder pressure. This service, as will be appreciated, is of a highly important character, supplying water through a separate system of mains to the fire hydrants in the business sections of the city. It may be interesting to note that a very definite penalty clause for failure to supply energy is included in the contract.

### Manhattan's Thirty-two Substations

The thirty-two substations serving the direct-current network in Manhattan have a total capacity of 380,000 kw. in 185 25-cycle synchronous converters, of which the largest units are of 4,200 kw. normal capacity. The conversion equipment is supplemented by storage batteries capable of supplying a discharge of 60,000 kw. for one hour. The output of these substations is distributed over 1,600 feeders connected to a network of 810 miles of service mains.

Part of this same territory is also served by 60-cycle low-tension distribution. This, together with the portion of Manhattan north of One Hundred and Thirty-sixth Street and the Bronx west of the Bronx River, is supplied by ten substations of a total capacity of 140,000 kva., the transformers used being mostly in sizes of 2,000 kva. and 3,000 kva. The 60-cycle distribution in Manhattan is at 3,000 volts, two-phase, three-wire, lighting being supplied across the outside legs. In the service fed from one substation this has now been changed to three-phase service and a low-voltage interconnected network has been put into service. In the Bronx the distribution is at 2,300 volts, two-phase, four-wire.

The system in Queens Borough, supplied by the six substations of the New York & Queens Electric Light & Power Company, with a total capacity of 90,000 kva., utilizes 2,300-4,000-volt, three-phase, four-wire distribution circuits, the high-tension feeders operating at 7,800 and 13,200 volts. Westchester County is served through thirteen substations of the Westchester Lighting Company, with a total capacity of 50,000 kva., the transmission voltage between substations being 13,200 and the distribution at 2,300 volts, two-phase. The city of Yonkers is supplied from the two substations of the Yonkers Electric Light & Power Company, the total capacity in step-down transformers being 15,000 kva., the transmission between stations at 13,200 volts and the distribution at 2,300/4,000 volts, six-phase, four-wire. The distribution from that portion of the Bronx east of the Bronx River is supplied from the Bronx Gas & Electric Company's substation at 2,300 volts, two-phase.

The foregoing can be considered a brief outline of the generating, transmission and substation features of the system of The New York Edison Company, The United Electric Light & Power Company and associated companies in the Bronx, Queens and Westchester Counties.

The districts other than Manhattan are largely similar to cities of the same population in the character of their load, composed of residential, business and power consumers. The load in Manhattan Island, however, an area of 21 square miles, represents the most concentrated diversified central-station load in the world, both from a standpoint of the population served (an average of 114,700 per square mile) and the density of the load itself.

As a result of the concentration of load and the restricted area the physical conditions affecting the distribution systems are peculiar. The load continues to increase year by year at a more or less uniform rate of from 12 to 15 per cent, and this means a continuing growth within a fixed area without reaching saturation.

The factors of building and population which cause the increase in central-station load carry with them also an increase in all other facilities such as transit, gas, water and steam, producing a progressive congestion of physical equipment within the fixed boundaries of the streets that makes the problem of construction of substations and installation and maintenance of distribution systems increasingly difficult because of space limitations and restrictions due to subsurface structures.

Coupled with the enormous concentration of load is the character of the load itself, which requires adequate and uninterrupted service at all times to newspapers, ticker service, telephone, telegraph and other wire communication systems, city lighting, fire service, hospitals, office buildings of great magnitude where the electric elevator service represents vertical transit facilities to innumerable tenants, and similar important service. The company-owned meters total in Manhattan Island alone approximately 350,000, to which should be added many thousands of customer-owned meters in individual buildings.

### Street Lighting System

It may be of interest to add a word relative to the carefully planned street lighting throughout the city. The companies referred to supply approximately 50,000 street lamps of the multiple and series types of the high-efficiency "type C" form of Mazda incandescent lamp. The outstanding feature of the planning of the street lighting is the zoning of the districts and the allocation of lamps from 100-cp. size for suburban districts to the twin form of post carrying two 500-watt lamps for districts comparable with Fifth Avenue, Times Square, etc.

The lamp posts are of an ornamental type designed for the particular districts both as to height and form and are of types suitable for the residential districts, the business sections and the boulevards, parks and more highly developed avenues. The wide variation in the size of the "type C" incandescent lamp from 100 cp. to 750 watts enables application of illumination intensities, and, in combination with the proper post design, provides for a standardized equipment suitable for any desired street illumination.

From this brief summary a conception may be had of the conditions under which current is generated and distributed from the generating stations and substations on Manhattan Island and in the Bronx and the territories adjacent thereto served by the distributing systems of the companies allied with the Edison-United companies and from the standpoint of generation of current operated as a unified system.

# Alternating Current in New York

## Growth of Business Has Necessitated Additions to the Hell Gate Station of the United Electric Light & Power Company—Interesting Features of New Equipment

By FRANK W. SMITH

*Vice-President and General Manager The United Electric Light & Power Company*

FROM its Hell Gate generating station and its Sherman Creek station The United Electric Light & Power Company supplies electricity both to its allied companies and to the 82,150 customers on its lines. Because of the first class of service the United company may perhaps be considered in the nature of a "superpower company." Apropos of the second, it is interesting to note that of the total 82,150 customers supplied with United service on April 30 of this year 56,277 represent those residing in the Washington Heights section—that territory in Manhattan north of One Hundred and Thirty-fifth Street, which is exclusively supplied by the United company. Electric light and power facilities were first introduced in this district on Dec. 26, 1899. The remarkable strides taken in less than a quarter of a century are apparent in the fact that nearly four-fifths of the company's business is established in this new field.

The Hell Gate station was constructed for an ultimate capacity of 300,000 kw., and at the present writing equipment to one-half of this amount has been put into operation. At the Sherman Creek station the total capacity of 150,000 kw. has been utilized for some time. During the month of April 40,000,000 kw.-hr. was generated at Hell Gate, and the maximum load was 103,500 kw. At Sherman Creek during the same month 33,500,000 kw.-hr. was generated, with a maximum load of 94,000 kw. In comparison with these figures the following data for January, 1923, may be of interest: Hell Gate, 40,700,000 kw.-hr., with a maximum load of 110,000 kw. Sherman Creek, 39,327,000 kw.-hr. with a maximum load of 103,300 kw.

### Additions to Hell Gate Station

A description of the new Hell Gate station appeared in the ELECTRICAL WORLD for April 29, 1922. In that issue the departures from conventional practice were accentuated and described in some detail.

Among the features which make Hell Gate station stand out as an unusual plant are the following: The turbine room is next to the river, with the boiler room between it and the electrical galleries; alternating-current-driven auxiliaries are used, with one or two exceptions; phase isolation of all electrical equipment has been carried out; the ashes are sluiced by hydraulic means; the station equipment has been divided into four independent groups, and heat-balance control is provided. The arrangement of condenser circulating-water intakes and discharge, the use of boilers with superheaters only six tubes above the combustion chamber, the extensive equipment of motor-operated valves, the truck-type switchboards for station service and the coal-handling facilities are also worthy of note.

Oceangoing coal boats may land directly alongside the station for unloading by means of the coal towers. In addition, a direct siding from the New York, New Haven & Hartford Railroad permits the receipt of coal by rail—a feature possessed by Hell Gate alone among the generating stations in New York. The existence of two independent routes for bringing coal to the plant is of tremendous value in view of the absolute continuity of service that must be maintained on the system. The Hell Gate site possesses a further safeguard in this respect in having an outside storage capacity of approximately 100,000 tons, which insures about four weeks' operation at the ultimate load in case all the other sources of coal supply are cut off.

When the Hell Gate generating station was constructed it was planned to add further sections of equipment as the demand would warrant. This policy has been adhered to from the start. In line with this three new sections of electrical galleries are being added this year to the four sections already installed. These three sections of electrical galleries occupy an area of, roughly, 105 ft. x 94 ft. and are seven stories high.

The same system of compartments will be employed in these sections, and the same method of installing the ducts with paper forms will also be used. As described in a previous issue of the ELECTRICAL WORLD, two of the first four sections of the electrical galleries were equipped for 25-cycle operation and two for 60-cycle. The three new sections will be equipped entirely for 60-cycle service, but two of the present 60-cycle sections will be reconnected for 25 cycles. The installation will then comprise four 25-cycle sections and three 60-cycle sections for the coming year. This reconnection does not involve any considerable expense as most of the apparatus is suitable for either frequency.

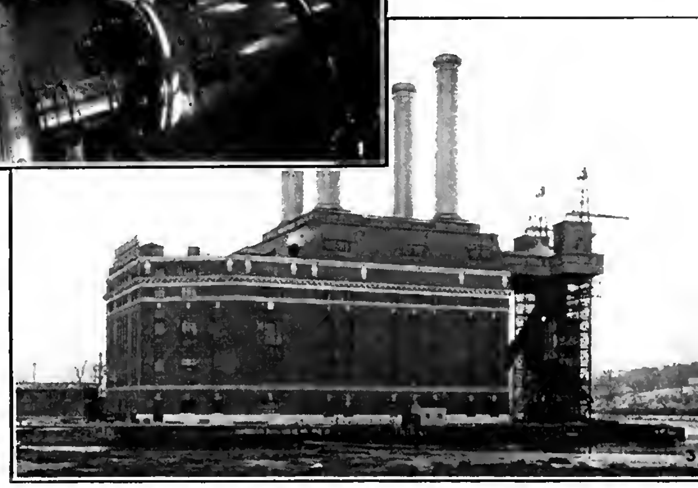
There have been purchased for the new sections ninety-nine Westinghouse circuit breakers of the same type and rupturing capacity—1,500,000 kva.—as was originally installed. These range in capacity from 3,000 amp. for the generators to 600 amp. for the feeders. The installation of this type of equipment in the present installation was an innovation, but the satisfactory service given made it advisable to continue the equipment along the same lines. In addition there have been purchased from the Metropolitan Device Corporation 120 porcelain-clad reactors of 3 per cent and 5 per cent reactance. This equipment also duplicates that installed originally.

### 50,000-Kw. Unit Purchased for 1924

For installation this year one General Electric 35,000-kw. turbine, similar in a general way to those now installed, has been bought. This turbine will exhaust into a Worthington condenser similar to that already in service. The circulating pumps, however, will be driven by two-speed motors instead of by the constant-speed motors used on all of the present circulating pumps.

A 50,000-kw. unit which is of especial interest has

been purchased from the Westinghouse Electric & Manufacturing Company for the 1924 installation. The turbine is to drive a 62,500-kva., 60-cycle, three-phase, 13,200-volt generator and will operate at 1,200 r.p.m. It is a single-cylinder unit, and in addition to the main generator it will be equipped with an auxiliary power generator of 2,000 kw., 2,500 kva., for auxiliary service at 60 cycles, three-phase, 2,400 volts. This auxiliary generator will be directly coupled to the main generator shaft, and a directly connected exciter will be on the end of the auxiliary generator shaft. The unit will have its best point of economy at 35,000 kw. and will have a peak-load capacity of 56,250 kw. A fairly flat performance curve between loads of 25,000 kw. and 56,250 kw. is guaranteed. The length of the entire unit with auxiliary generator and directly connected exciter will be approximately 77 ft. by about 22 ft. in width. This size permits the unit to fit nicely into the same space as is occupied by each of the present units. This unit represents the first 50,000-kw. single-cylinder unit which the Westinghouse company has contracted to make. Its design is of the impulse reaction type, consisting of one double Curtis wheel followed by the standard reaction intermediate blading and low-pressure blading of the so-called "Bauman" type, which permits the turbine to exhaust through one single-exhaust opening, there being three multiple passages through the Bauman blading to this single exhaust. It will be arranged for feed-water-heating purposes, the present plan being to provide for feed-water heating by four stage bleeding of the turbine, using the auxiliary generator to provide the necessary power incidental to the operation of the unit. It might also be noted that this is the first unit of this capacity to be equipped with a small generator on the main shaft for auxiliary power purposes. The present installation at Hell Gate consists of twelve 1,890-hp. Springfield boilers with no economizers but equipped with superheaters above the lower six rows of tubes. Under each boiler there are two fourteen-retort, seventeen-tuyère Taylor stokers discharging into a central ash pit. Although this installation is working satisfactorily, it was thought that further economies could be accomplished by a modification of it. Three new boilers have been purchased of the same general design but of 1,550 hp. each. Instead of being twenty tubes high they will be sixteen tubes high, with four rows instead of six below the drop leg. In addition to superheaters these boilers will be equipped with economizers. These are to be furnished by the Power Specialty Company. They are of the one-pass, counter-current design with elements 18 ft. long over rings and will have 13,824 sq.ft. of external heating surface. Each unit will be sixteen elements wide and fourteen rows high. The superheaters, instead of being placed in the original position, will be installed on the top of the first pass. Instead of a double stoker there will be a single fourteen-retort, thirty-three-tuyère Taylor stoker. These changes, of course, necessitate a different baffling arrangement.



HELL GATE AND SHERMAN CREEK STATIONS, SHOWING INTERIOR OF SHERMAN CREEK STATION

The same method of disposing of ashes by a sluicing system will be maintained. On account of these boilers being fed from only one side it will not be necessary to purchase another coal lorry at this time.

An equipment of forced-draft and induced-draft fans similar to that of the original installation will be installed driven by B. T. S. General Electric motors. These motors have operated satisfactorily, and their purchase for this installation is economically sound.

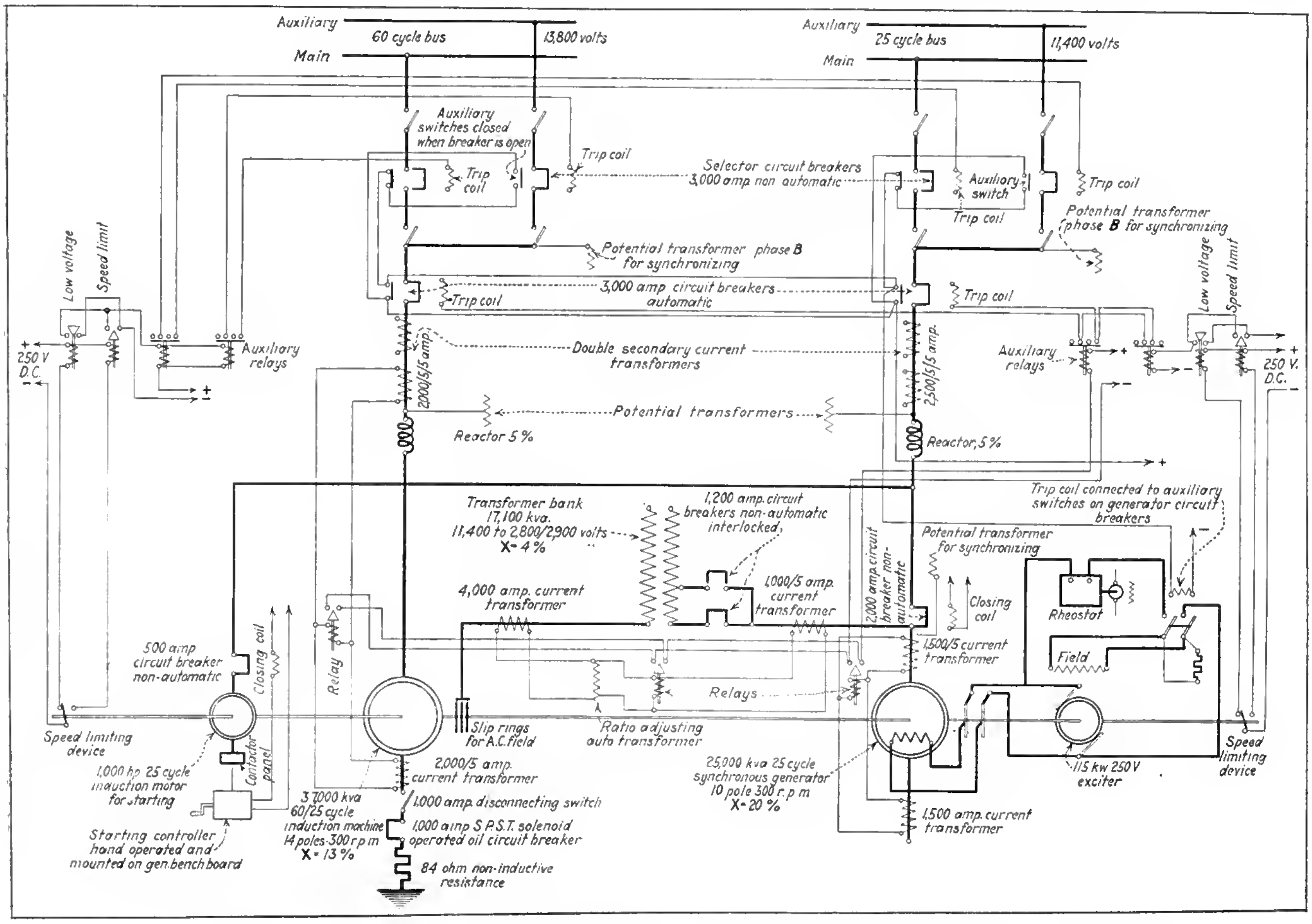
The present auxiliary power for the Hell Gate station is obtained from two banks of transformers fed from the main 60-cycle, 13,200-volt bus and stepping down to 2,300 volts, and from two 2,500-kva. turbo-generators generating at 2,300 volts. For the present year this will be sufficient. A further extension, however, is necessary to the truck switch installation. New switches have been purchased from the General Electric Company in sizes of 400, 1,200 and 2,000 amp.

An interesting addition to Hell Gate which is expected to be in operation during the coming fall is the installation of five 12,000-kva. oil-cooled outdoor-type transformers. These are the largest type of self-cooled transformers made. With their oil they weigh 42½ tons each, but in spite of this weight they will be shipped filled with oil to eliminate the drying out of coils after being received. They will be used to supply service to allied companies and will be installed at the extreme south end of the part of the property devoted to electrical galleries. They are delta-connected on the low-voltage side and star on the high and step up from 13,800 volts to 28,980 volts. They will have additional taps for approximate voltages of 27,600, 26,100, 24,700 and 23,000 for operation at full kilovolt-ampere capacity. They are of the core type with interleaved disk windings and will be equipped with conservators, ratio adjusters for the taps and temperature-indicating coils.

There will be installed for operation this year a 35,000-kw. induction synchronous-type frequency converter to be used for tying together the 25-cycle and the 60-cycle systems. Units of this type in large sizes have not previously been built, and its operation is looked forward to with interest. The set is to be furnished by the General Electric Company. It operates at 300 r.p.m. and consists of a 37,000-kva. wound-rotor induction motor having fourteen poles, a 13,800-volt, 60-cycle stator, and a 2,850-volt rotor wound for 25 cycles directly connected to a synchronous 25,000-kva., 25-cycle generator operating at 11,400 volts. On the same shaft are installed a six-pole, 115-kw., 250-volt exciter and a 1,600-hp., 11,400-volt, three-phase, 25-cycle starting motor. Between the slip rings of the main induction machine and the high-voltage 25-cycle bus is a 25-cycle, 17,100-kva. transformer stepping down from 11,400 volts to 2,850/2,950 volts.

The synchronous machine is a ten-pole generator having a synchronous speed of 300 r.p.m. The 60/25-cycle induction unit is wound for fourteen poles. At 60 cycles it would have a synchronous speed of 514 r.p.m. By holding the rotor speed down to 300 r.p.m. with the synchronous generator a slip of 214 r.p.m. is obtained in the induction machine, which gives 25 cycles at the collector rings of the rotor. The stator of the induction machine is connected to the 60-cycle line, and the rotor of the induction machine and the stator of the synchronous machine are both connected to the 25-cycle line. A transformer is required for connecting between the collector rings of the induction machine and the 25-cycle bus, because it is not practicable to build a high-voltage rotor for this machine, and this transformer also gives an opportunity for ratio adjustment for the control of current flow through the induction unit.

The induction machine will be excited from the 25-cycle side, the synchronous generator supplying this




LAYOUT FOR OPERATING A 35,000-KW. SYNCHRONOUS FREQUENCY CONVERTER USED TO TIE TOGETHER THE 25 AND 60 CYCLE SYSTEMS

excitation, so that the power factor on both the 25-cycle and the 60-cycle side of the set will be approximately unity, with full load on the set and power flowing in either direction. In order to provide this exciting kva. for the induction machine the synchronous generator is designed for 85 per cent power factor lagging load as a generator.

The induction machine furnishes an electromagnetic tie between the 25-cycle and the 60-cycle systems, similar to a transformer tie between the two parts of a system of one frequency. In other words, this machine forms a voltage tie between the systems in addition to being a power and frequency tie, and any variation or disturbance of voltage on one system will be transmitted to the other through this tie in a manner similar to that obtained through a transformer. The effectiveness of this voltage tie is dependent upon the reactance of the circuit through the induction machine between the two systems.

The flow of wattless current between the two systems may be controlled by adjusting the transformer ratio or by changing the bus voltage on either the 25-cycle or the 60-cycle system. For general operation these ratios will be adjusted to give unity power factor.

# Phenomenal Growth in Brooklyn

## Edison Company Erecting New Superpower Station, Changing Its Distribution System and Expanding Its Various Departments to Take Care of the Ever-Growing Demands

By M. S. SLOAN
*President Brooklyn Edison Company, Inc.*

THE progress of the Brooklyn Edison Company, Inc., has been rapid and consistent since the opening of the European War, and since the end of the war a large and steady average increase in business each year has been maintained. In 1922 this increasing business had reached a point where the company was justified in adopting a plan of expansion for the next five to ten years, conservatively predicated on past requirements, of a far greater scope than any previously contemplated in its history. A brief synopsis of this growth and the plan of expansion now in progress of execution is presented here.

The growth of the company's business is compactly shown in the tables, which cover the increases in customers, output, capacity, demand, gross revenue, domestic and industrial development.

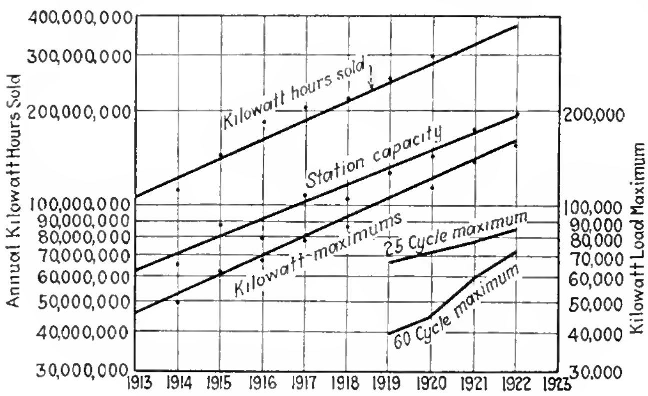
The diagram of output, maximum demand and capacity exhibited illustrates very clearly the basis of growth on which the present expansion is planned. The Brooklyn Edison Company, Inc., now has two generating stations in operation besides an interconnection with the plant of The United Electric Light & Power Company at Hell Gate in the Bronx. The largest of the two stations is on the East River at Gold Street; it has a capacity of 125,000 kw. of 25-cycle generators. The second station is at Sixty-sixth Street and New York Bay, having 65,000 kw. generating capacity at $62\frac{1}{2}$ cycles. To meet the future requirements of capacity and economy, to standardize and simplify its type of service in phase and frequency, and further to decrease its cost of distribution and increase its efficiency, all tending to improve and lower its cost of general service, the company has financed and started a remarkably large and comprehensive program of construction and improvement, which when completed about the end of 1924 will have cost $23,000,000.

The basis of this development is the design and construction of what will be when completed the largest steam generating station in the world, at the foot of Hudson Avenue, Brooklyn, adjacent to the Brooklyn Navy Yard. This plant will be of 400,000 kw. to 500,000 kw. capacity, consisting of eight turbo-gen-

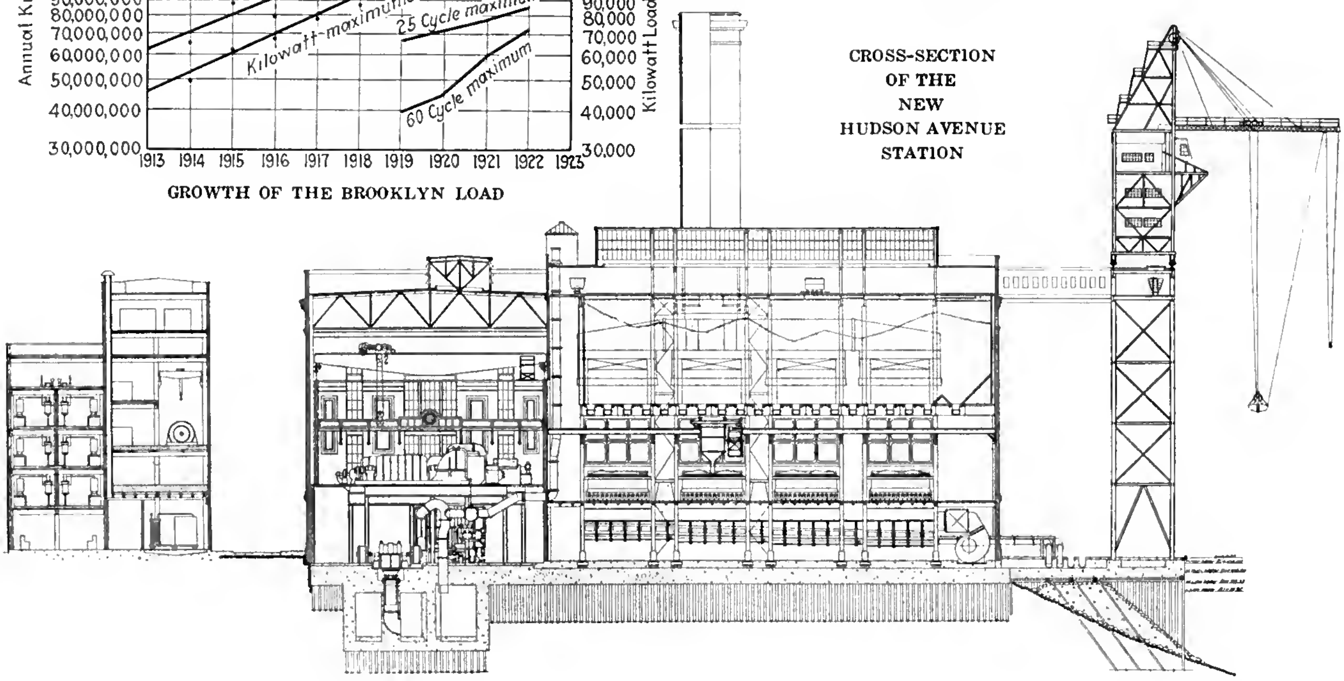
erators, three of which have been ordered. Each one of them will require a surface condenser of 70,000 sq.ft. cooling surface, supplied by two circulating pumps of 50,000 gal. each, or 100,000 gal. per minute total.

The station will be divided into four groups of two turbines each, each group being designed to be operated as a unit, the two turbines being served by eight boilers, each of 19,650 sq.ft. of heating surface, of which seven are required for normal operation of two units at maximum load, the eighth boiler being a spare.

The station is laid out on the most economical basis,




GROWTH OF THE BROOKLYN LOAD



CROSS-SECTION OF THE NEW HUDSON AVENUE STATION

the boiler room being adjacent to the waterfront, the turbine room next, and across a street the switch house, so that the least distance is required for handling coal and the most economical arrangement insured for transmitting the electric current from the generators to the switch house and thence to the transmission circuits.

The coal will be received in barges on the waterfront and hoisted by means of traveling towers on a coal trestle 112 ft. above the wharf, where it will be crushed and delivered to electric coal cars, which will be operated automatically and delivered to the bunkers over the boilers. From the bunkers the coal will be delivered by weighing lorries to hoppers of the individual stokers.

The bunkers will have a storage capacity of approximately 24,000 tons, which is six days' supply when full, based on normal steaming rate and the most economical load on the turbines. The ashes will be handled by means of hydraulic sluiceways under the ash pits of the boilers which lead to pipes under the surface of the wharf and thence to a pit on the dock, from which they will be dredged by locomotive crane into the ash scows and towed away to sea.

Steam will be received at the throttle of the turbo-generators at 265 lb. pressure, 200 deg. superheat. The electric current will be generated at 13,800 volts, stepped up to 27,600 volts in auto-transformers in the switch house and at this voltage transmitted to the 60-cycle substations of the company.

The turbo-generators have a guaranteed water rate of approximately 10 lb. per kilowatt-hour under the above conditions. It is confidently expected that the efficiency of this station will be approximately as follows:

| | 100,000 Kw., Full Load | 75,000 Kw., Three-quarters Load | 50,000 Kw Half Load |
|---|---|---|---|
| B.t.u. per kilowatt-hour........... | 17,380 | 16,760 | 18,000 |
| Total thermal efficiency, per cent... | 19.65 | 20.39 | 18.97 |
| Lb. coal per kilowatt-hour......... | 1.34 | 1.29 | 1.39 |
| Lb. steam per kilowatt-hour....... | 12.97 | 12.42 | 13.19 |

It will be noted from the foregoing that changes in the distribution system are also in progress. Originally the generation of energy by the Brooklyn Edison Company was two-phase at a frequency of 25 cycles. In 1912 about one-quarter of the energy was being distributed by alternating current, part directly at 25 cycles to large customers, and the rest at two-phase, 62½-cycle energy by means of a limited capacity in frequency changers. As the requirements and the refinements of the modern utilization of electricity have developed they have shown the desirability of three-phase and 60 cycles as the general characteristics of use, and in consequence, following the actual trend of the company's experience, an elaborate program has been adopted of changing to this phase arrangement and frequency. This program also includes a large extension of the alternating transmission system at much higher voltage than at present, for economic reasons as well as for those of physical limitations. It has proved desirable as well to change over certain portions of the low-tension direct-current distribution to alternating-current.

These changes are soundly predicated on the experience of the last ten years, during which the alternating distribution of energy increased from 25 to 45 per cent of the whole and during which the frequency-changer capacity increased from 18,500 kva. to 28,500 kva. of 62½ cycles, while 114,500 kva. of 62½-cycle substation transformers were also added.

Based broadly on these proved conditions and safely and conveniently to distribute through the streets of Brooklyn the greatly increased supply of energy from the new Hudson Avenue station, it has been necessary to increase the transmission voltage from 13,200 to 27,600, and the company is this year installing 80 miles of 350,000-circ.mil, 33,000-volt cable as an addition to its present 490 miles of transmission. The company's transmission cable in the past has always been conservatively rated, and studies now under way indicate that an appreciable portion of the existing cable installed for operation at 13,200 volts may, by rebuilding the joints, be safely operated at the new transmission voltage.

To utilize the output of Hudson Avenue station and to render available the higher transmission voltage, it has been necessary to purchase eighteen 10,000-kva. substation transformers, which will be installed during 1923. These transformers are of the oil-insulated, self-cooled type, as contrasted with the company's previous practice of using air-blast transformers of 5,500 kva. rating.

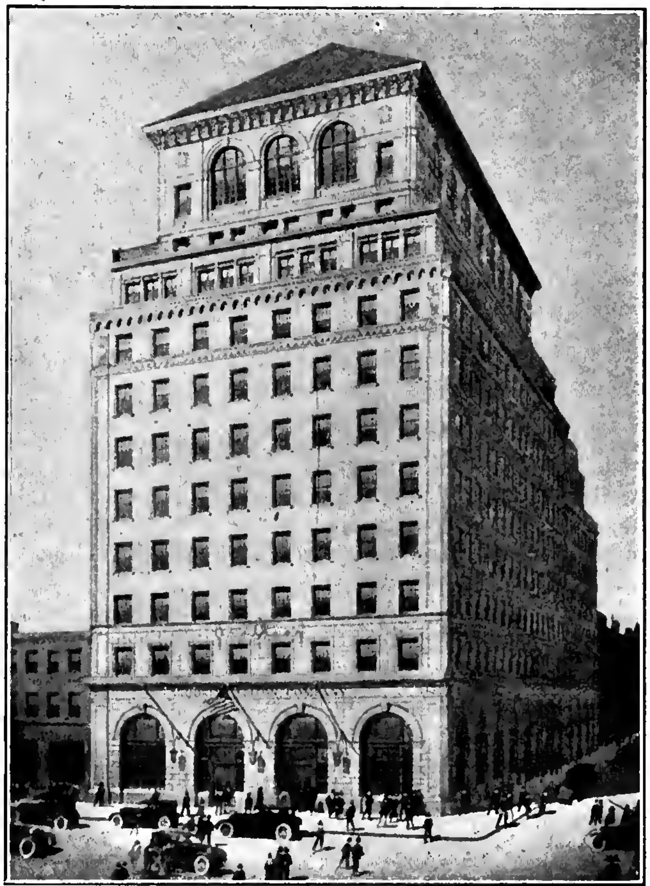
The rapid rate of growth of the company has now warranted a decision to change the distribution system from two-phase, 2,400 volts, to the almost universal standard three-phase, four-wire, 2,400-volt system, and accordingly two new substations now under construction are being developed as three-phase substations. Other substations in the process of reconstruction are being changed to three-phase, and during 1924 new substations and reconstructed old ones will be similarly changed to three-phase.

The relatively greater growth of the alternating-current territory has warranted the change in frequency from 62½ cycles to the standard 60 cycles. Both the change in frequency and the change in the number of phases will ultimately displace the present frequency changers from service, and the company is therefore installing this year a new 35,000-kva. frequency changer to interconnect the 25-cycle and 60-cycle systems. Provision has been made for the installation of a second such unit during 1924 or 1925 if occasion necessitates.

The pure economics of distribution, street congestion and the difficulty of obtaining adequate locations for direct-current substations have led to a policy of taking expansions within the direct-current district on the 60-cycle alternating-current service, and to this end a three-phase skeleton distribution network is being built throughout the direct-current territory. New business in the direct-current territory is now being taken on as alternating current, and during the year approximately 10,000 kva. of existing direct-current load will be transferred to the 60-cycle system. It should be noted that this change of direct-current to alternating-current customers is not being confined to the fringe of the substation territory but permeates the entire direct-current district. Only such customers are being changed as show a minimum cost of change-over, and the change-over, if extended in the future, will follow this general program. It is expected that some load on the premises of individual customers will remain on direct-current service for a number of years, even though the major load of the customer be transferred to alternating current.

The design, construction and extension program of 1923 is an extensive and arduous one and represents not so much fundamental change as an additional step in the maturing growth of the company. It has been the policy of the company to retain its existing standards and methods until modification should be clearly advisable and warranted and then to change in such manner as to give reasonable assurance of being in the line of development for some years to come. It is the expectation that the program for 1923 will give a large measure of flexibility and ease in making extensions and additions during the immediately succeeding years and that these extensions may be along lines standard not only with the Brooklyn Edison Company but in the industry as a whole.

In order to effect the many changes in the distribution system required in the program just described, marked developments have taken place in the application of mechanical appliances using air power for constructing services underground and in the use of trenching machines for the quick construction of duct excavations and the speedy repair of a street. All of these methods have shown not only a decreased unit cost but a decreased time of installation and better and quicker service.



NEW OFFICE BUILDING OF THE BROOKLYN EDISON COMPANY TO HOUSE ALL DEPARTMENTS

This growth of the company and the expansion of its various departments to take care of this growth have rendered it necessary during the past few years to rent considerable space and to establish many of its offices outside the present main office building. To remedy this condition the construction of a general office building has been authorized, and this is now in process of erection at the corner of Willoughby and Pearl Streets.

This building will be twelve stories in height, giving approximately 150,000 sq.ft. of available area for office purposes, and will be ready for occupancy in the early fall of this year. At that time all the departments will be brought together under one roof with the exception of certain of those concerned with construction, stores and distribution functions, for which it is planned to

GROWTH OF BROOKLYN EDISON COMPANY, INC., 1918-1923

| | Number or Amount 1918 | Number or Amount 1922 | Estimated Number or Amount Dec. 31, 1923 | Change 1922 Over 1921 | | Change 1918 to 1923, 1923 Estimated | |
|---|---|---|---|---|---|---|---|
| | | | | Number or Amount | Per Cent | Number or Amount | Per Cent |
| PROGRESS: | | | | | | | |
| Number of residential customers | 58,663 | 197,513 | 251,172 | 49,543 | 33.5 | 192,509 | 328.2 |
| Number of small atores and office customers | 30,002 | 47,596 | 60,383 | 4,721 | 11.5 | 30,381 | 101.3 |
| Number of wholesale customers | 7,189 | 9,417 | 9,636 | 842 | 7.3 | 2,447 | 34.0 |
| Total number of cuatomers | 95,854 | 254,526 | 321,191 | 55,106 | 46.6 | 225,337 | 235.1 |
| Estimated number of families in Brooklyn (basis of five) | 387,000 | 419,484 | 427,390 | 7,906 | 1.9 | 40,390 | 10.4 |
| Residential customera as a per cent of number of families | 15.2 | 47.1 | 58.8 | 11.1 | .... | 43.6 | ..... |
| OUTPUT: | | | | | | | |
| Station output, kw.-hr | 282,424,822 | 493,006,436 | 570,000,000 | 75,077,073 | 18.0 | 287,575,178 | 101.8 |
| Station capacity, kw | 104,750 | 189,500 | *189,500 | 16,000 | 9.2 | 84,750 | 80.9 |
| Maximum demand, kw | 86,000 | 164,495 | 188,681 | 26,695 | 19.4 | 102,681 | 119.4 |
| Pounds of coal per kw.-hr | 2.5968 | 1.8854 | 1.8854 | †0.2802 | †12.9 | †0.7114 | †27.4 |
| BUSINESS: | | | | | | | |
| Gross revenue | $8,854,302 | $19,326,489 | $23,000,000 | $2,811,391 | 17.0 | $14,145,689 | 159.7 |
| Gross revenue per dollar of investment, cents | 22 | 29 | 27 | 0 | 0 | 5 | 22.7 |
| Kw.-hr. sold per capita of Brooklyn | 113 | 181 | 210 | 23 | 14.5 | 97 | 85.8 |

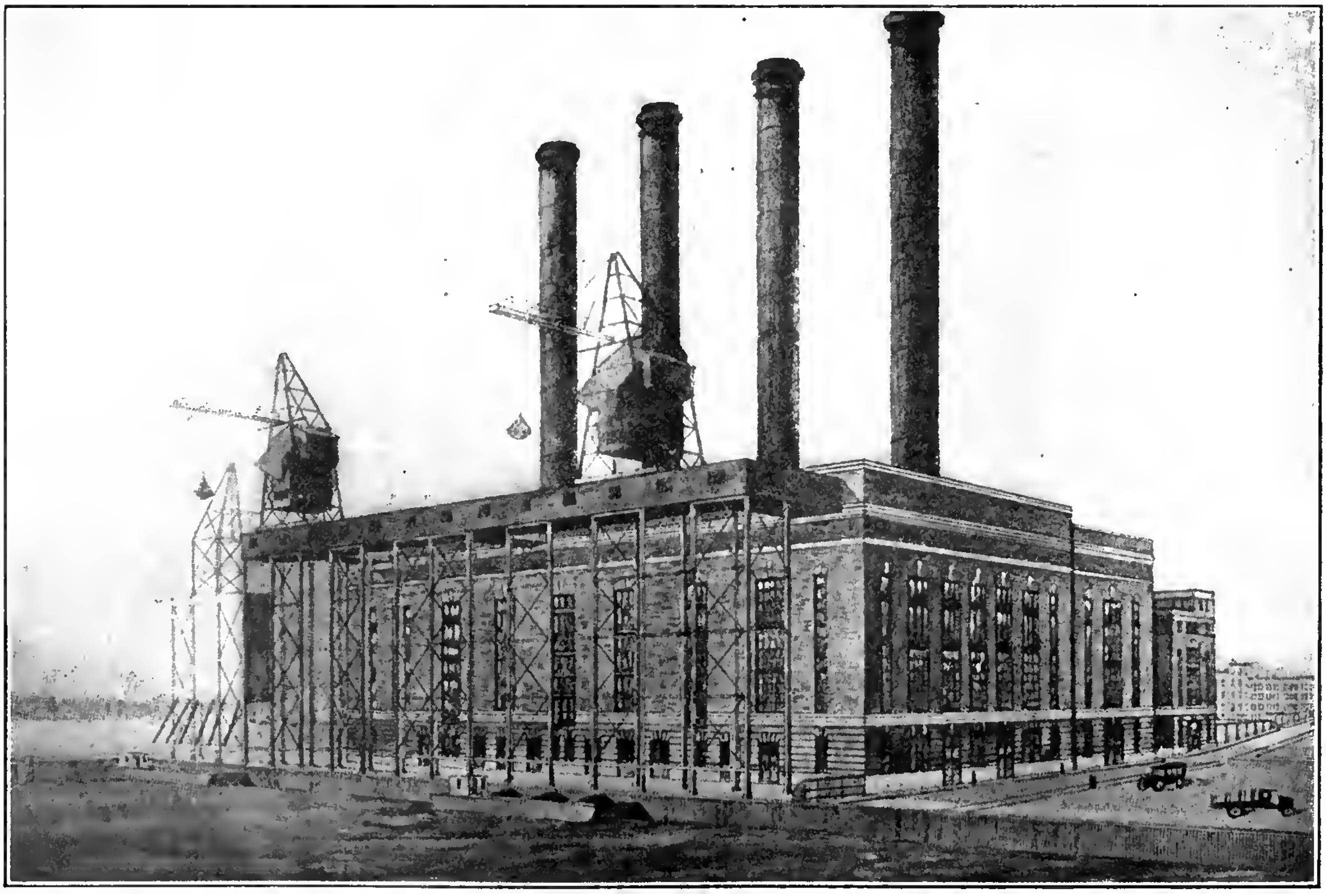
* Without Hudson Avenue. † Decrease.

erect a separate general service building at a convenient point in the near future. As the future growth of the company warrants, the general office building will be extended along Pearl Street as required.

Fuel oil will be used for generating the steam for heating the building. About 225,000 gal. of this oil will be used per year, and facilities for the storage of 35,000 gal. have been provided.

With all this increased and increasing business a strong and well-organized development is in operation for the continuous training and advantage of the company's personnel. These forces have increased from about two thousand in 1918 to nearly four thousand five hundred in 1923. The importance of surrounding this large number of individuals with proper conditions and opportunities is fully recognized, and the work is being carefully cultivated.

Within the past year a greatly improved educational training course has been established which has quadrupled the voluntary attendance as compared with previous years. This course, an employment division and a medical division are all in charge of the personnel bureau, which concerns itself entirely with the affairs of the employees in the company and their well-being. A medical examination is now required of all new employees, and free medical advice and regimen is open to all in the company. The employee and the job are studied with reference to each other, as well as the reward for excellence in the work, and an improved condition is beginning to show in the reduction of turnover. A self-governing club of the employees has been formed and is being developed by themselves with annual financial support from the company equal to what they raise by their own dues.

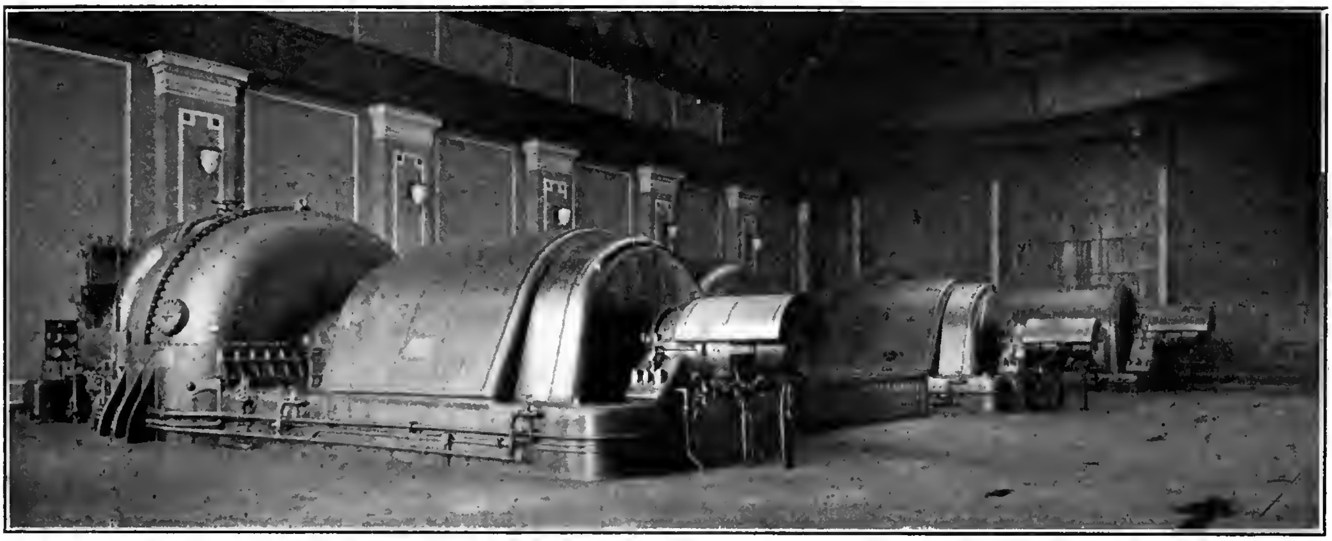


NEW HUDSON AVENUE GENERATING STATION AS IT WILL APPEAR WHEN COMPLETED

# Diversified Service in New Jersey

## Features of the Public Service Electric Company's System, Which Supplies Electricity to 202 Municipalities and Reaches the Large Industrial Centers Located Between New York and Philadelphia

By FARLEY OSGOOD
*Vice-President and General Manager of the Public Service Electric Company*



ESSEX STATION OF THE PUBLIC SERVICE ELECTRIC COMPANY

THE distinctive features that mark the operations of the Public Service Electric Company are, first, the wide extent of the territory served; second, the diversified characteristics of the communities within that territory, and, third, their rapid and continuing growth, both in population and industrially.

The area in which the company operates extends entirely across New Jersey, from the New York State line on the north to a point below Camden on the south and from the Hudson River and the waters adjoining New York Bay on the east to the Delaware River on the west. It embraces approximately 3,500 square miles, and electric service is supplied in twelve of the twenty-one counties of the state. In these counties live five out of every six of the state's inhabitants, while more than 90 per cent of the state's industrial activities are carried on therein. Probably no other electric utility in the nation serves so large a portion of the territory or of the population of the state in which it operates.

Two hundred and two different muncipalities, ranging in size from Newark, with more than 425,000 people, to communities of a few hundred, and including five cities with more than 100,000, five others with more than 50,000, ten others with more than 25,000, and sixteen others with more than 10,000, are supplied with light and power.

In their characteristics these communities are widely different. They range from great manufacturing centers, such as Newark, Jersey City, Paterson, Trenton, Perth Amboy and Camden, to purely residential towns of many classes, like Montclair, the Oranges and the hundreds of attractive suburbs in Bergen, Hudson, Essex and Union Counties in the northern section and in Burlington, Camden and Gloucester Counties to the south.

The social and industrial quality of the territory is to a large extent molded by its proximity to the great metropolitan cities of New York and Philadelphia. Sixty-six per cent of the total population served by Public Service live within 20 miles of the New York City Hall. Another 9 per cent live within 20 miles of the Philadelphia City Hall. Much of Public Service territory is within easier reach of the business center of New York than are many parts of New York itself.

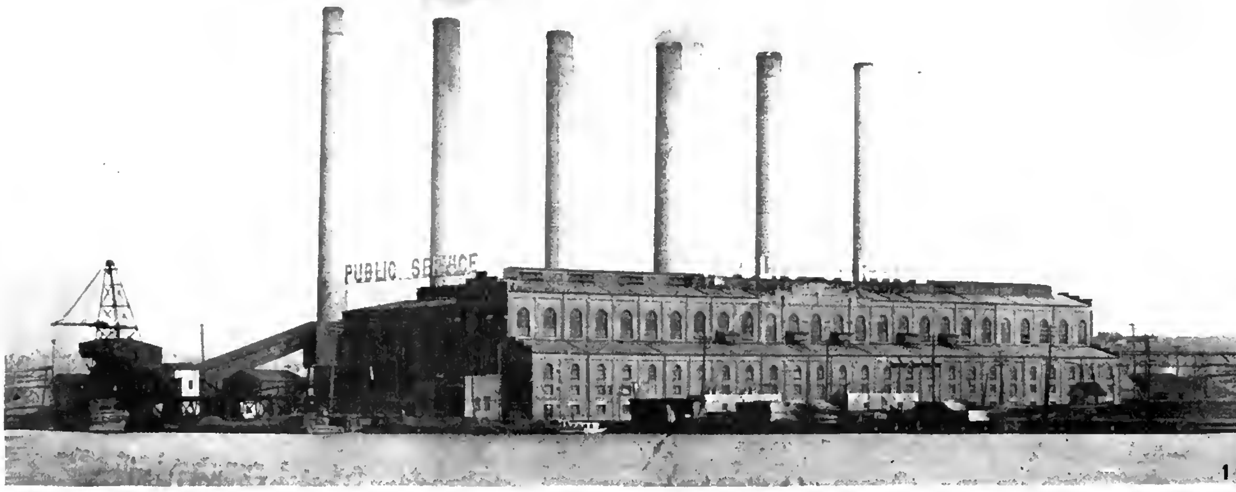
Nearly 75 per cent of the total population embraced in the twelve New Jersey counties served by the Public Service Electric Company live in six counties adjacent to New York City, although the combined area of the six is but 26 per cent of the total area served.

There is, then, in the northern part of the section of the state served by the company a territory about 20 miles in width, extending eastwardly from the banks of the Hudson and adjoining waters, with a high density of population; a territory extending 10 or 12 miles eastwardly from the Delaware with a lesser but still high density of population, and between them a territory of comparatively low density, and there is at the same time a concentration of industrial activities in these areas of dense population.

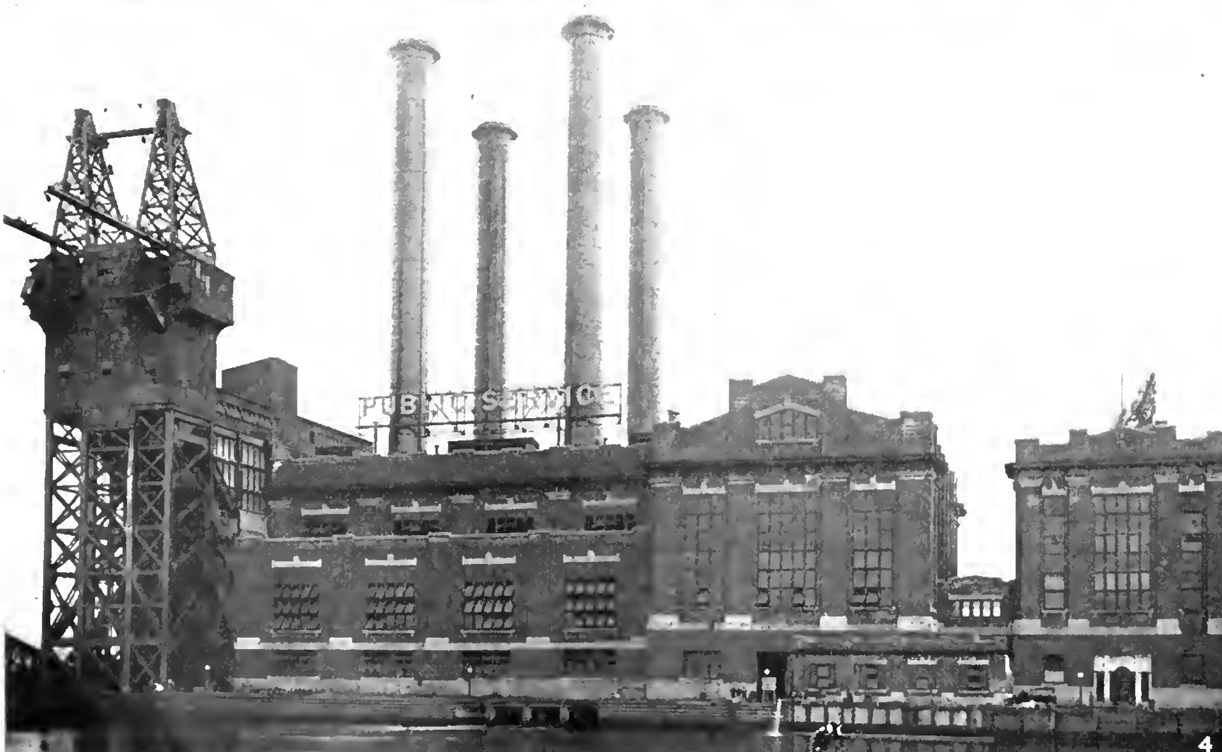
### ASTONISHING GROWTH OF POPULATION

The growth of all this community has been, and still is, remarkable. For the last twenty years there has been an accretion of population in the twelve counties served by the Public Service company of nearly 60,000 a year, and during this period the rate of population increase has been greater than that of New York City and much greater than that of Philadelphia.

## Marion and Essex Stations and Typical Branch Office and Substation





There has been an equally astonishing growth in manufacture. From the standpoint of the central-station man, this may best be expressed in terms of primary horsepower used in industry. The United States industrial census shows that between 1904 and 1919—the latest census was taken in the latter year—there was for New Jersey an increase of 87 per cent in the horsepower of industrial prime movers, and for the electric generators included in this total an increase of 297 per cent.

This increase came in very large part from extension in the sale of electric station energy, since we find from the census figures that while electric horsepower generated by the user increased 180 per cent in the ten years, that purchased by the user increased 852 per cent, or at the ratio of more than four to one.

The picture of the industrial and population conditions which is presented in the foregoing paragraphs is essential to an understanding of the operations of the company itself.

### Nearly a Billion Kilowatt-Hours a Year

In 1922 the company generated, to meet the light and power requirements, including those of the Public Service Railway Company, which operates a system embracing nearly 900 miles of track and which carried in 1922 some 410,000,000 passengers, 939,413,040 kw.-hr., with a load factor of approximately 44 per cent.

This total of nearly a billion kilowatt-hours was produced in fourteen generating stations. The conditions existing in the territory which has already been described indicate, in general, the distribution of load, and the general arrangement of both generation and distribution systems follows conditions of load.

The northern and central sections are very completely tied together, and energy generated in any of the stations in these sections can be distributed throughout the entire area. The southern section, extending from Princeton, near Trenton, to below Camden, is operated independently.

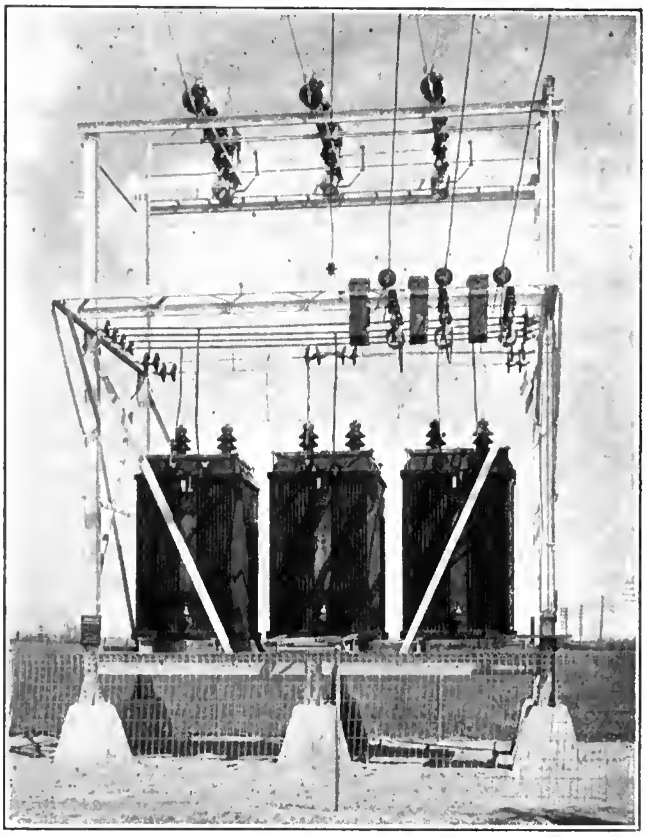
The total generating capacity of the fourteen stations is 290,900 kva., of which Essex station can furnish 85,000, Marion 90,500, Perth Amboy 22,500, and Burlington 37,500. Essex, Marion and Perth Amboy stations are in the northern and central sections. In addition, there are in this section stations of much less capacity and older design at Paterson, Secaucus, Edgewater, Hoboken, Crawford, Plainsboro, Red Bank and Newark.

The Burlington station is in the southern section and is reinforced by smaller stations at Trenton and Camden. To provide a further supply of energy when necessary, a tie with the lines of the Philadelphia Electric Company has recently been made at Camden.

The Essex station is the most modern of those operated by the company, and many of its engineering features are of interest. It is located at Point-No-Point on the Passaic River, about 2½ miles from the center of Newark, and contains at the present time one 35,000-kva. and two 25,000-kva. units, all operating at 13,200 volts, 60-cycle, three-phase.

The Passaic River at the point where this station is situated is of sufficient depth to permit coal and other material to be received by water. In addition, a spur from the Central Railroad of New Jersey provides for receipt of coal and supplies by rail. Coal received by water is handled by means of two towers erected on docks in front of the plant and capable of handling from barges 200 tons of coal per hour. Coal received by rail is handled by a system of horizontal and inclined belts and a skip hoist with a capacity of 90 tons an hour. Coal from both barges and cars is carried to bunkers at the top of the building adjacent to the boiler house. A bunker, of a capacity varying from 1,700 tons to 2,400 tons, is provided for each eight boilers. Each has a bottom dump, and coal is carried from bunker to boiler in weighing lorry cranes.

There are at present sixteen 1,370-hp. boilers, operating under forced and induced draft and equipped with modern underfeed stokers. Twelve of the sixteen are equipped with economizers. The entire switching equipment is of the remote-control type and with the bus layout is flexible enough to prevent interruptions to service as the result of switch or bus failures. An electrically operated load dispatcher's board indicates diagrammatically the exact load conditions in the system network of which Essex is a part and is of great value to the load dispatchers under the conditions of complicated and frequent operating changes that prevail.

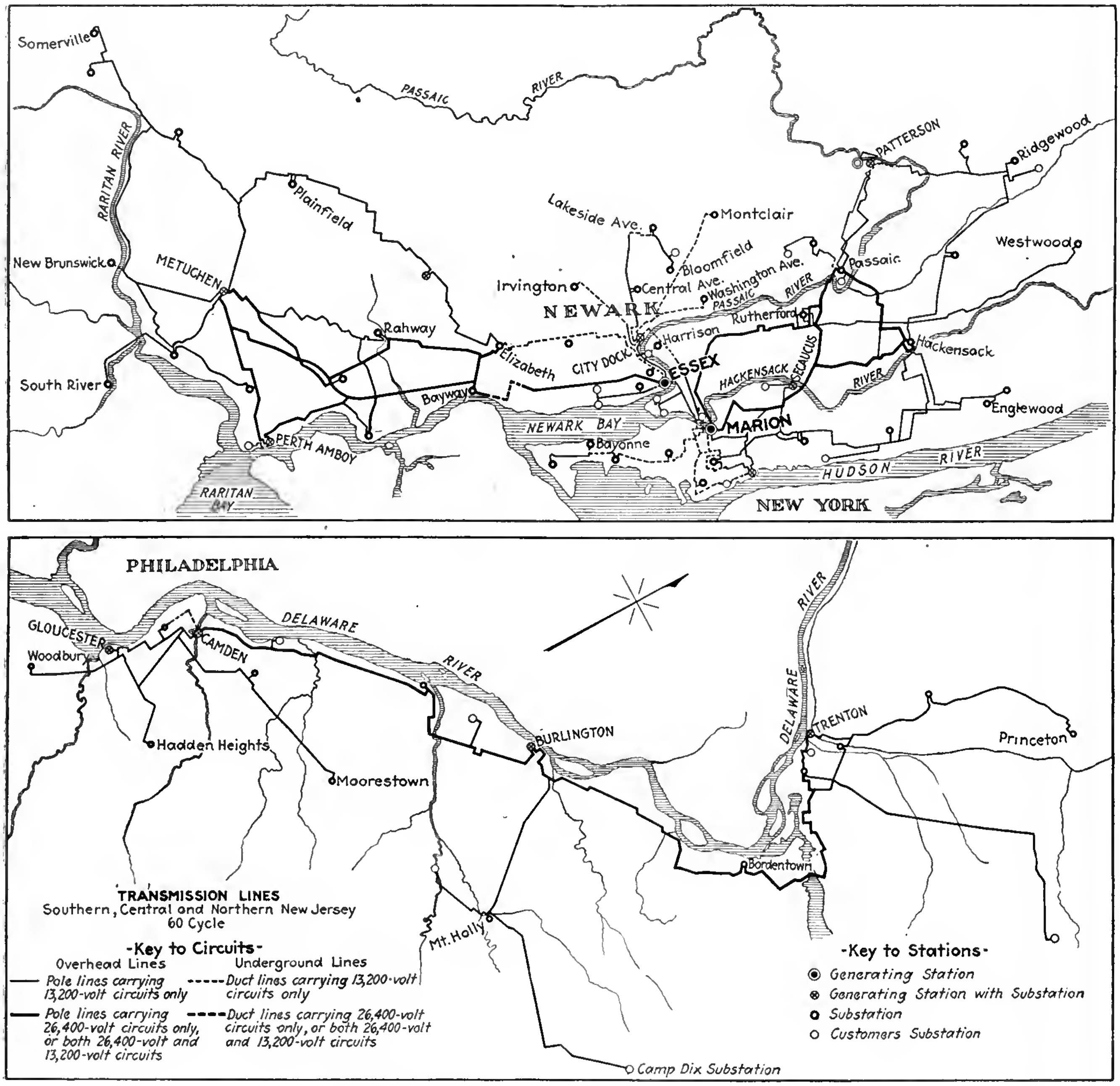


OUTDOOR SUBSTATION PUBLIC SERVICE ELECTRIC COMPANY

The architectural design of this station, both interior and exterior, is pleasing, the turbine room being a welcome departure from usual engine-room conditions.

Transmission from Essex station is, for near-by substations and plants of large consumers, at 13,200 volts. To more remote points it is, in order to cut down line losses, at 26,400 volts.

Extensions and improvements at the Essex station now under way will increase its capacity to 190,900 kva. An addition to the station is now being completed to house three 35,300-kva. turbo-generators, two of which will be in service during the summer of this year and the third in March, 1924. The boiler plant is at the same time being increased by eight 1,800-hp. boilers.




MAP OF TERRITORY SERVED BY PUBLIC SERVICE ELECTRIC COMPANY

The company has recently purchased twenty acres of land adjoining its station property, on which a high-tension substation is to be erected. This additional space will also be used to increase coal-storage capacity, a spur from the Pennsylvania Railroad permitting the use of the 600 coal cars now owned by the company for transportation of coal from the mines directly to the station.

The Marion station is built on the banks of the Hackensack River, on the outskirts of Jersey City. Its largest unit at the present time is a 20,000-kva. horizontal machine, constituting a part of the 60-cycle capacity. Of the station's total capacity of 90,500 kva., 28,000 kva. is furnished by 25-cycle generators furnishing energy for railway use.

The station's boiler plant consists of fifty 600-hp. boilers, thirty of which are equipped with Roney and twenty with underfeed stokers. Coal, from both barge and cars, is handled by means of a gantry crane and horizontal and inclined belt conveyors and by the use of this apparatus may be placed either in overhead bunkers or in storage under the crane.

Extensions and improvements at Marion now in process include the installation of a new 25,000-kva., 60-cycle turbo-generator, a 12,500-kva., 60-25-cycle frequency changer to be used in connection with the 25-cycle load, and a new switch house to take care of the increased number of feeders going out from the station.

The Perth Amboy station, on the Raritan River at Perth Amboy, has a generating capacity of 22,500 kva. in horizontal turbo-generators, with eight 600-hp. boilers fired with chain-grate stokers. Coal is received by water and by means of an unloading tower and an inclined belt conveyor is unloaded into overhead bunkers. The Perth Amboy and Essex stations are tied together by a 26,400-volt transmission line.

The Burlington station is at Burlington on the Delaware River, at about equal distance from Trenton and Camden. It has a capacity of 37,500 kva. in three

horizontal turbo-generators of 12,500 kva. capacity each. Its eight 600-hp. and two 1,500-hp. boilers are fired by underfeed stokers. Coal is received at this station by rail and handled by a skip hoist and inclined belts.

The 1922 peak load for the company's generating stations came in December, when 249,778 kw. was carried.

### THE TRANSMISSION SYSTEM

The company's transmission system consists of approximately 957 miles of line, operating in part at 13,200 volts and in part at 26,400 volts, interconnecting the fourteen generating stations and the seventy substations of the company and supplying energy to such large customer installations as are fed directly from the generating stations. The seventy substations have a static transformer capacity of 572,875 kva. and a rotary converter capacity of 120,884 kw., exclusive of that of street-lighting transformers through which are fed 50,500 street lamps.

In the large cities a considerable length of underground cable, both 13,200-volt and 26,400-volt, is in use, while at many points in the transmission system where conditions do not warrant underground construction and where open wire-circuits cannot be used to advantage aërial cable, the cable being of the same type used underground, has been installed with exceptionally good results, interruptions to service having proved negligible.

The system's substations operate at 13,200 volts, and where it is necessary to step down energy from the 26,400-volt lines the company's practice is to install an outdoor type of substation. A typical station of this class is the Bayway substation in the factory district of Elizabethport. Here are installed two 3,750-kva. water-cooled units placed on concrete foundations immediately under the high-voltage buses. High-tension oil switches, aluminum-cell arresters and buses are all carried on steel framework set on concrete foundations out of doors.

In most cases the transformers step down the energy to 2,400 volts on the secondary side, automatic feed regulators, a switchboard, a 2,400-volt double bus and 2,400 electrically operated oil switches being housed indoors. In cases where it is desired to have the transmission transformers deliver energy to station and substation buses connected with incoming and outgoing feeders operating at 13,200 volts the transformation is at the ratio of two to one, giving a secondary voltage of 13,200. A large number of the substations are operated with a primary voltage of 13,200, stepped down to 2,400.

Until 1922 the company's standard of distribution was 2,400-volt, two-phase, four-wire service to customers being furnished at 2,400 volts, or through transformers at 220/110 volts, three-wire, except in the case of about twenty large users, supplied with three-phase service at 13,200 volts or 26,400 volts. In 1922, however, a new standard was adopted, and for a large part of the system a change was made to three-phase, four-wire, with 4,150 volts between phase wires and 2,400 volts to neutral wires, which are in all cases solidly grounded at the substation. The change involved much work, both in the substations and in installations of line transformers, but resulted in an increase of distribution line capacity of about one-half and a reduction in line loss of 67 per cent.

All of the company's three-phase and about 85 per cent of its single and two-phase circuits are equipped with automatic potential regulators, installed in substations, to assure adequate and uniform voltage to users.

### A DECADE'S GROWTH IN DEMAND

Increase in demand has during the last ten years been little short of astounding. As was to be expected in a community of the character, war industries greatly increased industrial requirements both for power and light. Conditions following the war slackened in some degree the demand, which has, however, during the last sixteen months been renewed to a greater degree than ever before.

In 1910 the per capita consumption of energy for other than street-railway purposes in the territory amounted to 46.5 kw.-hr. per year, and the company had in service a meter for each 30.9 inhabitants. In 1922 per capita consumption was 205.2 and a meter was in service for each 7.5 inhabitants. In 1910 the kilowatt-hours sold, exclusive of energy generated for street-railway purposes, amounted to 89,742,689 and meters in service were 63,186. In 1922 kilowatt-hours sold amounted to 534,465,033 and meters in service to 344,309—a gain of 495 per cent in energy sold and of 445 per cent in number of meters in service. In the first four months of this year the gain in meters has broken all records for the same season of the year.

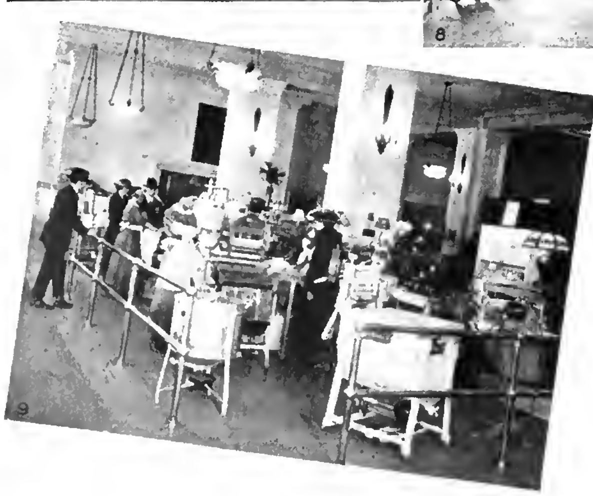
The development of the section of New Jersey served by the company is going on with increased momentum. Within a short time New York and New Jersey will be connected by a tunnel which will greatly increase ease of communication. A bridge to connect Philadelphia and Camden is under construction, and its completion will make the greater residential and industrial development of that portion of New Jersey surrounding Camden a certainty. The two states are now at work on the development of the port of New York, which lies largely within New Jersey waters. The port of Newark is already making a successful bid for increased business, while to further close the gap between New York and New Jersey projects for bridging the Hudson have gained substantial backing.

A survey of power requirements in the Public Service Electric Company's territory indicates for a number of years to come an increase in load demand upon the company of at least 30,000 kw. a year.

The company is laying its plans to keep pace with, or proceed a little in advance of, the needs of its territory. Within the last few months the Public Service Electric Power Company was organized by the Public Service Corporation of New Jersey, the parent company of the Public Service group of utilities, to construct and lease for 999 years to the Public Service Electric Company a new generating station with an initial capacity of 207,000 kva., to be enlarged within a comparatively few years to more than double this capacity. Within a short time construction work on this new plant will begin. The five units which will constitute the first installation will be two 45,000-kva. and three 39,000-kva. turbo-generators, all 13,200-volt, three-phase, 60-cycle.

The Public Service Electric Company feels that the industry is entering upon a phase of development in the use of electricity that is to be of stupendous importance both to the people of the country and to those within the industry itself, and that what is taking place in New Jersey is indicative of a general movement.

## Office Building and Showrooms of the New York Edison Company



THE showrooms of the New York Edison Company are located at advantageous points throughout the territory to afford the greatest convenience to customers: 1 and 8—Tremont Avenue display room, in the Bronx; 2—Bureau of Home Economics on the third floor at 124 West Forty-second Street; 3—Showroom on 125th Street; 4—Showroom on 149th Street near Third Avenue in the Bronx; 5—General office building, Fifteenth Street and Irving Place; 6—Appliance display room at 124 West Forty-second Street; 7—East Eighty-sixth Street office; 9 and 10—Showroom at Fifteenth Street and Irving Place.

# Metropolitan Merchandising

## A Review of the Policies Adopted and the Recent Activities in Selling Appliances Carried on by the Various Central-Station Companies Operating in the New York Metropolitan District

THERE is an exceedingly interesting situation in the metropolitan district as regards the merchandising of electrical appliances by the central-station companies. There are five electric light and power companies in or about New York City that may logically be considered in the group—the New York Edison Company and the United Electric Light & Power Company on Manhattan Island and in the Bronx, the Brooklyn Edison Company in Brooklyn, the New York & Queens Electric Light & Power Company in Long Island City, and across the Hudson River, with headquarters in Newark, the Public Service Electric Company. Each is confronted with conditions rather different from those confronting the others, and there is a considerable diversity of merchandising policy between them.

The Brooklyn Edison Company and the Public Service Electric Company are actively engaged in merchandising appliances for profit. The United Electric Light & Power Company is also selling appliances energetically, but profit is made a minor consideration. The New York & Queens Electric Light & Power Company merchandises appliances on a profit-making basis in its salesrooms, but is devoting most of its attention now to wiring old houses and obtaining customers in a very rapidly growing territory.

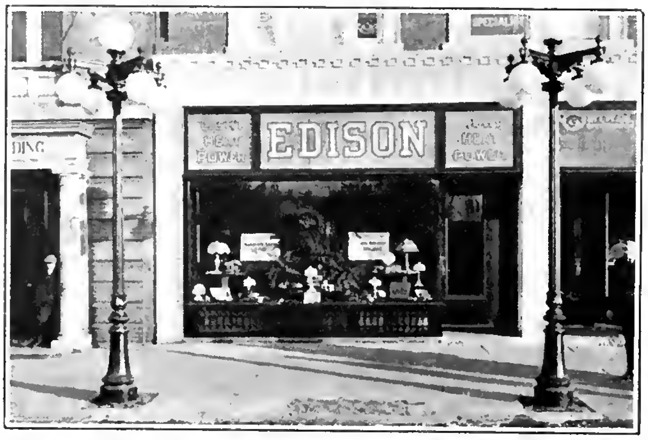
The New York Edison Company for many years has maintained display rooms and actively demonstrated appliances to the public, but for some time has not engaged in any merchandising activity. Recently, however, a new policy has been inaugurated under which household appliances of all kinds are being sold out of the Edison shops on deferred payments, charged with the monthly service bills. This merchandising, however, is being done in behalf of the manufacturer with consigned stock and does not pass through the books of the Edison company. A detailed statement of the Edison company's present attitude and policy toward merchandising by Arthur Williams, general commercial manager, appears on page 1211 of this issue.

### NEW YORK EDISON POLICY

The Edison shops and the Edison policy on merchandising will be of particular interest to utility men attending the convention. In the early days of central-station commercial activity the New York Edison Company sold appliances just as it sold power, lighting, signs and other applications of the service. With the rapid growth of the business and the increase in the appliance line, the Edison company withdrew from the merchandising field and turned over the entire function of retailing energy-consuming appliances to the local contractors and dealers. Since then the company has maintained its showrooms for display and demonstration purposes only. The devices have been shown but not sold, and customers have been referred to the dealers or manufacturers and orders have been taken on memorandum for delivery by the manufacturer or dealer.

APPLIANCE SALESROOMS OF THE UNITED ELECTRIC LIGHT & POWER COMPANY. LEFT, SHOWROOM ON FIFTH FLOOR 130 EAST FIFTEENTH STREET. RIGHT, SHOWROOM AT EIGHTY-NINTH STREET AND BROADWAY

The Edison company therefore has stood before the industry as probably the foremost exponent of the policy opposed to the merchandising of appliances by the utility. However, the American people have undoubtedly adopted the easy-payment plan as the method by which they prefer to purchase household equipment, and this policy of the Edison company has naturally made it harder for its customers to acquire electrical appliances than it is for customers of another utility that sells on deferred payments, charged with the service bills. A few months ago therefore the Edison company informed its customers and began to advertise in its stores that appliances could be purchased by consumers for a small cash payment and the balance in deferred payments monthly. Deliveries are made by the manufacturer or the dealer by whom the device purchased has been consigned, except in urgent cases where the customer wishes to take the appliance away immediately. To




ONE OF THE BROOKLYN EDISON COMPANY'S SALESROOMS

provide for such cases a small consigned stock is kept on hand.

The New York Edison Company supports the appliance market with generous advertising, displays, demonstrations and lectures, and it plays the major part in an annual electric show. The company operates a main salesroom at its general offices and has a number of branch showrooms throughout the city.

### UNITED COMPANY'S POLICY

The United Electric Light & Power Company serves 75,000 residential consumers in the uptown section of New York, with a very large proportion of apartment-house customers. The company maintains three salesrooms, twelve inside appliance salesladies and twenty outside appliance salesmen, and operates two wagon crews of eight men each. About $350,000 in appliances has been sold in the last twelve months. The company advertises extensively in the newspapers, direct by mail and on billboards, many of these displays featuring electrically operated clocks to attract attention. It takes active part in the annual electrical show and does much demonstration work.

The chief merchandising effort is made through monthly sales in which a particular appliance is featured at special inducements. Advertising matter is sent directly by mail to all customers, with an easy-payment

OFFICE OF THE NEW YORK & QUEENS ELECTRIC LIGHT & POWER COMPANY AT FLUSHING, L. I.

offer, and the wagon crew sells from house to house, using the special appliance of the month as a leader. A recent survey of all residences served by the United company led to a very energetic drive to fill up the empty sockets on the lines, and this greatly increased lamp sales.

### BROOKLYN EDISON ACTIVITIES

The Brooklyn Edison Company has been one of the most active of the metropolitan central stations in the sale of merchandise and in the last two years has increased its retail appliance business greatly. The company operates a main appliance shop at its general offices and is now erecting a very handsome new building, the conspicuous feature of which will be a large appliance store. There are also seven branch offices with salesrooms.

In 1921 the Brooklyn company sold nearly 25,000 appliances. Very satisfactory results were received from the house-to-house canvass by crews of salesmen working on commission. For several years it has been the practice of this company to conduct a special sale each month, featuring a specific appliance. This device has often been a special purchase for the sale, but has been sold at list price at a profit, and the privilege is

VIEW IN THE APPLIANCE SALESROOM OF THE PUBLIC SERVICE ELECTRIC COMPANY, NEWARK, N. J.

extended to the local dealers to take orders for this device at the same price and at a profit.

Remarkable results have been achieved in Brooklyn through the operating of a wagon crew. Forty men work from one wagon, carrying appliance samples to assigned blocks, returning to the wagon when the sale is made for a new sample. Post cards are received through the advertising, and these leads are used in the wagon selling. For each sale made on "cold canvass" the salesman receives a special assignment to a block from which a post card has been received. The location of this lead is not told, however, and the salesman canvasses the block until he finds it. These men, calling at the customers' homes, have made 40 per cent of all sewing-machine sales, an even greater percentage of vacuum-cleaner sales, and virtually 90 per cent of all clothes-washer sales. They work by the day on salary and commission.

The Brooklyn company last June conducted a sewing-machine school that proved an interesting innovation. A course of four lessons was given, and 153 pupils completed the course. There were also eighteen visitors, four of whom purchased electric sewing machines. In-

struction was given to 52 per cent of the women who bought sewing machines last year.

NEW YORK AND QUEENS POLICY

The New York & Queens Electric Light & Power Company maintains an appliance saleroom in each of its offices in Long Island City, Jamaica, Flushing, Bayside and Ridgewood. All merchandise is sold at a profit and mostly for cash. Only a few outside salesmen are employed by the company, but the manufacturers of standard appliances all carry on an active campaign resulting in large aggregate sales to its consumers, who have increased rapidly in the past five years. The company, however, plans as it approaches more nearly to the so-called saturation point to expand its merchandising activity and materially enlarge its sales force.

MERCHANDISING IN NEWARK

The Newark territory of the Public Service Electric Company is essentially a part of the great metropolitan district of New York. The company operates also throughout a large part of the State of New Jersey, which has necessitated a somewhat different commercial organization than that of the companies already discussed. It comprises a number of divisions in which there are district offices in all the important communities, with salesrooms in which active merchandising is carried on. A great deal of attention has been given by this company to the development of appliance business, and this is one of its principal commercial interests. There are eighty-seven combination salesmen on the staff selling both electric and gas appliances, fifty-one special appliance representatives selling only vacuum cleaners and washing machines, and thirty-nine people employed in selling in the various display rooms.

The Public Service Electric Company has made a notable success in campaign sales. In 1922 a special drive sold 22,000 flatirons, and the sales so far this year indicate a total of 25,000 for 1923. Last year the company sold 7,150 vacuum cleaners, and it has set the bogey for 10,000 cleaners for 1923, with 3,925 gone by April 30. A special percolator sale that began in April disposed of 196 in the first three weeks. In all, 72,639 appliances were sold in the last year.

These sales are all very carefully planned. A general outline of the new business plans goes out to all

## A Statement of The New York Edison Company's Merchandising Policy

**THE news that electrical appliances are now being sold on the deferred-payment plan in the showrooms of the New York Edison Company has naturally been received with great interest by electrical men, inasmuch as this company has long been looked upon as opposed to the sale of merchandise by the central station. The ELECTRICAL WORLD, therefore, invited Arthur Williams, general commercial manager of The New York Edison Company, to submit a statement of his company's policy on appliance merchandising for publication at this convention time. Mr. Williams says:**

In the merchandising of electrical appliances the New York Edison Company continues, in principle, a policy adopted a number of years ago when the company definitely gave up contracting for installations and the sale of fixtures, motors and other appliances. It did this in the belief that in opening the New York field to the electrical contractor and to manufacturers of fixtures and appliances, and thereby eliminating itself as an element of competition, it was serving not only its own interests and those of the general public, but also the larger interests of the electrical industry, broadly speaking. To the company it seemed that it should devote itself to the generation and distribution of electrical energy as its principal merchandising effort. I believe there has been no reason to regret taking this step, although at the time it appeared almost revolutionary, inasmuch as it was apparently eliminating a legitimate activity and deprived the company of large revenue, both existing and prospective.

But coincident with the adoption of this policy, the company recognized that it must continue its best endeavors to create a permanent demand for electrical energy on the part of the public in as many different directions as possible. Therefore it employed the best available agent of publicity—the public press—meanwhile not neglecting the very wide range of other advertising methods in the way of text and illustration—to inform the public of the advantages of electric service and of the constantly increasing appliances for its economic utilization.

As a matter of fact, what may be called the company's intensive merchandising effort is concentrated upon three points: First, of course, the providing of the best service attainable at the lowest possible prices; second, the constant effort, in the light of the most approved forms of publicity, to create a desire for electrical service and to see to it that means of satisfying this desire are adequate and conveniently placed; third, the maintenance of a competent organization to retain customers once secured and prepared to meet any question indicating a feeling of dissatisfaction with the company's service in such manner that the customer shall continue satisfied with our service. One of the results which we attribute to our policy of concentrating our merchandising efforts upon the points just outlined is the establishment of approximately 2,500 contracting and merchandising dealers in New York City. The number increases annually, and the character of the service rendered, the premises where exhibits are on display and the exhibits themselves are all constantly improving.

It has been urged that the New York Edison Company, following the example of many other central-station organizations, should abandon its policy of encouraging independent agencies and engage in direct merchandising. Undoubtedly, a very wide development along such lines could be attained. But activity of that character would require that the company confine its selling efforts to one, or at most a very few, types of appliances or apparatus. The company feels that it should always be helpful in the merchandising of all approved appliances.

In the company's showrooms, at the moment, there are on exhibition no fewer than twenty-four types of vacuum cleaners from as many different manufacturers; there are twenty-three types of washing machines and twenty-one types of electric irons—to mention only three of a very long list of appliances on display. During the past month sales have been consummated in the interest of seventy-four different manufacturers or agents who are making use of the facilities of the company's showrooms in order to reach the New York public.

One of the principal obstacles in the use of electric service is the initial cost of equipment and appliances. For many years the company has advanced funds which prospective customers require for wiring their premises, to be repaid on the installment plan. Recently this privilege has been extended to purchasers of new household appliances. In the case of appliances, however, credit is confined to customers in good standing. Today, therefore, no one need deprive himself of either electric service or any kind of household equipment on the ground of first cost. Here again, as when the purchaser himself makes full and immediate payment, the customer chooses what he wishes to use, the company receives and transmits his order to the manufacturer or agent and, upon satisfactory fulfillment of the order, pays the bill, being paid in turn by the customer.

Had not the present course of independent merchandising development seemed more desirable from the standpoint of the public at large, the customers of the company and the company itself, it surely would have been changed. In view of the fact that the company desires to follow such policies as best serve all, the present methods will be changed should others be found more useful and effective in carrying out the purpose of attaining the ideals which have been established as standards of possible attainment in our company's branch of New York's public utility service.

ARTHUR WILLIAMS,
*General Commercial Manager,*
*The New York Edison Company.*

offices three months before the drive starts, and special meetings are held to organize friendly competition between divisions. All the campaign work is backed up strongly with newspaper and direct-by-mail advertising, which is written after the style of department-store and mail-order copy. During one vacuum-cleaner sale a broadside folder went to 150,000 customers. But results have been gained for this company by specialization, and a separate crew is now being organized to sell domestic refrigeration. Other special crews are planned for other large appliances that are stiil in the pioneering stage, such as the fireless cooker, the ironing machine and the dishwasher. These crews will be put to work as the demands for these devices justify it.

In short, the general aspect of central-station appliance merchandising among the companies serving the New York metropolitan district is typical of the appliance situation throughout the industry. Steadily increasing attention is being given to the development of the residence appliance load, and in order to build up household utilization of electric service for labor saving, cooking and comfort the light and power companies have found it necessary to engage in the retail sale of electrical merchandise on a large scale. The success which has attended this work, especially where the business has been put on a strictly merchandising basis, has been such that the scale of the operations has steadily increased and indicates a continued expansion.

# Electric Trucks in Greater New York

## A Record of Remarkable Progress in the Introduction of Battery-Driven Vehicles —What the Rapid Growth of this Movement Means in Augmenting the Central Station Load

TRANSPORTATION in New York City has become a problem to which both city officials and engineers are devoting a great deal of attention, and the electric vehicle bids fair to play no small part in speeding up deliveries and relieving to a marked degree the congestion of the streets. The adaptability of the "electric" to the short-haul, frequent-stop city delivery makes it peculiarly suitable to the prevailing conditions, and although the number of electric trucks now in use is but a small percentage of the total, they are each year coming into more and more general use by business houses that make a careful analysis of their costs of delivery.

The accompanying tabulation, showing that there are now in use in New York City a total of four thousand electric vehicles, also shows the various kinds of business which have found it economical to adopt electrics for their delivery service.

### New York Edison Company a Pioneer

The New York Edison Company has long been an active advocate of the electric vehicle and believes in setting an example in this respect, for it uses in its own service a fleet of 121 electric trucks of all sizes. In the promotion of this business the company has organized an electric vehicle bureau in which four men are engaged, in co-operation with the manufacturers, selling trucks. In 1922 the company sent out more than one hundred thousand sales letters, and the company's records show that one thousand electric vehicles have been sold in the metropolitan district during the last two years.

NUMBER OF ELECTRIC TRUCKS USED IN NEW YORK CITY

| | |
|---|---|
| Department stores (seventeen) | 383 |
| Bakers (fourteen) | 479 |
| Bottling companies (twenty-nine) | 561 |
| American Railway Express | 400 |
| New York Edison Company | 121 |
| Eleto Company (department-store delivery) | 54 |
| Consolidated Gas Company | 52 |
| Westcott Express Company | 51 |
| Bush Terminal | 36 |
| United Electric Light & Power Company | 31 |
| New York Transfer Company | 29 |
| National Biscuit Company | 28 |
| Horn & Hardart (restaurants) | 27 |
| H. J. Heinz Company | 26 |
| Pine Hill Crystal Spring Water Company | 23 |
| All others | 1,699 |
| Total | 4,000 |

ELECTRIC TRUCK AND DERRICK USED BY THE EDISON COMPANY TO HANDLE CABLE REELS AND FOR OTHER HEAVY WORK

There are now in operation in New York eight electric garages, housing 275 cars and consuming a half million kilowatt-hours annually, netting the central-station companies more income than they receive from four thousand houses, or as many houses as there would be along 30 miles of street. What the use of the electric vehicle means in energy consumption in New York City is shown by the fact that in 1922 energy in excess of 4,000,000 kw.-hr. was used in the charging of vehicle batteries. Sales of electric trucks during the first three months of 1923 totaled 225, as against only sixty-four during the same period a year ago.

Express and trucking companies, department stores, laundries and provision dealers have been among the largest buyers of electric vehicles. Typical instances

of the adoption of the "electric" are interesting as they show the tendency to use them rather than gasoline or the horse-drawn vehicle. The Pilgrim Laundry, which is one of the largest laundries in Brooklyn, has completely motorized its delivery. It now owns thirty-eight electric and only four gasoline cars, or better than 90 per cent of its trucks are electric.

The American Railway Express Company is the largest single user of electric vehicles in Greater New York, and 83 per cent of all its motor vehicles now purchased for the metropolitan district are electrically propelled. This company is working to a virtually complete electrification of all its trucks used in the congested districts which prevail in a city such as New York.

A large baking company in Newark, N. J., last winter placed an order for a fleet of 177 electric trucks and forthwith advertised for sale all of its gasoline and horse-drawn equipment. It has been the experience of this company that the electric vehicle is not only much cheaper to operate and maintain, but that it can cover a given route much faster than a gasoline truck, owing to the fact that in congested traffic it can start and stop quicker than the other car. This observation has held true even on the longest routes with the less frequent stops.

### Obstacles Disappearing

Many conditions which heretofore have been detrimental to or have affected adversely the sale and use of the electric vehicle have been overcome within the last year. With the development of the high-speed gasoline truck it was felt for a time that the "electric" could scarcely compete with it, but this very characteristic has proved to be more of a hindrance than a help in cities and the electric truck is now coming into its own.

Another obstacle which has been overcome is the lack of information and data on the operation and maintenance of electric vehicles. The organization of an electric vehicle school in New York last winter was a big step forward in making this much-needed knowledge about the electric truck available. The popularity of the school may be judged by the fact that it had an enrollment of three hundred, whereas only about forty men had been expected to attend. It was conducted in conjunction with the Vehicle Bureau of the National Electric Light Association, and most of those who attended were operators and maintenance men sent by vehicle owners. A number came from other central-station companies.

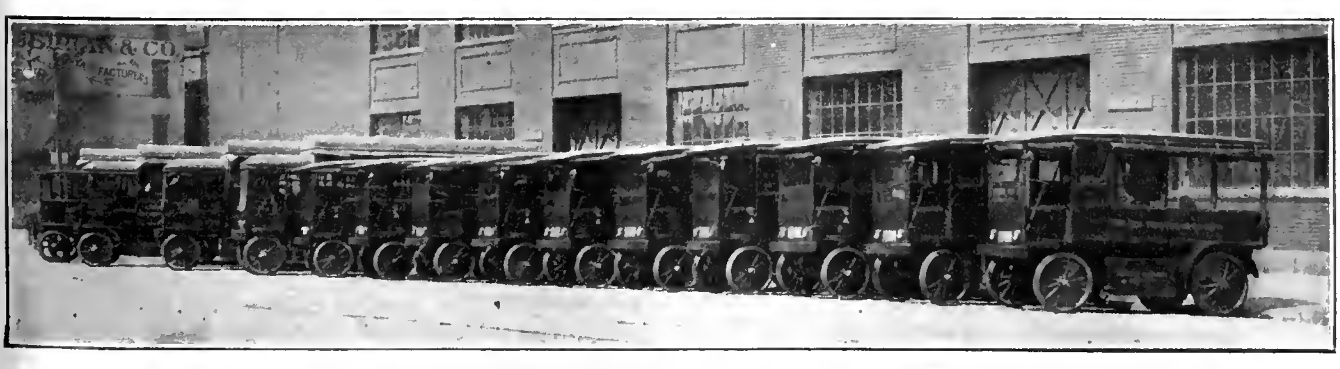
The central-station man himself has been slow to push the electric vehicle, although he has recognized its possibilities as a load builder. That this attitude is changing rapidly is seen in the fact that in the last twelve months central stations in the metropolitan district have bought a hundred electric trucks and that fifteen central stations in the United States have bought a total of 250 trucks.

INDUSTRIAL ELECTRIC VEHICLE SHOW IN PUBLIC SERVICE ELECTRIC COMPANY'S SHOWROOM, NEWARK

### Vast Market Ahead

While it is becoming increasingly evident that the electric vehicle will play an active part in the solution of New York City's transportation problem, its use is still in its comparative infancy and there is plenty of room for growth. A recent survey by the engineers of the New York Port Authority disclosed that 72.7 per cent of the commercial vehicles used in New York City are still horse-drawn, 25.8 per cent are gasoline trucks and only 1.5 per cent are electric. There is no doubt that all of the horse-drawn vehicles could be replaced economically by electric vehicles or that a large part of the work done by gasoline trucks could be profitably and more economically done by the "electric." This means that from 80 to 85 per cent of the transportation of goods in New York City streets should fall to the lot of electric vehicles.

With the additional electric vehicles which have been sold this year, The New York Edison Company estimates that approximately 10 per cent of the trucks in use in New York City and surrounding territory are of that kind. Taking the entire country over, only 2 per cent of the total number of trucks in use are electric. There should be, it is conservatively estimated, 200,000 electric vehicles in the United States, averaging an energy consumption of 6,000 kw.-hr. per truck per year. This means that here alone is a potential market for the central-station companies to sell 1,200,000,000 kw.-hr. annually by the proper development of the vehicle load, nearly all of which would come at off-peak hours and at a very profitable rate per kilowatt-hour.



A FEW OF THE ELECTRIC TRUCKS USED BY THE NEW YORK EDISON COMPANY

# Power Development in New York City

## Large Buildings Housing Many Small Manufacturers Create Unusual Conditions—Refrigeration Load Has Grown Rapidly—Private Plants Are Fast Giving Way to Service from the Central-Station Companies

BECAUSE it is primarily a commercial and financial center, Greater New York presents a power problem to the central-station companies that differs in many respects from that found in cities where industrial activity is more predominant. As might be expected in a city of these characteristics, particularly on Manhattan Island, the greater number of important electrical installations are in office buildings, commercial structures, hotels, department stores, apartment buildings, places of amusement and so forth. The metropolitan district, however, must be considered as including not only Manhattan, the Bronx and Brooklyn, but Queens County and the contiguous territory across the Hudson River in New Jersey as well, for it is to the two latter territories that the growing manufacturer of New York City must turn to find room for industrial expansion, and it is there that typical industrial power applications in the usually accepted sense are developing.

The New York Edison Company supplies energy in Manhattan Island from the Battery to 136th Street and in the greater part of the Bronx. With the exception of a comparatively few customers supplied under high-tension contracts, the service in Manhattan is direct current. In the Bronx it is alternating current.

Among some of the large primary power customers which are supplied by The New York Edison Company are the Third Avenue Railway, the Hudson & Manhattan Railroad Company and several plants of the American Ice Company, one of which has a demand of 1,828 kw. during the summer months. Nearly all of the larger refrigerating businesses have been taken over by the company since 1916, when it became evident to the ice manufacturers that the use of central-station service would be far more economical than the operation of private steam plants.

Other power users supplied with direct current make up a large volume of business of a highly diversified nature, and it is interesting to note that manufacturers of the same or closely related products have gravitated toward each other until they have formed districts given over to their particular class.

BANK OF ELEVATOR MOTORS IN THE CUNARD BUILDING, WHICH USES EDISON SERVICE

### SECTIONS OF THE CITY DIFFER

In a broad sense, Manhattan Island may be considered in three general sections—the downtown, in which the largest office buildings are located; the uptown, which is in the main residential, and the midtown, having some of the characteristics of the two other sections, with many others distinctly its own. In the last-named zone are to be found many large office structures, most of the theaters of the city, substantially all of the department stores, many apartment houses, and a large and important grouping of manufacturing loft buildings. In it is also located the center of the printing industry.

A recent review of the large buildings in the part of this district lying between Twenty-eighth and Fifty-ninth Streets and extending from river to river gave a fairly comprehensive idea of the character of the installations supplied by the Edison company. The largest grouping of important structures comprises 440 loft buildings, some of which reach a height of twenty stories. Of this number 350 are devoted to manufacturing purposes, including printing, and ninety to commercial purposes—salesrooms, offices, etc. Second on the list are the apartment houses, of which there are 275. Next is the office building group, which contains 205 structures, followed by the theaters, of which there are sixty-two. Completing the list are fifty-five hotels, twenty-two motion-picture houses and nine department stores. The electrical installations of the largest of these buildings run up to from 2,000 kw. to 3,000 kw.

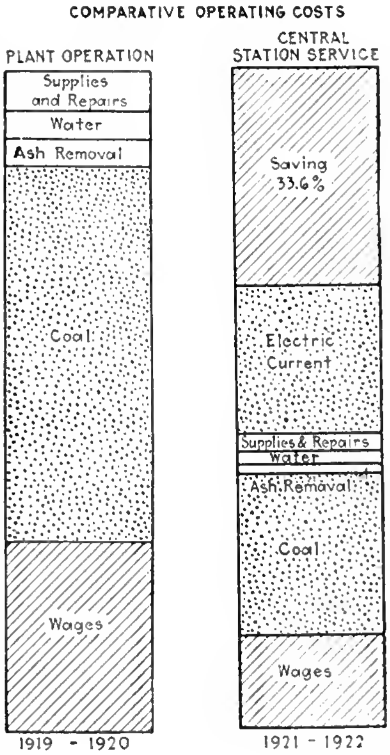
A very large proportion of New York's manufacturing is done in buildings of the manufacturing loft type, the units being comparatively small. The census figures show that in 1919 there were in Manhattan and the Bronx 24,382 manufacturing establishments, having an average of 13 hp. per establishment, while the average in a group of other large cities was 90 hp. per establishment.

The foremost industry of the city is garment manufacturing, and this is practically all carried on in these manufacturing loft buildings, nearly all of which use central-station service. Excellent examples of this type of building are the two huge structures of the garment center on Seventh Avenue from Thirty-sixth to Thirty-eighth Street. Here may be found in one service unit a large group of manufacturers of wearing apparel whose combined electrical requirements, including the building equipment, total 2,650 kw.

Second in rank are the printing and publishing trades. With the removal of the New York *Tribune* from its former location in Nassau Street to its new building on West Fortieth Street it became a customer

of The New York Edison Company, which now, with this acquisition, supplies every large newspaper in Manhattan. In general commercial printing and in the publishing of magazines and books central-station service is also predominant. The electrical requirements of these large newspaper and printing buildings, of which there are more than half a hundred in the city, run as high as 2,500 kw.

In Manhattan building operations during the past few years have been principally in the direction of office, loft and apartment construction, the latter of the more expensive kind. Many of the structures erected in this period will undoubtedly occupy permanent places in the list of New York's prominent buildings. Among them may be mentioned the Cunard Building, at 15-25 Broadway; the Pershing Square Building, Forty-second Street and Park Avenue; the Cotton Exchange, 60-62 Beaver Street; the Standard Oil Building, still in course of erection at Broadway and Beaver Street. All these and very many others are supplied with central-station service.




TYPICAL SAVINGS EFFECTED BY ABANDONING PRIVATE PLANT

## PRIVATE PLANTS DISAPPEARING

The private plant, while still a factor in large building service, is becoming less and less so year by year. In the last ten years the number of private plants installed in Manhattan and the Bronx in new buildings has averaged about two yearly. Contrasted with this is the record of twenty years ago, when during 1902 fifty-three private plants were installed in new buildings. This change in the situation is the more significant when it is remembered that the average size of the buildings erected in the city is very much greater now than it was twenty years ago.

Accompanying this decrease in the number of new plants arranged for is the constantly growing number of private plants abandoned in favor of central-station service. The New York Edison Company's records show a total of about eight hundred private generating plants shut down, of which about three hundred have been abandoned in the last five or six years. All sorts and sizes of buildings are represented.

The number of plants abandoned, while composing a fairly formidable list, would unquestionably be much larger were it not that when many of New York's large buildings were erected hydraulic elevators were installed as the best type then available. The owners of these properties are now faced with the necessity, if their generating plants are shut down, of electrifying the elevators or continuing in operation their high-pressure boilers and elevator and pumping equipment, the latter course making it difficult to realize the full measure of saving. While the alternative of installing new electric elevators or electrically operated pumping equipment involves a large initial outlay, the advantages are so pronounced that during recent years several hundred hydraulic or steam elevators have been changed to electric operation, the expenditures for this purpose running into hundreds of thousands of dollars.

In the Bronx district the principal growth during several years past has been along residential lines, the apartment-house construction in that section having broken all previous records by a wide margin. Included in the list are the new Roosevelt Apartments, widely advertised as the largest apartment house in the world. This building covers an entire city block, accommodates 260 families and has a lighting installation of more than five thousand lamps.

The manufacturing load in the Bronx is an important and constantly growing one, central-station service having been adopted not only in virtually all the new factories erected within recent years, but in a large number of older ones as well, which were formerly supplied from private plants.

The load of the factory plant business taken over during the past five years totals approximately 12,500 hp. distributed among 130 manufacturing establishments

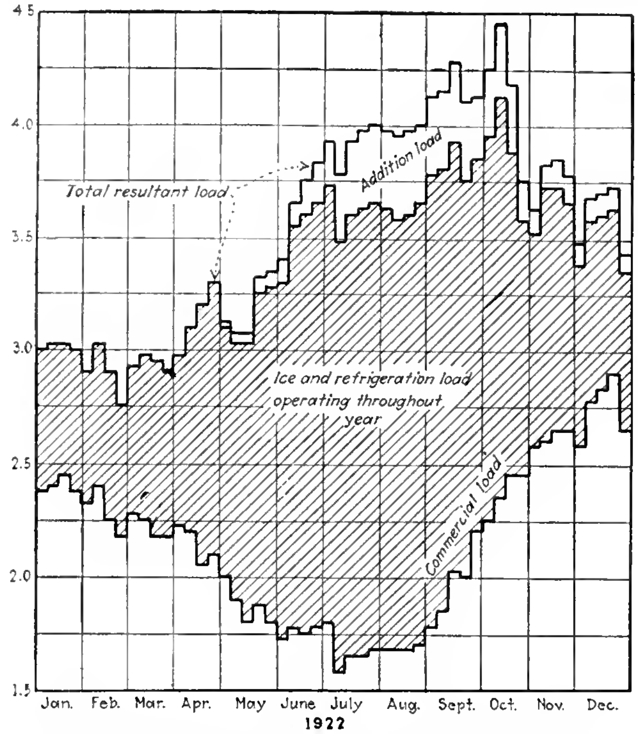
## THE UNITED ELECTRIC LIGHT & POWER COMPANY

The United Electric Light & Power Company, which produces alternating current only, overlaps the territory of the Edison company and supplies service to the extreme northern end of Manhattan Island. The company wholesales a large amount of high-tension power to other utilities, including The New York Edison Company, and supplies power to the New York, New Haven & Hartford Railroad Company for the operation of its electrified division as far as Cos Cob, Conn. The ice and refrigeration business, because of its desirable load factor, has had especial attention in the sales efforts of the company. The largest ice plant in the world is one of the United company's power customers. The results

TABLE I—UNITED COMPANY'S REFRIGERATION LOAD

| Year | Customers | Added Hp |
|---|---|---|
| 1917 | 0 | 0 |
| 1918 | 18 | 11,425 |
| 1919 | 42 | 10,430 |
| 1920 | 53 | 4,517 |
| 1921 | 62 | 8,485 |
| 1922 | 77 | 9,035 |
| Total | | 43,892 |

OLD PRIVATE PLANT REPLACED BY CENTRAL STATION POWER




HOW THE ICE AND REFRIGERATION LOAD FILLS UP THE VALLEY FOR THE UNITED ELECTRIC LIGHT & POWER COMPANY

as reflected in the connected load of the company's commercial business are shown in the accompanying analysis (Table I), showing the amount of this business added during the last five years.

During the past year special interest has been devoted to contracts for the manufacture of ice cream, one of the components of the ice and refrigeration business. In this period of twelve months 1,300 kw., representing a gross revenue to the company of $39,000, was added to the company's lines through this medium.

### Ice and Refrigeration Business Big Item in 1922

The high-tension ice and refrigeration business for 1922, as represented by twenty-seven plants supplied by the company, totaled an annual consumption of 73,804,520 kw.-hr. in commercial load.

The figures presented above apply only to the Borough of Manhattan and are exclusive of power supplied to allied organizations. The annual load factor of the high-tension ice and refrigeration business is 55 per cent as against the load factor of the entire commercial low-tension business of only 33.8 per cent. The average weekly load factor for all high-tension ice and refrigeration business for 1922 was 80 per cent. How the company's commercial power load is divided is shown in Table II. Service to large apartment houses makes up no mean portion of the United company's load and is increasing rapidly each year.

BATTERY OF THREE BRASS MELTING FURNACES ON THE LINES OF THE NEW YORK & QUEENS ELECTRIC LIGHT & POWER COMPANY

TABLE II—CLASSIFICATION OF COMMERCIAL POWER LOADS ON UNITED ELECTRIC LIGHT & POWER COMPANY'S LINES

| Kind of Load | Per Cent of Total |
|---|---|
| Ice and refrigeration | 59.0 |
| Woodworking | 8.3 |
| Provisions | 3.2 |
| Metals and furnaces | 8.8 |
| Tobacco, chemicals and laundry | 5.7 |
| Construction work (temporary) | 6.0 |
| Telephone exchanges | 3.7 |
| Glass and marble | 0.3 |
| Miscellaneous | 5.0 |
| Total | 100.00 |

Further extension of the power business in New York is now being developed through increasing the means of utilization of electrical energy by existing customers. In this respect vulcanizing and small heating applications, the use of glue pots, soldering irons, individual ventilating fans and small refrigerating plants offer an almost unlimited field. To develop this business The New York Edison Company has recently adopted a policy of selling this equipment to its customers, at the same time offering them the opportunity to pay for it on the deferred-payment basis.

### Brooklyn Edison Company

The Brooklyn Edison Company maintains a commercial engineering bureau which handles all power in excess of 10 hp. It compiles data regarding the development of large commercial installations and follows up the erection and equipment of all new buildings in the borough, maintains a "follow-up" of all existing customers by periodic calls, develops additional consumption of existing large customers, tests independent private plants, prepares engineers' reports, and follows up the development of federal, state and city public works and general large installation plans.

During the year many private steam generating plants and steam and gas engines were replaced by Edison service. A number of large original contracts were obtained, the principal ones being: Gowanus Canal Terminal, 3,000 hp., and Williamsburg Bridge municipal trolley line, 2,250 hp.

### Long Island and New Jersey

The New York & Queens Electric Light & Power Company is building up a substantial power load in the plants of manufacturers whose operations require more space than is available on Manhattan Island. Here the typical industrial equipment is found, and one of the recent installations shown here is a battery of three brass melting furnaces in the plant of the Neptune Meter Company.

In New Jersey the Public Service Electric Company has a wide diversity of power business and during the war played an important part in supplying power to shipyards, munition plants and other war industries. Among the large customers of the company is the Crucible Steel Company, which has a demand of 15,000

kw. There are many other large manufacturers among the company's power customers. So great has been the demand for power that the company is now installing three 33,000-kva. generators in its Essex station, two of which are to be in operation this year and the third early in 1924. The Public Service Electric Company also has perfected plans for another entirely new plant, the initial capacity of which will be 200,000 kw., with provision for expansion to 400,000 kw.

The magnitude of the use of energy in the metropolitan district becomes apparent when it is considered that in December, 1922, the five central-station companies had a combined peak demand of 947,150 kw. and their total output for the year was 3,254,675,938 kw.-hr. This is exclusive of the energy generated in the plants of the street railways, elevated and subway companies.

## House Wiring and New Homes Add 130,000 Customers

With the number of apartment houses increasing and the private homes decreasing each year, particularly on Manhattan Island and in the Bronx, the field for wiring old houses in New York is in a measure restricted. It must also be remembered that in a number of apartment houses energy is sold through one meter to the landlord, who sells to the tenants through his own meters. Such residential customers do not show on the companies' books. The central stations, however, have been very active in offering easy terms to owners of unwired houses.

The New York Edison Company and the United Electric Light & Power Company have been making extensive surveys on their lines and have taken a number of wiring contracts on the deferred-payment plan. These companies do no wiring themselves, but contract with the customer for the business, which is turned over to the electrical contractor.

The Brooklyn Edison Company last October conducted a special house-wiring campaign in which the company financed wiring accounts on easy payments and supplied the contractors with forms for handling the business. The terms offered were 15 per cent down and ten months to pay the balance. A 5 per cent discount was allowed for cash on completion of the work. About 20 per cent of the business taken was on a cash basis.

In Queens Borough the New York & Queens Electric Light & Power Company is making an active canvass of the entire territory and turning this business over to the contractors. The company has not adopted any deferred-payment plan, but during 1922 6,688 old houses were wired and connected to the company's line.

The Public Service Electric Company some time ago retired from the active solicitation of house wiring in order that more attention could be given to the sale of electrical merchandising and current-consuming devices.

During the year 1922 the four companies operating in Manhattan, Brooklyn and Queens Borough, Long Island, connected to their lines 130,000 new residential customers, divided approximately as follows: Brooklyn, 63,000; Manhattan and the Bronx, 35,000, and Queens Borough, 32,000. These new customers, if they were taken together, would make a city of 600,000 people, and, estimated at a cost for wiring of $100 per customer, they represent $13,000,000 of wiring business alone in Greater New York.

# Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

## Careless Advice from Power Companies on Equipment

*To the Editors of the* Electrical World:

Although we are not actually a part of the electrical industry, we have, in a way, a more or less indirect interest in a matter in which we believe there is considerable room for improvement in that industry. We manufacture a line of small air compressors sold to the garage trade, filling stations, small manufacturing plants, air-brush painters, users of pneumatic water systems and customers of a similar sort. These customers must buy power to operate their outfit. In sending us the order the customer often fails to specify the current characteristics or gives current characteristics which we are satisfied are not proper, and we tell him to consult his power company as to what current will be available for this size and type of motor. The customer secures this information from the power company, passes it on to us, and we furnish the motor accordingly. Then in a great many cases, entirely too many, we find that the power company has not given the correct information, or did not investigate the situation carefully enough for its prospective customer, or simply "shot up in the air" in the matter, so that, as a result, the customer has to exchange his motor for another one.

The writer has on his desk today papers concerning two cases of this kind. One of these is in Ohio, where the power company advised the prospective customer (its customer as well as ours) that he could install a ½-hp., three-phase motor to drive his air compressor, and then, after he had bought such a motor, told him that he would have to send it back and get a single-phase motor, because there was only a single-phase line available at that point. Another case occurred in Texas, where the same situation arose. Now, ½-hp., three-phase, 110-volt motors are not very good stock, and we are not interested in taking them back, which we would have to do in exchanging single-phase motors for them. In another case just the other day in Michigan the same circumstances arose and the power company, in the language of our jobber and our customer, was very "hard-boiled" about the matter. It didn't seem to care that it had given the customer the incorrect information.

We think the power companies ought to give their prospective customers just as much courtesy and attention and make as much effort to give them correct information as a manufacturer who is trying to sell this same customer a piece of equipment. We do not see that simply because the company is a public utility, with no competition, instead of a manufacturer, there should be any less reason for courtesy and correct information. Such a basic idea is all wrong.

We should appreciate it if the Electrical World would start the ball rolling and preach the gospel of a little more attention from the new-business departments of these power companies to the prospective customer who is looking for information.

Curtis Pneumatic Machinery Company, St. Louis, Mo. — Walter C. Hecker, Vice-President and Sales Manager.

# Central Station and Industrial Practice

**Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants**

## Effect of $CO_2$ Variation on Boiler Efficiency*

TO STUDY what effect variation of the $CO_2$ content of flue gases has on superheat some tests were conducted in which the flue-gas losses were calculated from the test data and the other losses determined by averaging a number of heat balances of evaporative tests conducted on the boiler. The loss due to "steam formed by burning hydrogen" was taken at 5.84 per cent and the loss due to "unconsumed hydrogen, radiation and unaccounted for" as 6 per cent.

These observations were made in an oil-fired 6,000-sq. ft. Babcock & Wilcox boiler with a double-deck Babcock & Wilcox superheater. The arrangement of the furnace was of the conventional "back shot" type with standard baffling.

The variation in $CO_2$ was procured by first obtaining the desired rating with good combustion, burners being carefully adjusted to get uniform flame from each, and then increasing the amount of draft, thereby lowering the $CO_2$, all other conditions remaining constant. In this manner good combustion was obtained throughout the test, the decrease in $CO_2$ being due to excess air only.

Steam temperature was measured with a chemical thermometer in a well with a mercury bath scaled for 3-in. immersion. Rating was determined by a flow meter permanently connected to boiler; $CO_2$, CO and O were determined with standard Orsat apparatus. There was no CO present in any of the tests made. All gages, meters, etc., were carefully calibrated and checked for accuracy before test. The steam pressure during the test averaged 210 lb. per square inch with the barometer 29.7 in.

Fig. 1 was constructed from the test data. The curves as drawn and marked for 75 per cent, 125 per cent and 175 per cent ratings are not, strictly speaking, constant-rating curves, but represent only the ratings at which it was endeavored to operate. $CO_2$ curves were constructed as shown in Fig. 2 from the average values given in Fig. 1 and show the amount of superheat to be expected with variations of $CO_2$. A further series of observations was made to obtain data from which heat balances could be calculated to give the efficiency curves shown in Fig. 2. Fig. 2 can be read in several different ways. It provides a means of determining whether the increase in superheat due to low $CO_2$ and poor combustion, which is partly overcome by the increase in efficiency of machines using the steam, is justified.

For an example, assume a boiler rating of 145 per cent and 14 per cent $CO_2$. With these conditions the chart shows the efficiency to be 80 per cent. By lowering the $CO_2$ to approximately 12.8 per cent the boiler efficiency is lowered 1 per cent and the superheat is increased 9 deg. F. An increase of 12 deg. F. superheat effects a 1 per cent saving on a modern steam turbine. This would indicate that the high $CO_2$ has an advantage over the high superheat by one-quarter of 1 per cent. Taking a wider range and reducing the $CO_2$ from 14 per cent to 10 per cent, the boiler efficiency falls off 3.5 per cent and the superheat is increased 43

*Abstract of paper presented at the Southwest Geographic Division, N. E. L. A., convention at Oklahoma City, Okla., March 14-16, 1923.

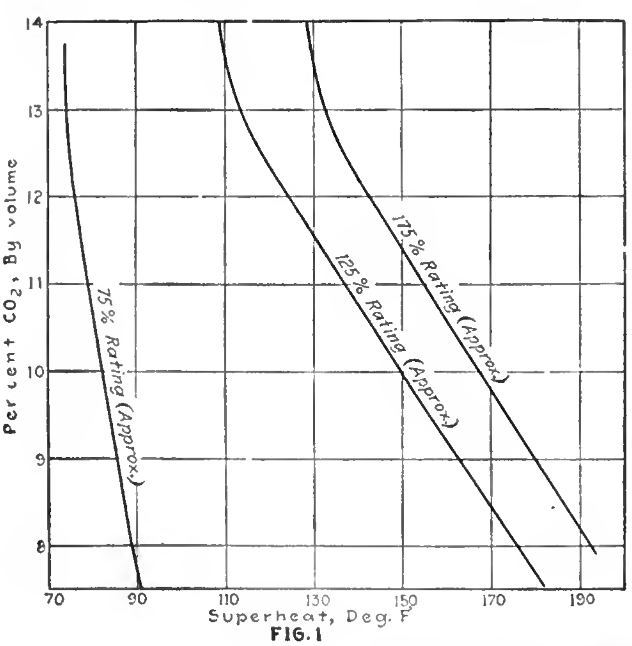



FIG. 1

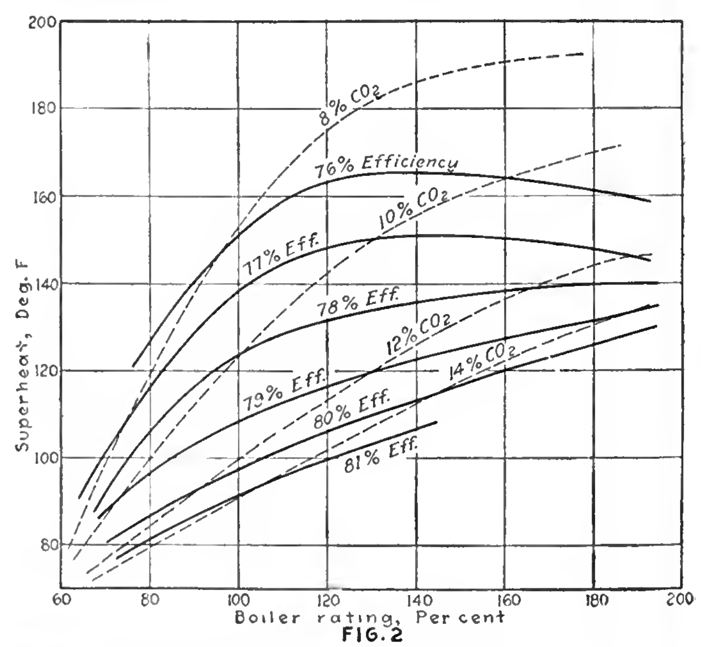



FIG. 2

FIG. 1—SUPERHEAT AND $CO_2$ RELATION AT VARIOUS RATINGS OF BOILER. FIG. 2—RELATION BETWEEN SUPERHEAT, $CO_2$ AND EFFICIENCY AT VARIOUS RATINGS

deg. F., which is equivalent to increased turbine efficiency of 3.5 per cent. This shows the loss in boiler efficiency to be exactly equal to the increased efficiency of the turbine effected by a higher superheat at this point.

The gain in efficiency due to high superheat is not so reliable as that obtained with good combustion in the boiler and high $CO_2$. Turbines will not produce this 1 per cent saving on light or heavy loads, and it is doubtful how many of them will produce it under normal load. Therefore, as such an extreme drop in the $CO_2$ is required to equal or surpass the saving due to high superheat, it is concluded that it would be advisable to maintain the maximum $CO_2$, keep the superheaters clean and let the superheat come where it will.

W. P. CREWS.

## Interruptions to Service Classified as to Cause

FOR the purpose of making a study of the causes of interruptions to service on its transmission and distribution lines and in its substations, the Southern California Edison Company makes out a monthly report classifying interruptions with respect to cause and to voltage of the line on which the trouble occurred. The report for the month of December, 1922, is shown herewith. The use of such a summary is of considerable value in analyzing the sources of trouble which cause interruptions on the system in order that steps may be taken to cut down these failures. The report is prepared by the load dispatcher from his operating records, and copies are sent to the manager of operation and the protection engineer.

TRANSMISSION-LINE INTERRUPTIONS CLASSIFIED WITH RESPECT TO CAUSE AND VOLTAGE OF LINES

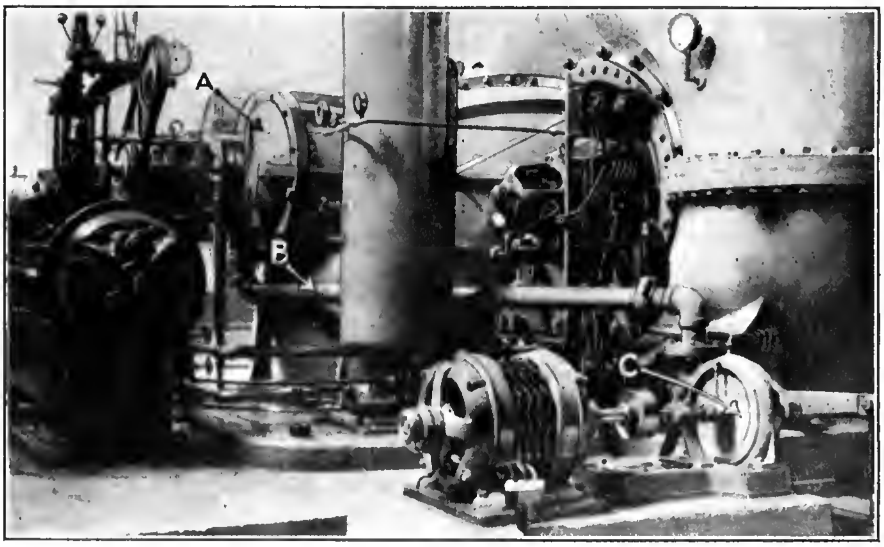
| | Number of Interruptions Voltage of Lines in Kv. | | | | | |
|---|---|---|---|---|---|---|
| Cause of Trouble | 10 | 15 | 30 | 50 | 60 | 150 |
| Unknown | 38 | 8 | | 2 | 6 | |
| Fires | | | | | | |
| Insulator failure | 10 | 6 | 2 | 2 | 3 | |
| Lightning | | | | | | |
| Flashovers | | | | | 5 | 2 |
| Accidents | | | | | | |
| Mistake in switching | | 3 | | | | |
| Oil-switch failure | | 2 | | | | |
| Failure of low-tension oil-switch to open, kicking out high-tension switch | 9 | | | | | |
| Switch trouble (mechanical) | 1 | | | | | |
| Switch trouble (control) | | | | | | |
| Pole broken by auto | 2 | 2 | | | 1 | |
| Pole raised into line | | | | | | |
| Pole burned off | 3 | 2 | | | | |
| Pole blown over | | | | | | |
| Wires blown together | | | | | | |
| Tree in line | 1 | 1 | | | | |
| Trouble on foreign lines | | 7 | | | 2 | |
| Birds | | | | | 3 | |
| Airplane hit line | | | | | | |
| Fuse holder grounded | | | | | | |
| Failure of consumer's transformer | 3 | 1 | | | | |
| Shorted by lineman | 1 | | | | | |
| Shorted by telephone line | | | | | | 1 |
| Shorted by house movers | 1 | | | | | |
| Circuit closed out of phase | 2 | | | | | |
| Lead melted out of lug | | 1 | | | | |
| Pothead failure | | 1 | | | | |
| Cable failure | | | | | | |
| Arrester trouble | 1 | | | | | |
| Jumper loop burned off | | 1 | | | 1 | |
| Total | 72 | 35 | 2 | 4 | 21 | 3 |

A word of explanation in connection with the report will make the nature of the trouble covered by some of the classifications clear. "Unknown" covers such conditions as where a switch on a transmission or distribution line "kicks out" and can be reclosed by hand with no repetition of the trouble, or where no evidence of a flashover can be found by a patrolman after going over the line. "Failure of low-tension oil switch to open, kicking out high-tension switch," covers cases where an oil switch of the voltage indicated fails to open and causes other switches to operate. "Trouble on foreign lines" refers to cases of trouble communicated to the company's system through interconnections with other power systems or to trouble arising on railway lines or distribution systems of municipalities supplied by the Edison company. The number of interruptions from insulator failures, as shown by the report, indicates that troubles from this cause are by no means confined to high-voltage lines on this system.

H. W. NEIR,
Chief Load Dispatcher.
E. R. STAUFFACHER.
Protection Engineer.
Southern California Edison Company,
Los Angeles, Cal.

## Auxiliary Pump on Turbine Counteracts End Thrust

THE end thrust of horizontal single-discharge reaction turbines is toward the draft-tube side and is generally counteracted by some type of balancing piston. On a 2,000-hp. unit provided with a hydraulic thrust piston and renewable bronze wear rings it was found that the rings had to be renewed quite frequently when the machine was operated under full load for any length of time. This thrust piston is placed where the shaft leaves the draft tube, and the piston chambers were orginally supplied by a pipe direct from the turbine casing. There was thus the full turbine pressure on one side of the piston against the draft-tube vacuum on the other, tending to counteract the end thrust.




RING REPLACEMENTS ON REACTION TURBINE DECREASED BY INCREASING PRESSURE IN HYDRAULIC THRUST PISTON

To prevent the rapid wear of the renewable rings on the thrust piston, a small centrifugal pump was introduced into the pipe line from the turbine to the piston. This raised the pressure in the piston about 5 per cent above the turbine pressure, with the result that the turbine could be operated satisfactorily at full load and with no appreciable ring wear at the piston.

The arrangement that solved this difficulty is shown in the accompanying illustration, in which *A* is the hydraulic thrust position, *B* the pressure piping and *C* the centrifugal pump driven by a 10-hp. motor and connected by a flexible coupling.

FREDERICK KRUG,
Superintendent of Hydro-Electric Plants.
Porto Rico Railway, Light & Power Co.,
Bayamon, Porto Rico.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD

New York, N. Y.

## Instructions for Operating Evaporators

EVAPORATORS, by vaporizing and condensing raw river water, remove from the make-up water of a station all mud and foreign matter, which, if allowed to enter the boiler, would cause excessive scale formation on the tubes. It is not advisable to use superheated steam in evaporators on account of the priming of the first-effect shell caused by too rapid boiling or evaporation. Water is admitted to the live steam to reduce the superheat to zero or to saturated steam temperature.

The coils should be covered with water, as any portion of the coil being uncovered will not only reduce the capacity of the evaporator but will have the scale baked on it so hard that it cannot be removed by the usual "cracking down" process. When an evaporator is taken out of service, the coils should be covered with water to prevent the scale from drying on the coils. It is important that the high-pressure and low-pressure traps be properly vented since steam contains more or less air and non-condensable gases. Furthermore, if not vented, the coils will fill up with air, which will reduce the capacity. The following rules for putting an evaporator into service and for taking it out are part of the operating code of the Philadelphia Electric Company.

PUTTING AN EVAPORATOR INTO SERVICE

1. See that water supply lines and exhaust steam lines to the evaporator heater are in operating condition.
2. Start the evaporator feed pumps.
3. See that all blow-down valves are closed and that the vent on each shell is open.
4. Fill each shell to the running water level as indicated by the mark on the shell.
5. Open the vents on the traps on both high-pressure and low-pressure coils.
6. Open wide the vapor valve on the first effect.
7. Open the vapor valve on the second effect.
8. Open slowly the high-pressure steam valve to the first-effect coils, noting that the reducing valve maintains 200 lb. gage pressure.
9. Maintain 388 deg. steam temperature by adjusting the boiler-feed supply to the desuperheater.
10. See that the trap is functioning on the steam separator.
11. Close the vents on the shells when the steam appears.
12. Slowly build up pressure in the shell of the first effect to 57 lb. by increasing the live steam to the coils of the first effect until 200 lb. at 388 deg. F. is maintained at the entrance of the coils.

TAKING AN EVAPORATOR OUT OF SERVICE

1. Close the high-pressure steam valve to the first-effect coils.
2. Close the water line to the desuperheater.
3. See that the float valves shut off the water after evaporation stops.
4. Close the vapor valve on the second-effect shell.
5. Shut down the evaporator feed pump.

## Starting and Stopping Small Motors on Auxiliaries

CONTINUITY of service depends upon having all equipment ready for immediate service, and definite instructions for operating apparatus will very often prevent interruptions caused by carelessness. The following instructions for starting and shutting down small motors, while not complicated, should always be kept in mind by operators. They have been abstracted from the operating code of the Philadelphia Electric Company.

SYNCHRONOUS MOTORS—STARTING

1. Close the starting switch and note that the rotor turns over.
2. After the motor comes up to maximum speed on the starting switch, open the starting switch and immediately close the running switch.
3. After the motor comes up to maximum speed on the running switch, see that all the field resistance is cut in, close the field switch and adjust the field for the maximum armature current.

SHUTTING DOWN

1. Open the running switch.
2. Cut all field resistance in.
3. Open the field switch.

INDUCTION MOTORS STARTED BY COMPENSATOR—STARTING

1. See that the compensator handle is in the "off" position.
2. Close the motor main switch.
3. Throw the compensator handle to the starting position and note that the rotor turns over.
4. When the motor comes up to maximum speed on the starting position, throw the compensator handle to the running position.

SHUTTING DOWN

1. Open the motor main switch.
2. Return the compensator handle to the "off" position if it does not return automatically.

MOTORS STARTED FROM AUTOMATIC CONTROL PANEL—STARTING

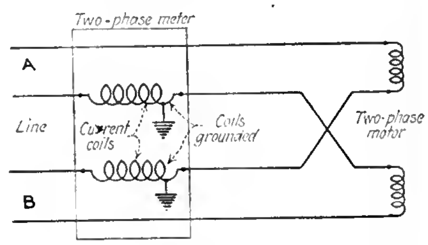
1. See that the controller is in the "off" position.
2. Close the motor main switch, if it is not already closed.
3. Throw the controller handle to the required running position.
4. Note that the motor comes up to the required speed.

SHUTTING DOWN

1. Throw the controller handle to the "off" position.
2. Open the motor main switch, unless other motors are fed by this switch.

## An Interesting Case of Two-Phase Meter Trouble

WHEN a two-phase meter supplying about 40 hp. of motors was tested in place the meter was found to be slow and did not respond to the usual adjustment. The tester arranged for a shutdown during the noon hour to replace the meter. After replacement the motors were tried and only one would start, the remainder appearing to receive single-phase current only. The new meter was removed and the meter loop connected through solidly. The single-phase condition still existed,




MOTORS OPERATED ON CROSS-PHASE CONNECTION BECAUSE BOTH CURRENT COILS OF METER WERE GROUNDED

although a lamp test showed both phases normal. The old meter was then replaced and all motors operated satisfactorily.

A later investigation disclosed the fact that both current windings of the old meter were solidly grounded to the case near the outlet, making one wire of each phase common. All but one of the motors were connected cross-phase, so that operation was possible only when the two wires passing through the current elements of the meter were tied together. Presumably the meter failure occurred prior to a recent rearrangement of motor wiring, and the electrican simply connected each phase of the motors across any pair of wires that had a difference of potential of 220 volts. This experience demonstrates the care that must be exercised when installing any equipment.

T. W. SNELL,
General Superintendent.
Coast Valleys Gas & Electric Company,
Salinas, Cal.

## Service Quickly Restored by Portable Substation

TO MINIMIZE the period of outage resulting from failures of power transformer installations on 6,600/2,200-volt lines and the expense of restoring service, especially when these emergency conditions occur after working hours, the Dayton (Ohio) Power & Light Company utilizes a portable transformer substation which can be hauled out to a job and placed in operation in a very short time. The use of this portable substation has enabled the company to change transformer banks up to 150-kva. capacity, replace bad transformers on existing banks and replace bad poles or timbers on transformer structures without interrupting the service to the customer. It is also useful for supplying power for temporary jobs of short duration where it is not deemed necessary to install a permanent structure.

The portable substation consists of three 50-kva., single-phase, 6,600/2,200-volt transformers banked in closed delta and mounted on a two-wheeled rubber-tired trailer. A definite idea of the substation may be obtained from the detailed plans and the illustrations shown herewith. The trailer is equipped with a rigid prop on the rear end and an adjustable prop on the front end which permits it to be maintained perfectly level when stationary, the weight of the transformers being so distributed that the entire structure is almost balanced. Each of the transformers is bolted to the substructure of the trailer by means of long through bolts extending down from the lid of the transformers, thus keeping them rigid at all times.

The transformers are completely housed in on all sides with a wooden housing extending from the bottom up to a point approximately 8 in. above the top of the transformers. This housing completely hides the transformers from view and also prevents any one standing on the ground from coming into contact with any of the primary or secondary leads.

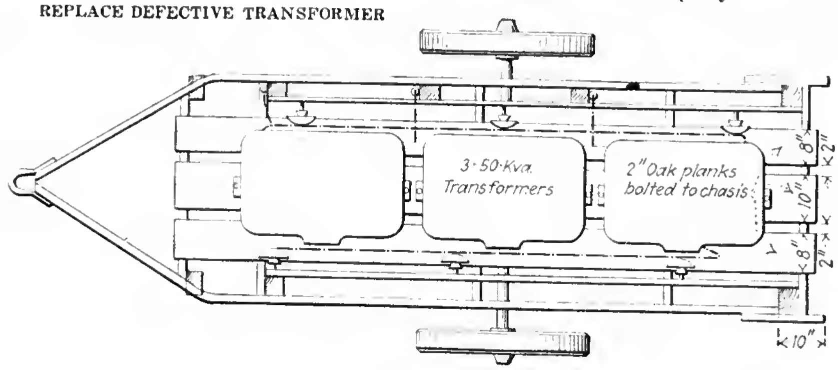
The incoming primary leads are supported on three 4-in. x 4-in. uprights spaced approximately 2½ ft. apart, which extend 15 ft. above the ground level and are fastened to the primary side of the transformer housing. The primary cut-outs are mounted on these uprights about 12 in. from the top and are so arranged as to be easily accessible.

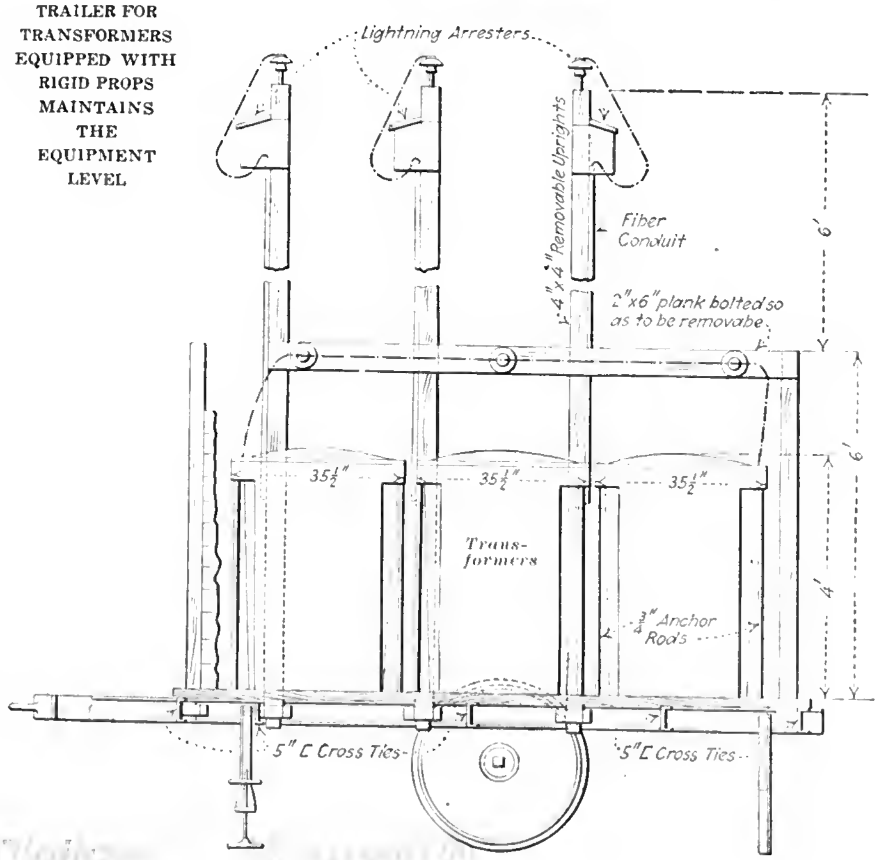

PORTABLE SUBSTATION CURTAILS EXPENSE OF WORKING LINEMEN OVERTIME TO REPLACE DEFECTIVE TRANSFORMER

A 5-kva. compensator has been installed and can be connected up to the secondary side of the transformer bank so as to supply 115-volt service for lighting if necessary. This compensator is only used when the transformer bank being changed is connected 230 volts on the secondary side and when the lighting is also supplied by the same transformers.

In keeping with the safety first policy of the company to warn the public of the proximity of high-tension wires, prominent danger signs are attached to the housing of the portable substation and are so placed as to be clearly legible and easily noticeable.

The use of the portable substation has enabled the company to cut down




TRAILER FOR TRANSFORMERS EQUIPPED WITH RIGID PROPS MAINTAINS THE EQUIPMENT LEVEL

the length of outages due to transformer failures during electric storms to a minimum and has also curtailed the expense of working its linemen overtime in order to replace defective transformers.

The company is contemplating a few changes in the design of the substation, however, one of the principal ones being the replacing of the two-wheel trailer with a four-wheel trailer. It has been found almost impossible in some instances to haul the substation right up to the source of trouble by means of a truck, and the four-wheel feature will permit the trailer to be pushed to the necessary location without the danger of upsetting the structure.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

## Testing Distribution-Line Ground Conditions

As most companies ground all secondary distribution lines at the customers' services it is essential to have a rapid and accurate check to determine whether the proper wire is grounded. Very often when an operating company takes over small systems and connects them to its lines it is found that the distribution secondaries are not grounded. The writer had occasion to check the grounding conditions in a small system taken over by this company and wished to make a check that was rapid and at the same time accurate. This was accomplished by using the simple device of two lamps in series, with means of grounding the wire between the two lamps.

Two weatherproof sockets were connected in series to an ordinary attachment plug, and a lead 20 ft. in length was taken from between the two lamps. The writer and a lineman then started from the substation, following the primary line. As each transformer was reached the lineman would obtain the necessary data by climbing the pole. The attachment plug was then inserted in any lamp socket in the nearest house taking service from the transformer. Then the wire connecting the two lamps in series would be grounded at the nearest source. If the transformer was properly grounded, one lamp would go out while the other would come up to normal voltage. In case of a three-wire service where an outside wire had been grounded by error, all services taken from the grounded side and the neutral would test as above, while a service taken from the neutral and ungrounded side would show double voltage to ground. In case of three-wire services care was taken to get a test from services taken from each outside-line wire and neutral.

When the transformer was not grounded at all, the two lights would burn at half voltage and no change in brilliancy would be made when grounding the test lead. In the case of several transformers that had been grounded to pipes there was a slight dimming of one light while the other would brighten to a small degree, showing that the grounding was insufficient.

Forty transformers were tested in one day, and it was found that less than one-half of them were grounded satisfactorily. Four had an outside wire of the three-wire, 220-volt service grounded, instead of a neutral, while others were entirely clear of grounds.

MERTON L. TAYLOR.
Meter Department.
Central Maine Power Company,
Augusta, Me.

## Cost of Installing Single Lightning Arrester

An itemized table of the cost of purchasing and installing a single 1,000-3,000-volt lightning arrester in a substation about two miles from the generating plant of a Massachusetts central station is given here. The labor and material charges were almost equally divided. The tabulation is suggestive because of the completeness with which minor items in the supply line are covered.

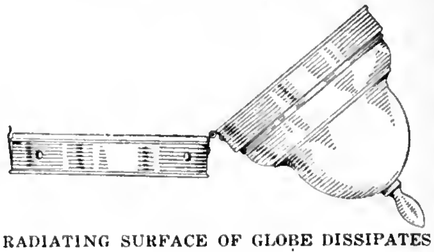
INSTALLATION COST OF LIGHTNING ARRESTER

| | |
|---|---|
| One 1,000/3,000-volt lightning arrester, complete | $397.00 |
| Freight | 7.99 |
| Angle iron | 13.40 |
| Channel iron | 2.60 |
| Paint, 3 gal., at $2.54 | 7.62 |
| Pipe, bushings, etc. | 1.33 |
| Fifty-four machine bolts, assorted. | 0.85 |
| Four rolls tape, at $0.61 | 2.44 |
| One 5-gal. can "Justrite" | 8.50 |
| Gasoline, 18 gal. | 4.60 |
| No. 227 compound | 1.22 |
| Waste | 0.59 |
| Expansion screws, ½-in. | 0.79 |
| Carriage bolts | 0.20 |
| No. 4/0 copper sleeves | 0.52 |
| String solder | 1.36 |
| Solder paste | 0.10 |
| No. 2 stranded bare wire | 1.07 |
| One weatherproof socket | 0.23 |
| Two rolls "Marlin," at $0.345 | 0.69 |
| Lag screws | 0.18 |
| Payroll, labor | 426.34 |
| Total | $879.62 |

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Modified Ventilators for Street Lamps

The question of just how much ventilation is necessary for the economical operation of single-light units of 400 cp. to 600 cp. for street lighting has been the subject of considerable discussion, and perhaps a statement of the experience of the writer will be of interest. The first trouble was experienced after the initial installation of forty 400-cp., 6.6-amp. single-light standards made about eight years ago, using the Macbeth-Evans Monax globes and copper ventilator, which is similar in design with all others, the hot air being expelled at the top through small holes under a protecting cap. In the north country we have some severe snowstorms accompanied by high winds, and we found that after such a storm, occurring in the daytime, the snow would enter through the ventilator and lodge on the top of the lamp. When the current was turned on to the circuit the lamps would explode one after another.



RADIATING SURFACE OF GLOBE DISSIPATES HEAT OF STREET LAMP

Investigation finally brought the remedy. All of the ventilators were brought into the shop and a circular piece of tin was soldered into them just where the top of the globe came. This tin was then covered with a heavy piece of cloth so that when put on the globe and screwed down all ventilation through it was cut off. We operated forty of the posts through one entire winter without a failure due to snow, and as fast as we installed posts thereafter we used the same method until last year, when the writer designed a "ventilator," or helmet which does not ventilate. We are now operating 170 400-cp., 6.6-amp. single-post lamps equipped as stated above and have had no failures due to snow entering globes. Tests have shown that the globe has radiating surface enough to take care of the heat generated by the lamp, our record being two and one-half renewals per post per year, burning 4,000 hours.

S. G. HUNTER,
Operating Manager.
Malone Light & Power Company,
Malone, N. Y.

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## Why Public Utilities Should Advertise

### Of Three Billion Dollars Gross Income the Four Major Utilities Spend but One-fourth of 1 per Cent for Advertising, Whereas They Should Appropriate $60,000,000 Annually

By W. P. Strandborg
President Public Utilities Advertising Association, Portland, Ore.

In a great many public utility companies the underlying reason why the executives have not been "sold" on the idea of the value of advertising is because their training, experience and habitual viewpoint have not brought advertising clearly above their horizon. If they have glimpsed its meaning at all, it has generally been that it deals with intangibles to a greater or less degree —and intangibles are something that technical engineers, lawyers and unimaginative operatives and managers have had little sympathy with or understanding of.

But once these executives have been "shown" what advertising has done and can do, when given an honest and thorough test, a great majority of them give it the recognition its importance deserves.

The writer has come in contact with many such cases, and that is why he has set down a few of the reasons why public utilities should advertise—so that our members, if they feel that their own companies are not giving the proper prominence to advertising, may use some of these suggestions as the basis for "selling the idea to the boss."

Public utilities should advertise because:

1. We have a seventeen-billion-dollar investment to protect.

2. This gigantic investment is subject to attack and harassment by all sorts of regulatory and legislative bodies, by the general public and the newspapers to a greater extent than any other large and legitimate business in the country.

3. We do $3,000,000,000 worth of business a year, and because intelligent advertising will stimulate it to greater growth.

4. We are far in the rear of every other modern business in advertising.

5. We need the greater good will of our 33,000,000 customers.

6. Our business comes into more intimate daily contact with more people than any other line of business in the world.

7. Our business, which is so essential to the comfort and well-being of the people, is highly technical, and the public does not understand it.

8. Our problems are the problems of the people, and we need their sympathetic understanding and support.

9. The people will be fair when they do understand all the facts, and systematic advertising is the most effective way to tell our story and give the people the facts.

10. Our exclusive business is salesmanship in its broadest application, and every form of salesmanship needs the fifty-fifty push and punch of advertising.

11. The selling of public service—essential and indispensable public service, if you please—is known, by experience and test, to respond as rapidly and in as great a measure to judicious advertising as the selling of any legitimate merchandisable commodity.

12. Many of our companies sell securities just exactly as investment houses do, and where would investment houses be if they didn't advertise?

13. Many of our companies sell merchandise exactly as department stores and specialty shops do—institutions whose advertising appropriations average from 2 to 7 or more per cent of their gross each year.

14. The demand for any worthy product—service, security or commodity—can be created and stimulated by means of advertising.

15. The greater the demand for any product, the less will be the ratio of production cost, with proportionately greater economy of operation.

16. It is the specific function of advertising to create consumer demand and consumer preference.

17. Truthful, sincere, interesting and believable advertising is a recognized asset in modern business.

18. Advertising will bring the full benefits of the merit of our product.

19. Advertising is the most inexpensive motive power that our industry or any industry can buy today.

20. The great "buyers' strike" following the world war proved that more and better advertising meant more and better business and more and better good will.

21. The place of advertising in the present economic system is thoroughly well established.

22. Business exists, in the last analysis, in the minds of its customers.

23. While you may supply the actual needs of the public without advertising, the actual needs are but a fraction of the demand that can be created, and advertising is a prime mover in creating this demand.

24. Public utility commissions in many states have recognized advertising as a legitimate operating expense, both in the creation of good will and in business building, thereby nullifying the somewhat widespread popular criticism that advertising by public utilities is a needless extravagance.

25. A public utility that advertises consistently finds it easier to finance its requirements than one which does not advertise. Bankers generally look upon a good advertiser as a good borrower, and prospective borrowers are frequently asked, "What is your advertising appropriation?"

26. Experience shows that public utilities which have adopted definite advertising programs on a budget basis have never abandoned this policy, but, on the other hand, have shown a tendency to expand their advertising appropriations year by year.

27. Advertising, properly used, will increase the turnover for utilities just as it does in other lines of business.

This list of "becauses" is by no means complete. It could probably be elaborated to twice the number given, and even among some of those set down there is some overlapping, yet the main thought is to show public utility companies that they have an abundant reason for giving advertising a fair trial and little, if any, reason for not doing so.

When it is considered that a mighty industry with a combined capitalization of more than $17,000,000,000, with a yearly gross business exceeding $3,000,000,000, deals in intimate daily contract relations with an aggregate of more than 33,000,000 customers, the importance of advertising to this industry need not be further emphasized.

There is expended in the United States each year for advertising a total of something in excess of $1,400,000,000, and of this amount the four major utilities—light and power companies, electric railways, gas companies and telephone companies—are using only about $7,500,000. It does look as if some of us have not acquired a very keen sense of business proportion.

Based on a 2 per cent minimum of annual gross business, the four utilities mentioned should be spending around $60,000,000 instead of $7,500,000. Instead of the 2 per cent minimum, the utilities are trailing along with an average of approximately one-fourth of 1 per cent. Five years ago, the amount was probably less than half what it is now.

## Central Station Boosts Dealers' Business

TEN illuminated billboards inscribed "The Electrical Dealers of Vancouver," similar to the one shown here, are paid for and maintained by the British Columbia Electric Railway Company of Vancouver, B. C. Although the company does a merchandising business itself, the billboards are maintained to help the dealers and to let the public know that there are other electrical interests in the city besides the central-station company. The company believes that in any event the sale of appliances results in the greater use of electrical energy, which will be reflected in increased revenue.


TYPE OF BILLBOARD MAINTAINED BY CENTRAL-STATION COMPANY

# Savings to Customer of Good Power Factor

### Increases Speed of Production—Reduces Energy Consumption—Increases Efficiency and Improves Operating Characteristics of Machines

ON MAY 14, before the Philadelphia Section of the A. I. E. E., C. J. Russell and J. F. Gaskill of the Philadelphia Electric Company presented a valuable paper entitled "Power Factor—Its Relation to Industrial Plants." Mr. Gaskill, who read the paper, pointed out that the attitude of the central-station companies on the much-discussed question of power factor was to stimulate the customer to purchase and install power-factor corrective equipment and that the companies have done this very largely by incorporating power-factor clauses in their rate schedules. The result has been that frequently attention has been focused only on the economics of rates and there has been a lack of fundamental attempts to convince the customer of the other benefits of a good power factor.

There are many conditions in industrial plants that may make low power factor a source of expense to the customer far in excess of the amount of the rate discount. Any power-factor correction must be based on an analysis of the plant and its operation, and a fundamental requirement is that the plant should be properly motored. This means that the type, rating and grouping of motors must be suited to the work and to taking the utmost advantage of corrective equipment. Many times, too, the copper sizes should be readjusted to the actual load conditions. After making this analysis the power-factor corrective equipment should make an annual saving of at least 20 per cent on the first cost to justify its installation. An outstanding example of this method was found in a factory having a 30-kva. demand and 60 per cent power factor before correction was applied. After rearrangement of motoring the demand was reduced to 20 kva. and the power factor raised to 77 per cent with only 8.5 kva. of corrective equipment. In another case a 33⅓ per cent power factor was raised to 82.5 per cent by using static condensers.

A great advantage to the customer frequently not pointed out is the fact that a good power factor lowers line losses, improves voltage regulation, and consequently machine operation, and raises the efficiency of the machines. These savings are often appreciable. For example, in a hosiery factory for thirteen weeks before correction was applied the energy consumption per unit of product was 0.895 kw.-hr., and for twelve weeks after correction it was only 0.553 kw.-hr. This gave a saving of about 30 per cent in consumption of energy in addition to power-factor improvements. In another case the load was 54.7 kw. at 59.1 per cent power factor, and 63.5 kva. correction was needed, but after rearranging the motors, only two of which were replaced, a power factor of 92.1 per cent was obtained with 30 kva. corrective equipment.

In order to obtain these results—and in many installations such results cannot be obtained—an analysis of the installation and the use of graphic-meter studies of load cycles of the individual motors is essential before attempting correction. Motors, regardless of make, often differ in characteristics as regards the amount of magnetizing current, and ordinary commercial tests made by

the manufacturers will not detect this condition. Therefore it is necessary to take duty-cycle curves on the machines *in situ* and to study the requirements of the task the motor performs.

Power-factor correction at the source is best because it decreases the energy bill of the consumer by reducing losses and demand, decreases the energy loss and voltage drop in the service circuits, and increases the speed of production by maintaining better and more uniform voltage regulation. With source correction the use of few large-size units saves on investment costs for corrective equipment, but where many small motors are used group correction is best applied. From a load-characteristic standpoint there is the non-fluctuating, unvarying load such as electrolytic loads, in which indicating meters only are necessary for analysis. For the intermittent load, such as woodworking machines and machine tools, a graphic-chart study is best, and for rapidly fluctuating loads, either intermittent or steady, flywheels often prove useful and can be applied intelligently by using graphic charts.

After proper metering has been installed the next question is the type of corrective equipment to use. All features of the installation must be studied. The ideal method is to install equipment carrying load current. Practically the load may vary, and corrective equipment is adjusted for the no-load condition, after which a fairly good power factor can be maintained over the complete load range. Economic considerations dictate the amount of corrective kva. to use. Synchronous motors should be considered, in general, for the replacement of induction motors on loads of 50 hp. and over. The synchronous condenser is a bulk corrective device and enters into consideration for loads of 900 kw. and over on 2,200-volt circuits. For these loads it competes with the static condenser. Group correction with static condensers offers good possibilities where there must be no cessation of production and where a large number of small motors are grouped.

Correction at the motor terminals is not well suited for loads of low diversity or where small machines are used, and in these cases group correction is dictated.

The static condenser has operated very satisfactorily on the lines of the Philadelphia Electric Company and has given no indication of bad features due to harmonics or resonance effects. In closing, the author again accented the point that the consumer gets a number of advantages from operation with a good power factor besides the rate discount.

D. E. Drake, in discussing the paper, said that in general a great change could be made in demand without great change in energy consumption. He cited an example on a 20-hp. motor where the use of a type with 10 per cent slip as compared with 2.5 per cent slip changed the demand 20 per cent with only 5 per cent change in energy consumption. M. E. Skinner said the importance of power-factor correction was very evident and that steps should be taken to secure it. He also discussed power-factor rate clauses and proposed using both a penalty and a bonus. The manufacturers might, he thought, do something in the way of getting better designs of machines from the power-factor standpoint. L. W. W. Morrow pointed out that the commercial application of power-factor correction involves the supervision of customers' equipment or the use of complicated rate and metering systems.

## Worcester Appliance Sales a Third Above Last Year

THE manager of the appliance department of the Worcester (Mass.) Electric Light Company, O. R. Underhill, reports that sales for the first quarter of 1923 averaged $2,194 per week against $1,610 for 1922 and that the estimated revenue from these sales in energy consumed is $4,930 per year. Merchandising conditions are also better than those of 1921 by about the foregoing margin. Among the items sold in the first quarter of this year are 330 flatirons, 106 vacuum cleaners, 106 portable lamps, 90 two-compartment fireless cookers, 78 washing machines, 39 heating pads, 39 toasters, 37 curling irons, 31 heaters, 23 fireless cookers of a different type from the above, 18 hot plates, 12 percolators and 10 waffle irons. During the past few months the company has authorized the use of more space for appliance demonstration on the main floor of its general offices and has paid increasing attention to effective window displays. A carefully prepared series of articles with an engineering "slant" on home electrification by George M. Hardy, general superintendent of the company, has been running in the company paper, the *Live Wire*, and these have aroused considerable interest among employees and outside readers.

## Ranges as Income Bringers

THE electric range and the electric water heater, like the automobile in transportation, are coming to fill an increasingly important place in the kitchens of the average home. The accompanying table is given to show what the electric range and water heater mean to the central station in yearly and monthly revenue. In compiling this table an electric water heater is rated the same as an electric range, and where both are used they are served through one meter.

The outstanding feature about the revenue derived from range consumers is the fact that, in spite of lowered rates, the income per month per range has increased. In the year 1921 the income per range increased almost 20 per cent in the face of approximately 30 per cent reduction in rates for this service. In 1922 there was a still further increase in income from each range with a 10 per cent reduction in the cost of energy to the consumer. The reason for this increase in revenue from ranges is not hard to explain. When an electric range is placed in the kitchen it soon proves itself to be a paying investment. It saves time, food and labor, protects the family health, and with the later automatic types of ranges has in some cases eliminated the necessity of a servant.

All of these factors are but the entering wedge for a completely

SOUTHERN CALIFORNIA EDISON COMPANY'S REVENUE FROM ELECTRIC RANGES AND WATER HEATERS
(1919 to 1922 inclusive)

| Year | Number of Ranges | Number of Water Heaters | Total | Total Yearly Revenue | Yearly Revenue per Range | Monthly Revenue per Range |
|---|---|---|---|---|---|---|
| 1919 | 1,689 | 663 | 2,352 | $89,811.74 | $38.19 | $3 18 |
| 1920 | 2,015 | 835 | 2,850 | 139,394.96 | 47.00 | 3.91 |
| 1921 | 2,549 | 652 | 3,201 | 178,729.70 | 55 80 | 4 65 |
| 1922 | 3,084 | 757 | 3,841 | 221,551.48 | 57 65 | 4 80 |

equipped electrical home—first one appliance and then another follows the range. Probably the first is the electric water heater, then the dish washer, air heater, mangle, toaster, percolator and so forth.

It is these additional electrical servants that are increasing the income from each range user. After installing a range a great many consumers have begun to heat their homes with electricity, and on the ranches electric incubators and brooders have been added.

Fifteen hundred to two thousand electric ranges and five hundred to eight hundred water heaters will be connected to the lines of the company during 1923.

## Vacuum Cleaner Show Brings Many Sales

ONE of the most successful of the New York Edison Company's series of appliance shows which have been held in its Irving Place showroom this spring was the vacuum cleaner exhibit from May 14 to 19. At this show twenty-eight different cleaners were displayed, and the manufacturers and dealers who participated in the exhibit expressed themselves as highly pleased with the results. Attendance at the show was exceptionally good, and 107 cleaners were sold from demonstrations on the floor.

The vacuum cleaner show was the sixth of the series which have been staged by the Edison company since the first of the year. The seventh and last of the shows will be the electric vehicle exhibit, June 4 to 9, N. E. L. A. convention week, and upon this special effort is being exerted to make it of particular interest to visiting central-station men.

## Utility Suspends Stock Sale to Help Another Industry

THE action of the San Joaquin Light & Power Corporation in suspending stock sales for a period of thirty days so as not to interfere in any way with the refinancing of the Sun Maid Raisin Growers' Association exemplifies the interest a power company should take in the community it serves. The company's campaign to sell $2,000,000 in prior preferred stock started on March 15 and was well under way when it became evident that the drive of the Raisin Growers' Association would require the undivided attention of every investor in the San Joaquin Valley. The raisin industry is of vital importance in the territory served by the power company, and accordingly a postponement in the sale of the utility's stock was declared so that the raisin men could have the right-of-way.

The following letter addressed to district managers and department heads of the San Joaquin Light & Power Corporation by General Manager A. Emory Wishon shows the company's policy of co-operation with other industries in its territory:

We have just started a campaign to sell our prior preferred stock to the public through the agency of our employees. Quotas have been allotted and the whole set-up has been based on the spirit of competition.

Just at this time the Sun Maid Raisin Growers are arranging for a drive to sell $2,500,000 in stock throughout the San Joaquin Valley. The stability of the raisin industry is the most vital and serious subject that has ever confronted this great valley. The Sun Maid stock must be sold. Our own drive will mean little to us if the raisin industry is not maintained on a strong, well-financed basis. Our drive must be regarded of secondary importance for the time being. We deem it highly advisable at this time to delay our own campaign until April 26 (Raisin Day), the date on which the Sun-Maid drive terminates.

On April 27 the sale of San Joaquin prior preferred stock will again be opened on the same basis as originally outlined. This delay will mean additional effort on the part of all of us during the remainder of the year; but I know you feel as I do that we must do everything possible during the next month to see that the Raisin Growers' effort at refinancing is successful.

## What Other Companies Are Doing

**Providence, R. I.**—On March 1 the Narragansett Electric Lighting Company's lighting division faced a deficit of 30 per cent in campaign meters as compared with the total set up during the corresponding period of 1922. A "nothing down" house-wiring offer was therefore instituted, the first payment being due thirty days after signature of contract and the balance monthly with the same time limit as in other offers. Business immediately picked up, March showing 506 meters added and April 1,045 meters, or more than double the previous maximum monthly record. In two months, says F. A. Gallagher, Jr., manager of the division, the 30 per cent deficit was changed to a gain of 49 per cent over the same period last year.

**Indianapolis, Ind.**—On May 12 the Electrical Development Association of Indianapolis opened a nine-room electric home in this city for a one-week display to the public. For the promotion of the home a budget of $4,000 was appropriated by the electrical interests of Indianapolis, of which $3,700 was spent for publicity.

**Manchester, N. H.**—To obtain the needed increase in space for its general offices and appliance sales department, the Manchester Traction, Light & Power Company has announced the plans for a new office building to be erected in the shopping center of the city.

**Fresno, Cal.**—Work on the ten-story office building of the San Joaquin Light & Power Corporation is progressing rapidly, and it is expected it will be completed and ready for occupancy by Nov. 1 of this year. A large electric sign will be placed on the roof of the building, and special attention is being given to the lighting and electrical installation in the building. A radio-telephone set for broadcasting programs and load dispatching will be a feature of the company's new quarters.

ONE AISLE OF VACUUM-CLEANER EXHIBIT AT NEW YORK EDISON SHOWROOM

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Generation, Control, Switching and Protection

*Dynamic Braking Characteristics of Induction Motors.*—T. P. KIRKPATRICK.—Dynamic braking is obtained by disconnecting the motor from the power line and applying direct current to one or more phases of one member, usually the stator, while the windings of the other member are closed through a resistor. Then when the rotor turns the conductor cuts the magnetic field, inducing voltage and current with the resulting torque. The method of predetermining the performance of a motor under these conditions is described. The torque obtainable is equal to about 150 per cent of full-load torque. While dynamic braking is not adapted to all braking requirements, there are many applications where its advantages merit careful consideration.—*Electric Journal*, April, 1923.

*Problems in High-Speed Alternators and Their Solution*—J. ROSEN.—The author presents in a concise form some of the more interesting problems encountered and the methods adopted to solve them. Among the subjects covered are the history and failures of turbo-alternators, mechanical construction of rotors and caps supporting the coil ends, stator windings and insulation, stator slots, ventilation and cooling, exciter instability, eddy currents in rotor and several oscillographic tests. —*Journal of the Institution of (British) Electrical Engineers*, April, 1923.

## Hydro-Electric Development and Steam Equipment

*Preliminary Developments on a Hydro-Electric Project.*—H. K. FOX.—On the north and west forks of the Kings River in California the San Joaquin Light & Power Corporation has started work on the first unit in a chain of hydro-electric developments that will ultimately produce more than 300,000 hp. The main features of the development discussed are the four storage reservoirs, ten diversion dams, 34 miles of tunnels and conduits and seven proposed power plants.—*Engineering News-Record*, April 19, 1923.

*Steel-Mill Power Costs Reduced by Heating Feed Water.*—L. HELANDER.—A significant reduction in fuel consumption can be obtained by using multiple-stage condenser heaters and bleeding the main turbine. This involves replacing the common method of the feed-water heating in an open heater by a series of closed heaters. The author demonstrates the merits of the various methods of heating the feed water and of driving the auxiliaries by establishing heat balancers for an assumed steel plant having steam-driven turbo-blowers, steam turbine generators and completely electrified mill drive. He presents a table of comparative fuel consumption and power data for various methods of driving auxiliaries and heating the boiler-feed water of a steel plant.—*Iron Age*, April 12, 1923.

*High-Temperature and High-Pressure Steam Lines.*—B. N. BROIDO.—An abstract of this paper, presented at the annual meeting of the A. S. M. E., may be found in the ELECTRICAL WORLD for Dec. 9, 1922, page 1291.—*Mechanical Engineering*, May, 1923.

## Transmission, Substations and Distribution

*Calculation of Direct and Alternating Current Networks.*—F. T. CHAPMAN.—The author discusses the "break" or "cutting-point" method for calculating direct-current networks and introduces a complementary theorem to show the usefulness of these methods for alternating-current circuits.—*Electrical Review*, March 30, 1923.

*Fatigue of High-Voltage Cables.*—M. KLEIN.—Basing his observations upon a large series of carefully conducted tests on specially made paper-insulated high-voltage cables, the author describes a heretofore unobserved phenomenon of fatigue observed on the cable. One of two equal lengths of cable was subjected to the standard voltage test, the other was intermittently tested with a considerably higher tension. Short lengths of these two cables were then electrically punctured. The higher-stressed cable broke down at 10 per cent lower values than the normally stressed cable. Further overvoltage tests lessened the dielectric strength of the cable to 13 per cent below that of the normally tested cable. Five weeks later the same cables were tested again, without previous stressing, and it was found that they both now showed the same dielectric strength. The author assumes from this that the previous decrease of the puncture voltage must have been due to a temporary fatigue effect from which the cable recovered. That the heating of the cable due to the overvoltage stress could not have been responsible for the lessened dielectric strength was demonstrated by check tests in which the cable was purposely heated before being tested.—*Elektrotechnische Zeitschrift*, March 15, 1923.

*Inductive Interference Between High-Voltage and Low-Voltage Lines.*—R. RÜDENBERG.—Much has been written on this subject, but all calculations were based upon the partial capacities of the two lines under consideration. This paper shows a direct and much more convenient method by taking into account the electric fields formed around the wires. Formulas are developed for single, two-phase and three-phase lines, with concrete examples for each case. An important part of the article is devoted to conditions on three-phase lines with a ground on one of the conductors.—*Bulletin de l'Association Suisse des Electriciens*, March, 1923.

## Units, Measurements and Instruments

*Directions for the Study of Pressboard for Electrical Insulating Purposes.*—The report of the British Electrical and Allied Industries Research Association on pressboard for electrical insulating purposes. It contains definitions, terminology and classification of pressboard, tests and a method of ascertaining the electrical strength of pressboard when subjected to long application of alternating-current stress. The specific tests described include the following: tensile strength and extension, compression strength, shearing or tearing strength, cohesion between layers, flexibility, electric strength, shrinkage and swelling, freedom from chemical reaction, conducting particles and pinholes, effect of oils, water absorption and determination of thickness and density.—*Journal of the Institution of (British) Electrical Engineers*, April 1923.

*Control of Boilers by Temperature and Draft Measurements.*—J. B. C. KERSHAW.—The author describes various types of draft gages and temperature indicators. He discusses the proper location both for induced-draft and forced-draft systems and points out the best location for draft gages and temperature indicators.—*Engineer*, April 27, 1923.

## Illumination

*Electrifying the Garment Industries.*—The methods used by a successful electrical contractor in wiring lofts for the garment industries are described. The description tells the requirements of each department and how these requirements are met both in the correct planning of the machines and the installation and selection of the proper electrical and lighting equipment. A comprehensive table of dimensions, outlets and lighting units used in a typical garment loft is given.—*Electrical Record*, April, 1923.

## Heat Applications and Material Handling

*Transformer to Heat Wheel Tires.*—T. PAUSERT.—Locomotive and car-wheel tires are fastened to the wheel body by heat shrinking. The heating of the tire is done either with a charcoal fire or with a number of gas torches. It requires 3 cu.m. to 6 cu.m. of gas to heat one tire of a diameter of 104 m. to 1.50 m. Considerable difficulty is encountered in heating the tire uniformly by these methods and in controlling the heating properly, and a new electric induction type of heater

has been developed for this purpose, based upon the same principle as an induction furnace. A two-legged transformer core with the primary winding placed around the lower yoke has an easily removable upper yoke, the magnetic joint being of the butt type. With the yoke removed, the tire is placed over one of the upright transformer legs, the yoke is closed, and the primary winding is energized. The tire represents the short-circuited secondary winding and will soon come to the necessary red heat. Two models are being manufactured for tires up to 0.80 m. and up to 1.90 m. diameter respectively. To heat an 0.80 m. diameter tire, 25 kva. at 65 per cent power factor is required for twenty-five minutes. Primary winding taps permit heat regulation within wide limits.—*Revue Générale de l'Electricité*, March 24, 1923.

## Motors and Control

*Starting of Three-Phase Induction Motor with Cage Rotor.*—T. HASEGAWA. — In the three-phase squirrel-cage induction motor the problem of increasing the starting torque and of suppressing the heavy starting current have been the most troublesome. The author classifies and tabulates the various methods that have been developed along this line.—*Journal Institute of Electrical Engineers of Japan*, March, 1923.

*Brush-Shifting Polyphase Motors.*—R. A. JONES and F. A. ANNETT.—For loads requiring speed adjustments the polyphase brush-shifting alternating-current motor is finding wide application. In this article the fundamentals governing the operation of this type of motor are explained by comparing its action with that of a direct-current series motor.—*Power*, April 17, 1923.

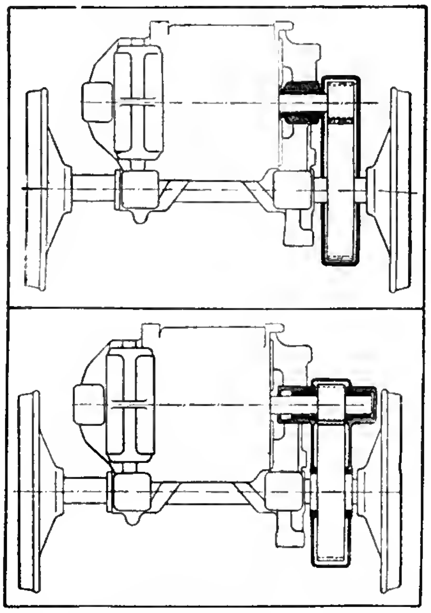
## Electrophysics, Electrochemistry and Batteries

*Reactions of the Lead Storage Battery.*—M. KNOBEL.—After a short theoretical discussion of the lead storage batteries, the results of the author's investigations are given. These support the evidence in favor of the Gladstone and Tribe theory of reactions in the lead storage batteries. The claim of Fery that only one mol of sulphuric acid is used per two faradays on discharge is not supported, which tends to disprove Fery's theory.—*Paper Presented Before American Electrochemical Society*, New York, May 3-5, 1923.

*Oscillations Produced by Means of a Tungar Rectifier.*—Y. WATANABE.—The author treats of the relation between oscillation and the heating condition of the filament of the tungar rectifier, which forms the cathode of the arc. When the filament current is comparatively small oscillating currents of relatively high audio-frequency are produced, traversing the condenser connected across the terminals of the tungar bulb. This oscillation may be considered to be due to an ionic oscillation of negative ions in the arc. When the filament current is increased an intermittent current is produced in the condenser circuit, which is of low frequency. This phenomenon was oscillographically observed by Hull's arrangement for rectification with the kenotron.—*Journal Institute of Electrical Engineers of Japan*, April, 1923.

## Traction

*Double Bearing for Railway Motors.* —M. KAMMERER.—The author suggests increasing the life of the gears by abandoning the traditional flying pinion and that a bearing on either side of the



PINION OF DRIVING MOTOR PLACED BETWEEN DOUBLE BEARING

pinion be used instead. As these two bearings can be each only half as long as the previously used single bearing, it should not be difficult to find room for this construction, as will be seen from the accompanying figure. With such a bearing construction, a pressure on the teeth not exceeding 600 kg., and lubrication with oil rather than with heavy grease, the life of these gears will be very materially increased. —*Elektrische Betrieb*, March 24, 1923.

*Alternating-Current Locomotives in Northern Sweden.*—W. REICHEL.—The important cross-country railway in northern Sweden connecting Lulea and Narvik, both north of the Arctic Circle, has now been completely electrified and is, with a length of 475 km., one of the longest European electric railroads. The road is used primarily for the transportation of heavy iron-ore trains. Thirty to forty cars, each loaded with 35 tons of ore, is the average train capacity to be hauled, and a yearly total of five million tons has to be transported. The paper does not go into any detail concerning the locomotive type, but describes in a general way the experiences of operation on this unusual line with the older (1914) and the latest type of 1C+C1 engines. The machines cover on the average 12,000 km. per month, or, with 250 operating days, 150,000 km. per year. *Siemens Zeitschrift*, March, 1923.

## Telegraphy, Telephony, Radio and Signals

*Specializing Transportation Equipment for Telephone Construction and Maintenance Work.*—J. N. KIRK.—The author describes in a general way the application of motor vehicles and their associated apparatus in connection with outside plant construction and maintenance work, outlining through the successive stages of development what has been accomplished in this respect up to the present time. To give a comprehensive picture, the more primitive types of equipment, together with the manual methods of doing work, are shown in comparison with representative instances of higher development during the past few years.—*Electrical Communications (published by the International Western Electric Company)*, February, 1923.

*Practical Application of Carrier Telephone and Telegraph in the Bell System.*—A. F. ROSE.—The author summarizes the application of carrier current up to the present time and gives a few typical examples where it has been found economical to provide circuits by means of carrier current rather than by other types. At present in the carrier telephone system there are twenty-nine channels, representing a distance of 14,636 miles. In the carrier telegraph system there are 151 channels, representing 83,713 miles. Line diagrams of the more important systems are given.—*Bell System Technical Journal*, April, 1923.

## Miscellaneous

*Electric Piloting of Ships.*—The entrances of several large harbors are already equipped for electric piloting, which is made possible by a submarine cable laid along the bottom of the entrance channel. The cable is charged from its shore end with alternating current of 500 cycles, while its other end is grounded at sea. On each side of the piloted ship a coil is placed, and the current induced in these two coils is compared by listening on two telephone receivers. As long as the ship keeps directly above the pilot cable the sound in the two telephones will be of equal strength. The Siemens piloting system, however, does away with the necessity of steering by sound. The cable is energized with commercial alternating current of 50 cycles, and the induced current in the coils, after being amplified through a set of electron tubes, is used to actuate a double moving-coil instrument, with one coil and pointer for starboard and the other coil and pointer for port. To enable a ship equipped with the Siemens system to respond also to a 500-cycle cable, two sets of amplifiers are provided for the indicating instruments, one set for the low-frequency and one for the high-frequency current. The induction coils on board ship measure each 1,000 mm. by 650 mm. and may be swung flat against the side of the boat when not in use.—*Siemens Zeitschrift*, March, 1922.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Drop Protest on Lock 17

**Alabama Power Company Likely to Get Permission to Build Plant—Power Loop Still Opposed**

WITH the withdrawal of a protest by the Birmingham Water, Light & Power Company against the granting by the Alabama Public Service Commission of a petition from the Alabama Power Company for permission to develop hydro-electric power at the government dam at Lock 17 near Tuscaloosa, it is thought certain that the company's petition will be granted. It was brought out at a hearing last Saturday that the projected plant would cost approximately $500,000 and would insure an annual saving of approximately $120,000 as compared with a steam plant. A 10,000-hp. unit can be ready for operation within twelve months from the time permission is granted. Successful operation of a plant at the site is dependent upon ability to tie in with transmission lines conveying the power to places where it can be used.

### Opposition to Power Loop

Strong objection was raised to the petition of the Alabama Power Company to build a transmission line from Sheffield to Huntsville, which, as shown in the Electrical World for May 5, page 1052, would complete a "power loop" in Alabama. The chief objection was that such a line would further hurt the chances of Henry Ford at Muscle Shoals.

It was revealed, however, that the Tennessee Valley is not a unit in opposing the plans of the Alabama company. Representatives of various cotton mills and other manufacturing enterprises at Huntsville, Sheffield, Athens and Albany-Decatur appeared before the commission and declared that their plants needed the power that would be carried over the new line. They called on the commission to grant the petition of the company at once.

## Public Service Company Is Mapping by Airplane

Following the growing practice of central-station companies of using airplanes in surveying the route for new transmission lines, the Public Service Electric Company of New Jersey is obtaining maps in this way instead of employing state and National Geographic Survey maps, as was its former practice. The state and national maps were made to a scale of 2,000 ft. to 5,000 ft. per inch, while the serial maps obtained from the airplane are on a scale of only 800 ft. to the inch and show in detail the surrounding territory. Relative heights of buildings, chimneys and trees are determined by the shadows on the ground. The character of the surface of the ground and of farm lands stands out in bold relief. Measurements made in the field between prominent land marks check accurately with the scaled-map distance.

In order to get accurate picture maps, the airplane flies at a uniform altitude of 10,000 ft. and many pictures are taken. When printed they are matched accurately, the sections which overlap being eliminated. The company has a continuous aërial map showing the meadows from Newark Bay and the Passaic River to Passaic and Paterson, also one of Hudson County, including the Kill von Kull, Bergen Point, Bayonne and part of Jersey City. A map is now being made of the southern division.

## Harris J. Ryan New President of A. I. E. E.

**Formal Ratification of Directors' Nominations Made at Annual Business Meeting—Net Growth of 1,035 in Membership, with 847 Section and Branch Meetings**

Prof. Harris J. Ryan
President-Elect A. I. E. E.

PROF. HARRIS J. RYAN of Stanford University, California, was elected president of the American Institute of Electrical Engineers at its annual business meeting, held in New York on May 18, and the other officers selected in March as "directors' nominees" were formally confirmed. The five new vice-presidents, who take office along with the president on Aug. 1, will be: From district No. 2 (Middle Eastern), William F. James, Westinghouse Electric & Manufacturing Company, Philadelphia; district No. 4 (Southern), Henry E. Bussey, General Electric Company, Atlanta; district No. 6 (North Central), Herbert S. Sands, Westinghouse company, Denver; district No. 8 (Pacific), J. E. Macdonald, Los Angeles; district No. 10 (Canada), S. E. M. Henderson, Canadian General Electric Company, Toronto. The three new managers are: William M. McConahey, Westinghouse company, East Pittsburgh; William K. Vanderpoel, Public Service Corporation, Newark, N. J., and H. P. Charlesworth, American Telephone & Telegraph Company, New York. George A. Hamilton, Elizabeth, N. J., was re-elected treasurer.

In the annual report of the board of directors, which was presented at this meeting, very satisfactory results of the membership committee's efforts were shown. The institute has now six honorary members, 578 fellows, 2,264 members and 12,450 associate members, a grand total of 15,298, which is a net gain of 1,035 as compared with the previous year. The report on activities of local sections and student branches showed that there are now forty-six sections and sixty-eight branches, a gain in each case of one over last year. Three hundred and forty-four section meetings, with a total attendance of 46,672, and 503 branch meetings, with a total attendance of 26,893, were held, making an aggregate attendance of 73,565 at 847 meetings.

Sixty-three deaths, five of fellows, ten of members and forty-eight of associates, occurred in the year.

## Another Step in Massachusetts Superpower Development

By the incorporation of the Montaup Electric Company of Fall River, Mass., with a capital stock of $7,500,000 divided into 15,000 shares of preferred and 60,000 shares of common stock, another forward step has been taken in the development of the superpower idea in the Bay State. As recently announced in the Electrical World, this company is formed to generate,

transmit and sell electricity from a new tidewater station to be built on Mount Hope Bay at Fall River, the systems of the Fall River Electric Light Company, the Blackstone Valley Gas & Electric Company and the Edison Electric Illuminating Company of Brockton to be the beneficiaries of the plan. Transmission lines and other equipment for the interconnection of these companies form a part of the program. The incorporators are S. B. Chase, president, and Henry B. Sawyer, treasurer, who, with R. F. Whitney, A. Stuart Pratt and V. D. Vickery, are directors.

## Eber Bill Amended

**Effort to Prevent All Water-Power Development in Wisconsin for Six Years Fails**

THE menace to the development of hydro-electric plants on water-power sites in Wisconsin by private companies which for a time was seriously threatened by the possible enactment of the Eber water-power survey bill was thought to have passed when the joint finance committee of the State Legislature voted on Thursday, May 17, to postpone a vote on the bill indefinitely. The proposed measure would have held up for six years all water-power development in Wisconsin pending an extensive survey by the Railroad Commission in the interest of state exploitation. A few days later, however, the Assembly ordered the bill engrossed, changing the six-year period of cessation to two years.

Among those who appeared in opposition to the bill at a hearing before the committee was G. C. Neff, vice-president of the Wisconsin River Power Company, who charged the sponsors of the Eber bill with trying to make the people believe that by developing water-power sites the entire state can be electrified. "This is untrue," he said. "Hydro-electric plants will serve only as supplementary sources of power. The steam plants will continue to be the dependable generating stations. If all the available water-power resources capable of economic development in Wisconsin were utilized and made available by 1930, it would amount to about only 25 per cent of the total electrical energy consumed." Mr. Neff also accused the sponsors of the bill of holding out the false hope that electricity can be generated so cheaply that it will take the place of coal in heating homes.

Russ A. Walter of Detroit, a personal representative of Henry Ford, also appeared in opposition to the bill. "Mr. Ford has already developed water-power sites in Michigan and has erected branch plants on his properties," said Mr. Walter. "The same policy will be followed in Wisconsin."

Mr. Walters upon being asked directly whether Mr. Ford planned to enter the water-power development field in Wisconsin in the next six years, replied that that was his plan.

## Water-Power Conference

**Eight Southern States, Including West Virginia, To Be Represented at Asheville Meeting**

AT THE second meeting of the Southern Appalachian Water Power Conference, to be held at Asheville, N. C., June 25-27, there will be in attendance representatives of the eight states of North and South Carolina, Virginia, West Virginia, Georgia, Tennessee, Alabama and Mississippi, including outstanding figures in public utility companies, public service commissions and state geological and conservation work, engineers, bankers and manufacturers.

One of the most important problems to come up will be interchange of power between companies in the several states, this involving not only economical and engineering but legal and industrial considerations. The possibilities of interconnection were vividly illustrated last summer and in the drought of 1921, when the Alabama Power Company diverted the power of the Gorgas steam plant near Muscle Shoals, sending it to the Georgia Railway & Power Company, which in turn transmitted an equal amount of energy to the Southern Power Company, the latter relaying the power received to the Carolina Light & Power Company for the use of its customers in Raleigh and neighboring sections. This operation involved a transfer of power over interconnected lines of approximately a thousand miles, operating in four states.

Another important question to be discussed will be the establishment of central steam plants to supplement hydro-electric stations. Preferably these plants would be built near coal mines and on streams affording a suitable supply of water for condensation. The only known site in North Carolina which fulfills the requirements is in the first stage of development by the Carolina Light & Power Company, which is building near Moncure a 15,000-kw. unit as a part of plans which contemplate an ultimate development of 60,000 kw. The plant is on the Cape Fear River and near the Deep River coal fields.

The conference will also consider an expansion of activities to include departments concerned with public relations, power companies, regulatory bodies and the general public, as well as departments for compiling and disseminating information as to natural resources, including water powers, minerals, forests, etc.

## Time for Obtaining New York Licenses Extended

Some confusion exists regarding the proper interpretation of the law passed in New York to govern the licensing of engineers, and as a result an emergency bill pushed through the Legislature and signed by the Governor has extended the period in which licenses may be obtained from May 5 to Aug. 1, 1923. The misunderstanding which originally existed has been further complicated by an interpretation of the law handed down at the last minute by Prof. A. S. Downing, in charge of its enforcement, to the effect that any person above the grade of plumber who may be compelled to exercise initiative, skill or judgment in engineering construction work must have a license. Interpreted more specifically in terms of electrical construction, this would mean that any construction man who builds a line and does not follow in detail a blueprint reviewed by a licensed engineer would be compelled to have a license.

The Empire State Gas and Electric Association points out that this interpretation makes no distinction between grades of engineering and allows anyone having a license to practice in any branch of engineering regardless of whether he is fitted to do so or not. Feeling that such a ruling is not justified, the Electric Section of the association, assembled at Utica May 17, voted in favor of appointing a committee to discuss with Professor Downing the proper interpretation of the law.

## Los Angeles City Authorities for Boulder Canyon Plan

A DEMAND on the municipal electric system of Los Angeles which is increasing at the rate of 20 per cent compounded annually is made the text of a folder prepared by the city's Department of Public Service for the information of its citizens. This folder says:

"The total quantity of power that can be developed by the city along the aqueduct and on Owens River streams amounts to about 220,000 hp. Contrast this available supply of electrical energy with the city's increasing needs. For the past five years the use of electrical energy in Los Angeles has increased at the rate of 22 per cent compounded annually. Assuming only a 15 per cent annual increase for the next seven years, by 1930 the entire city for all purposes will require 540,000 hp."

Boulder Canyon, on the Colorado River, is the logical source for the development of a large new hydro-electric supply for Los Angeles, in the opinion of the department. "Los Angeles should stand ready to secure its fair share of Boulder Canyon power," the folder says. "Boulder Canyon power, delivered to this city by its municipal electric system, will insure the continuation of low electric rates; it will supply the energy so urgently needed if Los Angeles is to continue to grow industrially and commercially. Los Angeles seeks only its fair share of this power after the requirements of all other communities within economic reach have been satisfied. In addition to supplying the urgent power requirements of Los Angeles and the Southwest generally, electrical energy developed at Boulder Canyon will provide the money to repay the federal government the entire cost of the high dam."

## Final N. E. L. A. Program

**Addresses by President Lowell of Harvard, Melville E. Stone and H. B. Swope Are Added**

OFFICIAL announcement by M. H. Aylesworth, executive manager of the National Electric Light Association, is to the effect that the program for the forty-sixth convention of that body in New York City beginning a week from Monday is now complete and the "best ever offered to any industry." Concerning some special features of the program Mr. Aylesworth says:

"The Public Relations Section will have a program for executives beginning Monday afternoon, June 4, at 2:30, dealing with all angles of this most important subject. On Monday afternoon Thomas A. Edison will deliver a message to the Public Relations Section which should mean a great deal to the industry. On Tuesday afternoon leading newspaper men will deliver timely addresses telling us more about publicity, and the subject will be thoroughly discussed in a symposium by chairmen and directors of state committees on public utility information. Herbert Bayard Swope, executive editor of the New York *World*, and Bruce Barton, editor and writer, will open the discussion. On Wednesday afternoon public utility commissioners from various states and electric light and power company executives will discuss public relations. Thursday afternoon has been set aside for the customer-ownership committee, and B. C. Forbes, publisher and financial writer for the Hearst organization and other syndicates, will open the discussion, while prominent leaders of the industry, including Samuel Insull and E. K. Hall, vice-president American Telephone & Telegraph Company, will address the meeting.

"The morning sessions, beginning Tuesday morning and closing Friday noon, will be addressed by prominent men in the industry and reports of great importance will be presented. Among those from without the industry who will talk at the four morning sessions are O. E. Bradfute, president of the American Farm Bureau Federation; Melville E. Stone, counselor Associated Press; Lewis E. Pierson, chairman of the board, Irving Bank-Columbia Trust Company; Dwight N. Lewis, president National Association of Railway and Utilities Commissioners; President A. L. Lowell of Harvard University, and O. C. Merrill, executive secretary Federal Power Commission. On the night of June 7, at Carnegie Hall, Julius H. Barnes, president of the Chamber of Commerce of the United States, will deliver an address on public ownership which will be carried by radio to the entire nation."

The addresses by President Lowell, M. E. Stone and H. B. Swope, as well as those by Samuel Insull and E. K. Hall, are features not included in the tentative program printed last week.

## Sixty-one Big Installations Under Way

**Larger Power Stations and Extensions Built in 1923 Will Have Rating of 3,546,000 Kva.—Nearly One-third of New Plants Are Hydro-Electric—To Cost $469,100,000**

BELOW is a tabulation of the chief power stations and extensions to existing power stations that are now under way and therefore belong in the electric building program of 1923. Nearly all of these have been noted in the ELECTRICAL WORLD at the time of their official announcement. As the table shows, twenty-one of them, with an aggregate rating of 1,145,000 kva., are hydro-electric, and forty, with an aggregate rating of 2,401,500 kva., are steam. There are eight entries of 100,000 kva. or more, the largest being the 210,000-kva. hydro-electric installation of the Niagara Falls Power Company and the next largest the 200,000-kva. steam plant of the Public Service Electric Corporation of New Jersey.

Geographically, the distribution (in kva.) is as follows: Middle West, 1,355,-500; Middle Atlantic States, 1,075,000; Southern States, 474,000; Mountain and Pacific States, 401,000; New England, 206,000.

### Electric Power Stations and Extensions Now Under Way

**(From the News Columns of the "Electrical World")**

HYDRO-ELECTRIC

| Company | Plant | Rating, Kva. | Company | Plant | Rating Kva. |
|---|---|---|---|---|---|
| San Francisco Municipal | Hetch Hetchy | 80,000 | Empire District Electric Co. | Table Rock | 60,000 |
| Metropolitan Power Co. | Susquehanna | 30,000 | Niagara Falls Power Co. | Niagara | 210,000 |
| Central Maine Power Co. | Skowhegan | 5,000 | Caddo River Power Co. | Ouachita | 90,000 |
| Western States Gas & Electric Co. | El Dorado | 30,000 | Pennsylvania Water & Power Co. | Holtwood | 30,000 |
| Portland Railway, Light & Power Co. | Oak Grove | 30,000 | Pacific Gas & Electric Co. | Pit No. 2 | 70,000 |
| Pacific Power & Light Co. | Deschutes | 7,500 | Great Western Power Co. | Caribou | 22,000 |
| New England Power Co. | Davis Bridge | 30,000 | Skagit River Power Co. | Skagit | 34,500 |
| Northern States Power Co. | St. Croix | 90,000 | Wisconsin-Minnesota Power Co. | Jim Falls. | 12,000 |
| Alabama Power Co. | Mitchell Dam | 90,000 | Los Angeles Municipal | San Francisquito | 25,000 |
| Denver Gas & Electric Light Co. | Boulder | 90,000 | Miscellaneous | | 35,000 |
| Georgia Railway & Power Co | Mathis | 62,000 | | | |
| Pacific Power & Light Co. | Hood River | 12,000 | Total | | 1,145,000 |

STEAM

| Company | Plant | Kva. | Company | Plant | Kva. |
|---|---|---|---|---|---|
| Louisville Gas & Electric Co. | Waterside | 20,000 | Indiana Electric Corp. | Wabash | 100,000 |
| East Penn Electric Co. | Pine Grove | 50,000 | Union Electric Light & Power Co. | Cahokia | 60,000 |
| Houston Lighting & Power Co. | Deepwater | 40,000 | Boston Edison Co. | Weymouth | 66,000 |
| Northern States Power Co. | High Bridge | 75,000 | Brooklyn Edison Co. | Hudson Ave. | 125,000 |
| Tri-City Railway & Light Co. | Moline | 26,000 | Duquesne Light Co. | Colfax | 60,000 |
| Commonwealth Edison Co. | Crawford Ave. | 70,000 | West Tennessee Co. | Springdale | 70,000 |
| Commonwealth Edison Co. | Calumet | 60,000 | Detroit Municipal | City | 100,000 |
| Sand Springs Power, Light & Water Co. | Sand Springs | 12,000 | Cleveland Electric Illuminating Co. | Lake Shore | 60,000 |
| Public Service Co. of Northern Illinois | Joliet | 30,000 | Southern Power Co. | Mount Holly, etc | 50,000 |
| Public Service Co. of Northern Illinois | Waukegan | 40,000 | Middle West Utilities Co. | Grand Tower | 50,000 |
| Connecticut Light & Power Co. | Devon | 75,000 | Ohio Power Co. | Philo | 70,000 |
| Tennessee Electric Power Co. | Nashville | 12,500 | Potomac Electric Co. | Washington | 25,000 |
| United Electric Light & Power Co. | Hell Gate | 70,000 | Counties Gas & Electric Co. | Barbadoes Island | 25,000 |
| Oklahoma General Power Co. | Muskogee | 27,500 | Philadelphia Electric Co. | Delaware | 60,000 |
| Oklahoma Gas & Electric Co. | Harrah | 20,000 | Toledo Edison Co. | Toledo | 37,500 |
| Pennsylvania Central Light & Power Co. | Saxton | 80,000 | Luzerne County Gas & Electric Co. | Kingston | 25,000 |
| New England Power Co., etc. | Montaup | 30,000 | Lorain County Gas & Electric Co | Elyria | 25,000 |
| Illinois Electric Power Co. | Peoria | 120,000 | Public Service Electric Co. | New Jersey | 25,000 |
| Detroit Edison Co. | Trenton Channel | 150,000 | Consumers' Power Co. | Zilwaukee | 100,000 |
| Public Service Electric Corp., (N. J.) | Kearney | 200,000 | | | |
| Public Service Electric Corp., (N. J ) | Essex | 60,000 | Total | | 2,401,500 |

TOTAL COST

| | | |
|---|---|---|
| Hydro-electric (21 Installations) | 1,145,000 kva., estimated at $200 | $229,000,000 |
| Steam (40 installations) | 2,401,500 kva., estimated at $100 | 240,100,000 |
| | 3,546,500 | $469,100,000 |

## Syracuse's Lighting Plan

**Well-Thought-Out System for Three-Million-Dollar Installation—Costs of Street Opening**

A PLAN adopted by the city of Syracuse, N. Y., for lighting its streets and described by K. V. Farmer at the Utica meeting of the Electric Section of the Empire State Gas & Electric Association last week provides for a thoroughly modern and well-considered system to cost $3,000,000. Briefly, the plan calls for four types of lighting, for business, main and secondary thoroughfares and residential streets. It includes the abandonment of 700 five-lamp ornamental poles and 2,000 4-amp. luminous-arc lamps on overhead lines. All the new lighting will be supplied from underground cables.

For business thoroughfares the plan provides cast-iron posts with two 6.6-amp. inverted luminous-arc lamps, spaced approximately 100 ft. apart, with the light source 18½ ft. above the street. On side streets one light is alternated on posts with the lamp source 14½ ft. above the street. For main thoroughfares cast-iron posts will also be used, with 400-cp., 7½-amp. incandescent lamps and large lanterns, the posts to be spaced 125 ft. to 200 ft. apart. For secondary thoroughfares the same type of post, with 400-cp. lamps spaced 200 ft. to 250 ft. apart and the light source 12½ ft. from the ground, is adopted, and for residential streets similar posts, spaced 150 ft. to 250 ft. apart, with small lanterns having a light source 12½ ft. above streets, are to be erected.

Mr. Farmer told of successful results achieved by gas companies through the use of compressed air in opening streets and making excavations. The Syracuse Lighting Company, he said, was considering also the use of a special plow built by the Philadelphia Electric Company for the installation of parkway cable in residential streets.

Following the presentation of Mr. Farmer's report, W. C. Blackwood, electrical engineer of the New York & Queens Electric Light & Power Company, declared that he is using 30 per cent Para rubber-covered single-conductor cable without a lead sheath in fiber conduit for series street-lighting circuits run underground. To increase the use of existing distribution lines and relieve the stations of equipment, type RO transformers will be connected to such lines for feeding street-lighting circuits.

Considerable time is being saved by the Brooklyn Edison Company in tearing up pavement preparatory to the installation of underground cable, R. A. Paine, Jr., outside plant engineer of that company, asserted, by using Ingersoll-Rand gas-engine-driven air compressors and hammers. Five of these are mounted on trailers for distant jobs, and five are on trucks for close-in routing. Space is being saved in substations by supplanting street-lighting tub transformers by pole-type regulating transformers of 10 kw. and 20 kw. controlled by time switches. These are connected to commercial 2,400-volt circuits and have been in successful use for seven years. About 150 time clocks are installed on the system, which require two men to keep them wound.

By installing moving-coil, pole-type, constant-current transformers for street lighting the Utica Gas & Electric Company expects to eliminate station fires and excessive maintenance of switchboards, E. P. Peck, general superintendent of the electrical department, declared. At the same time it will be able to control and meter the street-light circuit from a central point.

# Empire State Engineers Meet at Utica

**Street Lighting, Plant Economies, Hydraulic Design, State Survey of Interconnection Possibilities, Overhead Distribution, Underground Construction and Other Topics Discussed**

TIMELY engineering and operating problems were informally discussed by the Electric Section of the Empire State Gas and Electric Association at its meeting in Utica, N. Y., May 17 and 18, seven committees submitting reports. The manner of conducting the meeting was very effective and resulted in unusually valuable discussions. That on street lighting will be found at left.

Announcement of a survey of power and communication parallels in New York State now being made by the Empire State Gas and Electric Association in co-operation with the National Electric Light Association was made by W. F. Davidson of the Brooklyn Edison Company. Extensive studies are being made of the length of these parallels, the separation of the lines, voltage, frequency, type of power system and telephone circuit, satisfactoriness of telephone service, etc. This information is being collected to show the fallacy of placing drastic limitations on the proximity of power lines to telephone lines, it having been advocated in some sections that 2,300-volt parallels be limited to 3,000 ft. with 60-ft. separation and 110,000-volt parallels separated at least 1,500 ft.

It was pointed out by W. M. Carpenter, assistant secretary of the association, that rural service will be delayed if too drastic restrictions are placed on power and communication parallels.

E. P. Peck advised operating companies to consult the National Electric Light Association regarding their inductive interference problems rather than to try to handle them themselves.

Two peculiar cases of inductive interference were related by O. C. Davidson, Rochester Gas & Electric Company, and C. P. Scheller, St. Lawrence Transmission Company, which indicated the necessity of considering the circuit as a whole and not merely the parallels.

### Economies in the Boiler Room

Experiences in improving the operating economy of a specific plant were related by A. C. Jordan, general superintendent of the Elmira Water, Light & Railway Company. Particular attention was directed to reducing banking losses, blow-down, auxiliary steam and economizer troubles. By changing the method of banking the amount of coal required was reduced two-thirds; it now amounts to about one-tenth of a pound per boiler-horsepower per hour. Foremerly a station which had about 5,000 hp. in 750-hp. boilers had to blow down 15,000 lb. of water per day. Now they are not blown down at all. The boilers are filled once every three weeks with fresh water and 100 lb. of soda ash and tested regularly with a conductivity meter for salt content. When the concentration exceeds 35 grains per gallon the boiler must be blown down, but this has not been found to be necessary during the period of three weeks in which the boilers are operated continuously at 200 per cent. At the end of this time the boilers have to be shut down for maintenance anyway.

A study of the auxiliary steam requirements of circulating and boiler-feed pumps disclosed the fact that they were taking 50 per cent of the auxiliary steam. The equivalent steam consumption was greatly reduced by electrifying the auxiliaries and bleeding steam from the turbines for feed-water heating. In addition, the pump speeds were reduced to minimize the friction head and spring water at 56 deg. F. taken from driven wells mixed with river water at 32 to 80 deg. F. for circulating water. Means for adjusting the speed of pumps were highly favored.

Experiments with the best temperature of feed water for economizers disclosed the fact that it should be somewhere between 120 deg. and 157 deg. to avoid the extremes of sweating or steaming.

### Tendencies in Hydraulic Design

The design and installation of hydraulic equipment are tending toward simplicity, according to C. P. Scheller, St. Lawrence Transmission Company, who spoke on developments in this equipment. Impeller-type waterwheels are coming into use for heads up to 30 ft. While the efficiency of the unit is not so high as that of some other types of wheels, still its speed is so much higher that the over-all efficiency of a plant involving these units will be about the same. Straight-draft tubes are showing higher efficiency, and utilization of the siphon principle is enabling the setting of waterwheels above the pond level where this is not too much above tailwater. Integral-type governors attached to the turbine shaft are coming into use, and in some cases separately mounted flyball governors driven by synchronous motors are being used to

eliminate connections with the turbine. Oil-lubricated, babbitted bearings are gradually replacing lignum-vitæ bearings. Separate pumps for each bearing are also coming into use.

Committee work in New York State concerning the feasibility of greater interconnection within the state, as well as with systems in adjoining states, was outlined by E. P. Peck, general superintendent electrical department, Utica Gas & Electric Company. (See page 741, ELECTRICAL WORLD, Mar. 31.)

### OVERHEAD DISTRIBUTION PRACTICES

The report of the committee on overhead distribution, of which H. W. Watt, electrical engineer Westchester Lighting Company, was chairman, was presented in the form of separate papers by the members of the committee. Attention was called to the need of more accurate determination of the rupturing capacity of fuses, especially for underground service, by W. F. Butcher, who presented tables listing the ratings of various makes of fuses as well as the size of fuses used on transformers by five companies. H. S. Chartier pointed out that maps of overhead systems must be readily intelligible to every one who has occasion to use them; they must be easily made and not difficult to maintain, and they must be in easily accessible places and protected from dust and exposure. One method of meeting these needs was outlined.

Essential requirements in the design of three-phase, four-wire distribution systems were discussed by J. O. Montignani, Westchester Lighting Company, who contended that general interconnection of alternating-current mains has not proved practicable. Furthermore, he held, distribution circuits should not be allowed to ramble off from the territory assigned to them. Attention was called to the fact that the inductive reactance of No. 2/0 wire is about one and one-half times the ohmic resistance at 18 in. separation. In arranging the wires on cross-arms a definite and systematic plan should be followed and insulators of somewhat higher rating than the voltage of the line should be used. Economical alternating-current distribution, declared Mr. Montignani, requires the use of secondary mains of as great a length as possible fed by larger transformers. To permit isolating trouble the branch circuits should be provided with suitable cut-outs. The value of installing lightning arresters on distribution transformers was also emphasized.

Pole lines have not been sufficiently guyed in many places, C. W. Nickerson contended. He maintained that when a transmission line is constructed through open country and subjected to high wind pressure it should be guyed in both directions about every tenth pole. Tree guying was discouraged.

According to tests of poles reinforced with a concrete collar around the butt, newly reinforced poles give a strength at the ground line equal to, if not greater than, that of the original pole, L. B. Snyder asserted. Subsequently defects develop, however, such as shrinking of the pole within the concrete collar and resulting troubles from the accumulation of moisture. At best, this method only postpones replacement of the pole a few years, Mr. Snyder contended, and when replacement becomes necessary the added cost of removing and disposing of the concrete bases more than offsets the gain derived from the added life of the pole.

J. M. Howarth dealt with the economic loading of line transformers, and certain features of construction and operation which have a definite bearing upon the design of secondary systems were outlined by C. A. Bacon, Adirondack Power & Light Company. Mr. Bacon discussed methods of ascertaining the load to be handled, the effect of demand and diversity factors on wire and transformer sizes and approximate methods of calculating residential consumers' demand.

Operating a transformer underloaded is an inefficient utilization of the investment represented and is, furthermore, productive of low power factor and excessive core loss, declared Chairman Watt. Hence it should be avoided as much as exceeding the upper temperature limitation. Five methods of determining the loading of transformers were discussed, namely, record of meter load, voltage tests during peak load, indicating ammeter and wattmeter readings on secondary, recording ammeter or wattmeter, and use of a thermal indicator. The combination of thermal indicator with recording ammeter and recording wattmeter was recommended.

### SECTIONALIZING SWITCHES USED

In discussing the reports on overhead distribution W. G. Blackwood said that branch circuit cut-outs are not used by the New York & Queens Company because troubles on a circuit will interrupt service. Instead sectionalizing switches are used. Banking of transformers has been successfully employed on overhead and underground circuits for several years, expulsion fuses being used in the secondaries of small transformers and oil switches with large ones.

E. P. Peck spoke of the use of a common neutral for every purpose in Minneapolis. The system of the city is grounded at every possible point, considerable money being thereby saved. There is not much trouble in banking transformers, he said, if fuses rated at four times normal current are used in the primary or secondary side of the transformers.

The smallest transformer fuse used by the Brooklyn Edison Company, according to R. A. Paine, Jr., is 50 amp. With 50-kw. and 75-kw. transformers 75-amp. fuses are used and for 100-kw. transformers 100-amp. fuses are used. In specifying sizes of transformers that can be mounted on poles, he said, it is preferable to speak in terms of weight, rather than rating.

With three-phase, four-wire systems more tree trimming and more tree wires are required to insure uninterrupted service, H. W. Watt observed. W. C. Blackwood said that to insure economic loading of transformers the New York & Queens Company takes graphic readings at different periods. During the intervals the number of apartments, stores, etc., connected is recorded. Transformers of 25 kw. and larger have thermal indicators.

### UNDERGROUND SYSTEMS

Nine questions are to be specially investigated by the underground systems committee during the coming year, according to the announcement of R. A. Paine, Jr. They are conduit and manhole construction, manholes for transformers rated at 100 kw. and above, the best loading for cables, fireproofing cables, type of cables for four-wire three-phase systems, primary cut-outs for subway transformers, primary fuses or "disconnects" for underground lines, secondary distribution circuits (fused secondaries, single versus banked transformers, networks), and joints for high-tension cables. A. Hussey, Brooklyn Edison Company, presented a paper commenting on these and other subjects.

T. R. Eilenberg, New York & Queens Electric Light & Power Company, referred to some new manhole construction which has been adopted, new-type cable hangers and new distribution boxes which facilitate the location of trouble.

Creosoted-wood ducts are being used for primary and secondary services very successfully, Mr. Paine asserted. He referred to single-conductor, 45,000-volt cable with 20/32-in. paper insulation being installed by the United Electric Light & Power Company between the Sherman Creek station and the Hell Gate station, a distance of 11 miles. An installation of single-conductor, 66,000-volt cable with 30/32-in. paper insulation is being made by the Detroit Edison Company.

Experiences with high-voltage cable were related by W. F. Davidson, Brooklyn Edison Company, who called attention to the fact that ordinary compounds broke down in a relatively short time (thirty to fifty-five minutes) when 80,000 volts was applied between conductors and sheath owing to the formation of air bells in the compound. Petrolatum is now being used with much better results. The question is whether it will stay in the joints. It is possible that reservoirs may be required to keep the joints filled. Joints filled with this compound have been operated at 120,000 volts, three-phase, and 95,000 volts between conductors and sheath for seventy hours without failure, with "Conducell" partitions around the joints and no hand wrapping.

### RURAL SERVICE SITUATION

Rural service should be developed along such lines that it will be self-supporting, declared W. J. Reagan of the Utica Gas & Electric Company. He contended that the rural charge should be equal to the urban charge plus an excess charge equal to the additional expense of furnishing rural service.

## Clarion River Equipment

**Half of Apparatus for Piney Plant Now Ordered—Potential Development Reaches 400,000 Hp.**

THE first order for electrical equipment for the Clarion River project of the Penn Public Service Corporation has been placed by the General Construction Corporation with the Westinghouse Electric & Manufacturing Company and consists of two 12,000-kva. vertical waterwheel generators with transformers and switching equipment. This equipment will be installed in the Piney Creek power house, which will be the first of the three generating stations in the project to be put in operation. It is expected that this plant will be ready in 1923.

The plans for the Clarion project call for the construction of three dams and generating plants. One of these, known as the Foxburg development, is to be about two miles from the mouth of the Clarion River, which empties into the Allegheny 60 miles north of Pittsburgh. The second, the Piney development, is about 24 miles upstream. The third is still farther upstream, about 6 miles above the town of Clarion, Pa., and is known as the Mill Creek development. The dam at Piney will be about 75 ft. high, that at Foxburg about 175 ft. and that at Mill Creek about 250 ft.

The ultimate installation at Piney will be 44,000 hp., at Foxburg 88,000 hp., and at Mill Creek 130,000 hp. One half of the apparatus for the Piney plant is included in this first order.

The Clarion River is formed by the union of two branches 90 miles north of Foxburg and is fed by many other tributaries in its drop of 500 ft. to the Allegheny. Its total drainage area is 1,257 square miles, most of which is unsettled and unimproved forest land. When completed, the project will impound about 47,550,000,000 cu.ft. of water in the watershed of the Clarion River and its lower tributaries, a volume sufficient to develop 400,000 hp. of electrical energy. A total expenditure of about $28,000,000 will be necessary to complete the project. It is proposed to use the electric power for the industrial development of northwestern and western Pennsylvania and regions in eastern Ohio.

## Ford Reveals His Plans for High Dam Development

The formal application of the Ford Motor Company for a license covering the High Dam project at St. Paul was filed with the Federal Power Commission on May 22 by J. H. Manning, the managing engineer for Stone & Webster. This action is in pursuance of the terms of the preliminary permit which the Federal Power Commission granted the Ford Motor Company after the hearing held on March 2.

The application for license was accompanied by detailed plans of the development which appear to have met the commission's approval. Under the law these plans must be approved by the Secretary of War and the Chief of Engineers as well, because of the relationship between this project and navigation structures.

It will be necessary to cofferdam off the structure and make slight modifications in the original concrete to allow for the newer types of machinery which will be installed. In addition, the power house must be built and the necessary transmission equipment installed. The plans of the Ford company include a steam plant which is to be erected adjacent to the hydro-electric plant, or possibly may be housed in the same building.

## Municipal Ownership Mayor Elected in Denver

Ben F. Stapleton was elected Mayor of Denver on May 15 over D. C. Bailey in a bitterly contested fight in which municipal ownership of utilities played a chief part. Mr. Bailey, the present Mayor, had opposed the idea of the municipality acquiring its utilities. Mr. Stapleton, who had Governor Sweet's support, favored it, though not so unequivocally as five other candidates who went to defeat along with Bailey. Stapleton explained his platform as "the protection of the city's interests in the operation of public utilities and purchase of such utilities as can be purchased at a price which will permit the people to operate them advantageously." By the Denver charter all questions of franchises and ownership of public utilities must be submitted to the voters. Such a vote cannot be held for three years, but the newly elected Mayor's term will not have expired then.

## General Goethals Is Called in at Colorado Springs

The long-continued argument between the city of Colorado Springs and the Colorado Springs Light, Heat & Power Company over the amount of power that can be derived from the Pike's Peak watershed entered on a new phase recently when the city engaged G. G. Anderson, a Los Angeles engineer, to make a report. Mr. Anderson sustained the city's contention that there was sufficient water power obtainable to make it possible to supply the city from a strictly hydro-electric plant. This contention is disputed by the central-station company, which maintains that it will be necessary to have a steam station in reserve. In an endeavor to settle the question, the company has engaged Gen. George W. Goethals to survey the watershed and submit a finding.

On June 12 the voters are to pass upon the renewal of the company's franchise. If it is finally determined that no steam plant is necessary, the city plans to charge the company $100,000 annually for the use of the water. At present the company generates by both water and steam power.

## Johns Hopkins in Line

**Follows Trend of Engineering Education by Establishing New Arts Course for Technical Men**

THROUGH co-ordination between the Johns Hopkins School of Engineering and the College of Arts and Sciences it is planned to establish at the Baltimore university next October a preliminary arts course for students who expect to take later courses in mechanical, electrical, civil, chemical or gas engineering.

The new course will extend over a period of three or four years, depending upon the student's ability, after which he will be allowed to complete a regular engineering course in two additional years. The student will receive the degree of bachelor of arts at the end of his pre-engineering course and the regular bachelor of engineering degree upon completion of the two-year technical course.

The plan virtually tends to establish engineering training at Johns Hopkins upon a graduate basis, Dr. John B. Whitehead, dean of the engineering school, said, although it will not establish the pre-engineering course as a requirement for entrance to the engineering school and the regular four-year undergraduate courses in engineering will be continued as heretofore.

"The new course," Dr. Whitehead said, "has been arranged with special reference to the increasing demand for engineers who, in addition to the professional training, shall also have some knowledge of literature, history, modern languages, economics, business, other sciences and in general of those subjects usually understood as being part of a liberal education. It is now generally recognized that the larger undertakings of modern business and social enterprise require for their proper execution engineers who shall have as wide a knowledge as possible of social, political and economic affairs. A broad education is essential for this knowledge, and these courses are arranged with this purpose in view."

## Detroit May Purchase Generating Equipment

Although the Detroit City Council, which recently voted to award contracts to the Westinghouse Electric & Manufacturing Company for four 20,000-kw. turbo-generators, has rescinded this action, it is said to be likely that the city will eventually buy two, or possibly three, turbines to generate the 35,000 kw. or 40,000 kw. additional energy that it needs for lighting and pumping purposes and in the operation of the municipal railway. At present the city is generating about 19,000 kw. for these purposes and purchasing the rest from the Detroit Edison Company. It is the plan of the city administration to generate all the power needed for municipal uses, but not to compete with the central-station company in the supply of private customers.

## Against Excess Varieties

**Their Elimination Chief Topic of Discussion Among Jobbers at Hot Springs, Va.**

PROBLEMS involved in the elimination of obsolete, duplicate and other excess varieties from jobbing lines were the principal topics of discussion in the committee meetings and about the hotel at Hot Springs, Va., this week, when the Electrical Supply Jobbers' Association met for its fifteenth annual convention, meetings of the executive committee beginning on Monday and the convention proper on Wednesday. There was an unusually large attendance of both jobbers and manufacturers. No detailed recommendations are available as the ELECTRICAL WORLD closes its forms, but definite suggestions are expected which will clearly indicate the attitude of the jobbers on this subject.

E. W. Lloyd, chairman of the Joint Committee for Business Development, addressed the first session, and addresses by W. A. Durgin of the Department of Commerce, Congressman Clyde Kelly of Pennsylvania, C. G. Frang of the Apex Electrical Distributing Company, Cleveland, and J. Clyde Marquis, Department of Agriculture, were scheduled for Thursday.

A resolution was passed by the association in executive session to discontinue the separate meetings of the Central and Atlantic Divisions and to recommend that the Pacific Division hereafter hold but three meetings each year. O. Fred Rost was elected chairman of the Atlantic Division and W. R. Herstein chairman of the Central Division to serve for the ensuing year. The following were chosen to represent the divisions on the association's executive committee: Atlantic Division, E. C. Graham, V. C. Bruce Wetmore; Central Division, W. W. Low, George W. Johnson.

## Pacific Coast Jobbers Hear from Central-Station Men

Commercial managers of several of the large power companies of the Pacific Coast were present at the regular quarterly meeting of the Pacific Coast Jobbers' Association held at Del Monte, Cal., May 10 to 12. The credit men's association held their annual meeting at the same time, and one joint evening meeting was held at which several papers were presented. The credit men spoke of the upward trend of prices and the shortage of materials and warned against the fictitious activity that will result from the pyramiding of orders. At the open meeting Saturday morning central-station men told of the progress of the various co-operative movements on the Pacific Coast. A. E. Holloway, sales manager of the San Diego Consolidated Gas & Electric Company, told of a code of ethics which has been distributed among the contractor-dealers of San Diego and the success with which this movement is meeting. The next meeting of the jobbers' association will be held in the Northwest, probably in Portland, during the early part of September.

## Effort to Abolish Tennessee Commission Fails

Efforts to abolish the Public Utilities Commission of Tennessee have so far proved unsuccessful, the Legislature of the state having adjourned without passing an act of repeal. As reported in the ELECTRICAL WORLD at the time, Governor Peay on March 20 sent to the Legislature a special message advocating repeal. The House by a majority of seventy-four to thirteen had already voted for this course, but the Senate tabled the bill by a vote of eighteen to eleven.

At the hearing before the public utilities committee of the Senate the Mayors and the City Attorneys of Memphis and Chattanooga advocated repeal, while the officials of Nashville and Knoxville took an opposite view.

A bill increasing the personnel of the commission to five and adding a special lawyer to serve as counsel for cities and consumers passed the Senate, but was not brought up for consideration in the House.

## Conference Is Against Inclosing Attrition-Mill Motors

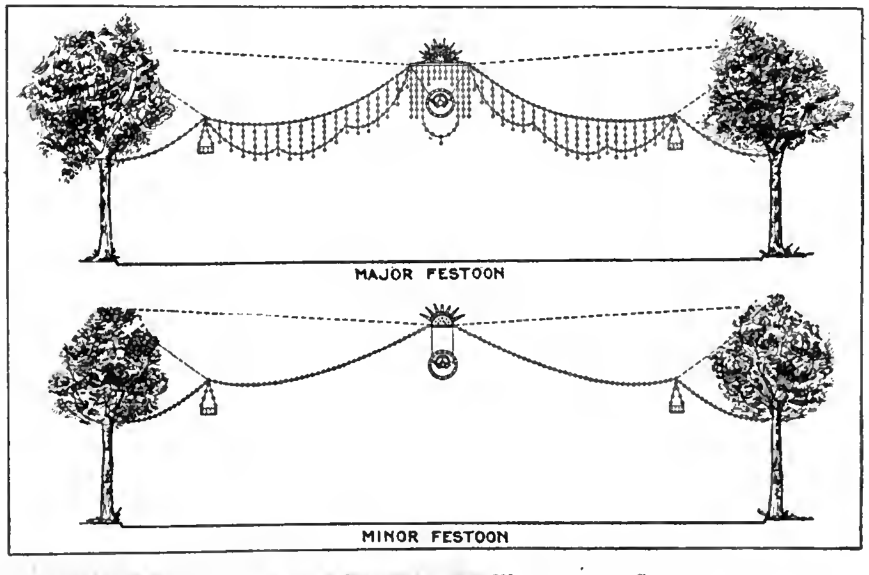
That squirrel-cage motors directly connected to ball-bearing attrition mills should not be inclosed was the finding of a recent conference composed of representatives of the Mutual Fire Prevention Bureau, the Electric Power Club and the attrition-mill manufacturers. It was held that rules must be based on facts and past experience rather than on the idea of trying to prevent something that may happen, and the point was made that the hazard with an inclosed ventilated motor or totally inclosed motor of ordinary construction might be greater than with the open-type squirrel-cage motor. No tests have been made to determine the relative factors of safety of the different types of construction. Experience, however, was held to have shown that the open-type squirrel-cage motor used on attrition mills for the last ten years has been satisfactory.

## Washington to Have Elaborate Electrical Display

Electrical decorations and special illumination for the streets of Washington for the convention of the Knights of the Mystic Shrine, to be held June 5, 6 and 7, will cost approximately $75,000, including installation. The principal display will be along Pennsylvania Avenue. From the peace monument at the Capitol to the Treasury Building, a distance of about one mile, the avenue will be illuminated by five major and fifty-eight minor displays. The major displays will consist of two ropes of lights across Pennsylvania Avenue, with lace effects between, a starburst and illuminated picture in the center and a design near each end. The lights will be red, green and yellow. Each major display will contain 700 lamps. The minor installations will consist of a single rope, with design in center, and each containing 350 lamps.

On Pennsylvania Avenue in front of the White House, where reviewing stands will be erected and the "Garden of Allah" created, there will be special floodlighting. In front of the Union Station a large electrical design, 30 ft. x 60 ft., is to be erected.

Poles have been set in Pennsylvania Avenue for the special installations and the underground power lines of the Potomac Electric Power Company will be tapped. The illumination will be used from May 26 to June 10. Plans prepared by the Westinghouse Lamp Company, slightly modified to meet financial needs, are being followed, and 25,000 Westinghouse "Mazda" lamps are to be installed.




OVERHEAD ELECTRICAL DISPLAYS FOR WASHINGTON CELEBRATION

## Texas Associations Unite

### Technical, Commercial and Accounting Discussions Fill Electrical and General Sessions at Fort Worth

DISCUSSING the methods used in changing 2,300-volt, single-phase and two-phase overhead lines to 4,000-volt, three-phase, four-wire, John Oram of the Dallas Power & Light Company pointed out, in a paper presented at the Fort Worth convention of the Southwestern Public Service Association last week, the advantage the latter system possesses in making use of 2,300-volt transformers previously installed. In changing polyphase circuits the changes are best begun in the outlying districts, he said, but with single-phase groups it makes little difference where the beginning is made. With a four-wire, two-phase system everything can be got ready while operation is continued at 2,300 volts, and the change can then be made in convenient steps, the noon hour having proved a good time to make cut-overs. Mr. Oram dwelt on the necessity of keeping proper clearances between conductors and structures and in climbing spaces on such cut-over lines and recommended that standard construction drawings be prepared for the guidance of the line crews. He pointed to the flexibility of the four-wire, three-phase circuits in providing any desired service through transformer connections recognized as standard and to the possibility of using special connections where these are necessary.

#### Operating Problems

Secondary and lightning-arrester grounds received attention in the round-table discussion of utility engineering and operating problems, and it was brought out that the Texas Power & Light Company has found 1-in. x 8-ft. ground rods more satisfactory in providing good grounds than the usual pipe where there are no water systems to use for grounding purposes. This is due to the greater tendency of pipe to corrode.

J. B. Thomas said that the ground rods used had pigtails attached at the factory, and the tendency on the part of line crews was to drive them full length into the ground, whereas if pipe is used the tendency is to saw the pipe off at some convenient point short of permanently moist earth.

It was stated in the discussion that the grounding of transformer cases has been abandoned in some instances because safety and accident prevention authorities felt that ungrounded cases were less of a hazard to linemen. That the practice would be resumed later was the opinion expressed by several who felt that grounded cases are less hazardous than ungrounded ones because the grounds are a protection in case of contacts between the primary circuits and the cases. The abandonment of grounded transformer cases has brought a reduction in the number of bushing failures, though this was attributed in part at least to the possibility that defective bushings would continue in operation for some time where the cases were ungrounded, while with grounded cases prompt breakdowns would occur.

The use of covering on line wires gave rise to a lively discussion, the opinion of the meeting being that as a means of showing the public and the legal authorities that bare wire is the safer practice on circuits of 2,300 volts and higher it should be actually used wherever possible.

#### Broad Functions of Arkansas Information Committee

Earl W. Hodges, director of the Arkansas Committee on Public Utility Information, proclaimed as the real foundation of utility prosperity good public relations. He said that in Arkansas it had been decided that development of the state resources was one of the important duties of his committee, and to that end efforts have been directed toward establishing relations with all kinds of societies in the state, including industrial, legal, ministerial, educational, civic and social.

In the Accounting Section meetings on Wednesday and Thursday customers' record and billing methods, preservation of records and budget estimates and analyses were discussed. Machine billing methods were the main subject under this heading. In the matter of preserving records it was felt that the general records should be preserved indefinitely. Supporting records should be preserved at least until an audit is made. It was shown that utility commission requirements influence the time of preservation of such records and that in the case of bills-payable records and other records of this character property appraisals at any time in the history of the property might make such records invaluable. Careless methods of filing in the past were shown to have made it difficult to use records even where they had not been destroyed.

Ice plants and power sales to them received attention in the Commercial Section on Thursday.

#### Amalgamation Effected

At the business session on Thursday afternoon the amalgamation of the Southwestern Public Utility Association and the South Central Gas Association was completed. This brought the light and power, electric railway and gas utilities of Texas all into the same association under the name of the Southwestern Public Service Association. The Fort Worth convention, at which nearly 450 delegates were registered, was a joint one. The chairman of the light and power section for the coming year is H. E. Borton of the Calvert Ice, Water & Electric Light Company, Calvert, Texas. The association officers are: President, J. H. Gill, Dallas Power & Light Company; first vice-president, C. B. McKinney, Lone Star Gas Company, Dallas; second vice-president, H. E. Borton, Calvert; third vice-president, George I. Plumber, Dallas.

## Pelton Wheel Built to Resist Dilute Sulphuric Acid

An engineering problem of more than ordinary interest has been worked out by the Pelton Water Wheel Company's Atlantic department in a contract just awarded for new hydraulic equipment by the city of Manizales, Republic of Colombia. This little city of the high Andes is more than a hundred miles from the railroad, and designs for a complete 500-hp. power-house installation have had to be worked out in sectional form to permit transportation by wagon, muleback and aërial tramway over mountain passes.

This, however, was not the only problem involved. The mountain torrent supplying power for the Manizales municipal light station, situated at the bottom of a deep canyon, is strongly impregnated with sulphuric acid. This has been traced to a subsurface flow through a stratum of volcanic rock extending far up the slopes above the city. So far as known, the Manizales plant is the only one in the world which runs on dilute sulphuric acid. Naturally no ordinary impulse wheel would last long in such service, as the acid would eat away every bit of steel with which it came in contact in a comparatively short time.

The Pelton design, consequently, had to be worked out on a basis permitting the use of bronze, brass and monel-metal, instead of steel, at every point that would be exposed to the water. This was successfully accomplished, as was the companion task of sectionalizing the entire equipment for transportation in small pieces and assembling on the spot, without prejudice to the strength or efficiency of the whole installation. The turbine except for these features is a standard type of Pelton impulse wheel. It will work on an effective head of 250 ft. and will be connected with a General Electric 350-kva. 60-cycle three-phase generator. The entire hydraulic installation and all auxiliaries will be built in the I. P. Morris Department shops of the William Cramp & Sons Ship & Engine Building Company, at Philadelphia.

## Utility Information Bureau Set Up in Pennsylvania

As foreshadowed in the notice of the preliminary meeting for that purpose of Pennsylvania public utility executives published in the ELECTRICAL WORLD of April 7, the Pennsylvania Public Service Information Bureau has been established for "the timely assembling and dissemination of reliable information relating to the commonwealth's public utilities." Electric light and power companies, electric railways, telephone companies, gas companies and water companies are behind the committee, of which P. H. Gadsden, vice-president United Gas Improvement Company, is chairman, and Walter H. Johnson, vice-president Philadelphia Electric Company, a prominent member. Headquarters are in Philadelphia.

## Brief News Notes

**New Municipal Ownership Provision in Wisconsin.**—The Teasdale bill has finally become a law in Wisconsin following its approval by Governor Blaine. It provides that no municipality that has acted to acquire privately owned electric light and power, street and interurban railway, gas or water systems may discontinue such action within thirty days after the commission has announced the necessary compensation for the properties to be taken over.

**San Francisco Installing 80,000 Kw. in Four Units.** — Generators for the Moccasin Creek power house of the city of San Francisco have been shipped from the factory of the General Electric Company at Schenectady, N. Y. Four units of 20,000-kw. rating each are to be installed. The new power house to contain this equipment will be of steel and reinforced concrete. It is planned to have the plant in operation within eighteen months.

**New River Project Must Be Readvertised.**—The Virginian Power Company has created a subsidiary to be known as the West Virginia Power Company. This subsidiary is intended to carry out the proposed development on New River. The change in name will make necessary the readvertisement of the preliminary permit for which the Virginian company applied. The advertisements, under the law, must be spread over a two-month period.

**Holtwood-York Transmission Line Nearly Finished.**—The transmission line which the Pennsylvania Water & Power Company is building from its generating station at Holtwood, on the Susquehanna River, to York, about 30 miles north, has been completed to within about a mile and a half of the substation which is to be built at Violet Hill, a short distance south of York. From this station energy will be supplied not only to York but also to Glen Rock, Red Lion, Railroad, Stewartstown and probably Spring Grove and Hanover.

**Standardization of Traffic Signal Colors.**—Forty-two men, representing the manufacturers and users of traffic signals, federal and state governmental departments, associations interested in the prevention of traffic accidents and representatives of the general public, are now drafting a national code on colors for traffic signals which it is expected will not only cut down the annual loss of life through traffic accidents but will eliminate many irritations to motorists and the operators of steam and electric railways. This work is being carried on under the auspices of the American Engineering Standards Committee. W. P. Blackwell of Newark, N. J., represents the National Electric Light Association and Clayton H. Sharp the Illuminating Engineering Society.

**Muscatine Company Changes Name.**—The Muscatine Hydro-Electric Power Company has amended its articles of incorporation to change its name to Eastern Iowa Power Company. Work began on May 1 on the dam which the company is erecting across the Maquoketa River at Muscatine, and it is expected that the plant will be ready for operation by Dec. 1.

**American Power & Light Company Pays Stock Dividend.** — The American Power & Light Company has, in addition to its regular quarterly cash dividend of 2½ per cent on its common stock, declared a dividend of 2 per cent payable in common stock. Both dividends are payable June 1 to stockholders of record May 19. This is the second holding company organized by Electric Bond & Share Company interests to pay stock dividends, the American Gas & Electric Company being the first.

**Giant Electric Sign for Standard Oil in St. Louis.**—A giant electric sign erected at a Standard Oil filling station just southwest of Forest Park in St.


Louis is said to be the largest double-faced sign in the world. It is 45 ft. high and 70 ft. long and is visible for a long distance either east or west. It is placed on sixteen concrete piers sunk 8 ft. in the ground. There are forty-two circuits and it requires five thousand lamps, varying in size from 10 watts to 100 watts, for its complete illumination. The words "Red Crown Gasoline" are outlined in red, the border lights are blue, and the remainder of the lights on the sign are white. The sign is illuminated from dusk to midnight each night. It was designed and built by the W. F. Williamson Advertising Service of St. Louis.

**Financial Success of St. Louis Electrical Exposition.**—The accounts of the St. Louis Electrical Board of Trade Electrical Exposition Company, under whose auspices the electrical exposition was held on March 12 to 17, show remarkable returns. The balance after all bills were paid enabled the company to pay to each exhibitor a sum equal to 24 per cent of the amount paid for rental of space and to return to each of the stockholders the amount he paid into the treasury at the time the company was organized.

**New Turbine for Okanogan Valley.**—The Washington Water Power Company, which recently acquired the property of the Okanogan Valley Power Company, has awarded a contract to the Pelton Water Wheel Company for furnishing a 2,500-hp. double-runner cylindrical-case reaction turbine, to operate under an 80-ft. head. This unit will be installed at the Similkameen River plant of the power company at Oroville, Wash. It will resemble in general design the Pelton turbine of the same capacity now operating at the plant, which was built for the Okanogan Valley Power Company in 1919.

**Utah Power & Light Shows Increased Earnings.**—Gross earnings of the Utah Power & Light Company for the twelve months ended Feb. 28 amounted to $7,338,990, an increase of $669,770 over last year. Net earnings after taxes totaled $3,670,866, compared with $3,205,190. Balance after preferred dividends was $1,184,547, an increase of $227,176.

**Charleston (W. Va.) Company Acquired by American Gas & Electric.**—The American Gas & Electric Company of New York has acquired the West Virginia Water & Electric Company of Charleston, W. Va., according to an announcement by A. C. Babson, general manager of the latter company. The West Virginia company supplies electric power and water to Charleston and surrounding territory. Details of the deal have not been made public. Electric light and power companies in Wheeling and in Logan, W. Va., are owned and operated by the New York corporation.

**Harvard Offers $1,000 Engineering Scholarship.**—A competitive scholarship of $1,000 has been offered by the Harvard Engineering School for the year 1923-24, to be open to seniors graduating in June from colleges or departments of liberal arts throughout the country. No student now in Harvard will be eligible for the competition, nor any student registered in any engineering or technical school. The award will be based on the complete academic record of the applicant, together with the result of a special three-hour written examination, including mathematics through calculus and general physics.

**Electrical Growth of Milwaukee.**—Milwaukee, according to a statistician of the Wisconsin Public Utilities Information Bureau, is rapidly becoming an electrical city. It is neck and neck with Pittsburgh in the use of the electric furnace for steel making and other metal melting and is a large user of electrical energy for japanning and similar purposes. To meet the demands of the city and the surrounding territory, including Racine, Kenosha and other places within a radius of about 40 miles, there is now a minimum generating capacity of some 176,700 kw., to which may be added 10,000 kw. received from the Wisconsin River hydroelectric plants. To this will be added by the end of the year 30,000 kw. more in the unit now being installed in the big plant at Lakeside by the Milwaukee Electric Railway & Light Company. It is predicted that within a short time the electrical energy generated in the steam plants in and close to Milwaukee will exceed the total of the big water-power developments now under way in

the state, which is put at 353,000 hp. This estimate does not include any of the industrial plants still in existence.

**New Jersey Utilities to Combine.**—The Morris & Somerset Electric Company, the Commonwealth Electric Company and the Lakewood & Coast Electric Company are to combine under the name of the Jersey Central Power & Light Corporation. New financing will consist of $3,500,000 in first-lien 6½ per cent bonds.

**Radio Signals of Standard Frequency.**—Radio signals of standard frequency are now being transmitted from the Bureau of Standards at Washington. These standard frequency signals are intended to be used for standardizing wavemeters and adjusting transmitting and receiving apparatus. The proper adjustment of such apparatus is particularly important in connection with the reallocation of waves as recommended by the second radio conference held in Washington in March. Methods for receiving and utilizing these signals for wavemeter calibration have been published in the *Radio Service Bulletin*, and more detailed information may be obtained upon application to the Bureau of Standards. The announced values of these signals are accurate to better than three-tenths of 1 per cent.

**Cities Service Company in April.**—The statement of earnings of Cities Service Company for the twelve months ended April 30 showed gross earnings amounting to $16,003,548, which compared with $12,688,908 in the corresponding period of 1922. Net earnings were $15,528,247, as compared with $12,229,894, and net to stock was $12,989,007, as compared with $10,086,102. Net to common stock and reserves amounted to $8,050,881, as compared with $5,205,591 in the preceding twelve months. In the twelve-month period the preferred dividend was earned 2.63 times, as compared with 2.07 times in the twelve months ended with April 30, 1922, while the percentage earned on the average amount of common stock outstanding was 17.28 as against 11.20. Net to common stock and reserves for the month of April, 1923, was $1,043,426, which compared with $752,462 earned in April, 1922.

**Engineers to Study New Power Codes.**—Two power test codes, part of a group of nineteen being framed as aids to industry by 125 engineers, scientists and educators under the auspices of the American Society of Mechanical Engineers, will be discussed at a public hearing in connection with the society's spring meeting at Montreal next week. For more than four years nineteen committees, representing practically every industrial center, have been engaged in this work, directed by a main committee of twenty-five. One of the codes to be considered at Montreal relates to instruments and apparatus for measuring physical and chemical quantities in connection with tests of power equipment. The second code deals with internal-combustion engines of all forms, but is limited to the engines alone. Sizes of internal-combustion engines coming within this code range from one to several thousand horsepower.

**Electricity in the Poultry Yard.**—The Department of Agriculture is officially advising poultry raisers of the benefits to be gained from electricity in their business. It recounts an experiment in which one 75-watt lamp was in a room housing fifty pullets for two and one-half hours daily for 140 days with excellent results. It was turned on automatically at 4.30 a.m. and allowed to run until daylight. When the light is used in the evening arrangement has to be made for dimming before the current is switched off entirely so that the hens will go to roost before total darkness prevails. The department also points out that a good way to keep water in the poultry yard from freezing during the winter is to cover a carbon-filament lamp with black cloth and submerge it in the drinking pan.

**Germany Turning to Large and Interconnected Plants.**—Existing conditions in Germany are forcing out of business the coal-burning power plants with high operating costs, according to a report recently received by the Department of Commerce. Such stations have had great difficulty in obtaining the necessary credit for extensions and new equipment. Difficulty in procuring coal has added to their troubles. The result has been a further concentration of power production in the larger and more efficient stations. This is stimulating interconnection, and as a result lower rates to consumers have been made possible. A very lively interest is being manifested in the conversion of some of the larger central stations from steam power to water power. The matter has been taken up with both German and foreign bankers, but because of the very large amounts involved no great amount of encouragement has been forthcoming.

# Associations and Societies

**Taylor Society's June Meeting.**—The Taylor Society, which has for its objects the promotion of the science and the art of administration and of management, will meet at the Hotel Onondaga, Syracuse, on June 7, 8 and 9 to listen to papers and inspect industrial planning departments.

**Baltimore Section, A. I. E. E.**—Prof. W. B. Kouwenhoven was elected chairman of this section at its meeting last week, F. T. Leilich vice-chairman and R. T. Greer secretary. Earl A. Anderson of the National Lamp Works spoke on illumination in office and factory buildings.

**Cheyenne Electric Club Organized.**—Electrical men in Cheyenne, Wyo., have recently completed the organization of the Cheyenne Electric Club with the purpose of bettering the electrical industry in the Wyoming city. The members will discuss electrical problems and educate the public concerning them.

**National Association of Manufacturers Elects Officers.**—John E. Edgerton of Lebanon, Tenn., president of the National Association of Manufacturers, was re-elected to office for another year in the closing session of the New York convention last week, as were also Henry Abbott of New York City, treasurer, George S. Boudinot, secretary, and Earl Constantine, New York City, assistant to the president.

**Nominations for Governors of A. M. E. S.**—In accordance with the constitution the nominating committee of the Associated Manufacturers of Electrical Supplies has selected as nominees for vacancies on the board of governors, to be voted upon at the annual meeting of the association during the week of June 25, S. B. Condit of the Condit Electrical Manufacturing Company, Boston; A. G. Kimball of Landers, Frary & Clark, New Britain, Conn.; W. W. Mumma of the Robbins & Myers Company, Springfield, Ohio; M. C. Rypinski of C. Brandes, Inc., New York City, and F. T. Wheeler of the Trumbull Electric Manufacturing Company, Plainville, Conn.

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## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Westinghouse Agent-Jobbers' Association—Hot Springs, Va., May 28-June 2.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

North Central Division, N. E. L. A.—Minneapolis, June 20-22. H. E. Young, Minneapolis General Electric Company.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association—Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Institute of Electrical Engineers—Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Iowa Section, N. E. L. A.—Mason City, June 26-29. M. A. Linn, Des Moines Electric Co., Des Moines.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association—Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Michigan Electric Light Association—Grand Rapids, Sept. 11-13. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

## Recent Court Decisions

**Supreme Court Again Finds that Cost of Reproduction New Must Be Considered in Valuation Proceedings.**—Rates for public service corporations which fail to take into consideration the cost of reproduction at prevailing prices were disapproved by a decision rendered by the United States Supreme Court this week in the case of the Southwestern Bell Telephone Company vs. Missouri Public Service Commission. "It is impossible," the opinion said, "to ascertain what will amount to a fair return upon properties devoted to public service without giving consideration to the cost of labor, supplies, etc., at the time the investigation is made. An honest and intelligent forecast of probable future values, made upon a view of all the relevant circumstances, is essential. If the highly important element of present costs is wholly disregarded, such a forecast becomes impossible. Estimates for tomorrow cannot ignore prices of today." It must never be forgotten, the court added, "that while the state may regulate with a view to enforcing reasonable rates and charges, it is not the owner of the property of public utility companies and is not clothed with the general power of management incident to ownership." A separate opinion by Justice Brandeis, in which Justice Holmes concurred, asserted that advocates of reproduction cost as an element of rate making would find its application harmful to the public utilities when the cost of material and wages was lower. Justice Brandeis suggested as a preferable basis the money invested in the enterprise. Urging the court to "lay down a rule which will establish such a rate basis and such a measure of the rate of return deemed fair," he criticised his colleagues for leaving many of the elements to be determined by the opinion of experts, instead of making rates dependent upon ascertainable facts. While agreeing that reproduction costs as an essential element in rate making are better than the old tests—selling price or net earnings—the minority insisted that "where the financing has been proper the cost to the utility of the capital required to construct, equip and operate its plant should measure the rate of return which the Constitution guarantees opportunity to earn." Such a rule, it added, would make rates based on facts and not on opinion. Under the rule the court adopted, the value for rate-making purposes, the minority insisted, "must ever be an unstable factor." The public utilities would try to make the court adopt reproduction cost or prudent investment as the measure of rates according to which was the higher at the time that valuation proceedings were under way.

**Milldam Owner Willfully Diverting Water of Natural Stream Liable for Damages.**—In a suit brought by one McKee against the Nebraska Gas & Electric Company damages were sought on account of the action of the company in diverting the waters of the Cedar River at Fullerton in order to save its power plant, threatened with destruction by a rise in the river, from which by means of a dam the company derived power to operate its turbine wheel. As a result of this change in the course of the stream the plaintiff claimed that heavy rains had on these occasions caused his land to be flooded, live stock to be drowned and crops to be destroyed. The Supreme Court of Nebraska sustained the trial court in finding for the plaintiff, maintaining that the good faith of the defendant in believing its action necessary to preserve its own property and the absence of negligence or malice could not absolve it from the liability to recompense those whose property had been damaged by its course. (193 N. W. 106.)*

## Commission Rulings

**Savings from Improvement in Street Lamps Divided Equally Between Utility and Municipality.**—A franchise granted the Marshall Ice & Power Company by Martinsville, Ill., confused watts and candlepower in such a way that the company stood to make a considerable saving on account of the improvement in the art of lighting. The Illinois Commerce Commission ordered that the saving should be divided between the utility and the municipality, holding that neither was responsible for the fact that it is possible "to secure the same quantity of light from the expenditure of 29 per cent less electrical energy."

**Reproduction-Cost Theory Criticised.**—In its valuation of the waterworks properties of the Newport News Light & Water Company, the Virginia State Corporation Commission criticised the theory of evaluating a property strictly according to reproduction cost. "Counsel for the city," said the commission, "comment on the fact that the strict reproduction-cost theory, vigorously opposed by railways and public utilities in the days when such cost was less than actual investment, has come into favor in times of high levels of unit prices. It is true that public regulation is a growing science and must change with the changing times. While some of the old methods of regulation may appear as dead as Tut-ankh-Amen, their relics may, in the cycles of time, again become the model of fashion and the object of public approval. . . . The commission believes that in this as in previous cases the determination should begin with pre-war values and appreciate them a reasonable percentage, so as to allow for higher price levels. To the sum thus arrived at there must be added the actual money since pre-war days honestly and prudently expended in the public service."

**Has a Public Utility Vested Rights?**—In its decision holding the Terre Haute, Indianapolis & Eastern Traction Company to be an existing and not a new light and power utility, and therefore entitled to extend its service and operate as a general electricity supply company within the city of Indianapolis, despite the protests of the two central-station companies established there (ELECTRICAL WORLD, April 21, page 942), the Indiana Public Service Commission made some general observations on the standing of public utilities in a community as follows: "Has a utility any vested right in a community? Can a utility claim a vested right in the increase of a city which has doubled its population within a short time? If a city extends its corporation lines, taking in a town having a utility operating efficiently within it, can the town utility be excluded at the request of the city utility? Can a utility in one town or community be excluded from rendering service in another? What influence do arbitrary lines bounding cities, towns and townships have on conditions affecting utility service? Would not the answer in each case depend upon the conditions in each community considered? Is there any other test that can be applied to all situations? Is it not *the* test? Those who embark in the operation of public utilities must, of necessity, be subjected to certain hazards of the business, the same as operators in other lines of commercial activity, and when the interest of any utility runs counter to the general public interest the utility must submit and the general public welfare must prevail, and this is true whether the condition is the result of any act of omission of the utility or not, because of the recognized principle that the interest of society in general outweighs the interest of any member or portion thereof, and that is the basic principle of laws regulating public utilities everywhere. Such laws, including the one under which this commission is operating, are enacted in the interest of the public welfare and not in the interest of the public utilities, except in cases where the protection against competition or confiscation works to the best interests of the general public, which involves, not cheap rates temporarily, but standard service for a reasonable remuneration for present and future needs, which includes opportunity, ability, financial support and readiness to render the required service. The commission is not unmindful of the fact that it is to the best interest of the public that utilities be protected against confiscation and destructive competition, and these considerations are constantly kept in mind."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Men of the Industry

**Changes in Personnel**
**Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry**

## C. H. Howell Goes to Atlantic City

C. H. Howell, general manager and vice-president of the Ohio Service Company, has been transferred to Atlantic City, N. J., to take charge of the properties of the American Gas & Electric Company in that state. Mr. Howell had been stationed in Coshocton since 1912, when he became manager of what was at that time the Coshocton Light & Heating Company. Later other properties in that section of Ohio were merged into a single corporation, the present Ohio Service Company, and Mr. Howell was made manager. He is a past-president of the Ohio Electric Light Association and has a host of friends in electrical circles in that state.

**Julian C. Smith** has been elected president of the Quebec Railway, Light, Heat & Power Company, succeeding E. A. Robert.

**Dr. Emmanuel de Margerie,** French exchange professor to the United States, was the guest of honor at a farewell luncheon given on May 18 at the Harvard Club, New York. Two hundred engineers attended and representatives of many of the leading colleges and universities were present. Dr. de Margerie has just finished a year of lecturing at Columbia, Cornell, Harvard, Johns Hopkins, Yale and Pennsylvania.

**O. M. Drischel,** manager of the Marion division of the Indiana General Service Company, has been appointed general manager of the company. Mr. Drischel has been associated with the company since its organization. The following changes are also announced: Roy Thurman becomes manager of the Muncie division, replacing O. E. Halderman, who goes to one of the Ohio properties, and T. M. Parker of Marion is transferred to the Hartford City (Ind.) division as manager, succeeding Henry Wallsmith, who is transferred to Benton Harbor, Mich.

**E. P. Peck,** general superintendent of the electrical department of the Utica (N. Y.) Gas & Electric Company, was unanimously elected chairman of the Electrical Section of the Empire State Gas & Electric Association at its meeting in Utica on May 18. Ever since going to New York State from the Georgia Railway & Power Company in 1919 Mr. Peck has been very active in the association. Most prominent among his recent committee activities have been the recommendations for standardization of transmission-line construction and his work as chairman of a committee that is endeavoring to solve the problems of greater interconnection of electric service systems within the state and in the adjoining territory. In the South, where Mr. Peck was superintendent of operation, tests and repairs, he became prominent for his original investigations and development work.

## Edmund Lang Elected President of Crocker-Wheeler

Edmund Lang, who was recently elected president of the Crocker-Wheeler Company, Ampere, N. J., succeeding the late Dr. Schuyler Skaats Wheeler, has been associated with the company since 1909, when he was selected to handle the many intricacies of the repair department, which had just been organized as an entirely separate unit from the main shop. His thorough and successful work so impressed the officers of the organization that in 1911 he was made purchasing agent.

EDMUND LANG

Two years later Mr. Lang was elected secretary of the company, and in 1915, when the office of sales manager became vacant, he was chosen to fill this post. Subsequently he was elected a director, and in 1919 he became senior vice-president and a member of the company's executive committee, devoting considerable time to administrative matters.

Mr. Lang was born in New York City in 1880 and inherited from his father, Charles F. Lang, who was for many years a manufacturer of steam engines and auxiliary machinery, a love of mechanics and engineering. He became associated with Arthur Schroeder, the New York sales agent for the Ætna Standard Iron & Steel Company of Martins Ferry, Ohio, in 1894, and in 1900 he entered the New York sales office of the American Steel Hoop Company, which later became a subsidiary of the United States Steel Corporation. When the sales department was removed to Pittsburgh Mr. Lang joined the force of Westinghouse, Church, Kerr & Company and later allied himself with the Keystone Electric Company, where he gained intimate knowledge of estimating and buying for the contracting and engineering branch of the business. In 1903 he joined the Wheeler Condenser & Engineering Company, but his desire for broadening his experience led him to organize in 1907 the Universal Engineering Company to build or reconstruct power and heating plants. Mr. Lang is a member of the Engineers' Club and is also vice-president and a director of the Curtis Gas Engine Company of New York.

**D. W. Roper,** underground cable superintendent of the Commonwealth Edison Company, sailed for Europe on May 19, to spend four months studying the foreign methods of cable manufacture and high-voltage distribution systems. His itinerary will include England, France, Italy and possibly Scandinavia and Germany. Other engineers of the company who sailed with Mr. Roper for the purpose of investigating European power-plant layouts were Secor Cunningham, Jr., B. G. Jamieson, Samuel Insull, Jr., and F. E. Goodnow of the Public Service Company of Northern Illinois.

**George A. Iler,** an electrical engineer of wide experience and a pioneer in the development of radio engineering, has been appointed electrical engineer of the Pennsylvania-Ohio electrical system at Wheeling, W. Va., succeeding C. A. Harrington, who recently resigned. Mr. Iler goes to Wheeling from Atlanta, where for the last year he was radio engineer for the Atlanta *Journal*, constructing and operating the big broadcasting plant of that paper. Mr. Iler is an Ohioan by birth and served for a time as electrician in the United States Navy. Following his naval service he devoted his energies to electrical work in various parts of the country in charge of construction and operation of power generating plants, transmission systems and general electrical engineering work, completing his education by a post-graduate course at the Georgia Institute of Technology. Among other important work in which he has been engaged are the building and operating of the first power-transmission lines for the General Electric Company in the New River coal district, W. Va., and the early application of electrical power to mining projects there, as well as the construction of the 100,000-hp. hydro-electric power plant at Atlanta for the Georgia Railway & Power Company. He early gave attention to the development of radio and for several years he was connected as consulting radio engineer with the Westinghouse Electric & Manufacturing Company.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Agencies Promoting Standardization

**An Outline of Association and Government Efforts to Stop Waste Throughout the World—Commercial and Engineering Sides Are Discussed**

By C. E. Skinner
Manager of Research Department,
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MANY millions of dollars could be saved to the consuming public in the United States each year by proper standardization and simplification. Much has been done along this line and many agencies are at work, but the field is as yet little more than touched. Proper standardization requires that the standards adopted shall be satisfactory to all parties at interest and that progress be not arrested by such standardization. Very much of the standardization already accomplished has been a very great aid to progress, and further standardization and simplification can and will accomplish still greater things.

C. E. Skinner

In the electrical business we will probably never make our transformers or motors or generators to exact duplicate specifications, but there has been a constant trend to greater uniformity in rating and to the standardization of those things which tend to make apparatus interchangeable. The very rapid increase in the application of electricity to new fields requires an added complexity of apparatus to meet these demands. The stabilization of applications in many fields, the necessity for quantity production and the cheapening of the product are leading to the use of standards wherever standards can be applied.

The proper balance between standardization and development along new lines is very difficult to strike. Too much standardization tends to delay development; too much development along different lines in an industry tends to complication and excessive costs. The more rapid the development, the more difficult to adhere to standards and the greater difficulty of effecting standardization

The United States is pre-eminently the leader in machine-made products. This is due to the necessity for quantity production along so many lines, to the relatively high cost of labor, and to what has sometimes been described as our Yankee ingenuity in the development of such machine methods. From the standpoint of labor conditions, we face competition at the present time more difficult than ever before. The answer to this competition is quantity production and machine methods. These depend primarily on standardization. This explains, in some measure, the nation-wide movement evident in so many lines looking toward standardization. It may be profitable to review some of the agencies at work, their accomplishments and promise for the future:

**Standards Committee, A. I. E. E.**—Among the early movements for national standardization in the United States was the organization of a standards committee of the American Institute of Electrical Engineers. This standards committee has confined itself very largely to the standardization of those fundamentals underlying the design and performance of electrical machinery and has concerned itself little or not at all with that kind of standardization which results in duplicate parts and which is usually known as dimensional standardization. The work of the committee has been continued through a period of extremely rapid development in the electrical industry, and the committee has been quick to make those changes which have been necessitated by the growth in knowledge of the subject and in the development of the industry. Indeed, the standards committee work has brought about very important researches intended to settle points of dispute and points on which there was not adequate knowledge. A large volume of standards has been produced, and these standards are very closely followed in the manufacture of most electrical apparatus in the United States today. Its work has had an international bearing. It is substantially in accord with the electrical standardization in other countries.

**American Society for Testing Materials.**—One of the most active organizations in standardization in the United States is the American Society for Testing Materials. This society has to do with the standards for testing materials and the production of specifications which may be used in the purchase of materials. In the formulation of its specifications the society has from the very start followed the principle that both the producer and consumer, as well as independent interests, must be satisfied with any specification before it is adopted. As a result, many of the specifications now issued have required years of patient effort to bring all parties into harmony, and numbers of them have gone through considerable periods of probation before they were made final. Furthermore, provision is made for revision, whenever such revision may become necessary owing to change in the art or change in requirements.

### Quality Standards Raised

As a result, purchasers of many kinds of materials utilize these specifications without change or they embody their requirements in their own purchase specifications. It is impossible to evaluate the influence for good which these specifications have had on industry generally. They have resulted in better materials, better understandings between producers and consumers; they have assisted in bringing about quantity production, and they have generally raised the standard of quality of the materials used in the particular industry for which the specifications are written.

**Society of Automotive Engineers.**—Perhaps in no other industry have both dimensional standardization and quality standardization been so essential to progress as in the automobile industry. Dimensional standardization was required because of the very large number of manufacturers and the enormous quantity of small parts required, such as screws, bolts, nuts, etc. The necessity for the production of a machine

which would stand the service required of an automobile and at the same time have minimum weight has required high-grade materials to a greater extent perhaps than any other device. It is certainly true that this standardization work has not been a hindrance in the development of new types of automobiles.

**American Society of Mechanical Engineers.**—The standards work of the American Society of Mechanical Engineers has been perhaps less extensive than that of the organizations already mentioned, but it has accomplished a great deal in the way of standardization. The Boiler Code of the American Society of Mechanical Engineers is the standard not only in the United States but in a number of other countries as well. The standards for machine screws have been quite generally adopted, and this society has on hand a number of other projects which will be of greater value when completed.

**Electric Power Club.**—Another organization which has been working along somewhat different lines is the Electric Power Club. This organization, composed entirely of manufacturers, has standardized more along commercial lines. It has dealt with sizes, ratings, interchangeability, testing and performance of electrical apparatus. The performance specifications of the Power Club have been very largely based on the standards of the American Institute of Electrical Engineers, the latter in the past dealing with what might be called engineering standards and the former with commercial standards. These two organizations are now working in the closest harmony in the further production of standards with regard to the rating of electrical machinery.

**National Fire Protection Association.**—The National Electrical Code, developed under the auspices of the National Fire Protection Association and with the co-operation of underwriters, contractors, manufacturers and interested organizations generally, is really a set of standards for the installation and use of electrical equipment to provide that such installations shall entail a minimum fire hazard. These standards are now generally recognized throughout the United States as satisfactory, and they have been adopted by many cities as municipal standards.

**United States Bureau of Standards.**—The Bureau of Standards was established under an act of Congress on March 1, 1901, and Section II of this act reads as follows: "That the functions of the bureau shall consist in the custody of the standards; the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce, and educational institutions with the standards adopted or recognized by the government; the construction, when necessary, of standards, their multiples and subdivisions; the testing and calibration of standard measuring apparatus; the solution of problems which arise in connection with standards; the determination of physical constants and the properties of materials, when such data are of great importance to scientific or manufacturing interest and are not to be obtained of sufficient accuracy elsewhere."

One of the activities of the Bureau of Standards has resulted in the production of what is known as the National Electrical Safety Code. This is a set of standards which deals with the life hazard of electrical installations, just as the National Electrical Code deals with the fire hazard. This code is mentioned on account of its importance to the electrical industry and on account of the fact that it illustrates a type of standardization which is receiving a very great deal of attention throughout the country today.

**Division of Simplified Practice.**—The Department of Commerce, under its present Secretary, has organized what is known as the Division of Simplified Practice. It is recognized that many of our industries and many more of our businesses are suffering from too great a variety of almost every article of commerce in this country. It is the object of the Division of Simplified Practice to bring about, through agreement of the parties interested, a radical reduction in the sizes and varieties of commodities manufactured and sold in the United States.

### A Point for Co-operation

THIS very complete account of the accomplishments and future purposes of the agencies that are carrying on the work of standardization of industries in all parts of the world is particularly interesting to every division of the electrical industry, which, as shown by this article, is with the leaders in eliminating waste for both the manufacturer and consumer.

During the last two years, the period of most interest in carrying on the work of these associations and government bureaus, progress in eliminating excess varieties has been hindered by the fear of manufacturers that others making their lines would not follow suit and that orders would be lost in the markets where many unusual demands are made. It is hoped that this review of what all industries are doing to reduce waste of effort and materials will do much to direct the minds of the manufacturers, jobbers and purchasing agents along the straight road that leads to the storehouse of standardized products.

The above list comprises only a few of the bodies of national scope engaged in standardization for the industrial world. They should serve to illustrate both the tremendous interest in standardization at the present time and the evident value that such standardization must possess to industry in general.

While the organizations described are all of national scope, there has been no organization until recently which could rightly issue standards with the stamp of approval in such a way that they might truly be called American standards. This fact has been very forcibly brought to the attention of delegates who have attended various international meetings with the view of international standardization. The desirability for some organization which could put its stamp of approval on specifications and standards in such a way that they could be truly denominated as American specifications or American Standards led the standards committee of the American Institute of Electrical Engineers to suggest the organization of what has since become the American Engineering Standards Committee.

**American Engineering Standards Committee.**—This committee was organized by the four founder societies, i.e., the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, together with the American Society for Testing Materials.

The organization work occupied approximately two years, and the organization committee attempted very carefully to go into every phase of the question so that the final organization might be truly representative of every branch of engineering which had to do with standardization. Provision was made for bringing into membership of the society all organizations which were of national scope and which were interested in engineering standardization. At the time of the organization of the A. E. S. C. there were more than one hundred organizations publishing engineering standards, most of which were formulated without systematic methods of co-operation between the organizations concerned. At the present time more than 160 organizations are actively co-operating in the work of the committee, having appointed accredited representatives on sectional committees.

For some years the unification and approval of existing standards will necessarily form an important part of the committee's work. The rules of procedure provide that: "Any standards adopted or in process prior to Jan. 1, 1920, may be approved by the main committee if, in its opinion, the standard has been developed by an organization and procedure substantially in conformity with these rules, or if it has, by actual practice, proved its right to become a standard," without the standards having gone through the machinery of a sectional committee. While the most satisfactory way of determining the status which a standard has in industry is to submit it to a duly organized sectional committee, there are cases in which such a full procedure would be considered a hardship. Hence the provision referred to. Before acting upon the approval of a standard submitted under this provision, a notice of its submission is sent to the technical press and to the industrial associations and technical bodies interested, requesting information as to the standard in meeting the needs of industry, and the matter is referred to a special committee for investigation. This special committee usually contains accredited representatives of those bodies which are most concerned with the standard, in order that the spirit of the sectional committee method may be carried out.

**Federal Specifications Board.**—This Federal Specifications Board has been set up as a part of the general scheme to promote economy and efficiency in

the routine business of the federal government. This board was organized under the authority of Circular 42, Bureau of the Budget, dated Oct. 10, 1921, in which it was stated that the establishment of the board was "for the purpose of co-ordination and economy in the procurement of materials and services used by the government under specifications prepared by the various branches thereof, to avoid duplication of effort and for the better utilization of industries."

The duties of the Federal Specifications Board are to compile and adopt standard specifications for materials and services and to bring the government specifications into harmony with the best commercial practice wherever conditions permit, bearing in mind the desirability of broadening the field of supply. Its work is being done under the leadership of the Bureau of Standards, and each interested department of the government has designated a representative to serve on the board. The circular establishing the Federal Specifications Board states that the specifications adopted and promulgated by the board shall be binding upon all and govern all departments and independent establishments of the federal government. These instructions were issued by the Director of the Bureau of the Budget, by the direction of the President.

The subject of standardization is receiving very serious consideration in practically all industrial countries. At the present time there are fourteen national standardizing bodies, including the American Engineering Standards Committee, in the United States. The countries having these national standardizing bodies are Austria, Belgium, Canada, Czechoslovakia, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Sweden, Switzerland and the United States.

The oldest national standardizing body is that of Great Britain and is known as the British Engineering Standards Association, established in 1901. This association has to its credit the largest number of projects completed and probably the largest number of projects under way. It has more than twenty-five sectional committees with more than three hundred sub-committees, with a membership of over one thousand four hundred individuals at work. The work of this association goes into every branch of industry, but up to date has not included work on safety codes, which is now becoming a considerable part of the work of the American Engineering Standards Committee.

Perhaps the next country in order of importance so far as its accomplishment in the line of standardization is concerned is Germany. The organization here is along a line somewhat simliar to that of the other countries, and during the last few years a great deal has been accomplished which will be of aid to German industry. Of interest to electrical engineers is the fact that in a number of lines standard performances and standard connections have been adopted, so that transformers, for example, of any make will run in parallel with similar transformers of any other make. Voltage taps of all makes are the same.

### INTERNATIONAL PROGRESS

Very serious efforts are being made to accomplish international standardization in many fields.

**International Electrotechnical Commission.**—The oldest and the most experienced of the international bodies whose primary purpose is industrial standardization is the International Electrotechnical Commission, which was organized in 1906 as an outcome of the meeting of the electrical engineers of the world at the St. Louis Exposition in 1903. The International Electrotechnical Commission consists of national committees in each of twenty-six different countries. The work is done by what is known as advisory committees, and decisions are reached at plenary meetings of the commission which are held from time to time.

The influence of the standards committee of the American Institute of Electrical Engineers has been a considerable factor in the past work of the commission, and the American standards are now in very substantial agreement with the international standards so far adopted by the commission. A recent meeting of the advisory committees was held in Geneva, Switzerland, at which meeting there were twelve nations represented, and a total of more than fifty delegates. The chief subjects discussed at this meeting were the basis of rating for general-purpose motors of the open type, standard transmission voltages, factors involved in the rating of water-cooled transformers, abbreviations, symbols and nomenclature, and standard screw plugs and sockets for incandescent lamps.

# Business Conditions

**A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand**

TAKING the electrical market as a whole, it is seen that jobbers and contractor-dealers are considering with less indifference the certain warnings of manufacturers made two months ago when prices were increasing on a rising market. Although a few price increases were made in the market last week, they are of an easier sort and are due mostly to the labor and raw-material situations. Conditions in the market are said to be of a more healthy state than two months ago, and this is certainly true of six months ago.

## Eastern Sections Are Buying in More Conservative Way

IN THE Eastern sections orders to electrical manufacturers, jobbers and retailers continue to flow in fair volume. Less buoyancy is apparent and commitments are a little more conservative, but widespread agreement exists as to the healthy state of the market.

In executive circles the feeling is general that business will be excellent for the rest of the year at least. The buyer is conservative in attitude, and recent tendencies toward inflation appear to have been checked. Price movements are spotty. An advance in direct-current motors amounting to about 10 per cent was scheduled for the first of the week and fuse plugs rose about 8 per cent last week. Brass dropped about a cent a pound last week and copper softened somewhat. Rail deliveries are below desirable standards, but embargoes are being relaxed and road-truck service is improving.

Manufacturers are working close to capacity. In New England the building contract total for the latest reported week exceeded $8,000,000, the best for this week in two decades. Conferences looking toward settling prevalent disputes in the building industry at Boston were scheduled for this week. Retail sales in the electrical field are in excellent volume, interest in ranges showing response to good merchandis-

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.034 | $0.0326 | $0.0236 |
| Cold finished shafting, per lb. | 0.042 | 0.0406 | 0.1466 |
| Brass rods, per lb. | 0.1850 | 0.1913 | 0.15 |
| Solder (half and half), por lb. | 0.2862 | 0.30 | 0.21 |
| Cotton waste, per lb. | 0.1231 | 0.1231 | 0.104 |
| Washers, cast iron (½-in.), per 100 lb. | 4.66 | 4.66 | 4.00 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.11 |
| Machine oil, per gal. | 0.349 | 0.349 | 0.40 |
| Belting, leather, medium, off list | 42% | 42% | 48½% |
| Machine bolts, up to 1-in. x 30-in., off list | 44¼% | 44¼% | 62½% |

ing methods. Cool weather has hurt the early spring fan trade. Lamps are in enormous demand and hollow ware is moving well. Collections throughout the eastern part of the country are showing an improvement.

## Neglecting Foreign Trade When Domestic Market Is Booming

After having captured considerable foreign trade, American electrical manufacturers are allowing it to get away from them while they cater to the domestic market, which for the present is more attractive. This turn in merchandising is true of most other industries of the United States, reports to the Department of Commerce from a large number of countries indicating that American exporters are neglecting their foreign business to a considerable degree.

Since the war upset the world's trade the average American exporter has been playing the flirt with foreign markets. For a time every attention will be given a foreign buyer and then without warning he will be jilted. Just as the coquette usually ends up an old maid, it is feared that many markets will be lost irretrievably if the present practices continue.

Largely as a result of fortuitous circumstances, the United States has built up an important foreign business. While favorable conditions were responsible for inducing American electrical manufacturers to go into foreign markets, their activities in that connection represent a large investment. Not only is this investment being jeopardized by the present business policies of many exporters, but it is sealing the way against any retracing of steps when domestic demand for electrical products begins to fall off.

Officials of the Department of Commerce are urging that a fair distribution of available stocks be made among all customers. If there is to be any favoritism shown, it should be in favor of the foreign market. American manufacturers and other exporters, it is pointed out, would be well advised in taking a leaf from the German book. Germany, and to a less extent England, fills foreign orders first. These countries are in a position to satisfy their domestic customers later if the latter

## Exports of Lighting Outfits, Batteries, Rectifiers,

(Original data supplied by the Bureau

| | | Self-Contained Lighting Outfits | | Searchlights And Projectors | | Primary—Dry | | Primary—Wet | | Storage | | Transformers | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Power | | Other | |
| | | No. | Dollars | No. | Dollars | No. | Dollars | No. | Dollars | No. | Dollars | No. | Dollars | No. | Dollars |
| 1 | Azores | 7 | 1,102 | 20 | 60 | 24 | 9 | | | | | 1 | 56 | | |
| 2 | Belgium | 18 | 4,241 | | | 21,880 | 5,156 | 3 | 79 | 1,915 | 27,657 | 42 | 63,474 | 71 | 4,37 |
| 3 | France | 45 | 9,356 | 739 | 3,240 | 1,115 | 286 | | | 9,716 | 38,336 | 42 | 592,088 | 293 | 15,74 |
| 4 | Denmark | 13 | 2,596 | 9 | 128 | 150 | 71 | | | 12,902 | 68,256 | 4 | 375 | 2 | 10 |
| 5 | Greece | 31 | 9,346 | | | 1,065 | 176 | | | 2,220 | 15,205 | | | | |
| 6 | Iceland & Faroe Islands | | | | | | | | | | | | | | |
| 7 | Netherlands | 6 | 2,614 | 1,446 | 5,954 | 25,118 | 6,507 | | | 339 | 8,461 | 10 | 1,614 | 145 | 14,27 |
| 8 | Norway | 4 | 1,158 | 8 | 204 | 79,097 | 18,208 | 4 | 16 | 990 | 31,598 | 5 | 48,083 | 18 | 2,67 |
| 9 | Spain | 39 | 13,575 | 199 | 789 | 132,529 | 32,016 | | | 3,200 | 37,826 | 76 | 45,281 | 102 | 3,90 |
| 10 | Sweden | 8 | 828 | 3 | 496 | 29,538 | 6,549 | | | 581 | 10,290 | | | 5 | 22 |
| 11 | Switzerland | | | 3 | 509 | | | | | 26 | 334 | 4 | 17,480 | 20 | 23,03 |
| 12 | England | 140 | 38,041 | 119 | 1,433 | 41,447 | 10,832 | 6 | 16 | 8,596 | 143,263 | 151 | 27,574 | 1,335 | 45,78 |
| 13 | Scotland | | | | | | | | | | | | | 4 | 94 |
| 14 | Canada: | | | | | | | | | | | | | | |
| | Maritime Provinces | 5 | 1,236 | 150 | 2,020 | 1,867 | 1,896 | 903 | 1,030 | 536 | 6,104 | 22 | 1,270 | 47 | 3,82 |
| 15 | Quebec and Ontario | 18 | 5,624 | 336 | 7,191 | 45,640 | 16,645 | 1,430 | 2,940 | 12,876 | 130,445 | 797 | 52,788 | 15,689 | 44,00 |
| 16 | Prairie Provinces | 19 | 5,834 | 204 | 1,885 | 11,784 | 4,326 | 753 | 1,622 | 863 | 16,243 | 115 | 13,524 | 958 | 3,58 |
| 17 | British Columbia and Yukon | 14 | 2,941 | 266 | 5,739 | 8,403 | 3,270 | 115 | 550 | 2,998 | 11,525 | 19 | 606 | 776 | 1,20 |
| 18 | British Honduras | 7 | 6,137 | 12 | 114 | 25,647 | 4,762 | | | 10 | 208 | 21 | 2,402 | 30 | 1,61 |
| 19 | Costa Rica | | | 40 | 203 | 19,230 | 2,965 | | | 32 | 1,064 | 23 | 1,406 | 66 | 1,20 |
| 20 | Guatamela | 2 | 719 | 10 | 204 | 22,632 | 4,485 | | | 176 | 3,328 | 33 | 2,301 | 6 | 15,48 |
| 21 | Honduras | 13 | 10,110 | 34 | 370 | 36,396 | 9,770 | 20 | 6 | 159 | 5,798 | 26 | 2,678 | 55 | 2,77 |
| 22 | Nicaragua | | | | | 13,309 | 3,512 | 104 | 267 | 98 | 1,630 | 6 | 721 | 12 | 2,53 |
| 23 | Panama | 5 | 1,051 | 44 | 1,578 | 29,934 | 5,601 | 45 | 62 | 645 | 13,811 | 10 | 509 | 49 | 1,17 |
| 24 | Salvador | 10 | 4,100 | 8 | 47 | 6,908 | 2,077 | 16 | 85 | 136 | 3,323 | 48 | 3,066 | 41 | 12,81 |
| 25 | Mexico | 86 | 27,658 | 353 | 3,782 | 554,730 | 130,312 | 2,245 | 19,217 | 3,862 | 63,627 | 878 | 232,561 | 8,877 | 48,90 |
| 26 | Newfoundland and Labrador | 1 | 295 | | | 170,074 | 43,104 | 12 | 213 | 410 | 2,418 | 55 | 6,623 | 150 | 1,61 |
| 27 | Bermuda | | | | | 11,408 | 2,426 | | | 1 | 36 | 53 | 5,010 | | |
| 28 | Jamaica | 5 | 1,780 | 4 | 88 | 35,646 | 7,467 | 26 | 432 | 834 | 3,294 | 12 | 1,570 | 14 | 1,09 |
| 29 | Trinidad and Tobago | 6 | 2,618 | | | 23,889 | 5,966 | | | 230 | 4,548 | 5 | 314 | 17 | 1,73 |
| 30 | Other British West Indies | 3 | 982 | 4 | 128 | 14,703 | 4,180 | 60 | 35 | 215 | 8,652 | 2 | 972 | 7 | 67 |
| 31 | Cuba | 28 | 8,183 | 337 | 2,168 | 327,889 | 71,969 | 2,039 | 685 | 3,682 | 49,234 | 355 | 27,744 | 861 | 27,64 |
| 32 | Dominican Republic | 31 | 10,139 | 11 | 239 | 29,316 | 6,463 | 25 | 70 | 613 | 5,784 | 15 | 3,342 | 6 | 15 |
| 33 | Dutch West Indies | | | | | 1,981 | 575 | 5 | 26 | 8 | 163 | 6 | 261 | | |
| 34 | French West Indies | | | | | 633 | 146 | | | 29 | 450 | | | | |
| 35 | Haiti | 3 | 1,118 | | | 8,855 | 1,611 | 4 | 7 | 176 | 3,753 | 8 | 674 | 2 | 5 |
| 36 | Argentina | 48 | 21,040 | 158 | 1,951 | 909,462 | 222,098 | 2,187 | 3,994 | 12,377 | 116,886 | 18 | 5,551 | 3,130 | 9,04 |
| 37 | Brazil | 5 | 1,727 | 454 | 36,986 | 181,521 | 50,447 | | | 3,998 | 56,066 | 1,687 | 96,057 | 1,631 | 41,03 |
| 38 | Colombia | 46 | 15,671 | 25 | 613 | 106,903 | 21,052 | 29 | 157 | 788 | 8,532 | 282 | 27,687 | 55 | 4,40 |
| 39 | Equador | 3 | 897 | | | 12,806 | 2,765 | | | 52 | 1,035 | 28 | 17,986 | 6 | 36 |
| 40 | Bolivia | | | | | 444 | 197 | | | 8 | 501 | 8 | 2,861 | 17 | 1,91 |
| 41 | Chile | | | 12 | 652 | 67,254 | 15,108 | 26 | 146 | 560 | 17,481 | 52 | 117,124 | 225 | 7,37 |
| 42 | Peru | 5 | 1,413 | 19 | 1,103 | 45,017 | 11,680 | 52 | 196 | 285 | 10,701 | 147 | 37,794 | 167 | 7,89 |
| 43 | Venezuela | 32 | 7,961 | 69 | 566 | 91,617 | 16,876 | 430 | 97 | 137 | 2,441 | 159 | 25,392 | 34 | 3,44 |
| 44 | Hongkong | 1 | 685 | 5 | 527 | 58,672 | 11,667 | | | 173 | 3,528 | 172 | 13,356 | 1,160 | 6,19 |
| 45 | Japan | 11 | 5,892 | 131 | 147,991 | 4,105 | 1,550 | 1 | 865 | 1,166 | 28,328 | 897 | 1,416,462 | 1,800 | 88,12 |
| 46 | British India | 45 | 14,791 | 106 | 898 | 111,706 | 24,882 | 51 | 268 | 4,228 | 68,662 | 297 | 128,161 | 529 | 29,22 |
| 47 | China | 3 | 992 | 20 | 1,652 | 62,025 | 14,710 | 18 | 83 | 1,819 | 22,855 | 301 | 158,876 | 1,293 | 36,19 |
| 48 | Philippine Islands | 1 | 1,000 | 566 | 2,633 | 200,711 | 31,676 | | | 1,488 | 44,073 | 65 | 11,435 | 108 | 1,51 |
| 49 | Siam | | | 6 | 400 | 20 | 28 | | | 136 | 12,563 | 60 | 7,159 | 200 | 25 |
| 50 | British West Africa | 3 | 1,398 | | | 262 | 70 | | | 68 | 1,050 | | | | |
| 51 | British South Africa | 22 | 6,811 | 172 | 3,376 | 38,337 | 4,482 | | | 3,857 | 65,218 | 51 | 5,036 | 998 | 10,09 |
| 52 | Australia | 463 | 123,934 | 1,400 | 26,919 | 257,073 | 71,227 | 32 | 285 | 18,318 | 122,945 | 578 | 545,236 | 2,658 | 113,57 |
| 53 | Dutch Guiana | 1 | 70 | | | 1,510 | 470 | | | 29 | 738 | | | | |
| 54 | Turkey in Europe | | | | | 205 | 73 | | | 22 | 408 | | | | |
| 55 | New Zealand | 9 | 2,451 | 27 | 291 | 251,426 | 57,776 | 1,401 | 1,952 | 4,475 | 83,203 | 273 | 45,223 | 1,148 | 54,39 |
| 56 | Italy | 43 | 7,875 | 2 | 28 | 1,363 | 442 | | | 123 | 1,117 | 62 | 38,904 | 67 | 66,34 |

should be displeased with deliveries to them. Concrete information is at hand from a hundred sources to indicate that foreign markets are being neglected by America. The situation applies to all lines and is not confined to the electrical industry. It is regarded as of sufficient seriousness to require the most energetic efforts to effect a remedy while there still is time.

## A Normal Week Is Reported in Chicago

CHICAGO jobbers and dealers report a normal week of electrical business. No important changes in price were announced, except an increase of 7 per cent on 1¼-in x 8-in. standard-grade locust pins and a 5 per cent increase on all wood-top pins. Plug fuses have advanced 6 per cent. High-tension equipment sales are keeping up to their previous standard, manufacturers reporting good business and sales to several large stations being made. Pole-line hardware manufacturers had a good week, with no advance in prices at this time, although one is expected shortly.

Numerous selling drives and advertising campaigns have been started on socket devices, such as flat-irons, vacuum cleaners and washing machines, this week. Dealers state that the sale of these commodities remains about the same, with no exceptional sales reported. Tape manufacturers assert that tape is being bought in considerable quantities and that the price will remain firm until the first of June.

## The Metal Market

COPPER is more steady and is holding its own at the 15.50-cent level. The volume of business transacted during the week was small. The more important producers are virtually out of the market, these selling only an occasional lot to regular customers.

NEW YORK METAL MARKET PRICES

| | May 16, 1923 Cents per Pound | May 23, 192[illegible] Cents per Pound |
|---|---|---|
| Copper, electrolytic | 15.25 | 15.50 |
| Lead, Am. S. & R. price | 7.25 | 7.25 |
| Antimony | 8.00 | 8.00 |
| Nickel, ingot | 28.00–30.00 | 28.00 to 30.0[illegible] |
| Zinc, spot | 7.15 | 6.60 |
| Tin, Straits | 45.00 | 43.00 |
| Aluminum, 98 to 99 per cent | 26.00 | 26.00 to 27.0[illegible] |

## [S]witches, Fuses, etc., from the United States During 1922

[o]f Foreign and Domestic Commerce.)

| [T]ransformers Rectifiers No. | Dollars | Condensers, Double Current and Motor Generators, Dynamotor, Synchronous and Other Converters No. | Dollars | Switchboards and Panelboards, Except Telephone No. | Dollars | Switches and Circuit Breakers No. | Dollars | Lightning Arresters Choke Coils, Reactors and Other Protective Devices No. | Dollars | Fuses and Fuse Plugs No. | Dollars | Metal Conduit, Outlets, and Switch Boxes Pounds | Dollars | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ..... | ..... | 2 | 382 | ..... | ..... | 16,105 | 4,493 | 10 | 294 | | | | | Azores | 1 |
| 50 | 2,165 | 338 | 5,805 | 16 | 5,912 | 148,537 | 52,985 | 354 | 3,012 | 4,361 | 1,443 | 1,478 | 228 | Belgium | 2 |
| 50 | 600 | 1,096 | 29,946 | 3 | 1,482 | 19,550 | 38,393 | 331 | 123,439 | 1,780 | 201 | ..... | ..... | France | 3 |
| 14 | 116 | 1 | 25 | ..... | ..... | 2,600 | 1,990 | 100 | 388 | 1,116 | 258 | ..... | ..... | Denmark | 4 |
| ..... | ..... | ..... | ..... | ..... | ..... | 21 | 155 | 22 | 121 | ..... | ..... | ..... | ..... | Greece | 5 |
| | | | | | | | | | | | | | | Iceland & Faroe Islands | 6 |
| 186 | 3,834 | 26 | 2,308 | 11 | 400 | 1,640 | 2,685 | 6 | 42 | 1,212 | 228 | 142 | 213 | Netherlands | 7 |
| 10 | 144 | 2 | 1,112 | ..... | ..... | 13,322 | 7,731 | 4 | 28 | 6,150 | 423 | 8,124 | 700 | Norway | 8 |
| 87 | 1,190 | 429 | 1,676 | 40 | 42,198 | 33,629 | 47,291 | 1,411 | 5,023 | 8,606 | 954 | ..... | ..... | Spain | 9 |
| ..... | ..... | ..... | ..... | ..... | ..... | 506 | 263 | 31 | 294 | ..... | ..... | ..... | ..... | Sweden | 10 |
| 4 | 500 | ..... | ..... | ..... | ..... | 8,421 | 23,356 | 1 | 15 | ..... | ..... | ..... | ..... | Switzerland | 11 |
| 47 | 1,871 | 4,813 | 56,339 | 292 | 32,137 | 86,705 | 73,356 | 1,397 | 10,758 | 30,295 | 7,105 | 993 | 513 | England | 12 |
| 3 | 66 | 1 | 1,455 | 1 | 40 | 34 | 5,938 | 1 | 84 | ..... | ..... | ..... | ..... | Scotland | 13 |
| | | | | | | | | | | | | | | Canada: | |
| 16 | 1,285 | 23 | 2,702 | 14 | 1,307 | 5,105 | 2,253 | 145 | 418 | 16,924 | 739 | 3,418 | 491 | Maritime Provinces | 14 |
| [illegible],650 | 22,282 | 3,845 | 55,506 | 728 | 43,484 | 557,528 | 307,892 | 18,798 | 34,105 | 940,750 | 44,185 | 301,700 | 43,480 | Quebec and Ontario | 15 |
| 126 | 2,359 | 786 | 4,816 | 38 | 2,125 | 24,706 | 13,581 | 3,029 | 4,070 | 98,583 | 4,820 | 10,420 | 2,036 | Prairie Provinces | 16 |
| 24 | 230 | 353 | 3,212 | 323 | 8,483 | 17,151 | 9,563 | 396 | 1,742 | 41,848 | 2,575 | 76,966 | 4,701 | British Columbia and Yukon | 17 |
| 1 | 104 | 4 | 174 | 5 | 1,111 | 658 | 438 | 162 | 142 | 2,309 | 438 | 1,390 | 158 | British Honduras | 18 |
| 1 | 18 | 243 | 2,873 | 1 | 125 | 1,845 | 1,010 | 27 | 521 | 2,685 | 508 | 905 | 144 | Costa Rica | 19 |
| ..... | ..... | ..... | ..... | 2 | 614 | 1,020 | 648 | 91 | 669 | 1,680 | 173 | 107 | 84 | Guatemala | 20 |
| 7 | 323 | 23 | 6,692 | 9 | 1,803 | 1,937 | 1,903 | 224 | 494 | 7,752 | 1,246 | 3,473 | 791 | Honduras | 21 |
| 1 | 165 | 14 | 244 | 4 | 258 | 799 | 868 | 87 | 678 | 3,199 | 312 | ..... | ..... | Nicaragua | 22 |
| 2 | 207 | 544 | 2,072 | 12 | 1,860 | 2,631 | 2,965 | 125 | 852 | 17,406 | 1,411 | 56,222 | 4,172 | Panama | 23 |
| 20 | 404 | 2 | 247 | 4 | 842 | 483 | 458 | 43 | 183 | 214 | 103 | 32 | 13 | Salvador | 24 |
| 42 | 5,530 | 322 | 61,518 | 1,826 | 115,865 | 67,770 | 97,823 | 2,604 | 19,132 | 156,226 | 19,968 | 307,265 | 24,854 | Mexico | 25 |
| 18 | 121 | ..... | ..... | 4 | 640 | 602 | 763 | 66 | 317 | 2,565 | 534 | 6,057 | 946 | Newfoundland and Labrador | 26 |
| ..... | ..... | 20 | 30 | 17 | 3,429 | 594 | 1,259 | 50 | 23 | 1,251 | 366 | 12,920 | 1,813 | Bermuda | 27 |
| 1 | 15 | 1 | 358 | 8 | 2,482 | 2,302 | 1,598 | 38 | 250 | 7,403 | 255 | 1,177 | 162 | Jamaica | 28 |
| 4 | 139 | 3 | 786 | 52 | 414 | 904 | 557 | 77 | 475 | 3,827 | 189 | 387 | 206 | Trinidad and Tobago | 29 |
| 48 | 48 | 12 | 7,501 | 20 | 9,862 | 2,116 | 636 | 8 | 41 | 349 | 247 | 87,178 | 10,861 | Other British West Indies | 30 |
| 87 | 2,350 | 17 | 16,030 | 96 | 33,444 | 22,872 | 31,925 | 1,878 | 13,644 | 126,565 | 13,509 | 269,968 | 28,877 | Cuba | 31 |
| ..... | ..... | 1 | 25 | 13 | 4,617 | 230 | 442 | 25 | 183 | 19,268 | 1,622 | 4,550 | 831 | Dominican Republic | 32 |
| ..... | ..... | ..... | ..... | 4 | 395 | 532 | 288 | ..... | ..... | 25 | 4 | ..... | ..... | Dutch West Indies | 33 |
| ..... | ..... | 1 | 20 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | French West Indies | 34 |
| ..... | ..... | ..... | ..... | 2 | 75 | 443 | 510 | 49 | 443 | 1,550 | 54 | 9,157 | 652 | Haiti | 35 |
| 106 | 440 | 105 | 5,130 | 30 | 6,042 | 111,788 | 49,883 | 303 | 2,550 | 147,978 | 19,462 | 221,463 | 20,912 | Argentina | 36 |
| 6 | 99 | 108 | 4,638 | 423 | 38,236 | 51,246 | 34,185 | 1,808 | 30,256 | 208,289 | 19,325 | 509,77 | 32,331 | Brazil | 37 |
| 2 | 33 | 7 | 2,126 | 21 | 10,266 | 6,494 | 4,233 | 94 | 3,218 | 9,140 | 770 | 14,324 | 1,471 | Colombia | 38 |
| ..... | ..... | 202 | 1,131 | 62 | 12,798 | 940 | 394 | 227 | 2,383 | 4,951 | 897 | 24 | 2 | Ecuador | 39 |
| 2 | 700 | ..... | ..... | 7 | 1,027 | 1,673 | 2,764 | 14 | 104 | 8,548 | 546 | 2,303 | 194 | Bolivia | 40 |
| 58 | 399 | 8 | 161,814 | 39 | 237,960 | 15,625 | 58,375 | 99 | 502 | 29,329 | 3,686 | 170,048 | 9,377 | Chile | 41 |
| 6 | 524 | 6 | 851 | 43 | 21,453 | 5,116 | 3,483 | 2,273 | 3,226 | 13,366 | 1,256 | 55,112 | 3,528 | Peru | 42 |
| 1 | 76 | 255 | 2,829 | 35 | 10,893 | 10,252 | 1,811 | 867 | 2,166 | 14,969 | 757 | 404 | 222 | Venezuela | 43 |
| ..... | ..... | 13 | 221 | 8 | 1,403 | 44 | 113 | ..... | ..... | 14,600 | 2,120 | ..... | ..... | Hongkong | 44 |
| 553 | 865 | 22,204 | 258,140 | 17,385 | 1,583,316 | 46,945 | 259,194 | 2,627 | 244,234 | 5,809 | 2,413 | 98,634 | 7,431 | Japan | 45 |
| 16 | 628 | 24 | 31,588 | 19 | 75,916 | 1,844 | 37,415 | 804 | 19,335 | 13,709 | 2,313 | 190,776 | 13,363 | British India | 46 |
| 34 | 1,283 | 9 | 6,290 | 272 | 52,259 | 65,540 | 72,088 | 515 | 10,520 | 9,915 | 2,626 | 88,848 | 5,995 | China | 47 |
| 17 | 370 | 8 | 18,500 | 32 | 15,356 | 33,923 | 13,755 | 621 | 5,016 | 9,160 | 1,279 | 62,437 | 5,832 | Philippine Islands | 48 |
| ..... | ..... | ..... | ..... | 1 | 65 | 21 | 201 | 1 | 287 | 50 | 5 | ..... | ..... | Siam | 49 |
| ..... | ..... | ..... | ..... | ..... | ..... | 150 | 48 | ..... | ..... | ..... | ..... | ..... | ..... | British West Africa | 50 |
| 21 | 727 | 23 | 27 | 121 | 6,475 | 3,373 | 15,299 | 1,661 | 2,178 | 25,400 | 2,128 | 4,695 | 347 | British South Africa | 51 |
| 181 | 3,531 | 106 | 410,020 | 303 | 232,791 | 231,242 | 525,260 | 4,421 | 38,459 | 59,935 | 15,466 | 195,042 | 51,318 | Australia | 52 |
| ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 76 | 384 | ..... | ..... | ..... | ..... | Dutch Guiana | 53 |
| ..... | ..... | ..... | ..... | ..... | ..... | 1,000 | 495 | ..... | ..... | ..... | ..... | ..... | ..... | Turkey in Europe | 54 |
| 52 | 1,174 | 87 | 8,018 | 19 | 9,946 | 21,222 | 27,289 | 1,095 | 30,892 | 9,927 | 6,432 | 415 | 304 | New Zealand | 55 |
| 16 | 216 | 348 | 18,056 | 8 | 1,296 | 807 | 5,137 | 163 | 689 | 6,303 | 500 | 1,295 | 811 | Italy | 56 |

### April National Delinquent Accounts Were Fewer

FIVE of the six territories reporting for April to the National Electrical Credit Association announce a smaller number of delinquent accounts over March, 1923, and April, 1922. In the Chicago central division section the April, 1923, accounts numbered 794, against 993 for March, 1923, although the average amount for this same period was $139.96, against $131.49 for March, 1923. New York reported 422 delinquent accounts, against 460 in April, 1922, but the average amount increased $28 per account.

Philadelphia's account went from 232 for April, 1922, to 241 in April 1923, but lowered the average amount from $148.51 to $145.60. In both the New England and the Pacific Coast territories the number of accounts for March and April this year has been decreasing. The total number and amount of delinquent accounts follow:

DELINQUENT ACCOUNTS IN APRIL

| Branch and Month | Number of Delinquent Accounts Reported | Total Amount | Average Amount |
|---|---|---|---|
| Central Division: | | | |
| March, 1922.. | 978 | $98,569.53 | $100.79 |
| March, 1923.. | 993 | 130,571.90 | 131.49 |
| April, 1922.. | 799 | 87,991.88 | 110.13 |
| April, 1923.. | 794 | 111,130.28 | 139.96 |
| New York: | | | |
| March, 1922.. | 643 | 72,843.00 | 113.00 |
| March, 1923.. | 584 | 73,655.00 | 126.00 |
| April, 1922.. | 460 | 56,616.00 | 123.00 |
| April, 1923.. | 422 | 63,771.00 | 151.00 |
| Philadelphia: | | | |
| March, 1922.. | 277 | 28,095.09 | 101.42 |
| March, 1923.. | 204 | 26,386.27 | 129.34 |
| April, 1922.. | 232 | 34,454.70 | 148.51 |
| April, 1923.. | 241 | 35,099.19 | 145.60 |
| New England: | | | |
| March, 1922.. | 129 | 11,170.85 | 86.59 |
| March, 1923.. | 60 | 4,782.71 | 79.71 |
| April, 1922.. | 68 | 7,128.00 | 104.82 |
| April, 1923.. | 44 | 7,979.04 | 181.34 |
| Pacific Coast: | | | |
| March, 1922.. | 18 | 2,681.95 | 148.09 |
| March, 1923.. | 48 | 7,522.26 | 156.92 |
| April, 1922.. | 25 | 3,594.67 | 143.50 |
| April, 1923.. | 39 | 8,444.75 | 216.53 |

# Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

### Westinghouse Electric Earns Twice Its Dividends

The net income of the Westinghouse Electric & Manufacturing Company for the year ended March 31, 1923, was $12,263,485 as shown by the company's annual report. The dividend requirements were $6,033,428, so that over twice this amount was earned and more than $6,000,000 added to the surplus. Gross sales for the year were $125,000,000, which represents an increase of $25,000,000 over the sales of last year. The cash position of the company is a strong one, the current assets totaling over $106,000,000 and the current liabilities less than $17,000,000.

"The bookings of new business steadily increased during the year," states Guy E. Tripp, chairman of the board of directors, "and the value of unfilled orders at the close of the year was $61,914,237, as compared with $50,740,696 at the close of the previous year.

### Three Important Western Jobbers Consolidate

The Wesco Supply Company, St. Louis, wholesalers of electrical goods, has purchased the business of the Electric Supply Company, Memphis, and the Gulf States Electric Company, New Orleans. The Wesco Supply Company has recently increased its capital to provide funds for the purpose of purchasing these two companies.

J. L. Buchanan, president of the Wesco Supply Company, will continue as president of the company and will be in active charge of the St. Louis property. W. R. Herstein, vice-president of the Electric Supply Company, will become vice-president of the Wesco Supply Company and will be in charge of the properties in Memphis and New Orleans.

The three properties will be operated as separate and independent units and there will be no change in personnel of office, warehouse or traveling forces. All three will remain General Electric distributors and will continue to handle the products of those manufacturers to whom their respective trades have become accustomed. With slight modifications of territorial limits, so as to conform to economic shipping conditions, the only result of the consolidation will be a common ownership, a greatly increased purchasing power and a stock-interchange arrangement which will give customers the benefit of all three warehouse stocks.

### Warner Elevator Expands

The Warner Elevator Manufacturing Company has completed a large addition to its plant at Cincinnati which gives it a main shop length of 500 ft., 200 ft. in width, two stories and basement. This addition, it is said, makes this the second largest factory in the world for the exclusive manufacture of electric passenger and freight elevators.

A traveling crane in the new south wing connects the railroad spur with the main bay and eliminates most of the trucking to and from the freight cars. A rather unusual problem was recently solved when the 165-ft. elevator test tower was moved bodily to a new location to avoid interference with the main crane track.

### Trumbull-Vanderpoel and Plainville Agreement

The Plainville Electrical Products Company, Plainville, Conn., has entered into an agreement with the Trumbull-Vanderpoel Company, Bantam, Conn., manufacturer of electrical switches, etc., to take over the business which the latter company had on its books covering switchboards and panelboards only.

The Trumbull-Vanderpoel Company has discontinued the manufacture of switchboards and panelboards and is now devoting its entire facilities to the manufacture of inclosed switches and switch parts.

The statement in the ELECTRICAL WORLD of May 12, saying, "The growth of the inclosed-switch business of the Trumbull-Vanderpoel Company has led to an agreement with the Plainville Electrical Products Company whereby the latter will assemble and market this portion of the Bantam company's output," is therefore in error.

### Combustion Engineering Plants at Full Production

New plants of the International Combustion Engineering Corporation are at full production and earnings are in excess of $1,000,000 annually. Business since the first of the current year has been at record figures, both in this country and abroad, the monthly average being in excess of $1,000,000. It is said that this increase is not due entirely to recent developments in burning coal in pulverized form, but also to the fact that business in mechanical stokers is larger than ever.

Business so far in May indicates that the company is having the largest month in its history. Unfilled orders on hand are in excess of $7,000,000, sufficient to keep plants busy at capacity for a full year.

### New Copper and Brass Wire Mill for Anaconda Company

The American Brass Company, subsidiary of the Anaconda Copper Company, has started work on a new mill at the Kenosha (Wis.) branch for the production of copper and brass wire. This mill will constitute a new department at this plant.

The building will be of brick and steel, two stories, 200 ft. x 600 ft., estimated to cost $600,000.

### Pelton Water Wheel Order

The Pacific Gas & Electric Company has awarded a contract to the Pelton Water Wheel Company for furnishing three 48-in. butterfly valves for installation at its Coleman power house. The working head for each of these valves is 470 ft., and they will be equipped for both hand operation and electric motor operation.

The electrical equipment is also arranged for remote control.

### Pittsburgh Transformer Company Making Extensive Additions

A survey of the expansion program now being carried out by the Pittsburgh Transformer Company, Pittsburgh, shows an addition, 80 ft. x 120 ft., being constructed to the Adams Street plant; additional property purchased for a new plant, replacing the old Bayard Street plant, covering an entire city block, contracts for which have been let and started, and property purchased at Metropolitan and Juniata Streets costing $24,000, which will be used for extensions.

When these improvements are completed the company will occupy four city blocks, three blocks covered by its own buildings, and the fourth block, consisting of the River plant, being occupied under lease. The new buildings will be of steel construction with glass sides and buff-brick trimmings of the same general appearance as the Juniata plant.

### Apex Appoints European Manager and Educational Director

Among the recent important appointments made by the Apex Electrical Distributing Company, manufacturer of home appliances, Cleveland, are those of A. L. Zollner as European sales representative and R. E. Palmer as educational director.

Early this month Mr. Zollner sailed for London, where he will establish his headquarters. He was formerly sales manager in foreign countries for the Singer Sewing Machine Company and director of the Willys Export Corporation's activities in the Far East.

Mr. Palmer is at work on a standard form of education for the company's retail salesmen and also a special course for teaching field managers their duties. It is planned to have these courses arranged in time for the company's Cleveland convention, after which it is intended to place a standard course in effect in all the large cities.

### National Conduit Financing Plan

The protective committee representing the holders of the first-mortgage 6 per cent ten-year bonds of the National Conduit & Cable Company has announced that it has received an offer from a responsible party to buy all of the bonds deposited with the National City Bank at a price of $700 net cash for each $1,000 bond. The committee, which consists of Charles E. Mitchell, James H. Perkins and W. O. Gay, has sent a letter to all holders of the bonds outlining the terms of the offer. An extract from the statement of the committee says:

"The undersigned committee has received an offer from a responsible party to buy all first-mortgage 6 per cent ten-year sinking-fund gold bonds of the National Conduit & Cable Company, Inc., which are deposited with the National City Bank of New York, 55 Wall Street, New York City, on or before Tuesday, June 5, 1923, at 70 cents on the dollar of principal, without interest; that is, at $700 net cash for each $1,000 bond, with the coupon due Oct. 1, 1921, and all subsequent coupons attached, payable at said bank, in New York funds, on or before June 20, 1923, provided that if less than 70 per cent in amount of the total issue of said bonds should be deposited with said bank on or before said fifth day of June, 1923, the party making the offer will have the right either to purchase at same price the amount of bonds which has been deposited or to withdraw the offer and refuse to take any bonds."

### Western Electric at Tacoma, Wash., Moves to Larger Quarters

The Western Electric Company at Tacoma, Wash., has recently acquired a new location, moving from 762 Commerce Street to 1511 "A" Street, where full stocks are carried. This new location contains about 2,500 sq.ft. with trackage facilities. The new quarters are up to date in every detail. According to F. N. Cooley, sales manager of the Seattle office, the outlook for electrical business in the Pacific Northwest territory is extremely good and the total year's business should be approximately 60 per cent above that of 1922.

### Granby Consolidated Absorbs Allenby Copper

At a meeting of the directors of the Granby Consolidated Smelting and Power Company last week the company took over control and 90 per cent ownership of the Allenby Copper Company. At the same time D. C. Jackling, August Heckscher, W. H. Coverdale and H. G. Moulton were elected directors of Granby.

The Allenby Copper Company has $800,000 cash in its treasury and General Manager Munroe will immediately start active operations at the Allenby property. Granby is producing close to 3,000,000 lb. of copper a month. Operations at Allenby will add about 20,000,000 lb. a year, making a total annual output of both companies somewhat over 50,000,000 lb. of copper a year.

Col. J. T. Crabbs was elected president of the company to succeed W. H. Nichols.

### General Electric April Business Estimated at $31,000,000

General Electric bookings of new business for the month of April are estimated at $31,000,000. Since Jan. 31 bookings have been at an annual rate of approximately $360,000,000.

Bookings for the first quarter of 1923 were $80,010,045. General Electric entered the current year with approximately $76,000,000 of unfilled orders, which means that, with business booked since Jan. 1, the company had to date approximately $190,000,000 of new business to work on. In the first four months of 1923 goods billed were running at an average of about $20,000,000 a month.

**The Electric Lamp Lock Company,** Kalamazoo, Mich., recently organized to manufacture locking devices for electric light service, is considering plans for the establishment of a plant, estimated to cost about $80,000. The company's products have recently been made at the plant of the Grubber & Smith Manufacturing Company, Jackson, Mich., A. M. Grubber of the latter organization is president of the new company.

**The Connecticut Telephone & Electric Company, Inc.,** Meriden, Conn., announces the appointment of James A. Bennett as sales manager. He succeeds Charles E. Stahl.

**The Gleason-Tiebout Glass Company,** 200 Fifth Avenue, New York City, reports several important orders for its lighting equipment, among which is a large shipment to the new million-dollar high school building in Ottumwa, Iowa, and to the Standard Oil Company of New Jersey's new office building at Baltimore.

**The Walker Vehicle Company,** State and Eighty-seventh Streets, Chicago, manufacturer of electric trucks, announces the removal of its Atlanta office, P. C. Pomeroy in charge, from 926 Hurt Building to 1012 Atlanta Trust Building.

**The Hoover Suction Sweeper Company,** North Canton, Ohio, reports its April business as record-breaking. Volume of shipments during the first two weeks of May indicates that May will show a 20 per cent gain over April.

**The Johns-Manville Company** is moving its big plant out of Milwaukee to Waukegan, Ill. The company has dismantled its machinery and is moving it to the Illinois plant and will allow the Milwaukee buildings to remain idle for the present. This company employs upward of three thousand men and expects to take the majority of its employees with it to the new location.

**The Dryden Rubber Company,** Chicago, announces the appointment of H. E. Lavelle as direct factory representative in Eastern territory for its insulating-tape department. Headquarters are at 15 Park Row, New York City.

**The Gibb Instrument Company,** Bay City, Mich., manufacturer of electric welding equipment, has been appointed distributor of the General Electric Company's arc-welding electrodes in the Middle West.

**The South Norwalk Electric Works,** South Norwalk, Conn., plan to build a two-story addition in the near future.

**The Peterson Storage Battery Company,** 323 South Lafayette Street, South Bend, Ind., has awarded a contract for a one-story addition to cost $30,000.

**The Domestic Electric Company,** 43 Warren Street, New York City, has acquired a portion of the building at 21 Murray Street, under lease, for the establishment of a new works.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Panama (No. 6,487) for radio receiving apparatus and small lighting and power plants operated by internal-combustion engines.

An agency is desired in San Juan, Porto Rico (No. 6,478), for lighting fixtures, etc.

An agency is desired in Cape Town, South Africa (No. 6,481), for household electrical appliances, etc.

An agency is desired in Panama (No. 6,482) for electrical materials used in building construction.

The following inquiries have been received by the Philadelphia Commercial Museum, which will furnish names and addresses of the inquirers to any one desiring them and mentioning the number given: A party in Durango, Mexico (No. 40,677), desires information concerning a moving-picture projector and generator to supply electricity for same and for from six to eight lamps. Representation is desired in Havana, Cuba (No. 40,678), for refrigerating and ice-making machinery. Parties in Popayan, Colombia (No. 40,687), desire pamphlets and literature covering small electric motors, lighting plants driven by water power, water-power machinery and also all kinds of electrical supplies and accessories and raw and prepared mica. Parties in Maracaibo, Venezuela (No. 40,649), are desirous of making connections with manufacturers of electrical supplies, automobile supplies, etc. Parties in Turin, Italy (No. 40,653), would like to represent American manufacturers of filaments for incandescent lamps, carbon filaments, tungsten wire and rods, molybdenum wire and rods, borated copper-clad wire and discontinuous tungsten coils for ½-watt lamps. A party in St. Martin, French West Indies, would like to receive catalogs and prices on ice-making and refrigerating machinery, moving-picture machines, telephone and telegraph material, etc. An agency is desired in Santa Clara, Cuba (No. 40,693), for electric lighting fixtures, incubators and brooders, ventilators, etc. A firm in Osaka, Japan, would like to get in touch with manufacturers of electrical apparatus, motor cars, farming tools, etc.

THE GENERAL SUGAR COMPANY, Havana, Cuba, operating thirteen large sugar estates, would like to receive catalogs from manufacturers of sugar-mill machinery, including steam-boiler plants; electrical machinery, including motors, generators; also equipment for power plants, railroad supplies, including locomotives, etc.

PROPOSED ELECTRIC SYSTEM FOR HUTT VALLEY, NEW ZEALAND.—The proposal of the Hutt Valley Electric Power Board to appropriate £200,000 for the installation of an electric system in the Hutt Valley district has been approved by the ratepayers in the district. Energy to the amount of 2,000 kva. is to be supplied from the hydro-electric plant at Mangahao.

## New Apparatus and Publications

WASHING MACHINE. — The Turbax Corporation, 54 West Twenty-first Street, New York City, has developed a washing machine "Turbax," which can be placed in a stationary tub, wash boiler or bathtub.

SAFETY-SWITCH TERMINAL COVER. —The Square D Company, Detroit, has brought out a new porcelain safety-switch terminal cover.

WASHING MACHINE.—A new washing machine, "Hydro-Vac," has been placed on the market by the Altorfer Brothers Company, Peoria, Ill.

VERNIER ADJUSTER. — The Walbert Manufacturing Company, Chicago, has developed a new vernier adjuster, known as the "Univernier."

VACUUM CLEANER. — A new electric vacuum cleaner, the "Magnetic House Cleaner," has been brought out by the Birtman Electric Company, Department M-32, Chicago.

ELECTRIC GLUE POT. — The Rohne Electric Company, 2434 Twenty-fifth Avenue South, Minneapolis, has placed on the market an electrically heated glue pot, known as "Sta-Warm."

WIRE INSULATION STRIPPER. — A tool for stripping the insulation from the ends of electric wires where connections are to be made, known as the "Bard-Parker" wire insulation stripper, has been developed by the Bard-Parker Company, Inc., 37 East Twenty-eighth Street, New York City.

INSULATION TESTER.—James G. Biddle, 1211-1213 Arch Street, Philadelphia, has issued pocket manual No. 1010, entitled "Concerning Insulation Testing with Special Reference to the Meg."

TRIPLEX AMMETER. — The Roller-Smith Company, 233 Broadway, New York City, is distributing bulletin No. 30, describing its triplex ammeter for three-phase alternating circuits, recently developed by the company.

WOOD PIPE. — The Continental Pipe Manufacturing Company, Seattle, Wash., has issued catalog No. 18, entitled "Continental Pipe Used the World Over," which describes and illustrates its products, including wire-wound wood pipe, continuous-stave wood pipe, "creo-wood" flume, etc.

ELECTRIC HOME REFRIGERATOR.— An electrical air refrigerator, "Odin," a new development of refrigeration, has been brought out by the Automatic Refrigerating Company, Inc., Hartford, Conn.

## New Incorporations

THE HAW CREEK WATER & LIGHT COMPANY, Haw River, N. C., has been incorporated with a capital stock of $10,000 to supply water and electricity in Haw Creek Valley and Argo Gardens and vicinity. The incorporators are George W. Craig, Robert H. Brown and Garland A. Thompson.

THE CUSTER COUNTY ELECTRIC COMPANY, Westcliffe, Col., has been incorporated with a capital stock of $25,000 by C. B. Beardsley, George L. Beardsley and Lee C. Mercier.

THE CORTEZ (COL.) LIGHT & POWER COMPANY has been incorporated by Robert W. Bryce, E. E. Johnson and A. A. Cowling. The company proposes to install and operate an electric plant in Cortez.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

PHIPPSBURG, ME.—Plans for the proposed feldspar grinding plant to be built by the Basin Quarries, Inc., Portland, to cost about $65,000, include a power house.

BOSTON, MASS.—The Boston Elevated Railway Company contemplates the construction of an electric power plant at 696 East First Street, to cost about $200,000.

HOLYOKE, MASS. — The Farr Alpaca Company has plans for a one-story power plant at its mill and will take bids at once. S. M. Greene Company, 293 Bridge Street, Springfield, Mass., is architect and engineer.

HOLYOKE, MASS.—The Holyoke Water Power Company is planning to install an electric generating plant of from 3,600 hp. to 4,000 hp. at the No. 2 overflow. The installation will be of the automatic type.

MIDDLEBORO, MASS.—Plans are being prepared for the construction of a municipal hydro-electric plant, at the Mattock dam, to cost about $35,000. H. M. Merrill & Company, Boston, are engineers.

MERIDEN, CONN. — Plans are under consideration for extensions to the Connecticut Schools for Boys, including a power house to cost $50,000; building for laundries, $150,000, and dormitory building, $150,000. E. S. Boyd is superintendent.

## Middle Atlantic States

GLENS FALLS, N. Y.—The Fort Miller Pulp & Paper Company will install electric power equipment in connection with the rebuilding of the portion of its plant recently destroyed by fire.

NEW YORK, N. Y.—The Texas Company, 17 Battery Place, plans to install electric power equipment in connection with the erection of additional units at its oil-refining plant in Wyoming, to cost about $2,000,000.

PHILADELPHIA, N. Y.—The Antwerp (N. Y.) Light & Power Company contemplates a hydro-electric development of 1,000 hp., under 60-ft. head, on the Indian River here, to cost about $150,000. The work will include a dam, power house, tailrace and generating equipment.

ROCHESTER, N. Y.—Staub & Son, Inc., have plans for a one-story power house at their plant.

HACKENSACK, N. J.—Bids will be received by the Hackensack Improvement Commission until June 4 for construction of sewers and pumping equipment, including three electrically operated sewage-pumping stations, together with pumping equipment, etc. The pumping equipment is to consist of A. B. Wood patent trash pumps, motors and switchboards to be of General Electric or other approved make. Lemuel Lozier is engineer of the commission.

KEARNEY, N. J.—Plans are being prepared by the J. G. White Engineering Corporation, 43 Exchange Place, New York City, for a power plant for the local works of the Western Electric Company. Post office address is Arlington.

KEYPORT, N. J.—The Monmouth Lighting Company has been granted permission to issue $200,000 in bonds and $60,000 in capital, part of the proceeds to be used for extensions and improvements.

MORRISTOWN, N. J.—The Jersey Central Power & Light Corporation, recently organized to merge the Morris & Somerset Electric Company, Morristown, Lakewood & Coast Electric Company, Lakewood, and the Commonwealth Electric Company, Summit, contemplates extensions and improvements in the power plants and systems.

NEWARK, N. J.—Electric power equipment will be installed at the plant of the Celluloid Company, 290 Ferry Street, in connection with extensions to cost $130,000.

WALDWICK, N. J.—The Waldwick Coal & Lumber Company is planning to rebuild its power plant and mill, recently destroyed by fire with loss of about $115,000.

DAUPHIN, PA.—J. H. Bucher and W. H. Schubert are organizing the Conewago-Dauphin Electric Company and the Londenderry-Dauphin Electric Company, to install and operate transmission and distribution systems in Dauphin County.

ERIE, PA.—The City Council contemplates the installation of three high-tension and low-tension conduit systems in State and Liberty Streets and the Cherry Street subway, to cost about $28,500. F. G. Lynch is city engineer.

JOHNSTOWN, PA.—The Clarion River Power Company has plans for the construction of its proposed hydro-electric plants on the Clarion River, at Piney, Foxburg and Mill Creek. The Piney station will have a capacity of 44,000 hp., Foxburg of 85,000 hp. and Mill Creek 130,000 hp.

LYKENS, PA.—The East Penn Electric Company has applied for permission to acquire the system of the Lykens Valley Light & Power Company. Negotiations are under way for the purchase of the Pine Grove Electric Company, Pine Grove. Extensions and improvements will be made.

NEW CASTLE, PA.—The Shenango Pottery Company plans to install electric power equipment in connection with a plant addition to cost about $80,000.

PERKASIE, PA. — The Pennsylvania Power & Light Company is negotiating for the local municipal electric plant. It is proposed to convert the plant into a substation.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company plans to remodel its Mount Vernon power plant for a substation.

PHILADELPHIA, PA.—Plans are being prepared by the Water Bureau for a power house and electrically operated pumping plant at Richmond Street and Wheatsheaf Lane.

PITTSBURGH, PA.—The West Virginia Power & Transmission Company has been granted permission by the Federal Power Commission to build hydro-electric plants on the Cheat River and plans will be prepared at once for the first station. The cost of the project is estimated at about $75,000,000, including power transmission lines. The present plans provide for a total development of 600,000 hp.

POTTSVILLE, PA.—The Philadelphia & Reading Coal & Iron Company, Philadelphia, plans to install a power plant at its Reevesdale Colliery. The coal mining plant will be electrified.

POTTSVILLE, PA. — Plans are under way for a merger of eighteen electric companies operating in Metal, Lurgan, Beale, Lack, Tell, Dublin, Clay, Milford, Tuscarora, Cromwell, Springfield, Letterkenny, Tod, Fannett, Bratton, Woodbury and Granville Townships. The consolidation will include extensions in the power plants and systems and the ultimate merger with the Penn Central Light & Power Company.

READING, PA.—The Metropolitan Edison Company plans to build a substation at Carsonia, near here.

SALEMVILLE, PA. — Electric power equipment will be installed by the Keystone Coal & Coke Company in connection with the rebuilding of its coal washery and coking plant, recently destroyed by fire, causing a loss of about $100,000.

SCRANTON, PA.—The Scranton Electric Company plans to increase the output of its electric power plant by 25,000 kw. at a cost of about $1,800,000. Additional transmission lines will be erected.

BALTIMORE, MD.—Bids will be received by the Board of Awards, at the office of the City Register, City Hall, Baltimore, until May 31 for furnishing and erecting two 8,000,000-gal. motor-driven centrifugal pumps and electrical equipment for the Druid pumping station, Water Department. William A. Megraw is water engineer.

BALTIMORE, MD.—The Standard Sanitary Manufacturing Company, Bessemer Building, Pittsburgh, Pa., has engaged Samuel Dieacher & Sons, Farmers' Bank Building, engineers, to prepare plans for its proposed new local plant and power house, to cost about $2,500,000.

ELKTON, MD.—The Circuit Court has authorized the North Maryland Electric Company to acquire the property of the Gilpin Falls Electric Light Company, Ellston. Extensions and improvements will be made.

HAGERSTOWN, MD.—The Water Commission is considering the installation of electrically operated pumping machinery and auxiliary equipment in connection with extensions and improvements to the waterworks system, to cost about $2,000,000.

MASON, W. VA.—The Hutchinson Coal Company contemplates rebuilding its power plant recently destroyed by fire, causing a loss of about $70,000.

TIOGA, W. VA.—The Cochran Coal Company plans to install additional electric power equipment at the plant of the Bear Run Coal Company, recently acquired.

WASHINGTON, D. C. — The Potomac Electric Power Company has issued $4,000,000 in bonds, part of the proceeds to be used for the construction of an electric generating plant.

## North Central States

BATTLE CREEK, MICH.—The installation of ornamental lamp standards on Chestnut Street is under consideration.

UNION CITY, MICH.—The Village Council has authorized Holland, Ackerman & Holland, consulting engineers, to prepare plans for the installation of a new municipal electric distributing system.

WATERVLIET, MICH.—Electric power equipment will be installed in the plant of the Watervliet Paper Company.

YPSILANTI, MICH.—The Ford Motor Company contemplates the construction of a power house in connection with its plant here for the manufacture of tractors, automobiles, etc., to cost about $1,000,000.

CLEVELAND, OHIO. — The Cleveland Electric Illuminating Company is asking for bids for a substation to be erected at the foot of East 170th Street, to cost about $750,000. J. C. Spencer, Engineers' Building, is engineer; E. J. Cook, Illuminating Building, is architect.

DOVER, OHIO.—Extensions to the municipal electric light plant are under consideration by the City Council.

LIMA, OHIO—Electric power equipment will be installed at the proposed new lubricating-oil plant at the works of the Lily White Oil Company, recently acquired by the Roxana Petroleum Company, Kansas City, Mo.

LOUISVILLE, KY.—The Kentucky Utilities Company, Marion E. Taylor Building, plans to erect a 33,000-volt transmission line from Rockport to Eckols, to supply electricity to the coal mines at Eckols, to cost about $30,000. The company contemplates erecting a transmission line from Lancaster to Richmond (33 miles), to cost about $150,000. G. T. Bogart is engineer.

OWENSBORO, KY. — Electric power equipment will be installed at the new plant to be built by the Owensboro Clay Products Company.

INDIANAPOLIS, IND.—Extensions and improvements will be made in the electric plants and system of the Indianapolis & Cincinnati Traction Company, to cost about $250,000.

JEFFERSONVILLE, IND. — The Interstate Public Service Company has acquired the property of the Jeffersonville Water, Light & Power Company. Plans are under way for extensions and improvements.

KANKAKEE, ILL.—Plans are being prepared by the Public Service Company of Northern Illinois for the construction of a dam and hydraulic power station at Aroma Park on the Kankakee River, about 4 miles from Kankakee.

CHIPPEWA FALLS, WIS. — The City Council is considering the construction of a municipal electric light plant and dam at the Brunet dam site.

GREEN BAY, WIS. — The Wisconsin Public Service Corporation plans to erect a 5-mile transmission line from High Falls to Ellis Junction. Bids, it is understood, will be asked for the work. Mead & Seastone, Journal Building, Madison, are engineers.

MILWAUKEE, WIS.—Bids will soon be asked for the installation of an ornamental street-lighting system in Shorewood, to cost about $85,000. A. J. Sweet, 531 Grand Avenue, is engineer.

MILWAUKEE, WIS.—The construction of a maintenance building to serve the power plant and other buildings and equipment of the Jones Island sewage disposal plant, now under construction, is under consideration by the Metropolitan Sewerage Commission. The building with equipment will cost about $200,000 and will contain a machine shop. John H. Fowles is secretary of the commission.

WILLMAR, MINN.—The City Council is considering the installation of a light plant in conjunction with the waterworks system, to cost about $150,000. Cory & Le Coque, Aberdeen, S. D., are architects and engineers.

BOLIVAR, MO. — Improvements to the municipal electric light system are under consideration. A. T. Archer & Company, New England Building, Kansas City, are engineers.

CARROLLTON, MO.—The Kansas City (Mo.) Power & Light Company has applied to the Public Service Commission to reconstruct and operate the transmission line from Carrollton to Glasgow.

FULTON, MO.—Bonds to the amount of $50,000 have been voted, the proceeds to be used to complete the water and light plant.

LEBANON, MO.—The Missouri Water Power Company is preparing plans for the construction of four hydro-electric power plants on the Niangua River, with total capacity of about 15,000 hp.

ST. LOUIS, MO. — The Columbia Can Company plans to build a power plant in connection with its new works in the Northwest industrial district, to cost about $500,000.

SWEET SPRINGS, MO.—A special election will soon be called to vote on the proposal to sell the municipal electric light plant to the Kansas City Light & Power Company.

BEULAH, N. D.—The installation of a large electric power plant to supply electricity to a number of towns and villages in this section is under consideration by the Beulah Electric Company.

DEVILS LAKE, N. D.—The Mid-West Power Company contemplates erecting a high-tension transmission line from here to Carrington, a distance of 45 miles, to cost about $55,000.

GENEVA, NEB.—The Blue River Power Company has submitted a proposal to the City Council offering to furnish electricity to the city and to build a distributing plant, to cost about $50,000.

## Southern States

CHARLOTTE, N. C.—The Ornamental Stone Company, 129 Brevard Court, contemplates the construction of a power house in connection with a proposed artificial stone plant, to cost about $70,000.

MICAVILLE, N. C.—The North State Feldspar Company, recently organized, plans to install a power plant in connection with a proposed feldspar mill, to cost about $100,000.

SOUTHERN PINES, N. C.—The Southern Pines Warehouses, Inc., contemplates the construction of a power house in connection with a planing mill and mechanical works.

WALNUT COVE, N. C.—A bond issue of $100,000 has been sold, the proceeds to be used for a municipal electric plant.

SAVANNAH, GA.—The Savannah Lighting Company, recently acquired by Mills B. Lane and associates, is being reorganized. Plans are under way for extensions and improvements to the property.

ORLANDO, FLA.—A bond issue of $630,000 is planned, the proceeds to be used for a municipal electric plant and waterworks system.

SEBRING, FLA.—The Light and Water Department will soon ask for bids for equipment for a municipal electric light and power plant.

NASHVILLE, TENN. — The Tennessee Electric Power Company has issued $2,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

SPRING HILL, TENN.—The City Council is considering the installation of an electric lighting system. Electricity will be furnished by the Southern Cities Power Company.

ATTALLA, ALA.—The Alabama Company will construct an electric power house in connection with the rebuilding of its mining properties recently destroyed by fire, with loss of about $100,000.

SAMSON, ALA.—The Pea River Power Company, Troy, has purchased the local light and water plant. Improvements will be made to the system, to cost about $22,000. A transmission line will be erected from Opp to Samson.

HATTIESBURG, MISS.—Plans for the proposed new mills to be built by the Clyde Lumber Company near Quitman, to cost about $150,000, include an electric power house.

JACKSON, MISS.—The Faust Brothers' Lumber Company will build a power house at its proposed new mill here, to cost about $125,000.

LECOMPTE, LA.—Bids will be received by the Mayor and Board of Aldermen until June 12 for improvements to the electric light and waterworks plant, including two crude-oil engines directly connected to alternators, switchboard, motor-driven air compressor, motor-driven domestic service pump, 8-in. water well, 125,000-gal. concrete reservoir, concrete foundations, new power station, etc. Swanson-McGraw, Inc., United Fruit Building, New Orleans, is engineer.

NEW ORLEANS, LA.—The Todd Dry Docks & Construction Corporation, 25 Broadway, New York, will build a power house in connection with its local drydock and shipbuilding plant, to cost about $2,000,000, with equipment.

BARNSDALL, OKLA. — Electric power equipment will be installed at the oil refinery of the Barnsdall Refining Company in connection with extensions to cost about $200,000.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company has purchased a controlling interest in the Shawnee (Okla.) Gas & Electric Company. It has also acquired the Oklahoma Light & Power Company, Ada, and the Southern Oklahoma Power Company, Byng. The plants will be improved and the transmission lines extended for an interchange of service. New lines will be built.

PAULS VALLEY, OKLA.—The Oklahoma Light & Power Company contemplates erecting a transmission line from its plant at Byng to Pauls Valley, which will eventually be extended to Wynnewood.

PRYOR, OKLA.—The Public Service Company of Oklahoma, Tulsa, has petitioned the City Council for a franchise to supply electricity in Pryor. Under the terms of the proposed franchise the company would take over the city light and ice plant and erect a transmission line to Vinita to supply energy for local service.

DALLAS, TEX.—The Dallas Power & Light Company will soon break ground for a power plant on Griffin Street, to cost about $400,000.

DALLAS, TEX.—Electric power equipment will be installed in the ice-manufacturing and cold storage plant of the Columbia Manufacturing Company, recently acquired by the Southern Ice & Utilities Company.

DEPORT, TEX.—An election will be held May 26 to vote on the proposal to issue $18,000 in bonds to construct a municipal electric light plant.

EL PASO, TEX. — Wells, Stillwell & Spears, Inc., contemplate the installation of a power plant in connection with a proposed cotton-oil mill, to cost about $130,000.

FORT WORTH, TEX.—The Texhoma Oil & Refining Company, Wichita Falls, plans to build a power house in connection with a new gasoline refining plant, to cost about $500,000.

SPEARMAN, TEX.—Bonds to the amount of $12,000 have been approved for the installation of an electric light plant.

## Pacific and Mountain States

NORTH BEND, ORE.—Improvements are contemplated by the Mountain States Power Company, including the construction of a new power house at the Smith mill, to cost about $200,000.

PENDLETON, ORE.—The Pacific Power & Light Company, Portland, plans to build a new local substation, with transmission lines to Kennewick, Wash., to cost about $350,000.

PORTLAND, ORE. — Arrangements are being made by the Portland Railway, Light & Power Company to appropriate $12,000,000 for the construction of its proposed hydro-electric plant in the vicinity of Oak Grove, including transmission lines.

EXETER, CAL.—Plans for the proposed cement manufacturing plant, to be built by John F. Hamburg and associates, to cost about $2,000,000, include an electric power plant.

LOS ANGELES, CAL.—The City Council plans to install an ornamental lighting system on Hollywood Boulevard.

SAN FRANCISCO, CAL.—The installation of an ornamental lighting system on Geary Street in connection with widening of the street is planned.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company plans to build a substation in the Vara district, to cost about $100,000, and also one in Berkeley, to cost $65,000.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company has secured a fifty-year license from the Federal Power Commission for the Mount Shasta Power Corporation, a subsidiary, for Pit No. 3 unit and a preliminary permit for two and one-half years for Pit No. 4 unit for the same company, both projects being on Pit River. These projects include a storage reservoir, created by a 100-ft. dam and a 4-mile pressure tunnel, to supply water to a 99,000-hp. plant, operating under a head of 307 ft. Below this plant a diversion dam with a 3-mile pressure tunnel will be built to supply a second power house of 53,000 hp. Electricity will be transmitted by a 220,000-volt transmission line through the Hat Creek plants to Cottonwood. Three more plants are contemplated on the Pitt River.

SANTA CRUZ, CAL.—The installation of an ormental lighting system in the business district is under consideration. James K. James is city engineer.

CANANEA, ARIZ. — The Las Chispas Mines Company, Arizpe, plans to build a power plant at its properties, to cost about $200,000.

## Canada

VANCOUVER, B. C.—Preparations are being made by the British Columbia Electric Railway Company for the erection of a transmission line from West Vancouver to Britannia Beach, a distance of 25 miles. The proposed line will supply electricity to the mines of the Britannia Mining & Smelting Company, which has contracted for about 5,000 hp.

WOODSTOCK, N. B.—The power house of the Woodstock Electric Railway, Light & Power Company was recently carried down the St. John River by a flood.

AMHERST, N. S.—A bylaw to secure hydro-electric power from the Economy River will be submitted to the rate payers.

CLIFFORD, ONT.—The rate payers have proposed a bylaw authorizing the construction of an electric light plant at Elora.

TIMMINS, ONT.—The Northern Canada Power Company contemplates building a hydro-electric plant at Ka-Ka-Ke Rapids on the Des Quinze River, where it is estimated that 100,000 hp. can be developed. The initial development, it is understood, will be about 20,000 hp. The cost of project is estimated from $3,000,000 to $4,000,000. Vielé, Blackwell & Buck, 49 Wall Street, New York City, are engineers.

ST. LAMBERT, QUE.—Improvements are contemplated to the electric lighting system, including a new intake to the power house.

SHERBROOKE, QUE. — A bylaw has been approved by the rate payers authorizing improvements to the gas and electric systems to cost about $125,000.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued May 1, 1923)

1,453,529. COMPOUND REGULATING SET FOR INDUCTION MOTORS; W. Seiz, Baden, Switzerland. App. filed Nov. 3, 1921. Auxiliary equipment enables speed control of induction motors above and below synchronism.

1,453,555. ELECTROMAGNET AND CONTROL THEREFOR; G. E. Stack, Ballston Spa, N. Y. App. filed Dec. 21, 1920. Control operation of circuit magnetically.

1,453,574. ELECTRIC WATER HEATER; Z. Trotzer, Budapest, Hungary. App. filed Nov. 1, 1921. Used in direct connection with water supply pipes.

1,453,584. DEVICE FOR AMPLIFYING TELEPHONE CURRENTS AND OTHER ELECTRIC OSCILLATIONS; J. Blankenburg, Berlin, Germany. App. filed June 17, 1919. Armature of a magnetic system coupled to microphone.

1,453,590. PLUG-RECEIVING WALL OUTLET; W. S. Mayer, Philadelphia, Pa. App. filed June 22, 1921.

1,453,595. MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS AND SIMILAR ARTICLES; L. E. Mitchell and A. J. White, Cleveland, Ohio. App. filed Aug. 3, 1920. Tipless lamps.

1,453,602. LIQUID-LEVEL INDICATOR; D. R. Price, Newtonville, Mass. App. filed Feb. 13, 1920. Electrically indicating levels at points remote from liquid.

1,453,612. SELECTIVE RECEIVER; R. L. Williams, Newton, Mass. App. filed Nov. 8, 1917. For receiving signals transmitted under water.

1,453,610. ELECTRIC HEATER FOR WASHING MACHINES; C. P. Russell, Brandon, Manitoba, Canada. App. filed Jan. 7, 1922. Heating element placed in bottom of reciprocating plunger-type washer.

1,453,682. RHEOSTAT; L. Kebler, Bronxville, N. Y. App. filed Dec. 20, 1920.

1,453,699. METHOD FOR SEPARATING MAGNETIC MATERIALS; O. Brophy, Philadelphia, Pa. App. filed Sept. 28, 1921. Heating of metals renders one temporarily non-magnetic.

1,453,724. GRID LEAK; E. L. Powell and C. E. Motto, Washington, D. C. App. filed June 26, 1922. Construction of grid leak having permanent characteristics.

1,453,774. HIGH TENSION CUT-OUT SYSTEM AND THE LIKE; F. C. Van Etten, Chicago, Ill. App. filed Jan. 9, 1920. Method of mounting equipment on transformer poles.

1,453,791. POST AND COVER CLAMP AND SEAL; W. E. Gossling, New York, N. Y. App. filed July 30, 1920. For storage-battery terminal.

1,453,793. ELECTRICAL CONNECTION; V. C. Hamister, Cleveland, Ohio. App. filed June 30, 1921. Pigtail for carbon brushes.

1,453,794. ELECTRIC LIGHT FIXTURE; J. W. Hancock, Denver, Col. App. filed April 18, 1922. Globe-inclosing bulb is combined with reflector.

1,453,817. ELECTRIC COUPLING FOR CARS; H. H. Westinghouse, New York, N. Y. App. filed July 5, 1918.

1,453,821. TELEPHONE SYSTEM; G. A. Yanochowski, Chicago, Ill. App. filed June 20, 1921. Automatic ringing systems.

1,453,827. ELECTRIC LAMP SOCKET; R. B. Benjamin, Chicago, and P. D. Phillips, Elmhurst, Ill. App. filed April 21, 1920. Method of locking lamp in socket.

1,453,829. RHEOSTAT; G. W. Camp, Mount Vernon, N. Y. App. filed Jan. 10, 1921. Theater dimmer.

1,453,832. ELECTRIC HEATER; E. C. Donaldson, Highland Park, Mich. App. filed Nov. 22, 1920. Heating appliance that can be used like a hot-water bottle.

1,453,858. POWER-DEVELOPING APPARATUS; H. F. Schmidt, Pittsburgh, Pa. App. filed July 21, 1910. Combination of two Diesel engines, one generator and two motors for three-screw propeller drive.

1,453,860. ATTACHMENT DEVICE FOR ELECTRIC FIXTURES; J. E. Watson, Philadelphia, Pa. App. filed May 26, 1922. Auxiliary connection for other units.

1,453,888. SPIRIT LEVEL; W. E. Winner and C. C. Patterson, Lowell, Mass. App. filed Feb. 16, 1921. Electrically lighted.

1,453,889. TIRE VULCANIZER; E. J. Rohne, Minneapolis, Minn. App. filed Jan. 8, 1921. Electrically heated and controlled by thermostat.

1,453,911. AUTOMOBILE SIGNAL; N. Browne, Chelan, Wash. App. filed March 26, 1920. Rear direction signal.

1,453,980. ATTENUATION EQUALIZER; R. S. Hoyt, Brooklyn, N. Y. App. filed June 29, 1918. System for telephonic transmission of speech.

1,453,982. ELECTRICAL RECEIVING OR REPEATING APPARATUS AND METHOD OF OPERATING THE SAME; B. W. Kendall, New York, N. Y. App. filed Sept. 13, 1915. Repeaters for submarine cables.

1,454,005. REGULATING TRANSFORMER; N. Wenzel, Twin Falls, Idaho. App. filed Feb. 10, 1921. System of dimming theater lights.

1,454,011. SYSTEM FOR ATTAINING UNIFORM ATTENUATION; O. B. Blackwell, Garden City, N. Y. App. filed June 29, 1918. Transmission system over which telephonic or multifrequency signals are transmitted.

1,454,017. REEL; M. P. Holmes, Claremont, N. H. App. filed Nov. 20, 1916. Gathering reel for mining machines.

1,454,022. THERMALLY CONTROLLED SWITCH; G. H. Whittingham, Baltimore, Md. App. filed July 10, 1922. For starting and stopping alternating-current motors.

(Issued May 8, 1923)

1,454,030. RHEOSTAT; R. B. Austrian, New York, N. Y. App. filed July 14, 1922. Electron tube-filament resistor.

1,454,033. CHARGING RACK; F. T. Baird, Blue Island, Ill. App. filed Oct. 24, 1921. For electric cells or batteries.

1,454,056. ELECTRIC TOASTER; H. Krueshcld, New Washington, Ohio. App. filed March 20, 1922. Sides turned by knot placed on top.

1,454,078. STORAGE-BATTERY ELECTROLYTE; E. J. Rueb, Oklahoma, Okla. App. filed Jan. 28, 1921. Electrolyte composed of two ounces of aluminum-potassium sulphate per pint of hard water.

1,454,085. ELECTRIC INDICATOR FOR VIBRATIONS OF THE AIR; E. A. Sperry, Brooklyn, N. Y. App. filed Jan. 27, 1917. Consists of long slender gas flame affecting sensitive electric apparatus.

1,454,092. SYSTEM OF ELECTRICALLY TRANSMITTING SIGNALS; H. E. Warren, Ashland, Mass. App. filed April 15, 1918. Range signaling for battleships.

1,454,123. ELECTRICALLY OPERATED OIL CUP; R. R. McClure, San Francisco, Cal. App. filed Oct. 20, 1921. Remote-controlled.

1,454,137. SYNCHRONIZED MACHINE GUN FOR AIRPLANES; O. A. Ross, New York, N. Y. App. filed Sept. 14, 1918.

1,454,147. LIGHT SUPPORT; T. G. Berman, Antigo, Wis. App. filed Sept. 8, 1920. Movable arm supports socket and shade.

1,454,157. PHONOGRAPHIC RECORDING AND REPRODUCING SYSTEM; H. C. Egerton, Ridgewood, N. J. App. filed July 19, 1918. Electromagnetic reproducing and recording means with amplifier.

1,454,158. MEANS FOR RINGING OVER MULTIPLEX TRANSMISSION CHANNELS; L. Espenschied, Hollis, N. Y. App. filed July 29, 1919. Means whereby ringing and other signals may be transmitted for each carrier channel.

1,454,159. MEANS FOR RINGING OVER MULTIPLEX TRANSMISSION CHANNELS; L. Espenschied, Queens, N. Y. App. filed July 30, 1920. Employs carrier currents.

1,454,166. INSULATION-SMOOTHING DEVICE; J. A. Heany, New Haven, Conn. App. filed April 10, 1919. For wires having rectangular cross-section.

1,454,195. PHONOGRAPH MOTOR; E. J. Tomlinson, Newark, N. J. App. filed May 20, 1920. Motor directly on record table shaft.

1,454,219. OZONE GENERATING APPARATUS; R. Goedicke, Berlin-Schöneberg, Germany. App. filed Feb. 28, 1920.

1,454,247. DESK STAND; R. H. Manson, Rochester, N. Y. App. filed March 12, 1920. Telephone stand for automatic system.

1,454,289. LIGHTNING ARRESTER; L. M Klauber, San Diego, Cal. App. filed Dec. 3, 1919. Resistance type.

1,454,296. CONTACT RAIL FOR ELECTRIC TRACTION; H. Parodi, Paris, France. App. filed June 15, 1922. Protecting guard placed over rail.

1,454,307. RADIO TELEGRAPHY; A. L. Anderson, Palo Alto, Cal. App. filed Dec. 23, 1919. Single-wave radio signaling system.

1,454,328. RECEIVING ARRANGEMENT FOR WIRELESS TELEGRAPHY; A. Messner, Berlin, Germany. App. filed Sept. 3, 1921. Energy transformed and amplified in cathode relay.

1,454,359. TERMINAL FOR ELECTRICAL APPLIANCES; C. H. Werenskiold, Brooklyn, N. Y. App. filed Nov. 4, 1919. For batteries, spark plugs, etc.

1,454,425. RADIATOR AND PROCESS OF PRODUCING SAME; I. S. Chapman, Venice, and C. E. Mort, Rialto, Cal. App. filed July 11, 1921. Electrically deposited metal binds ends of tubes together.

1,454,448. ELECTRIC KETTLE; C. de C. Matulich, Henley Beach, South Australia. App. filed Aug. 22, 1922.

# Electrical World

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## Publicity Versus Propaganda

PUBLIC service corporations are telling their story to the people as never before. By printed page and by word of mouth managers of utilities are sweeping away misconceptions of a generation as to the ownership, purposes, responsibilities and rewards of the people's savings devoted to the service of their communities along electrical lines. They are telling the man in the street and the woman in the home the meaning of the industry, its growth from experimental beginnings and hazardous nurturing to the present hour and the superb promise of future usefulness. And the public is responding to this policy of cards face up on table, but some still doubt, calling this work propaganda.

Inside the electrical family we know better. The councils of the industry are shot through and through with discussions by executives and employees in groups large and small of the problems of service. How to meet and how to anticipate the public's needs; how to become better acquainted with customers; how to reduce costs and give more and better service for a given outlay—these are the topics of committee meetings and conferences that never get into the newspapers, but which ought to yield local "copy." Honest efforts to do the day's work better comprise these programs from national conventions down, and if there is any industry striving harder to serve civilization fairly and intelligently, its name is yet to be told.

Sinister meanings are attached to the word "propaganda." The people remember some things a long time, and now and then fail to see the difference between the agency of warfare and hidden selfish purposes and the instrument of truth embodied in today's frank and adequate policy of opening an industry wide for inspection and popular information. Now there are two major requirements in utility publicity: Crystal clarity and statement 100 per cent true and a service matching such statements to the uttermost limit of human ability. Straightforward plain-English accounts of what is doing for the mutual benefit of company and people; rock-bottom elementary principles of finance and regulation; Anglo-Saxon sentences about mutual problems, all expressed in a friendly, nothing-is-being-concealed fashion — and then, officers and employees who strive mightily to live up to the implied ideals.

If the daily performance of every utility employee squares with these principles; if courtesy, honesty, loyalty and devotion are enlisted in the campaign, publicity will make friends for utilities, and the suspicion of propaganda, with its whole train of insincere implications and unwholesome reactions upon public relations, will be cast into the discard by enlightened public opinion.

# Reuben B. Benjamin

*A leader in rendering electrical service to the public which is both economical and entirely safe.*

ELECTRICAL conveniences in the home are nowadays accepted by the public as a matter of course and without any realization of the brains and energy that have been necessary to place these things at its disposal. To the effort and ability expended in the development of convenient and safe wiring devices the extent and popularity of the whole electrical industry have, none the less, been in very large measure due, and in this work the name of Reuben B. Benjamin stands in the front rank.

Born in Fulton, N. Y., in 1869, Mr. Benjamin grew up as a farmer and rancher in New York, Illinois, Virginia and South Dakota. On the South Dakota farm he went through the great blizzards of 1887 and 1888 and developed that pertinacity and strength of character that took him to the front in later life. Leaving the farm in order to develop his mechanical bent, he went to Iowa State College at Ames and was one of the three men to whom that college first granted a degree in electrical engineering.

After graduation in 1892 Mr. Benjamin went to Chicago and worked as an electrician. While he was employed by the Commonwealth Edison Company he invented the wireless cluster, a device which perfected and revolutionized the lighting fixture business and practices of that day and made his business successful. Once launched in business, he was successful from the start and the basement shop was succeeded by larger ones until in 1910 the company moved to its present commodious quarters.

The fertility of Mr. Benjamin's brain is shown by the fact that, in addition to the wireless cluster, he has been the inventor of the swivel plug, the "Benco" socket, "Benox" interchangeable devices, two-way plugs, many designs of industrial lighting equipment, safety lighting for oil refineries and places where gases or explosive dusts are present, besides hundreds of wiring improvements, many of which have been generally adopted. He is also a collaborator in the development of "Elexits." In his efforts to promote safety he has co-operated with the National Board of Fire Underwriters, the Underwriters' Laboratories, the National Safety Council and other bodies. He has been a hard-working member of the N. E. L. A. and other electrical societies.

# Editorial Comment

Electrical World, June 2, 1923

Volume 81 Number 22

## Simplifying and Interpreting Electric Rate Schedules

RATES for electric service have long provided a subject for discussion within the industry and for negotiation with authorities. They have frequently confused customers and at times have proved a serious bone of contention. At best the subject has its complexities, and methods to simplify and interpret are constantly sought.

The average customer is fully willing that the electric company be allowed a fair rate. But in acknowledging the electric rate as "fair" he is likely to have in mind that it is "fairly" understandable as well as "fairly" reasonable. Complicated rate schedules may find justification in accounting theory, but they usually result in added accounting costs as well as added confusion with the customer. The simpler the rate itself the better. However, the lay public has seen enough graphical representation in ordinary literature to grasp relations indicated by a straight line; so that any means devised to represent rate schedules by straight-line plots to that extent permit the introduction of what are probably more equitable if more complicated rates.

Elsewhere in this issue H. E. Eisenmenger adds to his already well-known contributions to the subject by outlining in a simple manner, free from abstruse mathematics, how this reduction of complex rates to straight lines can be made. He also shows the benefits that are derivable from this practice in analyzing existing rate schedules, projecting new ones, computing accounts for billing purposes and explaining the rate to a customer in doubt.

## Seventy-Million-Dollar Opportunity— Does Merchandising Effort Pay?

IT WAS estimated by *Electrical Merchandising* at the beginning of the year that some twelve and a quarter million electrical appliances would be sold during 1923 to the households of America. This meant a promise of a total sale of electrical merchandise by central-station companies, dealers, contractors and other retailers aggregating over $282,000,000; and from the use of this additional equipment in the home would come a new source of annual revenue to the public utility of $83,000,000. To such proportions has the business in electrical merchandise in this country grown.

These figures represent only the estimated ordinary growth of the business that is coming based on merchandising activities on the scale of the past two or three years. That is the ordinary expected business, the regular goods sold in the regular way. It is a little more business than was done last year, a little less than will be done next year, if history repeats itself. But it is worth while considering—just to dream a dream—what might happen if a little extra effort were applied —if the industry sold six fans, six cleaners, six irons, six of everything instead of five. No one knows, of course, exactly what it would mean—there are not sufficiently accurate data. But on page 1285 of this issue appears a tabulation of estimated sales of the various domestic appliances this year, according to normal expectation, and the energy revenue to be derived therefrom, together with an analysis of what a 20 per cent increase in these figures would be worth to the industry. The estimate is at least worth discussing, and if even approximately correct, it shows roughly a seventy-million-dollar opportunity for the price of a little added effort and a little better planning.

The attention of the entire electrical industry will be focused next week on the annual convention of the National Electric Light Association in New York. There will be much discussion of what the central-station company should do to sell more appliances. Here is one measure of the value of efforts in this direction.

## Nation-Wide Interconnected Superpower Survey

A PLAN of electric generation and transmission with proportions truly great has been worked out by Frank G. Baum, an engineer of wide experience in long-distance hydro-electric transmission. His scheme is outlined briefly in this issue. It involves the utilization of the country's vast water-power resources in a comprehensive interconnected system without jeopardizing the investment already made in large modern steam electric generating stations. He divides the country into twelve regional electric power districts, and if the zones are larger than any heretofore contemplated, it is because Mr. Baum is looking far into the future and after much study has mapped a logical system whose advantages loom greater the more it is studied. There is about it nothing visionary or provincial. It is national in scope, contemplates the transmission of large blocks of power, and is based on experience and surveys in the field. True, some of the transmission distances are quite long, but length of transmission is not generally a determining consideration; dependable economic power supply, good load factor and a large stable market are often more important.

Fortunately, no work of such a magnitude has yet been undertaken, so that there is nothing to be undone. The proposed superpower transmission system of energy trunk lines is merely superimposed on what is already in existence. A cursory examination of the regional zones in the East, for instance, indicates that the scheme is instantly applicable to that section. There is a million and a half hydro-electric horsepower available in Tennessee and half as much in West Virginia within easy transmission distance of the great industrial section in the Ohio Valley. The government's survey has shown the necessity of a superpower system along the Atlantic seaboard from Boston to Washington, and water-power development on a grand scale is the present topic of discussion in engineering and political circles in the Middle Atlantic States. We mention this merely to show the timeliness of Mr. Baum's

scheme and to indicate its practical value. The nation's resources of water power, coal, oil, and gas are known; so are the great power markets. What Mr. Baum has done is to fit one into the other in a masterly fashion, thus indicating the lines along which progress will march. His is a very valuable and far-sighted contribution to the art and economics of electric power transmission and will well repay close study and application.

### A Word About Artificial Lightning

THE brilliant and sensational results obtained with "artificial lightning," reported in the May 19 issue by F. W. Peek, Jr., bring to mind some of the characteristics of the natural phenomenon and their relation to experimental results of this sort. All through the history of power transmission it has turned out that as working voltages went up and the insulation of the lines rose with them there has been on the whole less and less trouble from lightning. In other words, the line insulation has been sufficient to take care of a great many disturbances charged up to lightning. Of course, the fact is well known that only a very small minority of the so-called lightning strokes on the line are at all of the nature of direct hits. Most of them are induced discharges of greater or less severity, sometimes giving rise to savage surge effects on the system. The supervoltages may amount to several times the nominal line voltage, but save in direct strokes do not reach any astonishing figures. As Mr. Peek shows, there is not much above 400,000 volts that occurs in actual practice.

The experimental investigation of lightning discharges has risen to high importance since the initiation of the various projects for superpower lines at working voltages exceeding 200,000. In particular, the effect of lightning discharges on the distribution of stresses over insulating strings is a very vital factor in design. Now, the beauty of the apparatus devised by Mr. Peek in its later stages of development is that a pressure of 2,000,000 volts can be momentarily applied to the line, or any voltage up to that astounding figure. The general method of obtaining these prodigious differences of potential is the charging of a static condenser of great capacity to the necessary voltage and then arranging for its discharge over, for instance, an insulator string so as to simulate anything which nature can show.

Lightning discharges are for the most part known to be of enormously steep wave front, generally nonoscillatory as regards any material part of the energy. By discharging a condenser of adequate size through known inductance and resistance it is obvious that almost any amount of damping or lack of it can be obtained on the wave front, giving approximately any wave shape that may be desired. Incidentally, the rate at which energy is turned loose on the system is enormously great as compared with any rate of output of man's devising, unless possibly the firing of a great coast-defense gun. Therefore with an almost indefinitely large amount of energy as reckoned in kilowatts available, with a wave shape which can be regulated with a good deal of precision, it becomes possible to try out in advance all the critical things which might be supposed to present the practical problems of insulation for superpower lines. The mere feat of getting the apparatus for doing this work is a memorable one. The usefulness which may be attained in the transmission work of the next half century is beyond present measure.

### Railroad Electrification and Power Supply

EVENTUALLY the railroads of this country will be electrically operated. Of that there is no doubt. Meanwhile, however, old-line steam-railroad men are doing all that is possible to prolong the present system by improving the efficiency of locomotives, lowering grades, eliminating curves, and so forth. This, of course, is praiseworthy, but it will not ward off the inevitable. It is well, however, for electrical engineers to recognize the situation and to visualize the immensity of the inertia to be overcome. Two weeks ago Julius Kruttschnitt, in an address before the International Railway Fuel Association, stressed the need of greater efficiency in the use of fuel by the railroads and indicated that thereby a reduction of 13 per cent of expense is possible. For the future, Mr. Kruttschnitt says, the hope for conserving fuel lies in (1) substituting hydroelectric energy for steam, (2) substituting steam turbines or compound condensing engines for simple engines, (3) use of a cheap high-gravity fuel, (4) reduction in weight of Diesel engines sufficiently to permit of their use as locomotive engines, and (5) development of a satisfactory variable-speed transmission gear for coupling the Diesel engine to the driving wheels of the locomotive.

In that he chose electrification first Mr. Kruttschnitt did well, but that electrification depends on water power does not follow. Electricity can be produced in steam generating stations just as cheaply in many instances as from water power, and under certain conditions of load factor cheaper. What the railroads need is not conviction on the necessity of greater water-power development, but conversion to electrification. When this is accomplished they will find that the electric light and power industry is not only prepared to supply all the energy they may need, but at a price that no railroad can afford to ignore. The railroads need never lack for electricity.

In this connection the last two recommendations of Mr. Kruttschnitt may be commended to the thoughtful consideration of the manufacturers of electric railroad equipment. If Diesel engines ever become available for locomotives, electrification will be set back a generation and the manufacturers of electrical equipment will have only themselves to blame. It will be a sad day for them if the "battle of the systems" shall lead to such an outcome.

### Electrical Heat Treatment Assuming Greater Prominence

RENEWED activity in the use of electric furnaces in all sorts of metallurgical operations has followed the resumption of business activity, and it may be well once more to indicate the virtues and limitations of their application in the light of present practices, problems and equipment.

Given the requirements of heat treatment for whatever purpose, two fundamental questions at once arise. First, what will be the over-all cost? Second, is electrical heat worth any more on account of any special bearing on operating and utilization?

As regards the first question, it is fairly easy to determine the necessary B.t.u. to supply the quantity of heat required for delivery to the articles in process. The basic quantities are the unit cost of heat used and the efficiency with which the energy thus provided can be delivered to the work. These calculations are inde-

pendent of the source of heat used, but the electric heat calculations are made more readily and accurately because of the difficulty in determining data when using gas, liquid or solid fuels. Speaking in general terms, the transformation of energy in fuel to heat delivered by furnace resistors is on a par with the thermal efficiency of the best heat engines, and when comparison is made with furnaces using direct heat the real efficiency is about a stand-off. On a thermal efficiency basis, therefore, there is no real reason for deciding at the start that electric heat is unnecessarily expensive.

As regards first cost of installation, many variables occur which make it difficult to fix upon a basis of comparison. The insulation material and quantity of insulation used is generally greater on the electric than on the directly heated furnace, but, on the other hand, when floor space, fuel storage capacity and other auxiliary installation details are considered, again a stand-off is generally reached on cost comparisons.

On the second count of production efficiency and convenience a long line of experience with furnaces for almost every sort of use shows that electric heat possesses superior merits from the standpoint of ease of application and control, flexibility in furnace location, accuracy of measurements, speed of production and uniform quality of product. In many industrial processes the fact that electrical heat can be applied uniformly and controlled accurately has been the deciding factor in its adoption, to say nothing of the advantages that come from the ability to work electric heating in vacuo or in any sort of neutral atmosphere that may be needed. Furthermore, the indirect saving obtained by having all process material turned out with exactly the same quality has been an important reason for the adoption of the electric furnace.

There is still much to be done in electric heating—many other applications to steel treatment would occur if the slightly oxidizing atmosphere in the electric furnace could be eliminated. Radiant and resistance types of heating elements and also furnace insulation are not yet perfected, but every indication points to a still greater increase in the load of electric heat-treating furnaces on the lines of the big central stations.

## Circuit Breakers and Other Switchgear

NOW and again calls come for radical improvements in circuit breakers, improvements that will lessen the cost and space demanded, improve the efficiency of the apparatus and the quality of the break, and in general relieve the art from what one may refer to as the hypertrophy of the switchboard. Now, by and large, the apparatus available from standard makers is of good operative quality. It meets the technical requirements on the whole remarkably well and almost daily advances are recorded; but any one who studies the ensemble of the circuit breakers and other switchgear in a modern station comes to a sudden realization that the tail is wagging the dog, that distribution practice has been built up along lines which have forced the switchboard into undue prominence.

While minor improvements in material and design will undoubtedly be made and will perhaps aid here and there in reducing the absurd overgrowth, anything of sweeping importance in increasing the effectiveness and cutting down the formidable expense of the switchboard must come from new conceptions of efficiency in distribution methods rather than from evolution along lines now well laid out. What would happen if there were given into the hands of an engineering committee not too closely devoted to the exploitation of things as they are the problem of laying out *de novo* the complete electrical system of a city of half a million or a million inhabitants? One could feel very confident that the result of its study would be startling to those who have grown up in the regular evolutionary course of conventional construction. Of course, no such blessed opportunity is likely to fall into the hands of any one in our day—this whole question of relatively inexpensive and efficient switchgear is inextricably bound up with the general problems of distribution. Most of our great systems in this country and elsewhere have just grown, each step being a forward one, but hampered by the whole history of the enterprise, financial and technical. In the matter of switchgear, just as elsewhere, real advance is likely to be slow, but some day there will be an opportunity to break away from tradition and make headway along new lines of progress.

## High-Voltage Insulation Still Baffles Analysis

ONE of the oldest experimental problems in the field of electrical engineering is that of the nature of the processes involved in high-voltage insulation. The question is important from both the practical and the purely scientific standpoint. It is a problem which is receiving increasing attention, and there is constant evidence that trained investigators are being attracted more and more to the wide variety of problems offered in this field. Recent evidence of this is the receipt in this country of German publications of the work of Dr. K. W. Wagner, who, it will be recalled, addressed the A. I. E. E. at the Chicago meeting in the spring of last year. Dr. Wagner's paper emphasized the importance of the influence of temperature on insulation, and he suggested that the process of breakdown is largely if not entirely due to the increasing conductivity of insulation caused by temperature rise. At about the same time there appeared in the ELECTRICAL WORLD an account of the experiments of Steinmetz and Hayden leading to very much the same conclusions, although the experiments were quite different in character.

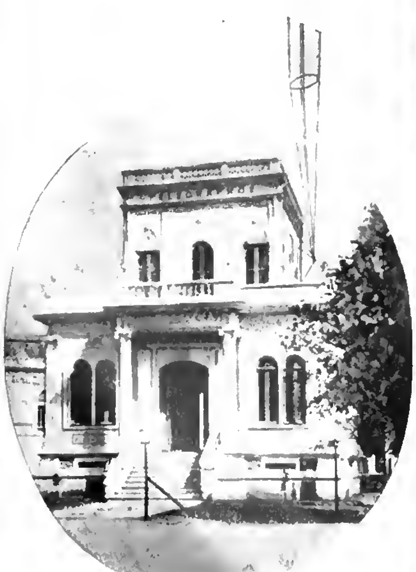
These two sets of experiments do not constitute the first suggestion of the importance of temperature as a factor in the processes leading up to the failure of high-voltage insulation. For a long time the occurrence of hot spots in cables has been noted and has led to the realization that insulation failure does not, in accordance with early ideas, occur as a result of abrupt or disruptive puncture. The important phase of experiments of this character lies, therefore, not so much in the suggestion of a new theory of breakdown as in the new methods that are opened for the further study of the nature of the processes of insulation. The subdivided electrode of Steinmetz and Hayden, on the one hand, and the high-resistance electrode of Wagner, on the other, both offer suggestions for new avenues of study of the behavior of limited regions of the dielectric or insulator. Neither method has been perfected, but each offers good promise of more exact study of this extremely important problem.

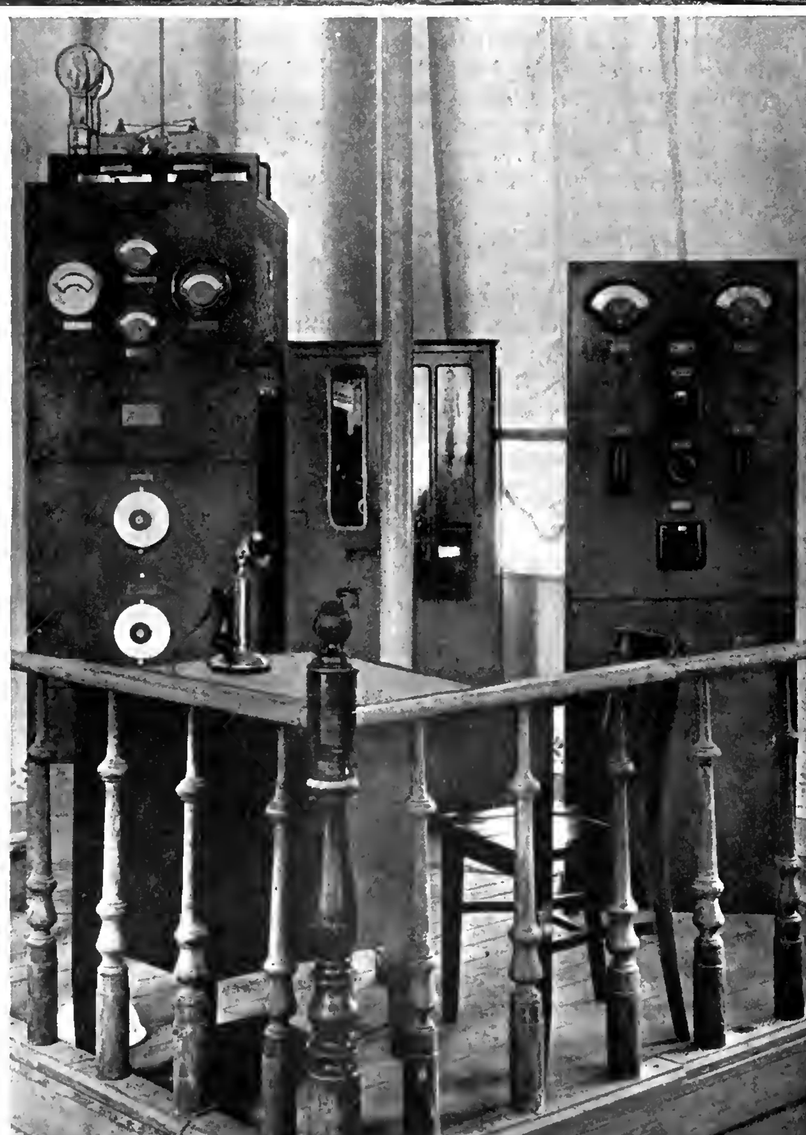
# Rio's Remarkable Radio Station

TO BE heard 8,000 miles is the remarkable record of the radio broadcasting station SPE erected by the International Western Electric Company at the Brazilian Centennial Exposition at Rio de Janeiro.

The antenna, which contributes considerably to the exceptional efficiency of this transmitter, is of a very unusual type. It is a six-wire cage antenna, 500 ft. long, and is suspended from a cable strung between the tops of two mountains, Urca and Babylonia, near the famous Sugar Loaf Mountain. Musical programs were broadcast from this station and were received on a Western Electric 3-A radio receiver and amplified for the enjoyment of thousands of visitors at the exposition by the Western Electric Public Address System.

On Feb. 2 an official demonstration was held, at which a speech delivered by Dr. Sampaio Vidao, Secretary of Agriculture, and military band music were transmitted from Rio and received at São Paulo. Here the Public Address System, installed in a theater, amplified the Rio program for a large audience, in which were the Mayor of São Paulo and many other notables.





# Automatic Plants Aid Western Water-Power Development

## Nine Semi-Automatic Generating Plants, with a Total Rating of 14,655 Kw., Are Now in Operation on Southern California Edison System—Operating Costs Are Reduced Approximately 45 per Cent

By E. R. STAUFFACHER* and GUSTAF CLINWALD†
*Southern California Edison Company*

WHILE attention has been focused on such developments as Big Creek, Pit River, Kern River and other large projects in California because of their spectacular nature, yet notice has not been lacking of the economical operation of some of the older and smaller hydro-electric plants by the use of automatic or semi-automatic control. Because of the greater savings in operating costs many small plants have been changed over from manual to semi-automatic operation and others which will be automatic or semi-automatic are either under construction or planned. There are now in operation in California about fifteen installations of this type with a total capacity of nearly 20,000 kw. It is safe to say that all of these plants would be economically impracticable if it were necessary to employ manual control. Automatic control has been confined so far almost entirely to the smaller plants which were the pioneers of the modern power plants of today. These small plants, with their high operating expense, cannot compete with the lower production costs of the larger plants and would have to be discarded if it were not for the economy brought about by automatic operation. Another factor in their development has been the problem of keeping competent operators. Present-day operators are rapidly assuming an attitude of independence and an air of indifference toward their work. They expect modern city conveniences and even with the best of accommodations do not always show the proper appreciation. With the present high labor turnover it is only logical that automatic apparatus should be meeting with favor in the small and remote hydro-electric plants of the West.

The automatic generating plant is comparatively new, and in the earlier plants most of the apparatus of necessity had to be home-made, particularly that for proper water control where storage capacity was very limited or there was none at all. The manufacturers are rapidly meeting this situation, and it is now possible to duplicate every operation of manual control, even to observing the operating conditions of an automatic station at some distant point. A system of supervisory control has been worked out by means of which over a single pair of wires it is possible to listen in on a distant station and determine the position of circuit breakers, water level, load on the station, hot bearings, etc. The present tendency in the design of these plants is toward the use of induction generators, although most of the plants now in operation are equipped with synchronous generators. The present economic limit of the automatic generating plant seems to be about 5,000 kw., or a limitation to plants where operating costs are relatively high in proportion to fixed charges. In the larger plants with high load factor and relatively

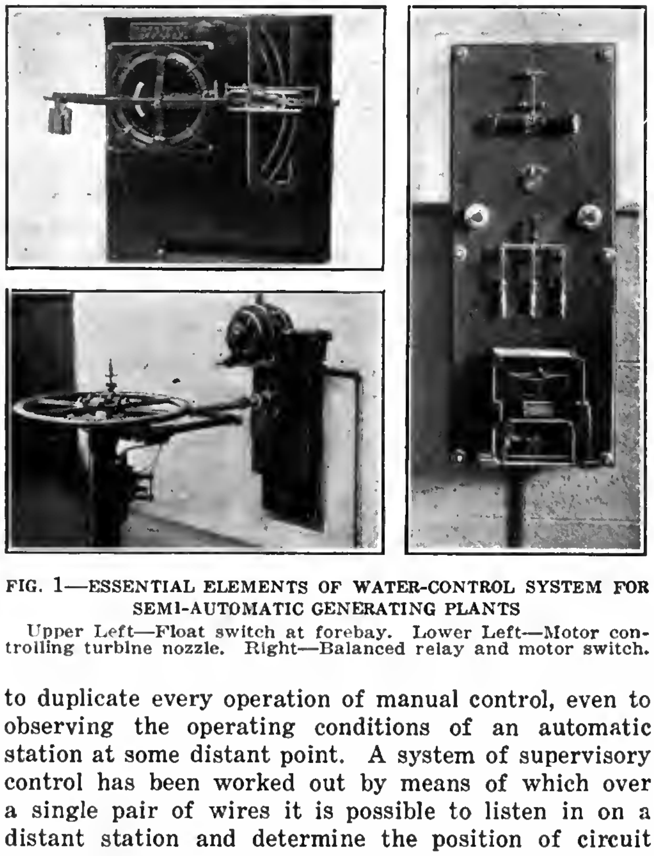


FIG. 1—ESSENTIAL ELEMENTS OF WATER-CONTROL SYSTEM FOR SEMI-AUTOMATIC GENERATING PLANTS

Upper Left—Float switch at forebay. Lower Left—Motor controlling turbine nozzle. Right—Balanced relay and motor switch.

*Protection engineer. †Assistant superintendent of generation.

TABLE I—DATA ON HYDRO-ELECTRIC PLANTS OF SOUTHERN CALIFORNIA EDISON COMPANY CHANGED FROM MANUAL TO SEMI-AUTOMATIC OPERATION

| Plant | Waterwheel Number | Rated Hp. | Size, In. | Make and Type | Total Generating Capacity (Kw.) | Static Head (Ft.) | Storage Capacity Additional to Forebay |
|---|---|---|---|---|---|---|---|
| Fontana (leased) | 2 | 1,200 | .. | Pelton-tangential | 2,000 | 760 | None |
| Kaweah No. 2 | 1 | 2,250<br>1,000 | 28<br>39 | Pelton-Francis<br>Pelton-Victor turbine | 1,700 | 360 | None |
| Kaweah No. 3 | 2 | 3,000 | 72 | Pelton-Doble tangential | 3,900 | 750 | None |
| Lytle Creek | 2 | 400 | 42 | Pelton-tangential | 585 | 483 | None |
| Mill Creek No. 1 | 3 | 250 | 30 | Pelton-tangential | 670 | 510 | 7 acre-ft. |
| Santa Ana R. No 2 | 2 | 800 | .. | Doble-tangential | 1,200 | 305 | Bear Valley Res. |
| Santa Ana R. No. 3 | 1 | 2,000 | 72 | Doble-tangential | 1,550 | 352 | Bear Valley Res. |
| Sierra | 2 | 400 | .. | Pelton-tangential | 750 | 628 | None |
| Tule River | 2 | 1,800 | 40 | Doble-tangential | 2,300 | 1,150 | None |
| Total | .. | ..... | .. | | 14,655 | 5,298 | |

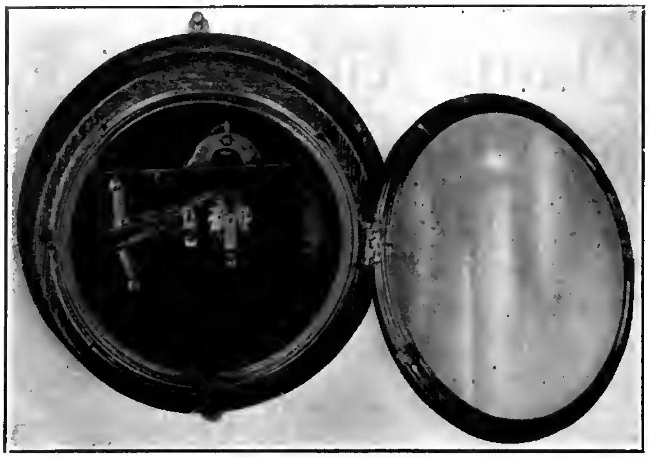


FIG. 2—TIME SWITCH WHICH ENERGIZES WATER-CONTROL MECHANISM FOR A FEW SECONDS AT PERIODS OF FROM TWO AND ONE-HALF MINUTES TO FIVE MINUTES

heavy fixed charges per kilowatt-hour, and where the capacity of the plant is such that a shutdown would seriously affect the system it is feeding into, manually controlled plants generally prove more economical and desirable.

### Automatic Plants of Southern Edison

Nine semi-automatic plants, varying in size from 585 kw. to 3,900 kw. and with a total rating of 14,655 kw., are in operation on the system of the Southern California Edison Company. Table I gives the number and capacity of the units in these plants, the operating head, etc. Full automatic operation was not considered necessary, because one man must be on the premises to act as watchman and caretaker and he is available at all times to start up the plant in case of a shutdown from any cause. The problem of changing to semi-automatic operation was primarily one of water control as the plants have little or no storage. Furthermore, in southern California, where water from small mountain streams is used for irrigation, it is necessary that the hydraulic plants be so operated that under no circumstances will water be spilled at the forebay and thereby wasted.

To meet these conditions special water-control equipment has been developed. In case of high water in the forebay the generator will automatically pick up more load, and in case of low water the nozzle on the waterwheel will be slightly closed so that there will be no danger of lowering the water in the forebay to the extent of allowing air to be trapped in the penstock or pressure pipe. In some of the older plants this is accomplished by means of current-balanced relays wired in the nature of a Wheatstone bridge so arranged that fluctuations of the water in the forebay cut in and out suitably arranged resistances. This causes relays to operate at the power house and open the waterwheel nozzle if the water in the forebay is high and close it if the water is low.

The specially designed water-control equipment used at the Sierra plant, the last one to be converted from manual to semi-automatic operation, is shown in Fig. 1, and the wiring diagram in Fig. 3. This newly designed equipment is operating very satisfactorily and will probably be made standard water-control equipment on the Edison system. At this particular station there are two units of 300 kva. each, operating under a head of approximately 700 ft. The storage is very small and the conditions of water control are severe. Roughly, the system is comprised of three essential parts—a motor with limit switch and gearing mounted at the needle valve, a slate panel on which are mounted the necessary relays, etc., and a specially designed float switch installed at the forebay.

To obtain the desired regulation the periods between the operation of the needle valve motor and the duration of an operating period should be roughly a function of the distance between the actual and the desired water level. The motor must move the needle valve in proper relation to the water level, and the action of the needle should be discontinued at any point, provided the water is moving toward the proper level. It will be seen from Fig. 3 that there are two circuits, one comprising a coil of the balanced relay *BR* and the reactance *BI*, and the other the remaining coil of the relay *BR* and the reactance *R*. The core of the reactance *BI* may be moved by means of a knurled nut to facilitate close balancing, and the core of reactance *R* is actuated by the float mechanism. These balanced circuits are energized every two and one-half or five

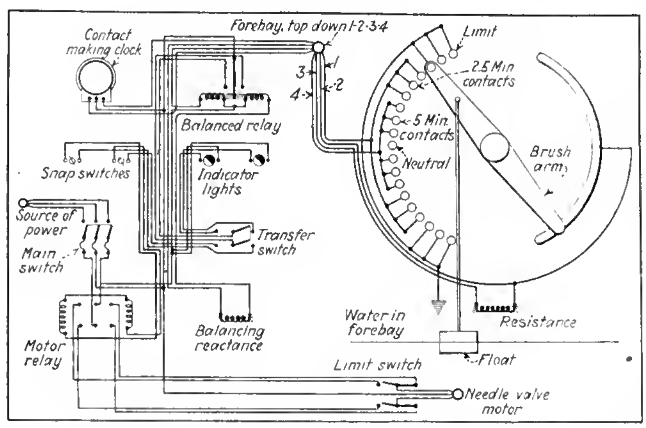



FIG. 3—CONNECTIONS OF ELECTRICAL EQUIPMENT AT FOREBAY AND POWER HOUSE FOR WATER-CONTROL MECHANISM IN SEMI-AUTOMATIC GENERATING PLANTS

minutes by the contact-making clock shown in Fig. 2, or continuously from ground as determined by the position of the float-actuated brush arm *BA*. If upon being energized the circuits are unbalanced by the position of the core in the coil *R*, then the balanced relay *BR* closes its contacts to the left or right and operates the needle valve motor, the motor relay and the limit switch, or gives a visible signal by means of indicating lights as determined by the position of the transfer switch. The

TABLE II—COMPARATIVE ANNUAL OPERATING COSTS OF MANUAL AND SEMI-AUTOMATIC GENERATING STATIONS

| | Estimated Cost 1922 | | | Actual Cost, 1922 | | | |
|---|---|---|---|---|---|---|---|
| Plant | Labor (Chief and Three Operators) | Maintenance (Three-year Average) | Total | Labor | Maintenance | Total | Annual Saving |
| Santa Ana No. 3 | $5,400.00 | $136.58 | $5,536.58 | $2,369.10 | $23.76 | $2,392.86 | $3,143.72 |
| Lytle Creek | 5,310.00 | 121.57 | 5,431.57 | 2,123.50 | 6.68 | 2,130.18 | 3,301.39 |
| Santa Ana No. 2 | 5,400.00 | 195.21 | 5,595.21 | 1,902.05 | 132.57 | 2,034.62 | 3,560.59 |
| Mill Creek No. 1 | 5,340.00 | 188.31 | 5,528.31 | 1,972.29 | 33.87 | 2,006.16 | 3,522.15 |

mechanism for controlling the movement of the core in reactance $R$ is shown in the upper left hand picture in Fig. 1.

Where a plant has more than one generating unit the regulating is done on only one waterwheel and the others are operated at continuous load.

PROTECTION AGAINST TROUBLES

Equipment is provided to protect against troubles developing inside the power house or on the transmission lines. This equipment is arranged so that in case of a short circuit the armature switch is kicked out, which in turn kicks out the field circuit breaker, thus causing the automatic governor trip to operate. Bearing thermostats are provided at the main waterwheel, generator and exciter bearings, and the thermostats and circuit breakers are connected with an annunciator so that the attendant can easily locate the trouble in case of a hot bearing or a switch kicking out. In case of a complete shutdown of a plant it is started up manually and put back on the line by the caretaker. It is felt that the complication necessary to accomplish this result would not be justified in view of the fact that there must be one man on the premises at all times for other reasons.

The equipping of these small plants for semi-automatic operation on the system of the Southern California Edison Company has resulted in marked savings in operating costs, as shown by Table II. Not only have operating costs been reduced, but it has been found that maintenance costs are actually less owing to the smaller use of oil and waste. On the whole, the plants have given more satisfactory operation than when under manual control.

# Fuel Economy and Production Expenses

## Data Are Given for Forty-five Coal Burning Plants Ranging from 10,000 Kw. to 122,000 Kw.—First Part of Analysis Which Will Be Presented in Installments

By ALLEN M. PERRY
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THE many expressions of appreciation of the operating data given in the July 15, 1922, issue of this periodical and the widespread requests for the article led the ELECTRICAL WORLD to solicit similar information from operating companies all over the United States. The response to its inquiries was so much beyond expectations that the data received willl be published in installments as they are compiled and checked, instead of waiting until the entire mass of material is ready for publication. The figures refer to the twelve months ended July 1, 1922.

If the operating conditions are carefully studied and the data properly interpreted, they should be helpful in showing the results that may be obtained by other companies operating under similar conditions. However, the chief interest of the information lies in showing the effect which concentration of power generation, extent of plant utilization, characteristics of coal, price of fuel and labor, etc., have on fuel economy and operating and maintenance expenses. Every engineer recognizes that the costs which are recorded are also affected by plant conditions (modernity, type of equipment, upkeep, etc.), plant management and the human factor involved in labor, but many of these factors are intangible and cannot be incorporated in a table of this kind. Neither can a large expenditure for maintenance be properly spread over a long period in the way it should be. Despite the many factors which influence operating economy and production expenses, it is interesting to observe how closely the results obtained in plants of similar size follow the plant factor and coal characteristics.

To make possible a more intelligent interpretation and study of results several changes were made in the form of this table as compared with the one printed ten months ago. For example, it was considered necessary to rate all stations in the same manner; hence the total installed rating as indicated by nameplates is given. Allowance has not been made for overload capacity, and reserve equipment has been included. Neither has the rating been reduced where there is insufficient boiler capacity, but each reader can make his own interpretation if he will compare the ratings with the figures given in the last two columns.

Last year load factor was given instead of plant factor (net output in kw.-hr. ÷ installed kw. × 8,760), but it is not believed that load factor has as much effect on performance as plant factor, or the extent to which the plant is utilized. The load factor can, however, be easily calculated by any reader who desires to know it.

In all cases it was requested that the amount of fuel burned be expressed in short tons to avoid confusion which arose last year in determining whether the fuel consumption was submitted in short or long tons. The price of fuel per ton was obtained this year so that readers who are studiously inclined may ascertain the plant value of coal containing different amounts of ash and heat content.

The wages paid for labor might also be interesting, but to be of any use it would also be necessary to show how this labor is distributed.

Maintenance expenses have been further subdivided this year into building and structures, boiler plant, prime movers and auxiliaries, generators and electrical equipment, and miscellaneous.

An analysis of the figures will show the value of concentrating power generation and operating at the highest plant factor, although it is surprising to see how one of the smaller plants (No. 57), operating at low plant factor, is holding down its production expenses. The remarkably low total production expense of this plant is due to the fact that the plant is operating with a much smaller force than it would require were

## Operating Economy and Production Expenses of Forty-five Coal-Burning Generating Stations (10,000-122,000 Kw.)

| Station | Installed Generator Rating (Kw.) | Annual Plant Factor, Per Cent | Annual Output (Kw.-hr.) | Peak Load (Kw.) | Annual Fuel Consumption (Short Tons) | Average Btus. Per Lb. | Average Ash, Per Cent | Price of Fuel Delivered (Per Ton) | Pounds Fuel Per Kw.-hr. | Btus. per Kw.-hr. | Unit Production Expenses (cents per kw.-hr. delivered from switchboard): Operating Expense: Fuel | Wages and Superintendence | Water, Lubrication and Supplies | Total | Maintenance Expense: Building and Structures | Boiler Plant | Prime Movers and Auxiliaries | Generators and Electrical Equipment | Miscellaneous | Total | Grand Total | Energy Consumed in Station, Included | Boiler Equipment No.—Hp. | Generator Equipment No.—Kw. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 289 | 122,000 | 18.6 | 198,786,421 | 62,900 | 223,177 | 11,019 | 14.4 | $3.96 | 2.24 | 22,670 | 0.442 | 0.102 | 0.056 | 0.601 | 0.004 | 0.043 | 0.010 | 0.003 | 0.001 | 0.060 | 0.661 | ..... | 32— 518<br>24— 558 | 3—20,000<br>4—12,000<br>1—10,000<br>1— 4,000 |
| 18 | 100,000 | 34.7 | 303,670,040 | 76,000 | 228,701<br>See footnote 1 | 13,000 | 11.0 | 6.82 | 1.51 | 19,650 | 0.522 | 0.059 | 0.013 | 0.594 | 0.002 | 0.011 | 0.012 | 0.006 | ...... | 0.031 | 0.625 | No | 10— 1,263<br>4— 1,384 | 4—31,250* |
| 64 | 95,000 | 8.96<br>See footnote 2 | 74,580,700 | 58,000 | 81,127 | 13,000 | 10.4 | 5.52 | 2.18 | 28,260 | 0.597 | 0.141 | 0.041 | 0.779 | 0.019 | 0.072 | 0.017 | 0.004 | 0.004 | 0.115 | 0.894 | Yes | 11— 1,140<br>with 9,400 sq. ft. economizers | 3—20,000<br>1—35,000 |
| 220 | 87,000 | 31.8 | 242,457,293 | 65,000 | 223,106 | 14,300 | 6.0 | 6.30 | 1.84 | 26,300 | 0.587 | 0.042 | 0.013 | 0.641 | 0.004 | 0.016 | 0.016 | 0.009 | 0.001 | 0.046 | 0.687 | ..... | 20— 600<br>7— 1,000<br>4— 525<br>1— 1,000 | 3— 9,000*<br>2— 5,000*<br>2—15,000*<br>1—20,000* |
| 7 | 72,000 | 16.9 | 106,641,022 | 40,300 | 95,694 | 14,698 | 5.9 | 5.76 | 1.80 | 26,400 | 0.618 | 0.092 | 0.020 | 0.730 | 0.006 | 0.047 | 0.028 | 0.028 | 0.008 | 0.089 | 0.819 | ..... | 16— 600<br>8— 755 | 3— 4,000<br>1—10,000<br>2—15,000<br>1—20,000 |
| 115 | 48,000 | 23.2 | 181,657,165 | 41,700 | 113,772<br>See footnote 3<br>374,631 bbl. oil | 13,000<br>18,000 | 14.0 | 4.68<br>1.22 per bbl. | | 25,800 | 0.544 | 0.150 | 0.024 | 0.718 | ...... | ...... | ...... | ...... | ...... | 0.123 | 0.841 | No | 14— 900 | 2—15,000<br>1— 5,000<br>1— 4,000<br>3— 2,500<br>1— 1,500† |
| 53 | 60,000 | 58.2 | 305,867,600 | 62,000 | 243,089 | 13,150 | 10.1 | 3.96 | 1.59 | 20,900 | 0.330 | 0.066 | 0.034 | 0.430 | 0.007 | 0.022 | 0.007 | 0.003 | 0.001 | 0.040 | 0.470 | Yes | 7— 2,087 | 1—60,000 |
| 84 | 60,000 | 40.8 | 214,351,541 | 48,400 | 212,415 | 10,733 | ...... | 4.86 | 1.98 | 21,250 | 0.537 | 0.059 | 0.022 | 0.618 | 0.001 | 0.020 | 0.001 | 0.005 | 0.008 | 0.034 | 0.652 | ..... | 8— 1,388 | 3—20,000 |
| 12 | 55,000 | 7.6 | 36,664,720 | 24,500 | 43,493 | 13,650 | 9.0 | 8.59 | 2.37 | 32,350 | 1.019 | 0.222 | 0.039 | 1.280 | 0.027 | 0.092 | 0.011 | 0.018 | 0.011 | 0.159 | 1.439 | ..... | 12— 700<br>See footnote 4 | 1—25,000*<br>1—20,000*<br>2— 5,000* |
| 186 | 53,000 | 28.7 | 133,200,300 | 28,200 | 149,171 | 10,457 | 16.1 | 5.30 | 2.24 | 23,400 | 0.596 | 0.052 | 0.018 | 0.666 | 0.007 | 0.048 | 0.006 | 0.006 | 0.005 | 0.071 | 0.737 | ..... | 7— 550<br>2— 450<br>8— 500<br>1— 1,500 | 2— 3,750<br>1— 5,000<br>1— 4,000<br>1— 1,500<br>1—15,000<br>1—20,000 |
| 187 | 50,000 | 57.5 | 217,351,608 | 50,650 | 344,414 | 10,120 | 20.0 | 2.20 | 3.17 | 32,105 | 0.340 | 0.091 | 0.047 | 0.478 | 0.018 | 0.072 | 0.049 | 0.032 | 0.045 | 0.216 | 0.694 | No | 8— 1,043<br>6— 1,179 | 3—10,000<br>1—20,000<br>See footnote 5 |
| 241 | 48,250 | 27.1 | 114,681,040 | 34,000 | 128,180 | 12,263 | 13.0 | 3.90 | 2.30 | 28,200 | 0.436 | 0.073 | 0.032 | 0.541 | 0.007 | 0.050 | 0.035 | 0.009 | 0.005 | 0.105 | 0.646 | No | 1— 520<br>10— 512<br>6— 1,000 | 2— 3,500<br>1— 6,250<br>1—10,000<br>2—12,500 |
| 13 | 45,000 | 36.3 | 143,075,400 | 37,500 | 127,221 | 12,770 | 11.3 | 4.56 | 1.78 | 22,720 | 0.443 | 0.050 | 0.026 | 0.519 | 0.002 | 0.043 | 0.028 | 0.004 | 0.001 | 0.078 | 0.597 | No | 6— 1,373 | 2—12,500<br>1—20,000 |
| 71 | 44,500 | 15.8 | 61,577,400<br>See footnote 6 | 28,115 | bit. 60,129<br>anthr. 10,685 | 14,270<br>12,000 | 8.1<br>18.16 | 7.34<br>4.55 | ...... | 32,000 | 0.638 | 0.127 | 0.078 | 0.843 | 0.021 | 0.044 | ........ | 0.025 | 0.014 | 0.103 | 0.946 | ..... | 6— 600<br>2— 700<br>6— 1,250 | 2—20,000*<br>2— 7,800* |
| 184 | 40,000 | 58.0 | 202,908,075 | 47,000 | 163,866<br>See footnote 7 | 11,961 | ...... | 4.94 | 1.61 | 19,200 | 0.394 | 0.067 | 0.008 | 0.469 | 0.002 | 0.034 | 0.003 | 0.002 | ...... | 0.041 | 0.510 | ..... | 8— 1,306 | 2—20,000 |
| 57 | 40,000 | 20.8 | 72,678,690 | 18,200 | 57,963 | 14,107 | 13.6 | 3.22 | 1.60 | 22,550 | 0.283 | 0.098 | 0.006 | 0.387 | 0.006 | 0.040 | 0.014 | 0.006 | 0.007 | 0.073 | 0.460 | No | 4— 1,425 | 1—20,000<br>2—10,000 |
| 234 | 37,500 | 30.5 | 100,420,900 | ....... | 41,521<br>2,164,191,000 cu.ft. gas<br>See footnote 8 | 10,700 | 15.0 | 3.91 | ...... | ....... | 0.711 | 0.092 | 0.036 | 0.838 | ..... | 0.038 | ........ | 0.047 | ...... | 0.085 | 0.923 | Yes | 32— 500 | 1— 2,000‡<br>1— 2,000‖<br>2— 7,500<br>1— 6,000<br>1—12,500 |
| 211 | 35,900 | 19.4 | 61,170,000 | 21,000 | 86,187 | 9,338 | 17.0 | 4.19 | 2.82 | 26,300 | 0.590 | 0.101 | 0.007 | 0.698 | 0.009 | 0.029 | 0.008 | 0.034 | 0.004 | 0.084 | 0.782 | Yes | 11— 503<br>4— 577<br>3— 1,003 | 1—16,000<br>1—10,500<br>1— 6,400<br>1— 3,000 |
| 85 | 33,000 | 34.8 | 99,418,700 | 22,900 | 114,547 | 14,500 | 6.8 | 6.10 | 2.30 | 33,350 | 0.703 | 0.111 | 0.012 | 0.827 | 0.001 | 0.022 | 0.016 | 0.008 | 0.0003 | 0.048 | 0.875 | ..... | 16— 512 | 3—10,000<br>1— 3,000 |
| 133 | 30,000 | 24.3 | 26,602,855 | 15,700 | 38,465<br>See footnote 9 | 10,921 | ...... | 4.11 | 2.89 | 31,600 | 0.594 | 0.211 | 0.053 | 0.857 | 0.005 | 0.076 | 0.006 | 0.003 | 0.003 | 0.092 | 0.949 | No | 4— 1,345 | 2—15,000 |
| 251 | 24,000 | 22.0 | 32,642,600 | 17,000 | 59,685 | ....... | ...... | 4.23 | 3.66 | ........ | 0.877 | 0.265 | 0.028 | 1.170 | 0.042 | 0.107 | 0.035 | 0.028 | ....... | 0.212 | 1.382 | Yes | 22— 400<br>2— 1,000 | 1—10,000<br>1— 7,500<br>1— 4,000<br>1— 2,500 |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | 3— 600<br>2— 755 | 1— 6,250<br>1— 2,000<br>1— 150<br>1— 75<br>3— 500¶<br>1— 675¶<br>2— 300¶<br>1— 35† |
| 243 | 22,600 | 24.0 | 47,581,394 | 10,900 | 58,084<br>110,563 bbl. oil | ...... | ...... | 4.41 | ...... | ...... | 0.73 | 0.17 | 0.05 | 0.95 | ...... | ...... | ...... | ...... | ...... | 0.27 | 1.22 | ..... | 15 totaling 8,762 | 3 Corliss<br>4 turbines totaling 22,600 |
| 144 | 22,500 | 30.1 | 59,381,412 | 16,000 | See footnote 10<br>50,781 | 13,997 | 8.0 | 7.71 | 1.70 | 23,800 | 0.633 | 0.129 | 0.054 | 0.816 | 0.013 | 0.101 | see boiler plant | 0.005 | 0.014 | 0.133 | 0.949 | ..... | 6— 750 | 1— 7,500<br>2— 6,250<br>1— 2,500 |
| 170 | 21,250 | 30.9 | 57,618,100 | 17,600 | 58,443 | 13,747 | 7.9 | 4.33 | 2.03 | 27,900 | 0.438 | 0.099 | 0.028 | 0.565 | 0.001 | 0.021 | 0.028 | 0.0004 | 0.007 | 0.058 | 0.623 | Yes | 9— 800 | 1—10,000*<br>1— 6,250*<br>1— 5,000* |
| 63 | 21,250<br>See footnote 11 | 18.1 | 30,631,000 | 10,500 | 38,640 | ...... | 12.0 | 8.51<br>See footnote 15 | 2.52 | ...... | 1.07 | 0.28 | 0.035 | 1.385 | 0.058 | 0.044 | 0.022 | 0.023 | 0.003 | 0.155 | 1.54 | No | 8— 400<br>2— 600 | 1—10,000<br>1— 6,250<br>2— 1,500 |
| 138 | 20,000<br>See footnote 13 | 50.6 | 89,089,000 | 23,000 | 67,007 | 14,027 | 10.8 | 4.52 | 1.51 | 21,200 | 0.328 | 0.039 | 0.044 | 0.412 | 0.032 | 0.121 | 0.079 | 0.0003 | ...... | 0.232 | 0.644 | Yes | 4— 1,242<br>Adding 3, totaling 35,000 kw. | 1—20,000<br>1—15,000 |
| 175 | 20,000 | 3.3 | 3,857,205 | 13,700 | 20,574 | 13,800 | 8.0 | 7.86 | 7.12 | 98,300 | 2.763 | 1.254 | 0.234 | 4.251 | 0.059 | 0.368 | 0.093 | 0.109 | 0.013 | 0.641 | 4.892 | No | 12— 650 | 2— 5,000**<br>1— 2,000<br>1— 7,500 |
| 263 | 19,350 | 39.4 | 66,884,900 | 16,900 | 172,129 | 11,500 | 12–15 | 3.65 | 5.14 | 59,100<br>See footnote 14 | 0.938 | 0.169 | 0.136 | 1.243 | 0.006 | 0.099 | 0.029 | 0.003 | 0.005 | 0.142 | 1.385 | Yes.. | 4— 800<br>12— 500 | 2— 1,000<br>1— 4,000††<br>1— 3,350<br>2— 5,000 |
| 50 | 18,000 | 33.5 | 53,059,470 | 15,000 | 90,940 | 10,000 | 22.0 | 2.36 | 3.43 | 34,300 | 0.405 | 0.163 | 0.048 | 0.616 | 0.006 | 0.091 | 0.001 | 0.027 | 0.002 | 0.128 | 0.744 | ..... | 10— 500<br>1— 600 | 1—10,000<br>1— 5,000 |
| 208 | 18,000 | 23.8 | 37,575,960 | 9,600 | 61,073 | 12,522 | 16.4 | 6.16 | 3.25 | 40,700 | 1.090 | 0.120 | 0.016 | 1.226 | 0.009 | 0.057 | 0.032 | 0.005 | ...... | 0.103 | 1.329 | ..... | 1— 509<br>7— 600<br>2— 520 | 1— 3,000<br>1— 7,500††<br>3— 500<br>2— 2,000<br>1— 5,000 |
| 40 | 16,500 | 27.2 | 39,372,170 | 11,300 | 53,600 | 12,000 | 10.0 | 5.81 | 2.82 | 33,800 | 0.803 | 0.18 | 0.02 | 1.003 | 0.02 | 0.153 | 0.04 | 0.02 | 0.002 | 0.235 | 1.238 | ..... | 6— 685<br>4— 306 | 2— 6,000<br>1— 2,000<br>1— 2,500 |
| 23 | 16,250 | 25.2 | 35,979,455 | 88,000 | 49,537 | 11,500 to 12,500 | 16.5 | 3.58 | 2.75 | 33,000 | 0.559<br>See footnote 15 | 0.128 | 0.036 | 0.723 | 0.008 | 0.079 | 0.030 | 0.008 | 0.006 | 0.131 | 0.854 | No | 7,600 | 1—16,250 |
| 25 | 16,000 | 31.6 | 44,321,480 | 13,100 | 46,733 | 13,200 | 8.0 | 4.80 | 2.10 | 27,800 | 0.504 | 0.168 | 0.048 | 0.720 | ...... | ...... | ...... | ...... | ...... | 0.055 | 0.775 | ...... | 6— 846 | 1—10,000<br>1— 6,000 |
| 273 | 16,000 | 14.0 | 20,033,319 | 6,000 | 24,380 | 14,800<br>10,000 for coke breeze | 6.0 | 7.77 | 2.44 | 36,100 | 0.946<br>See footnote 16 | 0.311 | 0.098 | 1.355 | 0.048 | 0.055 | 0.107 | 0.042 | 0.019 | 0.270 | 1.625 | Yes | 2— 350<br>8— 400<br>1— 880 | 2— 2,250*<br>1— 7,500<br>1— 4,000 |
| 27 | 15,200 | 15.1 | 20,130,130 | 5,600 | 41,104 | 11,000 | 14.0 | 4.32 | 4.08 | 45,000 | 0.885 | 0.187 | 0.022 | 1.093 | ...... | ...... | ...... | ...... | ...... | 0.076 | 1.169 | No | 10 totaling 4,900 | 5 totaling 15,200 |
| 286 | 15,000 | 31.0 | 40,805,000 | 12,400 | 60,278 | 11,000 | 11.5 | 2.81 | 2.94 | 32,400 | 0.400 | 0.150 | 0.210 | 0.760 | ...... | ...... | ...... | ...... | ...... | 0.180 | 0.940 | ..... | 5,000 | 15,000 |
| 232 | 12,500 | 34.8 | 38,128,500 | 14,300 | 53,197 | 9,891 | 7.0 | 3.00 | 2.89 | 28,600 | 0.450 | 0.169 | 0.029 | 0.648 | 0.008 | 0.078 | 0.032 | 0.013 | ...... | 0.131 | 0.779 | No | 5— 750 | 1—12,500 |
| 214 | 11,500 | 27.9 | 28,163,600 | 7,500 | 32,488 | 14,400 | 5.8 | 7.69 | 2.30 | 33,150 | 0.925 | 0.190 | 0.095 | 1.210 | 0.010 | 0.089 | 0.074 | 0.015 | ...... | 0.188 | 1.398 | Yes | 3— 520<br>6— 600<br>1— 400 | 1— 3,500<br>2— 2,500<br>1— 1,000<br>2— 1,000¶ |
| 288 | 11,000 | 33.9 | 32,728,000 | 9,000 | 45,365 | 14,000 | 12.0 | 2.99 | 2.78 | 38,900 | 0.410 | 0.090 | 0.090 | 0.590 | ...... | ...... | ...... | ...... | ...... | 0.060 | 0.650 | ..... | 3,700 hp. in 8 boilers | 3 turbines, totaling 9,000 |
| 269 | 10,800 | 20.3 | 19,210,150<br>See footnote 17 | 10,300 | 69,927 | 12,149 | 23.3 | 1.88 | 7.29 | 88,600 | 0.697 | 0.360 | 0.070 | 1.127 | 0.007 | 0.180 | 0.090 | 0.009 | ...... | 0.286 | 1.413 | No | 2— 950<br>8— 250 | 1— 5,000<br>1— 3,000<br>1— 2,000<br>1— 500§§<br>1— 300§§ |
| 283 | 10,200 | 32.1 | 28,760,070<br>See footnote 18 | 6,800 | 41,150 | 13,900 | 7.9 | 4.57 | 2.86 | 39,800 | 0.654 | 0.405 | 0.016 | 1.075 | 0.011 | 0.015 | 0.041 | 0.004 | ...... | 0.071 | 1.145 | Yes | 8 boilers | 3 turbines<br>2 engines |
| 11 | 10,200 | 58.7 | 52,519,034 | 11,500 | 83,123 | ...... | ...... | 2.00 | 3.16 | ...... | 0.320 | 0.120 | 0.020 | 0.460 | 0.003 | 0.050 | 0.009 | 0.009 | 0.004 | 0.075 | 0.535 | Yes | 10— 320 | 2— 1,300‖‖<br>1— 3,000<br>2— 1,000<br>1— 3,200 |
| 49 | 10,000 | 35.8 | 31,457,100 | 10,800 | 42,195 | 13,500 | 11.0 | 6.16 | 2.68 | 36,200 | 0.823 | 0.207 | 0.016 | 1.046 | 0.006 | 0.146 | 0.028 | 0.002 | 0.0007 | 0.183 | 1.229 | ...... | 3— 713<br>1— 732 | 2— 5,000 |
| 48 | 10,000 | 19.9 | 17,463,570 | 6,000 | 22,975 | 11,000 | 12.0 | 5.53 | 2.63 | 29,000 | 0.727 | 0.208 | 0.011 | 0.946 | 0.001 | 0.035 | 0.008 | 0.004 | 0.003 | 0.051 | 0.997 | ...... | 2— 981<br>5— 600 | 2— 5,000 |

[1] Burns natural gas and coal; coal given is equivalent coal; actual coal burned is 78,586 tons.
[2] Auxiliary to hydro power.
[3] Burns coal and oil.
[4] Boiler plant equivalent to 36,000 kw.
[5] Turbine rated at 20,000 kw. added 11/17/21; 6 boilers 5/27/21.
[6] Energy purchased, 9,297,600 kw.-hr not included.
[7] Burns powdered fuel.
[8] Burns natural gas and coal.
[9] Five months' operation; first turbine and two boilers started 10/16/21; second turbine and two boilers put in service 10/18/22.
[10] Burn coal and oil.
[11] Only 19,250 kw. in use.
[12] Coal price delivered in bunkers.
[13] Installed generator rating is 35,000 kw., but boiler capacity is limited to 20,000 kw.
[14] Include cost of steam to large heating load.
[15] Fuel expense includes ash handling.
[16] Burn coke breeze.
[17] 50 per cent of consumption in district served supplied by water power requiring 100 per cent steam reserve in readiness all the time; burns low-grade, high-ash, small-size anthracite.
[18] Energy consumed for excitation not included.
* Kva. † Engine-driven direct-current generator. ‡ Compound Corliss. ‖ Mixed-pressure turbine. § Hp. ¶ Reciprocating engine. ** Standby plant. †† One 1,000-kva. unit being removed and one 5,000-kva. unit installed. ‡‡ Installed 11/15/21. ‖‖ Corliss engines. §§ Engine driven sets.

its output larger, and to the further fact that the fuel expense is low owing to the proximity of the plant to a mine. Furthermore, the maintenance expense is minimized by operating the plant below rating.

If the fixed charges on some of these plants could be uniformly and accurately ascertained, the unit over-all costs might rank in a totally different order. It remains for some one to study the combined fixed and operating costs to ascertain how much money a company can afford to spend for refinements in equipment. Here again, however, it is necessary to determine whether an increase in operating expense is not justified by the greater reliability of service which may be assured.

Aside from plant No. 57, the station operating at the lowest unit cost (exclusive of fixed charges) is No. 53. This plant is producing a kilowatt-hour at 0.470 cent, but it has a 60,000-kw. unit and is operating at 58.2 per cent plant factor. As may be seen, its maintenance expense during the period covered had not yet reached large proportions.

Among the larger stations, No. 64 has the highest production expense—namely 0.894 cent per kilowatt-hour—because of the combination of low plant factor, high coal charge, high wages and high boiler-plant maintenance. Similar conditions obtain for station No. 12, and more particularly for No. 175. The expenses of the latter indicate what must be paid for standby service.

Of particular concern to companies interested in burning powdered coal are the operating economy and production expenses of station No. 184, which is rated at 40,000 kw. With coal containing 11,961 B.t.u. per pound and costing \$4.94 per short ton, this station is producing a kilowatt-hour on 19,200 B.t.u. The operating expense is only 0.469 cent per kilowatt-hour, and the total production expense is 0.510 cent per kilowatt-hour. Although these figures answer some of the principal questions which have been raised in engineers' minds, it would be interesting to know what the fixed charges on stations of this character are.

To enable readers to interpret the figures, the accompanying table was sent to each company submitting data with the request that explanations be given for results where they differ very much from the average for the group. Some of the comments are incorporated in the table as footnotes. Others, arranged in the same order as that in which the companies are listed (i.e., according to rating), are digested below:

No. 115.—From Sept. 1, 1922, to April 1, 1923, the production expenses considerably improved. They are:

| | Cents per Kw.-Hr. |
|---|---|
| Average fuel cost | 0.460 |
| Average labor cost | 0.127 |
| Average water, lubrication and supplies cost | 0.014 |
| Total operating expense | 0.601 |
| Total maintenance expense | 0.095 |
| Grand total | 0.697 |
| Average pounds of fuel per kw.-hr. | 1.932 |

During this period (on Aug. 16, 1922) a 20,000-kw. turbine was put in operation. The labor expense is above the average, largely owing to the fact that the plant is rambling; i.e., it covers considerable territory and has several floor levels. In order to safeguard against failure of one of the large machines it is necessary to have enough help to put one of the smaller units in service in an emergency.

No. 84.—"In comparing our station with others covered by this report, one point comes to my attention which I think would be well to incorporate in your form, that is, the number of B.t.u. for 1 cent. With the above figure it would be very easy to compare the relative operating conditions of the different plants and would permit a much more rapid comparison of the production costs of the various stations, instead of trying to compare the cost of coal and B.t.u. per pound."

No. 12.—Coal price is higher than others of group and plant factor is lower.

No. 186.—"Since putting two new 1,500-hp. boilers in service, our B.t.u. per kilowatt-hour for the past three months has averaged 19,723."

No. 184.—The third unit of this plant was placed in service in October, 1922. Since July 1, 1922, the fuel economy has improved somewhat, although the plant factor is slightly less. Figures follow:

| | |
|---|---|
| Installed generator rating of station, kw. | 70,000 |
| Station output in kw.-hr. for year ended Dec. 31, 1922 | 253,046,466 |
| Peak load for same period | 58,000 |
| Annual plant factor (net output in kw.-hr. divided by 8,760 times installed kw.), per cent | 41.27 |
| Fuel (coal or oil) consumption for same period, lb. | 391,953,556 |
| Average B.t.u. per lb. | 12,056 |
| Coal, lb. per switchboard kw.-hr. | 1.55 |
| B.t.u. per switchboard kw.-hr. | 18,674 |
| Average price of fuel delivered per short ton | \$5.47 |
| Operating expenses, cents per kw.-hr. delivered from switchboard: | |
| (a) Fuel | 0.4234 |
| (b) Wages and superintendence | 0.0594 |
| (c) Water, lubricants, supplies, etc. | 0.0058 |
| Maintenance expense, cents per kw.-hr. delivered from switchboard: | |
| (a) Station buildings and structures | 0.0015 |
| (b) Boiler plant | 0.0199 |
| (c) Prime movers and auxiliaries | 0.0036 |
| (d) Generators and other electrical equipment | 0.0024 |
| (e) Miscellaneous equipment | 0.0121 |
| Number, type and rating of boilers | Eight 1,306-hp. Edge Moor |
| Number, type and rating of prime movers (turbines): | Two 20,000-kw. G. E. horizontal<br>One 30,000-kw. G. E. horizontal |

No. 57.—"The pounds of coal per kilowatt-hour for our plant is probably below the average. This is due mostly to the fact that the equipment was run during this period at its most economical loading. The grand total cost is also possibly below the average, due to the fact that the mine from which the power-plant coal is obtained is immediately adjacent to the plant. Consequently we have no freight to pay on coal."

No. 234.—"Our maintenance expenses are only divided between boiler department and generating department. These divisions are as follows:

| | Cents per Kw.-Hr. |
|---|---|
| Total generator-room maintenance | \$0.0466 |
| Total boiler-room maintenance | 0.0384 |
| Total | \$0.08508 |

"This gives a total operation and maintenance expense of 0.92308 cent per kilowatt-hour."

No. 85.—"Since July 1, 1922, we have made a great many changes in this plant, which was in very poor condition in the year 1921, and have raised its economy very materially. The coal rate has been reduced from 2.30 lb. per kilowatt-hour to 1.77 lb., reducing the B.t.u. from 33,350 to 25,665 per kilowatt-hour. Figures for the first three months in 1923 follow:

| | |
|---|---|
| Installed generator rating, kw. | 33,000 |
| Annual plant factor, per cent | 37.7 |
| Annual output, kw.-hr. | 26,925,400 |
| Peak load, kw. | 23,500 |
| Fuel consumption, short tons | 23,919 |
| Average B.t.u. per lb. | 14,500 |
| Average ash, per cent | 6.8 |
| Price of fuel delivered | \$6.80 |
| Lb. fuel per kw.-hr. | 1.77 |
| B.t.u. per kw.-hr. | 25,665 |
| Operating expenses (cents per kw.-hr. delivered): | |
| Fuel | \$0.612 |
| Wages and superintendence | 0.093 |
| Water, lubrication and supplies | 0.008 |
| Total | 0.714 |
| Maintenance: | |
| Building and structures | 0.003 |
| Boiler plant | 0.022 |
| Prime movers and auxiliaries | 0.007 |
| Generator and electrical equipment | 0.025 |
| Miscellaneous | 0.00003 |
| Total | 0.058 |
| Grand total | 0.773 |
| Rating of boilers (sixteen), each, hp. | 512 |
| Rating of generators: | |
| Three, each, kw. | 10,000 |
| One, kw. | 3,000 |

No. 208.—"The large coal consumption per kilowatt-hour for the period covered by this questionnaire was due to the fact that on account of an accident to our 5,000-kw. unit we were forced to operate the older equipment for several months. At present our coal consumption is about 2.5 lb. per net kilowatt-hour, using coal with a heating value of approximately 12,250 B.t.u. per pound."

No. 11.—Low cost of coal is due to station being contiguous to mines.

No. 49.—Since July 1, 1922, the following results have been obtained:

| | |
|---|---|
| Annual plant factor, per cent | 41.0 |
| Average ash, per cent | 9.07 |
| Lb. fuel per kw.-hr. | 2.57 |
| B.t.u. per kw.-hr. | 34,695 |

# Straight Lines as Rate Curves

## A New Method for Making Rate Studies by Using Graphical Charts—Hyperbolic Curves Reduced to Straight Lines Without Making Calculations—Greater Accuracy and Convenience Secured

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IF RATE schedules are to be graphically expressed by curves, the almost universally chosen method is to plot the cents per kilowatt-hour on a vertical scale over the kilowatt-hours consumed. This results in curved lines. Just as some other curves can be turned into straight lines by using a logarithmic scale so these curves can be straightened if the kilowatt-hours are plotted on a "reciprocal" or "hyperbolic" scale. The design of this kind of scale, which is a very simple matter, is explained in the article. A scale of this kind, once constructed, can be reproduced by blueprinting, photostating, etc., and used for all subsequent work with rate curves just as the ready-made logarithmic scales are used for other investigations.

The use of the hyperbolic scale not only results in a great simplification, with a consequent saving of time and work, but it has also several other advantages which are fully explained in the article. Its principal application is in the study of rates and in the design of new rates.

In the latter part of the article other methods of rate representation and of rate comparison are discussed which make use of straight lines only.

GRAPHICAL representation of central-station rates for the purpose of comparing different rates, for designing new rates, etc., is, as a rule, carried out by plotting the average charge in cents per kilowatt-hour against the number of kilowatt-hours. This will generally not result in straight lines, except in case of the first block of a block rate or in case of a step rate. In practically all other cases curved lines result, notably for the various kinds of block rates. Even in case of step rates, curved lines join the straight lines to one another where the stipulation is made that the application of the lower step shall not make the bill for a larger consumer less than for a smaller consumer or *vice versa.* In other words, where there is an unchanged bill over a certain range of kilowatt-hours, also where the cents per kilowatt-hour are plotted as a function of the load factor, curved lines as a rule result.

The construction of these curved lines is a tedious work and must be preceded by the calculation of a table giving the values for a sufficient number of points of the curve. Even with the use of a calculating machine or where a slide rule is accurate enough, this work takes up much time. The accuracy of the curve is rather limited because a curved line can be made to follow points which are slightly wrong and does not show the consequent distortion from its true shape as readily as a straight line will.

For these and other reasons it is desirable to replace these curves by straight lines through the use of an appropriate scale. Double logarithmic scales will accomplish this, but they require a shifting of the scale for every block, which makes them worthless for this particular purpose.

I have shown in my book on "Central Station Rates"* (pages 360-365) that the curves in question are equilateral hyperbolas, the vertical asymptotes of which are identical with the axis of ordinates—that is, with the axis of cents per kilowatt-hour—whereas the horizontal asymptote is raised over the horizontal axis, or axis of kilowatt-hours, by an amount which is equal to the cents per kilowatt-hour charged in the respective block for the incremental kilowatt-hour. In case of constant bills (intermediate stages in step rates, also minimum bills) the horizontal asymptote is identical with the horizontal axis.

These fundamental facts bring the thought near that it must be possible to stretch these curves into straight lines if we step off the horizontal distances (kilowatt-hours) on a hyperbolical scale, so that the change of the horizontal distances which corresponds to a constant vertical distance in the original curve is offset by an equal but opposite change of the length of the unit on the horizontal scale. The exact proof that the curves must actually become straight lines is easy with the material on hand in the theoretical part of the book mentioned above, but no space shall be taken up with this point in the present article, which is concerned with the practical side of the question only.

### How to Construct the Scale

The scale is constructed in the following manner: Take a convenient horizontal length *MN* (bottom of Fig. 1) as unit; for instance, 100 divisions of a cross-section paper. Step off from the right-hand side *N* toward the left one-tenth of this length and call the point thus received 10. Then step off from *N* to the left a length equal to one-ninth and call the point 9; the point at a distance of one-eighth to the left of *N* will be called 8, and so on until the point 1 is reached, which is at *M*. Fractional values are determined in the same way; for example, the point at the distance 1/1.5 to the left of *N* is called 1.5, etc. In this manner as many points of the scale as seems desirable are determined. On account of the small size of the illustrations fewer of these points are shown in Fig. 1 than will be used for purposes of practice. One could, of course, also continue to the left of the point *M* and enter the points 0.9, 0.8, etc., but this will seldom result in any advantage. The range from 0.5 to 1 in this manner would take up more space than the entire range from 1 to 10. The point *N* represents infinity and the vertical line drawn through this point (dash-and-dot line) will be called the "infinity line." The vertical scale is an ordinary arithmetical cents-per-kilowatt-hour scale.

The use of the sheets ruled in the manner just

*"Central Station Rates in Theory and Practice," by H. E. Eisenmenger, Fred J. Drake & Company, Chicago, 1921.

described is best explained by an example. Suppose we have a block rate of 10 cents per kilowatt-hour for the first 10 kw.-hr. and 5 cents per kilowatt-hour for each kilowatt-hour after the first ten.

Each unit of the horizontal scale is assumed to represent 10 kw.-hr., so that the figures at the bottom of the sheet are to be multiplied by ten in order to give the number of kilowatt-hours and the point $M$ denotes 10 kw.-hr. There is now one point of the curve obviously at the height 10 cents per kilowatt-hour above $M$; this gives the point $A_1$ in Fig. 1. All there is to do now to draw the curve is to step off 5 cents per kilowatt-hour (that is, the charge in the second block) on the infinity line upward from $N$, which gives the point $B_1$, and then to join $A_1$ and $B_1$. (For $\infty$ kw.-hr. the average charge per kilowatt-hour is 5 cents). This

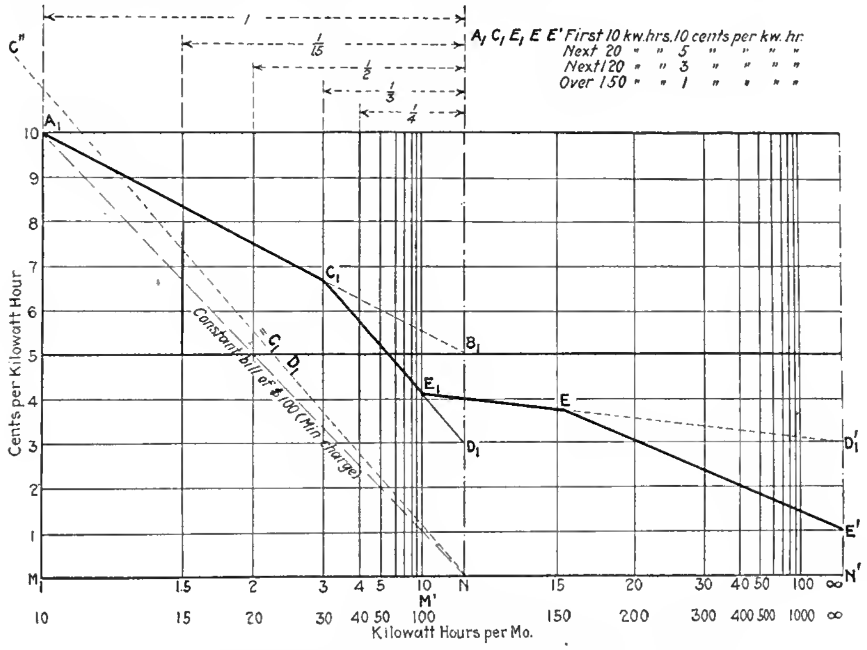



FIG. 1—CONVERTING BLOCK RATES TO STRAIGHT LINES

will immediately give the desired curve without any figuring.

Suppose now there is a third block commencing at 30 kw.-hr. and that all kilowatt-hours in this block are charged at 3 cents per kilowatt-hour; then one takes the intersection point $C_1$ of the rate curve $A_1B_1$ with the vertical which is laid through the point 3 (30 kw.-hr.) and joins it to the point $D_1$, which is found at the height 3 cents per kilowatt-hour on the infinity line.

Now, it will be observed that in the higher ranges of kilowatt-hours—say, above 100 kw.-hr.—the horizontal scale becomes very much compressed. If desired, this portion of the horizontal scale can easily be expanded in the following manner:

Draw a scale $M'N'$, which is identical with $MN$, but use figures ten times as large, placing $M'$ on the point 10 of the original horizontal scale. In this way another infinity line is obtained starting upward from the point $N'$. The old infinity line is then, as can be easily seen, located at the point $1/0.9 = 1.111$ of the new scale. Take now the intersection $E_1$ of the rate line with the vertical line drawn through the point 10 and connect it to the point $D_1$, which is situated at the distance 3 cents per kilowatt-hour above $N'$ on the second infinity line. This gives the equivalent of the portion $E_1D_1$ of the rate line over the expanded scale $M'N'$. The original and the added portion of the diagram shall be called "sections."

Just to carry the example further, assume now a fourth block beginning at 150 kw.-hr., all kilowatt-hours in this block to be charged at 1 cent. $EE'$ gives then the rate curve in this block.

One is, of course, not restricted to making the change of the scale at the point 10. It may be made at any other point that seems desirable, but as a rule this will be the most convenient point in practice. One can also, of course, add a third section to the right of $N$ representing 100-1,000 units; that is, in the case under consideration, 1,000-10,000 kw.-hr.

It is possible also (according to a suggestion by William B. Jackson) to run each section to the infinity line and start the next section a short distance, say one-half inch, to the right of the infinity line, so that each section is entirely separated from the other and no overlapping of scales occurs. With the former method the space between 10 and $N$ has two scales because the point $N$ represents infinity on the first section and 11.111 on the second. The gap between the line representing 10 in the first section and the line representing 10 in the second section must then be bridged by horizontal lines; in other words, the points on the line representing 10 on the section to the left must be projected horizontally to the beginning of the new section.

The line representing a minimum charge is constructed in an equally simple way with the use of a hyperbolic scale. For example, if there is a minimum charge of $1, the curve representing this charge is found in the following way: One dollar means at a consumption of, say, 10 kw.-hr., an average charge of 10 cents per kilowatt-hour, and point $A_1$ is therefore one point of the line. The bottom point of the infinity line $N$ must be of necessity another point of that line, because at infinity kilowatt-hours and a constant bill of $1 the average charge is zero. $A_1N$ is therefore the line representing a minimum charge $1.

The same applies for every constant charge such as are frequently found between the steps of step rates. Take, for example, a step rate as follows: If the consumption is 150 kw.-hr. or less, 8 cents is charged for every kilowatt-hour; if the consumption is more than 150 kw.-hr., 6 cents is charged for every kilowatt-hour. No bill for a larger consumption is, however, to be smaller than that for a smaller consumption. There results then (Fig. 2) a straight horizontal line at the height of 8 cents per kilowatt-hour until it hits the 150-kw.-hr. line. From there the straight line drops toward the point $N$ until it reaches the 6-cents-per-kilowatt-hour line (which, as the figure shows directly and without any computation whatsoever, takes place at 200 kw.-hr.), and from there on the rate curve proceeds as a straight horizontal line. The inclined straight-rate line also indicates, without figuring, how large that constant bill is. The line, produced, intersects the 1,000-kw.-hr. line at 1.2 cents per kilowatt-hour (or the 100-kw.-hr. line at 12 cents per kilowatt-hour), and therefore the bill is 1,200 cents or $12.

It will be noted that in each case the entire rate curve has been drawn without a single calculation, which compares favorably with the long tables that have to be tediously figured out to obtain a curve of similar accuracy under the old system with an arithmetical horizontal scale. The plotting of a large number of points from the table becomes also unnecessary with the new system.

A third advantage is that the loss of time connected with the tracing of curved lines is avoided.

If, therefore, the scale is once laid out, a very considerable saving of work and time is effected for all future rate curves. Printed sheets with rulings after a hyperbolic scale comparable to the well-known log or double-log sheets are not yet on the market as far as the author is aware. But an ordinary cross-section sheet of generous dimensions about 20 in. high and 10 in. wide for each section (to insure accuracy) can be easily ruled with a hyperbolic scale by any good draftsman in a short time and can then be cheaply and quickly reproduced in any quantity and any size by photographic methods as a photostat, blueprint or Van Dyke print. The method of reproduction preferred by the author is a Van Dyke negative direct-printed copy, from which positive contact prints are taken which may be blueprints or black or brown prints. The latter are preferable if it is intended to photostat the sheet after the rate curves have been entered, because blue lines will photostat poorly. It is advisable to rule three sections on this master sheet, every point of each section representing ten times as many kilowatt-hours as the corresponding point on the neighboring section to the left.

The advantages of saving time and work are not the only ones of this straight-line method.

Where two or more rates are compared by means of the curved-line method, the curvature distorts the impression to be conveyed by the curve. Supposing, for instance, as a simple case, that there are two rate curves, one running above the other at a constant vertical distance of 0.1 cent per kilowatt-hour, both curves will come very closely together in the range of the low kilowatt-hours where the curves are very steep, and this may go so far that the two curves finally even run together and cannot be distinguished from one another because their mutual distance is smaller than the thickness of the lines (Fig. 3). On the right-hand end of the curves, where the energy consumptions are high and the curves almost horizontal, the distance between the two curves is practically 0.1 cent per kilowatt-hour. The curves will therefore give the impression of converging toward the left, or even of crossing at some point near their left end, although their vertical distance from one another is constant and equal to 0.1 cent per kilowatt-hour. An experienced person may discount this apparent convergence, but where the vertical distance is only approximately constant he will not be able to tell without measurements where the curved lines are converging to the left and where they are converging to the right, or whether they are parallel. Measurements are uncertain in the steep parts of the curves. Straight lines have an unchanged slope, and it is seen at a glance with a great degree of accuracy whether the lines are converging to the right or to the left, or whether they are parallel. Similar considerations apply, for instance, where one curve is by a constant percentage (discount) higher or lower than the other.

At the end of each block the rate curve, whether under the old or the new system of representation, must show a characteristic break, a sudden change downward of its slope. If the change in the kilowatt-hour charge at the end of a certain block is not great, the angle caused thereby in the curved line may be so small that it is overlooked when tracing the curve, and the curve is thus wrongly smoothed out. This introduces a further element of uncertainty and inaccuracy into the curve and obliterates the expression of the law of the curve, as becomes particularly evident where there are two or more rate curves which run very close to each other. They may then, although plotted with great care, alternately converge and diverge in an apparently unjustified and confusing way, without pronounced breaks, which gives them an erratic, slovenly appearance and gives rise in the spectator to suspicions as to their accuracy. With a straight-line system the changes of slope at the end of each block are not only clear-cut and more pronounced, but they cannot possibly be overlooked when constructing the curve. This makes it much more easy for the eye to grasp the law which the various rates curves follow, even though the changes in slope be small and the curves close together.

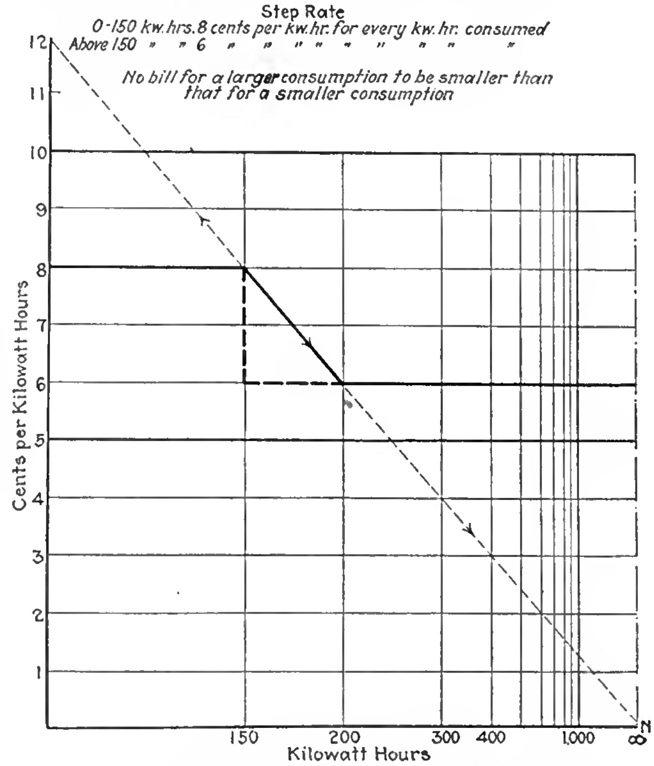



FIG. 2—CONVERTING STEP RATES TO STRAIGHT LINES

Another advantage is that the straight-rate lines are self-descriptive. By looking at a rate line of this kind one can read off the rate in words as easily as if it were printed, and even more readily. The breaks in the slopes indicate the ends of the blocks and the intersection of each straight line (or of its production respectively to the right) with the infinity line gives the cents per kilowatt-hour charged within the respective block. A rate curve under the old system has nothing to show to the eye what the charges are, and if the description of the sheet has been omitted or is not at hand, it is not possible to find what the rate is, except by solving equations with two unknown quantities.

This system of straight-line representation of rates is especially useful in designing new rates to take the

place of existing ones. In this case one wants to know what the resulting changes are in the cent-per-kilowatt-hour charges if certain features of the rates are changed—for instance, the length of a block or the charge per increment kilowatt-hour in that block, or both. The effect of these changes in one or more blocks can be demonstrated by simply tracing a straight line. The connection between the original rate and the tentative new rate is much clearer than under the old system with its elaborate calculations and curve tracings.

It is known, for example, that the rate line in every block of any block rate, no matter what the upper and lower limit of that block or how high the rate is for a certain energy consumption, converges to the same point of the infinity line as long as the increment kilowatt-hour charges within the block are the same. Two parallel rate lines indicate always that one rate is lower than the other one by a certain constant number of cents per kilowatt-hour, this number being given by the vertical distance between the two straight lines. Two lines intersecting at any point on the horizontal zero line (bottom line) of the diagram mean that one of the two rates is lower than the other one by a certain constant percentage—for instance, in consequence of a percentage discount.

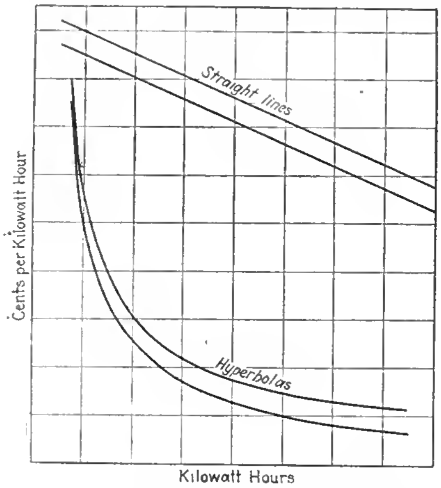



FIG. 3 — COMPARISON OF HYPERBOLAS HAVING A CONSTANT VERTICAL SEPARATION WITH STRAIGHT LINES HAVING A CONSTANT VERTICAL SEPARATION

As shown in the theoretical part of the book on rates quoted above, the total amount in dollars and cents charged under any block rate can be resolved into a constant amount plus another amount which is proportional to the total number of kilowatt-hours consumed. These two component parts of the charge are also easily evident from the straight-line representation. A parallel to the rate line is traced through the bottom of the infinity line. This parallel intersects the 10-kw.-hr. or the 100-kw.-hr. or the 1,000-kw.-hr. line, etc., respectively, at a height above the zero line which is one-tenth, one-hundredth, one-thousandth, etc., of the above-named constant component of the charges. The amount proportional to the total number of kilowatt-hours is, of course, equal to the kilowatt-hour charge per increment kilowatt-hour in the respective block and is given, as stated above, by the intersection of the rate line with the nearest infinity line to the right. Thus the equivalent two charges in the third block (3 cents per kilowatt-hour for every kilowatt-hour between 30 and 150) of the 10/5/3/1-cent rate dealt with in Fig. 1 will be found as 1.1 × 100 + 3 cents per kilowatt-hours, or \$1.10 + 3 cents per kilowatt-hour. This can be seen, on the one hand, from the intersection point of the parallel $C''N$, for instance, with the 10-kw.-hr. line, which takes place at 11 cents per kilowatt-hour, and, on the other hand, from the intersection of $C_1D_1$ with the infinity line at 3 cents per kilowatt-hour.

From this is seen the following general law: The slope of the line determines the additive constant (equivalent customer charge) of the respective block, and the intersection of the line with the infinity line determines the cents-per-kilowatt-hour charge for the increment kilowatt-hour in the respective block.

The hyperbolic scale offers the same advantages where the cents per kilowatt-hour are to be plotted against the load factor. This is often done to advantage where a certain charge is made per kilowatt with or without the addition of a separate kilowatt-hour charge. Here an even greater simplification is noticeable through the use of the hyperbolic scale.

Take, for example, as a simple case, the following Hopkinson rate: \$3 per kilowatt per month and 5 cents per kilowatt-hour. The average charge per kilowatt-hour varies not only with the energy consumption but also with the demand. With the energy consumption as abscissas, there would have to be separate curves for several representative demands; for instance, for 50, 100, 200 kw., etc. If, however, the cents per kilowatt-hour are plotted as a function of the load factor, a single curve will suffice which applies to every kilowatt demand.

To construct this curve choose one section of the scale for the range from 10 per cent to 100 per cent load factor (Fig. 4). If it is desired to take load factors of less than 10 per cent into the scope of the investigation, the preceding section might be used also or the scale extended back to 9 per cent, 8 per cent, etc., as desired. Choose, for example, a demand of 50 kw. (the demand cancels out later) at 10 per cent load factor. This means that the energy consumption is 0.10 × 50 kw. × 730 hours = 3,650 kw.-hr. The total bill is then (in cents) 50 kw. × 300 cents per kilowatt-hour + 3,650 kw.-hr. × 5 cents per kilowatt-hour, and the average charge in cents per kilowatt-hour is [(50 × 300) ÷ (0.10 × 50 × 730)] + 5 = 9.11 cents per kilowatt-hour. At infinity load factor the demand portion would be zero,

RATE SYSTEMS AND GRAPHICAL POSSIBILITIES

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| Method | Step off on the two axes the following values — One Axis | Step off on the two axes the following values — Other Axis | Assume at a constant value, one for each curve of the family | Rate line with ordinary arithmetic scale | Rate curve straightened if hyperbolic scale is used on the axis referred to in Column 2 or 3 |
| 1 | Average charge in cents per kilowatt-hour | Demand | Energy consumption | Straight | .......... |
| 2 | Average charge in cents per kilowatt-hour | Demand | Load factor | Curved | Column 3 (demand) |
| 3 | Average charge in cents per kilowatt-hour | Energy consumption | Demand | Curved | Column 3 (energy) |
| 4 | Average charge in cents per kilowatt-hour | Energy consumption | Load factor | Curved | Column 3 (energy) |
| 5 | Average charge in cents per kilowatt-hour | Load factor | Demand* | Curved* | Column 3* (load factor) |
| 6 | Average charge in cents per kilowatt-hour | Load factor | Energy consumption* | Curved* | Column 3* (load factor) |
| 7 | Demand | Energy consumption | Average charge in cents per kilowatt-hour | Straight | .......... |
| 8 | Demand | Load factor | Average charge in cents per kilowatt-hour | Curved | Column 2 (demand) |
| 9 | Energy consumption | Load factor | Average charge in cents per kilowatt-hour | Curved | Cannot be straightened in general |

* In case of a Hopkinson or Wright rate without blocks, the same rate line applies to all demands with method 5 and to all energy consumptions with method 6.

and at the infinity line (which now represents "infinity load factor") the average charge per kilowatt-hour will be equal to the energy charge of 5 cents per kilowatt-hour. Connection is made on the chart by a straight line between the point 9.11 at 10 per cent load factor with the point 5 cents per kilowatt-hour on the infinity line, and the desired rate curve appears as *AB* (Fig. 4).

If there are blocks in the Hopkinson rate, even this load-factor rate curve will in general vary with the demand, and it will be necessary to draw separate rate curves for a number of representative demands.

Take, for example, the Hopkinson rate just quoted but modified by the addition of blocks for the higher kilowatts and kilowatt-hours, as follows:

$3 per kilowatt per month for the first 100 kw.
$2 per kilowatt per month for all kilowatts in excess of 100 kw.
5 cents for the first 5,000 kw.-hr.
3 cents for the next 5,000 kw.-hr.
1 cent for all kilowatt-hours in excess of 10,000.

The curve for 50-kw. demand will remain unchanged from the above until it reaches the load factor at which the first block of 5,000 kw.-hr. is filled, that is at 5,000 kw. ÷ (50 kw. × 730 hours) = 13.70 per cent* (point *C*, Fig. 4). From there on it is necessary to draw a straight line *CD* to the point of 3 cents on the infinity line. This straight line is the rate line until the second block of 5,000 kw.-hr. is filled, which takes place at 2 × 13.70 per cent = 27.40 per cent. Connecting the point *E* at 27.4 per cent of the last-named rate line with the point *F* at 1 cent per kilowatt-hour on the infinity line furnishes the rest of the rate curve up to the 100 per cent point. In like simple manner the rate curves for 100 kw. and 200 kw. are constructed. They are also entered in Fig. 4.

This example furnishes an instance of the general type of rate, inasmuch as the kilowatt charge and the kilowatt-hour charge decrease with increasing demand or energy consumption respectively. The average charge in cents per kilowatt-hour depends then on both the demand and the energy consumption in such a way that one can no longer use a single curve with the load factors on the base line, as was possible with the elementary Hopkinson rate (*AB*, Fig. 4). In this case nine different methods can be used for the representation of the rate on paper, as explained in the following. Only one of these nine methods has been applied in the example above.

### General Type of Rate

The monthly or annual charge made under any electric rate is practically always a function of not more than three variables, viz., the energy consumption, the demand, and the time at which the energy has been consumed. The latter element cannot be taken care of in the graphical representation otherwise than by tracing different curves for the different times at which the energy is being consumed or, in other words, at which the demand occurs. It can therefore be disregarded for the present purposes.

Instead of either one of the variables, demand and energy consumption, the load factor can be substituted as variable and the general problem thus becomes: What is the average charge per kilowatt-hour for any possible combination of values of the following sets of variables: (1) Demand and energy consumption, (2) demand and load factor, (3) energy consumption and load factor?

This means that there are the following combinations of variables: (A) Average charge, demand and energy consumption; (B) average charge, demand and load factor; (C) average charge, energy consumption and load factor.

Given any two variables in any of the three last-

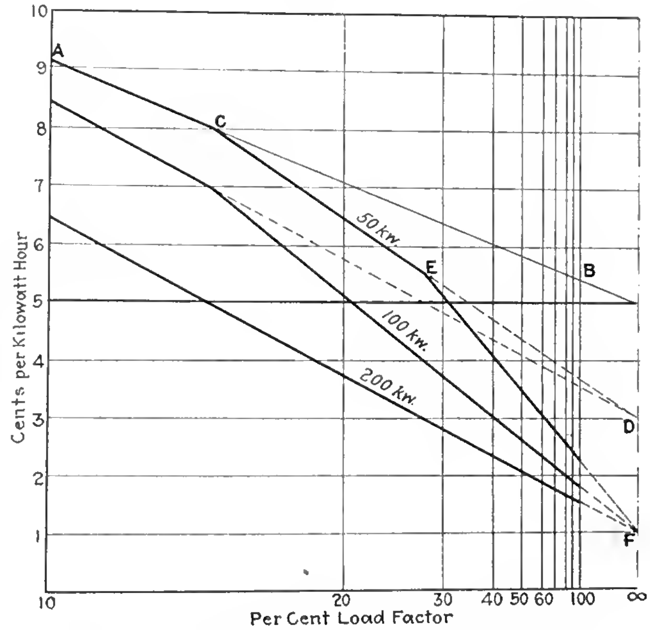


FIG. 4—HYPERBOLIC SCALES APPLIED TO RATES PLOTTED TO LOAD FACTOR

named combinations, it is requisite to show graphically what the third one is. This cannot be done by curves in a plane otherwise than by assuming one of the three variables at a number of representative constant values and drawing a separate curve between the two other variables for every one of these representatives values.

Thus under (A) one might draw a number of curves showing the average charge with varying energy consumption if the demand is 50 kw., another curve for a demand of 100 kw., another for 200 kw., etc. Or one may draw another family of curves showing the average charge (cents per kilowatt-hour) with varying demand, one curve for a given energy consumption of, let us say, 500 kw.-hr., another for 1,000 kw.-hr., a third one possibly for 1,500 kw.-hr., etc. Or it might be shown by a curve between demand and energy consumption how the energy consumption varies with the demand if the average charge per kilowatt-hour is, for instance, 6 cents, by another curve the variation is shown for a constant value of 5½ cents, then for 5 cents, 4½ cents, etc., as far as the circumstances make advisable.

Likewise three different types of curves are arrived at for combination (B) and three for combination (C) —altogether nine different possibilities for the representation of the rate on a plane. Seven of these result in rate curves which are hyperbolas if straight arithmetical scales are used vertically and horizontally; therefore they will turn to straight lines if the horizontal (or vertical) scale is a hyperbolic one as described above. The remaining two possibilities result in straight lines if straight arithmetical scales are used, and the use of a hyperbolic scale would therefore complicate matters in these two cases. The table

*On a regular hyperbolic sheet for practical use sufficient subdivisions will be entered to allow the point 13.7 per cent to be found with practical accuracy. If such is not the case, it is easy to find on the slide rule the distance of this point from the 100 per cent point of the scale, as 1/1.37 = 73.0 per cent of the distance between the 100 per cent and 10 per cent points of the scale.

enumerates the nine possibilities, and in addition it shows which of these result in straight lines on ordinary arithmetical scales and which require the use of the hyperbolic scale to straighten them.

The proof for the statements of the last two columns in this table follows naturally from the material provided in the present author's serial "Some Geometrical Aspects of the Three-Charge Rate System,"† especially with reference to its Figs. 7 and 8a to 8m, but no space shall be taken up with this proof here.

Where it is desired to compare two or more rates with either an explicit (Hopkinson) or an implied (Wright, etc.) demand charge, the comparison by means of the curves described so far—that is, by means of families of curves showing the average charges in cents per kilowatt-hour—becomes difficult and unsatisfactory.

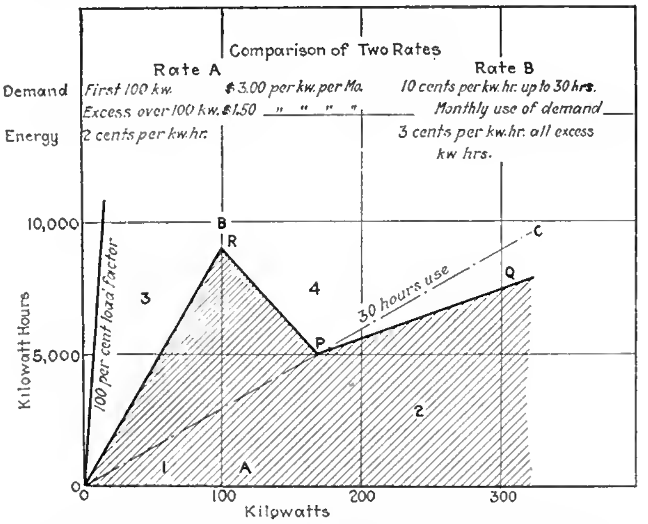



FIG. 5—ALL CUSTOMERS REPRESENTED BY POINTS IN THE SHADED AREA PAY MORE UNDER RATE A; THOSE IN THE NON-SHADED AREA PAY MORE UNDER RATE B

The following straight-line method is preferable. Lay out a system of co-ordinates with the kilowatts demand as abscissas (horizontal) and the kilowatt-hours consumption as ordinates (vertical) (Fig. 5). The points with equal load factors are then located on straight lines radiating from the origin 0. As far as the charges are concerned, every customer is characterized by a certain definite combination of demand and energy consumption; that means, he is characterized by a certain point in the system of co-ordinates just described. For the points on certain portions of the area of this system, rate A will be higher than rate B, and for the others the reverse will take place. One has now only to determine these portions of the area, and it can be seen at a glance for which customers rate A is higher and for which rate B. These areas are determined by straight lines whenever two three-charge rate systems are to be compared,‡ taking the term "three-charge system" in its widest meaning—that is, including those special cases where one or two of the three charges are zero. It will then be hard to find a rate system which does not come under the heading of "three-charge rate system."

A simple example shall illustrate this method. Let one of the two rates be a Hopkinson rate with the demand charge of $3 per kilowatt per month up to a demand of 100 kw., this charge to be reduced to $1.50 for every kilowatt above the first 100 kw. The energy charge is 2 cents per kilowatt-hour. The other rate, B, is a Wright demand rate as follows: 10 cents per kilowatt-hour for the first 30 hours' monthly use of the demand and 3 cents for every kilowatt-hour above that load factor.

Under rate A the average charge per kilowatt-hour follows a different law for the demand above 100 kw. from that for the kilowatts below 100. The line showing where rate A and rate B make the same charges may therefore be expected to have a break at the 100-kw. line *AB* in Fig. 5. Likewise the Wright demand rate B changes along the 30-hour monthly use *OC*. Thus there result four ranges (I, II, III and IV in Fig. 5), defined by the dash-and-dot lines *AB* and *OC*.

Calling $d$ the demand of a customer in kilowatts and $e$ his energy consumption in kilowatt-hours, then the total charges per month $a_A$ under rate A in cents per month will be $a_A = 300d + 2e$ as long as $d < 100$ kw.; that is, in ranges I and III (Fig. 5).

Where $d > 100$ kw. there results:

$a_A = 300$ cents per kilowatt $\times$ 100 kw. $+$ 150 cents per kilowatt $(d - 100\text{ kw.}) + 2e$

$= 15{,}000 + 150d + 2e$ ranges II and IV

Likewise we get for rate B:

$a_B = 10e$ ranges I and II

$a_B = 10 \times 30d + (e - 30d) \times 3 = 210d + 3e$ ranges III and IV

The locus of all combinations of demand and energy for which rate A charges the same as rate B is a straight line within each range. For all customers whose characteristic points are above this line rate A will be lower and vice versa. If it is desired to construct this straight line—for example, in Range IV—the amount $a_A$, which applies in this range, is set equal to $a_B$, also applying in this range, and there results:

$$15{,}000 + 150d + 2e = 210d + 3e,$$
$$15{,}000 = 60d + e,$$

which is the equation of a straight line.

To determine this line determine two of its points—for instance, the point on the line *OC* and the point on the line *AB*. In the former case $e$ will be $= 30d$, which changes the above equation to $15{,}000 = 90d$, from which $d = 166\frac{2}{3}$ kw.; consequently $e = 30d = 5{,}000$ kw.-hr. This gives point *P* in Fig. 5. The point on line *AB* is found by letting $d = 100$ in the equation of the straight line. This results in $e = 15{,}000 - 6{,}000 = 9{,}000$ kw.-hr. (point *R*). One thus gets the straight line *PR*, and repeated application of the same principle results in the construction of the broken straight line *ORPQ*. All customers whose demand and energy consumption is given by a point above that broken line will find the Hopkinson rate cheaper, the other ones the Wright demand rate.

†*Electrical Review and Western Electrician*, Feb. 11, 18 and 25, 1911.

‡Because the "rate surfaces" are planes. See "Rate Representation in Space," by H. E. Eisenmenger, ELECTRICAL WORLD, Nov. 4, 1911.

## Electrification Projects in Czechoslovakia

FOUR companies have recently been organized in Moravia, the leading agricultural province of Czechoslovaki, for the purpose of supplying the province with electric power. Plans include the utilization of power from Moravice and Dyje Rivers, says Consul C. S. Winans in a report to the Department of Commerce. Work has already been started on some of the plants. The cost of the scheme is estimated at 225,000,000 Czechoslovak crowns ($6,525,000), and most of the material will probably be purchased locally.

# The Residence Consumer—What He Costs and What He Is Worth

## Lack of Such Knowledge Prevents Intelligent Development Work—Attitude of Selected List of Middle Western Small City Companies — How Appliance Sales Increase Consumption

A GREAT deal is being said about the central-station commercial problem in convention and committee meetings. The sources of additional revenue open to some central stations, such as those in the big industrial centers, where all sorts of manufacturing industries are concentrated, are almost unlimited. In such sections the possibilities of commercial lighting and residence lighting and appliance loads are big, but smaller perhaps in the proportion of their total revenue-producing possibilities than the industrial loads. In these centers men of experience are available to work out the problem of proper development of all the varied kinds of business.

Unfortunately, from a load building standpoint, the larger area of the country lies outside these congested centers. By far the greater part is agricultural territory where population is limited. The general commercial activities of the central station are those necessary to serve the agricultural community, and such manufacturing projects as do exist are not an important source of load development. In such communities from perhaps 20 to 35 per cent, or at most 50 per cent, of the total revenue can be classed as commercial or industrial, and in some cases, particularly in very small communities, the revenue attributable to this class of business may drop as low as 10 per cent of the total. The direction in which revenue can be developed lies principally in the field of the small consumer and is largely a residential customer problem.

TABLE I—WHAT THE ORDINARY RESIDENCE CONSUMER PAYS TO THE SMALL-CITY CENTRAL STATION IN THE MIDDLE WEST

| Consumers | Average Monthly Kw.-Hr. of Residential Consumers | Average Monthly Revenue | Monthly Cost of Carrying Residence Consumers |
|---|---|---|---|
| 48 | 11.00 | $1.94 | ..... |
| 130 | 25.00 | 5.00 | ..... |
| 150 | 10.00 | 1.50 | ..... |
| 180 | 15 | 1.50 | ..... |
| 181 | 12.25 | 1.94 | ..... |
| 200 | 33 | 2.30 | ..... |
| 206 | 17.75 | 2.45 | ..... |
| 211 | ..... | 1.50 | ..... |
| 225 | ..... | 2.15 | $0.75 |
| 248 | 15 | 2.80 | 1.25 |
| 564 | 15 | 2.50 | 1.25 |
| 619 | ..... | .... | ..... |
| 650 | 15 | ..... | ..... |
| 664 | 27 | 3.75 | ..... |
| 773 | 19 | ..... | 0.75 |
| 800 | ..... | 2.50 | ..... |
| 975 | 10 | 1.50 | 0.75 |
| 1,000 | 19 | 2.04 | 1.50 |
| 1,350 | 25 | 2.92 | 1.25 |
| 2,028 | 24 | 2.14 | 1.95 |
| 2,029 | 21 | 2.06 | 1.49 |
| 2,374 | 30 | 3.24 | 1.50 |
| 2,545 | 19.4 | 1.87 | 1.75 |
| 2,546 | 23.8 | 3.06 | ..... |
| 3,102 | 22 | 2.19 | 1 65 |
| 4,000 | 17 | 1.66 | 0.50 to 0.65 |
| 4,555 | 22 | 2.00 | 1 93 |
| 5,172 | 25 | 2.00 | 1.00 |
| 5,535 | 32 | 3.25 | 1.29 |
| 6,091 | 26.7 | 2.58 | 2.26 |
| 7,191 | 45.8 | 3.11 | 2.50 |
| 10,234 | 21 | 1.74 | ..... |
| 10,438 | 23 | 2 30 | 0.90 |
| 11,194 | 20.3 | 2.18 | 2.50 |
| 11,510 | 30 | 2.25 | 2.24 |
| 101,71 | | | |

These figures are taken from replies to a questionnaire on the subject of residential energy sales and revenue sent to thirty-five Middle Western utilities. They reveal a wide variation in monthly average consumption and revenue and indicate a widespread lack of knowledge of the cost of carrying residential consumers. The figures on these costs ranging from $2 to $2.50 per month are those which appear to be based on a careful study. In the majority of cases this sort of cost information is not in possession of utility organizations because no attempt has been made to analyze the costs.

At the convention of the Iowa Section of the National Electric Light Association in 1922 N. T. Wilcox said that the average residential lighting customer yields an annual gross income of about $20, and he went rather fully into the possibility of increasing this revenue through the medium of the electric range and small household refrigerator outfits as well as the smaller appliances. He made the statement then that through the medium of such devices there is the possibility of an annual revenue of more than $100 per kilowatt of station demand. The same possibilities were stressed in this year's convention of the Middle West Division of the National Electric Light Association at St. Louis.

In the various convention and committee discussions there has been evident a decided lack of knowledge as to just what the condition of the residential service is. Fundamentally there should be a knowledge of what it costs to carry the average residential consumer. By this is meant the fixed investment costs and maintenance of all plant equipment employed in this class of service plus the bookkeeping, meter reading and service costs without any charge for kilowatt-hours used.

### What the Residence Consumer Pays

Table I, which represents nearly 102,000 consumers, is taken from a recent survey made in the Middle West to ascertain if possible what the ordinary residence consumer uses in energy, the revenue that may be expected and the bare cost of carrying a consumer on the system before he is charged for energy. The figures are given exactly as they came from the various companies to show the wide discrepancies that exist for the highest and lowest reported average consumptions on different systems and the apparent lack of fundamental cost knowledge that prevails.

On the systems serving up to 1,000 consumers it seems that there is almost a total lack of knowledge of what it costs to carry a residential consumer. The four figures given are evidently an estimated cost of billing and meter-reading expense. On systems with from 1,000 to 5,000 consumers there is more information, though it is evident that there must be a serious lack of data as to the actual costs, since the discrepancies, after eliminating those that evidently cover billing and meter-reading costs only, is too great to represent a true knowledge of the situation, especially when studied in the light of the figures for systems having more than

5,000 consumers. On these latter systems, after eliminating several which clearly do not contain fixed investment and maintenance costs, costs of carrying residential consumers are given which show a monthly expense of \$2.25 to \$2.50. Nearly 26,000 consumers are represented in this group.

### WHAT THE RESIDENCE CONSUMER COSTS

In Table II are given some cost figures on residential consumers taken from data presented before the 1922 convention of the Northwest Electric Light & Power Association by George H. Davis of the Idaho Power Company and published on page 1398 of the Dec. 23, 1922, issue of the ELECTRICAL WORLD. The cost of carrying residential consumers is given at \$2.25 per month, or \$27 per year. In the Oct. 28, 1922, issue of the ELECTRICAL WORLD, page 929, in an article by Messrs, Greene, Schoonmaker and Gorton on the allocation of electric service costs, are found residential consumer costs of \$1.03 per month and demand costs of \$1, or a total of \$2.03. While these figures are not based on one specific community, they represent costs that are typical for many communities in Iowa. Another careful analysis covering very small communities on a large Middle West system the name of which cannot be given has shown a monthly cost of \$1.20 for consumer and \$1.20 for demand costs. This represents small communities containing in the aggregate several thousand consumers fed from a transmission system and the figures were prepared with enough care to render their practical accuracy unquestioned.

It would appear fundamental in dealing with residential business development that there is room for a great deal more work in ascertaining the cost of giving service. There is considerable ground for suspecting that the cost of carrying the average residential consumer on Middle Western properties, outside industrial districts, lies somewhere around \$2 to \$2.50 per month, or \$24 to \$30 per year, for all costs except the actual production cost of energy delivered. If this is the case, then the average revenues shown in Table I and that indicated in Mr. Wilcox's statement before the Iowa convention show a discrepancy between costs and revenue that is a serious problem and one only aggravated by the addition of such consumers.

The remedy is the development of greater use of energy by the individual consumers. Just how this is to be done is the question around which the present discussion is revolving. The three principal suggestions are: (1) An increase in the size of lamps used and a higher standard of illumination. This has obvious limitations. (2) An increase in the use of the smaller appliances. This again has limitations, although both in the number of appliances in use in a home and in the extent of their habitual use it is susceptible of a very great development. (3) The general adoption of the electric range and refrigerator in domestic service.

A number of companies that have made a definite attempt to increase the use of electric light in the household report considerable progress and benefit. There is a surprisingly large number of customers who buy lamps smaller than the 40-watt size and will continue to do so for many purposes, and there is also a lamentable proportion of empty sockets. Considerable can be accomplished, however, by informing and reminding the public of the advantages of larger lamps and better light, but in communities of this size in this section it is necessary, in order to influence the situation much, to obtain and sustain the co-operation of the local merchants who sell lamps. Lamps are sold in a large proportion of the general stores in small towns, and it is a matter of considerable importance to the lighting company that a working basis of co-operaton be established between all these retail outlets and the utility both for the service of the public and the guidance of lamp selection.

In canvassing this selected list of thirty-five Middle Western small city central stations the direct question was asked: "What special efforts are you making to increase your average monthly residential bills?" One reported that it was pushing larger-voltage lamps primarily, sending men from house to house to repair bad sockets. Another said that it was campaigning on the sale of a kitchen lighting fixture which uses a 150-watt lamp. Several mentioned activity in this field of lighting as a part of a general effort to get more business. Twenty-five companies particularly specified appliances as their chief interest at the moment. The following statements are typical:

1. "Pushing the sale of appliances both in our jobbing department and also by drug stores, hardware stores, plumbing shops, etc., that might sell such appliances in our city."
2. "Holding demonstrations for the sale of electrical appliances, particularly cooking devices."
3. "Promoting the use of grills, small stoves, percolators, washing machines, cleaners, etc. Most customers now have flatirons."
4. "Pushing the sale of appliances of all kinds."
5. "By maintaining a free inspection service, following the regular meter routes, we are able to sell and demonstrate the use of appliances and better lighting. These appliances are carried in an electric truck as a base."
6. "Sending men to homes of consumers to make minor repairs to appliances and ascertain just what they have, so we may know where to push lamps and appliances."
7. "Having our salesmen concentrate on revenue-producing appliances. Considering developing an electric home for display purposes."
8. "Pushing electrical appliances in general and making special effort on ranges."
9. "Selling ranges, washing machines, irons, sweepers, electric incubators, etc."
10. "We have built a model electric shop and have a low cooking rate and make a special effort to develop this business by selling electric ranges at cost and donating the wiring. Electric cooking, we believe, offers the biggest chance for expansion in the residence field."

Two companies made a particularly interesting report on their experience in the sale of electric ranges, which will be made the substance of a further article. They are successfully concentrating on the development of a range load, considering it their most promising opportunity.

### BILLS LARGE ENOUGH

Letters were also received from ten other companies reporting no effort to increase business. These are interesting, too, as indicating a lack of appreciation on the part of some central-station executives that the unit of residence business is, after all, the home and that every household is susceptible to the appeal of electric service if its many diverse benefits are adequately interpreted. One man says in answer to the same question ("What effort are you making to increase residence bills?"): "None. Feel that bills are large enough. Irons and lights are about all the small-town man can use electricity for to advantage in his residence. Believe it more satisfactory to get more customers than to run bills up on present consumers." Yet it is surely a fact that floors must be swept in the small-town home, and clothes must be washed, and coffee is made, and toast also, and baby bottles are warmed, and a cool

breeze is as much enjoyed as in any dwelling in the large city. Moreover, the small-town man has money which he is quite as glad to spend on the things his family needs and wants, as is evidenced by the number of automobiles that are owned in every village, and there is a considerable proportion of them that are medium-priced or expensive cars. The families that use these cars should certainly buy electrical appliances if they are properly sold.

Another company writes: "None. Rates as low as we can possibly make them to the customer on our investment." The assumption here seems to be that the only way to sell more service is to cut the price. But the small-city public does not buy these things on price or it would buy transportation only in the form of Ford cars. With the low rates obtaining in this town there should be no obstacle to the sale of more and more appliances and better and better light until the houses are all completely equipped and properly illuminated.

Several other companies report no capacity, and the

TABLE II—COST OF CARRYING RESIDENTIAL CONSUMERS
(Presented by George H. Davis, Idaho Power Company, at the 1922 Convention of the Northwest Electric Light and Power Association.

| | |
|---|---|
| Annual generation, transmission and transformation costs | $14 25 |
| Annual distribution costs | 5.25 |
| Annual customer costs | 7.50 |
| Total annual costs | $27.00 |
| Average per month | 2.25 |

rest simply answer that they are doing nothing to build up business. The predominant note for the entire list, however, is optimism and confidence, and no man can doubt that all of them will recognize the opportunity.

Just what can be accomplished in increasing residential consumption by introducing larger lamps and by the sale of more appliances is shown in the series of curves herewith. These four curves are taken from the records of a Middle Western transmission system and embrace twenty-nine towns ranging in size from about 80,000 to less than 1,000 population. On this system special attention is paid to the merchandising of appliances from the central-station salesroom and also to the encouragement of the independent dealers to do a better merchandising job and become more prosperous. Every town where an office is maintained has a display room appropriate to the size of the town, and no reasonable expense is spared to make it the most enterprising and attractive electric shop in town. Sales campaigns are carried on from time to time in which seasonable appliances are pushed. These campaigns are not heavy, whirlwind selling ventures, with a slump between times, but a steady, consistent effort in which the particular articles featured are varied to suit the season of the year.

These curves are typical for the entire system, being selected to show the results for the largest, the medium and the small-sized communities served. The records extend back to 1917, and the monthly average kilowatt-hour consumptions for 1921 and 1922 are available. The average monthly consumptions since 1917 have increased between 50 and 100 per cent for all the communities that have been served during that period. The appliance load involved consists mainly of the smaller household equipment, and with all that has been accomplished it seems fair to question whether these devices alone are of sufficient energy-consuming capacity to

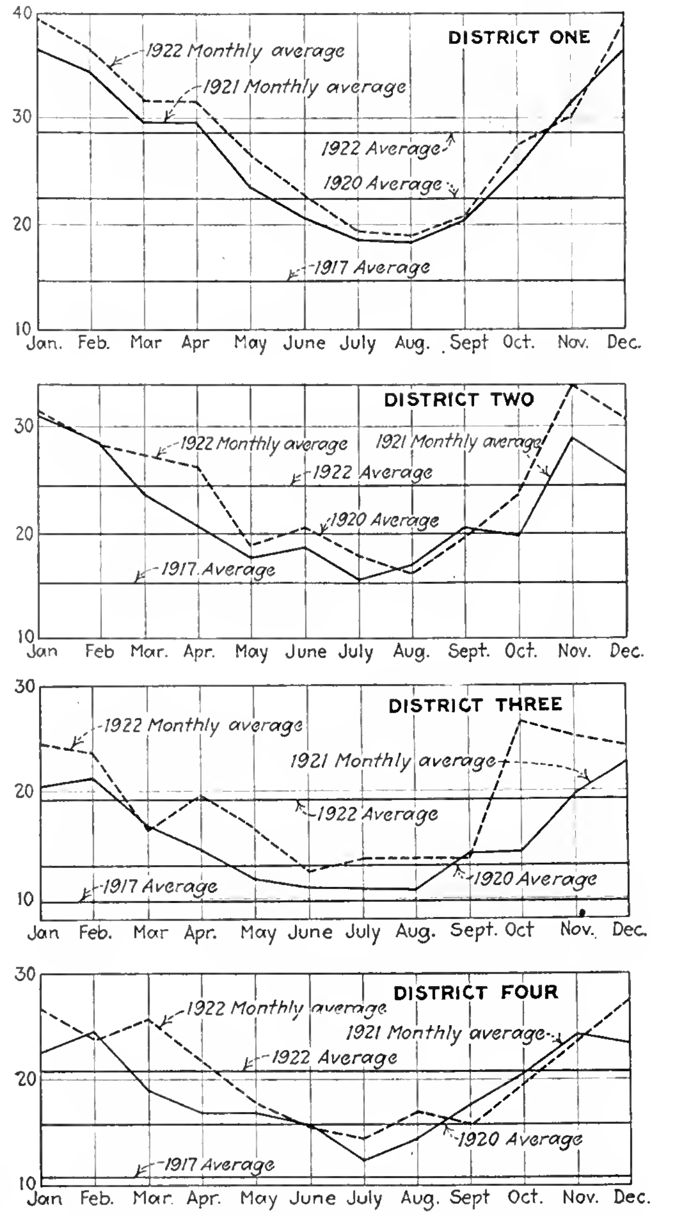



FIG. 1—RESULTS FROM INTELLIGENT EFFORT IN PROMOTING BETTER RESIDENCE LIGHTING AND SALE OF APPLIANCES

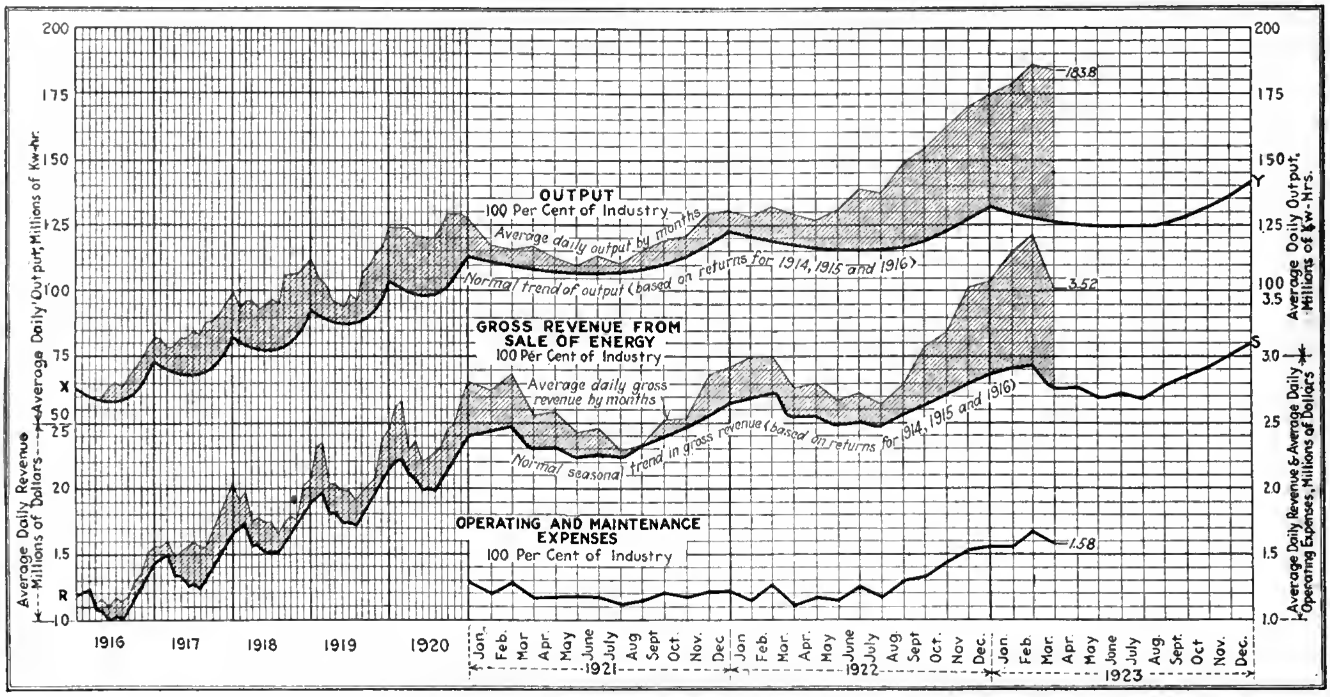
District 1 is for a city of 80,000 population, District 2 for one of 10,000, District 3 for one of 1,500 and District 4 for one of 1,100.

bring the average to a point where the residential service ought to be.

This statement in no way questions the value of ordinary appliance sales, but merely points the fact that usage is such that the smaller appliances alone are not a solution of the problem. They provide a profitable load whose importance is tremendously enhanced by their effect in popularizing electricity in the home. Opinion, however, seems to be steadily strengthening that adequately to solve the residential service problem more attention must be given to the electric range.

## Two Chief Factors

To sum up the principal factors in the present discussion of the Middle Western smaller central-station situation as it affects the residential customer, it seems fair to question, in the first place, whether there is an adequate knowledge of the bare cost of handling such consumers, and without this knowledge no really intelligent means of solving the problem can be devised.




DURING MARCH THE CENTRAL STATIONS OF THE COUNTRY SOLD A TOTAL OF 5,690,000,000 KW.-HR., OR A DAILY AVERAGE OF 183,812,000 KW.-HR.

in its solution the smaller electric appliances are a necessary factor and extremely important because of their effect in popularizing electricity in the home.

The final factor in increasing residential consumption, in as far as the present outlook goes, appears to be the use of the larger appliances, such as the electric range and the household refrigerating outfit. There are ample data available to indicate that the range is no longer an experiment. In the smaller communities where gas is not a possibility the electric range has arrived as a commercial proposition and needs only intelligent handling. The refrigerator has so far been somewhat an object of suspicion because it is not so far advanced as the range; but one unusually capable central-station executive in the Southwest told an ELECTRICAL WORLD representative this spring: "We are satisfied that the refrigerator has arrived. This year we will put all our energies behind it and expect to influence our residential sales materially."

## Record Output During March

REPORTS received by the ELECTRICAL WORLD for the month of March from central generating and distributing companies representing 72 per cent of the installed generator rating of the country indicate that a new output record was established by the industry during the month.

The average daily output during March was 183,812,000 kw.-hr., which was slightly below the record figure set during February. However, the total output for the month of March was 5,690,000,000 kw.-hr., which was about 160,000,000 kw.-hr. in excess of the previous record figure set during January of this year. This was the first instance in the recent history of the industry in which the operations during March have exceeded the previous December, January and February. In the first quarter of the year the central-station companies of the country sold a total of 16,400,000,000 kw.-hr. of electrical energy, which was 27.8 per cent over the amount sold during the first quarter of 1922. Such operations point unmistakably to the most prosperous year in the history of the central-station industry.

The average daily revenue from the sale of energy during the month was $3,522,000, which was $402,000 under the record figure set during February. The total gross revenue for the month was $49,100,000, which was about $300,000 below the record figure for revenue set during January. The total gross revenue for the first quarter of the present year was $149,200,000, as against $119,000,000 for the first quarter of 1922, or an increase of 25.2 per cent. If these percentage gains in output and revenue were to continue throughout the year, the indications would be that the output of the industry is doubling about every three and a half years and that the revenue doubles about every four years. Given the proper background of general industrial prosperity, there is no doubt that this rate of growth will continue for several years to come.

CENTRAL-STATION RETURNS FOR THREE MONTHS

| Mos. | Percentage of Installed Ratings Represented | Kw.-Hr. Output (Companies Reporting) 1923 Thousands | 1922 Thousands | Per Cent Increase | Percentage of Installed Ratings Represented | Revenue from the Sale of Energy (Companies Reporting) 1923 Thousands | 1922 Thousands | Per Cent Increase |
|---|---|---|---|---|---|---|---|---|
| Jan.... | 74 | 4,095,895 | 3,176,836 | 28.9 | 68 | $79,892 | $67,683 | 18.0 |
| Feb.... | 72 | 3,735,830 | 2,918,625 | 28.1 | 68 | 74,709 | 61,838 | 20.8 |
| Mar.... | 72 | 4,102,725 | 3,237,221 | 26.8 | 68 | 74,308 | 61,518 | 20.8 |

| Mos. | Percentage of Installed Ratings Represented | Operating and Maintenance Expenses (Companies Reporting) 1923 Thousands of Dollars | 1922 Thousands of Dollars | Per Cent Increase | Operating Ratio: Steam Plants 1923 | 1922 | Hydro Plants 1923 | 1922 | Combined Systems of Steam and Hydro 1923 | 1922 |
|---|---|---|---|---|---|---|---|---|---|---|
| Jan.... | 56 | $27,706 | $22,904 | 21.0 | 47.3 | 45.3 | 23.8 | 23.4 | 45.3 | 43.1 |
| Feb.... | 56 | 26,147 | 21,521 | 21.5 | 46.0 | 46.1 | 24.0 | 26.6 | 42.0 | 41.2 |
| Mar.... | 56 | 27,499 | 22,323 | 23.2 | 44.0 | 48.3 | 23.6 | 27.1 | 40.0 | 40.7 |

# National Superpower Scheme

## Frank G. Baum, After an Extensive Study and Survey of the Power Resources of the Nation, Outlines a Constant-Potential Transmission System of Immense Magnitude

READERS of the ELECTRICAL WORLD are familiar with the superpower survey made by the United States Geological Survey in the district extending from Boston to Washington. A much larger survey, nation-wide in its scope, has been completed by Frank G. Baum, well-known consulting engineer of San Francisco, whose most recent accomplishment was the Pit River development of the Pacific Gas & Electric Company. Mr. Baum has divided the country into twelve regional power districts, all of which would be interconnected to obtain the greatest possible benefits from diversity, service, insurance, etc. The main features of such a system are given here: Mr. Baum in his "Atlas of U. S. A. Electric Power Industry," now in press, gives a wealth of supporting data from which his conclusions are drawn.

On page 1274 are shown the suggested regional electric power districts and proposed main routes for lines representing such a national power system. For some of the Eastern states a system of this kind has been very much needed. The reasons which led Mr. Baum to choose the routes indicated are given by him as follows:

"Lines to be built from the Adirondacks to New York with a connection to District 1 are shown, in view of the New England States being short of water power. District 1 may in addition in time get some water power from Canada, and two proposals for bringing power from Canada are now under consideration. From the Adirondacks the line would finally extend back to the St. Lawrence water power. A second line would be required to take the St. Lawrence power to New York, and this could be from the St. Lawrence River southerly toward Utica and then to the metropolitan areas. In time two tower lines over each route to carry a total of 1,200,000 kw. may be required for the Adirondack and St. Lawrence power.

"A line is shown extending from Niagara Falls southeasterly to the metropolitan area and connecting southerly through the Susquehanna River region with the Susquehanna power at Holtwood and the Niagara power and the St. Lawrence power, interconnected as shown, through Philadelphia and the industrial regions of eastern Pennsylvania west of New York. From Niagara a second line is shown extending westerly to Erie, Cleveland and Toledo, connecting with the power systems of Michigan and going westerly, finally connecting with the large steam plants on Lake Michigan. The two lines from Niagara would require 600,000-kw., 60-cycle power, available at Niagara. Steam reserve for District 2 may come from District 5 over the connecting lines shown. This will result in great savings of anthracite coal and reduce rail transportation of coal over the Allegheny Mountains.

"A line is shown in district 5 extending westerly from Pittsburgh to Columbus, Dayton (connecting with Indianapolis), Cincinnati and Louisville. This is an easterly and westerly high-tension power route to which available water-power and large steam-power stations should supply their output. Some water power can be delivered to the Pittsburgh district by power lines from branches of the Allegheny, Monongahela and Youghiogheny rivers. A line is shown running southeasterly from Cincinnati and from near Columbus, Ohio, to Charleston, W. Va., and thence over the Appalachian range, connecting with the system of the Southern Power Company. The upper Kanawha River and the New River can be developed to yield quite a large amount of water power, sufficient to justify a double-circuit, 220,000-volt transmission line. Along the Kanawha and New Rivers there could also be large steam plants using the coal of this region. This line would serve a very valuable function in feeding power into District 5 and also acting as a steam reserve plant to District 3 for the systems east of the Allegheny Mountains. District 2 may finally get some steam power from this region.

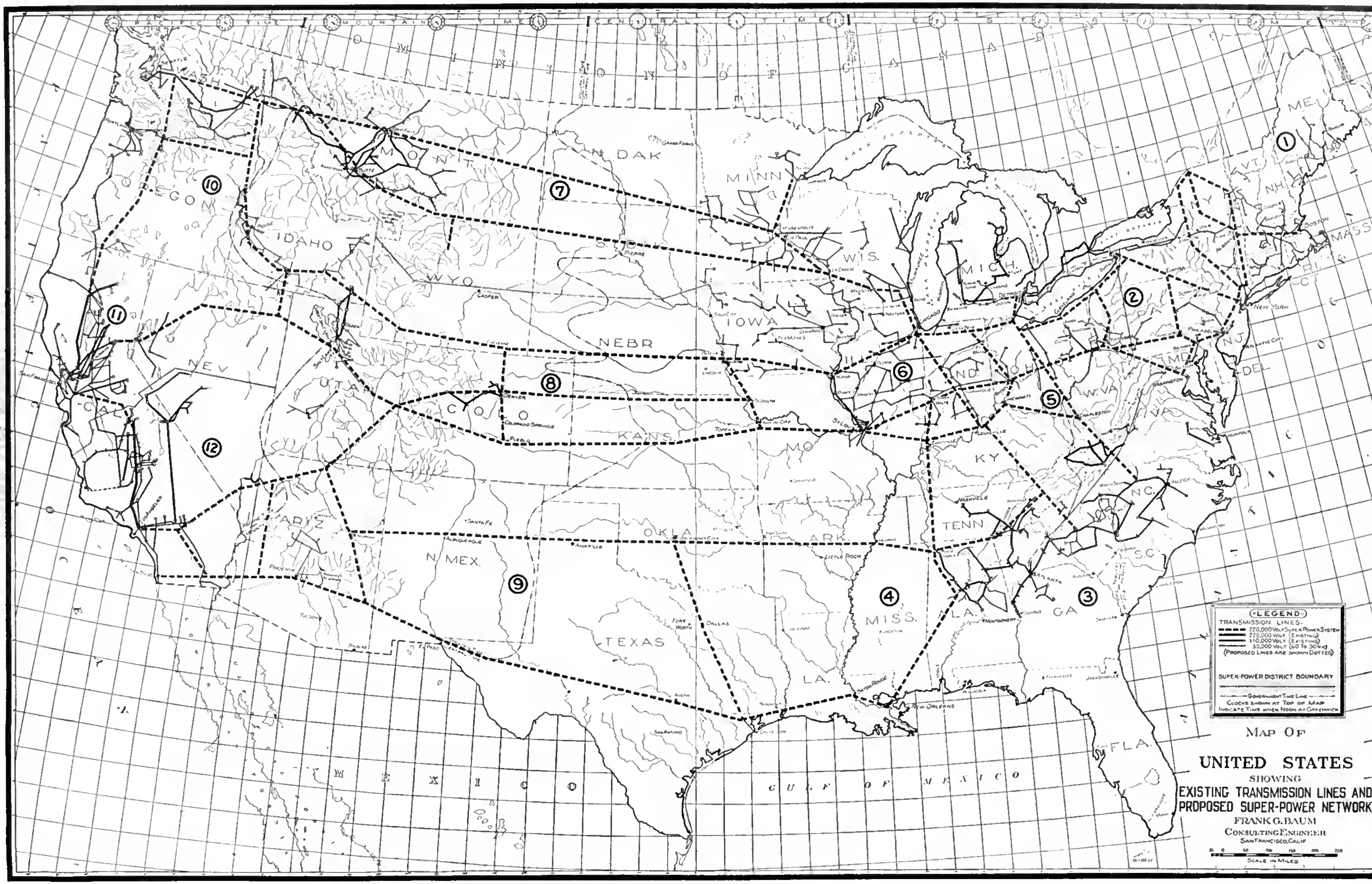
"No 220,000-volt lines are shown in District 3 except those bringing steam reserve and water power over the mountains from Districts 5 and 4. From Louisville, extending southeasterly, another trunk line is shown, going to the branches of the Tennessee River, where a considerable amount of water power can be developed. It is probable also that steam plants could be located on this line and a line connected across the mountains for reserve to the systems in District 3, east of the Appalachians, as shown. Another line is shown extending from Muscle Shoals northerly, to connect with the trunk line to Louisville and St. Louis, as this seems the best means of disposing of this power at this time.

"It would seem logical that the Muscle Shoals power should finally be used largely in District 4, but it will take some time for this market to develop, as outside of Alabama no large market is now available. But with the reclamation of the lower Mississippi, which contains the largest undeveloped land area in the United States, large amounts of power will be required, and I have therefore shown the Muscle Shoals lines as running westerly across the Mississippi near Memphis and southerly to New Orleans, and westerly from New Orleans into Texas, connecting with the power lines finally to be built to supply Region 9 from the power of the lower Colorado River and power developments in Texas and Oklahoma. Some of this power could be developed from the waste gases of the oil fields. The lines radiating in eastern Oklahoma are to take away the power from the gas fields.

"District 6 is largely a steam-power district, which may be used to balance the water power flowing toward this district from all directions. Fortunately District 6 has large coal resources. District 6 may finally get some water power from Minnesota and Manitoba.

"From the power available on the upper Missouri River and its branches trunk lines are shown going easterly which could supply the three northern railway routes with power for electrification, one main power line going to Minnesota and St. Paul and connecting finally with Milwaukee as shown.

"From the upper Colorado River three lines are shown




**Baum Plan for National Superpower Development, Utilizing Natural Resources to Maximum Advantage**

Four main power problems confront the industry. One is the development of water powers and supply of markets in District No. 2. The second involves the same problems for District No. 5. The third is to find a market for Rocky Mountain power. The fourth involves the same problem for District No. 10.

going easterly, one along the route of the Union Pacific, another along the route of the Santa Fé, the third being intermediate.

"In the Pacific Coast states, in District 10, the market conditions have not yet developed sufficiently to determine all the main trunk transmission routes. Districts 11 and 12 have already 220,000-volt lines, which are shown as part of the entire system as outlined. The new plant being built on the Tuolumne River for San Francisco should connect the 220,000-volt lines of District 11 with those of District 12 as indicated. This is a practical example showing the value of such a transmission system.

"It is thus seen that there are four main power problems confronting the industry. One is to develop the water powers and supply the markets of District 2. The second is to develop the water powers on the Ohio River drainage to supply the markets of District 5. The third problem is to find a market for the power in the Rocky Mountains, and it seems that this latter must be done largely by taking the power easterly along the railway routes as shown. (This problem of taking the surplus power from the Rocky Mountains to the Mississippi Valley may require in the future 330,000 volts, but initially 220,000 volts will suffice.) The fourth problem is to find a market for the very large amount of water power available in the states of District 10—Washington, Oregon and Idaho—and in this region should be located at various points some large power-using industries, such as are now near Niagara. All of these problems require for their best solution large-capacity transmission systems."

# Superpower as a National Policy*

## Not Engineering Obstacles but Legal, Political and Financial Difficulties Stand in the Way of Vast Interstate Networks—Mining and Railroad Loads Waiting—Civilization and Superpower

By M. H. AYLESWORTH
*Executive Manager National Electric Light Association*

THE idea of bulk supply is not new. It is as old as the electric lighting industry itself. From the very beginning it was recognized that the economics of the situation demanded that the supply of electricity for the home, for the store, for the factory and for transportation come from one central source. Superpower is merely an elaboration of the central-station principle making for the greatest possible economies and conservation and enabling the electric light and power industry to keep the price of its service constant in the face of enormous increases in the cost of labor, fuel, equipment and supplies.

Considering the numerous and marked advantages which accrue from superpower stations and systems, and the desire of the electric light and power industry to engage in a progressive and far-reaching program of expansion, one is naturally surprised that the number of superpower stations in existence is not larger. Certainly it is not for want of vision on the part of the industry, nor yet for want of load. Our companies have great difficulty even in normal times to keep abreast of demands for service, and they are erecting and will erect superpower stations just so fast as financial and economic conditions warrant and handicaps are brushed aside. It is a matter of great national interest, however, whether the billions of horsepower-hours produced in this country shall be produced at an expenditure of six pounds of coal per horsepower-hour in a small plant or one pound of coal in a superpower station. It is also a matter of public concern whether we shall continue to be prodigal in the utilization of our fuel resources and at the same time permit our water powers to run to waste.

### LEGAL DIFFICULTIES

According to the second annual report of the Federal Power Commission, applications have been made for licenses for the development of an aggregate of 20,000,000 hp. on lands over which the federal government has jurisdiction. This is twice the water power which has been developed in the United States to date and is from five to six times greater than the aggregate of all applications filed with the federal government since hydro-electric development became an art. Obviously the inclination and desire to develop water power in this country has not been lacking; the right to do so under reasonable legislation has only just been granted.

Now, the source of half the power represented by the applications in the hands of the Federal Power Commission is found in three rivers, the St. Lawrence, the Colorado and the Columbia, and every one of these streams is at present involved in legal entanglements. The St. Lawrence, for instance, is an international boundary stream, and until a treaty with reference to its greater canalization and control is negotiated between the United States and Canada no American water-power projects of any magnitude can be undertaken.

The Colorado River is involved by a compact signed in Santa Fé, N. M., last November. This compact must be ratified by the seven interested states—all but Arizona have already signed—and then by the National Government. The treaty between the states allocates the water of the Colorado between the geographical divisions and provides for flood control, irrigation and power development. Thus far the Federal Power Commission has taken no final action on the applications involving this stream, and it is not likely to do so until some unity of action is agreed on by the States of California, New Mexico, Nevada, Utah, Wyoming, Colorado and Arizona.

The Columbia River has been under investigation by a special board to determine the relation between water power, irrigation and navigation, and for these reasons action on almost all the projects on that river has been suspended for the time being.

To cap the climax, the State of New York has brought suit in the United States Supreme Court to have the federal water power act of 1920 and the activities of the

*Part of an address made before the Pittsburgh convention of the A. I. E. E., April 25, 1923.

Federal Power Commission thereunder declared unconstitutional. Already Pennsylvania and seven Western states have announced that they will fight the suit, and it is not unlikely that in the end as many as forty states may appear against New York. Annulment of the federal water-power act would produce a chaotic situation in Western states, where much hydro-electric development has begun under it, and would open the way to further selfish state discrimination such as now obtains in the State of Maine. Until, therefore, the federal law is upheld by the United States Supreme Court, all permits issued by the Federal Power Commission are under a cloud, and because of that fact very little money will be available for water-power development. It is just as difficult to sell bonds on a hydro-electric property thus encumbered as it is to raise a mortgage on real estate the title to which is not clear. Other superpower streams, like the Delaware, also are involved in legal controversies, and until these are settled many hydro-electric superpower projects will be effectually checked.

It will be recalled that the United States Geological Survey made an exhaustive study of the Boston-to-Washington power zone and brought to light the enormous economies procurable through a proper co-ordination of steam and water-power resources in the district. Were it merely a matter of engineering, the recommendations of W. S. Murray and the other engineers who made the survey would now be carried out; but legal and financial difficulties are not easily disposed of. As it is, the plans laid down in that report are already being carried out in part through the natural evolution of the business.

The electric light and power companies are not pessimistic over the outlook. On the contrary, they are going right ahead with characteristic enthusiasm and optimism, building huge stations here and extending transmission lines there in spite of handicaps. The road is not strewn with roses, however, nor do the handicaps always go down before a frontal attack. More often they necessitate a long siege.

## National Aspects of Superpower Supply

Manifestly, if we are to maintain the high standard of living which is characteristic of America, the per capita earnings of the country must also be high. The United States, through its great use of machinery and electricity, is able to maintain a higher standard of living than any other country because its labor produces more and earns more. During the twenty years prior to the war, the annual national per capita earnings in the United States increased 116 per cent, those of Germany 52 per cent, France 27 per cent, and Great Britain 21 per cent.

These percentages reveal much. They show what an enormous influence cheap power, which means electricity, has on the productive capacity of a nation and people, and it is chiefly because they are such great users of electricity that Americans excel in so many directions. But if we are to continue to enjoy an abundant and cheap supply of power, we must concentrate more and more in its production; we must erect fewer but larger stations; we must develop our water powers, conserve our fuel resources and through interconnected networks of transmission lines make power available in every market.

Thus the water power of the Sierras will be the mainstay of industry on the Pacific Coast; the Rockies will provide sufficient power for local needs and large blocks of energy ought to find their way into the prairie states far to the east; the Middle Atlantic and New England States must look for hydro-electric developments on the Niagara and St. Lawrence Rivers to augment their supply of energy, the watersheds of the Southern Appalachian range ought to provide additional power for the states bordering on the Ohio River in addition to meeting the fast-growing needs of the South.

## Economic Advantages of Water Power

There are in existence numerous examples of electric superpower stations and systems which have not only justified the faith which the electrical industry has in them but have also proved their value to the nation and to its industrial development. A romance could be written around the use of hydro-electric energy by the electrochemical industry at Niagara Falls, and one of the most interesting chapters could be devoted to tracing the use of those electrochemical products manufactured through the instrumentality of cheap electricity in the thousand and one essential industries scattered throughout the country. It would be vain to dilate on the application of electricity in California and what hydro-electric development means to it. It is an open book, and the story can best be told by a citizen of that state.

The Montana Power Company furnishes 85 per cent or more of all the electricity used in the State of Montana. This energy is derived from numerous hydro-electric stations which are interconnected and which feed high-tension transmission lines traversing the greater part of the State. The mining and production of copper is the chief industry of Montana. Before the present hydro-electric stations on the Missouri River were built the mines of Butte and the smelters of Anaconda were depending on steam power to the extent of 35,000 hp., and it was costing them on an average $85 a horsepower-year. Hydro-electric energy was transmitted into the district from Great Falls, 130 miles away, and sold to the mines at $30 a horsepower-year. In other words, the mining companies were enabled to carry on their operations for $2,000,000 less money a year than it cost before. But the most significant fact of all is that this cheap electric power made it commercially porfitable to refine and reclaim tens of millions of tons of low-grade copper ore that otherwise would have had to be passed by—and the United States is the largest producer of copper in the world.

The question of transportation is one of the most active in the national mind today, and in its solution the electric light and power companies will play a most prominent part. As indicative of the savings which electrification makes possible, the case of the Chicago, Milwaukee & St. Paul Railway, which receives electricity for operating its transcontinental line from central-station sources, may be cited. At the time the Milwaukee road was electrified a long-term contract was made with the Montana Power Company for power to be delivered over 450 miles of the road. The cost of the electricity was something like $550,000 a year, whereas, although the Milwaukee railroad furnished its own coal from its own mines and one-third of its equipment was used in hauling the coal, the cost of the coal to operate the steam trains over the same section that was afterward electrified was approximately $1,750,000 a year. The same power company provides electricity for the Butte, Anaconda & Pacific Railroad Company at the same price and practically under the same conditions as it does to the Chicago, Milwaukee & St. Paul Railway Company. The cost of electrical energy

for the Butte, Anaconda & Pacific Railroad Company a year after its electrification was $8,000 a month, whereas it formerly cost the railroad $22,500 a month for coal alone.

Aside from the advantage which accrues to every shipper over these railroads owing to the more dependable and cheaper electric power, such an arrangement possesses other marked advantages. It saves coal in the ground and utilizes an absolutely waste product—water power—which until recently was permitted to flow unmolested to the sea. It also contributes not a little to the growth of the state because it enables industry to locate in the territory and assures it of low-priced power anywhere along the line of the railroad.

The acquisition of a large amount of railroad load is especially beneficial to electric public utilities in that it makes for cheaper operation in direct proportion to the volume and diversity of the business, and this in turn means cheaper money and lower rates to the consumer. It is the experience of every public utility operator that under regulation the only way to be successful is to follow the modern plan of big volume and small margin. For purely economic reasons little plants and distributing systems and little companies in the electric public utility field have gone forever. Even in the case of the great steam-railroad systems of the country, traversing as they do many states, it has been found that the best interests of the public as well as the railroads lies in still greater consolidation of railroad groups under a single management.

### CIVILIZATION AND SUPERPOWER

Superpower is a measure of advancing civilization. It is machinery raised to the *n*th degree, superseding municipal and state boundaries and becoming national and continental in its character. It can find no abiding place in countries where life is primitive and labor cheap. A superpower system in China or India, for instance, would manifestly be a wild extravagance. The simpler manufacturing processes, the only ones that are performed in primitive countries, are in those lands more economically carried on by man power than they could be through the use of electrical energy, even at a rate that will barely pay interest on the cost of setting up the generators and building the transmission lines. But, as civilization grows in backward nations, the demand for machinery will grow, and a time may come when progress will not only bring with it the multiplication of steam and hydro-electric stations, but will cause their energy to be carried for scores or hundreds of miles to supply light, heat and power to every district and to turn the wheels of innumerable factories.

In America that day has already come. Electricity is demanded in ever-increasing quantity. Kilowatt-hour output grows by leaps and bounds. It is becoming a matter of common knowledge that to build a central station in every little town is as wasteful as it was to install a plant in every building. The individual plants once so numerous will soon be almost things of the past. So, too, will the small central stations, disadvantageously situated, disappear as the economy of service from greater stations, built near mines or on water-power sites, becomes more and more apparent. Interconnection, already a proved boon to consumers in economy of rates and reliability of service, will extend until the isolated system becomes a rarity, and over all parts of the land networks will be built offering power to every user at a rate relatively far less than he would otherwise pay.

# Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

## Relays on the West Penn System

*To the Editors of the* ELECTRICAL WORLD:

In the May 5 issue of the ELECTRICAL WORLD, in the report of the A. I. E. E. convention in Pittsburgh, page 1029, the report of my remarks in the discussion on relays is slightly in error in other ways besides the prefix of wrong initials to my name. I am made to say that the voltage-restraining relay scheme on the West Penn system was discontinued on account of the purchase of properties equipped with other relay schemes. This is not correct. The reason for discontinuing the relay was the growth of the system, involving additional generating plants and a multiplicity of loop connections. It is further stated that I advocated test of all relays in the laboratory before installation, but this is not the case. My statement was to the effect that many companies are adopting this scheme of laboratory test before installation, whereas out of a total of approximately 600 relays installed within the last two years not more than ten have been in our laboratory, and that our present program allows the relays to be shipped direct from the factory to the job, where they are installed on panels and tested in place.

H. A. P. LANGSTAFF,
Relay Engineer.

West Penn Power Company,
Pittsburgh, Pa.

## Transmission Towers

*To the Editors of the* ELECTRICAL WORLD:

Your editorial of May 19 commenting on the diversity of tower design is extremely pertinent. It can hardly be possible, however, to standardize designs when there is no universal acceptance of loading conditions. The most important of the various test loads, that corresponding to one or more broken wires, is variously estimated by different engineers as equal to (a) the maximum wire tension plus 35 per cent for safety factor and allowance for impact, or (b) the maximum wire tension, or (c) the maximum wire tension less 30 per cent to allow for the reduction in stress when the insulator string swings into line with the wire, or (d) 3,000 lb., being the maximum load which the suspension clamp will carry before it slips.

If a wire is strung for a maximum tension for 5,000 lb., then the broken-wire load on the cross-arm may be variously estimated as (a) 6,750 lb., (b) 5,000 lb., (c) 3,500 lb., or (d) 3,000 lb.

For strain and anchor points (c) and (d) do not apply, but for suspension towers each and every one of the above assumptions is used in different locations, according to the opinion of the engineer concerned. Obviously they cannot all be right, and either the towers are far too heavy with assumption (a) or far too light for condition (d).

With the present widespread use of heavy conductors, especially of steel-cored aluminum, strung with a maximum tension of between 5,000 lb. and 8,000 lb., a more uniform and satisfactory method of estimating the broken-wire load is called for. ERNEST V. PANNELL.

New York, N. Y.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Testing Transformer Polarities

THE proper connection of instruments and relays with potential and current transformers necessitates polarity marks on the primary and secondary side of transformers. This applies to distribution transformers also, aiding the linemen to make proper connections.

Manufacturers as a rule check the instrument transformers and mark the proper polarity at primary and secondary terminals. This work is often checked by the purchaser, and in case of errors the mistakes are corrected. Distribution transformers are often supplied with the statement of "subtractive polarity," and if polarity marks are preferred a proper check is necessary to prevent any mistakes in marking.

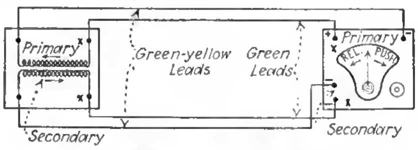
In order to check up polarities of transformers by a simple and quick method an instrument was constructed by the writer which consists of a 3-0-3-volt differential voltmeter to be connected across the secondary terminals of the transformer under test. A battery of three ordinary dry cells in series is connected to the primary terminals of the transformer with a push-button making and breaking the current contact.

The instrument with batteries, terminals with polarity marks, push-button and leads is mounted in a wooden box. Its weight complete is 18 lb., and the dimensions are 11 in. x 9 in. x 7½ in.

The instrument shown in the illustration is not a standard instrument, on account of its 3-0-3-volt scale. However, it is not necessary to have this scale range. Any scale up to 10 volts can be used, but for a larger scale higher-battery voltage is necessary, thus increasing the size and weight of the apparatus.

An instruction sheet placed in the cover of the testing apparatus gives the operations to check polarity. These instructions are given below the accompanying diagram. The different-colored leads are used to simplify the hook-up and to prevent any mistakes being made by the inspectors. An approximate cost list of materials is given in the accompanying table.

East Orange, N. J. E. J. MOMMO.





APPARATUS FOR DETERMINING POLARITY OF TRANSFORMERS

Connect green leads to the terminals with polarity marks and green-yellow leads to remaining terminals of test set. Connect the leads from primary terminals of set to the high-potential side of transformer, and from secondary to the low-potential side of transformer. Push the button; deflection should be low and to right-hand side of scale. After the pointer returns to zero release the button; deflection should be high and to left-hand side of scale. Then the polarity marks should go to the terminals of the transformer, where the green (polarity) leads are connected. If the deflections are reversed as compared with the above, reverse either primary or secondary leads at transformer terminals and repeat the operation. In cases where the deflections are too small, connect primary terminals of set to the low-voltage side of transformer and secondary terminals of set to the high-voltage side of transformer.

PRICE OF MATERIALS USED IN POLARITY TESTING SET

| Bill of Material | Price |
|---|---|
| One box, with hinges, etc. | $5.00 |
| Three dry cells, at 45 cents. | 1.35 |
| Four binding posts, at 10 cents | 0.40 |
| Four name plates (primary, secondary and two blanks) | 0.16 |
| One carrying handle | 0.50 |
| 25 ft. lamp cord at 3 cents. | 0.75 |
| One differential-scale voltmeter, 3-0-3 volts | 15.00 to 30.00 |
| One bakelite panel, 8½ in. x 7 in. x $\frac{3}{16}$ in. | 1.80 |
| Total cost | $24.96 to $39.96 |

## Foundry Flasks Repaired by Arc Welding

ONE of the most recent applications of arc welding in foundry practice is that of repairing worn flasks. This operation is proving to be such a success and to bring about so marked a saving that all foundry superintendents should learn how to take advantage of the process to help reduce their foundry expenses.

After use, the malleable iron lugs of the flasks become worn to such an extent that the pin on the other half of a flask will not fit in it tightly enough to hold the parts in alignment. The method of making repairs in the past was to ream out the hole to a diameter of ⅞ in. and then press in a bushing having a ⅝-in. hole. When the bushing wore too large it was replaced with a new bushing.

The new method of repair, however, is even less expensive and much more satisfactory. The practice is to ream out the hole to ⅞ in. diameter and then fill the hole completely, using the metallic electrode arc-welding process. A piece of copper is placed under the hole and the welding is done, using about 175 amp. and a $\frac{5}{32}$-in. welding wire. The time required to weld one hole is about three minutes. When these holes are again worn too large it is not necessary to ream them out before the welding operation. The time required to weld a hole is then reduced to about two minutes.

The cost of welding each hole as originally drilled to ⅞-in. diameter is about as follows:

| | |
|---|---|
| Labor, at 70 cents per hour | $0.035 |
| Welding wire, at 8 cents per pound | 0.016 |
| Electric power, at 3 cents per kw.-hr. | 0.013 |
| Total | $0 064 |

A question naturally arises as to why it is necessary to drill a ⅞-in. hole in the casting when only a ⅝-in. hole is required. The reason for this is that there will be a layer of very hard chilled high-carbon cast steel about $\frac{1}{16}$ in. thick in the region where the deposited metal unites with the casting; therefore it is necessary to

have the original hole ¼ in. larger than the final hole so that no difficulty will be experienced in drilling the final hole through the deposited metal.

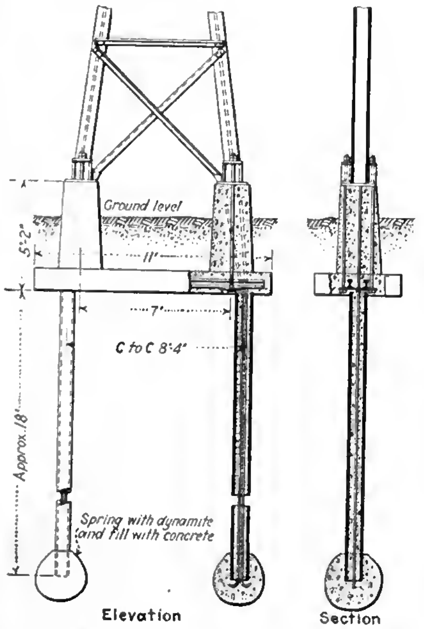
A. M. CANDY,

General Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

## Steel Towers Illustrate Interesting Design

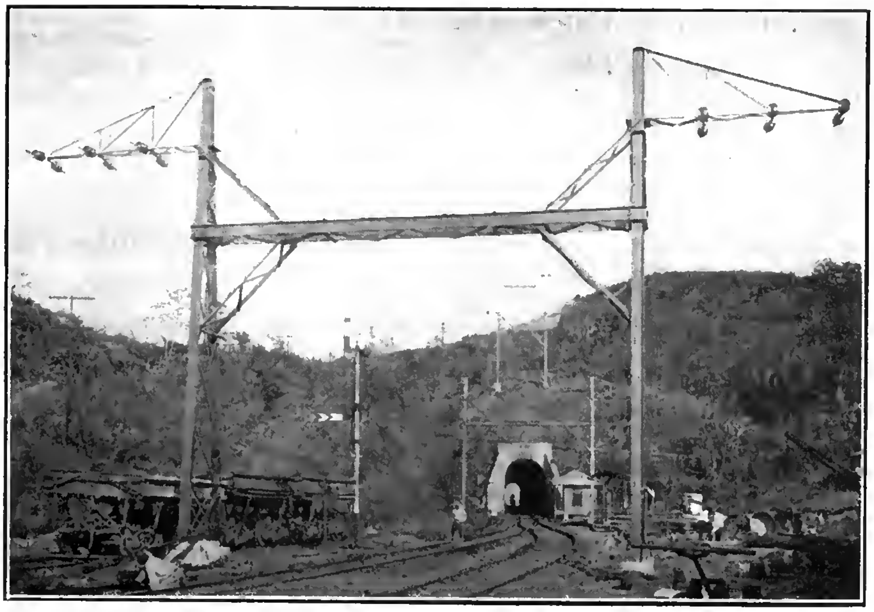
AN ANCHORAGE for transmission-line towers described by A. W. Malone in the ELECTRICAL WORLD of March 3, 1923, page 524, recalls a similar design used ten years ago by the Isthmian Canal Commission in the construction of a 44,000-volt transmission line for the Panama Canal. Mr. Malone's anchorage for transmission line towers consists of a drilled hole with a dynamite-sprung bottom, filled with concrete embedding a steel anchorage.

The Panama Canal transmission line on which the dynamite-sprung anchorage was used is shown in the two accompanying illustrations. The transmission line and its anchorage were described rather completely in the *Canal Record* of July 9, 1913. About 800 towers were erected, and the anchorages aggregated more than 3,200.




RESISTANCE TO OVERTURNING INCREASED BY THIS CONSTRUCTION

The transmission-line tower of the Panama Canal is essentially a track-span structure that provides for the support of a three-phase circuit on bracket arms at each side, with a ground wire at the apex of each side frame. Provision was made in the design for a possible future installation of compound-catenary trolley wires.



DOUBLE TRACK SPANNED BY TRANSMISSION TOWER CONSTRUCTION

The foundation under each of the side frames consists of two concrete pedestals cast upon a slab with a 4-ft. x 11-ft. base, 1 ft. thick. The base slab, which is reinforced longitudinally with used steel rails, provides the necessary foundation area for the worst assumed condition of broken conductors, and the weight of the backfill on top of the slab provides to a certain extent for the overturning moment.

Additional resistance to overturning is secured in the dynamite-sprung anchorage, which for each slab consists of two 8-in. holes, bored with a well drill to a depth of about 18 ft. The bottoms of these holes were sprung in exactly the same manner that drilled holes were sprung on the canal excavation work, to provide sufficient space for large dynamite charges. Steel-reinforcing rods having ends bent over at the bottom were inserted down the drilled hole, reaching to the bottom of the cavity, which with the 8-in. hole was solidly filled with a rich concrete mixture, well tamped.

The concrete ball at the bottom of the anchorage, when called upon to function in resisting overturning of the tower, bears directly on virgin earth (or shattered rock if the hole is drilled in rock), instead of bearing on the backfill of the customary transmission-line footings.

W. R. MCCANN.

Stone & Webster, Inc.,
Boston, Mass.

## Cost of Transformers

AN EASTERN central station company located about 200 miles from the factory which supplied the equipment tabulated the cost of its distribution transformers purchased during 1922, and from these data the accompanying table has been prepared showing the cost per kva. at the factory for the different sizes purchased. All were 60-cycle designs. The cost of some miscellaneous equipment is also included.

TABULAR ANALYSIS OF 1922 DISTRIBUTION TRANSFORMER PURCHASES

| Rating, Kva. | Voltage Ratio | No. | Price: Total | Price: Per Kva. |
|---|---|---|---|---|
| 0.5 | 2,200/122/244 | 3 | $99.84 | $66.50 |
| 1.5 | 2,200/122/244 | 22 | 735.36 | 22.20 |
| 3 | 2,200/122/244 | 27 | 1,291.68 | 15.90 |
| 5 | 2,200/122/244 | 24 | 1,547.52 | 12.90 |
| 7.5 | 2,200/122/244 | 9 | 758.16 | 11.20 |
| 10 | 2,200/122/244 | 14 | 1,434.16 | 10.25 |
| 15 | 2,200/122/244 | 39 | 5,313.36 | 9.10 |
| 5 | 2,200/608 | 3 | 193.44 | 12.90 |
| 10 | 2,200/608 | 6 | 614.64 | 10.20 |
| 15 | 2,200/608 | 12 | 1,634.88 | 9.10 |
| 25 | ...... | 3 | 592.80 | 7.90 |
| 50 | 2,200/608 | 3 | 976.56 | 6.50 |
| 100 | 2,200/608 | 2 | 979.63 | 4.90 |
| 100 | 13,800/600/2,400 | 3 | 1,950.00 | 6.50 |
| 1.5 | 575/115/230 | 1 | 36.48 | 24.30 |
| 5 | 2,200/1608 | 6 | 656.64 | 21.90 |
| 7.5 | 2,200/608 | 3 | 277.02 | 12.30 |
| 10 | 2,300/608 | 2 | 224.58 | 11.22 |
| 10 | 2,300Y/608 | 3 | 482.22 | 16.07 |
| 15 | 2,200/122/244 | 3 | 448.02 | 9.95 |
| 25 | 2,200Y/608 | 3 | 891.00 | 11.90 |
| 25 | 2,200/608 | 2 | 433.20 | 8.66 |
| 50 | 2,200/122/244 | 3 | 1,070.46 | 7.12 |
| 100 | 2,200/608 | 3 | 1,610.82 | 5.70 |
| | | | | Eahc |
| Thermal temperature indicators, price of 110 | | | 930.02 | 8.46 |
| Transil oil, drums hought, 42 | | | 630.00 | 15.00 |
| Freight and teaming, including a few other units not listed completely | | | 639.98 | ..... |

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Boiler Settings Patched to Prolong Life

THE life of boiler settings can be prolonged by carefully patching when the opportunity affords. More serious repairs may be saved if small cracks or open joints are attended to before the brick or tile becomes loose. Success in the work depends on the method of application as well as the materials used. The method used in patching the boiler of a large company in the Middle West has given very good results.

In this method the clinker was first removed and the surface chipped and nicked until most of the glaze was gone and the original texture of the brick exposed. Care was taken in this work so that the bricks would not loosen. Then the entire surface to be patched was brushed until free from dust. This surface was then well saturated with a thin milky wash of "hytempite," which was quickly absorbed by the exposed brick surface. The foundation for the patch, consisting of a somewhat thicker mixture, was then applied as a bonding coat. Where the surfaces were large this was done in sections so as to insure a moist surface for applying the patching mixture. The patching material consisted of diluted hytempite to which carbosand was added gradually until thoroughly mixed. The consistency was such that no free moisture showed when the mixture was squeezed in the hand. Care was taken to apply the patch while the foundation coat was still moist. The dark portions of the patching as seen in the background of the illustration show the method of applying the patch to a large surface by plastering on a small section at a time.

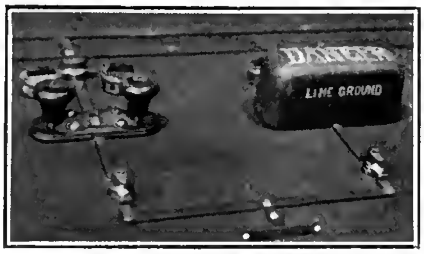
After the patching was completed on all large and small surfaces it was allowed to set for about an hour before applying a final surfacing of the same mixture as used for the bonding coat. The object of the final coating was to fill pores and small voids and give a smooth surface that would resist pitting action of flames and hot gases.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

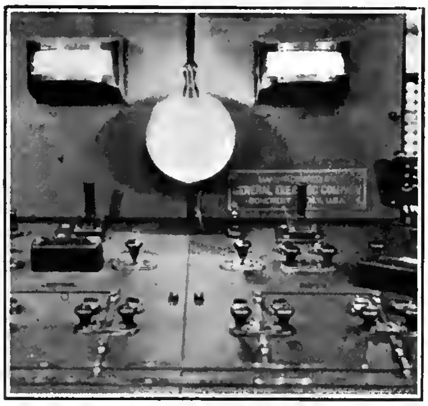
PATCHING MATERIAL APPLIED TO BOILER SETTING AVOIDS MORE SERIOUS REPAIRS

## Guards on Switchboard Prevent Mistakes

ON MODERN power-plant switchboards it is necessary to take some precaution to prevent accidental or thoughtless closing of high-tension switches that have been opened for making repairs on equipment or for other reasons. This is generally done by tagging the switch in some manner, but the operators at Big Creek No. 1 power house of the Southern California Edison Company use the wooden block shown in the accompanying illustration for this purpose. Two holes are drilled in a wooden block, which is then chiseled out so it will fit over the oil-switch control knobs on the switchboard. On the top of the block is the word "Danger," on one side is "Line ground," meaning that the line is grounded at the station, and on the other side is "Men working." An operator would certainly have to be very careless or in a bad state of coma to remove this guard and close the oil switch without stopping to think whether everything was clear.




SIMPLE GUARD PREVENTS CARELESS CLOSING OF OIL SWITCH



GENERATOR FIELD SWITCHES PROTECTED AGAINST ACCIDENTAL OPENING

Similar guards are used to protect the oil switch-control buttons on the generator field switches. The turbine governor-control switch is located right alongside the field switch-opening button. The governor switch requires frequent manipulation, and if an operator should carelessly pull the field-switch button instead of the governor-control button, the generator field switch would be opened and serious damage might result. G. C. HECKMAN,

Superintendent Electrical Construction,
Southern California Edison Company,
Big Creek, Cal.

## Venting of Transformers Direct to Air

IN the ELECTRICAL WORLD for March 31, page 753, there was an article regarding the experience of a Southern power company which operates its transformers with open air vents to encourage the circulation of air above the oil level, the idea being to sweep out the oil vapors. We have taken samples of oil from the transformers to which you refer and this oil has shown excellent color and dielectric characteristics. However, we believe that the company's success with this method of ventilation is due to the fact that its transformers are all operated at low temperature. It is

well known that the oxidation which occurs at temperatures usually encountered in power transformers is much reduced at abnormally low temperatures.

However, if the oil temperatures were as high as usual in power transformers, the sludging and deterioration of the oil would most certainly be accelerated by the circulation of air over the oil level. We should be interested to know by what theory the oil could possibly be kept in better condition through contact with air than by isolation from air.

W. M. DANN,

Transformer Engineering Department.
Westinghouse Electric & Manufacturing Company.
East Pittsburgh, Pa.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## How to Remove Scale from Evaporator Coils

"CRACKING down" of the evaporator effects is to remove the scale which is deposited on the coils. The rapid expansion of the metal of the coils, due to the sudden changes of temperature obtained, will crack the scale from the tubes. The specific instructions for cracking down evaporators as abstracted from the operating code of the Philadelphia Electric Company are given below:

CRACKING DOWN EVAPORATORS—FIRST EFFECT

1. Close the hand valve on the automatic feed-water valve control.
2. Close the steam valve to the coil and blow down the first-effect evaporator shell completely through the blow-down meter.
3. Close the blow-down valve.
4. Open the vent valve.
5. Fill the first-effect evaporator with cold filtered river water to the top of the gage glass.
6. Close the vent valve.
7. Close the vapor valve on the first effect.
8. Open the steam valve on the first-effect coil suddenly.
9. Close the steam valve when the cracking ceases and see that the pressure does not exceed 15 lb. or 20 lb. in the shell.
10. Blow down the shell to the discharge tunnel, completely.
11. Close the blow-down valve.
12. Open the hand valve on the automatic feed-water valve control.
13. See that the shell fills the hot water to the normal running level.

SECOND EFFECT

1. Close the hand valve on the automatic feed-water valve control.
2. Close the vapor valve on the second effect.
3. Open the vent on the low-pressure shell.
4. Blow down the shell completely through the blow-down meter.
5. Close the blown valve.
6. Fill the second-effect evaporator with cold filtered river water to the top of the gage glass.
7. Close the vent valve.
8. Admit steam suddenly to the second-effect coils through the steam line connected to the vapor line. Do not exceed 60 lb. pressure.
9. Close the steam valve when the cracking ceases and see that the pressure does not exceed 5 lb. on the shell.
10. Blow down the shell to the discharge tunnel, completely.
11. Close the blow-down valve.
12. Open the hand valve on the automatic feed-water valve control.
13. See that the shell fills with hot water to the normal running level.

FIRST AND SECOND EFFECTS

1. Open the vapor valves.
2. Proceed to put in operation according to rules for "Putting an Evaporator Into Service" given in the last issue of the ELECTRICAL WORLD.

## Correcting Reversed Polarity on D. C. Generators

FOUR methods for correcting reversed polarity of direct-current generators are given in the operating code of the Philadelphia Electric Company. The first method is applicable only to compound-wound generators which can be paralleled with one or more compound-wound generators of correct polarity carrying load. The equalizer switches of these machines, when closed, connect the inner terminals of the series field windings of two or more generators in parallel, equalizing the potential at these points and thereby causing proper division of the total load current among the series-field windings. When the equalizer switches of all the machines in operation are closed and when the equalizer switch and the bus switch on the same side of the reversed machine are also closed, the series field of the reversed machine is placed in parallel with those of the machines in operation and so takes its normal share of the total load current. The current in the series field of the reversed machine is in the same direction as the normal operating current and thus tends to build up a field of proper polarity; if strong enough to overcome the residual magnetism, it will reverse the polarity to normal.

If this method fails to reverse the polarity, the method about to be described should be used. This method applies to shunt-wound or compound-wound generators when the bus can be energized from a source of correct polarity. By this method, with the positive machine switch open and the positive shunt-field lead connected to the positive bus, current flows through the shunt field circuit, but not through the armature when the negative and circuit breaker and negative machine switch are closed. This develops a field of correct polarity in the field circuit, and when the machine is shut down the residual magnetism will be of correct polarity. Therefore, when the machine is again started up, it will build up with correct polarity.

When no source of correct polarity is available, a third method known as "flashing" may be used. In this case the shunt-field leads are reversed and the circuit through the shunt field is closed for an instant while in this reversed condition. This causes a wave of current to flow through the shunt-field circuit in the normal direction and of sufficient strength to reverse the existing residual magnetism. If the machine is then started up normally, the field will build up with correct polarity.

The fourth method is applicable to motor-generators which can be started from the direct-current end. This method is based on the fact that a shunt-wound or compound-wound generator of given polarity must be supplied with current of the same polarity in order to operate as a motor in the same direction. When current of normal polarity is supplied to such a machine, it reestablishes the normal polarity of the field and, consequently, that of the generator.

# Radio Communication Being Developed in the West

THAT radio communication is rapidly being adopted by Western power companies as a means of maintaining communication with their distant power plants during times when wire lines are inoperative was a feature brought out at the recent meeting of the sub-committees of the Technical Section of the Pacific Coast Electrical Association.

The Great Western Power Company is now using a carrier radio-telephone system between its Caribou plant and its receiving substation in

Oakland, a distance of 156 miles. This system is used for all dispatching and has been in successful operation for several months. The Pacific Gas & Electric Company is installing a similar system between its Pit River No. 1 plant and Vaca substation for operation over 200 miles of 220-kv. transmission line.

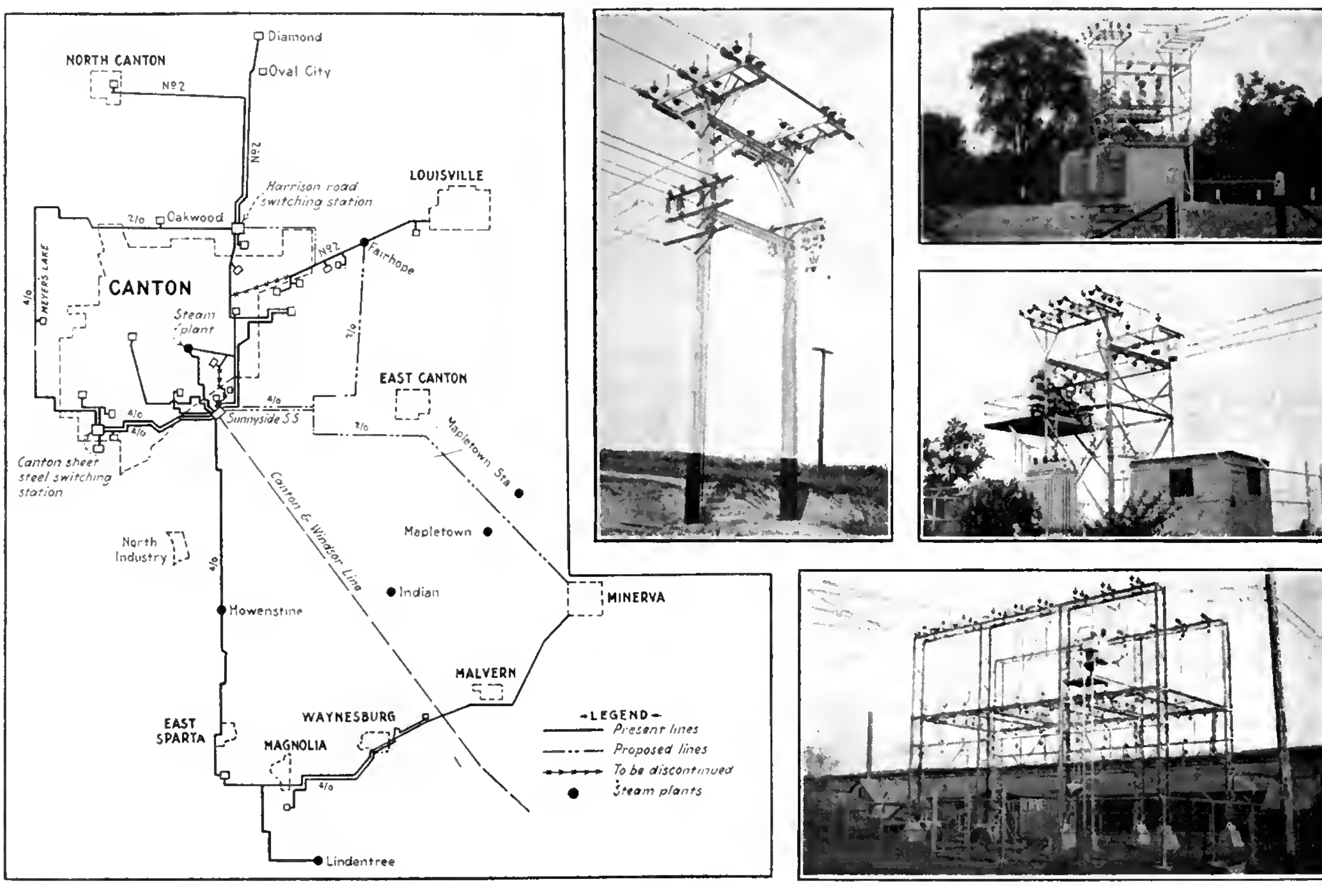
The Southern California Edison Company is using continuous wave wireless telegraph as the only means of communication between its main field office at Big Creek and its five construction camps in the upper Sierras. A total of 300,000 words a month are handled between these stations. This company is also experimenting with carrier radio telephone with a view to utilizing it as a means of communication between its Big Creek plants and the dispatcher in Los Angeles, a distance of 240 miles over its two 220-kv. Big Creek transmission lines. Carrier radio telephone seems to be generally favored where it is possible to utilize a transmission line running in a direct route between the two stations it is desired to keep in communication with each other.

On account of the character of the transmission system of the San Joaquin Light & Power Corporation conditions are not favorable for carrier radio, and it is experimenting with straight radio telephone. While carrier radio is working successfully in many cases, it is felt that a number of improvements will have to be made before it can be absolutely relied upon under all operating conditions.

FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

## Belt-Line System Solves Distribution Problem

THE Ohio Power Company at Canton, Ohio, has had a very large increase in load during the past few years. This growth of business made its distribution problem complicated. The situation was met by building a 22,000-volt wooden-pole belt line around the city with transforming and switching stations at intervals. The line is complete with the exception of the south link, which will tie the Bryan Avenue switching station to the station at sunnyside, the terminus of the 130-kv. line from Windsor. The line is built on wooden-poles with No. 4/0 wire. The Harrisburg switching station is used as a sectionalizing point and controls the tie line to Sunnyside and feeders to heavy industrial loads. The Oakwood substation will distribute at 4,000 volts to a district two miles distant. Meyer's Lake station will supply a section two miles each way at 4,000 volts, while the Bryan Avenue station will control the south tie to Sunnyside and the west section of the belt line and in addition some heavy industrial feeders.




DISTRIBUTION PROBLEM SIMPLIFIED IN CANTON, OHIO, BY 22,000-VOLT TRANSMISSION BELT AROUND CITY

Left—General layout of transforming and switching stations. Upper right and right center—East Sparta and 750-kva. Oakland substations, typifying type of construction employed. Right bottom—Bryan Avenue switching station, terminus of 130-kv. line from Windsor. Top center—Oakland sectionalizing station.

At each switching station the incoming 22,000-volt lines go to a high-tension outdoor structure equipped with air-break switches, oxide-film arresters, etc., and thence to outdoor transformers. The secondary leads enter a concrete or brick switch house at 4,000 volts. In this switch house meters, relays, breakers and low-tension buses are installed. Underground construction is used from switch house to secondaries.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## Should Central Stations Merchandise?*

**Considered from the Consumer's and Central Station's Viewpoint—Where a Utility Works with Dealers Experience Shows More Active Local Interest in Appliances**

By A. W. Krueger
Edison Electric Appliance Company, Chicago

SHOULD the central-station company sell appliances? Our experience permits only one answer: "Yes—most emphatically." Everybody benefits through central-station appliance selling activity. The reasons for this are readily apparent.

Let us take the consumer. Not nearly the number of women today would know of and enjoy the benefits of electrical household devices had central stations remained inactive or indifferent to their educational responsibilities. Most of them would still be pushing a broom over their carpets instead of using a vacuum cleaner and realizing its tremendous labor saving. In most cases they would still be turning a flywheel on the family washing machine. They would not be enjoying the advantages of electrical cookery and many other similar benefits.

This one constructive factor in itself is sufficient reason for the central station to merchandise appliances, because by so helping their customers they render a real service as a public utility through bringing the public to a realization that electrical service only starts with lighting. Helping to educate the public, the central station benefits not merely through good will but very materially in dollars and cents because of increasing the energy day load, most of which is consumed at the lighting rate. In addition, nearly all central stations which sell appliances today are receiving from their commercial departments a merchandising profit.

The story of these benefits does not stop here. The widespread public acceptance of electrical appliances has automatically created thousands of electrical appliance dealers. They effectively supplement central-station activity. Their success means additional central-station day-load revenue. They are a valuable asset in broadening the appliance field and are well worth the c'osest cultivation and co-operation.

### Merchandising Progress Gradual

In the early days of central-station merchandising thousands of flatirons were distributed at cost. In a great many cases they were actually given away. It was good business then because the increased day load more than offset the expense involved. The public began to realize the labor-saving advantages of electrical household devices. They began to appreciate that electrical service meant something beyond lighting bulbs. This, however, was not conducive to dealer expansion, for they could not compete. The practice was relatively short-lived because it was soon found that the public responded to intensive campaigning and people were ready and willing to pay reasonable prices for electrical conveniences. Central stations abandoned the earlier plan of no merchandising profit and put their individual commercial department on a profit-producing basis. They realized the advantage to themselves as well as to the dealer of the active co-operation of all electrical appliance-selling outlets, such as electric specialty shops, hardware stores, department stores and electrical contractors—in fact, every legitimate merchandising outlet for household devices. Manufacturers' suggested list prices were maintained, and an extremely healthy condition resulted—a condition that holds true today in virtually all communities.

It is unfortunate that there are today some dealers who still carry the point of view that the game is one-sided in favor of central stations. They have not stopped to analyze the facts of the case. A great deal of progress has been made in educating the dealer and making him a better merchant, but there is still room for a lot more good work that can be promoted by the central station to produce more harmonious relations between these branches of the industry.

George A. Hughes once declared: "Show me an inactive central station and I will show you a dead appliance town." This statement clearly defines the facts. Consider a concrete case, that of a busy Mid-Western city with a population of 250,000 inhabitants. Up to a few years ago the policy of the local utility was to sell energy and lamps only. "Leave it to the dealer," was its motto. Did the dealers appreciate this situation? Did they get busy and make the most of their opportunity? Did they advertise on billboards? Advertise in the newspapers? Conduct demonstrations? Circularize their mailing list? Did they ever make an appliance analysis of the town? Not so you could notice it! They sat back and wondered why their appliance business was not better.

### Utility a Gage of Activity

The central station in question finally came to a realization of this condition. It decided to get busy and to become an active merchandiser and it believed in "doing the job up brown." A location was secured in the heart of the shopping district. No expense was spared in fitting out the display room as the outstanding appliance showplace of the city. Neither was any money spared in widely advertising that fact. A tremendous howl went up from the dealers. Appliance business was going to be ruined! The central station would wreck the whole merchandising works. It would kill what little had been accomplished.

What actually happened? The town just began to wake up to the value of appliances. Nobody had ever taken the trouble to tell it the

*An abstract of a paper presented before the Commercial Section, Indiana Electric Light Association, Indianapolis, May 3, 1923.

real story before. The central station used billboards, newspapers, sales letters, attractive windows and freely advertised the appliance shop. The public's interest was aroused. People were soon thoroughly "sold" on the electrical household idea. Appliance sales increased by leaps and bounds. Dealers who had bitterly fought the movement sold more appliances than they ever dreamed was possible. Department stores opened special electrical departments. Electrical specialty shops with high-grade equipment and merchandise sprang into being. Hardware stores got busy. Everybody was benefited. Even the dealers admitted that. Had the central-station company not changed from a passive to an aggressive merchandising policy, that city today would still be plodding along in the same old way.

There are a few exceptions, of course, where, for instance, the central station does not actually sell merchandise, but where it does actively co-operate with the dealers through showroom and window displays, billboards, newspaper advertising and special electrical shows. These cases, however, are exceptions to the general rule. Selling merchandise at cost has been proved unnecessary. Both merchandise and energy profit can be produced at the same time. Maintaining list prices puts everybody on an equal footing. The more everybody sells, the more the central station benefits; the more everybody sells.

Another concrete example of the result of central-station inactivity is the experience, some years back, of our company. Our selling records included a comprehensive map tack system. A black tack was placed on every town showing the location of our dealers, which in those days reflected the town's appliance activities in a large sense. The map was pretty well covered throughout the state with the exception of an area in central California that was practically barren of dealers. An investigation easily revealed the fundamental cause—central station passiveness and inactivity. The public was not "sold" on the electrical household idea. It was surprising to note how quickly this condition changed when these central stations interested themselves in appliance merchandising. The barren area filled up rapidly with tacks as new dealers sprang into existence.

Almost every central station maintains an office with a large amount of display room available. In the majority of cases they are active merchandisers. Great numbers of people come into their offices during the month to pay their bills. Aside from other considerations, this puts the central station in a very favorable position to merchandise which is not enjoyed by the majority of other classes of merchants. It is good business from every angle because the display room can be made to pay overhead and show a profit. How could we answer the question of "Should central stations sell appliances?" with anything but "Yes"? We believe that individual experience will justify this answer.

## How Syracuse Connection Service Stood Up on Moving Day

THE account of the Syracuse (N. Y.) Lighting Company's method of connecting customers' service within three hours after the signing of the application which appeared in the ELECTRICAL WORLD of April 14 has aroused much interest among central-station men. One question has been raised as to how the system would operate under stress of abnormal conditions such as are presented by the annual moving of many customers from one house to another. Manager G. I. Vincent answers this question in describing the annual moving rush, which comes in Syracuse the last few days in April and the first two or three in May. He says:

"In a normal day about 150 orders go over the counter at our customers' department. About as many more go directly to the order executing department, as all trouble orders coming in on the telephone pass the customers' department altogether. In addition, the men pick up some orders themselves. On April 30 759 orders went over the counter. I watched the operations myself several times during the day and do not believe that any customer waited more than thirty seconds for attention. This flexibility is obtained by having a number of employees in adjacent departments trained to wait on the customer. These employees are engaged in work which does not have to be done instantly so they can drop it on call and return to it later. A buzzer at the customers' counter connects with this department, which is immediately adjacent. A touch of the button calls an employee at once. During one short period on April 30 there were sixteen employees at work on the counter.

"The number of orders of all descriptions executed in normal times is about 350 per day. On May 1 1,042 orders were completed and on May 2 2,322. As nearly as we can ascertain there was absolutely no customer left without service who desired it on either of these two days. Of course, very many had to request postponement from the first to the second of the month because they were unable to secure the services of the movers. The flexibility in the order executing department is obtained by using all alternates who are regularly engaged in other work and by dropping all routine work, such as changing meters.

"No attempt was made to keep actual time lapses because any of our customers securing service on these two days would be more than satisfied. On normal days we still maintain easily the bogey of two minutes for transmission and three hours for completion."

ONE OF THE SYRACUSE COMPANY'S EIGHTEEN SPECIAL TRUCKS USED IN ITS THREE-HOUR CONNECTION SERVICE

# If 1923 Appliance Sales Were Increased 20 per Cent

CENTRAL-STATION companies recognize the importance of domestic appliances as load builders, but their full value becomes apparent only when it is considered that they may add over $75,000,000 to the annual gross income of these companies this year. This does not mean money received from the sale of merchandise—it is purely operating revenue from energy sales, and most of it at profitable rates. If the expectation, based on data compiled by *Electrical Merchandising*, is realized, $287,875,000 worth of appliances will be sold during 1923. These figures embrace in all 12,956,000 appliances classified as the accompanying table shows. And it is estimated that the income value of these appliances to be added to the lines in 1923, in revenue for energy consumed, will approximate $83,000,000. Consumption on the appliances included is calculated at a 10-cent rate and on the following annual income basis:

| | Per Year |
|---|---|
| Washing machines | $8.00 |
| Vacuum cleaners | 4.00 |
| Portable lamps | 3.00 |
| Flatirons | 12.00 |
| Fans | 2.00 |
| Ranges | 60.00 |
| Refrigerators | 60.00 |
| Radiators | 18.00 |
| Toasters | 4.00 |

Naturally, these figures are only estimates, as no adequate definite information on this subject exists. Sewing machines, ironing machines, dishwashers, kitchen power units, violet rays, vibrators and utility motors have not been figured in because their consumption is still more difficult to estimate. Heating pads, curling irons, waffle irons, grills, hot plates, fireless cookers, hair driers and miscellaneous heating appliances, totaling in all 626,000 appliances, are lumped as good for probably $2,000,000 in revenue to the central stations.

Taken this way, as mass statistics, these totals carry little inspiration. It is interesting to consider, however, what any extra effort to increase the sales of these commodities would mean. On the above basis, if a 20 per cent increase were realized, this would mean a gain in sales to the central stations, dealers, contractors and other retailers of 2,591,200 additional appliances, bringing an additional income from sales of $57,575,000 and an increase in annual revenue to the central station of $16,303,000.

In an average city of 100,000 population it is estimated from these figures that electrical merchandise sales would be swelled by at least $100,000 and the local light and power company would secure an increase in residence appliance income of approximately $30,000. This calculation is based on the rough assumption that half the population of the United States is beyond the reach of power lines and would not be affected.

WHAT 20 PER CENT INCREASE IN APPLIANCE SALES WOULD MEAN

This tabulation is based on *Electrical Merchandising's* estimate of electrical appliance sales for the year 1923. It shows what a 20 per cent increase in sales would mean in terms of the various household appliances which, according to this estimate, will be sold this year.

| | | | | | If 1923 Estimates Could Be Swelled 20 per Cent the Increase Would Be | | |
|---|---|---|---|---|---|---|---|
| Items | Est. No. Sold, 1923 | Est. Reta Value | Energy Consumption per Unit per Year* | Estimated Annual Value of Energy Consumed by 1923 Sales | Number of Machines Sold (Increase) | Value of Sales (Increase) | Annual Value of Energy Consumed (Increase) |
| Washing machines | 600,000 | $75,000,000 | $3 | $1,800,000 | 120,000 | $15,000,000 | $360,000 |
| Vacuum cleaners | 1,000,000 | 50,000,000 | 4 | 4,000,000 | 200,000 | 10,000,000 | 800,000 |
| Portable lamps | 3,000,000 | 30,000,000 | 3 | 9,000,000 | 600,000 | 6,000,000 | 1,800,000 |
| Irons | 4,000,000 | 24,000,000 | 12 | 48,000,000 | 800,000 | 4,800,000 | 9,600,000 |
| Fans | 800,000 | 16,000,000 | 2 | 1,600,000 | 160,000 | 3,200,000 | 320,000 |
| Electric ranges | 75,000 | 10,000,000 | 60 | 4,500,000 | 15,000 | 2,000,000 | 900,000 |
| Electric refrigerators | 22,000 | 7,000,000 | 60* | 1,320,000 | 4,400 | 1,400,000 | 264,000 |
| Radiators and heaters | 400,000 | 3,800,000 | 18 | 7,200,000 | 80,000 | 760,000 | 1,440,000 |
| Percolators and hollow ware | 250,000 | 3,000,000 | 4 | 1,000,000 | 50,000 | 600,000 | 200,000 |
| Violet rays | 125,000 | 2,500,000 | ... | .......... | 25,000 | 500,000 | .... |
| Toasters | 500,000 | 2,400,000 | 4 | 2,000,000 | 100,000 | 480,000 | 400,000 |
| Waffle irons, grills, hot plates, fireless cookers | 165,000 | 3,175,000 | 3 | .......... | 33,000 | 635,000 | 99,000 |
| Heating pads | 200,000 | 1,250,000 | | .......... | 40,000 | 250,000 | .......... |
| Curling irons | 250,000 | 1,250,000 | | .......... | 50,000 | 250,000 | .......... |
| Hairdriers, miscellaneous heating appliances | 200,000 | 2,000,000 | 3 | 2,000,000 | 40,000 | 400,000 | 120,000 |
| Sewing machines | 170,000 | 12,000,000 | ... | .......... | 34,000 | 2,400,000 | .......... |
| Ironing machines | 63,000 | 7,500,000 | .. | .......... | 12,600 | 1,500,000 | .......... |
| Kitchen power units | 100,000 | 5,000,000 | . | .......... | 20,000 | 1,000,000 | .......... |
| Vibrators | 300,000 | 3,000,000 | .. | .......... | 60,000 | 600,000 | .......... |
| Utility motors | 225,000 | 3,000,000 | .. | .......... | 45,000 | 600,000 | .......... |
| ish washers | 11,000 | 1,000,000 | ... | .......... | 2,200 | 200,000 | .......... |
| Discellaneous motor appliances | 500,000 | 25,000,000 | ... | 500,000 | 100,000 | 5,000,000 | .......... |
| Totals | 12,956,000 | $287,875,000 | | $82,920,000 | 2,591,000 | $57,575,000 | $16,303,000 |

* Note.—Energy consumption figured at 10 cents pec kilowatt-hour in case of all appliances except ranges and refrigerators, where 5-cent rate is assumed.

## Purchased Power Gaining in Cement Industry

THAT the advantages of electric drive are well recognized by the portland-cement manufacturers is evident from the United States Census Bureau's recently published figures on that industry. The heavy power requirements of cement making and the development of conflicting tendencies with reference to the purchase of power from central stations give these figures especial significance. The trend toward the purchase of central-station power is verified by recent observations in the cement industry.

The total primary horsepower reported by cement manufacturers for the year 1919 was 488,808. With a liberal allowance for the comparatively small amount of natural and pozzuolanic cements made, over 485,000 hp. must have been devoted to the manufacture of portland cement. This, includes purchased power, all of which was electrical. The average horsepower per plant was well over 4,000, while the total ranked the industry tenth among all manufactures.

Rented primary power increased nearly 23 per cent in the ten-year period 1909 to 1919, raising the percentage from 14.6 in the former year to 37.3 in the latter. Of the total power, 70.7 per cent was utilized to operate electric motors. Slightly over half of this electrical power—52.8 per cent, to be exact—was obtained from central stations.

Since the number of cement plants operating last year, the record year in the industry, was greater than in the slack period extending through 1919, and since the 1922 output was about 40 per cent larger, the power needed for cement making was also considerably more. The increase in installed horsepower was by no means proportional to the gain in production, however, for the plants were operating at only 60 per cent of capacity in 1919 and much of the manufacturing equipment was idle or running under light load. The

record output of last year was about 78 per cent of the producing capacity of the plants.

All recently built cement mills have been equipped for electric power, and several of the older establishments have changed over to the use of electricity since the last census was taken, in most cases buying power.

The consumption of power in the cement industry is chiefly in the many crushing and grinding operations. The raw materials, including the coal for the burning, must be finely pulverized and the resulting clinker reduced to a fine powder to produce cement. From the nature of these operations wear on cement-mill equipment is rapid. In consequence stoppages for repairs or replacements are frequent, making unit motors convenient and economical. Because of this suitability and the industry's heavy power requirements, it offers an important market for electrical energy—a market equal to that furnished by the manufacturers of glass, agricultural implements, paints and hardware combined.

The change to electric drive in some cases has brought unexpected complications. For instance, an electrically operated shovel was put to work in a cement-mill quarry alongside two steam shovels. The electric machine was repeatedly tied up by breaks in the shafts, while such mishaps were unknown on the steam shovels. Finally it was ascertained that whenever the electrical shovel took too big a bite the motor, instead of stalling, would momentarily carry 100 per cent overload, stressing the shaft to twice its designed capacity. As the load was suddenly applied, this proved enough to break the shaft, whereas with the steam equipment the engine merely stalled when the dipper was overloaded.

Since the shafts could not be made larger without a radical change in design, a special nickel-chrome steel shaft, carefully heat-treated, was employed. The new shafts then had twice the elastic limit of the metal used in the original shafts and were sufficiently ductile to withstand all usual shock and vibration, yet they were no larger.

BATTERY OF MOTORS OPERATING FINISHING MILLS IN CEMENT PLANT

Opposing the tendency to purchase power for cement-mill operation there is one factor to which cement manufacturers are giving careful consideration. That is the installation of waste-heat boilers for the utilization of the heat in the gases which leave the kiln at 1,200 deg. to 1,600 deg. F. in dry-process plants and 800 deg. to 1,100 deg. in wet plants. Though a number of these installations are in operation, their cost is high and involve large initial expenditures. Not only is the boiler equipment itself expensive, but the arrangement naturally entails a generating plant for which the cost of operation, maintenance, interest and depreciation may offset the apparent savings of the waste-heat boilers.

## Customer's Monthly Bill and Check Combined

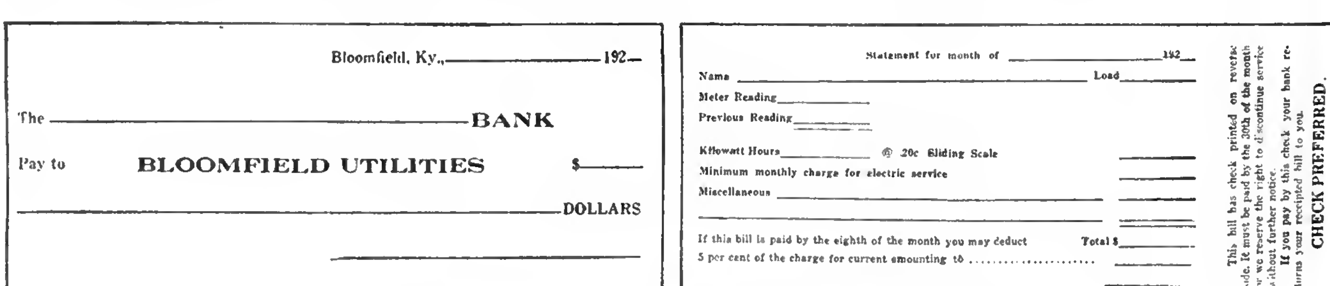
THE Bloomfield Utilities of Bloomfield, Ky., uses the reverse side of the customer's bill as a check should the customer at that time be without blank checks. Wherever possible the money is collected at the time of reading the meter. The meter readings are entered on this check, the bill figured and a 5 per cent discount allowed if the bill is then paid on the spot. By thus combining both the bill and a readily available check it is a very simple matter for the consumer to pay the bill on presentation, for all he has to do is to write the name of his bank, the amount of the check and his name.

## What Other Companies Are Doing

**Minneapolis, Minn.**—As a result of an active employee-ownership policy the Northern States Power Company has increased the number of employee shareholders from 15 to 83.5 per cent. Out of the 2,180 employees, 1,820 now have one or more shares of the company's stock. This campaign was started a short time ago under the direction of R. F. Pack, vice-president and general manager, in order to induce the employees to share in the company's earnings.

**Boston, Mass.**—Fifteen thousand persons visited the electric home established by the Boston Electrical League April 14 to May 5, and sales of household conveniences and of house wiring appear to be directly traceable in many instances to this exhibit. A feature of the display was the visiting of the home by various groups of people residing in distant communities, automobile parties being made up for this purpose with provisions for their comfortable reception by members of the organization and their employees.

**Illinois.**—Following the example of the Commonwealth Edison Company, the Public Service Company of Northern Illinois has published a thirty-two-page year book, which presents to its stockholders detailed information relative to the business, properties and finances of the company in which they hold part ownership. The year book reviews the business of 1922, when the company served 220,160 customers, and points out the interesting fact that 36 per cent of the company's stock is now held by women.



Bloomfield, Ky., ______ 192__

The ______ BANK

Pay to BLOOMFIELD UTILITIES $______

______ DOLLARS

Statement for month of ______ 192__

Name ______ Load ______

Meter Reading ______

Previous Reading ______

Kilowatt Hours ______ @ 20c Sliding Scale

Minimum monthly charge for electric service

Miscellaneous ______

If this bill is paid by the eighth of the month you may deduct 5 per cent of the charge for current amounting to ...... Total $______

This bill has check printed on reverse side. It must be paid by the 30th of the month or we reserve the right to discontinue service without further notice.

If you pay by this check your bank returns your receipted bill to you.

CHECK PREFERRED.

REVERSE SIDE OF BILL IS A BLANK CHECK FOR CUSTOMERS' CONVENIENCE

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Midway Plant of the San Joaquin Light & Power Corporation.*—E. A. QUINN.—The presence of large quantities of natural gas developed as a byproduct from oil wells in its district had a definite bearing upon the locating of a steam-electric plant of the San Joaquin Light & Power Corporation at Buttonwillow, Cal. The low cost of the gas enables this company to supplement its hydro-electric power with the energy generated in this steam plant. Some of the features discussed are the boiler-room equipment and turbo-generators, which are rated at 10,000 kw., 11,500 volts, 80 per cent power factor, three-phase, 60 cycle.—*Journal of Electricity and Western Industry*, April 15, 1923.

*Pulverized Fuel Plant at Providence.*—The United Electric Railways of Providence is making power-plant improvements which will cost upward of a million dollars by installing new boilers equipped to burn pulverized coal in one-half of the present boiler house. An interesting feature of this installation is the method of ventilating the boiler walls. Drawings show the vertical section of the boiler plant and a plan view of boiler showing pulverized-coal equipment and cross-section of burner and mounting.—*Electric Railway Journal*, April 28, 1923.

## Generation, Control, Switching and Protection

*Short-Circuit Forces in Transformers.*—J. BIERMANNS.—The electrical and the mechanical design of a transformer are frequently opposing problems, requiring a compromise solution satisfying fully neither of them. For example, from the standpoint of electrical strength it would be highly desirable to abstain from any solid material coil-supporting structure, because good oil is still the most dependable insulator. For mechanical reasons, however, the coils have to be strongly braced, to withstand safely the pressure of many tons exerted upon them during overloads or short circuits. The theory of short-circuit forces on transformers is not fully developed yet. Little can be found in textbooks, and nothing has been published as yet on the influence of asymmetries, such as must occur in the process of manufacture or the bringing out of leads and taps, upon the resulting unbalance of mechanical forces. In order to arrive at definite conclusions, the author was forced to idealize some of the conditions with which he deals, but this has been of such a nature as not to cause any appreciable difference between theory and practice. The developed formulas were checked on a 10,000-kva. transformer and gave values slightly higher than those actually measured. In his highly mathematical paper the author calculates the forces on a cylindrical transformer winding and modifies the equations for other types of coils, such as disk coils, etc. The short-circuit forces are first calculated for perfect symmetry between the windings themselves and between windings and the magnetic core and are then investigated for slight asymmetries. — *Bulletin de l'Association Suisse des Electriciens*, April, 1923.

## Transmission, Substations and Distribution

*Rotary Converters to Improve Power Factor.*—E. EVERS. — A theoretical paper showing to what an extent the power factor of a network can be improved by using standard rotary converters. A six-phase converter is compared in its phase-regulating ability with other devices for the same purpose, and it is shown that a rotary can be used with economical advantage if the phase advance in the net does not exceed that equivalent to 80 per cent power factor, measured at the collector rings. For larger displacements the synchronous motor will be more advantageous owing to its lower cost.—*A. E. G. Mitteilungen*, March, 1923.

*Unusual Sleet Formation on a 120,000-Volt Line.*—C. DUVAL.—The double three-phase, 120-kv. transmission line of the Basse-Isère plant, connecting Beaumont with Saint-Etienne, passes over Mont Pilat (1,186 m. in height) and traverses a country of extremely rough climatic conditions. The cables used are steel-aluminum. In the most endangered sections the cross-section of this cable is increased from 102 sq. mm. to 148 sq. mm., while at the same time the normal span of 140 m. is reduced to only 80 m. Various forms of sleet formation on the line are described.—*Revue Générale de l'Electricité*, March 31, 1923.

*Electricty on the Farm.*—J. W. PURCELL and A. G. LANG.—A nine-page review of progress up to date in the Province of Ontaria as concerns electric light and power in the rural districts. The authors consider the difficulties encountered, the limited rural demand for power, basis for estimating rates, primary distribution, installation of power lines, pole spacing, underground construction and electrical appliances that may be utilized on farms. —*Electrical News*, April 15, 1923.

## Units, Measurements and Instruments

*Measurements of Oil Flow in Transformers.* — F. MÜLLNER. — Two new methods are given for measuring the speed of the oil flow in transformers caused by the heating of windings. By the first method the time is determined which it takes for a thermometer to drop from a preheated point down to the temperature of the flowing oil. The faster the oil flows, the faster the mercury will drop. Calibration curves are given for these measurements, not only for oil, but also for water and air. The second is an electric method and is recommended for all cases where it would be impossible to read the indications of a thermometer. A very small ball of fine, insulated copper wire is wound, its diameter being only about ¼ in., its ohmic resistance at 15 deg. C. about 0.15 ohm. This measuring ball is used with three adjustable resistances in a Wheatstone bridge connection. The ball is inserted in the flowing oil, and the amount of watts is measured which is required to keep this ball heated to a constant temperature. This is accomplished indirectly by determining the resistance of the ball. The other three resistances of the bridge are varied in such a way as to keep the current through the bridge galvanometer zero. Calibration curves are given for different temperatures. — *Elektrotechnik und Maschinenbau*, April 8, 1923.

*Production of Porcelain for Electrical Insulation.*—F. H. RIDDLE.—This article deals with ceramic raw materials, chiefly clays, quartz and feldspar used in making insulators or insulating materials. Porcelains are now being used in which natural and synthetic sillimanite, reclaimed quartz and alkaline earth replace alkali.—*Journal of the A. I. E. E.*, May, 1923.

## Illumination

*Illuminating Business Districts.*—S. B. WILLIAMS.—The author considers the reasons why an ornamental lighting system is an asset to the business district of every city, together with information gathered from numerous sources on desirable practice under present conditions for size of lamp, pole heights, spacing and arrangement, glassware, posts and illumination intensity, cost and the necessity for a maintenance schedule. Several types of painted posts and glass-globe units, suitable for white ways, are illustrated. —*Electrical Record*, April, 1923.

*Flexibility in a Lighting System.*—J. M. KETCH and A. F. IRISH.—The author shows the value of flexibility and how it can be obtained by adequate wiring and switching, correct spacing of outlets and selection of proper lighting reflectors. Among the factors that contribute toward flexibility of an electric system are the proper spacing of outlets, so that, regardless of the lamp wattage, a uniform level of illumination may be obtained over the entire work-

ing surface, an illumination of sufficient high foot-candle value to care for the most exacting work carried on, sufficient copper to permit more light or wattage to be obtained when needed, a switching arrangement that will economically provide light at the desired time and place, and the selection of a reflector that will allow for a future change in lamp size and wattage.—*Industrial Engineer*, May, 1923.

### Motors and Control

*Large Sump and Night Pumping Lower Peak Load in Coal Mine.*—A. F. Brosky.—By employing a large sump and pumping the water out of the mine during non-peak load, the Hecla Coal & Coke Company, at Isabella, Pa., has effected a very large saving. The water in this mine was originally pumped out by steam pumps, which have recently been replaced by electric pumps. Pumping at non-peak hours was made possible by employing a reservoir that holds over a million gallons into which the water gathers during the daytime. The electrical features of the installation for pumping are considered.—*Coal Age*, April 19, 1923.

*Application of Electric Motors for Driving Tube Mills.*—F. Jeffrey.—One method of individual drive is through the medium of a reduction-gear unit, the main gear of which is an integral part of the tube mill proper, and a low-speed direct-current motor. When dust and dirt are prevalent the gears may be inclosed and occasionally run in oil, although it is always advantageous to eliminate the foreign matter from the surrounding air if possible. Another method of individual drive is through the medium of the gear unit, but a high-speed motor is used and belted to a countershaft. Group drive is used extensively, and in cases of this kind the tube mills are usually belted to a line shaft. Such a method of drive presents a different problem, which may, however, be studied from a knowledge of the requirements of each individual mill and the results then combined in such a manner that all overlapping will be properly considered. The author discusses the application of the slip-ring-type induction motor and squirrel-cage motor to the tube mill, and the application of a synchronous motor to the tube mill.—*Journal of the A. I. E. E.*, April, 1923.

### Heat Applications and Material Handling

*Dimensioning of Contact Trolleys on Cranes.*—E. Rosseck.—The paper gives data on a great number of three-phase brake magnets and on a few brake motors, stating the current demand at the start and for holding the torque, etc. The motor brakes are electrically better and require much less current, but their high cost prevents their more general use. In a practical example, in which the current consumption of the lift motor of a crane is calculated and vectorially checked for each controller contact, the great importance of considering the large current demand by the brake magnets is illustrated.—*Elektrotechnische Zeitschrift*, March 29, 1923.

*Heat-Insulating Materials for Electrically Heated Apparatus.* — J. C. Woodson.—While there are numerous grades of heat insulators on the market, there are none that can compete with electrical insulators. Of all the different grades, there are only a few fundamentally different sorts. In all of these materials the insulations are utilized almost entirely in the entrapped dead-air spaces of their structure. While the conductivity of an insulation is of primary importance, other thermal characteristics must be considered, such as specific heat and specific weight. The application also has to be considered with regard to the physical properties of the material.—*Paper presented before American Electrochemical Society, New York*, May 3-5, 1923.

### Traction

*Magnetically Controlled Track Switch*—E. Halle.—This apparatus, used to some extent on European street-railway systems, serves to set track switches from the running trolley car by means of an auxiliary contact on the trolley wire and a magnetic solenoid, actuating with a lever the tongue of the switch. Passing the contact with the current in the car on or off sets the switch in one or the other direction. A different trolley contact has to be installed for the arch-type or the wheel-type current collector. The apparatus may be erected above or entirely below the surface of the road and is in both cases built waterproof. To enable the motorman to see safely in which direction the switch is set during the night hours an automatically operated luminous arrow sign is usually part of the switch equipment. — *A. E. G. Mitteilungen*, March, 1923.

*Locomotives for the Swedish Riksgräns Railway.* — P. Friebel. — The paper describes in great detail the freight and express locomotives being built for the Riksgräns railroad. This is a single-phase, 14,000-volt, 15-cycle main-road electrification, used primarily to haul heavy ore trains. The power transmission from motors to drivers is accomplished with an elastic pinion and gear to a jack shaft and with horizontal rods to two or four drivers. The freight engines are of the O-D-O type, whereas the express engines are built as 2-B-B-2 and represent two identical halves coupled together. It is of interest that the entire electrical equipment of one-half of the express-type locomotive is in every respect the same as that of the freight-type engine. Some of the characteristic data of these two machines are given in the accompanying table.—*Elektrotechnik und Maschinenbau*, April 22, 1923.

CHARACTERISTICS OF FREIGHT AND PASSENGER LOCOMOTIVES

| | Freight | Express |
|---|---|---|
| Length over all, m | 11.25 | 21.4 |
| Diameter of drivers, mm | 1,350 | 1,350 |
| Weight complete, metric tons | 68.6 | 123.2 |
| Weight of electric part, metric tons | 42.1 | 70.6 |
| Weight of mechanical part, metric tons | 26.5 | 52.6 |
| Maximum speed, km.-hr | 60 | 100 |
| Maximum torque at start on circumference of drivers, kg | 18,000 | 16,000 |
| One hour output of locomotives, hp. | 1,130 | 2,260 |
| Number of motors | 2 | 4 |
| Motor current for one hour rating, amp | 1,700 | 1,700 |

### Telegraphy, Telephony, Radio and Signals

*Use of Loud Speakers in a Hospital.*—A unique use of telephonic loud speakers has been made in a French hospital where medical students can watch operations performed by a surgeon. Above the operating room is a glass roof through which the procedure of the operation can be observed. The surgeon, who gives during his work an explanation of what he is doing, talks into a microphone, the current of which is amplified by a battery of ten electron tubes, and actuates a number of loud-speaking telephones in the upper observation room so that the students not only see what the surgeon is doing but receive also the necessary explanations at the same time.—*Radio Electricité*, April, 1923.

*Theory of Electric Wave Filters Built Up of Coupled Circuit Elements.*—L. P. Peters.—An abstract of this paper may be found in the Electrical World report of the A. I. E. E. midwinter convention, Feb. 24, 1923, on page 442.—*Journal of the A. I. E. E.*, May, 1923.

*Some Improvements in the Poulsen Arc.*—P. O. Pederson.—The possibility of increasing the efficiency of the Poulsen arc by burning it in a non-homogenous magnetic field is mathematically investigated and experimentally verified.—*Proceedings of the Institute of Radio Engineers*, April, 1923.

*Development of Cables Used in the Bell System.* — F. L. Rhodes. — The author discusses early types of cables, loaded cables, the application of repeaters to loaded circuits in cable, quadded cables and various types of sheathing for cables. — *Bell Telephone Quarterly*, April, 1923.

### Miscellaneous

*Methods of Analyzing Power Costs.*—A. J. Whitcomb.—An analysis of the different ways in which power costs can be checked and distributed among departments or processes in proportion to the amounts required. The author deals with the auditing of power-service requirements and tells what a proper distribution of power costs is and what it is not. He points out that power in kilowatt-hours represents dollars and cents of the same kind that go into the pay envelopes for labor. For the same reason that the paymaster is not allowed to make an error of 10 or 15 per cent in figuring his payroll, the method of accounting for power used should not permit such a range of guesswork.—*Industrial Engineer*, April, 1923.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Discuss Power Test Codes

**Public Hearing at Montreal Convention of A. S. M. E. Arouses Interest—To Work with N. E. L. A.**

MEETING in Montreal for its annual spring convention on Monday to Thursday of this week, with a registration of more than six hundred, the American Society of Mechanical Engineers held a public hearing on two of the nineteen power test codes being framed for suggested international adoption. These two codes deal with standardized measurements for power equipment and for internal-combustion engines. The hearing created great interest and much discussion. The general opinion was that it would be desirable to co-operate with the National Electric Light Association's code committee on the same requirements.

H. G. Acres, hydraulic engineer of the Hydro-Electric Power Commission of Ontario, predicted the use of propeller-type turbines for the St. Lawrence development and stated that the Johnson valve and surge tank, the spreading draft tube and the Kingsbury bearing had made possible large turbine development. Recent tests showed that the turbine in which the hydrocone extended to the runner hub was the most efficient type. The Queenston unit gave 93 per cent efficiency by the Gibson method, he said. Prof. R. W. Angus said that Mr. Acres' paper applied also to low-head plants. H. B. Taylor and L. F. Moody agreed with the statements made in the paper. Mr. Taylor said there was no limit to the size of units from the construction standpoint.

A paper on steam-line sectionalization and control presented by Peter Payne Dean, president Payne Dean, Ltd., Stamford, Conn., was well received.

## Power Survey Bill Becomes Law in Pennsylvania

Governor Pinchot of Pennsylvania has signed the power survey bill passed by the Legislature at his instance. This law creates a board, consisting of the Governor, Attorney-General, Commissioner of Forestry, secretary of the Water Supply Commission, chairman of the Public Service Commission, Secretary of Agriculture, Commissioner of Labor and Industry, State Geologist and a Deputy Attorney General, to undertake an outline survey of the water and fuel resources available for the state and of the most practicable means for their full utilization for power development. The board is also empowered to recommend in outline a policy with respect to the generation and distribution of electrical energy to railroads, farms and homes.

The Governor has also signed the bill providing for a board to confer with similar agencies of New York and New Jersey on the regulation of the flow of the Delaware River

## Los Angeles' Public Service Body Wants $35,000,000

A thirty-five-million-dollar bond issue to cover the projected activities of the Public Service Commission of the city of Los Angeles will be voted on at the municipal election June 6. Approximately $10,000,000 will be spent in rehabilitating the city distribution system and in improvements to the present hydro-electric system, if the voters indorse the issue. The remaining $25,000,000 is to be used for power development at Boulder Canyon on the Colorado River when the dam at that location is completed. The bond issue is being opposed by the Taxpayers' Association, a newly formed organization.

## Los Angeles Loses Again

**Highest Court Decides Against Its Power to Acquire Property Already in Use to Serve Public**

THE United States Supreme Court has recently dismissed the petition of the city of Los Angeles for a rehearing of the city's case against the Southern Sierras Power Company for condemnation of property owned by the power company on the Owens River, in southern California. The decision of the Supreme Court ends a controversy which has been in progress since February, 1920. The first decision, handed down by the United States District Court, granted the city a right to condemn the property. The power company appealed to the United States Circuit Court, and Nov. 5, 1922, that body decided that no showing had been made that the public use of natural resources by a municipal corporation was more necessary than use by a public utility privately owned and serving other communities. The decision of the lower court was thus reversed.

Throughout the litigation the cities of Riverside and San Bernardino gave legal assistance in the fight against the city of Los Angeles.

A bill designed to give Los Angeles the power sought and now finally denied her was recently tabled in the State Senate.

## Contracts for 240,000 Kva.

**Generating Equipment Ordered from Canadian Westinghouse by Quebec Development Company**

EIGHT hydro-electric generators rated at 30,000 kva. each at 80 per cent power factor, generating 13,200 volts, three-phase, 60-cycle, at 112½ r.p.m., have been ordered from the Canadian Westinghouse Company, Hamilton, Ontario, by the Quebec Development Company. These generators are to be of the vertical-shaft type equipped with Kingsbury thrust bearings. A directly connected exciter with a capacity of 225 kw. at 250 volts will be supplied with each generator. The contract also includes the installation of this equipment in the new plant of the Quebec Development Company at Isle Maligne, on the Saguenay River, 3 miles from Lake St. John. The apparatus covered by this order was designed by the engineers of the Canadian Westinghouse Company in collaboration with the engineers of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and is of standard Westinghouse construction. It will all be built in the Hamilton shops of the Canadian Westinghouse Company.

In December, 1922, James B. Duke, president of the Southern Power Company, and Sir William Price, president of Price Brothers & Company, Ltd., of Quebec, incorporated the Quebec Development Company for carrying out the great hydro-electric and paper-mill project described in these columns at that time. A potential development of 1,200,000 hp. through the construction of a dam at the Grand Discharge from Lake St. John at the head of the Saguenay River is foreseen.

Price Brothers will erect two new mills in which much of the new power will be used, and existing mills will be converted to the use of electric power. They have agreed to take from the company 200,000 hp., perhaps the largest contract ever placed by a consumer for electric power. It is estimated that the saving of coal thus effected will amount to $1,500,000 yearly. The cost to Price Brothers of building the new mills and making alterations to the old ones is put at about $17,000,000.

Of the eight officers and directors of the Quebec Development Company, six are American and two are Canadian. The company, which is incorporated under Canadian law, is capitalized at $25,000,000, the entire capital stock being supplied by Mr. Duke and Sir William Price.

## Federal Board Activities

**Declarations Filed Affecting Development of Delaware and Future Status of Muscle Shoals**

A DECLARATION of intention has been filed with the Federal Power Commission by the Pennsylvania Power & Light Company, a subsidiary of the Electric Bond & Share Company, covering a large project in the vicinity of Scranton, where it is proposed to construct a reservoir storing 9,000,000,000 cu.ft. of water. It is proposed to develop 47,000 kw. in the Wallenpaupack River. This reservoir will have an important bearing on the development of the Delaware River. Plans being considered for the development of this river call for the ultimate harnessing of 450,000 hp. between Hancock, N. Y., and Belvidere, N. J.

Another declaration of intention has been filed with the commission covering a project on the Pigeon River in North Carolina. The Pigeon River is a tributary of the French Broad River, which in turn is a tributary of the Tennessee. While the Pigeon River project concerns a development of only 30,000 hp., it is regarded as possessing great significance. This proposal, together with projects on the Clinch, Powell and Holston Rivers, indicates that big interests in the power and industrial fields have turned attention to this important region. It is understood that most of the power is being sought for electrochemical and electrometallurgical use. It is fully expected that the next few years will see the power resources of this region developed as they have been on the eastern slope of these mountains by the Southern Power Company. These developments, however, are being actively opposed by certain interests concerned with the development of Muscle Shoals as it is feared they may detract from carrying through cherished hopes.

As much as possible of its pending business will be disposed of by the commission prior to June 15. On that date two of its members, Secretary Work and Secretary Wallace, will leave with the President on his Alaska visit. This will preclude any further meetings of the commission until early fall, and for that reason a large amount of important business will be transacted in the next two weeks.

## Electric Steel Founders Pursue Research

The "electric steel founders' research group" held a regular meeting of executives of the five electric steel foundries conducting co-operative research work at Wernersville, Pa., on May 14 to May 17. Representatives were present from the Electric Steel Company of Chicago, Fort Pitt Steel Casting Company of McKeesport, Pa.; the Lebanon Steel Foundry of Lebanon, Pa.; the Michigan Steel Casting Company of Detroit and the Sivyer Steel Casting Company of Milwaukee, in addition to R. A. Bull, research director of the group.

The various phases of the research work being done by the members of the group to improve the quality of steel castings and increase efficiency in methods were discussed in detail. Formal reports giving the status of the present research investigations were read on such subjects as facing-sand mixtures, core-sand mixtures, electric furnace practice, heat treatment of steel castings, production control, porosity in castings, etc. Plans were made for conducting research investigations on additional steel foundry problems. The results obtained from the work done have, in the opinion of the research group, been so beneficial as to make it highly desirable to study intensively some of the additional complex problems involved in making thin-section electric steel castings of intricate design.

# Missouri Operators Sail the Mississippi

**Transmission Economics, Oil Engines for Small Central Stations and a Manufacturer's Viewpoint of Utility Problems Are Discussed at Annual Convention Afloat**

ELECTRICAL transmission problems dominated the proceedings of the seventeenth annual convention of the Missouri Association of Public Utilities, which was held aboard the steamer Harry G. Drees on May 23-26. The paper on this subject had been prepared by L. W. Helmreich and N. C. Mann, engineers of the Missouri Public Service Commission. Besides explaining the economics and value of interconnection, four factors were considered in analyzing the future growth of long transmission lines, namely, absorption of acquired isolated plants, formulation of equitable rate structures for transmission groups, financing of initially unremunerative projects, especially rural service, and, lastly, conflicts with communication systems.

With regard to the financing of rural lines, Mr. Helmreich reviewed the practices adopted by other states and concluded that while transmission and primary rural extension lines may be viewed simply as extended urban primaries, the main rural lines represented an investment serving a restricted, unchanging group.

F. S. Dewey, Kansas City, warned operators of a future day when rural reconstruction will be a still harder problem for the utility and the farmer if the utility does not require a high grade of construction at the present time. J. E. Hillemeyer, St. Louis, urged that more study be given to the uses of power on the farm in order to reduce the fixed charges and energy rates. He failed to see why a telephone company operating a grounded system should be allowed to blame unbalance on the power companies. W. F. Corl, Mexico, declared that since electricity would eventually decentralize industry by bringing it out to the country it was better to give the farmer service than eventually to face a farmers' "bloc."

### Plan for Rural Rates

N. C. Mann presented an illustrated paper on proposed rates which would be proportional to the product of the connected load and its distance from the generating plant. The plan was to isolate and deduct from the total system charges those peculiar to transmission elements. The remainder would form a basic rate structure applicable throughout the entire group. The deductions properly allotted would determine the differential to be added in each case to the basic structure.

On Thursday morning George A. Hughes, president Edison Electric Appliance Company, Chicago, treated public utility problems from a manufacturer's viewpoint with special reference to social and economic unrest. He pleaded for an avoidance of prejudice as well as of socialistic pitfalls.

W. H. Henby reported on the year's work of the Missouri Committee on Public Utility Information, which is now distributing 1,900 copies of its weekly bulletins to 600 state newspapers, high schools and members of the Legislature. He felt that if utilities based their story on the development and conservation of national resources, they would encounter little difficulty when asking for higher rates.

J. D. Van Maur, St. Louis, thought that the public was fair-minded when once it was told all the facts in terms it could understand. He drew especial attention to the published letters from high-school principals commending the committee for its work with the classes in economics and science.

### Diesel-Engine Costs

The paper on the application of oil engines for small central stations prepared by Stanley Stokes, St. Louis, was read in his absence by J. E. Hillemeyer. Cost data were included from five plants ranging from a capacity of 50 kw. to 1,000 kw., with a net monthly generating cost per kilowatt-hour varying from \$0.0369 to \$0.1833. Since it was the load factor which created such a wide variation in costs, the investment costs must be kept at a minimum. Costs on the Diesel type will run \$168 to \$187 per kilowatt of rated capacity fully installed.

J. B. Sheridan, manager of the Public Utility Information Bureau, gave a comparison of utility earnings for 1915 and 1921 during a period when the total operating expenses of Missouri electrical utilities had increased 136.3 per cent with a decrease in net return of 33.9 per cent. For the same period taxation had increased 170 per cent, coal costs had jumped 170 per cent and labor 131 per cent.

A question-box session was conducted Saturday morning. J. E. Hillemeyer, St. Louis, advised a continual checking up of suspicious bills and favored informing the public of the new state law which holds that a discovered "jumper" is prima facie evidence of theft of electrical energy. Some apprehension as to lawsuits for damages in case of failure to secure conviction was expressed, but John C. Hall St. Louis, urged that utilities should not hesitate to apply the law.

PRESENT VALUATION

The reproduction-new basis of valuation was questioned by C. C. Hellmers of Maryville, James R. Abercrombie of St. Joseph and F. S. Dewey of Kansas City, since it would require continual revaluations without consideration of high costs of construction during a boom period. W. F. Corl and Ben H. Locke, Mexico, felt that since prices of other commodities varied with exchange values utility rates should be based on the same principle.

F. S. Dewey said that since a utility's turnover usually is only once every five years instead of four to five times yearly, it would not need much argument to make the business man see the absolute necessity of an 8 per cent return.

For the coming year the following officers were elected: President, H. C. Blackwell of Kansas City; vice-presidents, J. D. Von Maur of St. Louis, C. L. Proctor of Joplin and Wiley F. Corl of Mexico; secretary and treasurer, F. D. Beardslee. The members of the executive committee will be L. P. Andrews, chairman; E. R. Locke, Herman Spoehrer, F. S. Dewey and John P. Casey. The attendance on this trip numbered 150.

## Westinghouse Jobbers in Session

The eleventh annual convention of the Westinghouse Agent-Jobbers' Association has been in session this week at Hot Springs, Va. The only open meeting was held on Monday afternoon. E. W. Lloyd, chairman of the Joint Committee for Business Development, opened the program and described the work of that organization and its plans. The need for a wider appreciation on the part of the dealer of the fact that his prime function is that of purchasing agent for the public was discussed at length by Howard Ehrlich, editor of the *Jobbers' Salesman*. He pointed out that too many dealers maintain the point of view that they are merely representatives of the manufacturers, whereas the public looks to them for actual advice and assistance in the acquiring of electrical equipment for their homes.

An interesting analysis of the present set-up in retail distribution of electrical merchandise and appliances was presented by H. A. Lewis, manager of *Electrical Merchandising*, in which he pictured the present position of the department store, the hardware store and the drug store in the electrical market. There are at the present time, he said, four thousand department stores and ten thousand hardware stores selling electrical appliances. The department store has a distinct feminine appeal and is chiefly interested in selling staples. The hardware store appeals particularly to men and is organized and habituated to selling established specialties, among which it has gathered a considerable number of electrical devices. About one thousand drug stores are selling electrical merchandise also, principally through window and counter display, and with practically no creative selling. Because the electrical manufacturer in the effort to protect the electrical trade is not selling these retailers quality merchandise, they are largely stocking cheap goods and the public is receiving an improper impression of the quality of electrical merchandise. Mr. Lewis recommended that the electrical industry meet this situation by selling the non-electrical retailer quality merchandise so that the public may select electrical appliances intelligently and not with only cheap goods before them.

Frank E. Watt, editor of the *Electrical Record*, discussed "Liquid Capital as a Check on Business Depression." William L. Goodwin presented the present program of the Society for Electrical Development. An extensive program of committee reports and discussions was scheduled to fill the rest of the week.

# Jobbers Launch Simplification Program

### Many Recommendations Made for Elimination of Excess Varieties—Committee Appointed to Work with Manufacturers and Department of Commerce

DECIDED impetus was given to the promotion of a practical program for simplification in the electrical industry at the last day's meeting of the Electrical Supply Jobbers' Association at its annual summer convention at Hot Springs, Va., last week. Definite recommendations were made by a number of the commodity committees for the elimination of excess varieties in several important lines. The general principle of simplification was enthusiastically indorsed, and a committee was appointed to get in contact with the manufacturers and endeavor to influence a larger reduction in stock varieties and also to call upon Secretary Hoover of the United States Department of Commerce and enlist the aid of the Bureau of Simplified Practice.

COMMITTEE RECOMMENDATIONS

The committee on wire conductors recommended that the number of varieties of heater cord be reduced to one or two and that silk cord be reduced from the twenty-four colors and styles now listed to five or six. The committee on pole-line hardware reported many excess varieties, notably in cross-arm braces, and recommended to the manufacturers a careful study of the existing duplications and the elimination of as many styles as possible. The committee on wiring devices reported that the General Electric Company has recently dropped 860 numbers from its line, Bryant Electric Company 500, Harvey Hubbell, Inc., 400, and Hart & Hegeman 157. The committee held a meeting earlier in the week with representatives of the wiring-device manufacturers, who were present at the convention, and discussed the progress that has thus far been made and the possibilities for further action. An urgent request was made that other manufacturers take similar action in regard to their lines and that these removals be eliminated from all new catalogs both of the manufacturers and the jobbers.

The committee on heating devices called upon the manufacturers to reduce the number of varieties of household appliances, particularly hollow ware, and a questionnaire is being prepared for the purpose of determining what devices should be dropped. Special emphasis was given to the need for standardization of contact pins and plugs at the appliance end of the cord, and manufacturers were asked to adopt the practice of dropping one of the older models whenever a new style is brought out. A resolution was offered by this committee and passed by the meeting addressed to the National Electric Light Association commending the work of the N. E. L. A. wiring committee. The committee on fans recommended the complete elimination of the 16-in. non-oscillating fan, now already abandoned by several manufacturers, and reported that the cost of the ceiling fan is at present entirely out of proportion to the cost of desk-style fans and is seriously interfering with its sale, urging the manufacturers to readjust fan prices on a more equitable basis. The outlet box manufacturers were reported to have already reduced the number of styles from 116 to 21, and it was stated that they are ready to go to one finish as soon as the conduit manufacturers will standardize on one finish for conduit. In support of this situation conduit manufacturers were urged to give consideration to the possibility of the elimination of black iron conduit and the adoption of the galvanized finish as a single standard.

GOING TO HOOVER

Universal enthusiasm marked the delivery of an address by W. A. Durgin, chief of the Division of Simplified Practice, United States Department of Commerce, in which he pictured the progress that has been made in various indus-

tries in the elimination of obsolete, duplicate and other excess varieties. A resolution was passed requesting the Associated Manufacturers of Electrical Supplies to invite Mr. Durgin to give his address at the coming convention of this group of manufacturers in New London on June 26, and a committee on standardization and simplification was appointed, consisting of E. C. Graham (chairman), W. I. Bickford, F. W. Van Winkle, Frank S. Price, Clarence Wheeler, George Cullinan and George W. Johnston. This committee was instructed to confer with the standardization committee of the manufacturers' association in an effort to promote co-operation in the development of the purposes of simplification within the electrical industry and to proceed to Washington for a conference with Secretary Hoover.

## Alabama Company Ready to Develop Tallapoosa

The Alabama Power Company hopes to begin preliminary work on the first of its Tallapoosa River projects by June 15. It will be necessary to build 25 miles of railroad so as to connect the site with transportation. Ultimately the company expects to develop six sites on the Tallapoosa. Plans for this project have just been completed by O. G. Thurlow, the chief engineer of the Alabama Power Company, and provide for the initial installation of two 50,000-kva. units and the ultimate installation of another similar unit.

Application has been made to the Federal Power Commission for the license covering the first development. It is the lowest location on the river and is known as the Cherokee Bluffs project. A dam 105 ft. high is to be built at that point, which is 12 miles above Tallassee, Ala. This dam will create a reservoir with a superficial area of 22,000 acres. The company will be required to discharge a certain maximum flow so as to meet the requirements of navigation in the Alabama River below Montgomery. This requirement is being drafted in such a way that the discharge in the Coosa and the Tallapoosa may be co-ordinated in the satisfying of navigation requirements. Very little storage is possible on the Coosa, so that in high water the Tallapoosa can be stored and the load carried on the company's Coosa plants, while in low water the load will be put on the Tallapoosa plants.

## Training for Leadership to Be Keynote of S. P. E. E.

For its thirty-first annual meeting at Cornell University, Ithaca, N. Y., on June 20-23, the Society for the Promotion of Engineering Education has adopted as its general theme "Training for Leadership." An address with this title will be made by Dexter S. Kimball, dean of the College of Engineering, Cornell. Other prominent educators who will speak or take part in discussions on this and closely related subjects are C. F. Scott, J. H. Dunlap, M. E. Cooley, F. W. McNair, D. C. Jackson, H. E. Dyche, F. E. Turneaure, G. B. Pegram, F. L. Bishop, G. O. Frampton and Ira N. Hollis. "The Engineer as a Leader in Public Service" will be discussed by T. H. MacDonald, chief of the Bureau of Public Roads, Washington, D. C.; "The Engineer as a Leader in Industry" by Oliver S. Lyford, representing the National Industrial Conference Board, and "The Engineer as a Leader in Business" by W. E. Wickenden of the American Telephone & Telegraph Company.

Others who will take prominent part in the proceedings are Profs. J. Raleigh Nelson of Michigan, Edward Bennett of Wisconsin and L. S. Marks of Harvard and Chancellor J. A. Bowman of Pittsburgh. On Wednesday evening, June 20, President Livingston Farrand of Cornell will make his welcoming address, responded to by Professor Scott, president of the society; on Thursday evening the annual dinner will be held, and on Friday evening a "round-table" smoker.

# May Yield Advances to 6.47 per Cent

A TOTAL of $52,026,000 in new electric light and power public utility financing was placed on the market during the month of May. This figure represents a decrease of more than $13,000,000 under April and of more than $17,000,000 under May, 1922. The offerings were large in number—twenty-one—but small in volume. Only two issues exceeded the five-million-dollar mark. The largest single issue was the ten-million-dollar issue of the Illinois Power & Light Company, offered at par and yielding 7 per cent. The average rate of return yielded the investor advanced considerably, from 6.38 per cent in April to 6.47 per cent in May, and was the highest since December, 1922. While the tendency toward long-term securities is still evident, three short-term issues appear in the accompanying tabulation.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN MAY

| Name of Company | Amount of Issue | Period, Years | Class | Purpose | Interest Rate | Price | Per Cent Yield |
|---|---|---|---|---|---|---|---|
| Arkansas Central Power Co. | $2,500,000 | 25 | First and refunding mortgage gold bonds | To provide working capital | 6 | 94½ | 6.45 |
| Paducah Electric Co. (Ky.) | 1,006,000 | 15 | First mortgage sinking-fund gold bonds, series A | Refunding | 6 | 97½ | 6.25 |
| Counties Gas & Electric Co. (Pa.) | 6,600,000 | 30 | First and refunding mortgage gold bonds | Additions and refunding | 6 | 98 | 6.15 |
| Illinois Power & Light Corp. | 10,000,000 | 30 | Sinking-fund debenture gold bonds, (closed issue) | Refunding and to provide working capital | 7 | 100 | 7 |
| Salt River Valley Water Users' Assn. (Ariz.) | 1,800,000 | 5–24* | Gold bonds | Extensions | 6 | 99 | 6.10 |
| Tennessee Electric Power Co. | 2,500,000 | 24 | First and refunding mortgage gold bonds, series A | Additions, extensions and refunding | 6 | 94½ | 6.45 |
| Arkansas Light & Power Co. | 500,000 | .... | Cumulative preferred stock | Extensions | 7 | 92½ | .. |
| Penn Public Service Corp. | 2,500,000 | 15 | Convertible gold debentures | To acquire common stock of Erie Lighting Company and provide additional working capital | 6½ | 97 | 6.80 |
| Coast Counties Gas & Electric Co. (Cal.) | 250,000 | ... | Cumulative first preferred stock | Improvements and refunding | 6 | 86 | 6.98 |
| Great Lakes Power Co. (Ont.) | 320,000 | 20 | First mortgage gold bonds, series A | | 6 | 97½ | 6.25 |
| Potomac Electric Power Co. (D.C.) | 4,000,000 | 30 | General and refunding mortgage gold bonds, series B | Refunding and to reimburse for construction | 6 | 101½ | 5.88 |
| Pennsylvania-Ohio Power & Light Co. (Ohio) | 2,000,000 | 3 | Secured gold notes | Refunding and additions | 6 | 99 | 6.35 |
| American Public Service Co. (Ill.) | 300,000 | 19 | First lien gold bonds | To provide working capital | 6 | 91½ | 6.80 |
| Eastern Connecticut Power Co. | 1,500,000 | ... | Cumulative first preferred stock | Extensions, purchase of securities and retirement of floating debt | 7 | 100 | 7 |
| Jersey Central Power & Light Corp. | 3,500,000 | 25 | First lien sinking-fund gold bonds, series A | General corporate purposes | 6½ | 97 | 6.75 |
| Kansas Gas & Electric Co. | 3,500,000 | 29 | First mortgage sinking-fund gold bonds, series A of 1922 | Construction | 6 | 95½ | 6.35 |
| Power Corporation of New York | 1,000,000 | 19 | First mortgage sinking-fund gold bonds (series B) | Additions | 6 | 94½ | 6.50 |
| Utica Gas & Electric Co. | 500,000 | ... | Cumulative preferred stock | Additions | 7 | 102 | |
| Edison Electric Illuminating Co. of Boston | 1,000,000 | ¾ | Notes | | 5 | ... | .... |
| Utah Power & Light Co. | 3,500,000 | 21 | First lien and general mortgage gold bonds | General corporate purposes | 6 | 99 | 6.10 |
| Metropolitan Power Co. (Pa.) | 3,250,000 | 30 | First mortgage gold bonds, series A | Construction | 6 | 96 | 6.30 |
| Total | $52,026,000 | | | | | | |

* Due annually.

## Supersystems for New York

**Two Zones, 25-Cycle and 60-Cycle, Will Probably Be Necessary in Interconnection Schemes**

THE plan outlined in considerable detail on page 741 of the ELECTRICAL WORLD for March 31 for interconnection of transmission systems in New York State and connection between New York State systems and those of other states was discussed at the recent Utica meeting of the Empire State Gas & Electric Association by E. P. Peck of the Utica Gas & Electric Company in the light of work done by a committee of the association just named. Mr. Peck said that there was no desire to try to force any recommendations the committee may make on any company, but only to make suggestions for future guidance when interconnection becomes an urgent question.

Owing to the large 25-cycle power system that exists in Niagara Falls and New York City, and because 60-cycle systems are used extensively in other parts of the state, it will probably be necessary in any plan of interconnection to divide the state into 25-cycle and 60-cycle zones. Niagara Falls could never be expected to change from 25 cycles to 60 cycles, because all its power development can be utilized locally and because the only help available to it is from the 25-cycle system across the river. The 25-cycle system in the metropolitan district will never be embarrassing because it is used almost exclusively for railways. For immediate needs it would be adequate to the purpose in view to construct 66,000-volt lines for the interchange of energy, but the towers should be designed for 110,000 volts with more distant requirements in view.

### LOAD-DISTRIBUTION COMMITTEE'S WORK

Considerable work has been done by the load-distribution committee in studying magnitude of loads in different centers, the distances between these loads and between generating stations, the distances between adjacent systems and the amount of power which may be required for interchange, and the most desirable voltage, Mr. Peck said. A map showing the results of this study, as well as systems in adjoining states with which it may be desirable to interconnect some day, is in preparation. The cost of making these interconnections is also being thoroughly studied.

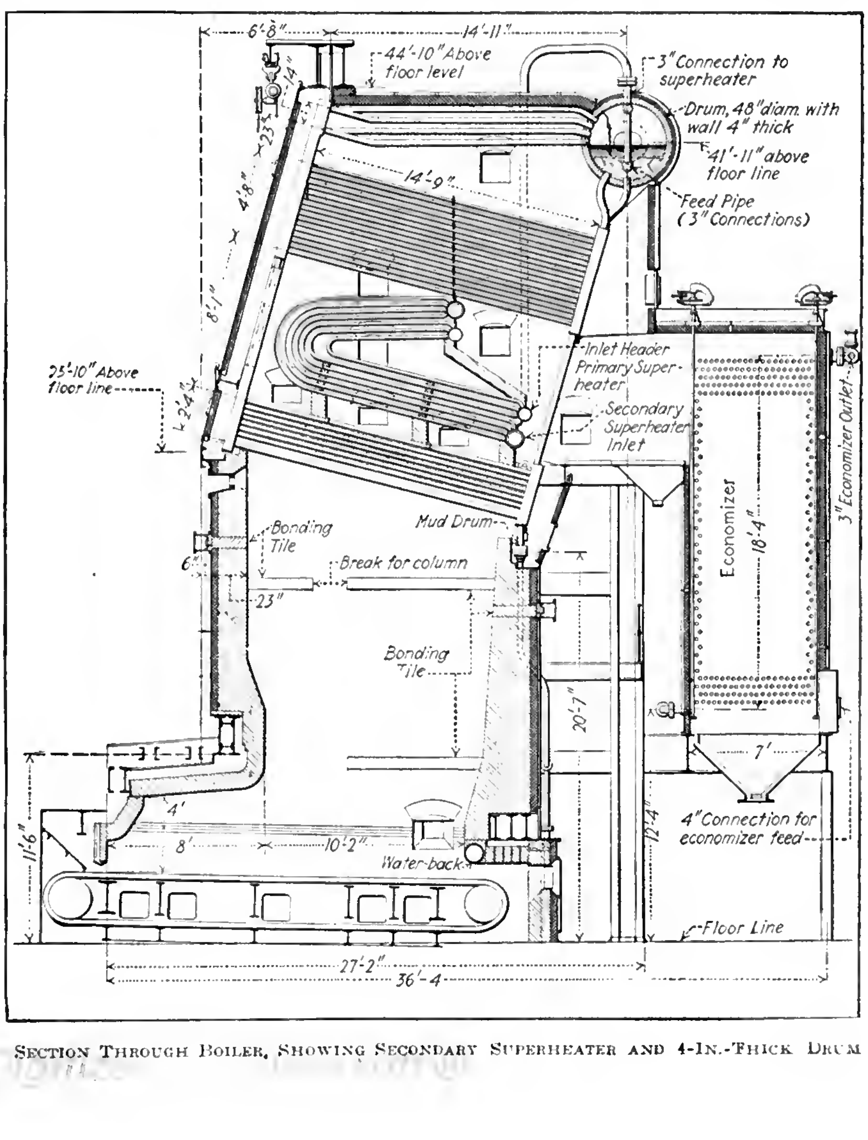
If interconnections are anticipated, declared Mr. Peck, the ultimate expense will be greatly reduced and interconnection hastened. With several sources of emergency supply, the small plants will benefit by interconnection through the assurance of more reliable service. Contrary to the usual impression, low-voltage ties can be used to exchange energy between distant companies without the equivalent transmission loss, because the company nearest the system which has surplus power can utilize that energy in its own system and transmit its power on to the next system and so on, thus relaying the energy to the company which is in need of power. Neither does the plan contemplate parallel operation. Only in emergencies will the companies be connected together. After the engineering problems have been solved and contractual relations settled by executives, the chief problem will be one of load dispatching or adjustment of frequencies and voltages. This problem will be minimized if a friendly spirit is stimulated among the various load dispatchers and their activities are co-ordinated. In its present construction work as well for the future the Utica Gas & Electric Company is planning for such interconnections, as are other companies.

## Commonwealth Edison Innovations

**Experimental Installation Using Steam at 1,200 Lb. Pressure to Be Made in Calumet Station—Design for Turbine Lay-out in Crawford Avenue Has Unusual Features**

AN EXPERIMENTAL installation of a boiler designed for an operating pressure of 1,200 lb. per square inch is to be made at the Calumet station of the Commonwealth Edison Company, Chicago. With it will be coupled a small extra-high-pressure turbine exhausting at 300 lb. pressure into the steam mains which supply the large turbines of the station. The turbine has not yet been ordered and the details of the system have not been completely worked out. The details of the boiler design, however, have been practically completed by the Babcock & Wilcox Company in conjunction with the consulting engineers of the Commonwealth Edison Company.

The unit will be of the inclined-header, cross-drum type and comprise a lower deck of 2-in. tubes in sections eight high, having a setting height of 25 ft. 9⅝ in., a primary and a secondary superheater in an interdeck space 8 ft. 1¼ in. between decks, an upper deck of seventeen-high sections of 2-in. tubes, horizontal 3¼-in. circulating tubes entering a 48-in. cross-drum, and a Babcock & Wilcox steel contraflow economizer. The lower deck will not be baffled, but the upper deck will have a vertical baffle, causing the gases to




SECTION THROUGH BOILER, SHOWING SECONDARY SUPERHEATER AND 4-IN.-THICK DRUM

make two passes. The complete unit is to be about 28 ft. wide and 36½ ft. deep, including the economizer, and 45 ft. high above the floor. The heating surfaces have not yet been definitely fixed, but they will be approximately as follows: Boiler, 15,750 sq.ft.; primary superheater, 2,120 sq.ft.; secondary superheater, 3,300 sq.ft.; economizer, 9,230 sq.ft.

The headers will have 1¼-in. thickness front and back and ⅝-in. sides, and are designed to give the tubes a stagger of nearly 4 in. The eight tubes in each section of the lower deck are to be expanded into nine-high headers, the tube space not filled being that next to the bottom. The mud drum is to be 7¼ in. square, 1 in. thick and extend through each side of the setting, with a flange for blow-off valves at each end.

The cross-drum is to be a forged-steel cylinder 48 in. in diameter and 4 in. thick, with integral drum heads, each with a manhole closed by a 12-in. x 16-in. manhole fitting. In order that the holes for connecting the circulating tubes to the drum may have the largest practicable ligaments between circumferential rows of holes, an unusual arrangement of connections has been adopted. At the top of each uptake header two horizontal circulators will be connected, but the circulators from each alternate header will be bent downward and sidewise so that they will be connected to the drum in the same circumferential row as the circulators without such bends. This will make the distance between these circumferential rows about 16 in.

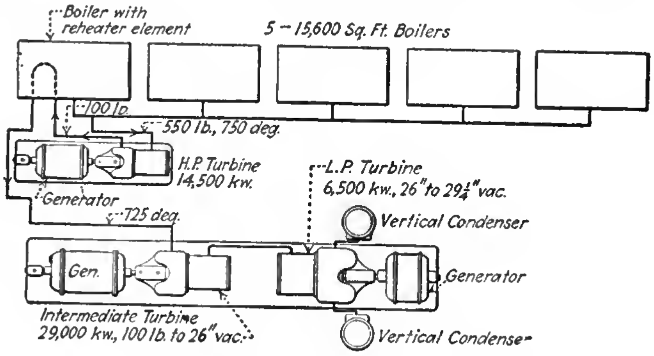
In the same way, the downtake nipples will not be straight, but bent so that two downtake headers will be connected to each of these circumferential rows of holes in the drum. The drum will have four 3-in. nozzles for safety valves, a 3-in. nozzle for the saturated-steam connection to the lower header of the primary superheater, and two 3-in. nozzles for connections to a feed pipe extending the length of the drum below the water line.

The primary superheater will have 8-in. headers drilled for three staggered rows of tube holes, with seventy-two tubes in each row. It is designed to raise the temperature of the steam under 1,200 lb. pressure to 750 deg. The secondary superheater has 11¾-in. headers drilled for four staggered rows of seventy-two tubes each. This secondary superheater incloses the primary superheater and is intended to raise the temperature of the exhaust from the extra-high-pressure turbine to 750 deg. The economizer will have forty-four rows of tubes.

## Arrangement of Parsons Turbine in Crawford Avenue

An unusual arrangement will characterize the 50,000-kw. unit which C. A. Parsons & Company of England are building for the new Crawford Avenue station of the Commonwealth Edison Company. This unit will consist of three turbines, a 14,500-kw. high-pressure element running at 1,800 r.p.m., a 29,000-kw. intermediate turbine running at 1,800 r.p.m. and a 6,500-kw. low-pressure turbine running at 720 r.p.m. Each will have its separate generator, but the intermediate and low-pressure turbines will be arranged in tandem on the same bedplate with the generators at either end.

Two other units, as previously stated in these columns, are already on order for this station, from the General Electric Company a 60,000-kw. cross-compound machine consisting of a high-pressure turbine running at 1,800 r.p.m. and a low-pressure turbine running at 1,200 r.p.m., each with its separate generator, and from the Westinghouse Electric & Manufacturing Company a cross-compound unit of 50,000-kw. capacity, consisting of a high-pressure turbine running at 1,800 r.p.m. and a low-pressure turbine at 1,200 r.p.m., each element with its own generator.*




ARRANGEMENT OF 50,000-KW. PARSONS UNIT

Instead of the usual arrangement all the turbines will be supplied with vertical condensers, two for each unit, these condensers standing alongside of the low-pressure cylinders. A steam pressure of 550 lb. and temperature of 750 deg. F. will be carried at the turbines. Provision will be made for reheating the steam at about 100 lb. pressure to a temperature of 725 deg. F.

The boilers for the Crawford Avenue plant will be of the Babcock & Wilcox high-pressure design, but will be built for a maximum working pressure of 650 lb. per sq.in. For each unit there will be five boilers, each with about 15,600 sq.ft. of steam-making surface, except that one boiler on each unit will be of special design and equipped with the interstage superheater.

*Adding the ratings of the three units under order by the Commonwealth Edison Company, a total of 160,000 kw. is found, which should be substituted for the 70,000 kva. given in the table on page 1231 of last week's issue. The figure given for Calumet—60,000 kva.—was also an underestimate, new equipment under order reaching 67,000 kw.

The Crawford Avenue station is being laid out for an ultimate rating of 500,000 kw. or possibly 600,000 kw.

## Electric Power Club Issues June Program

The program for the annual meeting of the Electric Power Club, to be held at The Homestead, Hot Springs, Va., on June 11-14, has just been issued. In addition to the section meetings and the usual reports from the officers and committees, C. L. Collens, 2d, will discuss the accomplishments of the Electrical Manufacturers' Council and tell what happened at the Geneva meeting of the International Electrotechnical Commission, A. M. MacCutcheon will deal with technical standardization, E. R. Harding with commercial standardization and A. H. Moore with Electrical Safety Conference activities. A. L. Ashby of the Westinghouse Electric & Manufacturing Company will make an address on "Contracts," and R. W. Gardner will speak on "Waste Prevention in Manufacturing."

At a dinner to be held on Tuesday evening F. M. Feiker of the McGraw-Hill Company will talk on "New Tasks for a Manufacturers' Association." Entertainment plans include golf tournaments, tennis, driving and riding, mountain climbing and dancing.

## Standardizing Pipe Joints

At an informal conference held in New York City last week between representatives of manufacturers and users of pipe flanges, engineers and others concerned, in the interest of standardization, a letter was read from C. F. Hirshfeld of the Detroit Edison Company, chairman of the prime movers committee of the National Electric Light Association, asking, on behalf of that association, that an agreement be reached for various pressures and temperatures covering allowable working stresses of different materials, gasket pressure, specifications for material and methods of testing, and the rational pressure for which standards should be specified.

Users of pipe fittings as well as manufacturers recommended that in standardizing fittings as few sizes be used as practicable. This means fewer patterns for the maker and fewer spare parts for the power plants. New standards appeared desirable. A method of reducing the number of standard fittings strongly advocated was to standardize the outside diameter of pipe for a given size and vary the internal diameter to suit pressure conditions. This would make one, or possibly two, standard flange diameters possible, from 250 lb. to 1,200 lb.

A motion was passed that pressure standards of 250, 400, 600, 800 and 1,200 lb. be recommended. The need of haste was emphasized, as in some cases fittings for 600 lb. and higher were being made with no official standards to follow.

## Electric Truck Show Will Be Held Convention Week

New York's annual electric truck show will be held in the Irving Place showroom of the New York Edison Company from June 2 to 9. More than twenty manufacturers of trucks and accessories have accepted the company's invitation to exhibit. A newcomer will be the Autocar Company. This company has just added an electric model to its line which will be exhibited for the first time at the truck show.

In the accessory exhibits will be shown new charging apparatus, which, according to Charles R. Skinner, Jr., manager of the automobile bureau of the New York Edison Company, will make the charging of electric truck batteries as simple a matter as connecting an electric flatiron.

An electric truck session forming part of the N. E. L. A. convention will be held at the Commodore Hotel on Monday afternoon, June 4. Among the speakers announced are E. S. Mansfield of Boston, who will report for the electric vehicle school committee; Charles S. Morris, past-president of the National Furniture Warehouse Association; Col. John Stilwell, general superintendent of transportation, Consolidated Gas Company, and William Van C. Brant of the Electric Storage Battery Company.

## Progress of Electric Arc Welding

At a recent meeting of the electric arc welding committee of the American Bureau of Welding, the sub-committee on arc welding of cast iron gave a description of hardness tests which had just been completed. These tests, carried out in accordance with a pre-arranged program, indicated that the hard zone exists in the cast iron near the junction line, not in the deposited metal.

The arc welding of non-ferrous metals was discussed, and a sub-committee with O. H. Eschholz of the Westinghouse Electric & Manufacturing Company as chairman was appointed to prepare a summary of the art to date and lay out a program of research. Specimens are to be welded by various companies and sent to Union College, Schenectady, for test.

Harold Ewertz was appointed to collect data and prepare a summary on the subject of the speed of welding and its effect on the weld. No definite program of investigation of the arc welding of thin-sheet metal was laid out, but R. E. Wagner was appointed to collect such data as could be obtained.

The subject of the application of arc welding to structural steel work was discussed, and it was decided that test specimens would be prepared by several welding companies and tested if possible at Union College. Specifications for these tests are to be prepared under the direction of H. M. Hobart.

# Brief News Notes

**Large Bushing for City of Seattle.**—The accompanying photograph shows what is probably the largest roof bushing ever manufactured. It weighs 2,600 lb., has an over-all length of, roughly, 17 ft. and is designed for a normal voltage of 187,000. It is one of four built by the Westinghouse Electric & Manufacturing Company for the Skagit River development of the city of

Seattle. Three of the bushings will be used for connecting a 165,000-volt bus line with a bank of three 10,000-kva., single-phase transformers, and the fourth will be used as a spare.

**Tirso River Reservoir Completed.**—Consul Russell reports from Rome that the hydro-electric reservoir on the Tirso River in Sardinia is completed and is now being filled. This artificial body of water will have an area of 19.305 square miles and will contain 460,000,000 cu.m. of water. It is calculated that this storage will produce 50,000,000 kw.-hr. of electrical energy for industries and will irrigate 74,000 acres of land.

**Insulator Tests at Purdue University.**—On May 15 and 16 insulator tests were carried out in the high-voltage laboratory of Purdue University, Lafayette, Ind., under the direction of Prof. C. F. Harding, head of the electrical engineering department. These tests were witnessed by engineers from Pittsburgh and New York City and also by Prof. H. B. Smith, head of the department of electrical engineering at Worcester Polytechnic Institute.

**Radio Monopoly in Great Britain Unpopular.**—The broadcasting monopoly in Great Britain has become so irksome to the public that a change of policy would cause no surprise, say recent advices reaching this country, particularly since the new Postmaster-General is apparently not in full sympathy with the plan. The control has been far from complete as evasions are known to be many. It is estimated that there are fully two hundred thousand unlicensed receiving sets in the British Isles.

**Bristow, Okla., Increasing Capacity.**—Owing to rapid increase in load, the Bristow substation of the Oklahoma Gas & Electric Company will again be enlarged. Three transformers rated at 500 kw. will replace others of 200-kw. capacity. This will require a rebuilding of the high-tension line now feeding the locality. The new line will have a voltage of 63,000. Three years ago the capacity of this substation consisted of three 75-kw. transformers, which served 340 consumers. The number of consumers is now 1,400.

**Fifty Iowa Cities Abandon Municipal Ownership.** — Fifty Iowa cities and towns which formerly had municipal electric lighting plants have abandoned them and are receiving their electrical energy from privately operated companies, according to records compiled by the Iowa Committee on Public Utility Information. There are fifty-eight cities and towns which have municipally owned distributing systems but which buy their energy wholesale from the lines of privately owned companies or from other towns, which have municipal lighting plants.

**Development on the Rio Grande.**—The Colorado and New Mexico Legislatures passed laws at their recent sessions authorizing the formation of a joint state commission to draft a compact between the two states relative to the use of water from the Rio Grande River. Governor Sweet of Colorado has appointed Delph E. Carpenter as the commissioner from Colorado. Mr. Carpenter favors the removal of embargoes placed on the use of the river water by the Department of the Interior to assure the rights of federal reclamation projects to the south.

**For Better Lighting in Mountain States.**—The local branch of the Association of Electragists International has established a lighting service bureau with headquarters at the office of the Rocky Mountain Electrical Co-operative League to promote better understanding and application of the best practice in lighting. The members of the bureau staff are E. A. Evans of the Westinghouse Lamp Company, Ernest L. Dee of the Edison Lamp Works and S. S. Stevens, representing the Bryan-Marsh Division of the National Lamp Works.

**New Library for Franklin Hall.**—The Electrical Engineering College of Cornell University has just been equipped with a library for the use of the students as a memorial to the late Prof. Alexander Gray, formerly its head. The McGraw-Hill Book Company purchased the books of Professor Gray after his death and gave them to the college. Along with this gift the company gave a copy of each of the tech-

nical books that it publishes. A classroom in Franklin Hall has now been set aside for their proper arrangement and access.

**Twelve-Hundred-Foot Submarine Cable Laid in Seven Minutes.**—The Northwestern Electric Company of Portland, Ore., recently laid a 1,200-ft., 250,000-circ.mil, 13,200-volt submarine cable across the Willamette River at Portland in the remarkable time of seven minutes. This was accomplished by laying one length of cable in a figure eight on the barge and splicing to this another length on a reel before the cable-laying operation was started. It was found preferable to use two tugs instead of one where the current of the river is swift because of the greater ease in controlling the barge.

**Electrical Spectacle Planned for Denver Exposition.**—Members of the electrical industry in Denver have taken preliminary steps to arrange for a spectacular electrical display at the "Pageant of Progress" to be held in that city in July and have called into consultation William D'Arcy Ryan, head of the illuminating laboratories of the General Electric Company. The Denver Electrical Co-operative League will handle the electrical end of the pageant, and all of the electrical men in the city will work through the league. The plans at present call for an iridescent color scheme of illumination throughout the exposition grounds.

**North American Company to Control Wisconsin Utility.**—The North American Company of New York has purchased nearly all of the capital stock of the Wisconsin Traction, Light, Heat & Power Company, which furnishes electric light and power, street-railway, interurban and gas service in the cities of Neenah, Menasha, New London, Bear Creek and Appleton, Wis. Most of the capital stock of the Wisconsin utility has been held by John I. Beggs and associated Milwaukee capitalists. No information was given out as to the price paid. No change in the management or operation of the property will result from the transfer.

**Northwestern Electric Company to Install Large Motor-Generator Set.**—An order has just been placed by the Northwestern Electric Company of Portland, Ore., for a 2,500-kw. motor-generator set consisting of one 3,600-hp., 11,000-volt, three-phase synchronous motor, directly connected to two 1,250-kw., 275-volt direct-current generators. The unit will operate at 720 r.p.m. It will be installed in the company's Pittock substation and will bring the total direct-current generating capacity up to 7,000 kw. The new machine is being built by the Westinghouse Electric & Manufacturing Company and will be, it is said, the largest motor-generator set of its kind on the Pacific Coast.

**Rural Service Projected by Tucson Company.**—A tentative offer to finance the construction of a hydro-electric power line that will bring cheap energy to the farming districts of Pima County, Ariz., and to sell the farmers power at 2½ cents per kilowatt-hour, has been made by the Federal Light & Traction Company of New York, parent company of the Tucson Gas, Electric Light & Traction Company. In making this proposal the president of the Federal company asserts that the company has no desire to make more than a fair return on an investment of this character, realizing the indirect benefit that will accrue to its city business by the greater development of agriculture in the neighborhood of Tucson.

**Contest Over Ownership of Former Municipal Plant in Indiana Town.**—A vigorously waged three-cornered utility contest is awaiting final decision from the Indiana Public Service Commission. Cambridge City (Ind.) voters decided recently that the municipal electric plant should be sold for private operation and at a public sale Robert Ashe bid $10 more than the Interstate Public Service Company. The city accepted Ashe's bid, and the transaction has come before the commission for approval, the Interstate filing a petition for a certificate of convenience and necessity with the commission and asking the right to intervene. The commission indicated that it would rule the Interstate had no right to intervene, but reserved decision on the question of which applicant should have the property.

**Holyoke Will Rebuild Municipal Plant.**—The Holyoke (Mass.) Gas & Electric Commission has decided to rebuild the municipal electric plant on its present site and abandon for the time being the project of a new site and a larger plant, for which a million-dollar bond issue was considered. The alternative plan of continuing the municipal plant at its present capacity and buying additional energy from the Holyoke Water Power Company or some other source did not command strong support. It is estimated that the arrangement decided on will take care of the department's business for the next five years. The commission has voted to accept the Holyoke Water Power Company's offer of a permanent connection between its plant and the city's. New waterwheels and turbines will be installed to meet the requirements of the department.

**Milwaukee Company Seeks to Acquire Waukesha Utility.**—The Wisconsin Gas & Electric Company, Racine, a subsidiary of the Milwaukee Electric Railway & Light Company, has applied to the Wisconsin Railroad Commission for authority to issue $400,000 of serial notes for the purpose of paying in part the purchase price of the electric and gas plants of the Waukesha Gas & Electric Company, which furnishes electricity for light and power purposes to a population of nearly 13,000. The plants of the company are about 25 miles from Milwaukee and 35 miles from Racine. At present the output of the steam plant of the Waukesha company is supplemented by energy from a high-tension transmission line from the Lakeside plant of the Milwaukee company. The Waukesha Gas & Electric Company is owned by the American Gas Company of Philadelphia.

# Associations and Societies

**Canadian Electrical Association.**—This association will hold its annual meeting in Montreal on June 21-23, and the convention committee announces an original feature in the shape of a "veterans' night," to be held on the evening of June 22. The minimum qualification for participation is twenty years in the electrical industry, but with this limitation a widespread invitation is extended to pioneers everywhere and many acceptances have already been received.

**Chicago Section, A. I. E. E.**—The development of vacuum tubes in power service was discussed on May 21 by Dr. A. W. Hull, General Electric Company, before a joint meeting of the Western Society of Engineers and the Chicago Section, A. I. E. E. He dwelt upon the fundamental characteristics of vacuum tubes, which he explained with slides. Dr. Hull also spoke of the 1,000-kw. power tube, but declared that some time would elapse before this tube could be standardized sufficiently to warrant its manufacture.

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### Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

North Central Division, N. E. L. A.—Minneapolis, June 20-22. H. E. Young, Minneapolis General Electric Company.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association—Montreal, June 21-23. Louis Kon, 65 McGill College Ave., Montreal.

American Institute of Electrical Engineers—Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Iowa Section, N. E. L. A.—Mason City, June 26-29. M. A. Linn, Des Moines Electric Co., Des Moines.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association—Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Michigan Electric Light Association—Grand Rapids, Sept. 11-13. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

# Recent Court Decisions

**Powers of Tennessee Commission.**—The United States District Court for the Middle Division of Tennessee has held, in Cumberland Telephone & Telegraph Company vs. Railroad and Public Utilities Commission of Tennessee, that an order of the commission suspending increased rates for an indefinite period until the commission should determine the matter was invalid in so far as it suspended the rates for an indefinite period that might continue more than three months after the effective date of the increased rates, but was valid in so far as it suspended the increased rates for such three months' period. Where existing rates asserted by a public utility to be confiscatory have not been imposed on it by any act of the commission, but were voluntarily established by the utility itself with the approval of the commission, and the utility gives notice of an increase in rates, enforcement of an order of the commission suspending the increased rate pending a reasonable period of investigation will not be enjoined on the ground that the existing rates are confiscatory and in conflict with the United States Constitution. (281 Fed. 406.)*

**Three-Year Contract Between Utility and Consumer in Oklahoma Invalid and Cannot Be Validated by Commission.**—In Southern Oil Corporation vs. Yale Natural Gas Company the Supreme Court of Oklahoma has declared invalid a three-year contract by which the defendant agreed to sell and deliver its product at a specified rate to the plaintiff. The court found that rates so fixed were binding on neither party, the Corporation Commission having been established to determine rates of all public utilities, and that the commission could fix a different rate at any time. The fact that when the contract was first brought before the commission that body held that it did not establish discrimination, as claimed at that time by the oil corporation, was not tantamount to approval of the three-year rate by the commission, and its more recent order establishing a higher rate did not impair the obligation of a contract. The Corporation Commission, moreover, was not vested with the power to approve contracts, but was charged with the duty of fixing and establishing rates in the manner provided by law. (214 Pac. 131.)

**City Cannot by Inaction Continue Confiscatory Rates at Its Pleasure.**—In City of Wagner vs. South Dakota Light & Power Company the Supreme Court of South Dakota was called on to adjudicate an action for injunction brought by the plaintiff city against the defendant public service corporation to prevent it from charging rates for electricity in excess of the maximum rates specified in its franchise. The company, finding itself unable to continue service at existing rates without loss, sought permission to increase its charges, which was granted by all the cities on its lines except Wagner. That city did not controvert the company's assertion that it must have an increase in rates or discontinue its business. The Supreme Court sustained the Circuit Court in dissolving a temporary injunction obtained by the city, saying: "The issue on that question is simple. On the part of plaintiff we have the presumption that the franchise rates are reasonable. On the part of defendant we have the undisputed showing that they are unreasonable and confiscatory. A presumption cannot stand against such showing. The city contends that the franchise rates must be continued unless and until it changes them regardless of whether they are or are not confiscatory. Such is not the law. The city cannot by inaction and by refusal to adopt reasonable rates continue confiscatory rates in effect at its pleasure, and it matters not whether the question arises in an action brought by the city or in an action brought by the public service company." (193 N. W. 129.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**Municipal Tax on Poles Condemned.**—An ordinance imposing upon a telephone utility a charge for each pole maintained in the streets of a city was declared by the Indiana Public Service Commission to be unlawful, unreasonable and void, in an instance where a municipality sought to impose such a tax on the Citizens' Independent Telephone Company. In addition to holding that the municipality had no power to impose such a burden the commission said: "It cannot be said that the question is of no moment because the taxes go to the municipality and the service is rendered to the people who live in the city, for the reason that the taxpaying public is a separate and distinct unit from the utility-using public receiving service from the petitioner. There are some taxpayers who are not patrons of the petitioner, and there are large taxpayers receiving only a small amount of service, and there are small taxpayers receiving a large amount of service from the utility. To permit a charge or tax of this kind would be to lift a burden which has been fixed by law upon the taxpaying public of the city and to place it upon the patrons of the petitioner, because such added burden would necessarily be reflected in the rates to be charged by petitioner. Before the days of regulation, when cities and towns had the absolute power to grant or refuse franchises, it was possible to affix to a franchise hard conditions which the utility must meet or be banished from the city or town, and these conditions were binding, not on the ground of regulation but on the basis of contract. When the franchise has been surrendered the conditions attached go out with the franchise and are no longer binding upon the utility."

**Steam-Heating Service from Electric Plant.**—Combating the prevailing opinion that the furnishing of central-station steam-heating service in conjunction with the generation of electric power is a function which involves practically no effort or expense on behalf of a central-station operator, and that such use of steam represents a use of something that would otherwise be wasted, the Public Utilities Commission of Michigan said, in fixing steam-heating rates for the Lapeer Gas-Electric Company: "The value and desirability of central-station steam heating does not develop from its cheapness, but from relieving the customer from the necessity of worrying over his coal supply, the stoking of his furnace, the removal of his ashes and the dirt and discomfort caused to him, his family or patrons by the presence of the individual heating plant in his residence or place of business. When accurate or approximate money values are placed on these various benefits, it is usually found that the central-station service is as cheap as, or cheaper than, isolated heating service with its attendant worries and discomforts. The electric power generating plant at Lapeer is a thoroughly modern installation of medium-pressure, high-speed engines operated condensing. Such operation secures nearly the greatest possible efficiency from the coal burned under the boilers that can be secured in a plant of such size. During the heating season, however, the condensing feature of the generating plant must be sacrificed in order to obtain steam at sufficient pressure to supply the heating customers. In sacrificing the condensing feature of operation the amount of coal required per kilowatt-hour of power generated is substantially increased, and the cost of generating the electric power is increased correspondingly. An analysis of the operating results during the various seasons of the year indicates that almost one-third of the coal consumed at Lapeer is consumed for the purpose of providing steam for the heating service. In other words, if no heating service were furnished, one-third less coal would be needed than actually has been consumed in the past years. In addition, boiler-house labor must necessarily be higher with this steam-heating coal to be handled than would be required to handle electric generation only. . . . Probably the total collections from heating customers have been less than the fair and reasonable expenditures necessary in rendering the service. The resulting deficit has been borne by the lighting and power customers, many of whom are not heating customers."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## Julian C. Smith Heads Quebec Company

Julian C. Smith, who has been elected president of the Quebec Railway, Light, Heat & Power Company, as was announced in the May 26 issue of the ELECTRICAL WORLD, has been a prominent figure in Canadian hydro-electric developments during the past few years. Besides occupying the chief executive office of the Quebec company, Mr. Smith is vice-president and general manager of the Shawinigan Water & Power Company of Montreal, president

International Press Service
J. C. SMITH

of the Public Service Corporation, Quebec; president of the Canada Carbide Company, vice-president of the Dominion Engineering Works, Ltd.; director of the Dominion Bridge Company and president of the Canadian Electro-Products Company and North Shore Power Company, Three Rivers, Quebec.

Mr. Smith was born in Elmira, N. Y., in 1878 and was graduated from Cornell University in 1900. He began his business career as draftsman with Wallace C. Johnson, consulting engineer at Niagara Falls, N. Y., and later went to Shawinigan Falls, Quebec, as assistant engineer to Mr. Johnson. In 1903 he allied himself with the Shawinigan Water & Power Company as superintendent and three years later was advanced to general superintendent. Subsequently he became general superintendent and chief engineer, and in 1913 he was made vice-president. At present, in addition to his position as vice-president and general manager of the Shawinigan company, he is executive of all subsidiary companies. Mr. Smith has taken an active interest in engineering societies—American, Canadian and British—and has made many important contributions to technical literature. Interests which are identified with the Shawinigan company have recently acquired control of the Quebec company. Several of the old directors of the latter resigned, and their places were filled by officials representing the Shawinigan company. .

**E. W. Robinson**, formerly assistant chief engineer of the E. W. Clarke & Company Management Corporation at Columbus, Ohio, has joined the Alabama Power Company, Birmingham, in the capacity of assistant superintendent of distribution.

**A. H. Kendall**, master mechanic of the Quebec district of the Canadian Pacific Railway, has resigned to become manager of the Chicoutimi Pulp Company, the Saguenay Light & Power Company and the Roberval & Saguenay Railway Company, Chicoutimi, Que.

**Frederick H. Hill**, vice-president and general manager of the Elmira Water, Light & Railroad Company, completed ten years of service with the company on May 12, when he was presented by his associates with a silver service. Three hundred employees attended the dinner which preceded the presentation.

**N. I. Garrison**, manager of the El Reno division of the Oklahoma Gas & Electric Company, has been appointed manager of the southern division of the company, with headquarters at Ada, Okla. J. T. Naylon, from the commercial department of the Oklahoma City division, succeeds Mr. Garrison as manager at El Reno.

**John T. Sharp, Jr.**, for several years superintendent of the Canton (Miss.) Light & Water Works Plant, tendered his resignation on May 1 to take effect as soon after May 15 as possible to accept a position as manager of the Helena (Ark.) Gas & Electric Company. The Helena property is owned by the Arkansas Utilities Company.

**F. F. Winfree**, electrical engineer at the head offices of the Mountain States Power Company, Albany, Ore., has assumed control of the Eugene office. Mr. Winfree is taking the place of Fred Brown, who leaves for Tacoma, Wash., and will be stationed in Eugene only until a resident engineer can be obtained to take charge of the company's properties in Lane County.

**W. H. Damon** of Madison nas been appointed to succeed E. J. Steinberg, whose resignation became effective June 1, as resident engineer in Milwaukee for the Wisconsin Railroad Commission. Mr. Damon has been with the Railroad Commission for approximately ten years and served as resident inspector in both the Eau Claire and Appleton districts prior to his promotion to his present position at Madison. His work in Milwaukee will consist largely of investigations of the service of the electric, street-railway, gas and telephone utilities.

## Eugene B. Criddle Vice-President Southern Sierras

Eugene B. Criddle, who was made a vice-president of the Southern Sierras Power Company at a recent meeting of the board of directors, as was announced in the May 5 issue of the ELECTRICAL WORLD, entered the public utility field in 1911, when he became associated with the Nevada-California Power Company and the Southern Sierras Power Company. After serving as manager of the northern district for two years he was made general agent of these companies with headquarters at Riverside, Cal. He con-

E. B. CRIDDLE

tinued in this capacity until the promotion just referred to. Before engaging in utility work Mr. Criddle spent some time in managerial positions with industrial concerns and gained an extensive training in drafting, railroad rate making and shop work.

**H. W. Watt**, electrical engineer of the Westchester Lighting Company, Mount Vernon, N. Y., was elected vice-chairman of the electrical section of the Empire State Gas & Electric Association at its meeting in Utica on May 18. He had previously been chairman of the overhead-distribution committee. Mr. Watt has been connected with the Westchester company for about fifteen years.

**Frank D. Fagan**, vice-president and general manager of the Edison Storage Battery Company for the past three years, has been selected to go on a special mission to Japan for the International General Electric Company. Mr. Fagan has risen from the ranks of the General Electric Company and is the originator of many remarkable ideas in connection with the sale of incandescent lamps. He sailed on May 17.

### Eric A. Lof Leaves Schenectady

Eric A. Lof, who since 1909 has been connected with the power and mining engineering department of the General Electric Company as industrial engineer and specialist, has resigned to take up work with the American Cyanamid Company, one of the Duke interests. He will have important tasks in connection with the electrochemical projects that form part of the large water-power developments now in progress on the Saguenay River above Quebec, Canada. His headquarters are in New York City, and he assumed his new duties on June 1.

Mr. Lof became associated with the General Electric Company in 1909 when the power-apparatus section of the Western Electric Company, with which he was connected, was taken over by the first-named company. He spent several months in Europe two years ago for the International General Electric Company, partly in connection with the extensive power transmission and railway electrification projects in Sweden and Norway. About a year ago the Royal Order of Vasa was conferred on him by the King of Sweden in recognition of services rendered to the Swedish government. He is well known to the engineering profession through his many contributions to the technical press, his frequent lectures on various subjects and as the author of several books.

**P. T. Sealey**, formerly superintendent of power for the Potomac Public Service Company, Hagerstown, Md., is now superintendent of the Southern Utilities Company, Palatka, Fla.

**Jason C. Leighton** of the Boston office of Stone & Webster, Inc., has been made vice-president of the El Paso (Tex.) Electric Company to succeed Donald C. Jewett.

**C. E. Brenton** has been appointed general manager of the Missouri Public Utilities Company, St. Louis, having charge of the operations of the properties which have been leased to the Union Electric Light & Power Company of the same city.

**Walter Byrne**, who has been sales manager of the Nebraska Power Company since 1919, has resigned to become assistant treasurer of the Thomas Kilpatrick Company. Kenneth Goewey, who has been closely associated with Mr. Byrne in the sales department, has succeeded him as sales manager. Mr. Goewey joined the Nebraska Power Company in 1917 as a heating specialist from the research laboratories of the General Electric Company. Previous to his association with that company he was with the Milwaukee Electric Railway & Light Company.

**L. L. Price**, who for the past three years has been manager of the gas and electric appliance department of the Winnipeg (Manitoba) Electric Railway Company, has just been appointed superintendent of distribution and sales, including the sale of all by-products. While this new position involves large responsibility, Mr. Price will still maintain charge of the appliance department. He is well qualified for the responsibilities of his new office, having had seventeen years' practical experience in utility accounting, office management, shop, distribution and merchandising of gas and electric appliances.

### J. H. Gill Heads Southern Association

Joe H. Gill, who was elected president of the Southwestern Public Service Association on May 17 at the annual convention of the association at Fort Worth, Tex., is assistant general manager of the Dallas Power & Light Company and is one of the younger men in Texas who have risen rapidly in the electrical industry. Mr. Gill was born at Kerrville, Tex., in 1886 and was graduated from the University of Texas in 1910 with the degree of electrical engineer. After receiving his degree from the university he joined the forces of the General Electric Company at Schenectady, N. Y., and remained with this company until 1912. Subsequently he allied himself with the Texas Power & Light Company of Dallas, where he served first as resident engineer in charge of transmission-line and distribution-line construction and later as supervisor of transmission lines in entire charge of all construction of this character undertaken by the company.

J. H. GILL

Mr. Gill was with Stone & Webster from October, 1917, to April, 1918, as electrical engineer on design of the American ordnance base depot in France, and in April, 1918, he enlisted in the United States Army. When his service was over he returned to Dallas, entering the employ of the Dallas Power & Light Company as power salesman on Feb. 1, 1919. He has been successively power salesman, chief engineer and assistant to the general manager and is at present assistant general manager. Mr. Gill is a member of the University Club and of the Technical Club of Dallas and president of the Electrical Club.

**R. A. Haigh** has been appointed sales manager of the Paducah (Ky.) Electric Company to fill the vacancy resulting from the transfer of R. A. Gordon to Pawtucket, R. I.

**M. H. Hallenbeck**, for the past six years a power engineer specializing in applications of electricity to the paper industry on the staff of the Westinghouse Electric & Manufacturing Company at East Pittsburgh and Boston, has opened offices as consulting engineer in the latter city.

**Elbert G. Allen**, formerly chief engineer of the Philadelphia Rapid Transit Company, is now in the Boston office of Stone & Webster, Inc., as consulting engineer. Mr. Allen returns to the Stone & Webster organization after about twenty years of service in its engineering activities, embracing electrical interests in many parts of the country.

**Henry C. Peeples**, formerly with the Puget Sound Power & Light Company and for several years attached to the engineering department of the Stone & Webster division of construction and engineering, and until recently connected with the Wenatchee extension, has gone to Indianapolis, where he will be engaged on the construction of a 75-mile steel-tower line between Indianapolis and Terre Haute.

## Obituary

**Charles Sigel, Jr.**, of the Nevada-California Electric Company and president of the Sigel Manufacturing Company of Denver, is dead, aged seventy-eight. Mr. Sigel was born in Hamburg, N. Y., and was for many years in the leather industry there.

**Edwin F. Davis**, formerly state electrician for twenty-five years and co-inventor of the Sing Sing electric chair with Harry L. Tyler of New York, died at his home in Corning, N. Y., on Saturday, May 26. Mr. Davis retired five years ago to return to his home in Corning.

**William Jones**, who had been a director of the Pacific Power & Light Company since its organization in 1910, died recently at his home on American Lake, near Tacoma, Wash. Mr. Jones was also president of the Cordova (Alaska) Light & Power Company and had been connected with a number of other companies. He was born in Stratford, Ontario, and was sixty-eight years of age.

**Dr. Hans Goldschmidt**, inventor of the Thermit process for welding iron and steel and for producing high-grade metals and alloys and originator of many other scientific inventions, died suddenly in Baden-Baden, Germany, on May 20, after a stroke. Dr. Goldschmidt visited this country frequently and was president of the Goldschmidt Thermit Company, now the Metal & Thermit Corporation, from 1904 to 1916.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Action Needed to Prevent More Inflation

### A Discussion of the Dangerous Drift of Advancing Prices—An Appeal for Active Propaganda to Safeguard Our Industry

By J. H. Fall, Jr.
Treasurer Benjamin Electric Manufacturing Company, Chicago

THE time apparently has come when manufacturers in the electrical and other industries should seriously consider and discuss what steps may be taken to nurture the widespread business activity now in existence. It is also imperative that steps be taken to initiate propaganda, so that in the event of a reaction setting in we may head off a repetition of the disastrous losses manufacturers were forced to assume by reason of wild cancellations in 1920 and 1921 respectively.

#### General Conditions Are Unsatisfactory

Renewed activity has brought with it increased expense of manufacture, which of necessity has forced the price of goods up. But in my judgment the advances in many lines have been too rapid and more than expense conditions warranted, and as a result the price level at the present time is on a basis which the most conservative thinkers regard as a secondary period of inflation.

As far as it is possible to analyze the general condition, stocks of material in the hands of distributors are light, for the reason that manufacturers had no large stock of finished goods on hand when the present activity started. Therefore orders accumulated more rapidly than it was possible to manufacture and deliver.

This has reacted in all directions, resulting in congestion, a situation not unlike that obtaining in the spring of 1920. For it will be remembered that in the fall of that year, when the bubble burst, manufacturers not only had tremendous amounts of money tied up in goods in process of manufacture, but in addition thereto were committed to the purchase of material several months ahead against accumulated orders on hand.

Almost over night a great mass of buyers apparently lost all sense of moral responsibility, cancellations became rampant, prices tumbled, manufacturers were forced to assume terrific losses. And all of this could have been in large measure avoided if each buyer had been willing to assume his particular responsibility.

A repetition of this situation should not again be permitted by manufacturers in the event that another reaction sets in from the present nation-wide activity. Yet one will almost certainly be precipitated unless the large and basic corporations which have been so boldly announcing wage and price advances face about and change their policy by contributing something constructive to prevent prices from going higher and if possible stabilize them where they are.

#### Price Advances Dangerous

It is the opinion of the largest bankers and of the ablest leaders in the electrical industry that this price advance has been entirely too rapid and has become obnoxious. The steel corporation a few weeks ago made an announcement through the public press of a wage advance. This was followed by the packers and other basic industries with price advances in one form or another. These mean just further contributions to the vicious circle of wages followed by price advance, all of which, if something is not done, may result in the end in another smash similar to that of 1920.

What these people hope to gain heaven only knows, for we, their customers, do not. We do know this, however, that signs of hesitancy on the part of buyers are already appearing and appearing rapidly, and unless this policy is changed and prices are held at April 1 levels, we are all riding for a fall, and with it will be accomplished the death of "the goose that lays the golden egg."

I believe in all earnestness that the business men of America should register an objection to such price advances and appeal for a general announcement from manufacturers of these basic products that prices will remain firm at the April 1 level with no advance or decline contemplated for the rest of 1923.

In our judgment, this will contribute more toward a steadying of the present uncertainty than anything else. The General Electric Company recently reduced the price of some of its products 10 per cent as a contributing effort along this line.

#### Propaganda Needed

In so far as the electrical industry is concerned the writer feels that propaganda should be initiated over the signature of the Associated Manufacturers of Electrical Supplies as an organization to build public confidence that further price advances need not be feared and to impress upon manufacturers that every effort will be made to stabilize prices and that no orders will be accepted subject to cancellation.

Customers should be notified and articles should appear in the various trade journals advising buyers of electrical material that cancellations should not and will not be accepted by electrical manufacturers, as was the case in 1920, without proper indemnity against loss. This should include depreciation in the price of materials on hand or in process of manufacture and yet undelivered which have been purchased in good faith by manufacturers against orders on hand.

If this vicious circle of advance is permitted to go ahead unchecked, there can be only one result, a smash-up with a period of depression following. Surely, therefore, it is worth while making every possible effort to prevent it, and I believe that if propaganda along the general lines suggested above could be "put across" to every dealer, wholesaler and retailer alike, it would be

an exceedingly wholesome thing. The consumer would understand clearly, when a purchase was made, that the goods would have to be taken, the dealer in buying from his jobber would clearly understand the same thing, as would also the jobber with respect to purchases made from the manufacturer. In a nutshell the whole thought in the matter is simply this, that if manufacturers are to be saved from tremendous losses, in the event of another depression, it should be guarded against now by organized propaganda, which should be steadily supported by all manufacturers until the danger mark has been passed.

## Who Should Pay the Cost of Improvement?

**A Discussion of the Question Whether Code Changes Should Be Postponed to Suit the Convenience of the Manufacturer**

BY KASSANDRA

WHENEVER an improvement or an invention is made there are two sets of costs involved. The first and most obvious is the labor of the inventor and of the people who develop the improvement and put it in use. These costs, of course, are paid by the people who use the improvement. It would not be an improvement unless it could be sold at a price such as to pay these costs, or rather no one would work to make an improvement unless he anticipated that he could collect his costs from the user and that the latter would most willingly pay them out of the savings effected as compared with the old methods.

In addition to these obvious costs of making an improvement, there is another set of costs—those involved in scrapping the goods or material made under the old methods. When railroads were introduced stagecoaches became of less value. When turbines came into use the value of reciprocating engines decreased. When cloth came to be spun and woven by machinery the skill of the old hand workers did not earn the wages for them that it had formerly earned. These costs of an improvement are like growing pains. The community suffers from them, but it does not want to sit still and make no advance merely because improvements involve costs which in the beginning are an evil.

Now, there are two ways to handle these costs of the second class. One is the normal and ordinary way. Every one when building a machine or acquiring a trade understands that there is a certain risk, that the machine may become antiquated before it is worn out, and that it may even become antiquated before it is put into service. This is the ordinary risk of business just as if a man buys an automobile for a given price and later the manufacturer cuts that price. The man who bought some time ago at the higher price does not expect to be able to sell out at a price based on what he paid. He can sell only at a price based on the market.

If a man builds an office building when the prices of building material are high, and then later a competing office building is put up at low prices, the rents will be the same irrespective of the original cost. This is the normal and ordinary course in case of any change or improvement.

### PROGRESS NOT TO BE POSTPONED

Now, however, it is being suggested that in the case of certain changes and improvements—namely, those in the National Electrical Code—those who have stocks on hand should not only be allowed to dispose of these as they see fit, but, further, that no one should be allowed to use the improvements until the old and inferior stocks have been sold off without any competition from material conforming with the better methods. This would almost correspond to a suggestion that nobody should have been allowed to ride in railroads until the stage coaches had worn out.

The idea that the use of an improvement must be postponed merely for the benefit of the people who have made goods or have acquired skill under the old methods would seem to be a very dangerous one to put into effect. To do so would seem to put an entirely unfair burden on the user, who would like to use the improvement as soon as it is made. Why should he be asked to pay for all this cost, when the user who is willing to postpone buying for a few months is to have the full benefit of the improvement contemplated?

The municipal and other inspectors who pass on safety should not go outside of their province to determine who should and who should not pay the cost of improvements. Their province is merely the province of safety. The payment of costs should be left to the normal and natural course of business.

## Further Waste Inexcusable

**Experience Plus Jobbers' Cost Study Proves Importance of Discarding Excess Lines**

BY W. E. ROBERTSON

Robertson Cataract Electric Company, Buffalo, N. Y.

THE avenue of hope to realize a reasonable return on the investment in our branch of the industry lies in close analytical study of the possibility of reducing the excess varieties of stock now manufactured and carried. More real progress toward better conditions is to be found in that way than in any other single thing we can do.

The creation of demand for special shapes and sizes of articles that vary but slightly from generally accepted standards and the stocking of these articles, while questionable in the past, will be an inexcusable waste if continued in the future, now that we are realizing what it is costing the industry and the insignificant value of the service thus rendered. We have made one of the most exhaustive studies of this question that has ever been made in the history of the jobbing industry, and while this study was carried on in 1921 at the expense of the jobbers' association, it has been continued, for comparative purposes, at our own expense during 1922. We intend to give the benefit of these studies, and our conclusions, to the trade, and we intend as a matter of practice, so far as our company is concerned, either to eliminate from our stock the articles that are substantial duplicates of standard articles, and also to eliminate articles that are likely to become obsolete in a short time, or else to charge enough for articles of this kind to repay us amply for having them on our shelves to serve the occasional demand.

If we can neither eliminate nor get a satisfactory price for the articles we sell, we will eliminate the line in its entirety and confine our efforts to those things that will yield a profit, even if it takes us as far afield as the sale of spaghetti or shoestrings. We are not in business for our health, but to make a net profit on the investment intrusted to us, and we do not intend to ruin our health fighting impossible conditions, once we understand the facts.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

ORDERS to manufacturers are in more wholesome volume than three weeks ago, say several leading authorities, and general business of the industry has a more favorable outlook for the coming summer months than was the case a year ago. Business in small motors, appliances and wiring devices is much improved throughout the country. Lamp sales at the present time are known to be enormous.

Sales of transmission material are reported as only fair, owing to a lull started in the line extensions by utilities three weeks ago. Stocks of poles are plentiful in all parts of the country.

Wire and rigid conduit stocks are much improved, and there is little trouble being experienced in filling orders.

The fixture, radio, signal apparatus and transformer markets have shown a slight falling off during the past week.

## General Business Horizon Becomes Brighter

THE past week has brought about a change in sentiment in many lines of industries, and "more disposition has been shown in different quarters this week to stress the favorable aspects of the business situation," according to *Dun's Review*. "While commercial activities have lately abated, both production and consumption of goods continue to be of large volume in the aggregate," add the paper, "and the fact that speculative excesses are still being discouraged is considered reassuring.

"The prevailing policy now, as it has been for a long time past, is one of conservatism, and there has been plain evidence that the heavy transactions of recent months have been based mainly on actual requirements. Despite reports of some cancellations of contracts, no indication exists that this condition has developed generally, the bulk of the merchandise ordered being taken promptly by most purchasers. Returns of car loadings testify each week to the remarkable magnitude of the freight movement on the railroads, new maximums for the season being regularly established, and various other statistical measures show that operations remain on an active scale in many instances. With many needs already provided for, however, some contraction of new demand at present is not unnatural, and the approach of summer usually is accompanied by a slackening of work both in mercantile and industrial channels.

"In the building field, as at certain manufacturing centers, labor troubles have begun to impose restraint on progress and to restrict the public buying power. The backward weather, moreover, has prevented a full development of retail trade and signs of price concessions at the counters have not been lacking."

## Well-Sustained Demand for Control Apparatus in Varied Fields

ALTHOUGH inquiries for control apparatus have diminished slightly as compared with the peak business of March, manufacturers of this class of equipment are extremely busy filling orders and are receiving a very healthy volume of new trade. In the rubber-manufacturing industry business has been particularly good for control makers, and the printing industry has bulked large in recent requisitions. Late developments along the line of providing automatic control for certain processes in series in textile production have brought an increasing business to producers of electrical control equipment.

A revival of purchasing in the industrial electric truck, tractor and electric road-truck fields has led to the placing of numerous orders for charging panels and auxiliary apparatus, some of these running into scores of units. At the factories raw materials are being kept well in line with demands, labor is well employed and none too plentiful, and deliveries are keeping well ahead of motor shipments except where delays occur through the failure of buyers or their engineers to furnish the control-equipment maker with complete field data. Prices of control equipment now seem steady after a recent advance of 10 per cent in accord with the upward swing in motor prices.

## Conditions in Eastern Section Show Little Change

CONDITIONS in the Eastern section show little change in the electrical field during the past week, barring a tendency toward a reduced volume of business which is enabling jobbers and manufacturers to catch up somewhat on deliveries and to replenish low stocks. In most lines stocks are now in excellent volume and sizes are well assorted. Some difficulty is still reported in getting porcelain into this territory.

Recent shortages in rigid conduit are for the time being a thing of the past, and some jobbers are so well stocked that they are buying very conservatively. Less and less danger of inflation appears to be evident, and, on the other hand, opinions favor a continuance of good business for many months.

In the telephone field new construction is extremely active, and central-station extensions continue at a good pace. Labor troubles in the leather industry are causing some disquiet in this district, and some uncertainty surrounds the telephone labor situation, in view of the refusal of a New England company to grant increased wages and a seven-hour day at its operators' recent demand.

Machinery agents are handling an excellent volume of business; the electrical appliance trade is very active for this season, and house wiring is being done on a large scale.

## Wider Use of Electricity Is Shown in Japan

PROGRESS of electrification in business, industry and home in the Orient seems to be directly dependent upon the stability of government and the faith in the government that big business interests have, according to C. G. Schluederberg of the Westinghouse Electric & Manufacturing Company, who has just returned from a six months' business survey of the Far East in the interests of the merchandising, supply and industrial departments of his company.

Japan is highly electrified and from the survey made by Mr. Schluederberg is rapidly approaching the highly specialized use of electricity to which Americans are now accustomed. The country is very widely covered with a network of high-tension lines that extend from city to city and thus afford the Japanese opportunity for all applications of electricity.

In home life especially is the Japanese beginning to find wider use for electricity. The average Japanese in absorbing Western civilization is finding an increasing dislike for cold houses, and as the houses are of wood lightly constructed, and the doors, windows and walls are only framework, covered with paper in many cases, they are exceedingly cold in winter if no artificial heating method is installed. Formerly the only heating appliance the natives had was a sort of charcoal stove on which the meals were cooked and a few small portable crocks or braziers called "hibachis" in which a little charcoal glowed. These are beginning to disappear and electric heaters and cooking appliances are taking their places.

Another reason for the rapid conversion of Japanese to electrical domestic appliances is the increase in wages demanded by the workers and household servants. For this reason the electric washer, ironer, heating appliances such as irons, hotplates, table stoves, etc., and fans have taken the place of many picturesque servants.

So completely are the cities wired that even the street peddlers, somewhat on the order of our own, except that they have stands along certain streets during the evening hours, have electric lights hanging in front of their carts or above their wares as spread along the edge of the sidewalk.

Street lighting is a problem that Japan will have to deal with just as has

America. Her street lighting in the larger cities is only fairly well taken care of. Although there are none of the great white ways of the many American metropolises, Japanese cities have well-illuminated business streets, largely on account of the store fronts, which, brilliantly lighted at night, add materially to the street-lighting installations, and as it is customary for the Japanese stores to remain open quite late the business thoroughfares at least compare favorably in illumination with those of America.

### Appliances Are Quite Slow in Pacific Coast Territory

MAY construction in the Pacific Coast territory was very brisk. Monthly building totals all through California exceed the corresponding 1922 totals by 20 per cent to 50 per cent. Electrical stocks are lower than for several months. Rail freight rates are expected to drop soon, a recent conduit carload rate drop of about 10 per cent being taken as fairly indicative.

Appliance business is quite slow except for the extraordinary call for household irons. Radio business has decreased in volume but is being satisfactorily renovated for an encouraging future. The wire market is unsteady, rubber-covered having fluctuated from a 5 per cent advance to a 10 per cent drop in certain sizes and lamp cord and weatherproof having dropped rather sharply.

### Tape Market Active with Unsettled Prices

FULL-TIME factory operation, cautious buying by jobbers and considerable uncertainty in price movements characterize the friction tape market at present. In manufacturing circles it is reported that up to Jan. 1 orders were being received at a rate which was breaking all records, and production by strenuous exertions only was keeping pace with demand.

The large volume of business being handled attracted new producers into the field, and in the trade it is a frequent topic of discussion how these later entrants can conduct a successful business on the basis of price cuts which the older manufacturers have been encountering. In one instance a manufacturer quoted on tape on a basis of sheeting costs around 9 cents per unit, whereas this raw material was then actually upon a 14-cent cost basis. When the discrepancy was called to his attention surprise was expressed and some recognition given to the importance of more accurate factory accounting and a closer co-ordination between the production and sales functions of the concern. During the past week both rubber and sheeting have fallen off slightly in price, and this has been reflected in immediate inquiries of the manufacturers from large purchasing agents as to the possibility of corresponding reductions in tape quotations. Incidentally, labor has just been advanced about 10 per cent in wages.

In manufacturing quarters there is a widespread desire for price stabilization. Well-informed opinion is to the effect that rigid prices are undesirable in the face of fluctuating costs, both fixed and operating, but representative sales managers feel that purchasers should take more account of the time interval between raw-material price changes and the utilization of such material in the factory, and that a reasonable allowance should be given to the accumulation of stocks of raw material at high prices in order to render good service to the industry. If cotton drops on the exchange, some purchasing agents at once expect reductions in tape quotations, not realizing apparently that the tape manufacturer cannot immediately begin to fabricate his product with the lower cost raw material. Prices are responsive in time to these changes in basic commodity quotations. Perhaps even more important is the question of recognizing quality in purchasing material of the tape class. The idea is that "tape is tape" still persists among buyers, and both laboratory and service tests discount this view as most inaccurate and deserving of modification in practice.

### Eastern Manufacturer Comments on Western Co-operation

"THE wonderful spirit of co-operation among electrical men is the thing that has impressed me most on my Western business trip," said J. H. Parker, porcelain manufacturer of Parkesburg, Pa., to a representative of the ELECTRICAL WORLD, while in San Francisco recently. "Not only is this spirit evident at the various gatherings of electrical men which I have attended, but I find that the men carry it with them to their offices and manifest it in their business relations with each other. I cannot help being impressed with the building activity and the hydro-electric development that one sees on every hand in all parts of the West."

Commenting on the present upward trend of prices, Mr. Parker said: "Eastern manufacturers are making a concerted effort to forestall another period of inflation by suspending all buying for a period of ninety days. If manufacturers will avoid raising prices more than just enough to cover the increase in cost of raw materials and labor and the buyer will assist in preventing the pyramiding of orders, we shall come out of the present situation without any serious harm."

### Slowing Up of Business Reported for Chicago Market

RUMORS of impending building-trade strikes about June 1 have caused a slackening of trade. While building permits still exceed those issued last year, the same number of buildings are not being started. This would seem to indicate that conditions are not normal, a fact due to the forthcoming labor troubles. Fourteen trades were granted an increased scale of wages under the Landis award.

A few reductions of list prices in certain types of meters were announced this week. No advances were announced, and several firms are again quoting firm prices on conduit, although deliveries apparently are lengthening out. Pole-line hardware demand is up to its last week's standard. Numerous high-tension equipment sales have been made this week. The demand for radio material is consistent with this time of the year. One firm announced a reduction of list prices on several of its larger units. Hollow-ware sales are keeping up; buying is normal.

### The Metal Market

COPPER ended the week about one-quarter of a cent under the previous week's close. Producers were openly naming 15.37½ cents delivered, and buyers were confident they could obtain the metal at 15.25 cents delivered, but at the same time were not anxious to try. Some producers are not naming under 15.50 cents, which is equivalent to being out of the market.

The official contract price of the American Smelting & Refining Company continues at 7.25 cents, New York. The new level of price seems to be satisfactory to producer and consumer alike, and there is no immediate likelihood of a change unless something unforeseen happens in London. Prices there are about on a New York parity, making an allowance for freight and duty. Sales have been made in much better volume during the last week, mostly for June and early July delivery at the 7.25-cent level.

NEW YORK METAL MARKET PRICES

| | May 23, 1923 Cents per Pound | May 29, 1923 Cents per Pound |
|---|---|---|
| Copper, Electrolytic | 15.75 | 15.25 |
| Lead, Am.S.& R.price | 7.25 | 7.25 |
| Antimony | 8.00 | 8.00 |
| Nickel, ingot | 28.00 to 30.00 | 28.00 to 31.00 |
| Zinc, spot | 6.60 | 6.60 |
| Tin, Straits | 43.00 | 43.00 |
| Aluminum, 98 to 99 per cent | 26.00 to 27.00 | 26.00 |

### Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.034 | $0.0326 | $0.0236 |
| Cold finished shafting, per lb. | 0.042 | 0.0406 | 0.032 |
| Brass rods, per lb. | 0.1850 | 0.1913 | 0.1466 |
| Solder (half and half), per lb. | 0.2862 | 0.30 | 0.21 |
| Cotton waste, per lb. | 0.1231 | 0.1231 | 0.104 |
| Washers, cast iron (½-in.), per 100 lb. | 4.66 | 4.66 | 4.00 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.17 |
| Machine oil, per gal. | 0.349 | 0.349 | 0.40 |
| Belting, leather, medium, off list | 42% | 42% | 48¼% |
| Machine bolts, up to 1-in. x 30-in., off list | 44¼% | 44¼% | 62¼% |

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Allis-Chalmers Unfilled Orders

The Allis-Chalmers Manufacturing Company, Milwaukee, reports that orders were slower in all departments during May, in line with what officials state is a trade decline for the products they manufacture throughout the market. The company gained $1,000,000 in unfilled orders on May 1, with a total of $12,590,000, compared with $11,570,000 on April 1.

The company had averaged a net gain in unfilled orders of $1,000,000 a month in 1923 up to May 1, but this ratio is not expected to be maintained on June 1. The company is still taking on additional employees to cope with the large increase in orders during the first four months of the year.

## Surgical Instrument Maker Enters Electric Tool Line

The Bard-Parker Company, 37 East Twenty-eighth Street, New York City, manufacturer of surgical knives with detachable blades, has entered the electrical market with a recently perfected wire insulation-stripper. The basic patent for this tool was bought from the Wood interests, manufacturers of the "Wood stripper."

Production facilities at the company's plant at 150 Lafayette Street, New York City, allows for 4,000 insulation strippers monthly, which production is being maintained in order to fill orders already received. The company plans to enlarge its line with other tools for the electrical industry. Morgan Parker is president and Charles R. Bard is secretary and treasurer.

## Wetmore-Savage New Additions Will Soon Be Completed

The Wetmore-Savage Company, electrical jobber, 74 Pearl Street, Boston, will soon complete alterations to its recently acquired building next to it on Pearl Street. When alterations to the new and old quarters are finished, its salesroom space will be doubled and considerable space will be added to the general offices and shipping room.

## Westinghouse Homewood Plant Was Opened Last Week

With an inspection by executives and managers of the company, the new renewal-parts plant of the Westinghouse Electric & Manufacturing Company, Homewood, Pittsburgh, was formally opened last week.

The plant, which will begin operations immediately, fills a long-felt need for such an activity in this district and it constitutes an addition to the already broad service program of the Westinghouse company. The new works, with other additions to be erected in the future as they are needed, will specialize in the manufacture of renewal parts for motors and other apparatus already in service but which have become non-current and obsolete.

The new building, situated near the Homewood station of the Pennsylvania Railroad and connected to that railroad by a siding running into the building, is of brick, cement and steel, 202 ft. long and 102 ft. in width. It is built on a plot of three acres, providing ample space for future expansion.

The management of the new plant is headed by E. C. Brandt, a Westinghouse employee for eighteen years. Mr. Brandt came to the Homewood plant from Brooklyn, N. Y., where he directed the operation of the Krantz Manufacturing Company, which was combined by the Westinghouse Electric Company under the name of the Electric Products Company of Mansfield, Ohio. W. C. Henderson, formerly general foreman of the railway department at the East Pittsburgh main works of the Westinghouse Company, is superintendent. F. F. Rohrer will direct the sales activity, and A. L. Broomall will be renewal-parts engineer.

## Orders "Simplex" Suit Tried in U. S. District Court

The suit of the American Steel Foundries against Thomas E. Robertson, commissioner of patents, and the Simplex Electric Heating Company, to compel registration of the trademark "Simplex" will be tried by the United States District Court. Suit was filed in the District Court for Northern Illinois. The court dismissed the bill on the ground of lack of jurisdiction. The Supreme Court on May 21 declared that the dismissal was erroneous and that the law regarding trademarks is not the same as that governing patents.

## Wagner Electric Company Loses in Supreme Court

The Wagner Electric Company lost in its efforts to resist payment of a judgment of Lamar Lynden for royalties on a patent when the United States Supreme Court on May 21 affirmed the decision of the lower courts dismissing the company's suit against Lynden and the sheriff of St. Louis. Lynden sued, won a judgment, and an execution was issued for the $12,029 ordered by the jury. The company paid, then sued to prevent the sheriff turning the money over to Lynden and recover it.

## General Electric Receives Large Sawmill Orders

The General Electric Company has received an order for the complete electrical equipment of the power plant of an immense sawmill being built by the Long Bell Lumber Company at Longview, Wash. The mill will have a steam-electric power plant of 20,000 kw. capacity.

The equipment which has been ordered includes three 6,000-kw. generators and turbines, a 200-kw. motor-generator exciter set, a 200-kw. turbine-exciter set, two 300-kw. direct-current motor-generator sets, two 25-kw. battery-charging motor-generator sets, power-house local supply and lighting transformers and complete switchboard.

The Oregon-American Lumber Company at Veronia, Ore., has placed an order for one 2,000-kw., one 1,000-kw. and one 100-kw. turbine and generator, as well as for complete switchboard and all mill motors.

## Duncan Electric Appointments

The Duncan Electric Manufacturing Company, manufacturer of meters and transformers, Lafayette, Ind., announces the appointment of the following district sales agents:

The Power Machinery Company, 601 Dwight Building, Kansas City, L. H. Keller, president, A. G. Miller, secretary, for Missouri, Kansas and Oklahoma. A. F. Krippner, 905 Fourteenth Street, Denver, for Colorado, Wyoming and New Mexico. E. H. Albrecht & Company, 309 Lewis Building, Portland, Ore., for Oregon and Washington. Wallene Engineering Company, 511 Hippodrome Building, Cleveland, for northern Ohio. J. Harry Burroughs, 106 Macamley Street, Buffalo, for the State of New York exclusive of New York City. J. W. Murphy Company, 108 S. LaSalle Street, Chicago, for Chicago and Cook County, Ill.

## Porphyry Copper Earnings Show Improvement

The report of the Utah Copper Company for the first quarter of the current year shows total income of $2,241,111, equivalent to $1.37 a share (par $10) on $16,244,900 capital stock, against $1,740,249, or $1.07 a share in the preceding quarter. Operating profit was $1,797,521, against $1,346,287, and the surplus after dividends, $616,621, against $928,004.

The first quarter output of Utah amounted to 33,103,190 lb. of marketable copper, against 31,495,654 lb. in the last quarter of last year, according to D. C. Jackling, president of the company. The cost of production was 8.825 cents a pound, including all fixed and general charges, except depreciation and federal tax reserves.

The Nevada Consolidated Copper Company reported for the first quarter a total income of $544,222, equivalent to 27 cents a share (par $5) on the $9,097,285 capital stock, as against

$417,082, or 20 cents a share, in the preceding quarter. Operating profit was $446,929, against a loss of $164,764 for the last quarter of last year. In commenting on the result of operation of this company, Mr. Jackling notes that production amounted to 11,780,815 lb. of copper, against 7,448,465 lb. the previous quarter.

The Ray Consolidated Copper Company for the first three months of 1923 showed a total income of $488,425, equivalent to 31 cents a share on the $15,771,790 (par $10) capital stock, against $201,903, or 12 cents a share, for the previous quarter. Operating profit was $458,988, against $165,538, and other income $29,436, against $36,365. In his remarks to stockholders, Sherwood Aldrich, president, points out that production for the first three months of the current year amounted to 14,009,441 lb. of net copper, against 12,249,695 lb. in the preceding three months.

## Guth Lighting Fixture Firm in Million-Dollar Organization

The Edwin F. Guth Company, manufacturer of lighting equipment, is the new name by which the unified interests of the St. Louis Brass Manufacturing Company and the Brascolite Company, St. Louis, will hereafter be known. The two companies amalgamated have always been interrelated. The Brascolite Company was a division of the St. Louis Brass Manufacturing Company. The St. Louis Brass Manufacturing Company, the parent company, was incorporated in 1902 by Edwin F. Guth and associates for the manufacture of lighting fixtures of all types.

## Complaint About Hygrade Lamp from Federal Trade Commission

The Federal Trade Commission has issued a complaint against the Hygrade Lamp Company, Salem, Mass. The respondent is charged with acquiring the capital stock of the Lux Manufacturing Company, a competing concern, and has therefore gained control and management of such competing company. This, the commission alleges, has the effect of substantially lessenging competition heretofore existing between the two companies.

Further allegations are to the effect that the respondent adopted and enforced a policy of requiring each and every jobber purchasing its lamps to enter into an exclusive agreement whereby such jobber agrees to purchase its entire requirements of electric lamps for a period of one year from the respondent and not to offer for sale, quote or sell Hygrade lamps to customers outside of the jobber's exclusive territory, which is clearly defined in the agreement, the respondent agreeing to sell exclusively to the jobber in his exclusive territory.

The respondent's acts, the commission alleges, have a tendency to deprive the general purchasing public of the benefits of free competition in the products which are handled by the respondent. Thirty days will elapse in which the respondent may make answer to the charges before a day is set for further hearing before the Federal Trade Commission.

## Eureka Cleaner Sales Meeting

A. S. McCarthy, vice-president and general sales manager of the Eureka Vacuum Cleaner Company, Detroit, visited Spokane May 11 and was the guest of honor at a banquet held the same evening. Fifty of the Eureka sales staff in Washington, Idaho and Montana were present.

"We will sell 200,000 cleaners in 1923," said Mr. McCarthy. "This may seem like a large statement until you hear that we sold 150,000 in 1922 and that the buying power is greater this year than last. I found prosperity in every city visited on this tour. Two-thirds of the districts have made sales that are ahead of their quota in number."

Mr. McCarthy's address was followed by the display of half a mile of film showing the manufacture of Eureka cleaners. Stress was laid on the point that every part of this machine is made in the company's plant.

The Wireless Resistor Company, Milwaukee, has been organized by Arnold Pfau, 3011 McKinley Boulevard, consulting engineer of the Allis-Chalmers Manufacturing Company, to engage in the manufacture of a new metal alloy under exclusive American rights to Swiss patents. J. Rohn and Arthur Voss are associated with Mr. Pfau. A factory is being equipped in Milwaukee and it is planned to start production of bars by June 1.

The Arnold Electric Drill Company, New Haven, Conn., recently incorporated under the laws of that state, will engage in the manufacture and sale of electric drills, electric tools and appliances, and will have a factory in that city. The capital stock is $50,000 and the incorporators include Frederick E. Levere, 658 Campbell Avenue, West Haven, Conn.; E. O. Levere and H. A. Walzenberger of New Haven.

The National Light & Electric Company, 291 Market Street, Newark, N. J., radio equipment and electrical specialties, has acquired the four-story building at 57-59 Lafayette Street for a new plant and headquarters. The company will occupy the entire building, totaling about 20,000 sq.ft. of space. George Allendorf is president and Harry Hirsch, treasurer.

The Packard Electric Company, Ltd., St. Catharines, Ont., manufacturer of electric apparatus, announces the appointment of Andrew S. Tait as district sales manager with headquarters in Montreal. Mr. Tait was formerly chief electrical engineer of the Canadian Car & Foundry Company and its subsidiaries and prior to that time with the Canadian General Electric Company as district engineer during a period of thirteen years.

The Glow Electric Company, Cincinnati, manufacturer of portable electric tools and motors, will shortly commence the erection of a factory at Second Street. It will be one story, of concrete construction, with provision for additional floors later.

The Edison Storage Battery Company, West Orange, N. J., has preliminary plans under consideration for the construction of a new plant on a site adjoining the factory of the Ford Motor Company, now in course of erection on Green Island, near Troy, N. Y. Power from the hydro-electric generating plant of the Ford company now being built will be used at the proposed works, which will be used for a certain branch of battery production. It is expected to commence work late this year or early in 1924. The plant will give employment to about 300 operatives.

The Luminier Company, 577 Broadway, New York City, has been incorporated with capital stock of $50,000 to manufacture electric fixtures and equipment. The incorporators are J. Schiller, L. A. Schoen and L. L. Lazaroe.

E. T. Cunningham, Inc., San Francisco, recently incorporated with capital stock of $200,000, will manufacture electrical equipment. The company acquires business and assets of a firm which has been engaged in electrical manufacturing for some time. E. T. Cunningham, 248 first Street, San Francisco, is president.

The Conveyors' Corporation of America, 326 West Madison Street, Chicago, has appointed the Pittsburgh Machine Products Company, Oliver Building, Pittsburgh, as district representative. It is also announced that S. L. Wright & Company, district representatives of the Conveyors' Corporation in Butte, Mont., have moved their offices from 109 East Broadway to 812 East Iron Street.

The Overflow Alarm Corporation, Brooklyn, N. Y., recently organized with capital stock of $100,000, will manufacture electric alarm devices. The company is looking for a plant somewhere in the vicinity of New York. Plans for manufacturing are as yet undetermined. The incorporators are J. E. Tobin, H. Gessler and T. Wolkind. The present address is 51 Chambers Street, New York City.

The Connecticut Telephone & Electric Company, Meriden, Conn., has purchased the former plant of the Wilcox & White Company, makers of Angelus player pianos. This new addition will be known as Plant No. 2 and is located but a short distance from the Connecticut company's plant No. 1. The new plant is a four-story modern brick structure built in the form of a hollow square with power house in the center and contains approximately 125,000 sq. ft. of floor space. It will be used for the general expansion of business.

## Foreign Trade Opportunities

ARAPUNI (NEW ZEALAND) ELECTRIC POWER SCHEME.—Tenders will be received by the secretary of the Public Works Tender Board, Wellington, New Zealand, until Feb. 28, 1924, for section 1, headworks, of the Arapuni electric power scheme. Specifications may be seen on application at the New York, Cleveland, Chicago and San Francisco offices of the ELECTRICAL WORLD.

HYDRO-ELECTRIC PROJECT NEAR SAO PAULO, BRAZIL.—Application has been made by the Sociedad Anonyma Brasital, according to *Commerce Reports*, for permission to build a hydro-electric plant on the Tiete River near the falls of Ittu, a short distance from São Paulo. A concession covering this same project was obtained by the company in 1911.

POWER DEVELOPMENT FOR IRISH FREE STATE.—A company has been formed under the name of the Inner Liffey Power Development Company, Ltd., to supply electricity for lamps and motors. It is proposed that the Free State government should guarantee the financing and take over the operation of the system when completed, either for itself or in collaboration with the corporation of the city of Dublin. The promoters, however, are willing to carry out the entire scheme and are endeavoring to secure a license under Article II of the constitution.

PROPOSED ELECTRIC POWER SCHEME FOR IRELAND. — Plans are progressing, *Commerce Reports* states, for utilizing the water power of the Bann River flowing into Lough Neagh, in County Antrim, Ireland, about 30 miles from Belfast, for the purpose of supplying electricity for all industries in that section. Early this year a bill was introduced into the Imperial Parliament for the chartering of a company and conferring upon it the necessary powers to proceed with the project.

PROPOSED HYDRO-ELECTRIC PLANT IN RIO GRANDE DO SUL.—Plans have been approved to utilize the Toca Falls of the Santa Cruz River in the State of Rio Grand do Sul, Brazil, according to *Commerce Reports*, to supply electricity for light and power for a number of municipalities in São Leopoldo and Taquary. A 40,000-volt transmission line, 79 km. long, will be erected. The cost of the project is estimated at 2,000,000 milreis.

## New Apparatus and Publications

ENGINE-DRIVEN ALTERNATORS. — Leaflet No. 2,390-A issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates the construction of its type "E" engine-driven alternating-current generators rated at from 50 kva. to 3,000 kva.

TEMPERATURE INDICATOR. — The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing leaflet No. 3,477-A, which covers its "Hot-Spot" temperature indicator for transformers.

HOT PLATE. — The Rogers Electric Laboratories Company, Cleveland, has placed on the market a new model hot plate, known as the "Rogers-Quality."

SHOW-WINDOW LAMP. — The Pittsburgh Reflector & Illuminating Company, Bowman Building, Pittsburgh, Pa., is distributing a folder describing the "Pittsburgh" show window "Flood-O-Lite" with center spot for spot lighting and for color lighting.

TEST SET.—The Western Electro-Mechanical Company, Inc., Oakland, Cal., has developed an alternating-current test set in conjunction with an alternating-current ammeter.

ELECTRIC VACUUM CLEANER. — A new electric vacuum cleaner, "Bissle Home," has been placed on the market by the Bissell Motor Company, Toledo, Ohio.

COMMERCIAL LIGHTING UNIT. — A line of lighting units known as "Cora-Lites" has been brought out by the Consolidated Lamp & Glass Company, Coraopolis, Pa.

PORTABLE MOTOR UNIT.—The Champion Appliance Manufacturing Company, Inc., 44 Main Street, Yonkers, N. Y., has placed on the market its "Champco Service Unit," a portable ball-bearing motor mounted on a movable pedestal, which can be adjusted so as to operate various household appliances.

PORTABLE TEST METER.—The Sangamo Electric Company, Springfield, Ill., has placed on the market its "HP-6" alternating-current portable test meter.

ELECTRIC FURNACE TENDER.—The Domestic Stoker Company, Paterson, N. J., has developed an electrically driven machine which enables buckwheat coal and anthracite coaldust to be burned in the ordinary household furnace and which automatically feeds the fuel into the furnace and at the same time withdraws the ashes and deposits them in an outside bin.

WASTE-HEAT BOILER PLANT. — The Heine Boiler Company, St. Louis, is distributing a booklet which describes and illustrates the waste-heat boiler plant of the Cape Girardeau Portland Cement Company, in which "Heine" boilers are used.

INDOOR BUS SUPPORTS.—Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, are distributing bulletin No. 223 covering their type C indoor bus supports.

WATT-HOUR METERS.—The Sangamo Electric Company, Springfield, Ill., has issued bulletin No. 61, giving instructions for the "Sangamo" type-H single and polyphase watt-hour meters.

ELECTRICAL SUPPLIES. — The Mid-West Electric Company, Omaha, Neb., has revised its monthly publication, *Cost Finder*, which contains a list of products carried by the company.

STREET-LIGHTING FIXTURES. — The Mid-West Electric Company, Omaha, Neb., is distributing its street-lighting bulletin which describes and illustrates different types of ornamental lighting fixtures.

## New Incorporations

THE PIGEON RIVER POWER COMPANY, Waynesville, N. C., has been incorporated with a capital stock of $50,000 to construct a hydro-electric plant on the Pigeon River. The incorporators are Feliz E. Alley, Jr., D. L. Boyd and Feliz S. Alley.

THE WILLIAMSBURGH POWER PLANT CORPORATION, Brooklyn, N. Y., has been incorporated by S. Clerke, J. V. Cline and O. Everett. F. J. Knorr, Albany, is attorney.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

WORCESTER, MASS.—The New England Power Company has petitioned the Department of Public Utilities for permission to erect a 110,000-volt transmission line from Adams, Mass., to North Albany, N. Y., connnecting with the substation of the Adirondack Power & Light Corporation at that point. The cost in Massachusetts is estimated at $250,000.

MONTVILLE, CONN.—The Eastern Connecticut Power Company has sold $1,500,000 in stock, the proceeds to be used for the construction of an addition to its local steam-driven electric plant and for the acquisition of other electrical properties.

NEW BRITAIN, CONN.—The P. & F. Corbin Company, a division of the American Hardware Corporation, will build an addition to its power plant, to cost about $30,000.

WINSTED, CONN.—The Riverton Paper Company will install electric power equipment and other machinery at its mill.

## Middle Atlantic States

MEDINA, N. Y.—The Western New York Utilities, Inc., has issued $560,000 in capital stock, part of the proceeds to be used for extensions and improvements.

NEW YORK, N. Y.—Bids will be received by the superintendent of lighthouses, Staten Island, until June 18, for 375 dry cells, 2½ in.x6 in. (Circular 14,866.)

NEW YORK, N. Y.—The New York Edison Company has completed plans for a substation at 49-51 Park Place, to cost $140,000.

NEW YORK, N. Y.—Electric power equipment will be installed in the proposed ice and refrigerating plant to be erected on Washington Street by the Fox-Goldberg Holding Corporation, 350 Broadway, to cost about $150,000. Robert S. Kaplan, 56 West 115th Street, is architect.

POTSDAM, N. Y. — Electric pumping equipment will be installed in connection with the proposed new municipal water system.

WATERTOWN, N. Y.—The Power Corporation of New York, Northern New York Trust Building, has issued $1,000,000 in bonds, the proceeds to be used for the construction of a 6,500-hp. hydro-electric station at Herrings, and to complete the generating plant now in course of erection at Norwood.

NEWARK, N. J.—The Public Service Electric Company plans to build a substation on West Street, Bloomfield. Extensions and improvements will also be made in the mechanical shop and pumping plant, foot of Duffield Street, Jersey City.

BIRDSBORO, PA.—The Birdsboro Stone Company, plans to rebuild its power house and crushing plant recently destroyed by fire, causing a loss of about $250,000.

CHAMBERSBURG, PA.—The Weitzel Lumber Company, Germantown Avenue, Philadelphia, plans to install elecrtic power equipment at its local mill, recently acquired from the Hollinger Planing Mill Company.

ERIE, PA.—The Mutual Telephone Company contemplates the construction of a new exchange building, to cost about $400,000.

MARCUS HOOK, PA.—The Philadelphia Electric Company is reported to have acquired a local site, on which it will erect a large power plant.

NEW OXFORD, PA.—The New Oxford Shoe Company contemplates the construction of a power house in connection with its proposed local plant to cost about $200,000.

PITTSBURGH, PA.—The Bertha-Consumers' Coal Company plans to install electric power equipment at its properties in Pennsylvania and West Virginia.

SOMERSET, MD.—Electric power and mechanical equipment will be installed in the coal-mining properties to be operated by a new company now being organized by D. B. Zimmerman, Somerset, and F. E. Rowe, Jr., Meyersdale, Pa. The new plant will cost about $150,000.

BLUEFIELD, W. VA.—The Morrow Coal Company, recently formed, contemplates the installation of electric power equipment at its local properties.

CABINCREEK, W. VA.—The Virginian Power Company plans to build an addition to its local power plant.

CHARLESTON, W. VA.—The American Gas & Electric Company, 30 Church St., New York, N. Y., has acquired the West Virginia Water & Electric Company and its subsidiaries, the Dunbar (W. Va.) Light & Power Company and the St. Albans (Va.) Power & Light Company. Plans are being considered for extensions in power plants and systems.

GILMER, W. VA.—The Quaker Coal Company contemplates the installation of electric power equipment at its properties, to develop a daily output of 500 tons.

RICHWOOD, W. VA.—Electric power equipment will be installed in the local tanning plant of the Armour Leather Company, in connection with extensions and improvements to cost about $90,000.

SHINNSTON, W. VA.—The Fairmont-West Virginia Coal Company plans to instal electric power equipment at its local properties.

CLARION, VA.—The Altavista (Va.) Light & Power Company has been granted permission to extend its line to Clarion to furnish electricity for lighting purposes.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until June 12, for one motor-generator set, one switchboard panel, 880 ft. of cable and three potheads (Schedule 863); also, until June 19, for miscellaneous quantity of flashlights and batteries (Schedule 892.)

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until June 5 for a quantity of single-pole, double-throw toggle switches. (Circular 23-212.)

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until June 9, for 60 radio control boxes (Proposal 14,738-2CP); also, until June 11, for 110 radio receivers and 110 radio transmitters (Circular PR 14,600-10CP).

## North Central States

DETROIT, MICH.—Plans are being prepared by the Department of Street Railways for the construction of 4 miles of double-track railway line on Warren Road, East Warren and Linwood Avenues, to cost about $500,000. W. C. Markham is chief engineer.

CLEVELAND, OHIO—The Cleveland Railway Company is planning to build six automatic substations, to cost about $1,500,000. Contract has been awarded for equipment for two of the stations that are to be erected at once.

COLUMBUS, OHIO.—Bids will be received by the superintendent of purchases and printing room, room 76, State House, Columbus, Ohio, until June 5 for furnishing materials for rewiring State institutions in or near Cincinnati, Sandusky, Gallipolis, Toledo, Cleveland, Dayton, Columbus and Athens, Ohio.

ELIZABETHTOWN, KY.—The Kentucky Utilities Company, Louisville, contemplates erecting a 33,000-volt transmission line from Elizabethtown to Hardinsville, via Sonora.

LANCASTER, KY.—The Kentucky Utilities Company, Louisville, contemplates doubling the capacity of the local electric plant and to construct an ice plant, to cost about $50,000. G. T. Bogard is chief engineer.

LOUISVILLE, KY.—The Louisville Gas & Electric Company is preparing plans to construct a new power plant, to cost about $2,000,000.

INDIANAPOLIS, IND.—The Indianapolis & Cincinnati Traction Company contemplates extending its electric railway from Connersville to Cincinnati. The cost is estimated at about $1,000,000.

CHICAGO, ILL.—The Commonwealth Edison Company will build a substation on Seminary Avenue, to cost about $50,000.

GRANITE CITY, ILL.—Plans have been prepared by the Commonwealth Steel Company for extensions to its plant, including addition to power plant, pattern shop, new coke-oven building, extension to foundry, new furnace, etc. The cost is estimated at $1,000,000.

BARABOO, WIS.—The Wisconsin Power, Light & Heat Company contemplates extensions and improvements in the local plant of the McFetridge Lighting Company, recently acquired, including extensions to transmission line.

LITCHFIELD, MINN.—The City Council is considering an issue of bonds for remodeling the municipal electric light and waterworks plant.

ST. PAUL, MINN.—Contract will soon be awarded by the State Board of Control for an addition to the power plant at the Crippled Children's Home.

DUNBAR, IOWA.—The Dunbar Light & Power Company, recently organized, is planning to supply electricity in the village of Dunbar and vicinity. John Ingebritson is president.

MAQUOKETA, IOWA.—Contract has been awarded by the Hydro-Electric Company of Maquoketa for the construction of a large power dam on the Maquoketa River in connection with a large hydro-electric project. No machinery or equipment is included in the contract.

OSKALOOSA, IOWA.—The Oskaloosa Ice & Cold Storage Company plans to build a power house.

KANSAS CITY, MO.—The Ralston Purina Company, Eighth Street, plans to build a power house in connection with its plant at Scott and Rochester Streets, to cost about $1,000,000.

STOCKTON, MO.—The installation of a municipal electric light plant, to cost $20,000, is under consideration.

CROSBY, N. D.—The erection of an 13,200-volt transmission line from Crosby to Noonan is under consideration by the United Power Company.

CHANCELLOR, S. D.—Bonds to the amount of $10,000 have been issued for the installation of a municipal electric distributing system.

ARKANSAS CITY, KAN.—The Roxana Petroleum Corporation, St. Louis, plans to build a substation in connection with its proposed local refinery, to cost about $4,000,000.

BETHEL, KAN.—The Commissioners of Wyandotte County have instructed O. K. Williamson, county engineer, to prepare plans and estimates of the erection of a transmission line from Bethel to the county poor farm, a distance of about 2½ miles, to connect the poor farm with the lines of the Standard Light & Power Company. It is proposed to abandon the power plant at the institution.

EMPORIA, KAN.—The City Commission has authorized the Kansas Electric Power Company to rebuild the transmission line to the pumping station on the Neosho River. The cost is estimated at about $3,000.

OXFORD, KAN.—Plans are being prepared for the erection of a transmission line from Winfield to the Arkansas River station for local service, to cost $18,000. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

WICHITA, KAN.—The Kansas Gas & Electric Company has disposed of a bond issue of $3,500,000, part of the proceeds to be used for extensions to its system.

## Southern States

HIGH POINT, N. C.—The Giant Furniture Company contemplates rebuilding its power house and plant, recently destroyed by fire, with loss of about $150,000.

LEXINGTON, N. C.—The Poneemah Mills Company plans to install a substation in connection with its proposed local cotton mill, to cost about $100,000.

SANFORD, N. C.—The Virginia & Carolina Mining Company, Winston-Salem, plans to construct a power house at its new local smelting plant.

WAYNESVILLE, N. C.—Surveys are being made by the Pigeon River Power Company, recently organized, for a large hydro-electric development on the Pigeon River, between Waynesville and the Tennessee line.

GREENVILLE, S. C.—The Southern Worsted Corporation contemplates the construction of a substation in connection with a new local mill. Lockwood, Green & Company, Charlotte, N. C., are engineers.

HEATH SPRING, S. C.—Bonds to the amount of $35,000 have been voted for extensions and improvements to the electric plant and waterworks.

DAWSON, GA.—Plans are under consideration for the construction of a hydro-electric plant to supply electricity in Dawson, Shellman and Cuthbert. W. H. Locke is member of a committee appointed to look into the matter.

ROME, GA.—Plans are under consideration for the construction of a hydro-electric plant on Two Run Creek to supply electricity for the Eureka Mill, operated by Roy Wright and George Flemister.

BLOUNTSTOWN, FLA.—The Florida Orchard & Packing Company contemplates the construction of a power house at its proposed local fertilizer plant.

CANAL POINT, FLA.—The Florida Sugar & Food Products Company, Lake Worth, contemplates the installation of electric power equipment at its local mill in connection with proposed extensions and improvements to cost about $300,000.

HALE'S BAR, TENN.—Plans are being prepared by the Alabama Power Company and the Tennessee Electric Power Company for the construction of a steel-tower transmission line from Huntsville, Ala., to Hale's Bar, for interchange of service. The cost is estimated at $600,000.

BIRMINGHAM, ALA.—The Alabama Power Company has been granted permission to extend its transmission line to Childersburg, Waverly, Wetumpka, Centerville and Brent.

BIRMINGHAM, ALA.—The Alabama Power Company is preparing plans for the construction of an addition to its hydro-electric power plant, near Lock 17, on the Warrior River, to cost about $500,000.

UNION SPRINGS, ALA.—Permission has been granted the Alabama Power Company, Birmingham, to extend its transmission lines from a point near Tuskegee to Union Springs.

GREENWOOD, MISS.—The City Council has awarded a contract for the construction of a new power station for the municipal light and water plant.

LOUISVILLE, MISS.—The Council is considering calling an election to vote on the proposal to issue $30,000 in electric light bonds.

CAMDEN, ARK.—The Morris Oil Company plans to construct a substation in connection with its proposed local oil refinery, to cost about $300,000.

PINE BLUFF, ARK.—The Arkansas Light & Power Company has awarded contract to Ford, Bacon & Davis, 115 Broadway, New York City, for construction of dam and power station on the Ouachita River, near Malvern, to develop 10,000 hp. The cost is estimated at $1,250,000.

CROWLEY, LA.—Plans are under consideration for the installation of an improved fire-alarm system.

STILLWATER, OKLA.—The Council is considering the installation of electrically operated pumps in connection with a municipal waterworks system to cost about $150,000. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

ORANGE, TEX.—The Houston, Beaumont & Orange Interurban Railway Company, organized to construct a traction line from Houston to Orange, 100 miles, plans to build a power plant and install a series of substations. S. M. White, Orange, is interested in the company.

TULSA, OKLA.—The installation of a series of electrically operated pumping plants in connection with a new pipe line from Owens Junction to Midway, a distance of 28 miles, and from Midway to Burbank Junction, 18 miles, to cost about $300,000, is under consideration by the Prairie Pipe Line Company.

FORT WORTH, TEX.—The Fort Worth Elevator Company contemplates the construction of a substation in connection with its proposed local grain elevator, to cost about $500,000.

SAN ANTONIO, TEX.—W. H. Williams and associates have acquired lignite lands in McCullen County, where they will build an electric power plant, using lignite for fuel.

YORKTOWN, TEX.—The Texas Central Power Company, San Antonio, will extend its transmission line to this place for service at Victoria, Nordheim, Nursery and Craig.

## Pacific and Mountain States

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 12, for electric equipment for the Puget Sound Navy Yard, including one switchboard (Schedule 881); miscellaneous quantity of electric cable (Schedule 882), and two transformers (Schedule 880).

PORTLAND, ORE.—The Grand Rapids (Mich.) Showcase Company contemplates the construction of a power house in connection with its proposed local branch plant, to cost about $500,000.

VERNONIA, ORE.—The Oregon-American Lumber Company will build an electric plant in connection with its proposed local mill, to cost about $175,000.

ALHAMBRA, CAL.—An election will be held June 5 to vote on a proposal to issue $250,000 in bonds, of which $75,000 is to be used for the installation of a new fire-alarm system and the purchase of fire apparatus.

COMPTON, CAL.—The City Council is planning to install street lamps from the northern limits of the city south to Olive Street.

EUREKA, CAL.—Electric power equipment will be installed in the proposed ice-manufacturing and cold-storage plant to be built by the Eureka Ice & Cold Storage Company, recently organized, to cost about $100,000.

FULLERTON, CAL.—Electric power equipment will be installed in the two cold-storage and precooling plants to be erected by the Placentia Orange Growers' Association at Fullerton and Placentia, to cost about $75,000 and $85,000 respectively.

LOS ANGELES, CAL.—An ordinance has been approved for the installation of an ornamental lighting system on Hollywood Boulevard from Verona Avenue to Vine Street.

LOS ANGELES, CAL.—Bonds to the amount of $808,000 have been issued for the installation of an ornamental lighting system on Belle Porte Avenue between Weston and 255th Streets.

LOS ANGELES, CAL.—The City Council has passed an ordinance authorizing the submission of a power bond issue of $35,000,000 to the voters at the general election to be held June 5. Of this amount $25,000,000 will be used for the proposed hydro-electric development at Boulder Canyon and the erection of a transmission line, and $10,000,000 for additional distribution facilities.

OAKLAND, CAL.—The Pacific Gas & Electric Company has acquired a site in the East Bay district on which it will erect a large substation.

OAKLAND, CAL.—The Victor Talking Machine Company, Camden, N. J., contemplates the construction of a power plant

at its proposed new branch factory, to cost about $250,000. J. C. Wicks is general production manager.

PASADENA, CAL.—The City Directors have approved an ordinance calling for an issue of $730,000 in bonds, recently voted, of which $300,000 will be used for improvements to the Light and Power Department.

BOISE, IDAHO.—The Idaho Power Company has applied for permission to erect twenty-nine transmission lines, totaling 438 miles, in Idaho and Oregon, to serve sixty-seven communities along the Snake River.

CEDAR CITY, UTAH.—Tentative plans are under consideration by the Dixie Power Company for the construction of additional plants in the Pine Valley Mountains and a steam-driven plant in the coal district east of Cedar City.

RICHFIELD, UTAH.—The Royal Purple Mines Company has filed application with the state engineer for water rights to be used for the development of power.

CORTEZ, COL.—The Cortez Light & Power Company has been granted a franchise to construct and operate an electric light plant in Cortez.

WESTCLIFFE, COL.—The Custer County Electric Company, recently incorporated, is planning to construct an electric plant at Westcliffe. C. B. Beardsley is interested in the company.

## Canada

FREDERICTON, N. B.—The construction of a transmission line from the Maine & New Brunswick Electric Power Company's lines near the Brunswick border to the St. John River valley as far as Woodstock is under consideration by the New Brunswick Electric Power Commission.

PORT DALHOUSIE, ONT.—The Public Utilities Commission is considering the reconstruction of the distribution system on the south side of the proposed canal.

SMITH FALLS, ONT.—The ratepayers have approved a bylaw authorizing the purchase of a power plant for use in connection with the waterworks system.

MONTREAL, QUE.—The Montreal Island Power Company, recently organized, with a capital stock of $1,375,000, proposes to build a hydro-electric plant on the Back River on the Island of Montreal to develop about 45,000 hp.

## Electrical Patents

**Announced by U. S. Patent Office**

(Issued May 8, 1923)

1,454,474. POTENTIAL INDICATOR; O. E. Huebner, Richmond Hill, N. Y. App. filed July 5, 1921. Device to show if underground cable is alive.

1,454,493. MILL; A. Sundh, Hastings-Upon-Hudson, N. Y. App. filed Oct. 8, 1920. Instrument for indicating travel of moving part of mill.

1,454,495. SYSTEM OF CURRENT-WAVE TRANSMISSION; H. J. Vennes, New York, N. Y. App. filed May 26, 1919. Two-way transmission of modulated currents applied to telephony.

1,454,496. CALLING DEVICE; A. Vischer, Jr., Floral Park, N. Y. App. filed Dec. 21, 1920. Dial for automatic telephone system.

1,454,526. ELECTRIC BATTERY CONTROL DEVICE; W. V. Turner, Wilkinsburg, Pa. App. filed Oct. 29, 1917. Automatic device for operating storage batteries in parallel, preventing unequal discharge.

1,454,530. HANDLAMP; A. A. Arnold, Hartford, Conn. App. filed April 2, 1921. Electric flashlight.

1,454,532. METHOD OF AND MEANS FOR SECRET SIGNALING; W. E. Beatty, Bayside, N. Y. App. filed Aug. 1, 1917. Carrier wave unintelligible unless received by specially designed apparatus.

1,454,533. SUPPORT FOR TELEPHONE RECEIVERS; M. A. Bowen, Fresno, Cal. App. filed July 13, 1921. Holds receiver to ear of speaker.

1,454,566. ELECTRICAL DISPLAY DEVICE; C. E. Smith, Johnstown, Pa. App. filed Sept. 8, 1921. Successively lighting series of lamps.

1,454,567. METHOD AND APPARATUS FOR PRODUCING A CHEMICAL UNION BETWEEN HYDROCARBON GASES AND HYDROCARBON OILS; H. B. Snyder, Fullerton, Cal. App. filed Dec. 27, 1921. By electric arc.

1,454,571. STORAGE BATTERY; W. H. Thorpe, Mount Vernon, N. Y. App. filed Aug. 22, 1921. Small current output with large ampere-hour capacity.

1,454,592. WIRELESS DIRECTION-FINDING MEANS FOR AND METHOD OF PILOTING AIRCRAFT; H. R. C. Van de Velde and J. M. Furnival, Bromley, England. App. filed Jan. 7, 1921.

1,454,598. WIRELESS TRANSMITTER; W. T. Ditcham, Twickenham, England. App. filed Dec. 18, 1920. Valve transmitter for wireless telegraphy.

1,454,622. CHANGEABLE SIGN DEVICE; H. W. Cairns, Detroit, Mich. App. filed June 15, 1920. Automatic mechanism driven by motor.

1,454,623. ELECTRIC TESTING DEVICE; R. H. Carter, Cleveland, Ohio. App. filed Feb. 2, 1920. Mechanically protected test lamp in series with sharpened contact points.

1,454,624. RADIO-TELEGRAPHY SIGNALING SYSTEM; C. C. Chapman, Palo Alto, Cal. App. filed April 27, 1920. Single-wave radio signaling.

1,454,629. RADIO-TELEGRAPHY SIGNALING SYSTEM; H. F. Elliott, Palo Alto, Cal. App. filed June 6, 1921. Uniwave continuous oscillation transmission system.

1,454,630. RADIO-TELEGRAPHY; H. F. Elliott, Palo Alto, Cal. App. filed June 6, 1921. Single-wave signaling system.

1,454,634. INSULATOR; W. T. Goddard, Hamilton, Ontario, Can. App. filed Jan. 25, 1919. Construction of insulators subjected to large tensile strains.

1,454,644. ELECTRIC SPEEDOMETER; C. F. Kettering, Dayton, Ohio. App. filed Aug. 28, 1918. Magnetic type.

1,454,652. RADIO-FREQUENCY TRANSMISSION SYSTEM; H. Pratt, San Francisco, Cal. App. filed Nov. 22, 1921. Embodies Poulsen arc.

1,454,673. TROLLEY GUARD; M. Firl, Meyersdale, Pa. App. filed July 15, 1922. Prevents wheel from disengaging from wire.

1,454,706. TROLLEY-POLE SAFETY DEVICE; G. W. Dague, Oklahoma, Okla. App. filed May 12, 1922. Prevents pole from disengaging from wire.

1,454,719. FAC-SIMILE TRANSMISSION SYSTEM; H. G. Bartholomew, London, England. App. filed May 18, 1922. Photographic transmission on wires.

1,454,722. SWITCH BOX; L. Boutin, New York, N. Y. App. filed May 29, 1922. For house wiring.

1,454,736. ELECTRIC WATER STERILIZER AND PURIFIER; W. T. Harrell, Wichita, Kan. App. filed Aug. 8, 1922.

1,454,744. ELECTRIC SWITCH-HOUSE CONSTRUCTION; B. G. Jamieson, Brookfield, Ill. App. filed April 8, 1922. Complete switch-house and bus structure outlined.

1,454,768. LOCK; R. R. Raymond, New York, N. Y. App. filed May 8, 1922. For telephones to prevent unauthorized use.

1,454,773. TELEPHONE ATTACHMENT; G. W. Sumner, Dorchester, Neb. App. filed Oct. 11, 1921. For selective ringing or party line systems.

1,454,833. ELECTRICAL MACHINE; L. A. Darling, Philadelphia, Pa. App. filed April 30, 1919. Effective ventilation of armature.

(Issued May 15, 1923)

15,597 (reissue). MEASURING AND INDICATING APPARATUS; H. Brewer, Wilmette, Ill. App. filed Feb. 21, 1919. Temperature indicator.

1,454,840. MEANS FOR RINGING OVER MULTIPLEX TRANSMISSION CHANNELS; H. A. Affel, Brooklyn, N. Y. App. filed July 29, 1919.

1,454,847. SALT-BATH FURNACE; O. A. Colby, Irwin, Pa. App. filed Jan. 16, 1920. For heat-treating and tempering steel tools.

1,454,853. MOTOR-CONTROL SYSTEM; R. T. Kintzing, Wilkinsburg, Pa. App. filed July 30, 1920. For motors applied to cloth-printing apparatus.

1,454,858. CONNECTION PLUG; W. E. Price, New York, N. Y. App. filed May 12, 1920. Heavy-current stage plug.

1,454,867. MOTOR-CONTROL SYSTEM; W. R. Taliaferro, Pittsburgh, Pa. App. filed Aug. 18, 1921. For railway motors.

1,454,872. COMMUTATOR REPULSION-INDUCTION MOTOR; C. A. M. Weber, Edgewood Park, Pa. App. filed Oct. 16, 1918. Has characteristics of both repulsion and induction motor.

1,454,875. ELECTRIC HEATER FOR SHOE MACHINERY; C. L. White, Medina, N. Y. App. filed Jan. 24, 1921. For edge-setting soles.

1,454,878. MAGNETIZABLE METER VANE; T. D. Yensen, Swissvale, Pa. App. filed June 9, 1919. Alloy of nickel and iron.

1,454,879. CONNECTION OR BINDING TERMINAL; R. Zollner, Dresden, Germany. App. filed April 6, 1921. Distribution block.

1,454,895. ELECTROLYSIS MITIGATION; G. G. Jones, New York, N. Y. App. filed Sept. 24, 1920. By raising earth potential in vicinity of trolley tracks.

1,454,925. DYNAMO-ELECTRIC MACHINE; R. E. Hellmund, Swissvale, Pa. App. filed Nov. 19, 1917. Single-phase commutator-type motor.

1,454,928. CONTROL SYSTEM; G. W. Hurtt, Wilkinsburg, Pa. App. filed Aug. 17, 1920. Automatically shunting starting resistance in series with motor armature.

1,454,943. ELECTRIC BATTERY; D. Pepper, Philadelphia, Pa. App. filed Aug. 9, 1921. Primary battery.

1,454,954 and 1,454,955. CLOCK; T. S. Casner, Plainfield, N. J. App. filed Sept. 18, 1920. Secondary clock with electromagnetic drive.

1,454,969. MOTOR; F. Hornby, Liverpool, England. App. filed April 28, 1920. Toy motor.

1,454,997. CRYSTAL DETECTOR; G. Greco and K. G. Wolff, Newark, N. J. App. filed April 18, 1922. Dust-proof holder.

1,455,001. STOP AND TURN SIGNAL; Y. Honda, Fowler, Cal. App. filed July 26, 1922. For automobiles.

1,455,054. AUTOMOBILE SIGNAL; M. G. Ivandick, North Chicago, Ill. App. filed April 18, 1922. Rear direction signal.

1,455,074. APPARATUS FOR RECORDING LIGHT; T. W. Case, Scipio, N. Y. App. filed Dec. 11, 1920. Apparatus reading in footcandles utilizes photo-electric cell.

1,455,081. INDUCTANCE COIL; E. G. Danielson, San Francisco, Cal. App. filed May 25, 1921. For radio apparatus.

1,455,099. HIGH-FREQUENCY SIGNALING SYSTEM; W. R. G. Baker, Schenectady, N. Y. App. filed Jan. 5, 1922. Radio transmitting system.

1,455,122. ELECTRIC LAMP SOCKET; C. E. Stahl, Meriden, Conn. App. filed Jan. 22, 1920. Miniature bulb socket.

1,455,139. ELECTRIC DEHYDRATOR; F. W. Harris, Los Angeles, Cal. App. filed Oct. 19, 1920. For removing water from petroleum.

1,455,141. RADIO RECEIVING APPARATUS; P. D. Lowell and F. W. Dunmore, Washington, D. C. App. filed March 27, 1922. Radio and audio frequency amplifier using alternating current on tubes.

1,455,188. METHOD OF FORMING FLAT COILS; H. G. Cox, Chicago, Ill. App. filed June 23, 1919. Making oval coils at high speed.

1,455,194. MOTOR CONTROL; J. Eaton, Schenectady, N. Y. App. filed March 15, 1921. For motors operating feed of planer or the like.

1,455,205. ELECTRIC SADIRON; R. J. Hovey, Chicago, Ill. App. filed Jan. 19, 1921.

1,455,231. MANUAL SIGNAL FOR VEHICLES; J. Spaventoy, Brooklyn, N. Y. App. filed Sept. 10, 1921.

1,455,246. ELECTRIC IMMERSION HEATER; M. C. Furstenau, Philadelphia, Pa. App. filed Dec. 10, 1921.

1,455,285. TELEPHONE INDICATOR; W. H. Eastman, Concord, N. H. App. filed June 1, 1922. Indicates whether some other party on line is using it.

1,455,287. ELECTRIC HEATER; I. L. Hadley, Hartford, Conn. App. filed Aug. 23, 1922. Bottle to be heated placed in bag lined with heating element.

1,455,344. VENT PLUG FOR STORAGE BATTERIES; L. Lyndon, New York, N. Y. App. filed Sept. 7, 1921.

1,455,375. LIGHTING FIXTURE; H. C. Adam, St. Louis, Mo. App. filed Aug. 30, 1920. Inclosed globe designed to reflect most of light downward.

1,455,399. FLUSH WALL-RECEPTACLE PLATE; W. R. Keavaney, Waterbury, Conn. App. filed March 13, 1920.

1,455,415. CONDUCTOR CONNECTION; J. T. Tighe, Scranton, Pa. App. filed Jan. 14, 1921. For trolley cross-over wires.

1,455,422. DIRECTION INDICATOR FOR MOTOR VEHICLES; S. H. Boitnott, Roanoke, Va. App. filed April 18, 1921.

1,455,458. MEANS FOR DETECTING SMALL ELECTRIC CURRENTS; J. S. E. Townsend, Oxford, England. App. filed Oct. 15, 1918.

# Electrical World

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# A Challenge to Initiative

TO GATHER at conventions, to learn by direct contact of one another's accomplishments, to realize the progress going on about one, is always an inspiration. Each convention leaves some evidence of its being. But the N. E. L. A. convention just closed proved more than an inspiration—the records of progress, the opportunities for the future, the very insistency of the demand for action to meet various needs, provide a challenge to the initiative of every man in the electrical industry.

Who can sit idly by when nation-wide superpower networks are discussed on such a sound basis of knowledge, with such background of experience, such assurance of ultimate accomplishment, as was voiced this week? The opportunities thus unfolded appeal alike to executive, to engineer, to commercial man, each in his own sphere, to help make possible the development which will mean so much.

Who can listen to John A. Britton and others who talk his language without becoming imbued with a desire to make immediately effective the ownership of all utilities by the public through stock ownership—according to the basic ideals on which this nation has developed?

Can there be any one who would listen to a symposium on public relations such as was held on Thursday without being ashamed of any and every act of his own which contained the possibility of needlessly offending a customer, who would not feel bound to reform for the benefit of himself, his industry and his customers?

The demands made on accountants for more efficient methods and personnel—the direct appeal made by R. F. Schuchardt that engineers rise to their opportunities, while he pictured to the executives the extent to which they depend on the engineer and could depend on him still more in the future—the vision of opportunities opened up to the commercial men, with the accompanying analysis of markets hungry for energy and equipment, the demand for electric service from every quarter, as discussed by these men—all this is an exhortation to the industry and to the men who make it up that must and will be met.

The electrical industry is not one to slacken its pace for any reason. Rather at every opportunity it leaps forward with increased momentum. The convention just past has not only offered opportunity—it has issued a challenge to perform tasks, to conquer obstacles, and yet to render an unequaled service, which may well tax the initiative of every one who fills a place, however small, in the industry's ranks.

# Walter Howard Johnson

*A Philadelphian who has had a large part in building up the electrical industry in his native city and has made his influence felt beyond its boundaries.*

THE new president of the National Electric Light Association, Walter H. Johnson, has for more than thirty-five years been identified with the corporations engaged in developing the electric public utilities of Philadelphia. For the greater part of that time he has occupied an official position, and he is now the senior vice-president of the Philadelphia Electric Company, which furnishes light and power service in Philadelphia and its widely extended suburban communities.

Mr. Johnson was born on Aug. 27, 1863, at Philadelphia. After a public school education and a varied early experience he entered the employ of the Edison Electric Light Company of Philadelphia on its formation in 1887 and soon afterward was elected secretary. During this formative period of the central-station industry, in the capacity of general manager and secretary of the Philadelphia Edison company, he was associated with the pioneers of electric light and power who in every city were laying the foundations of the great industry that has so quickly grown to the mammoth proportions of today.

After several changes in company control the Philadelphia Electric Company was incorporated on Oct. 6, 1899. Of this organization Mr. Johnson has been assistant to the president, a director and vice-president for many years, and a little more than a year ago he was elected senior vice-president. His connection with the industry has not, however, been confined to the Philadelphia companies. He has been for ten years on the executive committee of the National Electric Light Association and for the last year has been the ranking vice-president of that body. He was president of the Electric Vehicle Association and closely associated with the founders of the Society for Electrical Development, of which he was chairman of the executive committee for some years. He was also president for two terms of the Association of Edison Illuminating Companies and has served for many years on numerous important committees of both the Edison association and the N. E. L. A.

He is a member of the Franklin Institute of Pennsylvania, a life member of the Navy League of the United States and a member of the Pennsylvania Society of the Sons of the Revolution, as well as being prominent in Masonic circles in Philadelphia. His Philadelphia clubs include the Union League, Racquet, Philadelphia Country and the Merion Cricket, and he is also a member of the Engineers' Club of New York.

# Editorial Comment

Electrical World, June 9, 1923

Volume 81 Number 23

## Convention of National Electric Light Association

IN POINT of attendance the forty-sixth convention of the National Electric Light Association, which closed its sessions yesterday in New York City, was by far the largest ever held by the association; in interest displayed, in scope of program and in its general features it was also signally impressive. Bigness was its essential characteristic. There was no escape from a consciousness that the electric public utilities of the country were doing great things and had even greater things in contemplation. Seldom has so vivid an impression of their opportunities and their obligations to serve the nation been given to the executive heads of the industry, and seldom has the question of public relations been so completely and so thoroughly discussed. Banker, farmer, educator, manufacturer, publicist, regulator and government official vied with men of the industry in their appreciation of the importance of this question, and evidence was not lacking that customer ownership of securities offers a partial solution. If there ever was a convention which served to impress executives, engineers, commercial men and accountants alike with the outstanding problems of the industry and which was effective in ridding them of provincialism, it was the one just closed. For this President Frank W. Smith, the staff at headquarters and the numerous committees deserve credit. The operating companies in the metropolitan district of New York are also to be commended for the excellence of the arrangements and the hospitality showered on the delegates and guests. In every way the convention was an accomplishment of which the industry may well be proud.

## Public Relations Work Assuming More Definiteness of Character

THE phrase "public relations" is an old one in public utility circles, and its indefiniteness has been one of the difficulties in reaching agreements on what to do and how to do it. As Chairman Sands aptly put it this week, when the Public Relations Section was started it sailed out on uncharted seas for a destination unknown, with but a vague notion of the haven to be sought. But any one who attended the three sessions at the convention, or who takes the trouble to study the record of these sessions, must certainly agree that the very accomplishment of such a series of meetings proves that bearings have been taken and a more definite course is being steered. Not that good public relations has any easy or specific definition—although "public sympathy and active appreciation in the degree to which it is merited" carries a good deal of significance. But the fact that discussions tend to leave generalities and get down to cases, the fact that more and more is the individual contact with and education of the consumer recognized as essential, and the fact that executives are taking active and not passive interest, all show that substantial and definite progress is being made.

This subject is admittedly—even emphatically—one of the most important for the future as well as the present of the industry. The reports of the meetings, the symposium of commissioners and executives, given in this issue are well worth study and should serve as inspiration to every utility man—and every other electrical man—in his daily life.

## Customer Ownership a Vital Necessity

ELECTRICAL men and women have been told the benefits of customer ownership of utility securities many times in the past half dozen years, but in the lens of the N. E. L. A. convention this week the growth and achievements of this wonderful movement for better public relations and more convenient financing were focused with new power by leaders of thought and action for the clearer visualization of the industry. At a notable gathering Messrs. Britton, Hall, Egan and Forbes held their audience almost spellbound as, with clarity of vision, they told what the achievements and opportunities of this great development mean to utilities. Barely nine years ago the first offering of securities to employees and then to the customer public was made by Mr. Britton's own company, and like a rolling snowball the development has spread from coast to coast and is now in amazing popularity. To its celebrated victory over state ownership last fall in California could be added numerous other triumphs if space permitted, but enough has been learned about this policy to establish it as absolutely essential to the permanent success of private management under public regulation.

No apologies are offered the readers of the ELECTRICAL WORLD for the pages devoted in this issue to the message of these able leaders as presented at the New York convention. In their addresses a new observation of latitude and longitude was taken for the industry's course toward the goal of full customer and employee participation in utility financing. These men made it plain that full speed ahead must be the order, coupled with a keen look-out for the rocks of indifference to human relations and the shoals of ill-advised security issues. The crew must be made partners in privilege and responsibility to insure a steady voyage, and the warm sun of friendly intercourse between navigating officers, personnel and passengers must be welcomed to drive away the fogs of misunderstanding and false propaganda. There must be no mistakes as to soundings of financial depths. Given these things, the good ship will speed over quiet seas, leaving old misunderstandings and errors to churn and die in the waters of the past, while, obeying the chart of the new policy, a straight course is steered to the port of entirely success-

ful public relations. Without this movement, private management might easily be swamped in the stormy seas of political control, leaving the industry to drift on the waters of lost initiative to an uncertain and perhaps fatal end.

### Company Budget for Control Needs Intelligent Use

THE annual budget has been a bugbear in many organizations because it has been made a method for beating down expenditures by tying department heads to estimates made months in advance on meager data and then treating failure to live up to the estimates as reprehensible. It is unfortunate if, as some accountants claim, so useful a method has become a stumbling block to its own greatest effectiveness. The whole—and wholesome—purpose of budget formation is to build up an intelligent control of business expenditures by placing before responsible officials the best guess that can be made of the things to be provided for over the budget period. At no time is it possible to estimate months in advance the actual expenditures that must be made. But the best estimate based on available data does show department heads the direction in which they are traveling, and as new conditions arise the budget should be unhesitatingly revised without discredit to any one unless it has been shown that real carelessness necessitated the revision. This is in line with the conclusion reached in the discussion of the budget system before the Accounting Section of the N. E. L. A. The budget system should not be used as a club rather than as the useful tool that it is.

### Higher Distribution Voltage Should Be Studied

THE plea made by C. W. Stone before the technical session of the N. E. L. A. on Tuesday for serious consideration of the use of the 250/500-volt, three-wire system for distribution will probably arouse a great deal of dissent. Two conditions becoming evident in the distribution field may help to throw light on the discussion. The first is the tremendous investment in copper going into low-voltage systems—a tendency just now most evident in the direct-current systems because of the use of direct current in the districts with high load concentration. The other is the difficulty of obtaining the necessary substation sites for low-voltage distribution systems, this tendency also being more evident in the direct-current field.

That a tremendous saving in copper costs can be made by raising distribution voltages, as stated by Mr. Stone, is self-evident. The first tendency of many engineers perhaps will be to jump to the conclusion that the expense and difficulty of adjusting the system to cover present low-voltage appliance and lighting service will overbalance the saving. Such an opinion should not be allowed to exist without first investigating what changes will be necessary. The natural tendency to shirk a task which apparently involves many problems should not, however, rule.

The fact is that an alternative tendency with the same purpose in view is evident in the gradual curtailment of direct-current distribution that is being accomplished by cutting off the outlying fringes of direct-current districts and the carrying of higher-voltage alternating-current circuits into the heart of such districts for large power service. The elimination of copper in the low-voltage circuits is accomplished to some extent by the use of numerous step-down points from high-voltage alternating primary circuits. It is possible that there is a limit to this practice which will appear as the concentration of load increases. It will then be necessary to consider an increase of service voltages.

Mr. Stone has made a suggestion that deserves careful study. The difficulties are far from insurmountable when economic considerations justify a change.

### New Life for the Commercial Section

CHAIRMAN WILCOX of the Commercial Section is to be congratulated on beginning his administration on the wave of a renaissance. For some years it has been recognized that the Commercial Section was not meeting the fullness of its opportunity. The older men after serving as chairmen have been drifting away from the section—outgrowing it because the section itself has not advanced with its best men. Hence many problems of an executive nature that are essentially commercial have followed these older men into the other sections, and such subjects as customer ownership and public relations are no longer on the commercial program, though vital in local commercial work. E. W. Lloyd, as chairman of the nominating committee, frankly and plainly discussed this condition and, while paying well-deserved tribute to the achievements of Chairman Hogue's administration, appealed for the support of the "old guard." Mr. Hogue got behind the effort in a pcactical way by recommending that six of the ex-chairmen be made members-at-large of the Commercial Section executive committee and put into harness.

Here is a most fitting culmination of a successful year of work, during which Mr. Hogue has brought new interest to this branch of the association. The initiation of the three national co-operative programs which have been organized to promote store lighting, industrial lighting and the electric truck stand as credits to the 1923 Commercial Section. All this should prove a stimulus to all central-station sales managers, and if the Commercial Section now receives the support of the ex-chairman great progress can be made.

Here is a matter of real moment. This frank recognition that the Commercial Section today does not stand on the high plane of the Technical and Public Relations Sections is the first step in the upbuilding of this branch of the National Electric Light Association to the position of major prominence that it must fill. With this support Chairman Wilcox has a great opportunity before him.

### Inductive Co-ordination Committees Have Overcome Suspicion

THE inductive-co-ordination committee session at Atlantic City last year was called by some a "love feast." K. L. Wilkinson, engineer of foreign wire relations of the American Telephone & Telegraph Company, in reviewing the year's progress before the same committee at this year's convention, protested against the designation and styled the demonstration then an

exercise of good business sense. The meeting this year included a free discussion of two specific though hypothetical problems in which telephone and power men participated with evident enjoyment and which could have been conducted only because mutual confidence has been established.

The inductive-co-ordination problem has not been solved. In the sense that it can be laid away and forgotten the solution probably never will be found, as Prof. C. F. Scott indicated in the discussion. The thing that the session this year demonstrated was that suspicion of each other's motives on the part of power men and telephone men has disappeared and in the future the work can proceed with only the normal differences of opinion that any human relationships involve. This result demonstrates as well as any association activity the value of honest co-operation.

### Agreement Reached on Circuit-Breaker Duty

NOW that all conflicting opinions have been brought into harmony by the general agreement regarding the definition of circuit-breaker duty, manufacturers will be in a better position to furnish circuit breakers for a specified rating since they have a definite basis on which to work. It will be up to operating companies to say whether they want circuit breakers which will have a certain rating for one, two, three shots or more; and, as the electrical apparatus committee of the N. E. L. A. pointed out in its report this week, companies which buy circuit breakers on a two-shot basis will have to depend on the use of factors to determine what the rupturing capacity will be on other duty bases. Moreover, present published ratings will have to be reduced approximately 20 per cent to comply with the new basis of rating.

### A Wider Outlook in Accounting

DESPITE the handicap of a reputation for dryness which has been much exaggerated, public utility accounting has increased in interest not a little within the past few years. Last year the sessions of the National Accounting Section of the N. E. L. A. illustrated by a very diversified program the newer aspects of this analytical specialty, and the New York convention of 1923 continued the good work. The advance of commission regulation, increased demands for more accurate allocation of expenditures in operation and construction work, the need of more complete information as to the make-up of capital accounts, and the stimulus of educational opportunities, have all influenced the development of accounting toward a well-established professional plane.

This wider outlook is a good thing for the industry, for it means a closer relationship in future between its accountants and other departmental workers and executives; it means another source of executive personnel—when duly qualified—and more accurate administration of properties representing large financial values. Commission cases are going to be more thoroughly prepared because of this breadth of interest which is coming to be associated more and more with accountants. One word of caution, however, should be uttered. Accountants should develop a broader and deeper sense of proportion in their work and discussions, lest too much occupation with hair-splitting points of procedure outdo the legal profession at its meticulous worst. Accuracy in computations and loyalty to the best practice must be observed without question, but veneration for routine should not be built into a barrier separating the accountant from his engineering, commercial and executive brethren. The growing diversification of interest in accounting pursuits is a gratifying sign of the times in electric utility circles.

### Preserve Records— They Are Valuable

AN IMPORTANT note of warning was sounded during the N. E. L. A. convention by the Accounting Section committee which rendered a detailed report on the preservation of company records from fire hazard. The almost unbelievable truth was brought out that so far as known there is not a single central-station company in the country which has taken the very ordinary precaution of insuring its records. When it is realized that one little volume of a hundred pages or so may contain summarized thought and labor representing many thousands of dollars, when a few minutes' study of the question brings out the fact that it would be virtually impossible to restore such records if destroyed and that, even if they were possible of restoration, it would be only at the cost of much money and months of labor, then the situation becomes apparent.

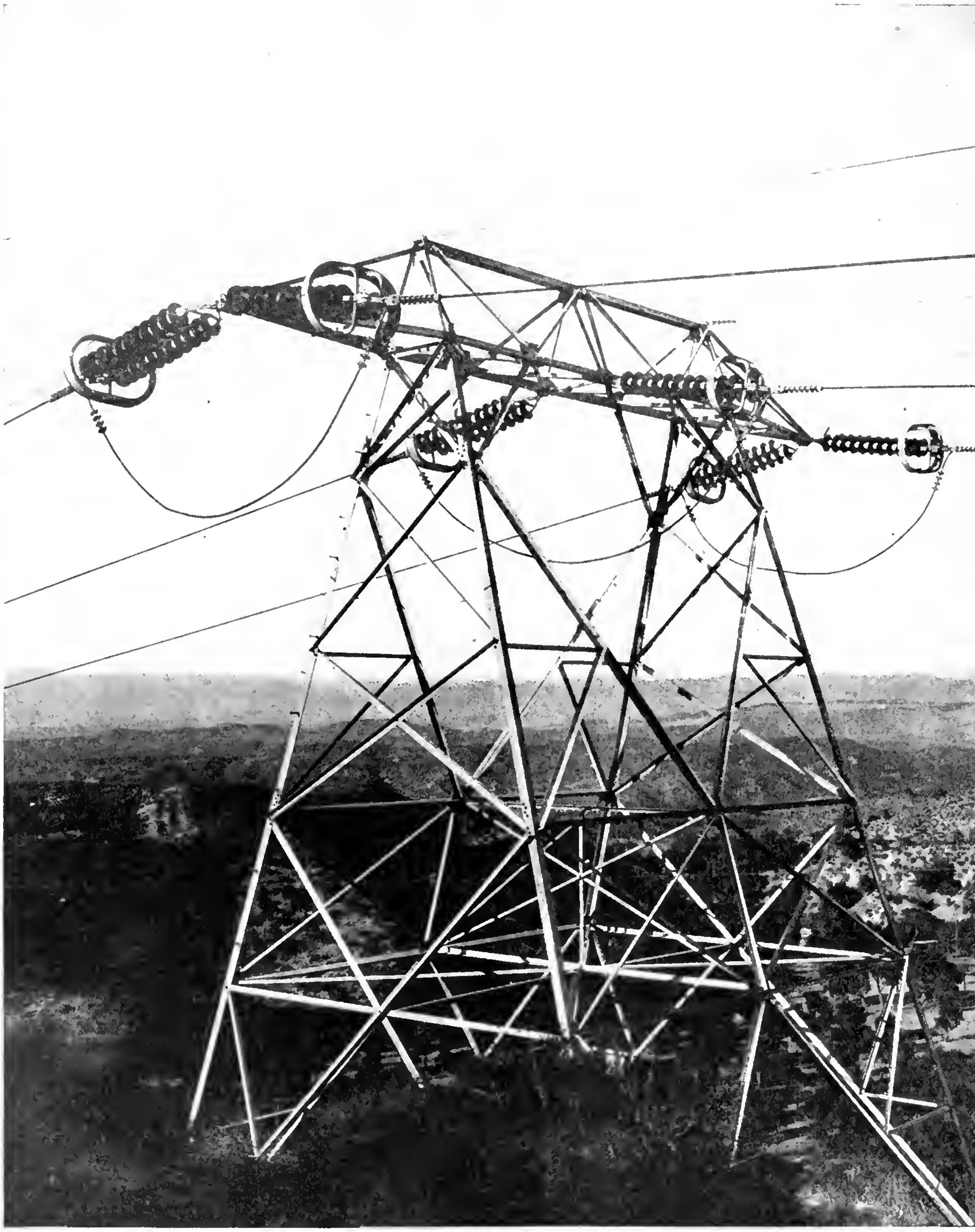
It is common practice to insure plants, office buildings and furniture. In fact, it is accepted as poor business judgment not to do so. If this is so, why should not the records, which in some cases may prove even more valuable that the plant itself, be insured? The natural questions arise as to whether the risk involved makes the rates laid down by insurance companies for such a class of underwriting prohibitive and whether the insurance companies have no classification for such a type of insurance and so will not insure. The Accounting Section committee studying this subject during the past year found the latter to be the case and that even Lloyds had not underwritten any such insurance. The national society has another task added to its schedule of activities in bringing this condition to the notice of the insurance companies. The industry has grown so fast, its history has been so short, that this important phase of company loss has been almost entirely overlooked. Insurance of records is essential to every central-station company, and the quicker it can be brought about the better for every company in the industry.

### Best Relay Practice Shortly Available to All

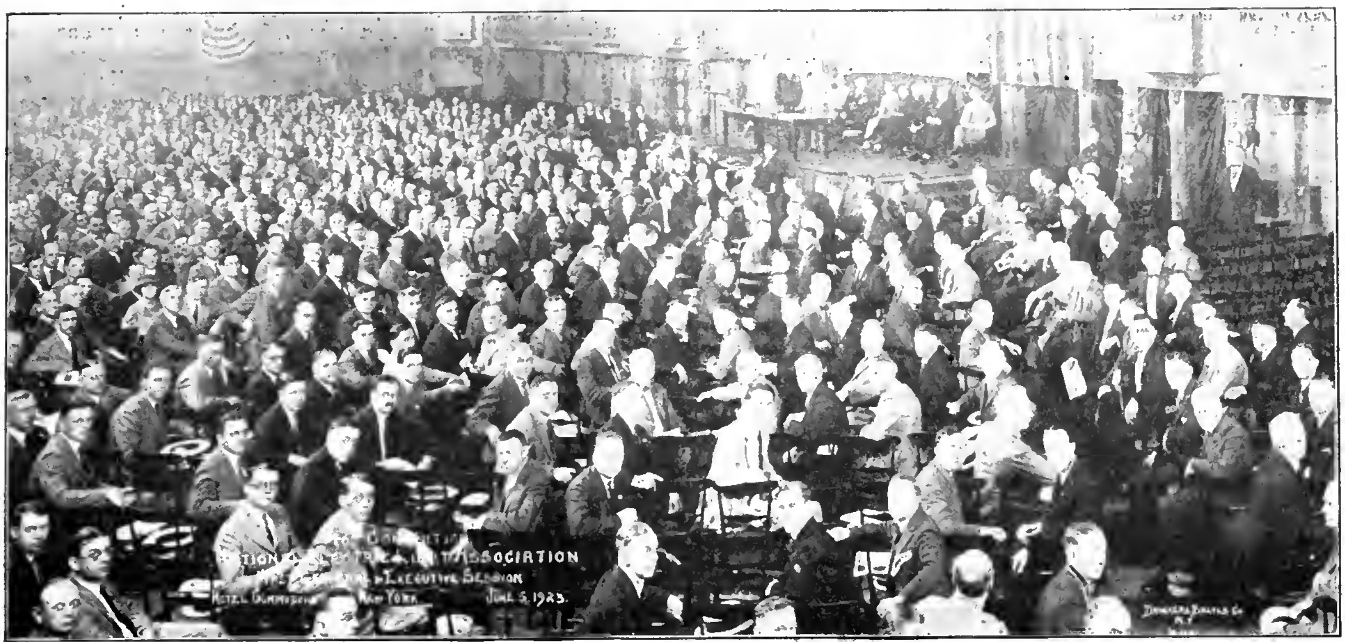
A MOST excellent treatise on relay practice in the form of the "Relay Handbook" will soon be made available in printed form by the N. E. L. A. Since control systems are the nerves of electric service plants, every company in the United States should find something of value in this compendium of practice—not theory. Much of the information which has been obtained on relay protection has been obtained through cut-and-try methods, yet operating companies which have not progressed very far in relay protection can be saved much costly pioneer work by acquainting themselves with the contents of this new handbook.

# Southern California 220-Kv. System Operating

## Is This the Beginning of a National Superpower Network?



THE Southern California Edison Company's 240-mile, 220-kv. transmission line from the Big Creek plants to Los Angeles, a tower of which is shown above, is now operating, and the supervoltage line of the Pacific Gas & Electric Company, it is reported, will be ready for operation in two or three months. Similar lines were proposed by Frank G. Baum before the N. E. L. A. this week for a national superpower network. The Southern California line, which has two 250,000-kva. circuits, is interesting aside from its voltage because of its having been converted from 150 kv. to the higher voltage. One operation involved in rebuilding these lines was to increase the tower heights, and the other required placing two additional insulators in each string and adding static or shield rings. Owing to load conditions it was impossible to spare more than a short section of each line at a time for reconstruction work.




# Record of Progress Gives Inspiration for Future at Forty-sixth N. E. L. A. Convention

THE forty-sixth convention of the National Electric Light Association, held at the Hotel Commodore, New York City, this week, in attendance, interest and scope established a new record for accomplishment in the affairs of the organization. There were twenty-two business sessions, and a public policy meeting on Thursday night. This arrangement called for four parallel sessions and all were well attended. The convention was notable for the large number of leaders of public opinion outside of the electric light and power industry who addressed the convention during the week. These included well-known newspaper men like Melville E. Stone, counselor of the Associated Press; Don Seitz, publisher of the New York *World;* Bruce Barton, well-known editor and writer, and B. C. Forbes, editor of *Forbes Magazine* and financial writer for the Hearst newspapers. Five public service commissioners from as many different states and Dwight N. Lewis, president of the National Association of Railway and Utilities Commissioners, also contributed to the program the viewpoint of the regulators.

The investment institutions of the country were represented by Lewis E. Pierson, chairman of the board of directors of the Irving Bank-Columbia Trust Company, and Richard T. Ely, professor of economics at the University of Wisconsin, spoke on closer relationship between educational institutions and public utilities. Water power was discussed from different angles by Gen. Guy E. Tripp of the Westinghouse Electric & Manufacturing Company and O. C. Merrill, executive secretary of the Federal Power Commission.

The association has made a determined effort, through rural papers and through numerous committees, to get into closer touch with the farmers of the country so as to gage their requirements as well as to inform them on certain phases of the electric light and power business. The rural-lines committee exerted its best efforts in this behalf, and in addition to its report O. E. Bradfute, president of the American Farm Bureau Federation, representing a million farmers, addressed the convention on Wednesday morning.

The chief speaker at the public policy committee meeting, held at Carnegie Hall on Thursday night, was Julius H. Barnes, president of the Chamber of Commerce of the United States of America, who dwelt on the social and economic aspects of American electrical development and the philosophy of individualism.

With so large an attendance special arrangements had to be provided for handling the crowds and looking after their entertainment. In this regard the public utility companies in the metropolitan district of New York were very generous. Through the courtesy of the American Telephone & Telegraph Company, the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Western Electric Company the proceedings of the public policy meeting on Thursday night were broadcasted throughout the country. To handle the telephone messages a system capable of handling the traffic of a city of fifteen thousand people was installed temporarily in the Commodore Hotel. This constituted one of the largest private telephone installations ever undertaken.

## Opportunities of the Industry

### Need for Power Still Challenges Central-Station Companies to Supply It—National Survey Suggested—Section Chairmen Report on the Activities of the Four Big Divisions

ALTHOUGH the convention got under way on Monday afternoon, after a luncheon to N. F. Brady and an ovation to Thomas A. Edison, who appeared at the opening session of the Public Relations National Section, its formal opening took place on Tuesday morning. At that time Mayor John F. Hylan of New York welcomed the convention to the city and expressed the hope that its streets would be as brilliantly illuminated as Luna Park on Coney Island before his term of office expired.

President Frank W. Smith in his address at the opening session gave a survey of general conditions throughout the country and their effect on the elec-

trical industry. In his estimation the outlook for the electric light and power business is exceedingly promising. Electrical output, he said, has doubled every five years for the past three five-year periods, and he saw no indication of diminution at this time nor for some time to come.

"Power is essential to industry, and the growth in physical volume of production at present indicates a rate of industrial recovery almost without parallel in American business.

"This development and industrial activity have involved a great increase in the output of electric light and power companies and necessitated large outlays for new equipment and construction. During the first four months of this year the electric light and power industry raised for all purposes 60 per cent more money than it did during the similar period of 1922, indicating that for the current year bond and stock flotations will reach over a billion dollars, compared with $750,000,000 last year.

"The output of electrical energy is even more imposing. The first three months of this year show an increase over the first quarter of last year of nearly 33 per cent. Up to the present time the growth of our industry has been limited to demand. There has been for many years no great surplus of electric power.

Mr. Smith said that bankers, financial institutions and the investing public throughout the country are holding public utility securities—and particularly those of electric light and power companies—in more esteem as investment mediums than they have ever done before. This attitude is the natural outgrowth of bettered operating conditions and is due in large measure to the improvement in public feeling toward the utility companies.

## Membership

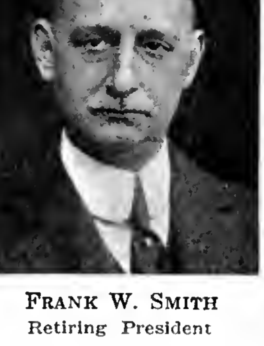
The membership committee, Howard K. Mohr, chairman, has been functioning along the lines laid down by its predecessor. The changes that have taken place in the various classes of membership during the administrative year were shown in the following table:

| Class of Member | April 30, 1923 | April 30, 1922 | Net Change |
|---|---|---|---|
| A | 1,057 | 1,134 | —86 |
| B | 8,336 | 8,110 | 193 |
| C | 111 | 93 | 16 |
| D | 219 | 237 | —22 |
| E | 1,087 | 976 | 103 |
| F | 196 | 188 | 4 |
| G | 315 | 227 | 95 |
| Foreign | 66 | 64 | 2 |
| Total... | 11,387 | 11,029 | 305 |

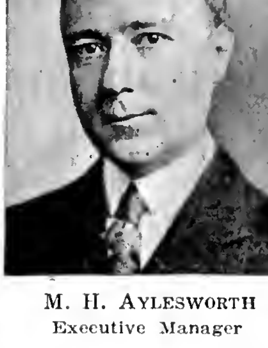
## National Survey Suggested

M. H. Aylesworth, executive manager of the association, outlined a plan for better public relations through a nation-wide survey to be made under the auspices of the national association, and the convention voted to make the plan effective at once. The purpose of the survey will be to inspect each customer's equipment at some time during the year to determine whether the service is satisfactory or not, to receive suggestions for its possible improvement, and to ascertain what appliances are in the household, and if all of these are not in use, the reasons therefor. While the main purpose of such a survey is to cultivate better public relations with customers, the by-products are, in Mr. Aylesworth's opinion, of inestimable advantage.

"While we have been making great effort to obtain popular support by enlisting financial co-operation through customer ownership and are giving excellent service to customers in so far as they utilize the service, it must be appreciated," said Mr. Aylesworth, "that empty lamp sockets earn no dividends, nor does household apparatus that is not in use."



FRANK W. SMITH
Retiring President



M. H. AYLESWORTH
Executive Manager

To serve well and ever better has long been the object of the electric light and power companies, for service and success are synonymous. But have we convinced our customers of this fact? Are they satisfied with our service? Do they believe in our sincerity, or are they skeptical and hostile, basing their unfriendliness on little things that could easily be put right, or founding it on ignorance of our methods and exaggerated notions of our earnings?

"Wonderful as have been our success and development, such a national survey under the guidance of your association offers still greater opportunities for service."

## Chairman Sands' Report

In reviewing the work of the Public Relations Section, Chairman H. T. Sands pointed out that central stations as an industry have been peculiarly lax in spreading the public utility gospel from the speaker's platform. "I know of no industry," said Mr. Sands, "which has a better story to tell or a story that will prove more interesting to the public when rightly told. Furthermore, the work of the speakers' bureau forms a splendid auxiliary to the work of the state committees, for invariably, whenever a public address is made before civic bodies, the local newspaper devotes very liberal space to publishing that address, and in this way the maximum amount of publicity is obtained.

"Under the direction of the Public Relations Section, two films, 'Back of the Button' and 'Yours to Command,' have been produced and quite generally distributed among our member companies. This distribution, however, falls short of what it should be. Here again our industry shows a peculiar trait of reticence, and almost an inability to understand the public mind.

"In the prosecution of its work," continued Mr. Sands, "the section has been somewhat handicapped owing to the character of its purpose. In the main we are dealing with intangible factors in the prosecution of our work, but we are, nevertheless, able to observe certain tangible results, and it is our belief that these results will become more and more apparent as the work goes on. Our greatest obstacle in securing these results lies in the apathy and indifference of many of our own company executives. Absorbed in the technicalities of their business, deeply interested in the rapid strides which the industry is making, they seemingly fail to realize that the public mind has not kept pace with the changed conditions of the industry, and they are not bidding for that intelligent understanding on the part of the public that makes for mutual confidence and spells success."

Mr. Sands regretted that some executives look upon public relations as a beautiful theory but without practical value. But public relations, he said, are neither a theory nor an idle dream. They are a pressing reality, the central station's greatest asset, to realize which should be the chief concern of executives.

## Broader Engineer Viewpoint

"Altogether too much emphasis is put on the names of the sections," declared R. F. Schuchardt, chairman of the Technical Section, in his address on the opening day of the convention. "There seems to be a feeling that the main purpose of these sections is to concentrate entirely on the problems of the section. This view tends very much to develop specialists of the limited-view type which some of our philosophers think is actually endangering civilization. We should make every effort to see that these specialists are of the broad-visioned type who not only work out the solutions of their special field but who also consistently remember the relation of this field to the rest of the industry. The danger is perhaps greater in the so-called technical field

JOHN BRITTON
First Vice-President

J. E. DAVIDSON
Second Vice-President

R. F. PACK
Third Vice-President

H. T. SANDS
Fourth Vice-President

**Four Vice-Presidents Elected to Serve with President Johnson**

as distinct from the so-called commercial. Technical operation is successful only when the commercial phases receive due consideration. Would it not be well for all of us to encourage the sections to emphasize the 'relation to the industry' phases of their work a little more and the self-contained unit idea a little less, and would it not also be well to bring the sections together for joint consideration of problems at as many points of contact as possible?"

A word was also addressed to executives who have not yet given much thought to the value of N. E. L. A. committee work and who do not fully realize the intimate relation existing between the work of their technical staff and their dividends. "In addition to the valuable information obtained from these committees," said Mr. Schuchardt, "they offer an advantage of even greater value, namely,. as training schools for your men, as a means for developing and inspiring your executives of the future. Here these men have the benefit of the broadening influence of meeting with others who are working on similar problems. With the well-organized plan of geographic divisional committee work and its coordination with the national committees it should be easy for every member company to partake of the benefits, even to the smallest companies.

"During the past months a new scheme of distribution for the information gathered by the committees has been worked out which should prove very satisfactory. It will get the reports promptly to the men interested and will greatly simplify convention reports." In general, this will be accomplished by making committee work a continuous function. Reportswill hereafter be made throughout the year and distributed in "homeopathic doses" so as to reach promptly those who are interested. "Executives receiving these reports will naturally refer them to those in their organization who can use the information most effectively for their company," added Mr. Schuchardt.

"The engineers who have caught the spirit of progress, as those must who act on these committees, appreciate that they are serving well only if they strive constantly to use the nation's resources in a manner which best conserves the interests of their fellow-men. They study the best engineering developments all along the line, think ahead, build and operate so that our product—electricity, the lifeblood of industry and the new servant in the homes—may be provided most economically and satisfactorily."

### Promising Outlook for Commercial Expansion

Oliver R. Hogue, chairman of the Commercial Section, in his address said that the central station company's opportunity to increase its income has never been better in the history of the electrical industry than at the present moment. There is a marked improvement in station capacity; the financial situation is materially better; the opportunity for greater expansion is at hand. Commercial departments are reorganizing their selling forces and striving to improve their efficiency. Others who had abandoned commercial activities are reorganizing their commercial staffs.

The question of public relations is squarely up to the commercial man. The salesman who sells proper equipment and appliances to the customer without misrepresentation, will build up right feeling and understanding with customers, who in turn will buy goods and make investments, stalling plans for public ownership.

### Adoption of Uniform Accounting

Calling attention to the very satisfactory progress made during the past year in the adoption of the uniform classification of accounts by public utility commissions of sixteen states, William Schmidt, Jr., chairman, summarized briefly the work of the Accounting National Section. His detailed report was presented in full at the first accounting session.

# Water Power and Rural Service

**National Importance of Adequate Development of Hydro-Electric Resources by Private Initiative—The Farmer Looks to the Electrical Industry for Service**

TWO papers were presented at the Wednesday morning session on water-power development—one by John A. Britton of the Pacific Gas & Electric Company, reporting for the water-power development committee, and the other by Gen. Guy E. Tripp of the Westinghouse Electric & Manufacturing Company. Mr. Britton traced the phenomenal interest in water powers and in their development since the passage of the federal water-power law and showed by statistics the horsepower and cost of the work now under construction in this country. He also showed to what an extent the United States exceeded all other countries in the amount of water power developed.

### Tripp Predicts a New Era of Development

"In striking contrast to all other public utilities, the electric light and power industry, I am convinced, is about to enter into a new era of development," said General Guy E. Tripp, in his address before the public policy session. The railway, telephone, telegraph and gas industries have, he said, become settled enterprises. They will continue to grow as the country grows and will from time to time improve their methods, but in all probability none of them will be called upon to furnish a radically new kind of service to meet the increasing requirements of our highly organized social life. But with electric power the case is quite different. Power is the basis of civilization. Without it men could not have emerged from barbarism. Nor can we make any progress except when notable improvements are made in our power supply. In order adequately to develop this power supply, the so-called superpower systems must be made accomplished facts. These systems will

utilize all the water powers that are available for economic development. They will render service more reliable and will allow steam-power plants to be built in the most economical and most suitable location.

These superpower systems, General Tripp said, will become vital to our national prosperity, and they must of necessity be monopolies; but also they will be shining marks of the advocates of government ownership. It so happens, however, that, regardless of the merits or demerits of the theory of the public ownership of the utilities as an abstract proposition, the government ownership of a power system of this magnitude is impracticable. Superpower systems must have no political boundaries, and any attempt to keep their lines within arbitrarily chosen limits will merely result in destroying them as superpower systems and depriving the public of the chief economic advantages that they offer.

National ownership, on the other hand, may at first sight seem entirely feasible, but analysis shows that great difficulty exists here also. In the first place, the authority of the federal government does not extend beyond national lands, boundary waters and navigable rivers. It could not, under present laws, control the power developed by non-navigable streams, to say nothing of the necessary steam plants. Any attempt on the part of the federal government to extend its control would be promptly resisted by the states with the support of public opinion, which sees danger to our republic in the growing tendency of the federal authorities to interfere in local affairs.

Therefore, if the nation is to have superpower systems, they must be built by private capital and operated by private companies. Government ownership in any form would be fatal to that development and disastrous to the best interests of the public.

Each new municipal plant that goes into operation and each new obstructive state law, like that of Maine, prohibiting the export of water power, presents one more obstacle to the completion of the general plan. It is most pleasing to note the broad-minded water-power policy of Governor Pinchot of Pennsylvania, and it is encouraging to remember that the New York State Legislature did not adopt the policy of hoarding the state water power. But, nevertheless, there is altogether too much sentiment in favor of the government ownership of electric light and power utilities, and especially of water power, and the growth of this sentiment can be stopped only by making the people clearly understand the fundamental policy involved in it and by proving by service that private ownership and operation is, from the standpoint of the public, the better way.

### Rural Lines

The rural lines committee (G. C. Neff, chairman) paid less attention to rates and financing of lines than to the use and value of electric service on the farm, for it is believed that if sufficient use can be made of central-station service, the rate and financing problems will automatically take care of themselves.

A meeting was held with representatives of the United States Department of Agriculture, American Farm Bureau Federation and American Society of Agricultural Engineers, and a comprehensive study of the farm power problem was outlined.

The various interests represented perfected the organization of a committee on electricity as related to agriculture, with J. W. Coverdale of the American Farm Bureau Federation as chairman and G. C. Neff, chairman of the rural lines committee of the National Electric Light Association, as secretary.

The following investigations are to be carried on under general supervision of this committee: (1) Farm power survey; (2) survey of central-station and isolated-plant services to farmers; (3) survey of agricultural uses of electricity in foreign countries; (4) experimental and research work on the uses of electricity in agriculture.

The report presented a series of tables and a detailed discussion of the cost of rural electric service and methods of charging based on experience in territory served by the Union Electric Light & Power Company of St. Louis.

There are three things that have hampered the development of farm stationary power:

(a) At present there is very little farm machinery made that has been primarily designed to be used with the electric motor.

(b) The farmer, on account of being pressed for time and because of the character of his equipment, has had to devote almost his exclusive attention to any machine that happened to be in use.

(c) While much work has been done by the experimental stations in running tests, the machinery for getting this information to the farmer has not been set in motion.

The inquiries of the committee brought to light many subjects that should be investigated. Field power is used abroad, but has not been used much in this country. The electric truck for farm use and short hauls would seem to be worthy of consideration. Experiments show that electricity is of value in fertilization of fields and that it can be used in sterilization to stop bacterial action in silos.

From the comparatively small amount of work and investigation which had been achieved, the committee was of the opinion that with the development of proper electrically driven farm equipment and machinery a greater use will be made of electric service by the farmer, which will result in larger profits to him and to the utility which serves him. During the development period it will be necessary to treat the rural electric service as a special service and it is well to have specific rules covering the supplying of rural electric service, and as a guide to these rules the committee recommends a study of the various rules shown in last year's and this year's report. These rules, however, are of a temporary nature and can be eliminated when rural electric service has developed to a point where the revenue received bears a ratio to the investment comparable with the same ratio in urban business.

### What the Farmer Seeks

One of the most interesting talks of the week was that given by O. E. Bradfute, president of the American Farm Bureau Federation, an organization representing a million farmers. Mr. Bradfute said that there was invested in the farms of this country eighty billion dollars and that the value of the food products raised yearly ranged from twelve to fifteen billion dollars. As indicative of the viewpoint of the farmer toward the question of electrical supply, Mr. Bradfute said:

"No one who was not born and reared on the farm can realize what it means to the farmer and his family when for the first time he presses the button and sees his home, lawn, barns and yards suddenly spring from darkness into a full noonday light and the activities of the farm take on, as it were, new life. When the farmer's wife enjoys the experience of the electric sweeper, full electric laundry equipment and the sewing-machine motor, and the family has the experience of a modern bathroom and the convenient kitchen sink with hot and cold water under pressure, these things alone give a trial of electricity which they will never after be willing to surrender, because it makes it possible for the farmer to have all the modern equipment in his home that may be found in the best city homes, and he feels at last that he has an even chance with his city brother in the social comforts of life. This simple test of electricity in his home leads him on with deeper interest as he begins to think of the possibilities of electricity if it could only be harnessed for general farm purposes.

"It is claimed," said Mr. Bradfute, "that modern farm machinery has increased the efficiency of the American farmer 20 per cent in the last decade. It is not unreasonable to expect a similar increase in efficiency in the next decade, and we no doubt should expect electricity to play an important part in accomplishing that result."

Speaking of water power, Mr. Bradfute said: "God has equipped America with many fine rivers and streams well scattered over the entire country. He must have had in mind the electrical age and surely intended that we should harness that great power now going to waste and wisely distribute it to all the people.

"I believe that a great majority of the farmers who own and live on their own farms believe in private ownership of public utilities under reasonable and fair regulation rather than municipal, state or federal ownership."

### Merchandising Policy

A detailed analysis of the profit and loss entailed in the appliance merchandising operations of eleven central-station companies covering the first three months of this year was presented by John F. Gilchrist, chairman merchandising policy committee, this being a study supplementary to the statistics which were published last year by the joint committee on merchandising policy of the N. E. L. A. and the Edison Association. The Accounting Section at the committee's request prepared a revised classification of accounts and appointed a sub-committee to supervise the installation of this system in the eleven organizations which are cooperating in the analysis. The figures presented are approximate for the first six weeks while the system was being developed, but for the rest of the term are accurate and by the end of the year will provide a very exact statement of the merchandising experience of these companies.

The net sales of these eleven companies were $1,892,935.45, which represents 100 per cent of sales income. The gross profit, or excess over the cost of material in the dealers' warehouses, was $587,616.32, or 31.1 per cent of the net sales income. The total selling expense of the eleven companies was $422,360.65, or 22.2 per cent; the general expense $358,038.36, or 19.0 per cent; the fixed charges $39,540.71, or 2.1 per cent, and the net loss of the group, after deducting the gain of those companies which show a gain from the aggregate losses of those which show a loss, was $232,323.40, or 12.2 per cent.

The margin over cost of merchandise is greater than the corresponding figure obtained approximately one year ago from the same group of companies. In the opinion of the committee, this indicates two things—that the companies themselves are appreciating the necessity of withholding goods from their counters which cannot be bought at a price to yield them a fair margin above cost of merchandise, and that manufacturers and jobbers are rapidly awakening to their own interests and are readjusting their prices so that retailers may enjoy more of a margin between the list price established by the manufacturer and their costs.

Average sales expense may be slightly larger than expected by most students of the situation, but it is probably more nearly as expected than the 19 per cent representing the general expenses. On the other hand, with more information gained from this cost-accounting record as the months go by, it is quite likely that the item representing general expense will increase more rapidly than that representing sales expense, as it is in the general expenses of the business that the expenses of merchandising are to the largest extent absorbed by the other branches of the utility business.

The committee believes it must be apparent to all who have made any study of this question that the margin over cost of merchandise is insufficient, when the cost of securing the proper volume of business which a territory should properly yield is taken into consideration.

These figures are calculated on the basis of what the normal costs would be if this merchandising business were being conducted as a separate enterprise and not as a department of a central-station company.

### Company Employees' Organizations

This committee, of which Robert B. Grove is chairman, expressed its belief that the national association can function in a valuable way by endeavoring to render service to employees of class A members and to managers of class A member companies in their relationships with their employees, and further, that this function can best be performed by a national general committee composed of members broadly representative of employee organizations.

The committee hoped that the action of the national executive committee on the recommendations of last year's committee would be favorable to the development of company sections and, in any event, recommended that the preparation of the suggested handbook be undertaken.

The El Paso company section of the N. E. L. A., El Paso (Tex.) Electric Railway Company, was formed during the year, and the United Electric Light Company of Wilmerding, Pa., requested authorization of the national executive committee to form a section.

### Publicity for Public Utilities

Melville E. Stone, counselor of the Associated Press, spoke of the proper relation of public service corporations to the newspapers. He intimated that there was no reason why public service corporations should not be proud of their work and admonished his hearers to play a fair game and not be moved from a course of rectitude by the blackmailing legislator or menacing newspaper. Mr. Stone said the jury which will pass on the merits of the case is the public and the public is not easily fooled, nor is it disposed to be unfair. Before such a jury the rascally editor has just as much to lose as the utilities. He was opposed to purchasing favorable editorial comment with useless advertising. "If you have occasion to advertise," said Mr. Stone, "do it on purely business principles; that is, advertise with a newspaper when and only when you are seeking a legitimate return. Never advertise merely as a sop. Such advertising is discreditable alike to the utilities and to the newspaper man. It always arouses a suspicion on the part of the discerning reader that you are seeking something you should not have."

Mr. Stone expressed himself as opposed to government ownership on economic grounds. Government ownership, he said, has been often tried and almost always proved expensive and inefficient. He believed, however, in honest and intelligent governmental regulation and said it was silly to attempt secrecy in the conduct of a public service corporation.

# Commissioner Dwight N. Lewis Speaks

## President of National Railway and Utilities Commissioners Voices that Association's Belief in Private Operation—L. E. Pierson Gives Banker's View of Utility Management

AN ADDRESS by Dwight N. Lewis, president of the National Association of Railway and Utilities Commissioners, was a feature of the third general session, which was all devoted to public opinion and executive relation to some of the newer phases of utility management. How to reach the public through the schools or universities was one point emphasized.

### Private Ownership Preferred

Mr. Lewis said that he was conscious of speaking to trained men representing billions of capital and a public service that has rapidly been metamorphosed from a luxury to a necessity. He said that many state commissions are still on trial, and this past winter has brought forth determined efforts on the part of some people to have utility commissions abolished. Bills were introduced in many legislatures to bring such abolishment about, but the legislatures have all adjourned and the ranks of the utility-regulating commissions are still unbroken.

Much of the discontent with state-regulating commissions arose because of the fact that war-time conditions made it imperative that rates in some instances be advanced. Increased cost of coal, materials and labor made changes in rates absolutely necessary. "It may be said to your everlasting credit," said Mr. Lewis, "that electric utility rates did not advance in the same measure that other prices advanced during the war period of high prices."

According to Mr. Lewis, there is yet a considerable portion of our population who believe in municipal ownership of public utilities. "I am," he said, "a firm believer in public ownership, in consumer ownership, of a private company efficiently operated in the interest of the consuming public as well as the owning public. The government should concern itself with purely governmental affairs, protecting both persons and property in their constitutional rights, and leave to private capital and initiative the advancement of business affairs. The rights of the public may always be secured by proper oversight and regulation, and this

should not go so far as to destroy incentive for investment of capital and talent.

"I am informed that many towns in my own state, tiring of the burden of municipal ownership, are discarding their expensive and obsolete plants and are obtaining their supply of electricity from central distributing plants, much to their pecuniary profit and satisfaction in service. There is every

DWIGHT N. LEWIS
President National Association Railway and Utilities Commissioners

reason to encourage the building of super-power plants. More efficient management and operation, conservation of fuel and lessened overhead expense mean better service at less cost to the consumer."

## Conservative Expansion Recommended by Customer Ownership Committee

That the great and growing customer-ownership movement may go forward under sound policies, member companies pushing this invaluable work should at all times keep it in conservative control, the customer ownership committee, through its chairman, M. R. Bump declared. During 1922 it is estimated that electric light and power securities totaling $175,000 000 were placed in the hands of customers, compared with $80,000,000 in 1921, and this year it is probable that the aggregate total of customer ownership sales will reach a quarter of a billion dollars. The committee wished to go on record as to the necessity of conservatism in the creation of issues in every reasonable way in order to prevent the possibility of a failure of any of these securities to pay dividends regularly. A comparatively small number of such failures would do an enormous amount of harm to the customer-ownership movement as a whole.

In the past eight years at least 425,000 customers have been attracted to the possibilities of investing in local company securities. The gain in numbers is extremely rapid, and it is estimated that within three years at least one million people will own the securities of the electric companies serving them. The committee recommends that the incoming administration give serious consideration to the preparation of a series of statements to customer-owners that will broadly outline the economics of the utility situation and help in an educational way in the solution of the industry's problems. To overcome the indifference of customer-owners in some localities, it is recommended that group meetings in convenient neighborhoods be held from time to time where company executives may meet with customer-owners and discuss their problems, and that attractive company booklets and statements be sent these customer-owners at stated intervals.

The committee feels that it is undesirable for any company to guarantee the future market price of securities sold. Every company should attempt to maintain at all times an active market for the resale of securities. The cost of distributing securities is becoming lower each year. The committee recommends that the sales manual be revised to date.

DATA ON CUSTOMER OWNERSHIP
(Summary of information from 156 Electric Light and Power Companies)

| | |
|---|---|
| Total population of territory served... | 40,899,096 |
| Total number of customers.......... | 7,698,313 |
| Gross earnings of combined companies reporting .................... | $555,553,901 |
| New stockholders obtained from customer-ownership plan............ | 426,495 |
| Shares of stock sold under customer-ownership plan*.................. | 3,449,185 |
| Percentage of sales on deferred-payment plan (average).............. | 32.5 |
| Percentage of stockholders obtained through customer-ownership plan to customers..................... | 5.5 |
| Average cost of selling per share as reported by seventy-five companies† | $4.39 |
| Ratio of stockholders to population.... | 1 to 95 |

Shares sold to customers, 780,438; employees, 150,511; others, 125,491.
(Only fifty-eight companies reporting on this item)

SUMMARY BY YEARS

| Year | Shares of Stock Sold* | Stockholders Obtained |
|---|---|---|
| 1914 | 92,310 | 4,044 |
| 1915 | 57,103 | 4,357 |
| 1916 | 38,057 | 3,681 |
| 1917 | 79,348 | 7,470 |
| 1918 | 30,783 | 4,115 |
| 1919 | 166,096 | 20,840 |
| 1920 | 416,089 | 62,885 |
| 1921 | 802,845 | 118,177 |
| 1922 | 1,750,707 | 198,018 |
| | ‡3,433,338 | ‡423,587 |

* Stated in par value of $100 per share.
† In report of average cost of selling the lowest was 5 cents per share, which included postage and printing circular letter. The largest amount was $9.64 per share, including commission, advertising, transportation, general office expenses and salaries.
‡ These totals do not check with the summary above because of the fact that some companies failed to list the data by years.

## Utility Management

If the electrical utilities were to cease functioning for a single day, said Lewis E. Pierson of the Irving Bank-Columbia Trust Company of New York, modern life as we know it would come to a sudden halt.

In this fact lies the basic reason for the interest of the public in the conduct of the electrical industry and for the public's right to demand that the industry shall be efficiently and intelligently administered.

On the other hand, the same fact places a great and pressing duty upon the industry—to protect itself from the imposition by the public of policies and theories the result of which would be to cripple the essential instruments of public service.

The world's experience with public utilities is comparatively brief. It has experimented with various forms of government for thousands of years and as yet has evolved nothing which even approaches perfection. The sum total

LEWIS E. PIERSON
President Irving Bank-Columbia Trust Company

of its knowledge of public utilities covers less than a century.

Thus far three major ways of managing and operating public utilities have been attempted: First, private ownership and operation without governmental regulation; second, public ownership and operation; third, private ownership and operation subject to governmental regulation.

The first two have proved to be undesirable in a number of ways. Public ownership and operation, however, has in practice proved even worse than private ownership without regulation. Out of the failure of government ownership and operation and the disadvantages of unregulated private ownership and operation has been evolved the third method of dealing with public utilities, namely, private ownership and operation subject to regulation by a commission representing the public.

In theory this method presents the most effective method yet devised for safeguarding the administration of public utilities. Practice has proved what theory indicated. Wherever the commission idea has had a fair trial through the appointment of officials of intelligence and character service has improved and the utilities have made progress. The electric light and power industry is today contributing to the comfort and prosperity of the country nineteen times as much as it contributed twenty years ago.

## Education and Research

In an address on this subject Richard T. Ely, professor of economics, University of Wisconsin, told of the possibilities for a better government and a better civilization through having the youth of the nation better educated in the fundamentals of the great utility business.

"I know something," he said, "of the vision as well as the achievement of the men in the electric lighting field. But we are only at the beginning. Farm and factory, homes in city and country, are going to receive increasingly the benefit of the growing marvels of electricity."

In Dr. Ely's opinion it is a privilege that educators may well crave to help realize the vision which animates the spirit of the leaders in the industry.

### Accident Prevention

In reporting for the accident prevention committee, its chairman, Charles B. Scott of Chicago, said that accident prevention in the electrical industry has passed from the experimental stage into one where it is an integral constant factor in every operation. Detailed reports were made on educational courses, resuscitation, health promotion, suggestion systems, usefulness of statistics, radio hazards, automobile hazards, grounding and its relations to accident prevention, locking doors in high-tension compartments, electrical apparatus and risks peculiar to hydroelectric plants. Mr. Scott said that these reports should be useful to the supervisory forces of member companies and recommended that they be placed in the hands of key men and be made a part of operating plans.

### Great Savings in Insurance

E. Wolff, reporting for the insurance committee, gave an excellent account of the work of the committee and the large savings in insurance premiums which it was able to effect. He recommended that the insurance activities of the association be consolidated under the direction of a member of the headquarters staff in order that such work may be fully co-ordinated.

The reduction in the fire insurance was approximately 25 per cent and for auto-trucks 31 per cent. From reports received from ninety-one companies a saving in premiums of $103,769 was reported. The lowest reported was $25 and the largest approximately $25,000, the average being $1,140.

President Smith, in referring to the committee's work, said that through its activities it had been able to save to member companies a sum of money exceeding the annual dues which these companies paid into the association.

### Army Engineers Co-operate

Reporting for the committee on electrical resources of the nation, M. S. Sloan, president of the Brooklyn Edison Company, told of the co-operative work of the Great Lakes Division, N. E. L. A., with the Chief of Engineers of the United States Army in compiling basic information on the electrical resources of that division. Mr. Sloan recommended that the government be provided with an accurate statement of present resources as well as an estimate of prospective growth, so that in time of shortage such as existed in 1918 definite and accurate information will be instantly available.

### Simplification and Standardization

Gen. George H. Harries indicated in his report of the committee on contact with the Department of Commerce just what can be accomplished by unification of effort in any industry. The survey of waste in industry showed the need of elimination of losses, and Secretary Hoover in seeking a man to head his department for simplification naturally took him from the electrical industry, which for economy and reliability's sake has practiced simplification for years.

### President Smith Commended

John W. Lieb, reporting for the committee on the president's address, commended President Smith for the unusual grasp of the problems of the association and details of the industry which his report indicated he possessed. The intimacy showed in his review of national and geographic section work, Mr. Lieb said, was gained by personal contact and proved the desirability of having officers and members of the staff headquarters making observations in the field. The committee commended the survey of general conditions made by Mr. Smith, stating that it sounded a note of confidence and optimism concerning the industry's future.

### Memorials

The report of the committee on memorials was made as usual by W. H. Onken, Jr., editor of the ELECTRICAL WORLD, and as a mark of respect the convention stood with bowed heads for a moment in memory of those who died during the year.

# The Utilities and American Initiative

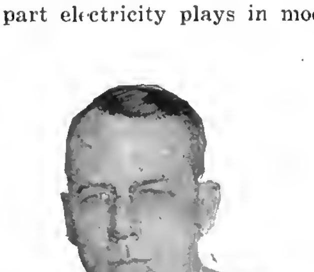
**Public Policy Session Listens to Julius Barnes and to Public Policy Committee Report—Charles A. Coffin Medal Awarded to Southern California Edison Company**

A LARGE audience was present in Carnegie Hall Thursday night to listen to the address of J. H. Barnes, president of the Chamber of Commerce of the United States of America, and to the report of the public policy committee, of which Martin J. Insull of Chicago is chairman. This report is given in abstract elsewhere in this issue.

The serious portion of the program was preceded by organ selections by M. E. Schwartz and by songs sung by Miss Anna Case. From a popular standpoint great interest centered in the meeting because of the remarkable use of radio broadcasting.

### American Inspiration and Initiative

Mr. Barnes' talk was highly inspirational and instructive. He told of the great part electricity plays in modern



*Clinedinst, Washington, D. C.*

JULIUS H. BARNES
President United States Chamber of Commerce

life and in individual production, and was insistent on the prerogatives of American traditions and institutions and on the exercise of private initiative and enterprise in the operation of public utilities and in the conduct of business in general.

The speaker indorsed state regulation of public utilities and paid a glowing tribute to the electrical industry of America. The fairy tale of modern industry, he said, lies in the area of American electrical development.

When the great truth is grasped that the standard of the average home possession is only surely raised by producing more and more of the articles of common use to divide among these homes, then we get the human meaning that is shown almost without exception in all American industry under this typically American philosophy of larger and cheaper production.

The American philosophy may be fairly called the philosophy of fair play: that the individual shall not be deprived of his opportunity for superior accomplishment and superior fortune by the rigid and blind processes of a government which injects itself into natural processes, with disastrous results, nor deprived of that rightful opportunity by strong combinations of either influence or of wealth, or of monopoly created by government favor.

In the preservation of this field of fair play there has developed as the proper relation of government to private industry the American theory of regulation. America recognizes that free and open competition is the great safeguard to individual opportunity, and when for any reason the play of competition is checked, then the organized authority of society must, in the very preservation of fair play, interest itself.

It is manifest that, when the supreme authority of the state is called into play to secure rights-of-way for power transmission, or for transportation across reluctant private property, there is set up a peculiar obligation toward the established constitutional authority

which exercises that right of organized government over individual opinion and preference. So that the policy of regulation is one which is approved by common sense and grounded on the American passion for fair play and equal opportunity.

But, as always in the exercise of supreme public authority through public servants, who are but human, we have passed through phases which require correction. In our own self-preservation such regulation must be fair and even generous. We must preserve in publicly regulated but privately owned services the field of opportunity which attracts the superior grade of ability and resourcefulness.

It is only in the domain of public utility service and its regulation by constituted authority that we have failed to grasp fully the principle that that regulation must preserve the divine individual stimulus which inevitably translates itself into enlarged human convenience and happiness. This policy of regulation is in the stage of evolution. It must be tested in this direction and that. Abuses must be eliminated and the stimulants preserved and developed. Experimentation matters not so much if only that policy of regulation shall be animated by a public conception of its own self-interest and of the spirit of fair play which shall interpret the relation of government to this great industry.

### Public Policy Committee

Martin J. Insull, chairman of the public policy committee, presented the report of the committee. The ideals of the industry as set forth in the report were loudly acclaimed and applauded by the audience. An extended abstract is given elsewhere.

# Water-Power Development and Coal Storage

**Secretary Merrill of Federal Power Commission Discusses Hindrances to Hydro-Electric Progress—Lieb on Coal Storage—Wiring Changes and Lamp Developments— Johnson Elected President**

O. C. MERRILL, executive secretary, Federal Power Commission, in an address which was listened to with interest and warmly applauded, placed emphasis on certain tendencies which retarded development. He stated that new construction already completed or involved in projects upon which construction has already started aggregates 1,470,000 hp. of proposed installation. The aggregate total of estimated installation in the 173 projects for which permit or license has been issued is 7,600,000 hp. Tracing the marked change which has taken place with respect to the development of water power on navigable streams, which for fourteen years preceding the present law was virtually at a standstill, Mr. Merrill showed that on navigable streams alone 2,000,000 hp. is under construction or applied for.

He made it plain that at present there is no surplus power and that despite that fact and the urgent necessity of greater water-power development in the East, the greatest water-power source in the country, the St. Lawrence River, is running to waste and the second greatest potential source, the Colorado River, is likewise unused because of conflicts over jurisdiction caused by interstate jealousies, by strife between the advocates of public and private ownership, by existing or prospective embargoes on power transmission or by restrictive action by state legislatures.

Touching on the situation at Muscle Shoals, Ala., Mr. Merrill said that the nation has in the federal water-power act established a definite national policy, representing the mature judgment of Congress and the consensus of public opinion. He intimated that it is necessary to safeguard that law from attack if maximum and proper development of the water-power resources of the nation are desired.

### Coal Storage Recommended

Reporting on the activities of the joint fuel committee during the recent coal and rail crises, John W. Lieb of New York, its chairman, told of the relief given to 225 companies which sought the assistance of the committee. He strongly urged member companies to store coal to the limit of their capacity so as to safeguard the service and at the same time relieve as much as possible the railroads of the company at the time of their peak loads. He also expressed the hope that public utilities would make contracts for their coal requirements and intimated that possibly public utilities might receive preferential treatment from Washington on contracts of this kind, insuring full delivery before operators could sell spot coal.

### Wiring Methods

Standardization of appliance plugs and prongs, changes in the National Electrical Code, polarization of portable devices, tests of heater cords and improvements in wiring methods were particularly noted in the report of the Wiring Committee (R. S. Hale chairman) this year. At present, the committee declared, it is not desirable to insist that appliance prongs shall be of the same design for all classes of appliances.

Some of the advantages of the solid-neutral, 15-amp. fuse and 660-watt rules recently adopted by the National Board of Fire Underwriters, were outlined by the committee, which has been advocating them for some time. The principal benefit emphasized is the saving in installation cost in all new construction, of which there is an unprecedented amount going on this year. The solid neutral will make easier the use of a consolidated neutral or neutral bus in apartments, and office buildings with meters in the basement and numerous circuits.

Among subjects which the committee suggested for future work are the following: Listing and discussion of new methods which are improvements on present practice but are not of a nature

# Growing Customer Ownership

**Distinguished Leaders of Thought and Action Portray Accomplishments in This Direction and Point to Promising Future for the Policy**

THE triumphs of customer ownership during its short career of nine years and the remarkable opportunities of the future in this branch of public relations work were set forth at the session of the customer ownership committee on Thursday afternoon, under Chairman M. R. Bump. The committee report emphasized the extremely rapid growth of this movement since the war and urged a continuance of the sound financial methods which have been so great a factor in its success throughout the country. John A. Britton, vice-president Pacific Gas & Electric Company, San Francisco, reviewed the rise of customer ownership from its inception by that company in 1914, pointed out its invaluable aid in the defeat of the California state water-power act at the 1922 election and described with telling force the bearing right public relations exert upon utility development. B. C. Forbes, editor *Forbes Magazine*, New York, gave an optimistic address upon the future of customer ownership and private management, urging continued care as to the quality of security issues offered to the public. E. K. Hall, vice-president American Telephone & Telegraph Company, New York, pictured the undeveloped investment field of the country and its attractiveness as a source of fresh capital for electric utilities. He urged making the utmost of the opportunities to develop friendly relations between utilities and owner-customers.

Louis H. Egan, president of the Union Electric Light & Power Company, St. Louis, spoke upon the desirability of broadening the security offerings placed before the public, the possibilities of preferred-stock absorption having in many companies been utilized up to the desirable ratio to other classes of securities. These addresses are abstracted at length elsewhere in this issue.

to warrant their being made obligatory by law or code; methods of standardizing interpretation of doubtful points in the code, and study of the general wiring situation and its probable development when all or nearly all the buildings in a district are connected to central-station lines.

## Rate Research

The rate research committee reviewed a number of important rate decisions and rulings of the past year having to do with confiscatory rates, ordinance rates, special rates and relief granted by the United States courts. The necessity for cost analysis was again urged. Cost analysis will show whether any class of service did or did not earn last year its fair share of earnings. But it cannot take account of the interlocking and reaction upon one another of all existing classes of service. In brief, analysis should be a light on the road of business management; it should not supersede the intelligence which must guide our car along that highway.

The report discussed at length the decisions of the New Jersey, Wisconsin and California commissions that deal with the large question as to whether uniform rate schedules should be established throughout areas which are economic but not political units.

The committee said: "The trend of decisions and of practice continues to be toward reduction of the number of rate classes and the simplification of forms.

We do not foresee early uniformity in power factor clauses. The mechanical basis of credits and debits for power factor should be the metering by an integrating meter of the reactive component of the supply, and every power-factor clause should be designed to discourage bad power factor and encourage good power factor, and not to apportion meticulously the added costs due to a lower power factor of the electric system."

Attention is called to the recently published experience of the Hartford company,* with a residence rate composed of a fixed charge based upon floor area, plus a meter charge of 6 cents per kilowatt-hour, which composite rate was substituted in January, 1922, for a straight 10-cent-per-kilowatt-hour residence rate.

## Co-operation with Telephone Companies

R. F. Pack reported progress in the co-operative work being carried on with reference to inductive co-ordination and other matters in which the electric light and power companies and the telephone companies are interested. The two utility organizations, he said, are working in full harmony, endeavoring to find solutions to certain definite problems. The element of suspicion and distrust, Mr. Pack informed the convention, has entirely disappeared.

*See Electrical World, Feb. 17, 1923, page 412.

## Activities of Joint Committee

A review of the work and accomplishments of the Joint Committee for Business Development since its organization was made by E. W. Lloyd of Chicago. The speaker outlined some of the savings which could be effected by co-operative effort and closer organization and said the "electrify" movement to which the joint committee is committed is not a temporary campaign. He asked that the joint committee be supported by every electrical association and interest in both the United States and Canada, stating that the running expenses of the organization were not large. In the estimation of the speaker the joint committee is essentially a consulting organization and serves its purpose when it brings its members together to consider a given proposition, no matter from what source it originates.

## Lamp Standardization

The total sales of tungsten-filament incandescent lamps (excluding miniature lamps) in the United States during 1922 amounted, according to the lamp committee (W. W. Freeman chairman) to slightly over 200,000,000. This is a 25 per cent increase, over the 1921 sales of 160,000,000 and is within 1 per cent of the 202,000,000 sold in 1920.

The demand for lamps in the different voltage groups for the past three years is shown in Table I.

TABLE I—PER CENT DEMAND FOR LAMPS 1920-21

| Voltage Group | 1920 | 1921 | 1922 |
|---|---|---|---|
| 115 | 85.2 | 85.8 | 88.2 |
| 230 | 5.6 | 4.3 | 4.0 |
| Street series | 1.3 | 1.9 | 1.4 |
| Street railway | 3.2 | 2.6 | 2.0 |
| 30 and 60 | 3.9 | 4.7 | 3.5 |
| Miscellaneous | 0.8 | 0.7 | 0.9 |

Attention was again called to the recommendation that the use of 112-volt lamps should be discouraged.

The committee earnestly recommended that the question of complete standardization and unification be seriously considered by those companies which have not standardized as to voltage or unification of voltage of their systems.

## American Engineering Standards

The purpose, organization and method of functioning of the American Engineering Standards Committee was outlined by S. G. Rhodes, executive member of the light and power group of the main committee, who explains that the organization is limited to the functions of fostering, encouraging and providing facilities for standardization originated by other bodies. Its purpose is chiefly to certify to the adequacy of the method of preparation.

## Award of Prizes

Association prizes were awarded before the close of the convention as follows: The Charles A. Coffin medal to the Southern California Edison Company of Los Angeles, Cal., for excellence of station, distribution and transmission equipment, company organization and relationship with employees, public relations, and in recognition of its work in popularizing the use of electricity. This award was made at the meeting of the public policy committee and accepted on behalf of the company by John B. Miller, its president.

The Doherty gold medal for the best paper of the year was awarded to G. Bertram Regar of the Philadelphia Electric Company, the subject of his paper being "More Business Through Better Lighting." A. H. Heitzler and S. R. Finley of the Ohio Public Service Company of Massillon were awarded the Harriett Billings prize of $50 in gold, donated by Arthur Williams of New York, for their joint paper "An Analysis of Consumption by and Revenue from Domestic and Commercial Lighting Customers."

## Officers Elected

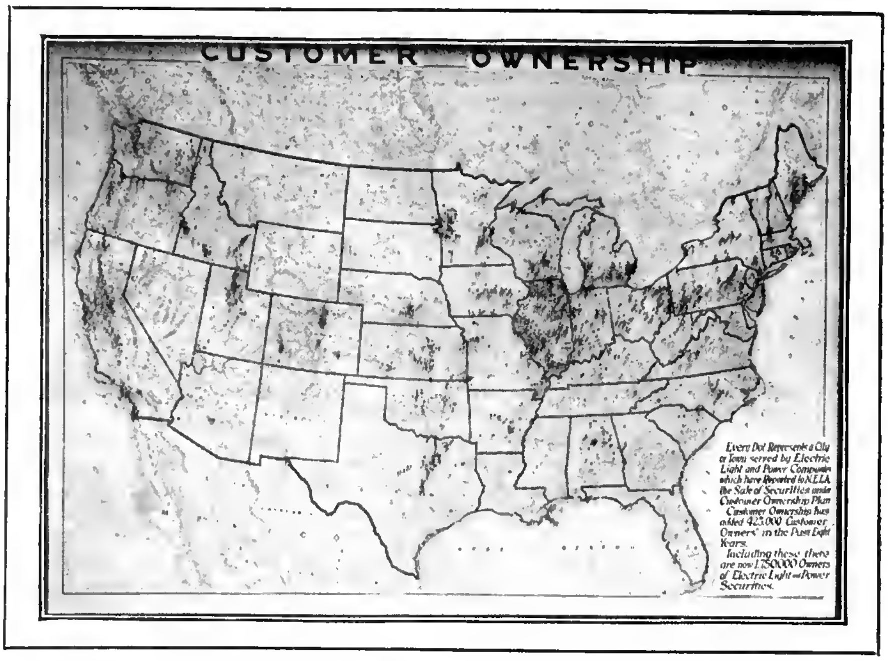
On the recommendation of the nominating committee, the following officers were elected: President, Walter H. Johnson, Philadelphia Electric Company; first vice-president, John A. Britton, Pacific Gas & Electric Company, San Francisco; second vice-president, J. E. Davidson, Nebraska Power Company of Omaha; third vice-president, R. F. Pack, Northern States Power Company of Minneapolis; fourth vice-president, H. T. Sands, Charles H. Tenney & Company of Boston; treasurer, Walter Neumuller, New York Edison Company. Of the five members of the executive committee whose terms of office expired, W. A. Layman, Wagner Electric Manufacturing Company, St. Louis; E. W. Lloyd, Commonwealth Edison Company, Chicago; J. E. Strong, Tucker Electric Company, New York, and W. E. Robertson, Robertson-Cataract Electric Company, Buffalo, were re-elected to succeed themselves for a term of three years, and Harry Reid, Interstate Public Service Company, Indianapolis, was elected to succeed J. F. Owens, Oklahoma Gas & Electric Company. The other members of the executive committee, who continue in office, are: I. E. Moultrop, Edison Electric Illuminating Company of Boston; H. C. Abell, Electric Bond & Share Company, New York; E. W. Rice, General Electric Company, Schenectady; P. S. Arkwright, Georgia Railway & Power Company, Atlanta; E. M. Herr, Westinghouse Electric & Manufacturing Company, East Pittsburgh, and T. A. Kenney, Hodenpyl, Hardy & Company, also elected.

Election of members to the exhibition committee of the Class D manufacturers resulted as follows: E. R. Whitney, Commercial Truck Company, was elected for a term of two years; J. C. McQuiston, Westinghouse Electric & Manufacturing Company, Pittsburgh, for three years, and George A. Hughes, Edison Appliance Company, Chicago, for three years. N. C. Garland, Ohio Brass Company, New York office, was also elected.

# Public Relations Sessions

***Greater Executive Attention to Customer Contacts Evident—Utility Commissioners Help Public and Utilities to Understand Each Other***

THE public relations section showed its virility by the program of its three sessions—one reporting the work of its committees, one devoted to a discussion of utility information bureau work, and one at which was presented a wonderful symposium by commissioners and utility executives.




## Committee Accomplishments Discussed

Taking as his text "We shall know each other better when the mists have blown away," H. T. Sands, chairman of the Public Relations Section, declared that this thought might well be taken as the motto and purpose of all public utilities in their public relations work. The continued success of the central-station industry will, he said, be determined by the extent that a company is able to gain and hold the confidence of the public which it serves. Between the industry and that confidence all mists of distrust and suspicion have one common origin—the lack of understanding of the public utility business.

What the public utilities must strive for is a better understanding between themselves and the public—an understanding on the part of the public of the industry and its problems, and, what is equally important, an understanding on the part of the industry of the mental attitude of the public toward it. The first prerequisite step toward securing this better understanding must be taken within the utilities' own household. Many employees still hold ideas regarding the fundamentals of the public utility business that are just as vague, just as erroneous and sometimes just as ludicrous as those held by the majority of the public. The first step, therefore, is for the utility to put its own house in order. To do this the executives must take their employees completely into their confidence, inform them as to the important fundamentals of their particular company, tell them frankly of its capitalization, its franchises, the contribution it makes to the community in the form of taxes paid, the size of the investment and how the money is obtained.

### Employee Relations with the Public

The committee on employee relations with the public (L. B. Herrington, chairman) drafted a proposed employees' manual which in its preliminary form embraces several commendable features.

### Co-operation with Educational Institutions

The development of closer co-operation with educational institutions in presenting the problems of public utilities to students has progressed satisfactorily under this year's committee, of which John C. Parker is chairman.

H. T. Sands
Chairman

Much attention has been given to determining how the needed public utility information could best be included in college courses.

With no attempt to influence or control, the association could well undertake to endow two or three professorships which would be intended primarily to facilitate research and secondarily to provide for the teaching of a series of public utility courses. Such a department would require an endowment of \$20,000 to \$30,000 a year. It was the belief of the committee that when the time is ripe for such an endowment the central-station industry could well afford the expenditure.

In view of the delicate character of the problem referred to the committee, it did not believe that any direct results could be produced in a hurry. None the less, the committee was persuaded that there is a very real opportunity to serve American education and incidentally strongly to benefit our industry. To this end the committee recommended that the following steps be taken:

(1) Compile a list of the schools at present giving public utility courses.

(2) Invite into conference with this committee a representative group of professors to determine whether our program will be acceptable.

(3) Communicate through a letter of inquiry to the school men, the country over, determining the acceptability of the proposed program.

(4) Prepare a general problem list for periodical dissemination to the schools.

(5) In special instances attempt to relate professors of economics with neighboring central-station institutions as source material for research.

(6) Discuss with the school men and formulate definite plans for a graduate group in public utility economics.

### Manufacturers' Advertising

Manufacturers of electrical apparatus and equipment have again had a part in the association program of building

through publicity better public relations for central-station companies. In the reports of the manufacturers' advertising committee (P. L. Thomson, chairman), the willingness of various manufacturers to use a part of their space in publications to talk about central-station problems was commended. The committee expressed its appreciation of the efforts of appliance manufacturers to co-operate with the committee and indicated that more of this kind of advertising may be expected in the future. There has been a growing disposition among central stations to recognize that the other branches of the industry which perform an economic function in the distribution of merchandise are entitled to fair play and an opportunity to reasonable return. This has resulted in a healthier point of view on the part of manufacturers toward the operating companies and their prosperity.

A number of security houses have co-operated with public utilities by running advertisements recommending this class of securities for investment. In connection with individual offerings of issues, much has been said in advertisements in favor of utility stocks and bonds, and their wide popularity has been widely recognized by financial writers in the editorial pages of both magazines and newspapers.

### Public Speaking

Back of the organization of the public speaking committee (A. C. Marshall chairman) is the theory that public utilities can no longer safely maintain an attitude of secrecy and mystery regarding the industry, and telling the story of utilities certainly is one of the best ways of informing the public and keeping it informed. During the past year a great deal of work along this line has been done through the public utility information bureaus and also by individual companies themselves. Among those which have done especially effective work are the Rocky Mountain Section public speaking committee, the New York Public Utility Information Committee, the Edison Electric Illuminating Company of Boston and the Michigan Committee on Public Committee Information; besides these a vast amount of work has been done in California under the leadership of S. M. Kennedy.

An important development during the past year was a series of lectures given by Carl D. Jackson, former president of the National Association of Railway and Utilities Commissioners. At educational institutions he spoke on general economic problems and brought the utility industry into his talk in a most interesting way. He also addresed bankers, editors, state and city officials and presidents and members of faculties of several educational institutions. This was thought by the committee to be the largest thing done this year.

### Information Bureau Organization

Public utility information bureaus have been organized in twenty-two states, their activities covering in all thirty states according to the report of the organization committee (H. C. Abell chairman). Bureaus are now functioning in the following states: Illinois, Indiana, Kentucky, Iowa, Ohio, Nebraska, Missouri, Oklahoma, New York, Kansas, Wisconsin, Michigan, Georgia, New England, Maine, New Hampshire, Vermont, Massachusetts, Alabama, Louisiana, Mississippi, Rhode Island, Connecticut, Colorado, Wyoming, New Mexico, Tennessee, Texas, Washington and Pennsylvania.

Organization of bureaus in four additional states is now under way, and work is in progress in other states.

### Relations With Financial Institutions

During the past year the committee on relations with financial institutions (M. S. Sloan chairman) has been working almost entirely on an effort to draft a law which can be introduced into the Legislature of the State of New York legalizing investment by savings banks in the securities of electric power and light utilities and also of gas and telephone utilities. The draft of the law has finally been completed and is ready to submit when it is deemed advisable.

In the consideration of this bill more or less discussion developed in connection with other types of utilities, particularly the electric street railway companies. It was found that, in view of the unfortunate condition existing in in the past few years from which the street railways are now emerging, the opinion of the savings-banks representatives was that they were not convinced of the advisability of including the electric street railways in this bill.

### Women's Public Information

The work of the women's public information committee (Miss O. A. Bursiel, chairman) was handled most effectively by dividing the work geographically. Efforts of this committee have been directed to promoting the plan of informing women within the industry about the public utility business as a whole and their own company in particular. A great deal was accomplished by talks given by heads of departments and by means of inspection trips over the properties of the various companies.

In some instances the activities of the women's committee have been carried into universities and women's clubs. However, while the committee believed that its educational activities might be carried into a wider sphere, taking in women outside of the industry, there remains much to be done in the education and information of those now within the industry. It was recommended that future organizations should not undertake to formulate new lines of instruction so much as to utilize what has already been developed and worked out through experience.

After the presentation of the various committee reports, L. D. Gibbs outlined the work of the Edison Electric Illuminating Company of Boston during the past year in showing a moving picture entitled "Edison Service," which had been accompanied each time by a lecture given by one of the company employees. In all, more than two-hundred thousand people in the company's territory have seen the film. The session closed with a presentation of the film as an illustration of what the central station can do to present its story to the public.

#### Election of Officers

Chairman H. T. Sands and Vice-chairman Frank R. Coates, W. H. McGrath and Edwin A. Barrows were unanimously re-elected to serve in their respective offices for another year, together with Martin J. Insull (ex officio), S. M. Kennedy, M. J. Sloan and E. C. Kifer, members-at-large.

## Information Bureaus Win High Praise

**Notable Addresses and Symposium of State Public Utility Information Committee Officials Are Features of Overheated Session**

IN SPITE of the extreme humidity and great heat, there was a large gathering on Tuesday afternoon to discuss the work of the state public utility information committees. The program included several addresses and a symposium in which officials of many of the state committees described the individual features of their work. Enthusiastic indorsement was given to this service, which now embraces thirty states, and the influence for good which it is exerting throughout the country. In opening the meeting H. T. Sands, chairman of the Public Relations Section, recalled the fact that when the first public utility information bureaus were organized newspapers were inclined to look upon the activity with suspicion. The frank, honest and constructive manner of the committees, however, has gradually won the confidence of the press.

H. C. Abell took the chair and spoke of the necessity of making clear to the people the financial needs of a public utility corporation. The work cannot be left entirely to the committee. The utility executive must study his own company and its place in the community he serves and must continue independently to work for better public relations at home. He must also give generous assistance to his state information committee for the common good, if much is to be accomplished.

The fundamental reason why it is necessary to make this effort to inform the public of the function and purposes of the public utility was discussed at length by Don Seitz, editor of the New York *World*. The misunderstanding between the public utilities and the public, he said, dates back to an inherent characteristic of the people, an unwillingness to be influenced to the

acceptance of benefits which they do not actively desire. The central station itself was born of a desire on the part of pioneers to develop an idea of which the public was not yet conscious. Overcapitalization became a feature of early utility operation, and the industry passed through an era of consolidation and reorganization which the general public neither understood nor approved. Thanks to the great resources of the country and to the unconquerable souls of the pioneers, in spite of all these handicaps the industry has achieved its present greatness.

In years gone by, Mr. Seitz continued, men were accustomed to say, "More power to your elbow." "More power at your elbow" should be the slogan of the electrical industry. The service which the public utility offers has become a matter of such constant convenience that the public fails to appreciate how comprehensive it is. The utility therefore must preach this doctrine of universal service.

Bruce Barton, president Barton, Durstine & Osborne, stressed the need for continuous, consistent, unflagging activity along the lines of education. "Scattered throughout this country as we talk here," he said, "there are several thousand old men lying sick, and before this meeting breaks up they will have died. During this same period there will be thousands of boys and girls born into the world. The utilities of this country have invested years of effort in the education of these old men, but it must be appreciated that this investment dies with them. The same story must be told in turn to the coming generation throughout all time. The work of informing the public, the upbuilding and maintaining of an intelligent public appreciation, is never done. The story of public relations is never completely told. It must continue so that each new child will grow up in the same well-founded background of information, that he may become a more understanding customer. Emerson said, 'What you are thunders so loud that I cannot hear what you say.' It is up to every company to endeavor to develop public relations by informing the public as to its deeds and its needs. There are three good rules to follow in public information work—be genuine, be simple, be brief. Talk in the language people understand and consistently continue in the work. No one can advertise in good times and expect to live on the memory of it when hard times come."

W. W. Freeman, Cincinnati, delivered an address written by Robert Lindsay, president of the Cleveland Electric Illuminating Company, as Mr. Lindsay was unable to be present. The public information bureau, said Mr. Lindsay, is the only mechanism available for representing all four utility elements. In the final analysis of things the public holds the fate of the utility industry in its hands, but only through mutual co-operation is it possible to develop the highest type of service at the lowest rate. This co-operation can be effected only when the methods and purposes of the utilities are interpreted to the public and understood. Much misunderstanding can be overcome by simplicity of rates and regulation. Information bureaus, however, cannot accomplish this by merely stating that the service is good and that the rates are low; it must be demonstrated also by the acts of the utility, and the commission that gets only funds and no active support from its members will not go very far.

There are now at least thirty bureaus of information. Each offers a valuable approach to the public and has proved of great influence. The future of the work lies in the hands of the central-station executives, and in Mr. Lindsay's opinion the development of the public information service would shape the development of the industry.

George E. Lewis, director of the Rocky Committee, told of the work his committee has done in developing contact and co-operation with colleges and universities. Sixty lectures in all had been delivered by this committee. The entire committee met periodically with the faculty from each of the institutions in that section, and the entire evening was spent in a general discussion of methods of presentation and the attitude of the students.

Joseph B. Groce, director of the New England bureau, said that the national scope of the work is an important consideration. Many evidences have been seen that matter from the New England bulletins has been published in newspapers of the West, and much information sifts in from other sections to the New England press. Educational influence on the editors of newspapers themselves is shown more in what they don't say than what they do say and is bringing a steadily increasing understanding of utility background.

John F. Gilchrist, chairman of the Illinois committee, announced that a public utility course has been established in the Illinois University. Much good has been accomplished by the work of the speakers' bureau, and in all approximately three hundred speeches have been made. This committee recently sent out a questionnaire to bankers asking what utilities can do to establish themselves in the confidence of the people. Ninety per cent of the answers said that good service was important above all else. Another canvass was made through the clipping bureaus to show what class of article is most acceptable to the newspapers. The committee had expected that the lighter articles and short items would be most useful to the editors, but found that the greater number preferred the longer articles, technical descriptions of properties and more detailed discussions. When the work through the schools was first organized the committee was somewhat fearful that the public would resent this activity and hold it to be selfish propaganda in the interests of the utility corporations. The teachers in the schools proved extremely receptive, however, and are co-operating heartily in the work.

Earle W. Hodges, director of the Arkansas committee, described the unique publication which this bureau is issuing. It is a sixteen-page booklet "boosting" Arkansas and is very generously supported. This monthly bulletin is distributed to sixteen thousand readers in the state—editors, ministers, teachers, clubs, farmers, business men and so on. A special appeal is made to the clergy. Mr. Hodges considers the ministers, the editors and the schoolteachers the most important elements in the public audience and is obtaining active co-operation from them by frankly interpreting the work that public utilities are doing.

# Commissioners Talk Frankly to Executives

## Public Attitude Toward Commissions, Depends on Utility Attitude Toward the Public

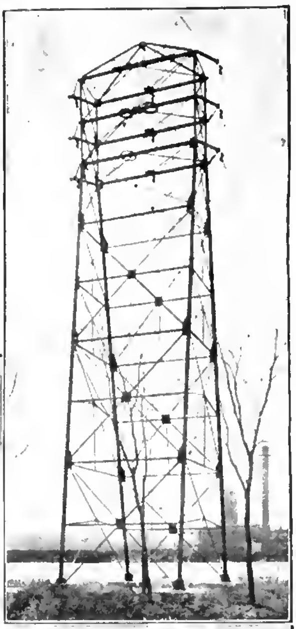
THE third public relations session was notable for the symposium on public relations by five leading public service commissioners and five leading utility executives.

A large audience, including most of the executives at the convention, attended the session. Closer attention to the detail of individual customer contact, advertising and publicity backed by 100 per cent efficiency in service, introduction of the subject of utility regulation as one of the elements of courses in civil government in the grade and high schools of the country, intelligent publicity of decisions, organization of the public relations departments of utilities on the basis of the organization of engineering and financial departments—all of these were suggestions discussed.

Chairman Sands pointed out that the Public Relations Section had started its career on uncharted seas, seeking advice and comments from those able to help, and that at this session men who were qualified from their positions to have a particular viewpoint of the situation were to talk.

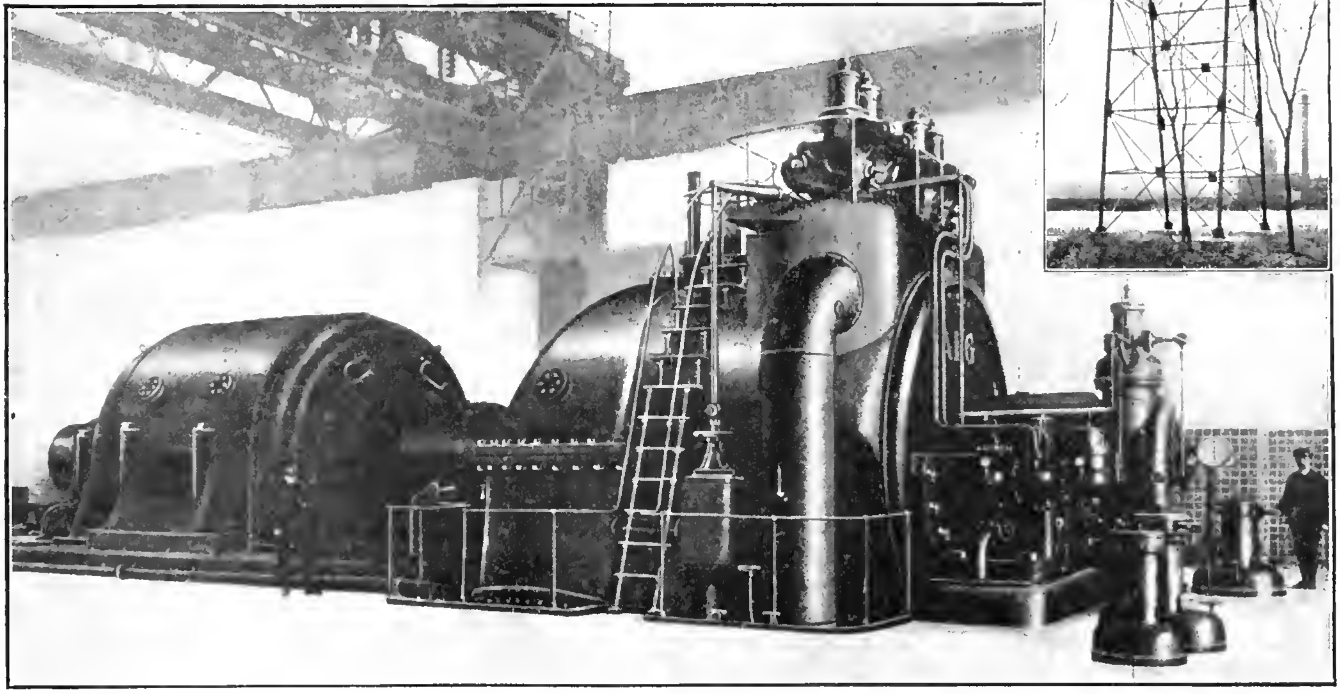
Executive Manager M. H. Aylesworth, in some introductory remarks, said that utilities used to think that service without talk was sufficient; later some thought that talk unsupported by service would accomplish satisfactory public relations; but both have been proved wrong, for both service and adequate publicity are necessary.

The individual addresses of commissioners and utility men are abstracted as a symposium which appears elsewhere in this issue.



# Technical Sessions

*Engineers Recognize Interlocking Responsibilities in the Solution of the Industry's Problems*



THE best indication of the interest-sustaining value of the technical reports of the N. E. L. A. this year is the fact that delegates to the convention crowded one of the great ballrooms of the Commodore Hotel each session and remained throughout, despite personal discomfort due to excessive heat and humidity. The discussions were so full of meat that to characterize the technical program as a whole in a short introduction would compel the omission of reference to many subjects which deserve the consideration of every engineer. However, attention must be called to some of the "high points," such as the discussions on higher pressures, steam reheating, stage bleeding and pulverized coal, increased need of attention to obsolescence, hydraulic penstock practices, experiences with automatic operation and definition of circuit-breaker duty, substations of the future, emergency connection between non-allied companies, bulk supply to industries, standardization of overhead construction, improvements in underground cable, the plan for a national superpower scheme and progress in inductive co-ordination.

As a group of specialists, each committee presented an excellent report, but all recognized that the greatest value comes from showing the relation of important developments and practices to the industry as a whole. To serve this purpose the Technical Section inaugurated this year the practice of having authorities contribute to a symposium on some of the major subjects of interest. The symposium discussions are particularly interesting as showing some up-to-the-minute individual opinions on the matters considered.

The symposiums, as well as abstracts and discussions of all the technical reports, are printed in this section, with the exception of the reports of the committees on prime movers and electrical apparatus, which have been treated more at length, beginning on pages 1353 and 1363. The subjects are classified according to the session at which they were presented. These sessions considered respectively related subjects on generation, conversion, outside plant and utilization.

## Mechanical and Electrical Innovations

### Higher Pressures, Reheating of Steam, Powdered Fuel, Useful Life of Turbines, Diesel Engines, Water-Turbine Developments and Automatic Substations Are Discussed

MORE than four hundred engineers attended the opening session of the Technical Section Monday afternoon, at which the prime movers, hydraulic power, and electrical apparatus committees reported. The general discussion was preceded by addresses by engineers prominent in the industry, such as Charles H. Merz, Frederick N. Bushnell, A. G. Christie, Peter Junkersfeld and H. Birchard Taylor. The prime movers report, which is printed in considerable detail elsewhere in this issue, was presented in two sections. Emphasis was placed on recent innovations, such as higher pressures, reheating of steam, stage bleeding, useful life of turbines and internal-combustion engines.

The electrical apparatus committee report, also digested rather fully elsewhere, featured experience with automatic substations.

In opening the first technical session Monday afternoon, Chairman R. F. Schuchardt called attention to the excellent work which the various committees, as specialists, have accomplished during the year and presented as printed reports. Rather than make the convention merely the scene for a glori-

fied presentation of the reports, he pointed out, the section had this year attempted to show the relation of certain outstanding practices, tendencies and innovations to the industry as a whole by having authorities on the subjects participate in a symposium.

## Hydraulic Power

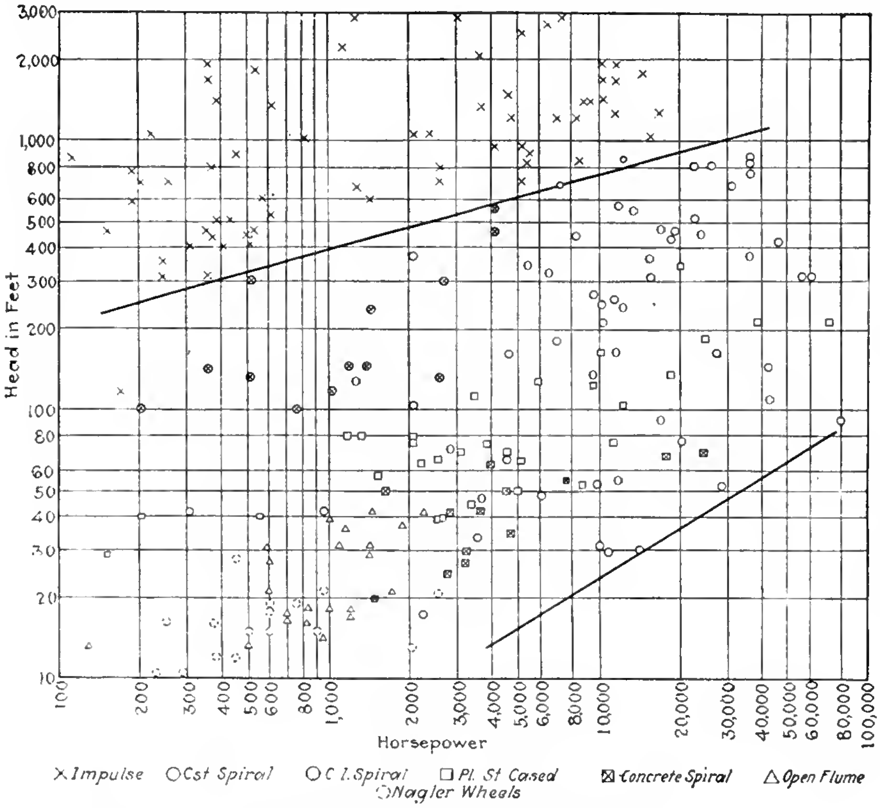
An account of the practice of various companies in the design of penstocks constituted the major portion of the hydraulic power committee's report this year. O. G. Thurlow is chairman. The subject was discussed in considerable detail, attention being devoted to the economic size, head used in determining thickness, factor of safety, minimum thickness of steel, buried as opposed to exposed pipe, coefficient of friction, air vents, expansion joints, anchor rings, anchors, piers, concrete riveted, welded and wood-stave pipe, painting, test and inspection, and specifications for steel and riveting. In addition, some space was devoted to the discussion of comparative tests on experimental draft tubes, the velocity method of measuring water flow, methods of forecasting water supply, effect of ice on water flow, and the proposed National Hydraulic Laboratory.

In general, air valves are installed on summits or at abrupt changes of grade where there is a possibility of the water column separating on a suddenly accelerating gradient, or where the hydraulic grade lines closely approach the level of the pipe line. The use of welded pipe for important penstocks is rapidly increasing. For this purpose welded pipe is practically limited to that made by a forge-welding process. Autogenous welding is not considered reliable enough for this class of work.

Reference was made to elaborate tests on twelve different types of draft tubes to determine their relative merits. Tests were made to show the effect of varying the threat openings and bell diameters, installation of supporting piers in the draft-tube bell, cones of various heights, flat plates, effect of extending horizontal diffusers down stream, effect of increasing the height of the vertical barrel, effect of enlarging the lower part of the vertical barrel, effect of decreasing areas in quarter turns to direct better the line of flow, turbine without draft tube, and other combinations. The performance of the higher efficiency tubes is almost identical. Two types of draft tubes were installed at the Mitchell Dam of the Alabama Power Company as a result of the tests shown.

Remarkable consistency of results has been noted in using the salt-velocity method for measuring water flow.

Comments from various companies on methods of forecasting water supply and observations made by several companies regarding the effect of ice on the flow of rivers were also reported. Statements of manufacturers on developments in the hydraulic field during 1922 conclude the report.




ENTIRE FIELD OF HYDRAULIC TURBINES, ILLUSTRATING PRACTICALLY ALL OF THE NOTEWORTHY PLANTS EVER BUILT

The outlying plotter points represent world records either in respect to size, extremes of head, either high or low, capacities, etc. The points above the top line represent impulse units, practically all of them being of the tangential type. The lower line represents approximately the limit of reaction units either in size or capacity for moderate and low heads, this limit being fixed by cost, shipping dimensions or generator speed. A shaded portion largely below but adjacent to the top line represents a field lying between the tangential impulse and the high-head reaction field, which is at present developed disadvantageously with these two types. It represents the field to which the proposed type of cross flow wheel is particularly adapted. Impulse wheel horsepowers are plotted for one jet.

## Adoption of Innovations Demands Reconsideration of All Factors

Charles H. Merz, consulting engineer, London, England, and member of the firm of Merz & McClellan, which designed the North Tees station in England, addressed the Technical Section Monday afternoon on the conditions which led up to the design of that station and the results of experience in its operation. This station was constructed in 1917 and embodied many of the innovations which have been adopted in this country recently, such as high pressure, air preheaters, stage bleeding and interstage heating. The adoption of so many innovations, Mr. Merz pointed out, demands that all factors entering into plant design be reconsidered seriously. Heat that can be taken back to the boilers instead of to the condensers should be transported there to secure the greatest economy. Since stage bleeding furnished all the heat necessary for raising the temperature of feed water, it was impossible to use economizers. Hence to save the heat in the flue gases air preheaters were employed to deliver air under the chain-grate stokers. Strange to say, Mr. Merz declared, no trouble has been experienced with this practice. The air preheaters have given less trouble than economizers and are cheaper to construct and maintain. No trouble has been experienced with stage bleeding, but the last heater next to the boiler had to be designed for boiler pressure, namely, 500 lb. Employing interstage heating has involved no problem except taking the steam back to the boiler and there superheating it to operate a 100-lb. pressure turbine. Some trouble has been experienced with the high-pressure cylinders of the prime movers, but this was due to the use of materials which would not have been employed at any time except during the war.

Commenting on the American tendency in driving auxiliaries, Mr. Merz declared that he did not believe it advisable to use house turbo-generators with high pressures. What is the necessity of striving for the last fraction of a per cent in economy in prime movers, Mr. Merz asked if the house turbines are used which offset the saving? If auxiliaries cannot be operated reliably by electricity derived from the station busbars, they can be driven from direct-connected auxiliary generators. The only place for the house turbine, Mr. Merz contended, is where an internal-combustion engine having an economy equal to the prime mover can be employed to drive it. This is one service where the internal combustion engine may possibly be used in large stations to advantage, he declared.

## Sets Goal of One Kilowatt-Hour per Pound of Coal

Development in the art of steam-power production has progressed far enough to make it entirely feasible to attain a goal of one kilowatt-hour per pound of coal in the near future, according to Fred N. Bushnell, Stone & Webster, who made an address on "Higher Steam Pressures and Improvement in Station Economy." One means of attaining this mark is through the use of much higher steam pressures. Materials and methods available at the present time will permit the use of two or three times the customary steam pressures, but higher temperatures must await development in metallurgy. The obvious method of preventing too early saturation is to restore the temperature of the steam by passing it through a reheater at an intermediate point in its expansion.

Already there are a variety of arrangements for utilizing higher pressure in conjunction with the reheating cycle. There is the single turbine arranged for extraction and return of the reheated steam, the tandem arrangement with high-pressure and low-pressure turbines driving the same generator, and the cross-compound arrangement of two or more distinct units which may be either adjacent or widely separated. Problems of design seem to demand that the pressure for the single reheating unit be limited to 500 lb. or 600 lb. For higher pressures one or the other two arrangements is probably to be preferred. The efficiency of the cycle demands that the reheating be accomplished with the lowest possible loss of pressure; this has an important bearing upon the arrangement selected. Control of the temperature of the reheated steam must likewise be carefully provided, especially where a varying load is to be carried.

In one arrangement promising reasonable flexibility as well as the highest efficiency a relatively small and simple high-pressure turbine will, for each individual boiler, reduce the pressure of the steam from 1,200 lb. to 375 lb. and deliver it through a reheater, in the same boiler setting, to a main header supplying turbines of the present standard type.

Already steam pressures up to 1,200 lb. have been definitely planned for commercial installation. For an experimental plant in England a critical pressure of 3,200 lb. will be adopted. Mr. Bushnell expresses confidence in the soundness of seeking greater economy through the use of higher pressures. Boiler and turbine builders, he explained, do not question their ability to produce reliable equipment for generating and utilizing steam up to at least 1,200 lb.

In order to be economically warranted, however, any station improvement must show an operating saving greater than the increase in carrying charges. The total cost of a high-pressure station, Mr. Bushnell announces, promises to be comparable with that of a station of equal generating capacity using the lower pressures now considered standard. The anticipated saving in operation should therefore be practically a net saving.

R. F. SCHUCHARDT
Retiring Chairman

H. P. LIVERSIDGE
Incoming Chairman

## Obsolescence Demands More Attention than Ever

On account of the almost unprecedented adoption of new practices in the central-station field, some of which are almost radical in the absence of extensive experimental data, and the fact that the use factor of equipment now being adopted is indefinite, there is more necessity than ever of giving serious consideration to obsolescence in determining the economies of new innovations, asserted Peter Junkersfeld in an address before the Technical Section. Furthermore, the prospective capacity factor or usefulness of the unit must be carefully estimated. Mr. Junkersfeld made the following observations:

According to an analysis of eight companies having 113 turbines with a total rating of 2,250,000 kw., nine turbines one year old had a generating-capacity factor of 45.2 per cent, twenty-one turbines two years old had a factor of 50 per cent, eighteen turbines three years old had a factor of 49.5 per cent, seven turbines six years old had a factor of 39.5 per cent, and sixteen turbines ten years old had a factor of 25.6 per cent.

In general savings and loss balance must be established. The balance should include operating and maintenance labor, supplies and adequate fixed return on investment. Coal savings will vary with the cost of coal being used and the yearly load factor at which the equipment is operated each year during its life. In determining the savings the life assumed should be the same as the life used in determining fixed charges on the loss side of the balance.

The fuel savings must obviously be placed on a kilowatt-hour basis. To have a true balance the extra fixed charges should also be placed on a similar kilowatt-hour basis.

## A Frank Appraisal of Powdered Fuel Presented

Prof. A. G. Christie, Johns Hopkins University, made a very frank appraisal of powdered fuel in an address before the Technical Section Monday afternoon. In general, he said that while powdered fuel has many points in its favor, there is a great danger in the extensive adoption of an underdeveloped practice by enthusiasts. The decision on whether to use powdered fuel depends entirely upon each individual installation.

Among the advantages cited for powdered fuel were the following: With this system low-grade fuel may be burned economically which could not be so burned in stokers. Furthermore, it permits of change from one type of fuel to another with very few modifications. Changes in load are easy to handle and standby losses are small as the coal supply can be shut off when the load drops. On account of the ability to minimize the excess air supply, it is possible to obtain higher efficiency, 80 per cent and greater efficiencies being possible of attainment above and below 200 per cent rating. Besides, the carbon losses are much lower than in stoker-fired boilers.

On the other hand, powdered-coal burning requires a higher grade furnace attendant than stokers. Very careful control of coal and air supply is also essential. Power requirements for pulverizing and transporting fuels are relatively large and there are still opportunities for improvements in pulverizing equipment. While water screens can be used to remove ash from powdered-fuel installations, it is very difficult to remove floating material in chimneys. In fact, removal of ashes may cost more than the removal of clinkers in stoker-fired plants.

Before there is a general adoption of powdered fuel, there is a great necessity to have power station records to analyze. Furthermore, there is an opportunity for considerable improvement in equipment. None the less, Prof. Christie commended manufacturers for the great strides they have made so far.

## American and European Hydraulic Turbine Practice

"There is no question that so far as mere magnitude of individual installations and number of installations are concerned American engineers have been pre-eminent" in hydraulic turbine practice, declared H. Birchard Taylor, of the William Cramp & Sons Ship and Engine Building Company, in his address. However, the advancement of the art may more justly be based upon the development of the creative ideas which have been produced.

"On this basis," Mr. Taylor continued, "the art of turbine design has reached a higher state of evolution in America

than in Europe. In this country the practice has been firmly established of putting every new development to the test. Since turbine construction is not a mere matter of furnishing material and labor, expenditures for experimental work are essential to the ultimate success of the industry."

The almost general adoption of vertical-type waterwheels and high-speed propeller-type runners and the development of the draft tube were cited by Mr. Taylor as three outstanding achievements of American engineers. "According to Holyoke tests on a diagonal propeller-type turbine having a specific speed of 680 or 153 (foot-pound system) an efficiency of 88.7 per cent was obtained, the turbine being equipped with the spreading type of draft of tube. The same turbine with a runner of somewhat lower specific speed, namely 497 (metric) or 112 (foot-pound), gave an efficiency of 90.7 per cent. In the still higher specific speed field an efficiency of 85.5 was obtained at 800 specific speed (metric)."

Commenting on some fallacious impressions which prevail regarding waterwheels, Mr. Taylor said: "Any type of reaction turbine — Francis, propeller or other type—obeys the laws of hydraulic similarity, namely, that their powers vary as the three-halves power of the head if the speed is allowed to vary as the square root of the head, provided that the turbine is located correctly with respect to tailwater. In the case of any type of reaction turbine which is placed too high with respect to the tailwater so that the continuity of flow through the turbine as a whole or in part is destroyed, the power will not vary in accordance with the above laws.

### Auxiliary Drives and Higher Temperatures Arouse Comment

In the selection of auxiliary drives, declared R. A. Hentz, Philadelphia Electric Company, reliability of operation is of the utmost importance. In attaining this requirement continuity of energy supply and control are important. After an interruption of service the equipment must return to normal operation. This is easy with induction motors, but may not be so with synchronous motors, he said.

In reply to this comment, F. C. Hanker, Westinghouse Electric & Manufacturing Company, contended that there are some places where synchronous motors are very satisfactory, and, besides, the psychological effect on consumers is desirable as a means of improving power factor. There are designs on the market which have a starting torque equal to the full-load torque. The speaker also referred to the use of a house generator driven by a simple turbine which normally floats on a line but drives the generator in an emergency. However, he warned that engineers must be careful not to adopt any equipment which will jeopardize reliability.

V. T. Malcolm, Springfield, Mass., referred to stability tests of metals at high pressures and high temperatures, saying that several oil refineries have pipe lines operating at 600 lb. and 900 deg. F. and even 1,200 lb. and 1,000 deg. Results of exhaustive tests at 1,000 deg. were cited in which an elastic limit of 21,000 lb. was obtained and a tensile strength of 52,000 lb. with 53 per cent reduction in cross-section and 29 per cent in elongation. At 800 deg. F. the characteristics of steel changes rapidly.

The stress due to high temperature is usually the one which is not sufficiently taken into account, declared Peter Junggren, General Electric Company. Expansion which takes place at high temperatures requires refinements not considered heretofore. Furthermore, most valves are designed incorrectly and produce unnecessary losses, which must be avoided at higher pressures and temperatures. They must be designed for freedom of expansion. Manufacturers expect no trouble in designing turbines for 1,200 lb. to 1,500 lb. pressure, he asserted.

Straight single-cylinder turbines have been adopted as standard for 600 lb. pressure by the Westinghouse Electric & Manufacturing Company, declared Frank Hodgkinson of that company. For higher pressure low-pressure elements will be compounded with such units. While reheating adds to the efficiency of operation at high pressure, it can be dispensed with if the turbines are designed for disposing of moisture and for bleeding steam for feed-water heating. However, this involves a problem of control to bypass reheaters, thereby injecting complications which might be undesirable.

# National Superpower Network Proposed

## Place of High-Voltage Cable in Such a System—Forty-four Standards for Overhead Construction—Analysis of Cable Failures —Motor Rules and Service Voltages

F. G. BAUM'S scheme for a national superpower network was the outstanding feature of the third technical session. The place which high-voltage cable will play in superpower schemes was touched on by W. S. Murray. In the reports of the overhead and underground systems the most important features were the overhead standards proposed and the analysis of cable failures. Sub-committee reports of the electrical apparatus committee (abstracted quite fully elsewhere) dealt with motor rules, transformer standards, radio and service voltages.

Mr. Baum's plan,* which is most ambitious in its scope, contemplates the establishment of 220,000-volt trunk lines between the major water-power and fuel-power centers of the United States and the most immediate markets for energy, including industries, mines and quarries and railroads. His proposal is based on four years' study of conditions as they are and of power requirements as he sees them in the immediate future as well as at a more distant time. Prior to presenting his plan, Mr. Baum outlined very generally but comprehensively the nature of studies which led up to his conclusion. These were explained by a series of graphs, charts and maps, giving results of surveys covering the following subjects: Existing systems and capacities, existing and prospective loads, diversity of customer, system and regional loads, as well as stream characteristics, distribution of fuel and water-power resources, etc. He arrived at the proper relation between steam and water-power plant capacities and pointed out that at the present rate of the growth of the industry the equivalent of one modern superpower plant will be required every thirty days. Attention was called to the fact that the Columbia River in the Northwest offers one of the most valuable sources of power in the whole United States.

*A more detailed account of this plan appeared in the Electrical World for June 2, 1923.

For the near future Mr. Baum believed that his plan was most feasible of execution in the Northeast; California, the Southeastern section of the United States, as well as the Middle West, have already started the nucleus of this superpower scheme. Later it may be possible to give the prairie states from Canada to the Gulf the benefits of power which they do not have now. Speculating on the future, he said that if power can be generated on the Columbia River for 0.3 cent per kilowatt-hour and 150,000-kw., 220,000-volt lines can be built for $40,000 per mile, energy could be delivered 600 miles from the generating point at about 0.8 cent per kilowatt-hour.

### Importance of High-Voltage Cable in Superpower Scheme

"The underground-cable structure is no less a part of a superpower scheme than the 110,000/220,000-volt overhead lines," declared W. S. Murray in an address before the Technical Section. "To realize the future rôle the high-voltage electric cables are to play one has but to look at the rapidly forming necessity of conducting large quantities of electric power beneath the earth's surface. Our overhead day within our cities and on the approaches to them is drawing to a rapid close. Henceforth what we shall need is not only 33,000-volt but 66,000-volt cables."

W. S. Murray expressed the firm belief that the policy of the public utilities is going to change rapidly and that eventually generating companies and distribution companies will be corporately distinct although possibly financially connected, as such separation will enable the distribution companies

to utilize money now spent for generation in extending the usefulness of electric service. He also referred to the important place which high-voltage cable will play in transmitting superpower into and within large cities, where the overhead line is fast becoming a thing of the past.

### Underground Systems

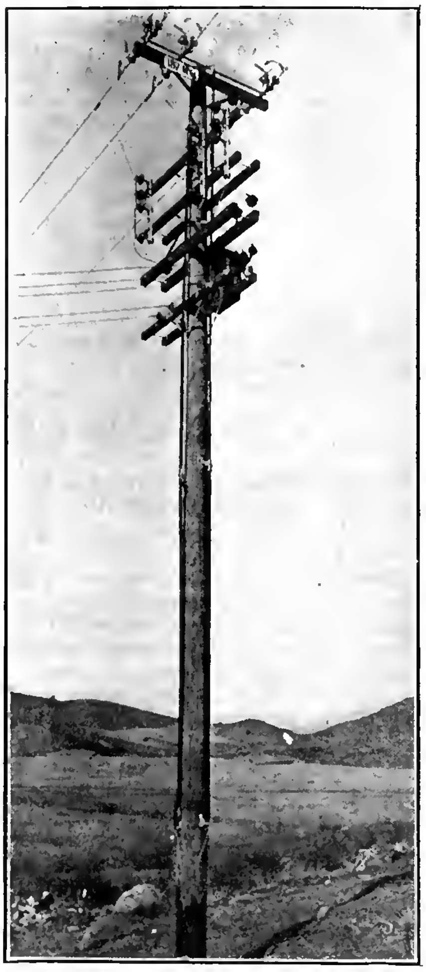
Two developments of great interest and importance to the central-station industry were apparent in the report of the underground systems committee, G. G. Post, chairman. First improvement in the quality of paper-insulated, lead-covered cables has made it possible to reduce the thickness of insulation without reducing the factor of safety of operation; second, the use of the kenotron for testing high-voltage cables with direct current promises to result in the ability to detect incipient failures of cables so that weak spots may be removed and the troubles due to cable failures largely eliminated. The insulation now used with Edison system cables ranges from $\frac{4}{64}$ in. on the smaller sizes to $\frac{6}{64}$ in. on the larger, such as 2,000,000 circ.mil. Cable rated at 12 kv., which in 1920 had insulation of approximately $\frac{13}{64}$ in. plus $\frac{6}{64}$ in., which since that time has been steadily reduced so that it now requires only $\frac{9}{64}$ in plus $\frac{4}{64}$ in., exceeds the voltage requirements in the breakdown tests on samples, with about the same margin of safety as formerly. Today the test requirements are easily exceeded. The recent factory breakdown tests between conductors have gone as high as 195 kv. and 174 kv. in the first and second tests respectively, without insulation failure, and up to about 115 kv. between conductor and sheath in both tests.

The power factor of the charging current at 80 deg. C. in the 12-kv. cable decreased from about 15 per cent to 3 per cent and recently has been as low as 1.4 per cent. The 33-kv. cable works at about 70 per cent higher dielectric stress and is more affected by the extra "ionization" loss. Its power factor at 80 deg. C. has dropped from values as high as 9 per cent in 1921 until now all manufacturers practically are furnishing cable under 4 per cent and as low as 2 per cent.

During the year 1922 one company was able by means of the kenotron almost to eliminate failures in service on a number of 6,600-volt rosin-oil cables. In making kenotron tests it is recommended by the committee that the direct-current voltage as determined by the voltmeter readings shall be two and four-tenths times the corresponding alternating-current voltage as given in the specifications.

During the past year one company has placed in successful operation about 30 miles of 350,000-circ.mil, three-conductor, 33-kv. cable, and it contemplates making further increases in this working potential on future lines. Another company is now installing some 500,000-circ.mil, three-conductor cable for operation on 44-kv., three-phase circuits. Several other companies are making investigations into the feasibility of securing single-conductor cable for operation on 66-kv., three-phase circuits. The chief limitation seems to be in the amount of ionization.

According to tests made on the Hochstadter-type cable, it seems reasonably clear that local charring due to tangential stresses between conductors does



SWITCHING AND TRANSFORMING EQUIPMENT FOR RURAL SERVICE

not take place to any marked degree in low-loss cables, although it probably is an important factor in high-loss cables. Hence the improvement in dielectric loss characteristic of recent cables makes this advantage of the Hochstadter-type cable of little value.

#### ANALYSIS OF CABLE AND JOINT FAILURES

Reports covering cable failures during 1922 were received from twenty-four companies operating cable systems which range from 6,600 volts to 33,000 volts, 13,000 volts being most extensively used. During the period covered there were 506 cable failures and 150 joint failures on systems aggregating 5,543 miles of cable. Hence the combined failures represent 11.8 failures per 100 miles of cable installed. The corresponding figure for 1921 was 14.1 and for the past five years it was 11.7. Considering the joint failures only, there were 2.7 per 100 miles, or 34 per cent lower than for 1921, despite a 16.5 per cent increase in cable mileage. During 1922 only 1.35 joints out of every 1,000 failed, while in 1921 there were 3.9 failures out of every 1,000 joints made. The majority of failures were attributed to factors external to the cable.

Classified according to voltage, there were 9.5 cable failures and 2.4 joint failures per 100 miles of cable operating at 6,600 volts and 15,000 volts, whereas with 20,000-volt to 33,000-volt systems there were 6.4 cable and 5.5 joint failures per 100 miles. The inference is that improvements in making joints, especially on the higher-voltage cables, has not kept pace with the improvements in the insulation of the cable itself.

There is a noticeable tendency toward the use of alternating current for underground distribution in large cities in connection with more recent installations. To secure the same continuity of service as in older direct-current systems, one company has started equipping its alternating-current substations with automatic selective protection. The distribution transformers on this system are connected in parallel on the secondary side with alternate transformers connected to different feeders on the primary side. At the point where transformers are connected to the secondary distributing mains a special automatic network switch is installed which operates to open the circuit on the reversal of energy flow equal to or greater than the core loss of the transformer. This switch also automatically recloses on resumption of normal voltage and power-flow conditions.

As a result of tests on heat radiation from conduits, it is now the practice of one company, where practicable, to install conduits not closer than 15 ft. apart and to limit the number of ducts installed to a maximum of eight, arranged two wide and four high, so that each conduit has at least one side adjacent to the surrounding earth. To minimize the temperature of its duct lines another company makes its ducts in the form of a U with a 4-in. drain pile located in the middle.

### Overhead Systems

Standardization and investigation of new and improved practices constituted the features of this year's report of the overhead systems committee (L. M. Klauber, chairman). Of the forty-four specifications for construction materials which were submitted and approved by the association as tentative standards last year, the committee this year presented thirty-eight for final approval. They covered guy clamps, clevises, side-groove and top-groove porcelain pin-type insulators, large and small porcelain spool insulators and side-groove, top-groove and service-glass-pin-type insulators.

Thus far the Western Red Cedar Association has refused to adopt the

proposed specifications for western red-cedar poles. This year the committee presented for tentative approval a new specification for chestnut poles. Several interesting modifications and innovations for timber preservation were submitted, and field practices of one company in pole inspection were described in detail. Some interesting notes were given on protection against termites, which continue to be great pests in the destruction of poles in some sections of the country.

Companies which use care in the selection of insulators based on climatic and physical conditions of the territory traversed will have few, if any, difficulties with the products now available in the market, the committee declared. There is still evident a tendency to charge insulators with failures which are in reality due to faulty pin design or utilization. Too rigid a type of conductor support is also to be avoided, as difficulties may be caused either by the breaking of the insulator top or by crystallization and ultimate failure of the conductor itself.

The sub-committee on insulator research continued its study on the effects of cyclic temperature changes on insulator life. A novel method of test to destruction, devised by A. Herz, was related.

A summary of some new and improved devices now available for line sectionalizing and protection was presented. Practices of several companies were related with reference to the position of transformers on poles and the sizes and weights which are hung on single poles. Attention was paid to labor-saving devices, automotive equipment, tools, etc., owing to the fact that companies are extensively adopting special mechanical equipment, such as pole-hole digging and pole-setting machines, air drills and concrete breakers, hoists and shaving machines.

A final report on the construction of the 220,000-volt lines in California was presented.

Two specifications for wood-pole transmission lines were included as indicating the practice of two large companies. The committee insisted, however, that it did not in any way wish to advocate their adoption as standards.

The use of high-voltage distribution lines is now on the increase. Not only is the rural and suburban field being covered by such circuits (as has been the practice for many years in the past), but thickly built-up districts as well.

Rural-line construction received considerable attention. Where such construction is utilized with due regard to local climatic conditions and the increased strength of structures which long-span construction involves a considerable reduction in first cost is often possible. Note was taken of the increased use of pole-type constant-current transformers and mast-arm construction for street lighting rather than span suspension.

**Differences of Opinion Expressed**

Certain recommendations and conclusions of the overhead, underground and electrical apparatus committees aroused adverse comment.

R. W. Atkinson disagreed with the conclusions of the underground systems committee regarding the value of the Hochstadter cable. He claimed that this cable shows its greatest advantages with improved types of insulation, since it is particularly intended to relieve the tangential stresses in the filler between conductors. He contended that the committee reached a different conclusion because tests were made with cables which apparently had old-type conductor insulation.

W. A. Del Mar urged caution in following the committee's recommendation of 2.4 times the alternating-current voltage value when direct current is used for cable testing. The factor should be more nearly 1.4, he claimed, where the impregnating compound is very fluid, as in new-type cables, or where the paper insulation is very loose, as in old cables. The speaker also questioned whether rise of power factor is necessarily an indication of air ionization. The opinion was expressed that the committee assumed too much in stating that air ionization is a serious limitation to cable operation at the higher voltages.

In discussing the reports of the sub-committee of the electrical apparatus committee on motor rules and service voltages (abstracted elsewhere), L. L. Elden, Boston, expressed extreme disappointment over the inclusion of increased starting currents and of running currents. Regarding three-phase as opposed to single-phase transformers, he said that the selection depends on individual circumstances, but appeared to favor the three-phase transformer. Temperature indicators were commended most highly as a means of reducing the investment in transformers, eliminating testing and increasing load factors. The comments were based on actual experience in Boston.

# 250/500-Volt Distribution Proposed

**Stone Believes Its Increased Capacity and Saving Warrant Study—Dow Outlines 4,600-Volt Distribution to Power Consumers—Torchio Suggests Principles of Interconnection**

THAT central-station engineers give serious attention to the use of three-wire, 250-500 volt distribution systems to replace the present nominal 110-220-volt practice was the recommendation of C. W. Stone, manager of the lighting department of the General Electric Company, in his address on "The Future Substation," in the symposium on substations, before the second technical session on Tuesday. Mr. Stone's address followed Mr. Tapscott's presentation of the substation and oil-circuit-breaker section of the electrical apparatus committee's reports, which appears elsewhere in this issue.

Mr. Stone said that, although developments had probably fixed a nominal voltage of 125 as a distribution practice, this service could be furnished efficiently and economically on alternating-current systems by the use of 250-125-volt auto-transformers and on direct-current systems by balancer sets. On a direct-current system serving 12,000 kw. per square mile and producing 46,000,000 kw.-hr. annually with sixty-four 1,000,000-circ.mil feeders, he said that approximately 560 tons of copper is required in feeders with 56 tons in the neutral and 140 tons in the network. Using a 250/500-volt, three-wire system, he said, 280 tons of copper could be saved. To supply 125-volt service sixty-four balancer sets of 100-amp. capacity would be needed at the feeder taps, costing approximately 10 per cent of the cost of the extra copper in the lower-voltage system. He was confident that the industry possesses the brains to make the 250/500-volt system work as it has in foreign countries and that the saving will make the effort worth while.

Indulging in what he characterized as dreaming on the subject of the vacuum tube and direct-current transmission, Mr. Stone said that all of the conversion operations from alternating current of varying voltages and frequencies to direct current and back again have been accomplished and that the elements of the necessary tubes are now in use. If the tubes are finally developed for practical service, he said that it means a revolution in high-voltage transmission practices. Existing lines could be used at three to four times present capacity.

The synchronous condenser would disappear from the substation, though it might become a necessary part of the generating station. The tubes required to transform from alternating current to direct current may be different from those for the reverse process, Mr. Stone said. For the low-voltage direct-current systems the substation might disappear and numerous feeding points from low-current tubes be substituted, since there is no present indication that tubes of ampere capacities running into the thousands will be developed.

L. L. Elden characterized C. W. Stone's advocacy of 250/500-volt distribution as a very disturbing suggestion now that operating companies have practically approached a standard, saying that the change-over would be almost prohibitive from an expense viewpoint. Furthermore, he declared that it is questionable whether the loss in distribution systems is as much as Mr. Stone cited, since 80 to 85 per cent of the input to substations is metered at the customers' premises. However, he advocated careful consideration of Mr. Stone's suggestions.

Alex Dow, president of the Detroit Edison Company, outlined the method of furnishing service to large power consumers from the 4,600-volt system in Detroit. This system has during a twelve-months period furnished an average of 210 consumers with 43,000,000 kw.-hr. in a single month and with 442,000,000 kw.-hr. for the year. A low limit of 100 kw. capacity for service from these circuits has been established because experience has shown that consumers using less capacity than this do not employ help capable of handling the higher voltages safely. Customers own their transformers and other service equipment except meters. A similar service is furnished from the direct-current system with a minimum of 300 kw. capacity, which is soon to be lowered to 200 kw. The higher limit is due to the greater cost of the cable and other equipment for the service under the Hopkinson form of rate used for both alternating-current and direct-current service.

Mr. Dow said that radial feeders with plain overload relays are used on the 4,600-volt system and loop feeders with balanced relays on the direct-current system. The 4,600-volt system is "plus" regulated only and therefore is not commendable from the standpoint of general service, and the responsibility for regulation is a burden of the consumer. In handling the 4,600-volt system, Mr. Dow said, the problem of contacts with trees is the most serious difficulty, and the 2,200-volt service still existing in some sections of the city can only be changed over as the standard of construction is raised and the difficulty mentioned is overcome.

### EMERGENCY CONNECTIONS BETWEEN NON-ALLIED COMPANIES

Philip Torchio gave as the first principle of emergency connections between non-allied companies the utilization of all existing facilities to insure continuity of power supply to the public, economies in investment and operation and saving of coal. The second principle is that the fixed and operating charges of the tie lines should be equitably divided among the contracting parties in proportion to the benefits derived. The third and last principle is that no company should derive a profit at the expense of another company, but only from the investment and operating savings due to the interconnection. Mr. Torchio cited a number of contact provisions which are designed to carry these three principles into effect.

## Safety Rules

Chairman Sproule in submitting the final report of the safety rules committee and recommending that it be disbanded, as its work has been accomplished, recommended that each technical committee be instructed to appoint a subcommittee on safety rules and that all safety codes be cleared through the engineering staff at N. E. L. A. headquarters, which will refer such codes to the committee concerned, with the understanding that a sub-committee will review the work and refer it back to the engineering staff with such suggestions for revision as are thought necessary. Mr. Sproule reported the organization of the sectional committee for revision of the National Electrical Safety Code under the American Engineering Standards Committee procedure which is composed of representatives from about twenty-five national associations. An executive committee of seven representatives from the insurance interests, employees, steam railroads, electric railway, utility commissions, municipal inspection interests, electric light and power and telegraph and telephone interests has been formed and sub-committees to consider the relative hazards of circuits in different situations, clearances, strength of materials and underground construction have been organized to carry on the work of revising the safety code.

## Meter Committee

The section on maintenance of relays prepared by the Metropolitan Section of the N. E. L. A. for the relay handbook was a feature of this year's report of the meter committee, with W. L. Wadsworth as chairman. Action on standardization of meter instrument design, a compilation of public utility commission rules on frequency of meter tests, company practice on limitation of two-wire meters and the regular résumé of manufacturers' developments concluded the report.

In addition to presenting various forms of records used in relay maintenance work, the report covered acceptance, installation and periodic tests, equipment in making tests, typical procedure for testing various types of relays and usual troubles with relay maintenance.

The committee has for several years encouraged technical universities and colleges to conduct short courses for metermen of their localities. Where the suggestion has been followed much good has been done.

Efforts have been made to eliminate certain special requirements specified by users of meters and instruments, but little progress has been made. The committee urged manufacturers of meter cabinets and wiring devices to provide such devices as will accommodate the meters with which they will be installed.

It was the committee's opinion that no change in register ratios and constants should be allowed. Neither should any terminal change that will not meet the specifications of the Association of Edison Illuminating Companies be allowed. To convert top-connected meters to bottom-connected meters it was recommended that the necessary parts be obtained from the meter manufacturer rather than by using some auxiliary wiring device. It was reported that manufacturers are of the opinion that the present rotating standards are not subject to temperature errors which cannot be compensated for by proper use.

In the redesign of existing types of instrument transformers a majority of the manufacturers have complied with the recommendations of the committee relative to the standardization of dimensions, polarity and polarity marking. Testing of such transformers on customers' premises has been a problem which is now solved to a considerable extent by the introduction of Silsbee current and voltage transformer test sets. The manufacturer's statement as to accuracy is fully justified, the committee reported.

Synchronous timing motors are being used generally, although the new type is gradually displacing the old. According to a questionnaire the 10-amp., 110-volt, two-wire meters are being used in preference to 5-amp., 220-volt, three-wire meters.

### METERMAN EDUCATION

Prof. Frank D. Paine, professor of electrical engineering, Iowa State College, in the symposium on metering, defined a properly qualified meterman as one who understands the fundamentals of electricity, the meter and how it functions and the fundamentals of meter design, who can think and take an interest in his work, who understands the relations of metering to demand and rates, and above all the relationship between the public and the utility he works for. Men selected for meter work should be capable of education to fill these specifications, and Professor Paine said that the utility companies must move first by raising the standard and pay for the work. To carry out better education of metermen he suggested more trade school courses of one or two years of which meter work shall be the primary part. He said that from twelve to fifteen hundred electrical engineers are being graduated this spring, of whom only a small number are entering the utility field, and that an opportunity is offered to bring many of these men into meter work, using this occupation as a stepping stone to a better position in the utility organization. In conclusion, Professor Paine outlined the work on five short meter courses held in the past five years at Iowa State College.

Frank G. Vaughn, sales manager meter department, General Electric Company, urged the same care in equipping and maintaining meter departments that is exercised in other departments of the business.

### LIVERSIDGE NEW TECHNICAL SECTION CHAIRMAN

Officers of the Technical Section for the administrative year from July 1, 1923, to June 30, 1924, were elected at the Tuesday afternoon session. They are: Chairman, H. P. Liversidge, Philadelphia Electric Company; first vice-chairman, L. M. Klauber, San Diego Consolidated Gas & Electric Company; second vice-chairman, C. F. Hirshfeld, Detroit Edison Company; third vice-chairman, W. K. Vanderpoel, Public Service Electric Company, Newark, N. J.

# Inductive Co-ordination in Good Shape

## K. L. Wilkinson and H. B. Gear Review Year's Progress—Hypothetical Cases of Co-ordination Are Discussed and Questions Answered

CALLING the attention of the fourth technical session on Thursday afternoon to the main principles involved in the work on inductive co-ordination, K. L. Wilkinson, engineer for foreign wire relations of the American Telephone & Telegraph Company, summed up the year's progress by saying that the status of the work is better today than it has ever been before. He attributed this result to the splendid support of the joint general committee by the N. E. L. A. member companies and the Associated Bell Companies. He further said that the previous estimates of the large growth and development of both the supply and signal utilities are being realized, if not exceeded, and the future work on co-ordination will require the most careful and intelligent study to insure that the public shall receive satisfactory and efficient service of both kinds. His conclusion was that the progress during the past year has shown that the fullest co-operation and interchange of information and data between representatives of the two utilities form the basis for successful co-ordination. It has also proved the desirability and necessity for the continuation and extension of this work.

H. B. Gear of the Commonwealth Edison Company, speaking on the same subject contrasted the present status with that of two or three years ago and characterized the progress by citing the recognition that has taken place that three parties are equally interested, the public, the power companies and the signal companies. He also brought out the recognition of inductive influence, inductive susceptibility and coupling as factors in the problem as an evidence of the progress made. Mr. Gear reviewed the progress of the geographic division inductive co-ordination committees and expressed the opinion that the difficult problems experienced in the early days of the national committee work in keeping in touch with field conditions and in spreading the information developed through its work are being solved by the division organizations and their work.

### Inductive Co-ordination

Establishment of co-operative procedure between the Bell Telephone System and the N. E. L. A. was one of the chief accomplishments of the year, according to the inductive co-ordination committee (R. N. Conwell, chairman). It resulted in the adoption on Dec. 9, 1922, of joint "principles and practices," which were given in full in the report this year. Continued organization and expansion of the activities of the geographic division and local committees on inductive co-ordination were other prominent results of the year's work. These committees practically constitute a field force or staff for service to member companies and have rendered most valuable assistance in carrying the "principles and practices" to member companies and also in collecting important field data and surveys for the national committee and headquarters staff.

Owing to the lack of exact technical data and insufficient knowledge of inductive phenomena, it was necessary to limit the "principles and practices" very largely to qualitative statements and provisions, which will be supplemented in the future by more exact detailed practices as the knowledge of the art is progressively advanced by the joint development and research program now organized by the Bell companies and the N. E. L. A.

In its broader aspects the national work on this problem is emerging from its exploration or pioneer period and entering its constructive stage. The future program recommended by the committee embraces continuation of the general study of the physical, economic and legal aspects of the problem; continuation of the educational and co-operative work with member companies, through the division and state committees and headquarters staff; co-operation with the joint committee on development and research, and general continuance of the division committee activities in making field surveys and tests and assisting member companies.

The committee urged particularly that executives, officials and engineers of electric service companies read this report in full because it contains material which can be made of immediate permanent value in procuring satisfactory handling of current problems of inductive co-ordination through co-operative procedure between the local interests directly concerned. The report contains detailed preferred practices, so that a basic code is now available for guidance in the co-operative settlement of specific cases. Difficulties which may arise in applying the "principles and practices," owing to unusually severe local conditions or to meeting inductive phenomena not as yet subject to full control or mitigation, or from any other cause, can be made to serve a very useful purpose in guiding the course of the research work.

### Hypothetical Cases Solved

As the final part of the program two hypothetical cases in inductive co-ordination were presented. The first, discussed by J. G. Hemstreet, superintendent of operation, Consumers' Power Company, Jackson, Mich., was that of the building of a power line between two points. Two routes were available, one being direct and resulting in a cost to the telephone company of three or four thousand dollars for retransposing, and the other route, which was a longer one, resulting in a cost of $30,000 to the power company. Either route involved difficulties to one or the other utility. The correspondence involved in initiating the line construction and the memoranda on the conferences between the power and telephone companies were read, and typical questions that might arise in such cases were asked by power men and answered by the representatives of the Bell and allied telephone companies present. It is assumed that all solutions would be reached under the principles and rules already adopted by the general joint committee representing the National Electric Light Association and the Bell companies.

The second problem, presented by O. H. Bundy, Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., involved a hypothetical case where a telephone company was experiencing inductive troubles and desired in addition to make extensions of its circuits. This discussion was given in the same way, the hypothetical correspondence and conference memoranda being presented and questions asked and answered by power and telephone men.

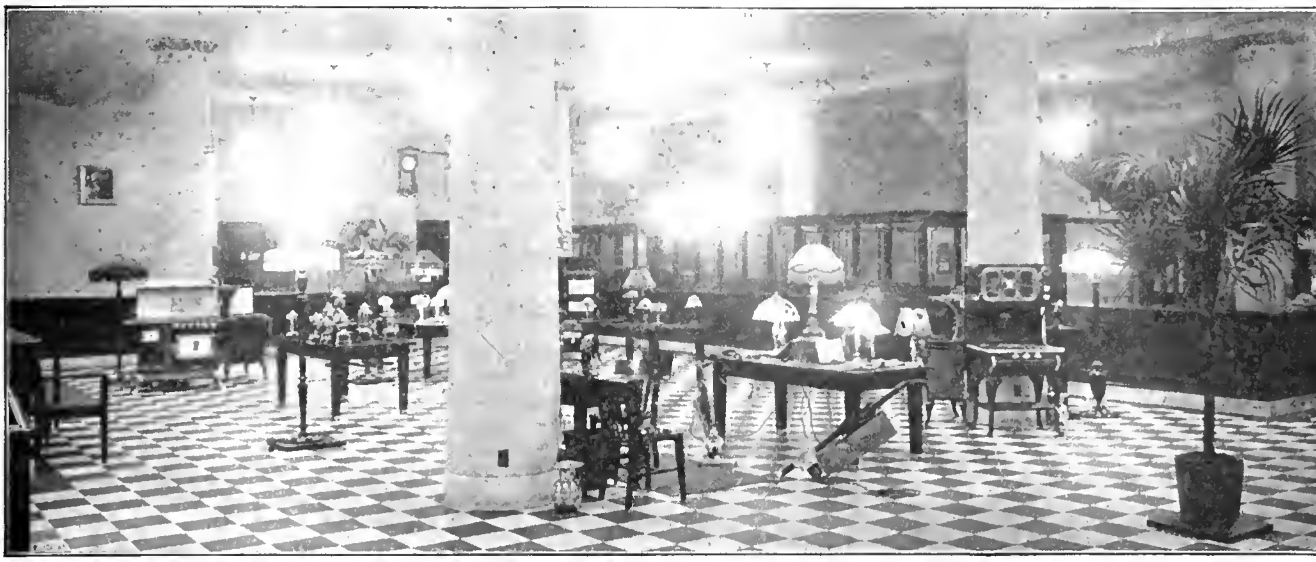
### Experiences Related

Elmer T. Sperry in a few words outlined the inductive troubles between the early telephone and electric light companies that resulted in the meeting in 1885 at which the National Electric Light Association was formed. This meeting was held at the old Grand Pacific Hotel, Chicago, and it was expected only a few men would attend. About 140 were present.

Prof. C. F. Scott outlined the change that has taken place in the attitude of the telephone and light and power companies toward each other. This attitude has changed from one of mutual suspicion to one of mutual confidence. As a result a joint discussion of problems like the one taking place as he spoke, in which both telephone and power men could participate with the greatest freedom, had become possible.

A. P. Way, American Railways Company, Philadelphia, indicated that it had been difficult to reach common ground in inductive co-ordination matters partly because the expense involved has been allowed to influence decisions and said that both parties can hope for a solution of the problem only when a straight open view is taken and selfish interest is not allowed to enter.

R. F. Pack of the joint general committee paid a graceful compliment to the inductive co-ordination workers, giving the credit for accomplishment to the engineers of both utilities. H. P. Charlesworth, speaking for Bancroft Gherardi of the American Telephone & Telegraph Company, expressed Mr. Gherardi's regret at his inability to be present because of business out of town, and said that the work had passed beyond the formative stage, in which suspicion was present, and had got to the fact-finding stage. He said further that unless the facts were ascertained it would be impossible to get far.



# Commercial Sessions

***Four Commercial Bureaus Present Unusually Substantial Reports—Movement Started to Expand Function of Commercial Section***

FIVE things stand out as of particular importance in the story of the Commercial Section sessions. Four of these are: (1) Enthusiastic indorsement was given the electric truck, and this indorsement was supported by the announcement of a national co-operative promotion campaign, for which a large appropriation has been raised. (2) An exceedingly informative and valuable report on residence lighting was produced and also an analysis and demonstration of store-lighting possibilities that should prove a distinct stimulus to this branch of the business, particularly as a practical advertising campaign has been made available for its support. (3) A very live session was devoted to the division reports of the Power Sales Bureau, in which an especial feature was made of the opportunities for the development of the industrial heating field, and the movement as well is to be supported by an organized national campaign of publicity and promotion adequately financed that will make this a notable achievement of the coming year's work. (4) A very careful study of the problem of compensating salesmen was an important feature of the merchandising session, but the discussion of the electric range possibilities overshadowed all else, and here again a project for national promotion has been organized and a campaign is to be conducted with a generous backing of money already pledged that promises a real awakening of interest and activity in range selling throughout the country.

But perhaps the most significant development in the entire course of the commercial program was the frank discussion on Thursday afternoon of the necessity for strengthening the Commercial Section itself by a determined effort to re-enlist the interest of the older commercial men of the industry and notably a considerable number of the ex-chairmen of the section. The hearty response which was expressed by the entire meeting on the announcement of the drafting of this "old guard" for duty was an indication that the need is now appreciated and the reform assured.

## Strong Indorsement for Electric Truck

**Commercial Men Discuss the Growing Opportunity for a Vehicle Load—San Francisco the Latest Convert to Its Desirability**

EVERY interested discussion of the electric truck, its record and its opportunity, marked the first session of the Commercial Section program. A warehouse man prodded the central-station industry on the lack of support through the more adequate servicing facilities which it might give. A battery manufacturer analyzed the market and appealed for a larger vision on the part of electrical men in considering what the truck can be made to mean to the industry. It was announced that the San Francisco central-station company has become the latest convert and is about to embark on an extensive development program.

The meeting opened with Oliver R. Hogue, chairman of the section, presiding. In his address he sketched briefly the work of the section during the past year and paid tribute to the conscientious, persistent work that has been done by the various bureaus and committees. A nominating committee was appointed consisting of E. W. Lloyd (chairman), Joseph E. Becker, T. I. Jones, C. J. Russell and R. R. Young. The meeting was then turned over to Charles R. Skinner, Jr., chairman of the Electric Truck and Car Bureau, who presented the bureau report to the session.

### Electric Truck and Car Bureau

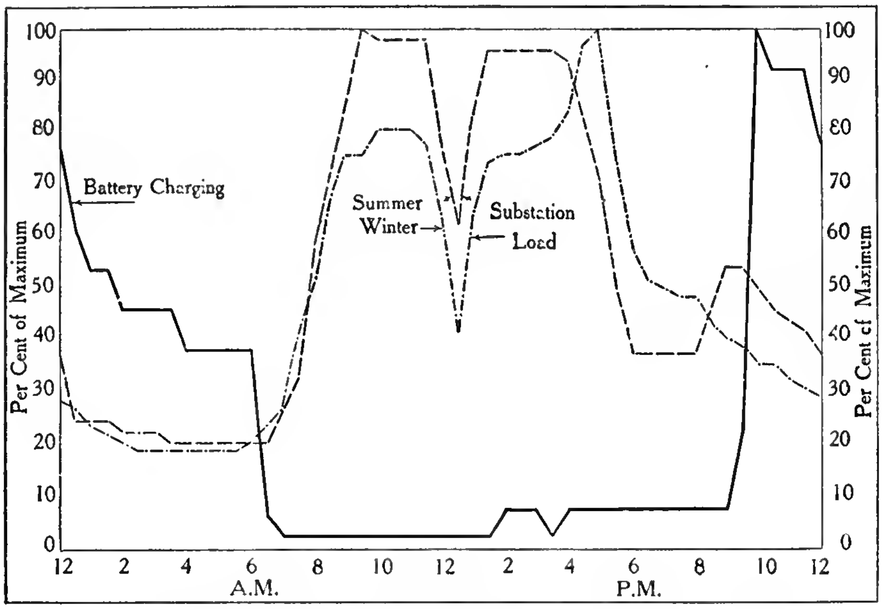
There has been a marked change in the method of selling trucks, he said. The former practice was for the manufacturer to endeavor to sell the central-station vehicles for its own use, and the central station was oftentimes permitted to apply them to unsuitable work. Today, however, the purpose is to secure the co-operation of the central station in the sale of trucks to local industries adapted to the electric vehicle. The Electric Truck and Car Bureau is actively supporting this work through the organization of two electric truck schools, one in New York and one in Chicago, to give instruction in the care, operation and maintenance of electric vehicles.

Central stations, appreciating the growth in electric truck transportation business, are following the lead of New York, Chicago, Boston, Hartford, New Orleans and Los Angeles in establishing departments equipped with the necessary expert talent to give advice on problems connected with electric truck transportation.

Public utility corporations have during the past twelve months purchased approximately two hundred electric trucks.

During the last two years over one thousand electric trucks were sold in the New York City section.

Through the Joint Committee for Business Development a tentative plan has been formulated for a more intensive all-year-around electric truck and car development program, which, however, was carried out supplementary to its report.




LOAD CHARACTERISTICS—ELECTRIC VEHICLE BATTERY CHARGING COMPARED WITH TOTAL SUBSTATION OUTPUT

Charles F. Morris, past-president of the National Furniture Warehouse Association, followed with his earnest appeal that the electric vehicle should have more helpful support from the electric light and power companies through the provision of adequate service facilities. Mr. Morris is connected with one of the large metropolitan warehouses and is operating electric vans exclusively. Eighty per cent of all the trucking done by the big city storage warehouses, he says, lies within the range of the electric vehicle, and the fact that electric vans can be stored in the warehouse and carry a lower insurance rate gives them great advantage over any other system of haulage.

There is just one element of dissatisfaction with the electric truck in Mr. Morris' opinion, and that is the fact that when the battery on an electric truck begins to run down the driver cannot find a convenient place to renew it. The chauffeur of a gas car can always purchase more gasoline within a block or two or obtain other assistance. For the electric truck, however, there are at present, even in the larger cities, but a scant number of service stations, and many of them are inadequately provided for and inexperienced. As a result they do not welcome the electric vehicle when it calls, and the service is given with an air of toleration. He closed with a spirited appeal to the central-station men present to provide this commodity on which the electric truck must depend for success.

In the general discussion which followed, W. L. Goodwin explained the program for promoting the electric truck which has recently been developed through the co-operation of the Society for Electrical Development and the Joint Committee for Business Development, for which the society has appropriated $25,000. William Van C. Brandt, Philadelphia, pronounced this program the greatest single step in the promotion of the vehicle industry. G. R. Freeman, Chicago, announced that the Commonwealth Edison Company has appointed a committee of executives to study the problem of what can be done to speed up the truck market. The central stations in New Orleans, Cleveland and San Francisco, he said, have all put on vehicle salesmen recently and are more actively taking up the development of the electric vehicle load.

The importance of centralized control of transportation equipment was stressed by John Stilwell, general superintendent of transportation, Consolidated Gas Company of New York, in a short address. Mr. Stilwell is in charge of the motor equipment of the New York utility companies.

## Supervision of Motor-Truck Equipment

Prior to 1902 he said the utilties of New York depended solely on horses for all trucking. Today the horse is practically eliminated and the work is being done by 757 motor vehicles. In short-haul city-delivery work the economy of the electric vehicle has been very pronounced. For instance, the transportation charges against one department in 1913 when it was horse-equipped amounted to $98,525.12. This department was completely equipped with electric trucks in the year 1917 and the total cost of cartage for the year was $55,403.53. This showing is the more remarkable when the increased business during these five years is taken into consideration. Any time or money spent on the selection of the proper type of vehicle, gasoline or electric, and the make and body specifications for the particular work to be done is amply repaid by the results obtained from using the vehicle best adapted for the particular service.

Another point which the speaker dwelt upon was the standardizing of equipment to the greatest possible degree, to have as few different types and makes of trucks as is consistent with the varied requirements of the service. Standardization of equipment greatly simplifies the repair-shop work, as a complete line of spare parts can be carried. Mechanics and repair men become accustomed to these particular trucks. It is also possible to transfer a truck from one department, which may be slack for the moment, to another department which is very busy.

An interesting story of the work of the electric vehicle school committee was told by Chairman E. S. Mansfield, Boston. As a result of a large number of inquiries from central stations as to how to start a vehicle department, it was decided to organize a vehicle school on the successful experience of the industrial heating school held some time ago. The vehicle manufacturers did most of the work and provided for all the costs, and to date they have spent over $10,000. Out of it, he says, have come the most useful data on transportation engineering that have ever been published. The first school was organized in New York on May 16 with about twenty-five attendants. A second school will be opened in Chicago on June 19, and at present there are applications from forty men. A third school is to be organized later in San Francisco. Ten men are already pledged, and twenty will probably be in attendance. As a result of this work, the subject of transportation engineering will be added to the N. E. L. A. educational courses hereafter.

## National Increase in Use of Electric Motor Trucks

In an address on the national increase in the use of electric trucks, William Van C. Brandt, Electric Storage Battery Company, Philadelphia, called for a bigger vision of the electric truck opportunity.

There are now in service 10,457 electric motor trucks, consuming on a most conservative estimate 60,000,000 kw.-hr. per year. There are in addition 10,192 electrical industrial trucks and 15,000 electric passenger cars operating, which will treble this consumption. There will be sold this year at least fifteen hundred additional trucks, which will mean that there will be required 9,000,000 additional kilowatt-hours next year for the trucks sold this year. This is a

conservative estimate of the immediate market which actually exists today.

Those who have studied the question, said Mr. Brandt, assert that 70 per cent of the city and suburban delivery service is short-haul, frequent-stop work well within the radius that can be handled to particular advantage by the electric truck. If this is a fact, then the total possibilities for the electric would be 70 per cent of all vehicles used in city and suburban delivery service.

The speaker did not believe it would be stretching the vision to an impossible degree to consider it possible to sell in this country one hundred thousand electric trucks within ten years. To the central stations this would mean the sale, on a conservative basis, of 600,000,000 kw.-hr. of off-peak energy per year. It would help considerably to flatten out the valley which now exists in the load curve and at the same time it would mean a revenue, at 4 cents per kilowatt-hour, of $24,000,000 per year. It would mean to the truck manufacturer $20,000,000 sales per year. To the storage-battery industry it would mean $15,000,000 per year additional revenue from the sale of the ten thousand trucks per year and as much again in renewal sales. To the manufacturers of electrical equipment, excluding batteries, it would mean $3,000,000 per year.

In answer to an inquiry, Mr. Ray of San Francisco announced that the Pacific Gas & Electric Company acknowledges itself the latest convert to the electric vehicle, and gives the credit to the Electric Truck and Car Bureau. As a result of a close study of the work of the bureau, this company has become entirely "sold" as to the value of the electric vehicle load. The executives have given almost unlimited authorization to go ahead and build up the electric truck on the Coast. Announcement could not yet be made, he said, of the details of the program, but the plan will be in operation by June 19.

## Electrically Equipped Furniture

The report of the electrically equipped furniture committee was presented by Ralph Neumuller.

Considerable strides have been made during the past year in the perfection of outlet fittings that simplify the electrical equipping of existing furniture.

The popularity of electrically equipped furniture depends largely upon the public interest that is aroused in it. The committee during the past year was able to secure a very large volume of publicity in furniture trade publications, in popular magazines, in select home-furnishing magazines and on woman's pages in the newspapers. It did not feel, however, that this was sufficient to create the necessary desire that will result in a more general adaptation of this innovation in American homes. What is needed is the interest and support of the entire industry. Manufacturers and central stations can assist materially by pictorially showing electrically equipped furniture instead of just ordinary furniture when the nature of their advertising requires furniture settings for appliances or other items.

O. R. HOGUE
Retiring Chairman

N. T. WILCOX
Chairman-Elect

If the thousands of men and women who are an integral part of our industry were each to equip electrically just one piece of their own furniture, the tea wagon or the dining-room table, for instance, it would afford publicity to hundreds of thousands of others. Central stations may lend a tremendous amount of support by sponsoring local campaigns for the wiring of just one piece of furniture by their customers.

In discussing the future of electrified furniture, J. F. Becker, New York, pointed out that wired furniture is of no use without convenience outlets, and that the work of this committee must have the backing of all the industry in the promotion of such outlets. Mr. Becker believed that if the central stations, manufacturers, contractors and other electrical interests could be induced to co-operate simultaneously in the promotion of convenience outlets a great advance could be made in the development of the use of electricity in the home. To this end he deplored any tendency to depart from the term "convenience outlet," because the combined strength of the industry is needed behind whatever name is used.

## Commercial Service and Relations with Customers

Harold Wright presented a report on Commercial Service and Relations with Customers. During the last two years this committee has given to the industry ideas, presented in the form of "Service Suggestions," which have been found of practical value to companies in which they originated. The following "Service Suggestions" were issued this year:

September, 1922—"Identification and Appearance of Meter Readers."

October, 1922—"Educating Employees in the Proper Use of Electrical Appliances."

November, 1922—"Plans for Reporting Complaints and Submitting Suggestions for Betterment of Service."

December, 1922—"The Business of Your Company Is to Render Service and Courtesy to the Public."

January, 1923—"Proper Location for Meters."

February, 1923—"Telephone Orders for 'Better Service.'"

March, 1923 — "Improving Service Rendered to Outlying Communities."

April 1, 1923—"The Practice of Disconnecting and Reconnecting Meters in the New York & Queens Electric Light & Power Company."

Since the results obtained are extremely gratifying and the expense involved is small, the committee recommended that this work be continued during the coming year. The committee felt it should have contact by representation with a similar committee of the American Gas Association and hopes that during the next year that feature can be added.

Very strong indorsement was given to the work of the committee on commercial service and relations to customers in the general discussion which followed presentation of the report.

G. E. Miller, Cleveland, urged that the succeeding committee continue sending out reports of this nature through the year in convenient form for use by the central stations. Cleveland has put into effect four of the suggestions which the committee has made this year.

C. E. Barton of Long Island City acknowledged his indebtedness to the committee for the suggestion to take care of the rush of service orders at moving time. He applied this suggestion on May 3. Under the system of his company orders for setting and removing meters passed through three departments, but to meet the emergency the entire operation was concentrated in one department, which greatly increased the capacity to handle them. Mr. Farwell, Chicago, said that one of the best ways to simplify routine is to diagram it. The drawing of a diagram immediately shows up indirect methods and duplication.

## Education

The session closed with the presentation of the report of the educational committee by Fred R. Jenkins, chairman.

During the past year the committee continued the publication and sale of the commercial engineering course and the course on practical electricity and offered for subscription three new courses on lighting sales, merchandise sales and power sales. It is anticipated that during the next year these new courses will be well established and in general use among central-station companies. Subscriptions to the commercial engineering course for the year ended March 1 were 189, an increase over the year previous. Subscriptions to the course in practical electricity for the year were 552. On the three new courses added subscriptions were received as follows: Lighting sales

course, 49; merchandise sales course, 112; power sales course, 82. All of the commercial courses have been self-supporting, and it is anticipated that with the support of the association and a suitable committee representation in each geographic section, the new courses will be maintained on a self-supporting basis.

Lloyd Prince and S. Bennett of New York and C. J. Liebman of Brooklyn reported benefits which they had experienced through the N. E. L. A. educational courses. In Brooklyn, in the case of a course on the organization and function of the sales department, more than 90 per cent of the sales department employees attended one or more lectures and 78 per cent were present at half or more of the lectures.

# Big Commercial Opportunities in Lighting

### Additional Loads and Attractive Revenues from Long-Hour, Large-Volume Business Await Central-Station Exploitation of Readily Accessible Field

The report of the Lighting Sales Bureau was issued in three parts, one devoted to residence lighting, one to store lighting and a third to six other specialized divisions. The residence lighting report, twenty-seven pages in length, which had already been published in the *N. E. L. A. Bulletin* and in *Electrical Merchandising*, presented a wealth of valuable data and constructive suggestions to aid in the development of better lighting for the customer and better business for the industry and was read by Dr. M. Luckiesh, chairman, of Cleveland.

## Residence Lighting

The first part dealt with commercial possibilities. It contained statistics showing the various conditions of lighting, types of fixtures, character of glassware, number and wattage of lamps and convenience outlets in the middle-class homes of the country covering several thousand cases. It compared these actualities with a "conservative ideal" home and showed that there exists a possible increase in revenue of $125,000,000 to the central stations in the present wired houses.

The second part contained a plan for properly lighting the home. The various rooms of the house were treated and the styles of fixtures for these rooms enumerated.

The third part of the report dealt with selling residence lighting. It pointed out that actual demonstrations of lighting are much more effective than any method of mere description, and then followed a compilation of methods, data and results of demonstration rooms, exhibits and electrical homes held throughout the country.

Per capita analyses of residence lighting revenue, declared R. D. Cutler, Hartford, Conn., in discussing Dr. Luckiesh's report, offer more enlightenment than per-customer data. From 1910 to 1922 the annual income per customer changed little, the respective figures being $24.90 and $23.90, while the per capita income increased from $0.90 to $4.58.

W. G. Blackwell, Newark, N. J., urged the use of model electric homes in stimulating residence lighting business. Six such homes are now on exhibition in New Jersey. The speaker pointed out that duplex outlets cost little more than single ones and should be generally installed. E. D. Tillson, Chicago, said that on the Commonwealth Edison system for every minute the use of lighting is extended in twenty-four hours the company's income increases $100,000. Closing, Dr. Luckiesh advocated the use of shades on fixtures in model electric homes, pointing out that the glare has been present in too many instances in the past.

## Store Lighting

The report of the store-lighting division was read by James Kirk, chairman, and presented a mass of valuable data in the nature of reports and illustrations, covering the possibilities of store lighting, including results of store-window and store-interior tests, publicity campaigns, interviews with merchants and a store-lighting booklet.

It characterized store lighting as the "untouched treasure chest," reporting on results gained in raising the "light level" in Chicago, classifying store "prospects," making definite recommendations for organizing a sales staff and suggesting successful ways to sell store lighting. Based on experience in Chicago, the committee estimated the possibilities for the complete development of store lighting in a city of that magnitude and of the respective sizes of Los Angeles, Duluth or Sharon, Pa., and told what this would mean, if applied uniformly throughout the United States, both in added profits to the merchant and in increased central-station load.

The sale of intensive store lighting, said George Miller, Cleveland, is one of the easiest jobs that the central-station commercial department encounters. One sales representative reported that not a customer called upon in four months in Cleveland had refused to listen to the message of improved illumination for stores. Up to June 1 the average intensity had been increased from 5 foot-candles to over 11 foot-candles. At high intensities the central station competes with daylight illumination.

## Goods Sold Direct from Illuminated Window

R. D. Cutler, Hartford, cited experience with a recently installed window in which the Hartford Electric Light Company lends space to local merchants for the most modern illumination of their goods. Although this is on a cross street at the side of the company's office, popular interest has led to frequent withdrawals of particular items of merchandise from the window for sale to persons passing by who have been transformed into purchasers by the attractiveness of the display. In this way local merchants get the benefit of the latest practice in colored and plain illumination for windows without undergoing the expense of having their own establishments changed over without knowing just how the layout will look before the expenditure is made.

G. H. Stickney, Harrison, N. J., urged that members actually get to work upon increasing window-lighting intensities in order to derive tangible benefits from such practice. C. A. Musson, United Electric Light & Power Company, New York, touched upon the recent formation of a "Rainbow Makers' Club" to show merchants the best practice in utilizing colored lighting for window displays, and offered to share its experience and knowledge with delegates applying for advice.

J. Daniels, Boston, described successful surveys of large Boston department stores for improved illumination, which have increased the company's income $600 to $2,000 per month according to the installation. This company is about to intensify its store-lighting field work, beginning with improved illumination installed in its district offices and extended to nearby representative stores, with intensive canvassing of the forty-two municipalities served. J. Campbell, Brooklyn, emphasized the part that specifications and drawings showing outlet locations may have in central-station co-operation with contractors. It was also brought out that in New York today 10 foot-candles is regarded as a comparatively low intensity for the clothing trade.

The report showed that the energy consumed in signs and displays is increasing each year and that the rapid development of this class of business promises to be exceptionally high in the next few years. A careful survey was made during the year, and an interesting report of these statistics was included.

The trend toward illuminating billboards was shown to be developing rapidly, and increased interest in adequate maintenance was evidenced. The central stations have not capitalized this valuable load to the extent that it warrants.

## Lighting of Large Buildings

The report of the division on lighting of large buildings brought out the important fact that central stations, realizing that approximately 60 per cent of their revenue is derived from lighting, are steadily adding men versed in illuminating engineering to their staffs to advise on lighting plans for new buildings and for the improvement of existing installations.

New building is continuing at a rapid

pace, and the new structures, together with many of the older buildings, are showing the results of the appreciation of higher standards of illumination. A report of additions to the bibliography of 1921 and 1922 was made, together with a table of recommended intensities of illumination.

The street and highway lighting division stated that street-lighting business has not always returned a fair interest on the investment and therefore has not been looked upon as an attractive load to the central station. There is no reason, however, why it should not undertake to sell better lighting on a business basis, for there is a public demand for better lighting from the standpoint of protection, safety and better business.

The year 1922 showed a decided improvement in street lighting, with exceedingly bright prospects for 1923. The report enumerated many improvements in lamps, standards, glassware and in various types of effective reflecting devices.

The report of the industrial lighting division was divided into several phases. The first covered a very thorough test, depicting the relationship of better lighting to output. The next pertained to portable lighting exhibits having for their purpose the education of the industrial public to the potentialities of good lighting. The next section dealt with lighting equipment and portrayed the importance of distribution. The following section covered the question of sales campaigns and helps, shown through the medium of pertinent charts. A bibliography of articles on industrial lighting appearing during the past year was appended.

The year was not noteworthy with regard to the development of equipment embracing any radical changes from existing types, according to the division on commercial aspects of lamp equipment. Many new pieces of accessories were developed, however. Attention was called to the advisability of luminaires being equipped with interchangeable attachment devices readily permitting the change of luminaires which would bring about the opportunity of increasing the service in lighting.

# Industrial Heating of Prime Importance

### Enormous Potential Load Awaits Development by Central Stations, but Executives Have Failed to Grasp Its Possibilities—W. S. Murray Outlines Superpower Outlook

POTENTIAL possibilities of industrial electric heating which indicate that this load will soon overshadow the motor load in the ratio of three to one monopolized the attention of the Power Sales Bureau at the third commercial session.

Attention of the Power Sales Bureau (C. K. Nichols chairman) during the last year was directed largely to the development of industrial heating, and a detailed report of accomplishments was given in the report of that division. The general power applications division (Ernest Pragst chairman) made no formal report at the convention, but devoted its efforts to the preparation of articles on power subjects for publication in the *N. E. L. A. Bulletin* and endeavored as far as possible to confine these articles to those industries where special requests were made for investigation.

The competitive power sources division (H. H. Holding chairman) started its work rather late in the year, and as the subject assigned to it is one requiring a very great amount of detailed study, no report could be made at this time. This division was instructed to study the comparative characteristics and costs of uniflow engines as well as the newer types of oil engines. Research engineers in different parts of the country are now carrying on these investigations, and as soon as they are completed the results will appear in the *N. E. L. A. Bulletin.*

W. A. Murray pointed out that the superpower system could not well be a company or a corporation as such a procedure might defeat its own purpose. He stated that super-utility would have been a better term and called attention to the fact that central stations have been practising its principles since they came into business. Mr. Murray traced the growth of the power business through four distinct steps: (1) Small companies first produced, transmitted and distributed small quantities of energy in their immediate territory only. (2) These small utilities then gathered themselves into groups and larger stations became necessary to supply the demand. (3) Expansion of these groups of utilities then followed, with further enlargement of power houses and the exchange of power between groups and stations. (4) Last came the present superpower plants and systems, with a very pronounced expansion of stations and interconnection. The present state of development stands for constantly increasing power plants and closer co-operation between companies.

## Industrial Heating

One of the chief activities of the industrial heating division (Wirt S. Scott chairman) was to compile a list of manufacturers and users of industrial heating apparatus, something that has never been available. This division also conducted the industrial heating school most successfully during the past year, and it plans to organize additional schools in the different geographic divisions.

It is felt that the development of industrial electric heating up to the present time has been more or less accomplished on the "hit-and-miss" basis and very little concentrated and co-operative effort put into it, except by individual central stations or electrical manufacturing companies.

It is the consensus of opinion of those who have had an opportunity of giving this matter any study at all that the industrial heating load eventually will greatly exceed the motor load; also that the revenue obtained from a kilowatt connected of industrial heating load will show an average of double the revenue received from a kilowatt connected of motor load.

Commenting on the work of the industrial heating division, Mr. Scott defined it as making two kilowatts grow where but one grew before and predicted that ten years hence this load will be at least ten times the lighting load. To show what this business means to the central stations of the country, he stated that there has been 1,200,000 kw. of industrial heating equipment sold during the past five years. On an average this load brings between $50 and $60 in annual revenue per kilowatt connected, thus adding, in the aggregate, approximately $40,000,000 per year. Within ten years this may be confidently expected to grow to $400,000,000. He declared, however, that, although the industrial heating load has grown thus rapidly, the idea has not as yet been thoroughly sold to the central-station executives.

To promote the business the Power Sales Bureau has worked out a program with the Joint Committee for Business Development, which, with the help of the Society for Electrical Development, will carry out an educational and publicity campaign through the daily papers and trade journals. Speaking for the society, William L. Goodwin stated that $25,000 had been appropriated and is now available for this purpose. He outlined the general methods by which the program would be carried out and expressed the pleasure of the society in being able to aid the Power Sales Bureau in its work.

### C. F. Hirshfeld Urges Growth in Heating Load

Failure of central-station executives to recognize and lend their whole-hearted support to building up the industrial heating load was reiterated by C. F. Hirshfeld. He warned against electrical men being too confident of the superiority of electric heating over fuel heating as the combustion men are constantly improving their apparatus so that in many respects it is now on a competitive basis. He urged central-station men to put forth as great an effort as possible at this time to obtain industrial heating business in order that it may become firmly established as an essential part of manufacturing operations.

Looking into the future development of electrical heating apparatus, Mr. Hirshfeld pointed out that much of the equipment was converted fuel apparatus rather than true industrial electric heat-

ing. Experimental developments indicate that some processes which are now being done in converted combustion equipment can be done by the direct application of electric current to the material to be treated. In addition to induction furnaces, nut and bolt heaters and the Northrup high-frequency furnace, which are true electrical applications, japanning and enameling operations may soon be done by an improved method.

J. C. Woodson pointed out that electric heating equipment is almost twenty-five years behind the development of other electrical apparatus. But this fact alone proves its merit, judging from the insistent demand for its use in industrial applications. He urged that, if the expected volume of this business is to be realized, attention must be concentrated upon the standardization of equipment wherever possible. Special applications should be discouraged.

Stephen Bennis, H. H. Russell, John H. Mitchell and V. M. F. Tallman paid high tribute to the work of the manufacturers in conducting the industrial heating schools and courses of instruction for central-station power representatives. At the suggestion of Mr. Tallman, a motion was passed unanimously by the Power Sales Bureau expressing its appreciation of the manufacturers' hearty co-operation. The session was closed by Chairman Nichols, who urged upon all those present the necessity of convincing central-station executives of the importance of creating in each company facilities for the proper and intelligent development of the industrial heating load.

### Frank W. Smith Prize Awarded

During the session the regular business was suspended while President Smith awarded the first Frank W. Smith prize of $100 to Cunard C. Nelson of the Edison Electric Illuminating Company of Boston.

# Salesmen's Compensation Feature of Merchandising Meeting

## Training of Salesmen and Testing of Appliances Discussed Before Large Gathering—Spirited Indorsement of Electric Range Opportunity

THE Merchandise Sales Bureau presented one of the most substantial reports ever delivered before any meeting of the commercial section in recent years. F. D. Pembleton was in the chair and in his introductory talk dwelt at length upon the importance of the appliance business to the modern central station. However, in spite of the fact that the subject has been very conspicuously before the industry for the past year or more, there still remain a great many executives who do not yet consider it one of their major problems. Many policies and many details still need to be worked out, but perhaps one of the most urgent needs is to thoroughly sell among central station men themselves the conviction that the central station has a big merchandising job to do.

In the absence of E. A. Edkins, chairman of the education and training of sales people division, the report was presented by Henry Kobeck.

In the opinion of the committee, the industry today is suffering for want of more and better salesmen, and this need is accentuated by the rapidly changing conditions in retail selling. After the spectacular collapse of the "buyers' market" three years ago, when it became painfully apparent that the buying public were staying away from stores, there developed an unprecedented demand for salesmen. The supply, of course, was, and still is, inadequate. In the effort to meet this demand thousands of unfit men have been "hired and fired," and the turnover has been tremendous. It is obvious that these new conditions cannot be dealt with successfully, either by the employment of inferior men or by attempting to recruit sales forces from those of other industries. The proper economic solution is to employ men who are at least reasonably well educated, personally presentable and mentally alert, and then train them in the industry's schools.

The committee was of opinion that the problem of developing good salesmen begins in the employment bureau. Too much money is spent in futile efforts to make salesmen out of the wrong kind of men. Not enough has been spent to get the right kind of men. Detailed recommendations on this point were offered.

The sales analysis division presented in its report a summary of some of the most successful sales campaigns that have ever been conducted in this country. The analysis sheets upon which the report is based are on file at national headquarters, where any one interested can study them. They embrace in detail experience in selling vacuum cleaners in Providence and Kansas City, washing-machine sales in Portland, Oregon; range campaigns in Raleigh, N. C.; Summit, N. J., and Vincennes, Ind.; toaster sales in Boulder, Col.; portable heater sales in Salem Mass., and selling general household appliances in Chicago.

### Standardizing and Testing

In presenting the report of the standardizing and testing division, R. S. Hale, chairman, announced that the purpose of his committee is not to establish standards, but rather to encourage tests that will develop testing processes and a higher standard of quality in appliances and accessories.

The standardizing and testing division had, through conferences with manufacturers and others, endeavored to establish proper methods of testing which may be used by any one for the purpose of determining the durability of an appliance, believing that when proper testing methods are universally adopted, or adopted by at least most of the manufacturers, member companies will be able to select appliances with much greater assurance that they will give satisfactory service, and manufacturers will find it much easier to sell appliances.

### Basis of Paying Salespeople

The report of the division of the basis of paying salespeople was one of the most instructive contributions on the commercial program and in the absence of Howard A. Lewis, chairman, was presented by Mr. Pembleton.

The committee interviewed a number of the biggest sales organizations in the country, secured their schedules of payment and methods of operation, and presented this information in a definite concrete form so that member companies might make a detailed study of the different systems employed and intelligently compile their own schedule of payment for their salesmen.

The committee report made an analysis of the favorable position of the central station in the community for undertaking the sale of household appliances, and a detailed study of the question of a drawing account and the conditions under which money should be advanced to salesmen. It also described the difference between the house-to-house selling of well-known and easily demonstrated appliances and the "negotiation soliciting" entailed in the introduction of appliances still in their pioneering period and considered the basis of compensation appropriate for both.

C. E. Greenwood, Boston, raised the point that central stations should be able to hire salesmen at a smaller commission than other merchandisers of electrical equipment, because in representing the central station the salesman has a preferred position with the public and gains the entree to the home more easily. This was corroborated by G. J. Liebman, Brooklyn, in describing a compaign to sell house wiring in Brooklyn last year. The Brooklyn Edison Company financed the contracts and made the collections. The contractors did the selling for a term of weeks. At the end of this period, when the central station advertising was discontinued and the contractors' salesmen were no longer able to introduce themselves as representatives of the lighting company campaign, they found it very much more difficult to sell house wiring.

The electric cooking and heating division reported that there are upward of seven thousand communities where a heating and cooking rate of 5 cents or less is available, which is about half of the total number of communities having a twenty-four-hour electric service. C. O. Dunten is chairman.

Of that portion of the population of the United States living within the zone of central-station service only about 25 per cent have a heating and cooking rate available. It is estimated that there are about 200,000 electric ranges in use at this time, an almost negligible fraction of the total business possible of being developed in communities where electrical service should logically be the chief dependence for cooking.

The chief activity of the committee was devoted to an effort to create an organization which would vigorously promote a more extensive range business. This was accomplished through the formation of a special joint committee composed of the cooking and heating divisions of the N. E. L. A. and representatives of manufacturers and distributors working in conjunction with the Society for Electrical Development. Arrangements were made with the society to carry out the program outlined by this joint committee working in close co-operation with the Joint Committee for Business Development.

The importance of adequate demonstrating in the sale of electric ranges was stressed by Don Ray, San Francisco. He said it is absolutely essential that a woman trained in domestic science call on the purchaser immediately and demonstrate the appliance, calling up to find out whether everything is doing satisfactorily. If this is done and the customer is satisfied at the end of sixty days, the range will never come out. The Pacific Gas & Electric Company has set a bogey of 2,500 ranges to be sold this year, and at the end of the first four months was ahead of the quota.

At present there are 5,436 ranges in service on the lines of the Idaho Power Company, and J. F. Orr, Boise, reported that the company is very much interested in developing tests on the lines to determine the diversity and demand factors of the electric range load. This work is being actively taken up by the Northwestern Geographic Section with the expectation that it will be possible to put on a man to give his entire time this year to making tests in different cities and under varying conditions.

Eastern central station men were urged by J. V. Strange, Portland, Ore., to put more effort immediately behind the electric range. The sales began on the Pacific Coast ten years ago, he said. Then the work dwindled until the point was reached where but a very small percentage of the houses remained unwired and the central stations of the Coast turned to the range as the next step in development. The same evolution will follow in other parts of the country inevitably, and it will be far easier and more profitable for the power companies to undertake the work now when it can be developed systematically and with deliberate planning, than to wait until public demand forces quick action. In Spokane, he said, there are at present 40,000 homes connected and 4,000 ranges in service. In one period of six weeks this year 429 ranges were sold in this city, and this business in itself raised the income per residence $1. No one need fear, therefore, that the rewards will be insufficient.

W. L. Goodwin congratulated the range division on the progress which has been made since the Denver meeting, when it was so enthusiastically decided that something should be done. In ten years of range selling, he said, approximately 200,000 ranges have been sold in the United States. It is not generally appreciated that 50 per cent of these ranges have been sold east of the Mississippi River. It is this lack of appreciation of how widely the electric range has been distributed over the country that is the greatest obstacle to progress. Men who believe in the electric range must undertake at once the job of converting the executives of the central station industry, so that they may be able to secure the permission, authority and financing necessary to such a market development.

### Lloyd Appeals for Support

A very moving appeal was made by E. W. Lloyd, preliminary to his report as chairman of the nominating committee, that better support be given by the central station industry to the N.E.L.A. commercial section. Executives are talking today of doubling the capacity of our central station system within the next five years. That means a tremendous job for the commercial men and will demand the very highest quality of leadership. Unfortunately, he said, the older men have drifted away from the commercial section, and for several years past the majority of the ex-chairmen of the commercial section have not been active at all in its affairs. This tendency has been in marked contrast with the technical section, where the older men continue active in the affairs of the section, serve on its committees and contribute freely to the discussion of the ever-changing problems.

Various elements of public relations and customer ownership, he said, are essentially commercial subjects, yet they have been relinquished and are today included in the programs of other sections. Mr. Lloyd announced that he had already made a recommendation to the executive committee that the commercial section be called into consultation in such details of the work of the public relations section as may be of importance to commercial men.

### Election of Officers

The following names were placed in nomination by the committee and unanimously elected to serve for the ensuing year: Chairman, N. T. Wilcox, Boston; vice-chairman, W. R. Putnam, Boise; vice-chairman, F. E. Pembleton, Newark; vice-chairman, George H. Jones, Chicago. For members of the executive committee, A. F. Berry, J. G. Tridle, A. K. Baylor, and to fill the unexpired term of Rawson Collier, W. E. Clement, New Orleans.

In congratulating Mr. Wilcox on his election Mr. Hogue recommended to the incoming administration that twelve members at large be appointed to the executive committee instead of six as in the past and that six of these members be ex-chairmen of the commercial section drafted for active work to the end that the commercial section may be strengthened and developed to a higher degree of responsibility and usefulness.

## Range Committee Meeting

**Facts of Successful Range Experience Must Be Interpreted to Executives to Get Action**

An extra session of the range committee was held on Friday afternoon to give further discussion to range experience and plans. W. L. Goodwin described in detail the promotion program which is to be organized behind electric range developments this year. F. D. Pembleton, Newark, N. J., dwelt upon the difficulty in overcoming the indifference of the central-station executive. There was a free discussion of the urgent need for searching out the facts of successful range experience and selling them to the central-station industry itself so that executives may become more understanding and enthusiastic as to the possibilities which lie ahead.

J. V. Strange, Portland, Ore., said that with all the Pacific Coast experience they cannot say how profitable the range business is, but they are endeavoring to find the answer, realizing that the greater the load is built up the more profitable it is bound to be. Don Ray, San Francisco, in answer to the question of whether ranges can be sold to combination companies in competition with the gas range, stated that the difficulty was generally overestimated. The Pacific Gas & Electric Company is selling electric and gas ranges at the same time. Their salesmen are competing for the business, though, of course, not disturbing existing installations.

J. F. Orr, Boise, described conditions in the Idaho territory, where range installations have developed an 11 o'clock peak load.

C. O. Dutton, Springfield, Ill., told of eight years of experience there. Their first thought was to sell to the wealthy people. Now nearly five hundred ranges are in use in the homes of miners. An analysis several years ago showed that 90 per cent of those purchasing electric ranges there were more than forty years of age. A recent analysis showed that only 60 per cent were persons over forty years of age, indicating that persons of smaller means and less established homes are entering the market. They used to think that it was impracticable to sell to the renter. They find now, however, that a very large portion of their customers are living in rented houses, many of whom pay for the services themselves and move the ranges when they move.

H. E. Young, Minneapolis, reported ranges on an established basis in that city, with more than three thousand ranges in service and sales running uniformly about 200 a month.

# Accounting Sessions

*Activities of the Accountants Are Broadening Each Year—Efficiency of Personnel Increases to Meet Greater Responsibilities*

A WIDENING outlook upon the industry, combined with a lengthening arc of contact with its administrative and operative problems, characterized the proceedings of the National Accounting Section, which culminated in well-attended sessions at the forty-sixth convention. The spread of the uniform classification of accounts into sixteen states and favorable prospects for its general adoption throughout the country in the comparatively near future mark the success of perhaps the most important work thus far undertaken by the section. General satisfaction in the acceptance of this classification was in evidence at these sessions. The co-operation of the various public utility commissions in this movement and the support of other national organizations have been vital factors in its advancement.

Improved methods of purchasing and storeroom accounting received much recognition at these sessions, with general agreement upon the importance of expediting procedure to take advantage of cash discounts and of reducing routine to the lowest practicable terms consistent with comprehensive and accurate records of operating transactions. Gratifying progress was noted in enrollments for accounting educational courses and in plans for the betterment of the advanced curriculum during the next few months. From all evidences the Accounting Section is hitting a stride toward higher planes of activity in which a closer co-ordination with other utility organizational tasks will be a dominant feature.

While considerable discussion took place at these sessions upon budgeting company expenditures, carrying forward the thoughts advanced last year upon this subject at Atlantic City toward the realm of wider application, there was general realization that the budget problem is destined to become more and more important in company planning. The subject is a very live one, and its scope is so broad that this year's program gave it a prominent place on the schedule. Billing by machinery, the insuring of property records, and the improvement of customers' records, security holders' records, payroll standardization practice, merchandising accounting and mortgage and trust agreements, received much attention. All these topics evidenced a larger activity on the part of accountants in utility affairs.

## Accountants Seek Greater Efficiency

**Gratifying Progress Noted Among the Companies in Acceptance of Uniform Classification, Stockroom Practice, Purchasing and Education**

MARKED evidence of the broadening of accounting interests was displayed at the opening session of the Accounting Section in the Hotel Biltmore, Monday afternoon, under the chairmanship of William Schmidt, Jr. General satisfaction was voiced at this session over the spread of the uniform system of accounts in the country and also over the growing interest of companies and employees in education and in improved methods of purchasing and storeroom procedure.

In his annual address the chairman of the Accounting National Section, William Schmidt, Jr., reviewed in considerable detail the history of this section during the past twenty-one years. In commenting on the uniform classification of accounts for electric utilities, which has been worked on during the year in conjunction with the National Association of Railway and Utilities Commissioners, Mr. Schmidt had the following to say:

"Now that the classification has been recommended, it remains for the Accounting Section actively to urge its general adoption. There still is much work to be done in seeing that it is accepted by all the regulatory bodies and that electric utility companies follow its rulings. The importance of accounting work in the successful operation of the utility companies, the absolute necessity and urgency of a uniform classification of accounts and a thorough agreement as to its interpretation by the regulatory bodies have been more fully realized of late. If the classification is followed and a harmonious interpretation is agreed upon by both the regulatory bodies and the accountants, little trouble may be anticipated in substantiating the statements or reports when called for in a rate investigation or by any other requirements of commissions."

Mr. Schmidt then commented briefly on the work of the various committees of the Accounting Section.

### Purchasing and Storeroom Accounting

This year the purchasing and storeroom accounting committee (J. F. Torrence, chairman) departed from the custom of previous years of reporting the practices of member companies and in its report has prepared and recommended a system for keeping purchasing and storeroom records. From the methods used by various companies which were obtaining almost identical results by different methods the committee has devised a system providing an alternative standard budget which

has proved satisfactory in actual use. While it is designed primarily for large and medium-sized companies, the smaller companies will find the principles applicable to their requirements, even though they do not follow the whole procedure.

The system, as prepared, divides the fundamentals or broad classes of the subject as follows: Ordering, purchasing, receiving and checking, storing, disbursements and returns, accounting, and material and supply purchasing.

A long discussion of the detail of handling invoices and remittances so as to take advantage of cash discounts followed the report, the speakers favoring the making of arrangements to insure this where possible. Several companies remit upon receipt of invoice or within the stated period of which the discount applies; others remit after receipt of shipment and by arrangement are still able to take the discount. Usually the invoice is kept in a suspense or other special account until the storekeeper announces the receipt of the material, and in many companies more care is being taken to insure that the stockroom follows these matters closely.

W. F. Stevens, Boston Edison Company, said that a recent study showed that about 54 per cent of the orders purchased through the stores department represented 2 per cent of the total value of orders thus placed. The importance of handling such orders through an emergency or petty cash account was touched upon.

J. E. Van Horne, Dallas, Tex., outlined the purchasing facilities of the Texas Power & Light Company, which serves 108 towns in twenty-one districts. Each manager has a petty cash fund of from $200 to $5,000, depending upon the territory. A large central storeroom is maintained through which orders clear when time permits. Requisitions are checked first against the material card system in the central stockroom, then by the operating department, and thence are sent to the purchasing agent.

C. E. Olwine, Newark, N. J., said that his company finds little difficulty in reconciling the inventory with the controlling account in the general ledger.

M. W. Glover, Pittsburgh, advocated discounting bills ten days after receipt of material. Ninety per cent of the West Penn company's bills go through without losing the discount.

C. E. Marden, Chicago, said that the Commonwealth Edison Company maintains a perpetual inventory with daily check-ups by five overseers who devote their time to visiting stockrooms.

In closing Mr. Brock said that the committee recommends that all requisitions which reach the purchasing agent should carry all necessary department head approvals.

## Accounting Education

The two courses of the Accounting Section showed a substantial increase in enrollment during the past administrative year of the association. The accounting education committee (Fred R. Jenkins, chairman) reported that up to March 1, 1923, for a period of twelve months since the previous report, it had obtained 287 subscribers for the elementary course as against 182 for the same period the year previous. For the advanced course during the year ending March 1, 1923, the committee received 107 subscriptions, as against seventy-three for the corresponding period of 1922. Improvement in the organization for grading and other detail work of conducting the courses has resulted in the elimination of virtually all complaints from subscribers. The correspondence service now is giving prompt and satisfactory results. The revision of the elementary accounting course of last year has resulted in a larger enrollment and much more satisfactory service. Interest in the accounting courses was greatly augmented this year by the Frank W. Smith prize, which President Smith donated to be awarded by the education committee.

WILLIAM SCHMIDT, JR.
Retiring Chairman

M. A. JONES
Incoming Chairman

During the past year there has been a marked improvement in the finances of the courses. Last year's report showed a deficit of $1,373.69, while this year a net surplus of $816.96 is shown. It was recommended that a special committee of a sufficient number be appointed to carry out a complete revision of the advanced accounting course, to be ready for enrollment by Oct. 1 of this year.

H. M. Edwards, New York Edison Company, highly commended the work of Mr. Jenkins and his associates, emphasizing the advantages of a high-grade accounting course, and E. J. Fowler, Chicago, urged the importance of revising the lessons in the advanced course, in order to include the latest thinking of the active practitioners in this branch of the industry.

Franklyn Heydecke, Newark, N. J., spoke of the growing interest of employees in the Public Service Electric Company in educational opportunities. Last year 103 enrolled in the course in practical electricity, nineteen in commercial engineering, and fifty-three in the advanced accounting course. The speaker said that his company has recently employed one man to take charge of educational work. He strongly advocated this plan for other companies, at least to the extent of placing the educational activities in the hands of one responsible and interested person.

## Preservation of Records

The committee on preservation of records (Franklyn Heydecke, chairman) made some very excellent recommendations for the safekeeping of valuable records and documents of public utility companies. The committee emphasized the failure of many companies to provide proper and ample equipment for the safe filing of valuable records. While it is possible to obtain record insurance, the cost is comparatively high, and the committee pointed out that the best solution of the problem appears to be absolute physical protection carried to its practical limit. As a means of preserving such documents as deeds, engineering reports, tracings and so forth, the committee recommended the use of either absolutely fireproof vaults, or if the volume of records to be kept warrants the expenditure, the use of an isolated document building. The committee pointed out that too often useless records are kept which only add to the fire hazards and recommended that there be a periodic destruction of such records. To this end an elaborate tabulation of documents and records, and the length of time which they should be kept on file before destruction, has been prepared by the committee.

C. S. Dressler, New York Edison Company, said that this organization is now centralizing its records and putting them in proper order. E. J. Fowler, Chicago, suggested that the committee should draw up rules and standards for the destruction of old papers, which should be a matter of good housekeeping, in view of the interference and danger resulting from excess material. J. R. Abercrombie, St. Joseph, Mo., urged taking the initiative in the destruction of useless records; otherwise utility commissions may establish regulations to this effect which may be inconvenient. J. G. Reese, Baltimore, touched upon the difficulties of securing adequate insurance on records and other data destroyed by fire. Basement vaults are of dubious value on account of possible water damage. Personnel records should be kept a reasonable time, perhaps more than three years, on account of the possibility of damage suits or other legal proceedings.

An informal report on behalf of the filing systems committee was presented by T. G. Spates. This committee has not held a meeting as yet.

# Uniform Classification in Sixteen States

## Fixed Capital Records and Handling of Discounted Bills Arouse Keen Discussion—Keeping of Accounts Under Federal Classifications Obviated

SATISFACTION with the general movement toward standardization and increased efficiency as indicated by the progress toward uniformity in accounting was expressed at the second accounting session. With one-third of the state commissions now using the uniform classification of accounts, it is confidently expected that the remaining two-thirds will adopt the classification within the coming year.

### Accounting, Classification of Accounts and Annual Reports

Promoting the adoption by public service and other commissions of the uniform classification of accounts recommended by the National Association of Railway and Utilities Commissioners has been the chief aim of the committee on classification of accounts and annual reports, of which W. J. Meyers is chairman. The classification has now been adopted as official by commissions of the following states: Alabama, Arkansas, Colorado, Idaho, Illinois, Kansas, Michigan, North Dakota, Tennessee, Utah, Virginia, Washington, West Virginia, Wisconsin and Wyoming.

Massachusetts has issued a classification so nearly like the National Association classification that for the purpose of uniformity it is considered that she is in the list of states adopting the uniform system.

In addition to appearances before state commissions, representatives of the committee conferred with representatives of the Federal Power Commission and others in a discussion of its official classification for use by licensees under the federal water-power act. As a result the elimination of some of the objectionable features found in the earlier federal tentative drafts was brought about, and it was agreed to recommend to the National Association of Railway and Utilities Commissioners certain changes in its classification, principally in connection with the abandonment of its group of accounts for transmission and distribution. Further recommendations resulting from the Federal Power Commission conference were for a single account for taxes in the income statement and for the more general inclusion of minor rents among operating expenses.

In addition to its work in connection with the uniform system of accounts, this committee, in conjunction with a similar committee of the American Gas Association, developed a form of annual report which contains in the space of sixteen quarto pages all of the information essential to the administration of public utility statutes of the various states and appropriate for embodiment in annual reports.

### Development of the Uniform Classification of Accounts

The development of the uniform classification of accounts on which the committee on statistics and accounts of public utilities has been working in collaboration with the National Association of Railway and Utilities Commissioners was traced by Fred. W. Herbert, superintendent of the service department of the National Electric Light Association. Much of the committee's time during the last year has been devoted to bringing together the classification of the National Association of Railway and Utilities Commissioners and that of the Federal Power Commission under the water-power act. While the two classifications differ materially, it will not be necessary for licensees under the water-power act to keep separate accounts for the two classifications.

A provision made in Section 3 of Regulation 20 of the Federal Power Commission "Rules and Regulations" is quoted as follows: "If the records and accounts of licensees are kept and maintained under and in conformity with accounting rules and regulations prescribed by public utility commissions or other commissions or regulatory bodies of the state or states in which the project is located, the licensee will not be required to maintain also the system of accounts prescribed by Section 1 of the regulation, but the system of accounts prescribed by the state regulatory body may be substituted therefor if desired."

Inasmuch as the classification of the National Association of Railway and Utilities Commissioners, as now amended, meets the universal requirements of the utilities and the regulatory bodies, the committee feels that this classification should govern. As a matter of fact, where the state commission's classification is followed the licensees under the federal water-power act will not be required to keep both the federal and national classifications of accounts.

The National Association of Railway and Utilities Commissioners' classification of accounts can be used as a basis, and companies operating under the water-power act can incorporate in their accounting methods those special accounts which are made mandatory by the water power act only as additional accounts and be able to report to the Federal Power Commission accurately the transactions of their company. The classification as prescribed by the National Association of Railway and Utilities Commissioners applies more strictly to the operation of electric utilities in the several states and is in no way an interference with utilities operating under federal license.

With the presentation of Mr. Herbert's account of the development of uniform classification, H. M. Edwards, for the executive committee, offered a resolution to adopt the uniform classification of accounts as approved by the National Association of Railway and Public Utilities Commissioners. Upon motion the resolution was unanimously adopted by the Section.

### Accounts Payable Records

The report of the committee on accounts-payable records, which was read by T. Wright in the absence of E. A. Davis, chairman, covered investigations of forms and methods in use by ninety-two average-size companies. Machine methods of vouchering were not considered in the report, as the committee felt that such methods would be applicable only to the larger companies. Particular attention was given to the methods of vouchering, including detailed information on numbering, indexing, forms, voucher register and cash disbursement records.

When describing the methods of vouchering, the committee found that where there are comparatively few the vouchering can be delayed until very late in the month and in some instances into the first few days of the following month. This method is ideal in that it reduces the number of vouchers to a minimum, but unfortunately cannot be followed by the larger companies without greatly increasing the vouchering force at the vouchering period to prevent an undue delay in the completion of the month's work. To overcome this peak in vouchering, recourse is had to voucher more frequently, either periodically or daily.

Under the periodic plan the invoice file is gone through at stated intervals during the month, say on the 5th, 15th and 25th, and all incidental invoices on hand are vouchered, withholding invoices from firms with which there are a number of transactions each month. These are Allowed to accumulate until the close of the month or until they have reached the maximum number of invoices assigned to a voucher. With companies having a very large number of invoices each month daily vouchering is necessarily a continuous operation. Under this plan also it is the usual practice to allow invoices to accumulate from those firms with which there are a number of transactions each month.

Where the vouchering is not continuous it is necessary to go through all invoices before filing and extract all discount items, which are vouchered immediately. When discount items are paid prior to the receipt of the material covered by the invoice, it is the usual practice to charge the net amount to the vendor's account or to a suspense account until the material is received, and it is then transferred by journal entry to its proper account. This process assures an exact account for the material, which might not be the case if the vouchering and payment of the invoice

closed the transaction. Some companies do not make a practice of taking discounts if the material is not received within the prescribed time for discounting, unless the amount of the discount is of consequence and the vendor known to be reliable.

The question of handling discount items aroused keen discussion by the members present. C. L. Hall thought it best to have all items approved first by the purchasing agent. M. W. Glover was in favor of charging all material to the material and supplies account and charging no material to construction or operation before knowing whether or not it was received and what the invoice called for.

### Fixed-Capital Records

The reports of the fixed-capital records committee (C. M. Breitinger, chairman) presented a simple system based on the association's standard classification of accounts for keeping records of fixed capital. In accordance with last year's committee's definition of fixed-capital records as a continuous inventory record of the physical unit of property and plant, showing values reconcilable to book values and kept in sufficient detail clearly to locate and identify each property, this year's committee developed the system by dividing each of the accounts No. 311 to No. 345 inclusive into sub-accounts, each sub-account to care for a unit or a set of units of plants such as would give a simple record of the property. Included in the report were general instructions applying to the proposed system as a whole and to the several accounts, detailed instructions for treating the said property covered by each individual account and specimen sheets illustrating the application of the foregoing instructions. In all of this work the desirability of simplicity and the later opportunity for elaboration were kept prominently in mind, and in cases of doubt the simpler method of classification was adopted. The application of the system was shown in appendices submitted with the report.

The report covered only the allocation of charges appearing in work orders, which in turn are charged to the aforementioned accounts, and the correlation of these charges with units of property. The committee left for the future such further development and expansion of the fixed-capital records system as might be undertaken by the larger companies. In the available time, it was not possible for the committee to reach final conclusions on two technical problems which were left for future consideration. These were (1) the basis of valuation required for initiating fixed-capital records and reconciliation with general books, and (2) treatment of overhead and other undistributed costs and intangible costs.

After briefly summarizing the report, Mr. Breitinger suggested two possible methods of starting fixed-capital records: (1) By appraisal to be made carrying a reconciliation on the books for the difference in appraisal and book values; (2) by book value distributed on a proportionate basis with appraised value, thus eliminating the factor of reconciliation.

H. M. Edwards desired to go on record as opposed to any method of using appraisal, life tables or other "abominations" for arriving at fixed-capital accounts, taking exception to the committee's recommendation. W. J. Thorpe emphasized the fact that because of the lack of fixed-capital records in the past appraisals are costing companies a great deal of money and trouble to reconcile valuations before commissions. He urged the use of a work-order system which should be carried out in considerable unit detail, giving costs for both material and labor.

Mr. Breitinger closed the discussion, pointing out that a method of setting up a fixed-capital records system is essential for rate-making purposes. He also said that it was the intention of the committee to present only a basis on which future committees can develop and expand the system.

# Accountant the Pilot of the Business Ship

## A. Monro Grier of the Canadian Niagara Power Company Tells Accounting Session the Accountants' Position—Machine Billing Receives Favorable Comment

SPEAKING on "The Value of the Accountant to the Industry" before the accounting session Wednesday afternoon, A. Monro Grier, Canadian Niagara Power Company, a past-president of the Canadian Electrical Association, said that the accountant must be able to furnish his executives at all times with the information on income and earnings necessary for rate cases before regulatory bodies. "He must keep constantly informed," said Mr. Grier, "of the existing financial trends, know the rules and regulations of public regulatory bodies and the laws established for taxing purposes." In financial matters he must be able constantly to supply the best methods of avoiding possible pitfalls. His position makes him the recorder of the company activities and virtually the pilot of the business ship. He is the doctor who must diagnose the business ills of the enterprise and the one executive official, if any, who is entitled to a seat on the executive board so that he may know intimately the problems of the business. Mr. Grier closed with an eloquent plea for the maintenance of friendship between the British and American people. He extended an invitation to the delegates to attend the Canadian Electrical Association convention at Montreal, June 21-23. A similar invitation was extended by P. D. Davies, president of the Canadian association, and F. W. Fee, vice-chairman of the Accounting Section of that association.

### Customers' Records and Billing Methods

The report of the committee on customers' records and billing methods, of which B. F. McGuire is chairman, includes a classification of billing costs for comparative purposes to be used as a help to the standard classification of accounts. It offers a basis upon which member companies can make comparisons of their billing costs. The classification of billing costs includes the items of meter reading, billing, duplicate bills, bookkeeping, bill delivery, credit and correction, customers' statistics, general supervision and total yearly cost. This classification is further divided by giving for each of the foregoing items the number of employees, cost per meter in service, cost per bill rendered and cost per customer. It is accompanied by an explanation of the different items listed in the classification.

During the year a sub-committee on methods and office appliances (J. F. Ford, chairman) was organized for the purpose of furnishing the smaller companies with details of the systems and office appliances in use by companies of similar size. Within the past year a number of member companies have been conducting tests with machines to be adapted to the customer's billing and bookkeeping work; also, tests of the Baltimore system modified and adapted to the individual needs have been made. The committee, however, did not believe that this work had been developed far enough to be presented at this time.

The discussion on the report of this committee was directed first to the "bookkeeping without books" methods of the Baltimore Consolidated Gas, Electric Light & Power Company, and favorable comment on the method was made by men experienced in it. The discussion of the comparison of costs of billing was summed up by Chairman McGuire, who pointed out the effect on costs exercised by complicated rate schedules and said that in using the classification suggested by the committee the companies planning to compare costs should get together and decide on how the work is to be carried out so that there would be no uncertainty as to the value of the comparisons.

Machine billing came in for comment, mostly favorable, but some unfavorable, as to costs as compared with older methods of billing. The experience of those who have used machine billing as expressed in the discussion indicated material savings where there are a large number of customers to be handled. The secret of saving of cost seems to lie in the combining of operations that under pen-and-ink methods must be handled separately.

### Budget

During the past year the budget committee (D. W. Harris, chairman) attempted to establish contact with member companies carrying on the study of the fundamental principles of budget development and offering solutions for some of the principal problems met in budget administration. As, however, the report of the committee presented at last year's convention was not received until the middle of February, 1923, there was not sufficient time for the committee to obtain opinions of member companies on the complete report outlining the methods of budget preparation and administration. The committee therefore recommended that it be permitted to continue its researches for another year with a view to completion of the work already begun and of giving the association the benefit of further development in budget procedure. The report included discussions of practical problems met in budget administration, development in methods, construction and cash budgets, use of materials and supplies budgets and the procedure in preparing a budget under different conditions.

In presenting the report Vice-chairman H. A. Snow, Detroit Edison Company, emphasized the thought that the budget is not a financial instrument, but a means of controlling and directing business activities that is of valuable assistance to all employees of a company as well as to the officers. The period for which the budget is prepared is not important, though he said it should be for as far in the future as possible. That a budget is a strict limitation of expenditures Mr. Snow characterized as a fallacy. The budget should be flexible so that it can be changed as needed and plans altered as new conditions develop. Mr. Snow viewed the budget as a guide rather than a control instrument. He gave as one of the important problems the getting of dependable estimates. Estimates should be made by the heads of the departments responsible for the work, and four budgets, one each for construction, operation, storeroom stocks and cash, were recommended.

Louis F. Mussel, Cities Service Company, asked for the consideration of the budget not merely from a dollars-and-cents basis but as a means of developing the human abilities of the business organization.

### Payroll Standardization

The payroll standardization committee (A. B. McCoard, chairman), after examining approximately fifty systems in use by various companies, prepared a tentative method which was outlined in detail in the report. The proposed method recommended the organization of a personnel department and an employment bureau if the size of the company warranted such procedure. The desirability of centralized payrolls was pointed out, and methods of reporting and checking time were explained, with suitable forms for this purpose.

# Renewal Reserve Analyzed

## Hon. Carl D. Jackson Presents Masterful Analysis of Reserve Accounts—Need of Revised Merchandise Account—Election of Officers

THE fourth and final session of the Accounting Section reached a fitting climax to a year notable for its accomplishment when it listened to Hon. Carl D. Jackson's remarkable address "Renewal Reserve." Calling attention to the fact that the word "depreciation" is nowhere used in the uniform classification of accounts Mr. Jackson pointed out that if a utility is well maintained and is rendering good service to the public there should be no element of depreciation of its property. Only when the physical property has actually been allowed to run down through neglect can the value be depreciated.

### Merchandising Accounting Committee

The formation of the merchandising accounting committee, P. H. Myers, chairman, was the outgrowth of the meeting of the joint merchandising policy committees of the National Electric Light Association and the Association of Edison Illuminating Companies held in New York on Jan. 5, 1923.

Classification of merchandising accounts was adopted for use by all of the companies represented on the committee, each one agreeing to apply it to his own merchandising activities.

After the presentation of the report Herbert A. Wagner of Baltimore called attention to the importance of merchandise sales to the central station company but warned that it must be conducted on a profit making basis, and stated that executives were looking to the accountants to provide the proper means of analyzing the business. "Merchandising is one of the greatest possibilities of our business," said Mr. Wagner, "but if the central station cannot make a profit, how can we expect others to engage in the business and thus bring about the great volume of sales which we all believe possible?"

Speaking in the same vein, W. A. Jones said, "It is a sad thought that many companies have not gone into merchandising, which appears to be the keynote of central station business. This situation may be attributed to the cry 'it is not profitable' which has been caused largely by inaccuracy of records which have led to an entirely wrong conception on the part of executives." Mr. Myers stated that eleven companies are now co-operating in the application of a uniform system of merchandising accounts providing for the operation of the department as an entirely separate business from central station operations. Results of this trial application will be reported at a later date.

### Security Holders' Records

The security holders' records committee (George B. Thomas, chairman) devoted most of its attention to the consideration of the legal requirements concerning the transfer of stock certificates. The statutes of the state in which a corporation is organized, federal revenue laws, the charter and bylaws of the corporation and the laws of the states in which stockholders or their representatives reside are often of vital importance in determining whether or not a corporation can transfer stock upon its records without subjecting itself to civil liability or fines and penalties. The report outlined in some detail the legal requirements for stock transfer, nature of stock certificates, variety of laws affecting the transfer, liability of the corporation, test of authority to transfer, handling of lost certificates and a set of instructions which has been used successfully by one company in its transfer department.

In view of the customer-ownership plan adopted by many large utilities, the committee urged the advisability of a utility cultivating the good will of its stockholders by assisting them in every way possible to transfer their shares in accordance with law and approved practice. The committee pointed out that a company which flatly refuses to make transfers unless certain legal requirements are met, without supplying information as to the practical steps and forms necessary, raises obstructions and invites dissatisfaction.

### Mortgage and Trust Agreements

A detailed report on mortgage and trust agreement (W. C. Lang, chairman) embraces a description of mortgage securing bonds and a general analysis of the various types of mortgages now outstanding against public utilities. Among the outstanding recommendations of the committee was a form of mortgage permitting the issuance of bonds of different series in respect to interest rate, dates, maturity, redemption and other provisions in preference to a single series indenture, as, under this arrangement, a utility has one mortgage with several series of bonds in place of many different indentures. Among other recommendations was that a definition of net earnings, when a requirement for the issuance of additional bonds, should clearly indicate that the amount set aside for the purpose of maintaining a reserve for property retirements should not be included as an operating cost.

The following officers were elected unanimously for the ensuing year: Chairman, W. A. Jones; vice-chairmen, W. Paxton Little, W. C. Lang and A. R. Patterson; members at large, C. M. Breitinger, E. A. Davis, W. H. Hodge.

President Smith, at the close of the meeting, expressed his appreciation of the hearty support of the Accounting Section during his administration.

# Symposium on Public Relations

***Outstanding and Critical Importance of Complete Understanding Between Public and Public Utility Frankly Discussed by***

W. D. B. AINEY, *Public Service Commission of Pennsylvania.*
ALEXANDER FORWARD, *Virginia Corporation Commission.*
E. V. KUYKENDALL, *Washington Department of Public Works.*
CLYDE M. REED, *Kansas Public Utilities Commission.*
H. G. WELLS, *Massachusetts Department of Public Utilities.*
MARTIN J. INSULL, *vice-president Middle West Utilities Co.*
JOHN B. MILLER, *president Southern California Edison Co.*
HENRY L. DOHERTY, *president Henry L. Doherty & Co.*
W. W. FREEMAN, *president Union Gas & Electric Co.*
ARTHUR WILLIAMS, *general commercial manager New York Edison Co.*

AN INSPIRING symposium on public relations, was the program of the third public relations session of the convention. It is impracticable to present complete reports of all ten addresses, but abstracts follow here.

### Commission the Balancing Agent Between Public and Utility

BY W. D. B. AINEY

The relation between utilities and their patrons is to be expressed, it seems to me, in a formula, but not an ordinary formula. It is a formula of equation, simple and recognized by every one academically, but in the application of it very frequently misunderstood.

On the part of the utility there is the responsibility to render adequate service, and the corresponding privilege and right that grows out of that responsibility is that the adequacy of service shall be supported by just and reasonable rates. On the public side, consumers are entitled to receive at the hands of the utilities adequate service, and the duty which falls upon them is to pay a reasonable rate.

That is the formula—so simple—yet there has been a difficulty in its application. I think a part of that difficulty arises from the fact that the utility companies themselves have not carried their end of the program and problem to the knowledge of their patrons, and therefore they, the patrons, have not had at all times a clear understanding of the difficulties that confront the companies.

You know there are those who think that the great problems of life are ones that can be solved from the standpoint of the logician. Never was a greater mistake made. The emotional characteristics of mankind are the factors which in final analysis control his life and control the nation. It is not cold logic by which men judge either social, economic or political affairs; but it is those other things that when rightly related make up the finer sensibilities and expression of man. The interrelationship that comes between two men who have established a friendly handshaking acquaintance brings them to a conclusion that no amount of controversy on printed page would ever bring.

As to the public service commissions, the conception of the Pennsylvania commission is that it must maintain a fair balance as a corrective body, and whenever there is inadequacy of service it meets the complaint by an appropriate order. Whenever the rates are unjust and unreasonable, either from the standpoint of the utility or the standpoint of the patron, it meets that emergency, and we have attempted to do so fearlessly, without any question of whether it was politically suicidal or whether it was not. When the day comes in Pennsylvania that any other conception of public responsibility shall actuate the Public Service Commission, then I will present my resignation immediately.

### A Utility with Good Public Relations Seldom Appears Before Commission

BY ALEXANDER FORWARD

You who are responsible for this very thing should know better than we of the regulatory commissions can possibly know that your treatment of your patrons may mean all the difference between success and failure, and that in your dealings with state tribunals, the rate-fixing powers and the city councils that grant or refuse municipal franchises the attitude of the public toward you is of the utmost importance. You already know that no executive who does not maintain the proper attitude of mind in this respect can for long retain his standing with his stockholders, nor, therefore, his position.

In my state—Virginia—the utility that receives the most considerate treatment at the hands of the public and its representatives is the one that never finds it too much trouble to talk things over through a responsible representative with a complaining individual. And the utility made to face the most persistent opposition to its proposals is the one whose organization is permeated with an attitude of indifference to the public and which, when ready to take any step, apparently gives no thought whatever in its own councils to the impact of its proposals upon the public mind.

In any state now where an electric utility has sold a large amount of preferred stock to its patrons, largely through its own employees and through local advertising, when any citizen asks the city council or the chamber of commerce to interest itself in securing a reduction of rates, the patrons who have that direct interest in the success of the business fall upon the said city council or chamber of commerce like a thousand of bricks to protest against any effort to impair the success of the company and injure thereby its service.

Some of our utilities, many of them in fact, recognize the fact that expert, intelligent and progressive service can succeed in part only unless the public knows about it. Many others do not indicate their grasp of this important point. Now, newspaper space costs money, but when intelligently used it is worth the price; and if it is not too much trouble to explain things to a patron, it certainly cannot be too troublesome to address meetings of civic and luncheon clubs and tell them what electric science is doing and planning in general, and what the utility in point is doing and planning.

All newspaper publicity does not have to be paid for. I pursued the newspaper business for twenty years, unless it pursued me, and I know that anything that the newspaper writer knows is going to appeal to the public imagination will receive from him a ready and responsive hearing.

### Educate by Introducing Utility Regulation Into Civics Courses

By E. V. Kuykendall

Errors of regulatory bodies are more likely to occur on the side of the public than of the utility. An examination of court reviews of commission decisions will demonstrate this to be a fact. I believe it is safe to say that state and federal courts have held three commission decisions unfair to the utility where they have held one unfair to the public.

Conceding that commission regulation should be continued, at least until something better has been devised to take its place, what should be done to insure its perpetuity? Commissions are creatures of the legislature, and the average legislator reflects the sentiment of his constituents. Unfortunately, many politicians are followers rather than leaders. The remedy, then, lies in an open, candid presentation of the facts to the public mind, the substitution of truth for error, and the eradication of prejudices born of ignorance and misinformation.

For some time I have believed and advocated that the fundamentals of valuation, rate making and regulation should be taught in the public schools as a part of civil government. These functions have become such important governmental activities, both national and state, that they should be included in textbooks on civics. A person informed on these topics would cease to be putty in the hands of the demagogue whose specialty is corporation baiting. For instance, if he understood even the rudiments of valuation, he would know the absurdity of the oft-repeated charge that regulative commissions are permitting utilities to make earnings on watered stocks and inflated bond issues instead of the value of the property devoted to public use. He would know that under regulation it is impossible for a utility to profiteer.

A good deal has been accomplished by your committee. Some steps have been taken toward the endowment of a chair or chairs in universities, but I cannot feel that that is the important thing. The important thing is to have those subjects taught in the public schools so that every high-school student will gain a knowledge of the fundamental principles which lie at the bottom of valuation, rate making and regulation. The pupils will go home and talk to their parents, and in a very short time all of this misinformation, this misunderstanding about utilities and about regulation, will disappear.

There are cases where utilities have incurred the ill will of the public by long-continued discourtesy or want of tact and diplomacy on the part of their employees or officials. In such cases the only remedy is a complete change of attitude on the part of the company. This change should begin by the discharge of every roughneck manager or discourteous employee who comes in contact with the people. Courtesy will gain and hold more friends and patrons than cheap rates and sheer efficiency combined.

Correct common prejudice through the unfailing exercise of courtesy, tact and diplomacy at all points of contact with the public. Educate along utility and regulatory lines. Reach the children in the schools, the men on the streets, and families in their homes, with a human and sympathetic appeal.

The electric companies have passed through the same character of hardship and vicissitudes that beset the pioneer home builders of both the Atlantic and Pacific slopes. They are entitled to a measure of the homage and appreciation so justly accorded the sturdy pioneers who risked all in the reclamation of the waste places of our continent.

### Good Public Relations Will Be Most Appreciated if Adversity Besets the Industry

By Clyde M. Reed

The fact now is that you folks have all the best of it. The fact is that you represent one of the rapidly expanding industries of the United States, if in fact it is not the most rapidly expanding. Your colleagues in public utility organizations have met with more difficulties than have you, and in making that statement and in drawing the conclusion that is to be drawn from that statement I am not underrating the intelligence with which you have approached your problem, even though I believe that that intelligence is greater than the approach to any other public utility line of business in the country.

The fact is that you have all the advantages of the public utility game in the rapidly developing needs of the public for your service. But if Henry Ford ever comes along and invents a match that will burn a whole day and a whole night and furnish heat for stoves and light for a whole residence, then you gentlemen will have your troubles just as the street car and electric companies have had theirs. You will then appreciate and need your public relations.

We live today in the age of the world's greatest romance, and you gentlemen, more than any other class of people I know, personify and reflect the execution and the desire of the most romantic thing in the history of the world.

It is up to you gentlemen and up to this association to continue along the lines of the very great efficiency that you have developed, along the lines of the great public usefulness that you have developed, and along the lines of continuing to aid and perfect and assist and carry on the development of our civilization.

If you fail to dedicate yourselves to that purpose, you will have failed to accomplish the great possibilities that lie before you.

### Individual Private Contracts Ultimately Make Up Public Relations

By Henry G. Wells

It is an interesting fact that the various complaints we receive in Massachusetts, in the gas and electric division, are confined virtually to one-fourth of the companies. And it is an interesting fact that those complaints from the public have all followed along certain definite lines as affecting the individual companies. In other words, they are characteristic complaints in each instance.

Of course, it may be said that companies in a large

community are handicapped, that companies that are near to the commission are handicapped, but a study of those complaints and of the one-quarter of those companies absolutely disabuses one of that idea.

There are companies that take the attitude that the customer is always right. That is not a natural attitude. There are other companies that indicate by their attitude, in spite of all the advertising they can put in the newspapers, that the customer is always wrong.

It is sometimes difficult to know whether to say that a customer is always right or always wrong; but let me give you one illustration that we had. It was an application for service. The company replied that it would require eight poles to connect up with the nearest line. The applicant, who was a very vigorous young lady, wrote back and said that the line ran right by her house. The company wrote back and stated that that must be some other public utility—perhaps the telephone company. The young lady went out and made a drawing of the stencil on the poles, took the numbers of the poles and sent that in to the commission. The commission communicated with the company, and the young lady received service.

That is just an illustration of the fact that the customer may sometimes be right, and perhaps after all it is a good idea, when an applicant states a certain thing as a fact, to investigate it.

### ORGANIZATION IN PUBLICITY WORK

No matter how much you may advertise, no matter how much you may inaugurate a publicity campaign, unless your companies are so organized, or organized in the same way that your engineering departments are organized, you are not going to be successful in a publicity campaign.

However, the great majority of the companies are carrying out your teachings on public relations. But the other companies that have not organized their public relations department upon the same basis that they have organized their accounting and engineering departments ought to do so.

It seems to me that the companies that have the most trouble to organize should call on these companies that have not had trouble and study the particular features in which difficulty has arisen. The companies that have failed have done so because of certain characteristic features, and that is indicated from the fact that complaints affecting the different companies are almost invariably along certain definite lines. In one company it is a failure in the adjustment division and not in the commercial division; in another particular company it is a failure in the commercial division and not in the adjustment division.

[Mr. Wells related several incidents of complaints which had come before the commission, to show how simple and commonplace some of the cases are which cause misunderstanding and how easily they yield to the application of ordinary common sense and a mutual desire to play fair.]

I say to you in conclusion simply this: In your several states study the situation and find out whether there are certain definite lines along which the public service companies are falling down, and then correct them. That can be done in Massachusetts, and I have no doubt it can be done in every other state. The great majority, as in Massachusetts, of your public service corporations are doing the best they can, and I believe that they all sincerely desire to do their best.

## Many Executives Not Yet Awake to Necessity of Public Relations Effort

BY MARTIN J. INSULL

I can honestly state that I think this industry is very greatly indebted to the public service commissioners of this country for the treatment it has received during the past few years. I don't mean by that that we have always got exactly what we wanted, but, taken by and large, we have received a square deal, and that is the most that we should ask for.

One of our greatest duties in this work of public relations is to so mold public opinion that public opinion supports, as far as possible, the action of the various commissions of the various states.

Commissioner Ainey very tersely gave us a formula for the utility business: Adequate service at reasonable rates. That is what we want; that is what the public wants. Why is there any difficulty between us and the public? The real difficulty is that our ideas of adequate service and their ideas of adequate service are probably the same, but our ideas of reasonable rates and their ideas of reasonable rates may be entirely different, because the subject is approached from a different point of view.

We approach it with a full knowledge of the utility business and the economic fundamentals of the business. As a general proposition, the public approach it without that equipment.

Who is responsible for the situation in which the public finds itself? Are not we? There is nobody else to tell it the fundamentals of our business unless we tell it to them. Are we to sit idly by and let people be misinformed by the political demagogue? Certainly not.

I agree that one of the best places to start is in the schools. We have already started to do some work in that direction. We can do more and more to a very great advantage.

Now I am not going to let you people sit here and take a compliment that I don't think you deserve. One of the commissioners said it was unnecessary to talk to you utility men about the necessity of good public relations. I do not agree with him. I think there are many men in our industry (and there may be men in this room) who have not yet caught the vision of what this public relation movement means. If you will sit down and quietly think about the utility business, you will come to the conclusion that the greatest interest in the utility business does not lie in the operator, but it lies in the public.

Take the question of reasonable rates. A misinformed man's idea of reasonable rates is the lowest rate he can possibly get for any particular service, yet a low rate might wreck the very industry which is his life's business blood.

To me the question of rates does not become of any importance until you consider the question of finance in the industry. It is there where the rate makes its greatest importance, because this industry cannot go forward, as it should go forward unless it can establish a credit that attracts money to it. That credit cannot be established unless it receives a rate that will establish that credit.

Now, neither you nor I can change public opinion alone. We can start, but this work has got to be done through our whole organization. We have got to support it.

Every man and woman in the organization of

an electric light and power company should thoroughly understand the importance of a favorable public opinion toward this great industry all over the nation.

## Utility Commissions Should Use Publicity to Interpret Their Decisions to the Public

BY JOHN B. MILLER

Publicity is very largely responsible for our relations with the public, and the commissioners, to a degree, are responsible for that publicity. The suggestion which I have to make is that no public utility commission is properly organized without a first-class expert publicity man to get the message, the real gist of their decisions and actions over to the public. I don't mean to get out reports. Who reads them besides us? The public does not. I don't mean long articles in the newspapers that are garbled, or even if they are in full are not properly news stuff. The publicity man of the public utility commission should take a rate order, for instance, prepare his stuff with headlines which tell, in a few words, just what has happened and why, and then let the rest of the story give an interpretation. But the headlines must be right, for that is what our public reads.

I think commissioners should be impressed with the fact that that is a proper and necessary part of their function in connection with the industry as a whole. Publicity can be good and it can be bad. It is very important that our commissioners should have good publicity.

## Commissioners Should Take Notes of Failings and Tell the Industry About Them

BY HENRY L. DOHERTY

I have sometimes been afraid that the almost unanimous indorsement that the electric light men have given to public service commissions would make the public think that we like public regulation by state commissions, and very often anything that we want they conclude must be wrong. Anything that we like they often conclude is not in their interest. As a matter of fact, of course, we are not seeking regulation, but if we must be regulated, we want intelligent regulation.

I want to say a word for the state commissions that perhaps has never occurred to most of you gentlemen, although I suppose it has occurred to them. I think we have all learned a good bit from public regulation by state commissions. I think a great many of us were in a rut; we didn't realize what we could and what we could not do.

I wish that we could have as many of the public service commissioners as would do so make a note all through the year of everything that they observed where they thought the public service company was wrong and come to our convention and tell us about it. In the last analysis, service cannot be merely lip service, and I know, having been the active manager on the job, how difficult it is to make every employee realize that he must do everything he can to give that customer what he thinks he wants, regardless of whether we think it is what he wants or not.

I am one of the advocates of making a customer pay for what he gets. I believe in that theory, but I believe in the other thing of letting him have what he wants, but be sure to be able to serve him with what he does pay for.

How many rules have you got that are good for nothing except to have holes shot in them? Then how often, if the man could get into your office—and here is the thing that is hardest of all to guard against—if you could deal with every customer you could put a smile in what you had to say and you could put it there in the right sort of way. You can tell your man to be courteous at the desk, but courtesy with him is often a kind of an insulting thing. You have got to make him feel in his heart that he is trying to serve the public, that he is trying to give each customer what he wants as nearly as possible.

I am very serious and I believe I voice the sentiment of most of the men in this meeting when I say to these commissioners that we invite intelligent criticism, that we would welcome having them make a note of everything that goes wrong that they see in the course of a year, come to our conventions and tell us about it.

I believe that our commissioners can do something more. It must be plain to everybody that we never can have peace if either the buyer or the seller is going to fix the rates. That is the great justification for the state commission. Of course, as one speaker pointed out properly, the state commission must necessarily lean toward the public, and the majority of decisions must be in favor of the public. Nevertheless, the commissions are a more disinterested body than either the buyer or the seller, and there is a chance for peace.

I am heartily in favor of this particular program that we have had here today, in inviting these public service commissioners in here to talk to us, to let us get closer to them and to figure out the problems that they are charged with and that we are charged with, because we are both charged with the duty of giving service to the public. They can't do it unless they know our position, unless they know us and know what we are working for and how we are working to it, and we can't do it withou knowing them.

## After Forty Years of Inaction at Last Utility Men Compete for Excellence in Public Relations

BY W. W. FREEMAN

It occurs to me that some of us may question in our own minds why it is not until the forty-sixth convention of this association that we devote so much time and give so much importance to the subject of public relations. In my opinion, that does not indicate that we have been asleep or that we have been neglectful of opportunities in the past. It means, rather, that in the evolution of our industry and of our business development we have reached a time when this subject becomes of very much more importance and very much more essential than it has been in past years.

Whereas previously we came in contact directly in a business way with perhaps 5 or 10 or 20 per cent of the public, now our ambition at least, if not our realization as yet, is to have business relations with 100 per cent of the public we serve.

But some of us—perhaps many of us—have had too little ambition, have had too little realization of the possibilities of the establishment of really friendly relations with our consumers. Whatever the facts may be, the thought is projected at this convention that proper public relations between the companies and their consumers can be secured. We enter into competition with each other as to how rapidly and how completely we can bring about that situation in our respective territories.

Our job is to see how quickly we can be in the forefront of this movement rather than merely act as the followers to those who do lead.

The solution of the public relationship problem can perhaps be voiced in two thoughts—one hundred per cent service, one hundred per cent publicity. One hundred per cent service means service unaffected in any detrimental form at any point of the operations where improvement is practicable. One hundred per cent publicity does not mean merely advertising, but placing before the public and before the consumers all of the facts the knowledge of which will assist to promote friendly relations.

### We Win Public Confidence and Esteem by Meriting It

BY ARTHUR WILLIAMS

Public relations to my mind is the most important question that is before our utilities today. I think it is greatly to our advantage as a great utility group to have the utility commissioners know us, and I think it is very important for us to know the men who are representing the public in these offices of public service control. I am convinced that antipathies, differences of opinion, disregard of regulation by fair men, all disappear when we get together in such meetings as this.

To my mind regulation has greatly strengthened the character of our relations with the public; it has, speaking from our own experience, greatly strengthened the confidence of the public in ourselves as utilities, but the thing that we need in holding office in public service control and regulation is that our commissioners shall not be subject to abuse and to the danger of being thrown out of office whenever they make a decision, whether it be for the utility or for the public, against the utility or against the public, which, in their judgment, is a fair decision.

To my mind, the tenure of office should be that which is given to our judges, and our public service commissioners should be so placed in their office that they shall be immune from the danger of removal because they give fair decisions based upon economic and not political conditions as they arise from time to time in their respective jurisdictions.

Our constant effort should be, day in and day out, to win the highest degree of public confidence and esteem by meriting it in every act of our company.

I just want to make this point where, I think, we have perhaps been negligent in the past. That is with reference to the training of men and women for public service. While we train our engineers and our accountants, we very often are somewhat haphazard in picking the men who represent us in the far more direct part of our business with the public. We ought to give just as much thought to the training of men and women of our companies that come in contact with the public as we give to the technical engineer or to the chief accountant.

The most priceless asset we can have as utilities is good and favorable public opinion, and too much attention cannot be given to its acquirement by our utilities.

# Necessity of Good Public Relations*

***Public Policy Committee Outlines Important Problems Confronting Industry and How Favorable Public Opinion Aids in Their Solution***

THE broadest question of public import with which we have to deal is the attitude of the public toward the industry as expressed by public opinion. The importance of a favorable public opinion toward the industry must be indelibly impressed upon the minds of every one of its employees.

#### ALL INTERESTS ARE IDENTICAL

The interests of the industry and the public are identical; namely, the best possible service at the lowest rate consistent with a high credit standing, for without the latter the industry cannot attract at low cost the money necessary to provide more service to meet the public demands.

The industry has invested in it today something more than five billions of dollars. It is estimated that during 1923 this will be increased to six billion dollars. If the present rate of growth of our sales of electric light and power continues, there will be invested in the industry in 1930, in order to take care of the business then, not less than fifteen billion dollars.

Therefore, we will have to raise for the next six calendar years an average of a billion and a half dollars per year.

The success we have had in inducing our customers themselves to become owners in our properties is of the greatest importance in the development of our industry and has materially increased the stability of the financial structures of the properties interested.

Companies selling preferred stocks to their customers should so plan that the proper proportion between the two classes of stock is maintained, so that the preferred dividend is earned at least one and one-half times.

#### SOLUTION OF COAL PROBLEM NECESSARY

The creation of a national commission fully empowered to get to the bottom of the troubles in the coal mining industry is the first serious attempt toward a solution of one of the most vital problems with which our industry has to contend. We have been disappointed that the cost of coal did not follow the downward trend of prices generally. The prices not only have been higher, but many of our operating companies have had to import large quantities of coal from England because of the curtailment of the American supply. Fortunately we have been able to introduce operating economies in our steam stations, and through a maximum use of equipment and facilities have overcome the handicap of higher-priced coal, and have given our customers service at the same, or at lower, rates. Statis-

*Abstract of report of public policy committee of N. E. L. A. delivered in New York, June 7, 1923.

tics gathered by the U. S. Bureau of Labor reveal the fact that during the past five years the average rate for electric service in every community from which the government obtains its data is less than the rate charged in 1914. This is in spite of the fact that the average monthly price of bituminous coal at the mine has increased from $1.14 a ton in 1914 to $4.36 a ton in January of this year. Nor does this tell the whole story; for increased freight rates on coal from mine to destination have added considerably to the cost of central station fuel.

It is hoped that some way of checking these ever recurrent strikes in the coal mining industry and in the transportation industry will be found by the constituted authorities without experimenting with government ownership of coal mines and railroads.

The development of large electric generating stations, serving wide areas, embracing many towns and communities, has very largely eliminated the local town plant and with it the question of municipal ownership. On the other hand, this very development and the next development of the interconnection of these systems by which one or more states may be served from one superpower system are given an opportunity for the advocates of state and government ownership to voice their ideas.

If it is at all possible to convert these unbelievers in private ownership and operation by furnishing infallible proofs of our competent initiative and efficiency, by all means let us do so.

### Water Power Development

The filing of a suit by New York State in the United States Supreme Court questioning the constitutionality of the water power act had the effect of retarding additional water power development and probably will continue to do so until the case is finally decided by the court. Notwithstanding this, more water power developments are under construction at the present time than at any other time in the nation's history.

While not all of the applications for water power permits are capable of immediate development, at least $750,000,000 is involved in projects now under permit.

There is a great deal which may be done in the hydroelectric field particularly in the direction of co-ordinating the operations of hydro-electric and steam central stations. Much more time may also profitably be spent in surveying and studying the hydro-electric resources of the several states.

It is our firm conviction that this work should be done by the electric light and power industry. Surveys of this kind have already been made by the industry in the Southern Appalachian region, in the Adirondack region, in the Pacific Northwest, and the Great Lake states. Similar surveys should cover the entire country, however, and the work of the numerous committees should be co-ordinated into a national survey.

### Rural Service Problem

Your association has gone into the matter of rural service this year more intimately than ever before, and many of its committees have been in close touch with farmers' organizations and worked in co-operation with them. Obviously, if people leave the farm those who remain must utilize more and more machinery, if the nation's output of foodstuffs is to keep pace with the rapidly growing population and the demands of other sections of the world for grain. The electric industry realizes its obligation to aid the farmer and stands willing to supply him with service whenever and wherever it is economical and feasible to do so.

There is no denying the fact that complete electric service on the farm brings with it great advantages, and as the systems of distribution spread out, more and more farms will come within the range of economic service. No engineering difficulties stand in the way. Every farm in the country could be reached, but in the present state of the art the cost of doing so would be so great that the rates which the farmer would have to pay for the service would be prohibitive.

In addition to the work which is now being done by our committees in co-operation with those representing farm organizations toward improving farm machinery, our engineers might also make a study of the situation with a view to determining the possibility of devising some less costly way of tapping high-tension transmission lines without jeopardizing the service on the rest of the system. While we want to do everything possible to improve service in rural communities and extend our lines to the individual farmer, we must be careful that overenthusiasm on our part does not raise in the breast of the farmer any false hopes with regard to electrical supply.

### State Regulation

While commission regulation of public utilities may be said to be in a state of flux, out of the wealth of opinions and decisions handed down by courts and commissions may be gleaned certain definite facts. The right of the state, within constitutional limitations and in the exercise of its police powers, to fix rates and regulate the character of public service is beyond question. Time and experience have shown that electric public utilities are absolutely essential and that good and adequate service at reasonable rates is a matter of first importance to the community.

The business in which we are engaged calls for a high degree of technical skill and experience coupled with practical business knowledge and practical understanding of the law of economics. To bestow the full benefits of our specialized knowledge on the community we need its moral and financial support. The public service commissions are an aid to this end. They act as impartial judges of our acts, pass on our service and, in a sense, vouch for the integrity of our securities. This being the case we should insist on commissioners of high caliber and then assist them by doing all we can toward their being supported by a sound public opinion. With commissions composed of men of this type our future is safe. Their decisions will be based not on prejudice but on reason born of their study and education in our industry with its resultant understanding.

### Co-operative Effort Necessary

The National Public Relations Section's work covers co-operation with educational institutions toward the establishments of courses in utility administration; the education of our men and women employees in the fundamental problems of our industry and a proper understanding of its interrelation with the public; the organization of public utility information committees in the various states; the establishment of speakers' bureaus in the geographic divisions; a closer co-operation between our association and the different classes of financial institutions; the development of good will

advertising toward the industry by the manufacturers and the compilation of a proposed uniform regulatory law.

It is regrettable, however, that one of the greatest difficulties that this section has had to contend with is the apparent indifference of some of the operators to the very important work which the section is doing.

Your association, your public policy committee, your Public Relations Section cannot by themselves make for the industry the necessary impression on public opinion. They can only blaze the way. The individuals of the industry must make and keep that way permanent. This cannot be accomplished without the interest and enthusiasm of the executives themselves. It is their duty to see that the importance of a favorable local attitude toward their particular companies and a sympathetic national public opinion toward the industry are appreciated and fostered by every member of their organization.

In companies large enough to support them there should be one official who should give all his time and efforts to this work. In the smaller companies the executive must do it himself. In every company it must be done.

As a general proposition, the public is fair in its conclusions, provided it has the data and facts on which properly to base those conclusions. Let us be more alive to our duty by seeing that these facts are common knowledge. Let us bring to the public a realization of the fact that it really has the greatest interest in the success of the electric light and power industry. We have nothing to hide.

We are engaged in supplying a great essential service that is doing as much as, if not more than, any other agency in the development of the nation. What our industry has achieved in the past, though much, is small compared with what it can achieve in the future with the aid of an enlightened and favorable public opinion based upon mutual trust and upon mutual and comprehensive understanding.

# Power Plant Practices Undergoing Change

***Prime Movers Committee Finds That Higher Pressures, Stage Bleeding, Reheating During Expansion, Air Preheating, De-aeration, Powdered Fuel and Diesel Engines Figure Most in New Activities***

IN GENERAL, the central-station industry is now actively considering higher pressures and temperatures, stage heating of feed water and reheating during expansion. Some companies are installing equipment of types considered quite distant not many months ago. However, many problems still remain unsolved, and there is a diversity of opinion with respect to the proper and best methods of utilizing higher pressures and temperatures.

Plants are now being considered with operating pressures from 400 lb. up to 550 lb. at the boiler. In one case boilers are being provided for 650-lb. pressure, but the turbines will be operated at 550 lb. The steam temperatures adopted in these plants range from 650 deg. to 750 deg. F.

According to information received by the prime movers committee of the N. E. L. A., of which C. F. Hirshfeld is chairman, many engineers feel that the adoption of pressures as high as 550 lb. at the present time represents too long a step into the unknown and that the advance to such pressures should be made slowly and conservatively. On the other hand, they agree that it would certainly be an error in judgment to adopt 200 lb. or 250 lb. for new work without giving thorough consideration to the possibilities latent in higher pressures.

The effect upon pressure loss of the design of piping, and particularly the design of valves and fittings, should have serious consideration before final decision. Instances are on record in which slight modifications in such parts reduced loss through them to values between one-tenth and one-half of those previously considered normal.

The increasing use of high-temperature steam has served to focus attention on steam-pipe insulating covering. Practice differs greatly, as all of the materials sold for this work seem to be in extensive use. However, 85 per cent magnesia is still the predominant material.

Expansion bends or offsets seem to be in almost universal use for high-pressure lines. These are reported as giving entire satisfaction except for leakage at flange joints in some cases, but this trouble appears to be the result of improper design rather than an inherent weakness of this type of joint.

### Ash and Coal Handling Practice

Statistical data on methods of handling coal and ash have been compiled from forty-one representative central stations. Of these, thirty-six received coal by direct railroad shipment and thirteen by water. Seasonal outdoor storage is provided at eighteen out of forty-one plants. Several mine-mouth plants are included in the eighteen. At twenty-eight plants locomotive cranes are provided for unloading or handling coal, while sixteen report bridge-crane facilities. Fifteen of the plants dump ashes direct into cars, while only seven dump direct into conveyors. The ash is transported from the plants by railroad cars in ten cases, and in ten others it is disposed of by dumping into hollows for grading, being transported by trucks, industrial cars, aërial trams and hydraulic sluices. In four cases the ash is disposed of by transportation in barges.

The trend is more and more toward the use of motor-driven auxiliaries, with in most cases some arrangement for insuring a continuous supply of power to those auxiliaries commonly classified as essential. The proper control of motor-driven boiler-feed pumps is causing a number of operators some concern. Numerous curves are embodied in the report of the prime movers committee, showing the variations in thermal performance resulting from different bleeder and auxiliary arrangements with and without economizers. The economical

TABLE I—SUMMARY OF OPERATING RECORD OF SEVENTY-FOUR TURBINE UNITS (1922)

| | | Percentage of Period-Hours |
|---|---|---|
| Installed turbine unit capacity, kw | 2,068,000 | ........ |
| Total period-hours reviewed | 642,902 | 100.0 |
| Kw.-hr. generated—total | 8,885,504,000 | ..... |
| Service hours demanded | 481,093 | 74.8 |
| Service hours operated | 437,902 | 68.1 |
| Idle hours | 205,000 | 31.9 |
| Unit service demand factor, per cent | ......... | 74.8 |
| Service demand availability factor, per cent | ......... | 91.0 |
| Capacity factor, per cent | ......... | 48.1 |
| Output factor, per cent | ......... | 70.6 |
| Service hours factor, per cent | ......... | 68.1 |
| Maximum possible service hours factor, per cent | ......... | 84.5 |
| STEAM TURBINE | | |
| Total hours of repair and maintenance | 51,136 | 7.9 |
| Steam casing and joints | 1,141 | 2.23 |
| Governors | 618 | 1.208 |
| Control gear | 615 | 1.202 |
| Packings | 1,800 | 3.520 |
| Nozzles | 140 | 0.275 |
| Shaft and coupling | 115 | 0.225 |
| Wheels or spindle | 20,113 | 39.33 |
| Buckets or blading | 2,485 | 4.86 |
| Vibration | 5,565 | 10.88 |
| Bearings | 1,824 | 3.57 |
| Lubrication system | 901 | 1.76 |
| Cleaning oil system | 1,663 | 3.26 |
| General inspection and overhaul | 14,156 | 27.68 |
| Repairs during service demand | 25,176 | 49.2 |
| GENERATOR | | |
| Total hours of repair and maintenance | 20,506 | 3.1 |
| Vibration | 465 | 2.26 |
| Oil leakage | 44 | 0.215 |
| Armature core | 1,050 | 5.13 |
| Armature winding | 9,771 | 47.6 |
| Field winding | 5,838 | 28.4 |
| Collector rings | 423 | 2.06 |
| Exciter | 46 | 0.225 |
| Fans and ventilation | 693 | 3.38 |
| Inspection and cleaning | 2,176 | 10.5 |
| Repairs during service demand | 10,430 | 50.7 |
| CONDENSER | | |
| Total hours of repair and maintenance | 16,369 | 2.5 |
| Leakage | 2,071 | 12.65 |
| Cleaning | 9,154 | 55.92 |
| Tubes | 2,386 | 14.58 |
| Shell | 13 | 0.08 |
| Circulating pumps | 1,692 | 10.34 |
| Hot-well pumps | 262 | 1.60 |
| Air pumps | 454 | 2.77 |
| Miscellaneous | 337 | 2.06 |
| Repairs during service demand | 3,694 | 22.5 |
| OTHER CAUSES | | |
| Total hours of repair and maintenance | 11,448 | 1.8 |
| General piping | 1,201 | 10.5 |
| Plant electrical | 1,720 | 15.0 |
| Outside electrical | 70 | 0.6 |
| Miscellaneous | 8,457 | 73.9 |
| Repairs during service demand | 3,086 | 26.9 |
| IDLE | | |
| Reserve ready for immediate starting | 105,248 | 16.6 |

feed-water temperature when economizers are used with stage heating appears to be higher than one would expect from experience in the older type of plants. The increasing use of deaërating equipment makes it necessary to consider the effects which such devices may have on heat balance.

Experience reported by a number of companies indicates that jet condensers can be used as heaters and at the same time operated so as to hold the oxygen concentration to values between 0.10 cu.cm. and 0.25 cu.cm. per liter. When very low oxygen concentration is desired, the concentrate and feed water must be handled in such a way that contact with the air is virtually eliminated. This may be done by maintaining a completely closed system except for a steam-sealed surge tank.

The closed heater has been used extensively for the higher temperature ranges. It is now coming into use for bleeder heater, as it offers decided advantages for such work. If provision is made for draining off condensate as rapidly as it forms, bleeder lines can be connected directly with the interior of heaters without check or non-return valves.

Some designers are now providing for the recovery in the condensate of heat in generator cooling air, in turbine lubricating oil and in transformer oil. The effect of make-up evaporators on heat balance is considered at length in the report, and numerous methods of connecting such evaporators into the system are given, together with indications of the effect on heat balance.

Close co-operation between manufacturers and users of turbines has resulted in considerable improvement in ability to meet severe requirements as to continuity of service and in gradual elimination of many of the minor defects which have been experienced in the past. Performance records of seventy-four large turbine units installed in twenty-seven power houses are given in the report for the year 1922. The outages of these machines have been analyzed very completely and classified according to power.

### General Use of Bleeder Steam

The very general use of bleeder heating of feed water in two or more stages is one of the notable movements of the year. The construction of a turbine to operate with steam at a pressure of 1,000 lb. to 1,200 lb. and to exhaust through a preheater into the high-pressure mains of an existing station is another development of the past year.

Control of the quantity of circulating water and various methods for effecting such control are discussed. It is shown that the use of two constant-speed pumps is only a partial solution in most cases and that variable-speed pumps make possible more economical control. The results of tests are included. The maximum permissible siphon is discussed, and records are given showing that one installation operates satisfactorily with a siphon of 32.5 ft. of water. Experience seems to indicate the desirability of a separate tank for hurling water with proper provision for cooling and make-up as the safest arrangement. Two cases are reported in which salt water used in hurling water has found its way into the condensate and ultimately into the boilers.

Rolling in condenser tubes at one end is considered entirely satisfactory by several companies, but others claim that it requires more time than it does to pack tubes in the ordinary way. Besides, the tubes have a very short life, and the removal of a tube is a more difficult job. The committee declares that it would be highly desirable that the users of condenser tubes should agree upon a single satisfactory specification for Admiralty metal tubes; tentative specifications have been prepared by the American Society for Testing Materials.

The first preheater is being installed in this country. It is designed to raise the air temperature 100 deg. F. at maximum load at the expense of heat contained in the flue gases leaving the economizer.

A study of arches over chain-grate stokers shows that no general agreement on details of design, size, shape, location, etc., is yet possible. Available life seems to vary from a few weeks to periods longer than one year, and in one instance a life varying between one week and five years is reported for arches of supposedly the same construction, operating in the same plant under what are supposed to be like conditions. Numerous methods of protecting side walls by air cooling and water cooling are being used; in a few cases the arch and its supporting metal are being cooled by air.

A number of plants are using stoker regulators with entirely successful results.

The increasing use of inclined baffles in horizontal

TABLE II—RESULTS OF OPERATION OF DIESEL ENGINES
(Data for three-year period ended Dec. 31, 1922)

| STATION | A | B | C | D | E |
|---|---|---|---|---|---|
| Number, Size and Kind of Diesel Units | Three 500-Hp. M. & S. Diesels | Four 225-Hp. B. & S. Diesels One 500-Hp. M. & S. Diesels* One 250-Hp. Primm Semi-Diesel† | Three 225-Hp. B. & S. Diesels | One 600-Hp. M. & S. Diesels Two 225-Hp. B. & S. Diesels One 170-Hp. B. & S. Diesels | One 500-Hp. M. & S. Diesel |
| Total Diesel plant capacity, kw. | 930 | ‡750–910 | 450 | 735 | 310 |
| Station load factor, per cent | 73.7 | 33.25 | 29.50 | 33.0 | 69.4 |
| Lb. fuel per kw.-hr. output | 0.675 | 0.925 | 0.985 | 0.804 | 0.741 |
| B.t.u. per kw.-hr. output | 12,820 | 17,580 | 18,720 | 15,430 | 14,090 |
| Lubricants in gal. per kw.-hr. output | 0.00098 | 0.00240 | 0.00232 | 0.00184 | 0.00092 |
| Engine maintenance cost per kw.-hr. output, mills | 3.23 | 6.91 | 9.05 | 7.95 | 4.60 |
| Fuel cost per kw.-hr. output, mills | 3.98 | 5.86 | 5.90 | 5.75 | 4.51 |
| Lubricant costs per kw.-hr. output, mills | 0.410 | 1.79 | 1.21 | 1.08 | 0.640 |
| Total maintenance costs per kw.-hr. output, mills | 3.39 | 7.40 | 10.01 | 8.65 | 4.94 |
| Miscellaneous supplies per kw.-hr. output, mills | 0.492 | 1.00 | 0.971 | 0.699 | 0.726 |
| Labor cost per kw.-hr. output, mills | 2.17 | 4.40 | 5.27 | 3.65 | 2.43 |
| Production cost per kw.-hr. output, mills | 10.442 | 20.45 | 23.361 | 19.829 | 13.246 |
| Number of employees (average) | 6 | 7 | 3 | 5 | 3 |

*Installed 1922. † Not used since 1920. ‡ Increased due to new unit.
Note.—The Diesel engines at the stations represented in the above tabulation vary in age from eight to seventeen years. All of these engines have been giving continual service with the exception of the time lost for regular maintenance and repair periods.

tubular boilers has stimulated development of many different varieties. Baffles of the monolithic variety and baffles consisting of monolithic material reinforced with tile have given trouble in some cases. The indications are that the use of Portland cement makes them more resistant to shock and does not reduce the refractory qualities to an undesirable extent.

The experiences of one company in protecting and repairing furnace walls by means of a cement gun indicate that the life of such walls can be greatly increased at very small cost.

Results obtained by various methods of treating feed water have been obtained from thirty-six operating companies, and these are tabulated in the committee's report for ready reference. In general, each company has been favorable to the method used, indicating that the conditions have been improved by the treatment adopted.

### Deaërators Stop Corrosion

Results of tests made on one installation of deaërators indicate that with condensate leaving the main condensers with zero oxygen contents the water drawn from open heaters at temperatures in the neighborhood of 180 deg. F. contains 0.75 cu.cm. to 1.4 cu.cm. of oxygen per liter. This material leaves the deaërators at temperatures about 10 deg. lower and contains no oxygen. In this plant the use of deaërators has stopped corrosion of steel-tube economizers, which was previously very rapid and serious.

General satisfaction is expressed with the use of evaporators for preparing make-up water. Attention is called to the fact that leaky condensers may largely vitiate the results otherwise obtainable. When the make-up water contains corrosive elements it may be necessary to treat it chemically before admitting it to the evaporators.

Very satisfactory results have been obtained by two companies with the Permutit system. One company reduced its tube replacement expense from \$2,600 a year to zero and reduced the boiler-cleaning expense to one-third of its former value.

Tentative specifications for coal are presented by the committee this year. These have been drafted with the idea of making them practical—that is, protective to the purchaser and still acceptable to the producer.

Many trial installations of pulverized-fuel firing have been made during the past year. This method of firing has been adopted by several large plants now being designed or under construction. Much experience remains to be obtained in fuel preparation and transportation, as well as in actual combustion. The present tendency is toward the installation of radiant-type superheaters for powdered fuel furnaces, arranging them in series with the convection superheaters already installed.

As the result of elaborate tests, the Stirling boilers have been modified in the arrangement of heating surface and baffling so as to give reduced flue-gas temperature. This design makes it possible to obtain a greater amount of heating surface within given column centers than with the older design.

Of 500 feed-water regulators reported on, 85 per cent are said to be reliable.

Statements received from two plants, one using integral economizers and the other steel-tube economizers above the boiler, indicate that the feed water must be virtually free from dissolved oxygen if internal corrosion is to be prevented.

### Mechanical Oil Burners Not Fully Appraised

Experiments are still being made with oil burners of different kinds with different furnace arrangements. The important features appear to be furnace volume and method of introducing air. Existing burners of the steam-atomizing type have a working range from 40 per cent to about 250 per cent of boiler rating, so that burners must be cut out to carry less than 40 per cent load. Greater flexibility is desirable. Mechanical burners are not yet fully appraised, but they possess recognized advantages with respect to efficiency and maintenance.

Brief accounts are given of one case in which refinery residue is burned successfully and of another in which undehydrated oil gas tar is being used. Research is still very active concerning the distillation products of coal, and semi-commercial trial of different processes continues.

Owing to the catalytic action of certain babbitts on lubricating oil, care should be used in the selection of the babbitt. Of the two forms of sludge formed, one can be removed with relative ease, whereas the other is very difficult of removal. Despite extensive development of oil-purifying equipment of various sorts, there is yet no completely successful device.

Attention is called to the fact that it is better to install too few instruments than to install more than can properly be taken care of and used to advantage. Consequently, the committee has listed the boiler-room and turbine-room instruments which it considers are essential and in the order of importance or preference.

Gas engines of 200 hp. and under are extensively used in the smaller stations in which limited capital favors the lower first costs in comparison with Diesel engines. When such limitations do not exist and when a reliable and uniform supply of cheap gas is not available, the

Diesel engine is more often used because of its greater economy. Actual operating costs are given for gas-engine and Diesel-engine plants. Figures are also given to show installed costs on a kilowatt capacity basis. Attention is called to the extreme importance of proper maintenance in the case of Diesel engines and to the fallacy of predicating operating costs upon periods which are not of sufficient length to span a complete cycle of maintenance. The committee pointed out in its report that there is apparently a very marked tendency toward the increased use of Diesel engines, not only in the small plants but also in plants of considerable total capacity, consisting of units of relatively large size.

# Customer Ownership a Safeguard Against Communism

***Britton, Egan, Hall and Forbes Champion Cultivation of Human Relationship in Utility Operation and Development***

A SYMPOSIUM notable in the annals of the association was held upon customer ownership at the Thursday session of the committee of that name. John A. Britton, vice-president Pacific Gas & Electric Company, San Francisco; B. C. Forbes, editor *Forbes Magazine*, New York; E. K. Hall, vice-president American Telephone & Telegraph Company, New York, and Louis H. Egan, president Union Electric Light & Power Company, St. Louis, Mo., addressed a large and enthusiastic audience upon the development and prospects of customer and employee ownership, emphasizing the opportunities now before the industry in this field. Abstracts of these addresses follow.

## Customer Ownership Spells Salvation of the Industry

By JOHN A. BRITTON

Vice-President Pacific Gas & Electric Company, San Francisco, Cal.

TODAY the United States is facing a menace through radicalism and all the other isms to which a nation like ours is heir, a menace greater in my judgment than a cruel war. Through insidious propaganda the public is being taught to have no respect for private property, whether owned individually or whether in the hands of corporations. The more you get that man or that woman to hold the little slip of paper that represents a certain interest in your affairs, and the more he knows that the protection of that slip of paper means the safeguarding of property and income to him, the greater seed you are sowing. Involved in this is the welfare of this great and glorious country of ours that must be preserved along the lines upon which our forefathers built and which no one must be allowed to tear down.

On June 1, 1914, a circular was sent out by the Pacific Gas & Electric Company asking employees to participate in the purchase of preferred stock about to be offered on the market. There was a very ready response. That was the first date in the United States that any public service corporation offered its holdings of stock to its employees or to the public. Within a month an offering was made to the public, and we have continued ever since and very successfully. In 1922 our sales were more than $10,000,000 of preferred stock, sold over our counter without much effort, without any sales organization, and generally through the spirit of our employees, who became, unconsciously perhaps, the salesmen of our preferred stock, because they had up to that time imbibed the spirit that was abroad in the land that they should be partners through investments in the enterprises for which they worked.

I think down deep in the heart of every man and woman in the United States, whether he or she be of foreign birth or otherwise, lies dormant that love of possessing something, else we would not be, as we are, a nation of home owners. It is only a step from the desire to own a home to an investment that will insure the protection of those near and dear to you. That underlying sentiment needs only to be awakened by a general popular knowledge that the investment they are going to make is sound and desirable. It appeals with more than ordinary force if it is of local character.

In the early years before regulation, company after company in this country paid for extensions out of the profits arising from their rates. Unfortunately that payment out of earnings by the maintenance of high rates has kept us in boiling hot water. If the men in the industry at that time had had common sense enough to have pursued the method of financing that is pursued today, and if a part at least of that surplus earning devoted to the extensions of capital had been devoted to the reduction of rates, less would be heard today of the odium that still, I am sorry to say, attaches to some of the public service corporations.

Then the companies got into the hands of speculators, more or less, and then that narrowed down to certain circles of control, and we were facing a very serious era in public service corporation work such as ours before this consumer ownership came into being. The general sentiment of the press throughout the United States was decidedly against public service corporations and their policies.

Now you are leading up to more perfect and positive public relations. I don't care whether a consumer of yours is a stockholder or not, if the treatment of him by the employees of the company is not 100 per cent perfect, he disregards his small holdings of stock, and becomes not a booster but an opponent of the company.

I realize fully as well as any man here what it means to have back of you, however, an army of stockholders who have become imbued with the policies of your company and with the fact that it is the part of every

one having an ownership in the company to stand behind the protection of private property.

Let me tell you what it means to have those stockholders who believe in that preservation of private property as well as the nation as a whole. We did have in 1922 a war in California against that type and kind of destructive work that would tear down anything builded in honor and on principle. We had a fight there, and if they had won out, it would have threatened with destruction every public utility throughout the United States—would have toppled from its foundations the edifice that we men in the industry have been building up for more than a century.

That was the menace of that water and power act. Had California put its stamp of approval upon state-wide ownership, it would have crept on its insidious and slimy way all over this great nation of ours, and I think we of California did the nation a service. We didn't fight the battle alone. We don't take that credit to ourselves. The N. E. L. A., I am glad to say, under its great leadership, was of inestimable benefit to us in the accomplishment of our purpose to keep our state clean from those sorts of reptiles.

How did we do it? We had in all the public service corporations of that state not less than 100,000 stockholders.

SEVEN VOTERS PER STOCKHOLDER

There were at least 400,000 citizens of the state of California who went to the polls that day and voted against the proposition and, aided and abetted by others who on general principles were opposed to it, we rolled up a vote there of nearly 700,000 against to a little over 200,000 in its favor.

However, while we put our foot on the neck of that dragon for the time, he still spits fire. He is still alive. He has more lives than the proverbial cat and we have to face him again and his cohorts in 1924, but strengthened by that vote, strengthened by the increase in consumer ownership, I feel certain that the result will be better for us than it was last year.

We in California were pioneers again on massed stockholders' meetings and I commend our policy in this respect to every executive. We determined that we had a message for our stockholders, as we saw their numbers grow in importance and influence in the communities. Incidentally it is a big mistake for men in the public utility game, where state regulation is supposed to take care of them, to ignore entirely local conditions and influences, as unfortunately sometimes is the case.

We went out and organized stockholders' meetings at different points in our territory. The executives of the Pacific Gas & Electric Company traveled for nearly four months to the distant points of the system—and the Pacific Gas & Electric Company covers an area of 42,000 square miles. We went to the little hamlets of only three or four hundred people and to the cities of 500,000. We addressed something like twenty-five meetings and we gathered together between eight and ten thousand of our stockholders. We told them of our troubles, we told them of the part that they had to play in solving our troubles. We laid our cards on the table and told them what property they possessed and how it had been acquired and what it was worth to them. It was a good story. We illustrated it during the evening with moving pictures and lantern slides of the more prominent parts of our system.

I commend to you all to do that sort of thing. Go and see your stockholders and talk to them. Do not expect them to come in to your presence. There is a chilliness on the ordinary individual who comes in to our office. I venture to say that he does not know John A. Britton except as an imaginary person sitting behind a mahogany desk, clothed in awe and majesty, and that he has to go through four or five doors and send his card in and is received with ice-water glances and thrown out as soon as possible, and he hesitates to approach the executive.

I wish to Heaven, gentlemen, that the executives of the companies and their employees as well could be put upon the same plane of understanding upon what part they play with their consumers and the public as that of the grocery man who meets you smilingly at the counter and hands you out what you want.

After all, it is the human element. If I don't accomplish anything else this afternoon than to have put into the minds of you people here that you must in your attitude and conduct toward those you are serving treat them as you yourselves would like to be treated, I will be satisfied. It is only the Golden Rule. And if you do that, the mistakes that are around the morning sun of your success are going to fade away as sure as God made heaven and the earth.

ANNUAL REPORTS BY RADIO

W. E. Creed, president of the Pacific Gas & Electric Company, radioed out of San Francisco his annual message on the day of the annual meeting of the stockholders, listened to I don't know by how many thousands of people. I thought it a wonderful accomplishment. We know he was heard in Oregon, in Idaho, in Utah, in New Mexico, and all over California.

Again we called in our stockholders that night in every little hamlet and village, and where they didn't have a radio set we provided it for them; our division and district managers gathered them in to halls in sections in our territory, and there Mr. Creed's speech was delivered again to our stockholders and I think there were more than ten thousand in attendance.

All that I have said has tended toward the encouragement of consumer ownership. We must keep our house clean and as much above suspicion as was Caesar's wife. We owe it to ourselves, to this great industry of ours, and we owe it as well to that nation that we serve and that we are proud to serve!

## Opportunity and Responsibility of Customer Ownership

BY B. C. FORBES
Editor *Forbes Magazine*, New York

CUSTOMER ownership as a policy in the electric light and power industry can do more than any other branch of the management for the well-being and the prosperity of this nation.

Suppose we ask "What is the outlook in our own democracy, in our own commonwealth, in relation to this matter of getting ahead of the game?"

In one word, the outlook is very inspiring. In thrifty France the savings deposits of the people amount to less than one billion dollars. In frugal England the savings deposits amount to a billion and a half dollars; in our own country the savings deposits exceed eighteen and one-half billion dollars.

I gather that in the last eight years your companies

have attracted 425,000 customers alone as stockholders, and that you are confident that within three years you will have 1,000,000 customer partners.

When you consider that one electric company alone recently, through one offering of securities, was able to attract over 40,000 customers and 16,500 employees, then I think you ought to have no difficulty whatsoever in more than reaching this goal of 1,000,000 inside of three years.

I am interested in the customer ownership movement; I was sufficiently interested to put up through *Forbes Magazine* $1,000 in prizes for the best letters, the best articles on the benefits of customer ownership.

I think that, through the co-operation of you men in the industry, at least something has been accomplished to spread information and widen interest in this movement by means of this contest, for one thing. Over 2,000,000 lines of newspaper advertising have been published throughout the country in connection with this subject, this contest. Manuscripts poured in from every state in the Union and from all classes.

Next to being able to deliver the goods, the most powerful thing in this world is printers' ink. By that I mean letting the world know, being able to convince the world that you are able to deliver the right goods at the right price.

I think perhaps it might help your industry a little bit if we were to get together the first three or four prize winners in a little booklet and get them out at a purely nominal price per thousand, so that you could distribute them to the people in your territory.

### Customer Ownership Slogans

If I were to presume to offer one suggestion in connection with the furtherance of the customer ownership movement, one suggestion that might help to attract more buyers of your securities, it would be that you play up the home appeal, using such slogans as "Keep the saved dollar at home"; "Keep the dividends at home"; "Boom home trade"; "Boom the home community."

The simpler the arguments, the closer they come to the pocket, to the life of the ordinary people, the better.

Advantages and privileges always bring increased responsibilities. The growth of customer ownership means increased, seriously increased, responsibilities. If your organization hasn't already (and I don't know whether it has) some sort of viligance committee, I would suggest that it seriously consider appointing one, to look after, to keep an eye on the securities offered for customer and for public consumption. Nothing would more fatally hurt this whole important, vital movement than a few bad, a few unsafe, a few unworthy issues, widely distributed in local communities.

I do not know that it is necessary to mention it, but I believe that equally important with customer ownership is employee ownership. After all, the working classes can roll up more votes on election day than any other class in the whole country. It is, therefore, extremely important to earn co-operation and the loyalty and good will of your workers, through inducing them to become stock owners upon as generous terms as you can afford to provide. Then your worker feels that "I am not working simply for an impersonal corporation; I am working for the benefit not only of myself but my next-door stock-owning neighbor, my stock-owning friends and the whole community."

He feels that he has risen to a new stature in the scheme of things. I believe that whether we are going to drift, to move toward state and municipal ownership of public utilities, will be determined very largely, if not wholly, by how this dual movement of employee ownership and customer ownership succeeds or fails.

If you prove that you have ability enough to develop this movement wisely and broadly, then I believe that when the test comes the results will usually, if not always, be very much the same as the result was out in California last November, when by an overwhelming majority the people there voted against state ownership of the hydro-electric companies.

### A Nation of Investors

I would ask all you executives to feel that you are playing an infinitely larger part in the scheme of things than merely being out to make money for yourselves and money for your companies, important and vital though that is. Through customer and employee ownership, you have the opportunity and the responsibility of doing something valuable to transform America into a nation of investors. If you succeed in a large way in transforming America into a nation of investors, you will thereby succeed in bringing about a happier, a more contented, a more prosperous people.

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## Capitalizing Owner-Customer Contacts

By E. K. Hall
Vice-President American Telephone & Telegraph Company, New York

I HOPE that in this customer-ownership proposition all of us in the utility business will not feel that our work is done when our customers have become stockholders. If we will all use that contact as an opportunity to follow that up with information about the business, about the problems of the business and about the principles of public utilities as related to the general public and to government, it will help a great deal.

### Public Understanding Needed

The one thing we need more than any other one thing is to have the public understand what we are trying to do for them, that we have no other job on earth but to furnish them service, and to set up a relationship with them so that they will be free to let us know just how they want that service. If all the utilities can get on that basis with the public it is going to be a whole lot better for us and infinitely better for the public themselves.

If we are going to interpret this public utility business to the public, then it has got to be done, not by the management, not by a few people at the top, but by the whole outfit. They have got to know the principles and the policies. They are the ones who can bring the public to a sympathetic understanding with the utilities as we executives never can begin to do.

This whole thing anyway, as we see it, is nothing but an attitude of mind. What is the attitude of mind of a given man toward a public utility company? Does he think that the public utility company is in business simply to make a lot of money? If that is his attitude of mind, he has it all wrong. The public utility man can't make a lot of money. The public utility is limited to a

fair return on the money that has gone into the business. That is all we can make. Until somebody changes the attitude of mind of that particular person, he has never got us right and we are never going to get him right. We can't get along right with him while he thinks in that way.

It is exactly the same way with the gang that is doing the job in the field. What is their attitude toward the company they are working for? Do they consider it simply a sort of an unknown organization to them where they come once a week and get their pay check, or do they really realize what it is—a great big combination of capital and muscle and brains and pep that are welded together in a big organization to give the public what it is absolutely essential for it to have—public service?

If the gang, if the crew in the field are a part of it, if they feel they "really belong," if they feel they have an opportunity to talk these things over and learn something about the policies of the company and the financing of the company and have a stake in keeping the company sound and successful, they can interpret the company infinitely better than they can if they don't have this feeling.

We don't need to argue that customer ownership is one of the best things that has ever happened to the public utility, not only in financial set-ups, but in their spirit toward the whole job; but here is the thing that perhaps we do not always keep in mind and perhaps we have not given enough thought to, and that is that never is any public utility going to go before the small investors of the country and sell them poor securities. Mr. Forbes said a good many wise things, but he didn't say any wiser thing than, that just a few issues of bad public utility securities are going to hurt us all and make the small investor lose confidence in the whole proposition.

### Sound Securities Aid Public Welfare

But assuming that every one of us will see to it that nothing but gilt-edge, first-class securities is sold to the small investors, then we are rendering, besides helping ourselves as we see it, a great service to the individual who buys our good securities. Probably 50 per cent of all the inhabitants of the United States have no idea today how to invest money, and very little opportunity to invest money.

In Texas we found a pretty good-sized town which would have to go further than from New York to Chicago to get to a first-class investment brokerage concern. Of course, the answer is, "Why, they can always go to their local banks." But they are bank-shy. It is very different for a citizen of such a community to come and talk with the people in his own town, his own public utility people.

### Losses to Frauds Could Nearly Finance Utilities

The Better Business Organization made an estimate not long ago that $700,000,000 a year in the United States was turned over to fraudulent promoters. It would not take very much more than that to keep building the public utilities of the United States, their extensions for more or less of an indefinite time in the future. If the money of the people who are being buncoed, whose money is being stolen from them, could be turned into public utilities, which, under government regulation, are the soundest securities next to government securities, practically, in the country, we would be doing the individual investor a tremendous favor and a great good.

We must be absolutely sure that no public utility securities that aren't good are sold to investors. It would be a bad thing for the social order in this country of ours if we destroyed the confidence of the small investor. If this first little experiment in saving and investing turns out wrong, he will lose confidence in the whole plan.

All taxes increased tremendously during and since the war and with no indication of a let-up. That means just one thing, that the source of supply for capital, for building and extending these public utilities is, to quite a large extent and to a very serious extent, impaired and yet the demand for the growth of the utilities is bigger than ever.

### Selling to Society in Cross-Section

Business is good. We have a prosperous country. The national income is about $60,000,000,000. Sixty per cent of that goes to people of less than $2,000 a year income, and 52 per cent of it goes to the wage earners. Those are the people who are going to buy these public utility stocks in customer ownership. It is not going to the rich people, not to the big investment concerns, but it is going to a cross-section of society which is the best place to have these things owned.

A list of the people who came in partnership with one of our companies recently in one of these customer-ownership stock distributions included lawyers, teachers, clergymen, government employees, newspaper men, manufacturers, bankers, barbers, blacksmiths, boilermakers, butchers, carpenters, chauffeurs, cooks, mechanics, firemen, waiters, shoemakers, housemaids, housewives, farmers. Housewives were at the head of the list.

We have a much stronger situation already in the distribution of wealth and saving in this country than abroad, but we should not be satisfied with what we have got. I mean the country should not. The more we can extend that, the safer this country is and the safer our institutions are.

All these countries in Europe are struggling along with poor public service. When they have poor public service they have not laid the foundation of sound, permanent and active business and industry. They have tried to develop it through government ownership. Through customer ownership we see what a wonderfully better thing we have! The whole people are going to own these utilities. In the next twenty years these securities are going to be even more widely distributed. That will bring about a better understanding between the public and the people, a very much safer situation for the country at large, infinitely better public service, and it will be better for the American nation as a whole.

If we carry out customer ownership intelligently and fairly, conservatively and soundly, we are guaranteeing the success in the future of these public utilities pretty nearly. We are doing a wonderful thing for the industry. We are doing a very much needed and very magnificent service to the individual investor, the small saver who wants to invest his money safely, and by distributing the ownership of all these great service companies throughout the country, we are doing the nation itself perhaps the greatest service that we can render to it.

## Broader Financing for Customer Ownership

By Louis H. Egan
President Union Electric Light & Power Company, St. Louis, Mo.

Of the $180,000,000 which has been sold during the past year and which is being exceeded this year, there has been $145,600,000 of it sold in the form of preferred stock. Why preferred stock? Going back to Mr. Hall's suggestion that the securities should be gilt-edged and first-class only that you sell to your customers, it is obvious that you can't sell bonds that way if you continue to sell them on the basis that you sold them in the past, namely, in large blocks as required.

If, however, you try to sell the common stock, you are getting very close to the point, unless your company is in a very satisfactory condition, unless it has a long record of dividend years on common stock, you are getting to the point where it is well to adopt something in between, so we came to preferred stock and started out on 7 per cent preferred stock because it was a convenient sum, it was about the return that we felt the stock should bring at that time.

Now, if we change that attitude, we must be careful in which direction we change it. As the business expands and as our securities become more and more secure, we will, of course, be able to sell common stocks with more assurance than we ever have before, but there are some difficulties about selling common stocks that are not inherent in the sale of preferred stock. The time is short, it is impossible to go into all of those, but they are there. It is not always as satisfactory, and yet if you are selling stock to customers and to others on the basis that you want them to work with you, when you are caught where the hair is short, then you ought to sell them common stock, and there is no question about it at all. That is the first stock that would feel any unfair advantage that might be taken of you. Your preferred stock would not be affected until some time thereafter, but your common would. That may be the next step as the business becomes more stable. The possibilities of it are crystallized in the minds of your purchasing public; it may be that the common stock is what you should sell.

### Ideal Security Set-Up

The ideal financial set-up of the public utility, as we view it today, is that approximately two-thirds of your investment is in the form of bonds and one-third of it is in the form of stock. If you want to get your money on the cheap basis, you probably divide your stock on the basis of one-sixth of it in common stock and one-sixth of it in preferred stock. How much money does each customer represent in your business? In your community it is approximately $300. Therefore, for each new customer that is coming into your business today it is necessary to provide $300 of investment. One-sixth of $300 is $50, and that is all the money that you will be able to get in the form of the sale of preferred stock, if you follow this very definite financial set-up that we are all more or less following today.

Now, on the basis of $50 to that customer, what chance have you of selling him in the future? In Missouri we have approximately $600 to each holder of our preferred stock. It has been very easy; all things considered, it has not been difficult at all. Six hundred dollars gives you a possibility if you maintain that ratio of only selling one in each twelve of your new customers. Is that difficult? Obviously not. Many of us have already reached that point, starting before the war and working up through these years when it was not easy always and when the government actually denied us the opportunity of selling, when 7 or even 8 per cent preferred stocks didn't have the very desirable ring that they have today.

We have then a comparatively easy future, if we are going to confine ourselves only to the sale of preferred stock, representing one-sixth of the investment that you have to provide for each customer. We look forward with confidence to our ability to do that. In fact, one of the reasons why the expanding companies in this industry have sold so much stock in the last few years is that they have so much to sell. We started from zero practically. We had had no past in that respect and so we have not only caught up but we are now exceeding the amount that is required, if we maintain this ratio of preferred, which is approximately what we are doing today.

We have worked up a selling force amounting to quite a considerable investment, not only the dollars and cents that we pay them, but the investment that we have made in educating them, just as you have in any employee, but even more than usual in the case of our securities salesman who came to you knowing nothing whatever probably about the business he was to undertake. Now, you have worked him up to the point where he knows all about your company, all about your future, as you have told it to him, all about your past as he has read it. He knows a great deal about the business, and yet when the month of May rolls around you are through for the year. It just won't do. You have got to sell something else. You have got the facilities to do it, you have got the clientele to sell it to, you have sold them what? Millions and millions of securities on which you have paid regularly dividends now for some years and with every prospect of a continuation of doing so.

### More Bonds Should Be Sold

Why shouldn't you sell him something that pays 5½ per cent, as well as 6 per cent or 7 per cent or 8 per cent, or some other per cent? It even comes back to Mr. Hall's idea that it approximates something first-class and gilt-edged. Why shouldn't you sell him some of your bonds? Right away you say: "Well, these have to be sold in buying lots and it is difficult to do it, and the bond people would probably object and the bankers would, too"—and so they would, but the bankers and those investment bankers and those who handle preferred stocks, when you undertook to sell your preferred stocks, predicted only failure.

You will find today that when you begin to talk about the sale of bonds the same answer will come back to you, and yet it can be done. It is done here in this report to the extent of a few million dollars a year but with, however, a minimum of effort in that respect. It can be done in Missouri today; we are doing it in a very quiet, modest way, just to try it out to see what the reception is that they get, to find out what the people say, so that we may study for the future and devise the best forms of sales that we can, covering that. I think that is what we are all coming to in time.

When we talk to customers and to commissions and to anybody else about our business we should adopt a happy attitude toward it. We should be proud of its past and confident of its future and that will help you

it sell securities as much as anything I know. There are possibilities in the sales of these securities that we don't dream of today. I am satisfied about that. Just the method by which we will accomplish that I am not so sure of, but let's be happy about it and confident about it, and every time we talk about it don't let us let out a bleat such as the railroads of this country do today. The public here, I am sure, is sick and tired of hearing every railroad man who speaks publicly groan and moan about the way he is oppressed. He may be oppressed, but I don't think it helps him any to talk so much about it.

# Renewal and Retirement Reserve

***Purpose and Effect of Property Requirements—Properly Maintained Utilities Do Not "Depreciate"—Questionable Value of Life Tables—Function of Commissions***

By Carl D. Jackson
Attorney-at-Law, Joint Counsellor for the National Electric Light Association and the American Gas Association
Formerly President of the National Association of Railway and Utilities Commissioners

THE question has been asked: "Has a depreciation reserve any other purpose than to provide a means of equalizing the effect of property retirements so that the disproportionate burden may not fall upon the operations of any one year?" The answer is in the words of Account 251 of the Uniform System of Accounts:

The losses which this account is intended to cover are those incident to important retirements of buildings; of large sections of continuous structure, like gas mains, or of definitely identifiable units of plant or equipment, and the object of the account is that the burden of such losses may be as nearly as is practicable equalized from year to year."

If the reserve is sufficient at all times to take care of the losses caused by retirements as they take place, it will accomplish the object stated if set up on a fairly uniform basis over a period of years, and it will accomplish the object of protecting the investment in the property; it will insure the property being kept in first-class operating condition and hence insure good service, the prime object of the utility, and it will bring about that stabilization of the financial structure of the utility upon which alone future adequate service can be predicated.

To those who say that a larger amount than that is necessary, the query must necessarily be: "What is the object of this excess amount and what right have you to demand this excess amount from the patrons whom you are serving?" To those who say that they have a right to levy an amount in excess of the amount necessary as above set forth, because no matter what that amount may be they are willing to credit to any reserve a stipulated interest, my answer is that "You have not got the right to make the patrons lend you this money on any such terms except through the issuance of securities or the recognition of a debt in terms of debt."

### Where Reserve Shall Be Provided

The National Association of Railway and Utilities Commissioners when it adopted the Uniform System of Classification of Accounts, as I understand it, substantially committed itself to the following propositions: That a reserve should be provided where practicable sufficient for the following purposes: (1) To take care of the cost of the retirements as they shall occur; in other words, that reserve shall be of sufficient amount so that it will, as near as practicable, insure the amount necessary to meet the costs of the retirements when and as they occur. (2) That it is desirable that the operating expense account shall not be unduly distorted from year to year by charges necessary for this reserve. In the words of the text of the account: "for this purpose shall be equalized as nearly as practicable."

If all these problems could so easily be solved by some simply worded mathematical formula and justice be done, both to the utility and the public, and the public interest be served thereby, there would be no objection to this being done that I know of. But when no such thing is practically possible there can be no greater mistake on the part of either the public or the utilities than to assume or admit the possibility of that which they know not to be possible or practicable.

Each utility should, so far as is practicable and possible, establish, either through operating expenses or through appropriations from surplus, a reserve for the purposes clearly stated in Account 251: that the reserve should be adequate for the purposes for which established. It may well contain a margin of safety in this respect assuring within reason its continuous adequacy, and it is to be preferred that the reserve should be, it seems to me, somewhat more than adequate rather than less than adequate.

### Only One Reserve Necessary

In order to simplify the precise matter under discussion, let us eliminate that branch of the mathematical theorists who would also go further and establish a separate reserve for each class or kind of property in the plant, and by all means, let us eliminate from this discussion further niceties sometimes put forth that at the time any unit of property is retired the so-called accrued depreciation on a life basis must be calculated and the capital accounts be determined by this calculation. I do not believe that there now exists among those who have closely studied the subject very much difference of opinion on the question of whether more than one reserve is necessary. Generally it is accepted that one reserve for all classes of property is all that is necessary. We, therefore, come down to the question of whether, leaving these other points out of the discussion, there is any adequate or reasonable basis for working out any general formula based on a prophecy or assignment of future lives.

Let us not overlook this fact to begin with: That not only have we got to calculate future lives, but it is

generally accepted that in determining the amount which will be necessary to meet the retirement costs we must deduct salvage value at the time of the retirement, and also provide for the cost of dismantling.

Let us also take into consideration the following: There is no property I assume, at least in the electric field, where every unit of property when it wears out or is retired is taken through the capital accounts. As expressed in Account 251, the practice of accounting for the cost of retirements relates to important retirements, to buildings, to large sections of continuous structures, definitely identifiable units of plant or equipment.

In estimating lives those committed to a general mathematical formula base that formula not only upon ordinary wear and tear, which is to be accurately estimated for the future, and which wear and tear will not be overcome by any maintenance or repair, but the lives must be based upon an accurate calculation of the losses or retirements which will result from incapacity for service, from obsolescence, from inadequacy, from supersession resulting from new inventions and discoveries, from changes of popular demand, and from the future requirements of public authority.

### Shortcomings of Life Tables

The idea is that such calculations have been possible in the past. It is my opinion that such calculations have never even approximated the lives for particular property in particular utilities. The manifest absurdity of doing some of the things which such a formula requires should upon little thought be sufficient to condemn it.

Professor Riggs, of Michigan University, in a few pages, has shown the impossibility of the whole matter in his recent book on "Depreciation of Public Utilities." He calls attention to the fact that the rail on the main line of a heavy traffic road may have a life of only two or three years while it may have a life of twenty years on another road. The life of buildings is generally determined by very many considerations having nothing whatsoever to do with the question of wear or decay. As he points out, one building may be in a city showing a 200 per cent increase of population in a decade, and may become inadequate in eight or ten years. In another city, it may last forty or fifty years before the requirements are such as to indicate its retirement.

Now, it is the experience of all of you that the abandonment of an electric power house or other operating unit of a large property will undoubtedly cause the retirement of hundreds of items which are far from ready for replacement; many, indeed, may be entirely new.

Furthermore, I think it must be your experience that in the electric industry many of the units ordinarily cared for through retirement reserve have required the use of that reserve not through wear and tear or inefficiency compared to its operating condition when new, but through the changed operating conditions that surround the locality and the industry and the art. It is beyond human ken to accurately forecast or use life tables on such a basis.

Is it not better, therefore, to face the facts as we all know them to be, rather than to build up some theoretical solution of a problem based on facts which do not exist and cannot be determined?

It does not follow that because a formula does not exist the question of an adequate or reasonable reserve cannot be determined from time to time and in such a manner as will protect all interests and assure an adequate plant and service. We must cease to think, however, in terms of generalities and confine ourselves to the individual utility and the individual situation. President McKinnon, of the United States Independent Telephone Association, in his letter of June 1, 1921, to the Interstate Commerce Commission, frankly stated the facts in terms equally applicable to the electric industry. He said:

"In dealing nationally with the question of depreciation as applied to telephone companies, we are at once met with the fact that conditions differ, not only in different states but in different parts of the same state, and between adjoining operating companies obsolescence varies according to the rapidity of growth and population. Hazards vary according to geographical location. Deterioration occurs rapidly or slowly according to climatic and soil conditions. It is at once apparent, therefore, that no answer can be given applying to the country as a whole, or by states or by companies when such companies have several exchange properties. In the ascertainment of a proper reserve for depreciation it seems therefore evident that companies must be considered individually rather than collectively or by groups."

When we come to exercise judgment in the individual case there are several factors which must be considered which give a reasonable approximation to the necessities of the situation. If the company is a large one with a considerable experience and its accounting system is in substantial accord with proper accounting practices, we have the history of retirements as casting considerable light on the situation, retirements as a whole rather than by classes of property. But we are not confined wholly to that past history. We have a present situation and the observable necessities certainly for the immediate future, and as to the individual company, a good deal of data throwing light upon future situations for perhaps a considerable period. Not only will the present condition of the property be taken into account, but the nature of the locality; any special risks or hazards; climatic conditions; wear and tear; the growth of the community, and the probable necessities which may arise within a reasonable and fairly observable time. The history of the company may show that a uniform credit to this reserve in the past indicates a reserve greater than necessary. On the other hand, circumstances immediately foreseeable may show the necessity for a larger reserve than the company has been setting aside.

I do not believe it possible to say that 5 per cent, 10 per cent, 15 per cent, 18 per cent or 20 per cent of investment should be the determining limit for a large class of companies operating under dissimilar conditions. Certainly a generalization could not be made for classes of companies throughout the country in the electric industry. And it must never be overlooked that under some circumstances and conditions a rather large percentage might be justified while in other cases a relatively small one could be shown to be adequate.

### Functions of Commissions

I do not wish to be understood as in any way advocating the abolition of the supervisory powers of the regulatory commissions over this matter. It is my belief that in the first instance and unless unusual conditions arise the utilities should themselves be permitted to exercise judgment; secondly, that where

the matter is brought into question the commissions investigate the matter; thirdly, that that power of supervision should be exercised in connection with the individual company or situation and not by any general theoretical formula. It is my belief that the tendency of regulation is not to substitute commission judgment for managerial judgment. Laws should not be passed compelling the exercise of managerial functions by commissioners. The exercise of the function by commissions in this respect recognized in the Uniform Classification of Accounts, it seems to me, is a discretion to be exercised only in the case of abuse by the corporate officers. This is in line with the decision in the Southwestern Bell Telephone Company case, recently handed down by the United States Supreme Court.

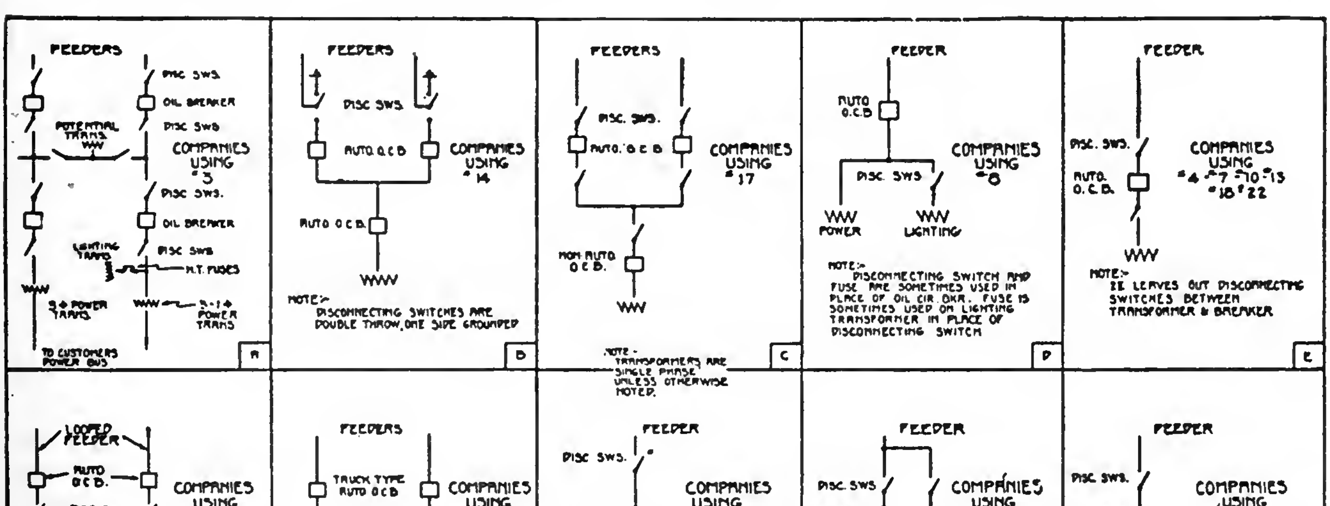
In case it becomes necessary for the commission to pass judgment in the matter of allowances or requirements for retirement reserve, if confined to the individual company or situation, the utility will have the opportunity of bringing forward all its own special circumstances relating to its own operation and plant, and the commission will have the benefit of as large a knowledge as possible of the requirements when it comes to pass upon the matter.

# Automatic Substations and Duty Cycle of Oil Circuit Breakers

***The Electrical Apparatus Committee Dwells on the Prevailing Practice in the Construction of Industrial Substations, Experiences with Automatic Substations, Agreement on the Duty Cycle of Oil Circuit Breakers and the Revision of Motor Rules***

ACCORDING to information obtained by the Electrical Apparatus Committee of the N. E. L. A. from thirty-four companies regarding industrial substation design, oil circuit breakers are used in most of the installations, with a strong tendency during the past ten years toward a much higher kva. rupturing capacity. The committee, whose report was presented before the New York convention this week by its chairman, R. H. Tapscott, said that four or five companies report installation in their own substations of reactors in all lines serving industrial customers and others only where they are necessary to keep the possible short-circuit current within the circuit-breaker rating. Two companies reported the use of non-automatic circuit breakers only in industrial substations, while two other companies use fuses instead of oil circuit breakers. In most cases oil circuit breakers are selected to interrupt the maximum calculated short-circuit current on the basis of manufactured rating. The practice of almost all companies reporting is to depend on hand operation of circuit breakers, only two or three providing for electric operaton.

Eleven companies regularly provide two incoming lines, seven looping in and out and four adding a second radial line when the character of the service warrants the expense. Of these eleven companies eight provide




CIRCUITS OF TYPICAL INDUSTRIAL SUBSTATIONS

automatic breakers for each transformer bank, while three depend on line circuit breakers in case of trouble. Seventeen companies regularly provide only one line into customers' substations.

In the construction of transformer vaults eight companies of fifteen provide substation ventilation by means of vents, louvers or flues, while three utilize windows. Six companies install oil circuit breakers in compartments, two employ truck-type breakers and five mount equipment on pipe frame or channel iron. All companies use single-phase transformers in banks of two or three units. Two companies use three-phase units to some extent.

### Reliable Service from Automatic Substations

The service rendered by automatic alternating-current substations has been reliable, and keen interest in this development is being shown by other central stations. The automatic control of street-lighting circuits is also increasing. Five companies report the use of time clocks only for control, one company reports remote control, another a complete automatic system, while a third uses the reclosing circuit-breaker method, controlling a group of "R. O." transformers in each station.

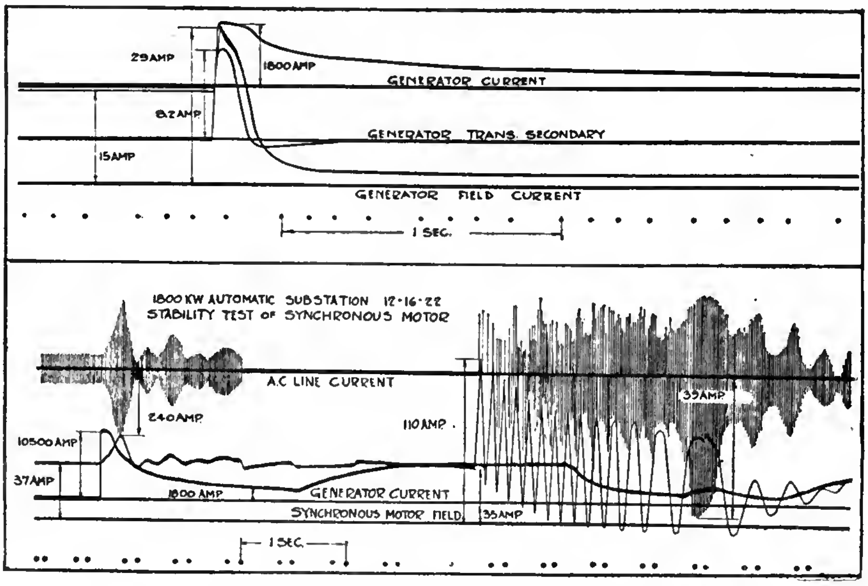
Truck-type breakers are coming more and more into use. Their advantage lies in the very simple connections between switch and bus, the elimination of disconnecting switches with their hazards and clumsiness, the small amount of labor required for installation, and ready interchangeability in case of trouble. At the present time breakers of this character are available for voltages up to 15,000, with rupturing capacity up to 20,000 amp.

Very convincing information regarding the reliability of automatic direct-current substations has been obtained during the past year in St. Louis and Cincinnati. With the 1,875-kw. motor-generator set of the Cincinnati substation in normal operation (rated load of 7,500 amp.), the alternating-current cable feeding this station was opened and reclosed after an interval of 4.56 seconds. The set continued to run on the direct-current side at reduced speed with the short-circuiting breaker across the differential series field open, thereby increasing the field strength of the generator and reducing the speed still further. By operation of the alternating-current relays the motor field was disconnected from the exciter and short-circuited, and the oil circuit breaker short-circuiting the starting reactors opened. When the alternating-current supply was again re-established the motor speeded up. When at 95 per cent normal speed the field was closed, and 15 cycles later the starting reactors were short-circuited. The conditions attending this operation were more severe than the ordinary alternating-current disturbance.

An additional test was made to determine the maximum torque of the synchronous motor while running as an induction motor. The alternating-current supply was opened, and with the generator tied to the Edison system full field was placed on the generator in order to reduce its speed as much as possible. With the generator motoring at 82½ per cent normal speed, the alternating-current supply was closed again. Within one second the generator was delivering 8,000 amp. at 268 volts. The total duration of induction-motor operation was ten seconds.

The generator normally operates as a shunt machine and the load is regulated by a contact-making voltmeter. When a gradual overload occurs the output of the machine is limited by the contact-making ammeter. In the case of sudden overload the contact-making voltmeter and ammeter both function to reduce the current on the machine, but a more rapid action is obtained by the opening of the short-circuit breaker across the differential series field, which limits the output of the machine to 9,000 amp. at zero voltage.

In a test in which a dead short circuit was thrown across the bus the generator current reached the maximum value of 59,700 amp. in four cycles. This overload current was reduced to rated value of machine (7,500 amp.) in one and a tenth seconds.




ACTION OF AUTOMATIC SYNCHRONOUS MOTOR-GENERATOR SET AT ST. LOUIS UNDER SHORT-CIRCUIT CONDITIONS

The 1,800-kw. synchronous motor-generator set of the St. Louis company was subjected to a momentary short circuit of 46,000 amp. and was in condition for continuous operation afterward. The short-circuit current was held to this value by the compensating pole-face winding. At this extreme overload there was only a very moderate momentary spit at the generator brushes. During the short circuit the voltage fell practically to zero.

To show motor stability the generator was loaded to approximately 125 per cent load and the high-tension feeder opened, allowing the generator speed to drop rapidly. After an interval of two and one-quarter seconds the feeder was reclosed. The highest fluctuation in the motor-field current was nearly three times normal. Three-quarters of a second after the feeder was reclosed the motor-slip relay reduced the generator load and the motor pulled quickly into synchronism.

Some companies are installing temperature indicators on all generators, some on new generators and some only on generators which show a relatively high temperature under ordinary operating conditions. A total of thirty-six have been installed to date, twenty-four for steam turbines and twelve for waterwheel units.

In practically all of the newer stations and those now under construction electric drive has been adopted for a very large proportion of the auxiliaries. Preference between a supply of energy from the main bus only and supply from a combination of house turbo-generator and house service transformers has shown a definite trend toward the latter, because of the advantage of independent sources of supply and adaptability to heat balance adjustment. The only outstanding new feature in this connection is the adoption of a direct-current shaft-driven auxiliary unit for supplying excitation and condenser auxiliaries or an alternating-current unit for supplying auxiliaries only.

Constant-speed alternating-current motors in generating stations are now being started by one of the following methods: (1) Individual starting compensators or auto-transformers; (2) starting bus; (3) through individual reactors; (4) directly across the line. In the Calumet station, Chicago, several motors up to 150 hp. are regularly started by connecting them directly across the line. The question has lately arisen whether the synchronous motor should not be used more largely by central stations to improve power factor.

Past experience with generator fires has shown the necessity of providing some permanently installed means of coping with this trouble, supplementing preventive means such as balanced differential relays, periodic insulation tests, etc. Only three of the companies which have installed such equipment have had experience in actual fire fighting, these fires all being extinguished by the use of steam. Test data on experiments with inert gas have been made by the Hartford and St. Louis companies, but neither company has had any experience with a fire.

Automatic control for waterwheel-driven generators is rapidly spreading throughout the country. This type of control has usually been installed with generators having a capacity between 200 kva. and 750 kva. However, a 5,000-kva. installation at Searsburg, Vt., has been so equipped recently, and an automatic station of the Peninsula Power Company in Wisconsin will have two 2,000-kva. units.

### Duty Cycle of Circuit Breakers Settled

A definition of circuit-breaker duty cycle has been agreed upon by the A. I. E. E. protective devices committee and the electrical apparatus committee of the N. E. L. A. as follows:

1. Interrupting rating is based upon the highest r.m.s. current at normal voltage at which oil circuit breaker can interrupt under the operating duty specified.
2. Operating duty shall consist of a definite number of unit-operating cycles at stated intervals.
3. Each unit operating cycle shall consist of closing the circuit breaker, followed immediately by the opening of the breaker.
4. The breaker shall perform its rated operating duty without emitting flame. The condition of the circuit breaker at the end of any operating duty within its rating shall be: (a) Inspection shall show the breaker to be substantially in the same mechanical condition as at the beginning. (b) Inspection shall show the main current-carrying parts of the circuit breaker to be in substantially the same condition as at the beginning. However, the interrupting ability of the circuit breaker may be materially reduced.

The foregoing operating duty is made on a two-shot basis. On any other basis the following factors shall be applied: (a) One interruption heavy-overload duty, 125 per cent; (b) two-interruption duty, with two-minute intervals between interruptions, 100 per cent; (c) four-interruption duty, with two-minute intervals between interruptions, 70 per cent; (d) four-interruption duty, with half-minute intervals between interruptions, 60 per cent; (e) four-interruption duty with no time delay between full open position and start of closing position, 30 per cent.

Several companies have installed equipment to provide communication over their high-tension transmission lines. In most cases it has been for simplex operation, although a duplex system is installed on the Duquesne Lighting Company's system. The operation of carrier-current apparatus is very satisfactory, and communication can be maintained through disturbances which would cripple the line telephone.

Several types of experimental relays have been developed to operate on carrier current, making possible the remote control of switches by means of impulses sent over the power lines.

At least two systems of complete remote supervision and control of distance switching over telephone lines have been developed and are being installed.

A joint committee of all interested organizations has agreed that the recommended standard voltage shall be that which will supply the proper average voltage to 115-volt lamps. One hundred and ten volts and 120 volts have been listed as recognized values, although the latter is discouraged for new systems.

As a whole, the use of single-phase transformers seems to be favored over three-phase, although there are several ardent supporters among the large companies for the latter, with sound arguments to back up their contention.

Regarding the effect of colors of transformer cases on temperatures, L. J. Moore and J. S. Moulton, San Joaquin Light & Power Corporation, advised the committee that gray paint will not reduce oil temperature more than 3 deg. to 4 deg. F. or 1 deg. to 2 deg. C. during extremely hot weather. They maintain that any expenditure to repaint black cases now in service would not be justified in any way.

Many companies report complete satisfaction with centrifugal oil separators; several say this method is slower than the blotter press, while others report using the centrifugal machine as a primary purifier and finishing up with one run through the blotter press.

Various opinions have been expressed regarding the features which should be incorporated in temperature indicators for distribution transformers. Among them are: (a) The device must be low in first cost and maintenance expense; (b) it must be compact, easily installed and readily visible from the ground; (c) it must be easily and quickly reset; (d) it must be positive and reliable; (e) it must be weatherproof.

Rules governing the installation and use of motors on central-station distribution circuits have been revised. Among the features were the incorporation of tables giving the allowable starting current for different-size motors with free and blocked rotor, also the full-load running current.

The recent rapid growth of transmission systems has produced a definite and increasing tendency toward the use of various types of voltage-regulating equipment, including tap-changing devices or ratio adjusters on transformers, induction regulators, step-type regulators, synchronous condensers and synchronous boosters. Of these the tap-changing device is coming into rapid favor. Several cases have been reported where large induction regulators are used for controlling the voltage at the end of the line or on the distribution buses.

For the purpose of promptly isolating an individual line feeding into an alternating-current network an automatic network protector has been developed.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Power Plant Records.*—F. S. RUTLEDGE.—A systematic method of tabulating important data is essential to the efficient operation of a power plant. Several examples of what this means and how it may be readily accomplished are given.—*National Engineer*, May, 1923.

*The Cross-Flow Impulse Turbine.*—F. NAGLER.—Particulars regarding a type of waterwheel designed for use with high heads and called the cross-flow turbine are discussed. In this turbine jets make an angle greater than 45 deg. with tangent, the buckets are flattened with curvature less than 90 deg. and the bucket inlet is inclined forward. Aside from the advantages in speed, the author claims that the wheel automatically corrects one of the defects that contributed greatly to the failure of single-flow impulse turbine. This failure is the backing of water into the wheel, resulting in its being dragged around with the wheel and ultimately discharged at wheel velocity.—*Mechanical Engineering*, May, 1923.

## Generation, Control, Switching and Protection

*Lightning Arresters.*—H. YAGI.—A formula is derived which gives the magnitude of the series resistance of the horn arrester required for a given number of air gaps. The shunt resistance that would make the arc unstable is then determined. The discharge characteristics of an aluminum-cell arrested are also considered, and it is shown that the volt-ampere characteristic, which simply gives the relation between effective values, is entirely inadequate to cope with the discharge phenomena, which generally contain complicated and abrupt changes of instantaneous values. The possibilities of utilizing the static capacity of the cell arrester as a high-frequency absorber are pointed out. The author proposes for this purpose the use of a shorter air gap with series resistance and also a static condenser in parallel with the simple air gap hitherto employed.—*Journal of the Institute of Electrical Engineers of Japan*, April, 1923.

*Oil Circuit Breakers of High Interrupting Capacity.*—C. PALESTRINO.—This paper, presented before the recent meeting of electrical engineers in Turin, deals with the latest achievements, studies and developments available and suggests how the type and the interrupting capacity of a breaker must be chosen in order to meet the conditions of a given installation. In the first part of this paper the distance at which the rupture of the arc must take place, the number of contacts, the duration of the arc, the oil level in the tank, the pressure of the oil, the velocity of the arc rupture, the formation of gas bubbles, and so on, are fully treated in detail with formulas and diagrams. In the second part the calculation of the maximum interrupting capacity and a close study on the phenomena following short circuits can be found. A general survey of the American, German and French rules for constructing oil switches concludes a very interesting paper.—*Elettrotecnica*, March 25, 1923.

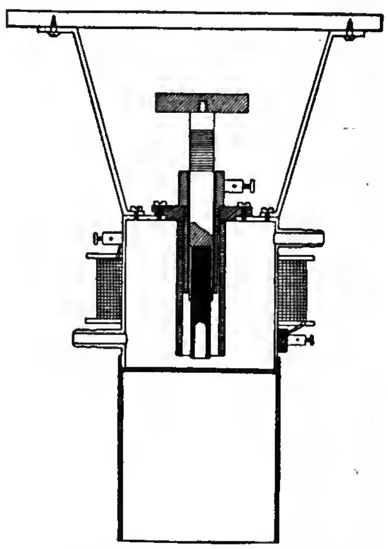
## Transmission, Substations and Distribution

*Heating of Cables Carrying Current.*—E. SACCHETTO.—The determination of the current intensities permissible in cables for transmission of electrical energy is still far from being on a practical working basis. The author makes some useful observations regarding the determination of the thermic resistivity of insulators and investigates the principles on which the tables, which give the maximum current capacity of buried cables of impregnated paper, were made.—*Elettrotecnica*, March 25, 1923.

*Cable Geometry and Calculation of Current-Carrying Capacity.* — D. M. SIMONS.—The main part of this paper deals with the errors in the standard formulas for calculating the thermal resistance and geometric properties between the conductors and the sheath. A graphical method of correcting the errors is obtained in terms of what is called the "geometric factor." The results are tabulated for two, three and four-conductor cables throughout the range of practical sizes. The check between the results of the graphical correction method and the published experimental data on this subject is very satisfactory and emphasizes the errors in the standard formulas. The thermal resistance between the sheath and the duct is mentioned briefly, and an appropriate method of finding the resistance between the duct and the region at base temperature is outlined. The previous work is then combined into a simple formula giving the allowable current for $n$-conductor cables, there being any number of similar cables in the duct bank. The formula is also enlarged to cover the case of cables in the metric and square-inch systems, and cables are buried directly in the ground. The method of including the effect of induced sheath currents in single-conductor cables and of dielectric losses is shown. Finally, the procedure to use in case the cables in the duct bank are not all of the same type is outlined. This paper is to be presented before the A. I. E. E. Convention at Swampscott in June.—*Journal of the A. I. E. E.*, May, 1923.

## Units, Measurements and Instruments

*Simple Poulsen Lamp.*—L. BERGMANN.—A very inexpensive and easily made Poulsen arc lamp is described, which gives, the author claims, undamped oscillations of remarkable regularity. This apparatus may be used for measuring or demonstration purposes where the relatively high cost and the limited life of a vacuum-type lamp are prohibitive factors. The arc is inclosed in a tight vessel through which illuminating gas is circulated and burns between a heavy carbon electrode



UNDAMPED OSCILLATIONS OF REMARKABLE REGULARITY CLAIMED FOR THIS POULSEN LAMP

and a copper plate. The latter forms the bottom of a copper pot, which is filled with water. Around the gas vessel is placed the winding of the magnetic field. To avoid a steady burning of the arc at one point, the carbon electrode is hollow. Around the carbon is placed concentrically an iron tube, which concentrates the magnetic flux. With 80 volts across the arc and 4 amp. direct current, a wave length of 3,000 m. at 5.5 amp. high-frequency current may be obtained with a suitable oscillatory circuit.—*Jahrbuch des Drahtlosen Telegraphie und Telephonie*, March, 1923.

## Illumination

*Paint Characteristics and Conditions to Be Considered in Effecting Better Illumination.* — C. H. BRYCE. — The author describes the two classes of paint—oil paints and water paints. In the first class are mentioned lead in oil, gloss interior, flat oil paint, gloss and flat enamels; in the second class, the kalsomines. Proper preparation of the painted surface for light reflection is discussed. The use of paint under artificial light and daylight is considered as well as other factors relative to the artistic and decorative use. Some interesting data on the variation of reflection factors of various paints under

different conditions are given in tabular form.—*Transactions of the I. E. S.*, April 1923.

*Refilling of Electric Lamps.* — O. RIGILLO.—A new and successful system of refilling worn-out electric lamps is explained and illustrated. At the end of the lamp a very small hole is made (about 6 mm. in diameter), and through it the lamp is cleaned, the old filament is taken out and the new one is introduced. The latter is elastic so that it can pass through the hole, but as soon as it is inside the lamp it opens. This refilling process can be made at a very reasonable cost and it requires but a few tools.—*Ingegneria*, Feb. 1, 1923.

### Motors and Control

*Motors for Mines with Explosive Gases.* — H. RICHTER. — The fine wire mesh which is used extensively in all open-flame miners' lamps to confine any explosion to the interior of the lamp has been found unsuitable for electric motors in which sparks are liable to occur. Much more satisfactory results were obtained with the plate protector, which is built up of a number of thin steel plates. In case of an internal explosion the gas pressure raises these plates about 1/16 in., and the resulting narrow slits permit the escape of the burned gases and yet cool them off sufficiently to prevent the ignition of outer gases. However, if one of these plates should become bent the entire protection would be lost and the motor would become dangerous. The latest types are therefore built totally inclosed and are so heavily designed as to withstand safely an internal pressure of 8 atmospheres. Every motor is tested by being filled with a mixture of 18 per cent illuminating gas and 82 per cent air, which is exploded by a spark. During this test the motor stands in a wooden box, also filled with the gas mixture. The motor is pronounced safe if its internal explosion does not ignite the outer gas atmosphere.—*Siemens Zeitschrift*, April, 1923.

*Starting Direct-Current Motors with Current-Limit Type Controllers.*—C. A. ARMSTRONG.—The principle of three types of series-lock contactors is explained and the operation of a motor-controller using these types of contactors is discussed. Diagrams and characteristic curves of various types of series lock-out contactors are given. —*Power*, April 24, 1923.

### Heat Applications and Material Handling

*Lining Acid Electric Furnaces.*—J. M. QUINN.—Careful selection of materials for lining the acid electric furnace is essential. It should be kept in mind that the materials containing the least amount of impurities have the highest melting point and therefore are more refractory than those containing elements which dilute the purity. The author describes the various materials which can be used and methods for handling them. What the author asserts to be the best method for lining an electric furnace is to use high-grade silica brick for the bottom and side walls up to the roof.—*Iron Age*, April 19, 1923.

### Electrophysics, Electrochemistry and Batteries

*Influence of Cold Rolling on the Properties of Sheet Steel.*—Y. NIWA and J. MATURA.—The change of the inner structure of steel by successive cold rolling as disclosed by the interference X-ray method is discussed. It is shown that the results obtained in the experiment may be interpreted by assuming that the crystal grains are divided by rolling stress into finer groups of cubic lattices which slide and rotate between adjacent planes and finally rearrange themselves in such a manner as to bring the edge of the lattice in parallel to the direction of rolling.—*Research Bulletin No.* 122 *of the Electrochemical Laboratory, Tokyo, Japan.*

*Current Distribution and Throwing Power in Electrodeposition.* — H. P. HARING and W. BLUM. — "Throwing power" in electrodeposition is defined as the deviation of the actual metal distribution from the primary current distribution. It is shown matematically and experimentally to be dependent upon the rate of change of cathode potential with current density, the resistivity of the solution and the cathode efficiency at different densities. A simple apparatus for the measurement of throwing power has been developed and applied to the study of copper sulphate and cyanide solutions. —*Paper presented before American Electrochemical Society, New York*, May 3-5, 1923.

### Traction

*New* 4,000-*hp. Electric Locomotives for Norfolk & Western Railway.*—T. C. WURTZ. — The conspicuously new features of the electric locomotives described in this article include cab structure carried by side frames of vanadium steel, four pairs of drivers in single truck per cab, a single 1,000-hp. motor per jack shaft, oil-insulated, force-cooled transformer and unique arrangement to reduce torque on any motor to prevent slipping. — *Railway Review*, April 14, 1923.

*Reducing Railway Maintenance Costs with an Electric Furnace*—The performance and results obtained through the use of an electric steel furnace of the Lehigh Valley Transit Company at Allentown, Pa., have proved that it is a very essential piece of apparatus for any electric railway. Through its use correct castings at a low cost are not only produced, but in a very short time and with very little inconvenience, so that it is unnecessary to withhold the equipment from service to any considerable extent while making repairs. The use of the steel furnace also enables the heads of various departments to make up special devices which result in labor saving and additional economies.—*Electric Railway Journal*, April 21, 1923.

*Application and Economics of Automatic Railway Substations.*—L. D. BALE. —An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. midwinter convention, Feb. 24, 1923, on page 443.—*Journal of the A. I. E. E.*, May, 1923.

### Telegraphy, Telephony, Radio and Signals

*Distortion-Free Telephone Receivers.* —J. F. J. BETHENOD.—The possibilities of a distortion-free telephone receiver are discussed. By means of triode devices it is theoretically possible to make such an apparatus having uniform sensitiveness over any range of frequency required. The same device may be applied to oscillographic or radiotelegraphic apparatus.—*Proceedings Institute of Radio Engineers*, April, 1923.

*Signaling on the Frankford Elevated.* —J. N. DODD. — The special problems met and solved on this recently completed elevated line are discussed. The first article deals particularly with the signals, trips, electric circuits and air lines, while the second considers the interlocking plans and speed-control signals. The signals cause the motorman to run no faster than a predetermined speed and to encourage him to run close to it and in this way to obtain full capacity for the run. — *Electric Railway Journal*, April 28 and May 5, 1923.

*Tests of Radio Receiving Sets.* — During the past two years the Bureau of Standards has been developing methods for testing radio receiving sets and has tested a number of different types of equipment. This circular describes tests of regenerative sets using electron-tube detectors of the type intended for the reception of continuous-wave signals from arc transmitting stations on wave frequencies down to 60 kilocycles or wave lengths up to 5,000 m. A limited number of these circulars are available.—*Letter Circular No.* 90 *of the Bureau of Standards.*

### Miscellaneous

*Developments During* 1922.—This issue of the periodical is devoted to a series of illustrations of machinery and apparatus constructed or put into operation during the last year. These are classified under "electric traction," "prime movers," "generation and distribution," "electricity in industry" and "aircraft."—*English Electric Journal*, April, 1923.

*Suggestions for Saving Heat in Manufacturing Plants.* — C. L. HUBBARD. — The author outlines several methods for reclaiming much of the heat that is now ordinarily wasted in manufacturing plants, and the suggestions presented should furnish much food for thought to the engineer operating plants of this character. Some of the places where heat may be gained and the methods of accomplishing this are saving of frictional heat, reclaiming heat from ventilating air, reclaiming heat from moisture-laden air, etc.—*Power*, May 8, 1923.

# New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

### The "Electrician" Handbook

Forty-first edition. London: Benn Brothers, Ltd. 1,364 pages.

This year's edition (the forty-first) of "The 'Electrician' Electrical Trades Directory and Handbook of the Electrical Engineering and Allied Trades"—the well-known "Blue Book"—contains the usual complete information on the electrical trades in Great Britain and all her colonies and possessions and has extenive information concerning the other countries of the world. Numerous British tariff changes have caused considerable revision of import duties. Among new subjects included in the volume are wireless broadcasting regulations and the conditions with which broadcast receivers must comply, an abstract of the electricity supply act of 1922 and particulars of the progress made with the reorganization of electricty supply—all these pertaining to Great Britain.

The various sections of the book contain an alphabetical and classified directory of electrical undertakings of all kinds and also a handbook of detailed and general information, such as a legal digest, wiring rules, tables, etc,

### Metals and Their Alloys

By Charles Vickers. New York: Henry Carey Baird & Company, Inc. 767 pages, 110 illustrations.

It appears that foundry practice in irons, brasses, bronzes and aluminum alloys is passing through a transition period. Books current and those being published in considerable numbers even now merely reflect conditions in thousands of small foundries scattered throughout the world. Shaping metal pieces by pouring melted alloys into molds is an art which has been known since antiquity. Following the general rule that the older the art the less is known about its fundamental principles, such foundries operâte largely by rule of thumb and tradition. Therefore it is not surprising to find that most of the books merely reflect these superstitions and practices.

Some engineering investigators have the hope that eventually the scientific principles underlying foundry management and production will be well known and that foundries in general will operate in strict accordance with those laws. That period undoubtedly is far in the future. However, scientific research has disclosed a number of attractive new alloys, which are being demanded in increasing amounts by consumers. Their production and even their heat treatment often involve entirely new processes at present unknown to the old-time foundryman. Therefore by press of circumstances he is being driven to a consideration of better production methods.

This book by Charles Vickers is typical of the transition stage. It has gone a long way forward from the foundry book published as recently as twenty years ago, without dipping under the surface of the tremendous ocean of material made available by more modern metallurgical research. Even though the author talks very little about scientific principles, the book apparently is free from the ridiculous beliefs and assertions which are spread as gospel truth in tons of "literature." As a compendium of useful information —"practical," if one will—this book is probably without an equal. It will find its way into the hands of every progressive foundryman or engineer interested in the production of non-ferrous alloys. E. E. Thum.

### Essais des Machines Electriques

By C. F. Guilbert. Paris: J. B. Baillière. 552 pages, illustrated.

This new book of nearly 600 pages, well illustrated with diagrams and figures, covers nearly the whole field of commercial testing of electrical machinery. There are sections dealing with direct-current generators and motors, alternators and synchronous motors, transformers, induction and alternating-current commutating motors and synchronous converters. For each of these types the author discusses characteristics of machines under load and predetermination of characteristics, followed by methods of direct and indirect testing and efficiencies.

The author, who has taught courses in electrical design and construction in French technical schools for many years, states that he wishes to shorten the time a machine must stay on test without sacrificing any accuracy, and in fact even increasing the effectiveness of the present commercial test, by making use of a "method of corrections" which he has used for some time. This is a method of correcting for variable speed (voltage, current, load or excitation) when this is supposed to have been kept constant.

The last hundred pages include appendices containing the French "Rules for Standardization and Specification of Electrical Material" (French Electrotechnical Committee), French rules for normal conditions of operation and test of turbo-generators, rules for standardization and specification of transformers and supplementary rules for standardization and specification of tests of electrical machinery—the last three of these being adopted by the Union of Electrical Manufacturers during June-July, 1920. At the end of the book is a very complete comparison of French, British, American, Swiss and German standardization rules.

M. Guilbert emphasizes the importance of graphic construction permitting the predetermination of characteristics of machines from experimental data that are comparatively easy to obtain at a relatively small expenditure of energy.

With its many references to original articles, its large appendices, its clear diagrams of connections and characteristic curves of machines, and, above all, its discussion of various tests and comparison of formulas, this book is a valuable addition to the engineer's library of books on commercial and laboratory testing. F. G. Tappan.

### Die Elektrometallöfen

By E. Fr. Russ. Munich and Berlin: R. Oldenbourg. 161 pages, 123 illustrations.

A review of the various types of non-ferrous furnaces used in America. Nearly all of the information is apparently abstracted from the bulletins issued by the Bureau of Mines and from various articles published in *Chemical and Metallurgical Engineering*. It seems at first as if the furnace which has prominence all through the book were an original design, but upon closer examination it is found to be practically a replica of the American Booth rotating furnace, built, however, for three-phase operation. For German conditions the author has no doubt done a great service toward popularizing electric alloy furnaces.
Arthur Palme.

### Der Funkentelegraphische Wetter und Zeitzeichen Dienst

By H. Thurn. Berlin: M. Krayn. 82 pages, 15 illustrations.

This booklet is a collection of articles by Mr. Thurn which have been published in German periodicals on the subject of radio broadcasting weather reports and time signals. A large part of the book is devoted to verbatim mention of rulings established at different international meetings. The Telefunken and the Huth sending, receiving and self-registering apparatus are described in detail, including the very latest time-registering set of Huth, which is based upon the Johnsen-Rahbeck effect. Arthur Palme.

## Books Received

**Elektrische Durchbruchfeldstarke von Gasen.** By W. O. Schumann. Berlin: Julius Springer. 246 pages, illustrated.

**Stimulating the Organization.** By Orline D. Foster. New York: Harper & Brothers. 413 pages.

**The "Electrician" Annual Tables of Electricity Undertakings—1923.** Thirty-sixth Edition. London: Benn Brothers, Ltd. 140 pages.

**Elements of Radio Communication.** By Ellery W. Stone. New York: D. Van Nostrand Company. 318 pages, illustrated.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Insull Buys in Indiana

**Chicago Interests Take Control of the Northern Indiana Gas & Electric Company**

THE Northern Indiana Gas & Electric Company of Hammond, Ind., has been purchased by Samuel Insull and his associates of the Commonwealth Edison Company, the Middle West Utilities Company and the Public Service Company of Northern Illinois. Announcement of this purchase was made on June 4, when an official statement declared that arrangements have been made by Randal Morgan, representing the United Gas Improvement Company of Philadelphia, and Samuel Insull to pass over this Indiana utility to the Chicago interests represented by Mr. Insull. The United Gas Improvement Company will, however, remain interested in the property.

The Northern Indiana Gas & Electric Company supplies electricity in Hammond, East Chicago, Indiana Harbor, Whiting, Michigan City and other places in the north end of the state. It serves a community with a total population put at 421,365. Last year the total gas and electric business was about $10,000,000.

The official announcement declared: "The exact corporate plans have not yet been decided upon, but the business will be operated as a separate organization and not as a subsidiary of any existing companies. The plan involves operating under one organization gas and electric properties in northern Indiana which have been heretofore prorated separately and the greater portion of which were in the Northern Indiana Gas & Electric Company. The basic principle involved is the centralized production of both electricity and gas. It is probable that a large central station for the generation of electric power will be built in northern Indiana and electrical energy produced will be distributed not only in that territory, but also on the Illinois side of the line."

## Los Angeles Bond Issue Fails to Carry

A dispatch to the ELECTRICAL WORLD from Los Angeles says that the issue of $35,000,000 in bonds to cover projected activities of the Public Service Commission of the city of Los Angeles, which was submitted to the voters on Wednesday of this week, failed to receive the necessary two-thirds vote, though a small majority was recorded in its favor. Exact figures are not yet available, but they cannot change the result to a sufficient extent to authorize the bond issue.

Ten million dollars of this issue, had it been authorized, would have been spent in rehabilitating the city distribution system and in improvements to the municipal hydro-electric plant. The remaining $25,000,000 was to be used for power development at Boulder Canyon on the Colorado River after the completion of the government dam at that point.

## First Mercury Boiler Is Now Installed

The mercury boiler to be used by the Hartford Electric Light Company at its Dutch Point plant is in place and preliminary operation will, it is announced, start within a few weeks. This installation has attracted much interest because of its novel character. The boiler is installed outside the original station. Oil is to be used as a fuel. There will be approximately 15 tons of mercury used in the installation, and every precaution against leakage in the form of vapor will be taken.

It would not be possible to develop and operate this plant were it not for the electric and acetylene welding processes. Mercury amalgamates with copper, and as the temperatures used are so much higher than steam temperatures, there is no form of fiber gasket which will stand the temperature. The pressure used as compared with steam is extremely low. The maximum on this boiler will not be in excess of 35 lb. by gage.

The mercury boiler itself is built up of a large number of tubes with the edges welded together at the bottom. These tubes are hexagonal for about two-thirds of their length and circular at the top. The tops of the tubes are expanded into a plate and welded. All pipe connections from the boiler to the turbine are also welded. The mercury vapor passes normally through the nozzles to the wheel and is governed in approximately the same manner as any other revolving apparatus. In case of change of load on the turbine, the governor does not close the valve as in ordinary cases, but diverts the proper amount of vapor from the nozzles direct from the boiler to the condenser. This operation requires a damper rather than a tight-fitting valve. On account of the high temperatures it would not be practicable to use a valve, as at the high temperature of the vapor the steel is liable to warp.

## Signs Electrification Bill

**Governor Smith of New York Disregards Railroad Pleas—Gas Service Charge Prohibited**

ON SATURDAY last Governor Alfred E. Smith signed the Straus-Kaufmann bill providing for the electrification of all railroads operating within the limits of New York City. This measure was fought by the steam railroads on the ground of expense and difficulty, their representatives contending that an outlay aggregating more than a hundred million dollars will be entailed upon the roads. The New York Central, which now operates freight trains by steam over tracks running from Spuyten Duyvil to the lower end of Manhattan Island by way of Eleventh Avenue, will be hardest hit. The Long Island Railroad, however, will have to spend in electrifying its freight tracks, terminals and sidings more than $30,000,000, according to the general solicitor of the company; the Baltimore & Ohio will have to electrify its Staten Island terminal and lines, another tremendous piece of construction, while the many terminals along the Brooklyn water front will have to be electrified too. It is announced that the railroads will contest the law.

The Pennsylvania and the New Haven alone among the lines entering the city limits have completely electrified their lines to date.

### GAS SERVICE CHARGE FORBIDDEN

Another public utility bill signed by Governor Smith provides that the maximum gas rate in New York City shall not be more than $1 per 1,000 cu.ft. The courts last year declared the 80-cent rate prescribed by former legislation confiscatory. The gas companies will contest the new law, which sets up a 650 B.t.u. standard alleged to be unsafe, in the courts. Still another bill approved forbids gas companies to impose a service charge. While this bill is statewide in its application, it was drafted principally for the relief of gas consumers in Westchester County. From comments made by the Governor at the hearing on this bill it had been expected it would be vetoed.

Governor Smith has also affixed his signature to the Ryan bill, which authorizes the transmission and sale at cost by the state to municipalities conveniently situated of electrical energy generated above the needs of the canal system. This will apply to the surplus energy generated at the

state-owned plant at Crescent Dam and Vischer's Ferry on the canalized portion of the Mohawk River and will make possible its sale directly to the cities in the capital district.

The much-discussed Ryan bill amending the Public Service Commission law has become Chapter 891 of the Laws of 1923. This measure is not retroactive in effect, but does take away from the commission the right in the future to fix a temporary rate or charge and strikes out the provision that the commission may establish a new rate or charge "notwithstanding that a higher rate or charge has been heretofore authorized by general or special statute." Its intent is to put the law back to where it was prior to the amendments of 1921 in relation to the power of the Public Service Commission to raise rates.

## Southern California Edison Gets Prize

### The First Award of Gold Medal of the Charles A. Coffin Foundation, Established by the General Electric Company, Goes to Pacific Coast—Selected from Eighteen Contenders

THE Southern California Edison Company, Los Angeles, was presented on June 7 with the gold medal of the Charles A. Coffin Foundation, offered for the first time last year to the electric public utility company of the United States which made the most notable contribution during the year to the development of electric light and power service. This is the first award of the medal to be made by the foundation, which was created by the General Electric Company. The recipient was selected from eighteen electric light and power companies which submitted their year's records for consideration, and the decision is understood to have been extremely close.

John B. Miller

The award was made during the meeting of the public policy committee of the National Electric Light Association held in the course of the New York convention. Frank W. Smith, president of the association and chairman of the association's Charles A. Coffin prize committee, officially presented the medal, which was accepted by President John B. Miller of the Southern California Edison Company on behalf of the company.

President Smith's address took the form of a report of the committee which designated the recipient company. This committee consisted of Frank W. Smith, vice-president of the United Electric Light & Power Company of New York; Martin J. Insull, vice-president of the Middle West Utilities Company of Chicago, and Dr. Samuel W. Stratton, president of the Massachusetts Institute of Technology, Boston.

The medal was modeled by Chester Beach of New York, a well known medalist. The obverse side shows a bust of Charles A. Coffin, with the words "Charles A. Coffin Medal." On the reverse side the artist has shown man controlling the forces of Nature—water and heat—and driving them, in the form of electricity, over land and sea. Beneath this appears the inscription: "For distinguished contribution to the development of electric light and power for the convenience of the public and the benefit of the industry." In a panel appears the name of the company receiving the award.


Gold Medal of Coffin Foundation, Won by Los Angeles Central-Station Company

The award of the medal was accompanied by the presentation of a check for $1,000 to be applied to the employees' benefit fund of the Southern California Edison Company, under the terms of the foundation.

The Charles A. Coffin Foundation was established by the board of directors of the General Electric Company in December, 1922. It constitutes a tribute to Charles A. Coffin, who retired that year after forty years of association with the electrical industry, this period including the founding by him of the General Electric Company, of which he was leader for thirty years.

The foundation comprises a fund of $400,000, the income from which, amounting to approximately $20,000 per year, is to be devoted to rewarding outstanding service in the electrical field. In addition to the gold medal to be awarded annually to an electric light and power company, provision is also made for a gold medal to be awarded to an electric railway company. Fellowships to graduates of American colleges and technical schools amount to $5,000 annually and prizes amounting to $11,000 annually are provided for employees of the General Electric Company who have made signal contributions toward the increase of the company's efficiency or its progress in the electrical art.

## Colorado Springs to Vote on Franchise Next Week

The issue of a new franchise to the Colorado Springs Heat, Light & Power Company will, as already announced in the Electrical World, be put to a vote of the people on June 12. The election is the culmination of a bitter fight during the past few months between the City Council, the public and the power company. Six weeks ago a committee representing the bondholders of the company went to Colorado Springs and adjusted every claim that the City Council had against it, which included a cash payment of $115,000 to cover the cost of a pipe line which the city claimed should under the terms of the franchise have been built by the company. Subsequently the Council adopted a resolution bitterly condemning the utility and asking the people to defeat a renewal of the franchise, which will expire Sept. 8.

When the company brought Gen. George Goethals to Colorado Springs to investigate the power possibilities of the water system a few weeks ago he requested certain information from the city which was refused on the ground that it was confidential and that General Goethals had been brought to Colorado Springs for political purposes. This attitude of the city authorities aroused much criticism, but the situation, with its possibilities of municipal ownership, is too confused to permit any prediction of its final outcome.

## California Board Set Up

### Federal Power Commission Provides for a Subsidiary Body to Study Three River Problems

AUTHORITY to set up an interdepartmental board for the study of certain streams in California, bestowed by the Federal Power Commission a month ago, has been acted upon by the three government departments concerned—War, Interior and Agriculture—which have each appointed a representative to the new board, and the Governor of California is expected soon to designate a fourth member. The commission, according to an official announcement from Executive Secretary Merrill, is referring to the board for its examination, report and recommendations the three following matters:

1. The best scheme of development of the American River and its tributaries above Folsom.

2. The proposed diversion of the waters of the Trinity River into Sacramento Valley for power and irrigation purposes.

3. The best scheme of development of the North Fork of the Stanislaus River.

#### POINTS INVOLVED

It is desired that these matters be taken up in the order named and that each be made the subject of a separate report and recommendations. The following are the principal matters to be considered by the board, as explained by Mr. Merrill:

1. American River. Applications are on file for power developments on this stream which are apparently not suited to a complete and coherent development of the stream in the combined interest of power, irrigation, hydraulic mining and flood control. In carrying out its study the board should investigate and determine whether in its opinion the Rubicon River should be developed by diversion into the South Fork of the American River, by diversion into the North Fork of that river, by development along its own natural course, or by any combination of these; whether the Middle Fork of the American River should be developed by diversion into the North Fork, or along its natural course, or by a combination of these two. In general it is desired that the board draw up, to the extent that the data available warrant, a general plan for the complete development of the American River for power, irrigation and flood control above Folsom as designated, except that in considering the South Fork of the American River no consideration should be given to existing and proposed developments of the Western States Gas & Electric Company and the Eldorado Power Company, inasmuch as these projects are already covered by license from the Federal Power Commission.

2. Trinity River Diversion. Applications are on file with the commission for the construction of storage reservoirs and power projects on the upper Trinity River, for the diversion of the waters therefrom into the Sacramento Basin and for the construction of storage reservoirs and power plants after such diversion, the waters so diverted to be used eventually for irrigation in the Sacramento Valley. It is desired that the board investigate the effect of such proposed diversion upon power development on the remainder of the Trinity River, upon irrigation and fishing interests along that river and upon navigation at the mouth of the Klamath. It is also desired that the board review the proposed plans for development within the Sacramento Basin, and finally, that it reach conclusions as to whether in view of all the interests involved it is desirable that such diversion be authorized.

3. North Fork of Stanislaus River. The commission has before it an application contemplating the creation of storage on a tributary of the North Fork of the Stanislaus River for use in connection with existing canals and power plants in the vicinity of Angels and Murphy. It appears probable that a development such as proposed is not economical and might seriously interfere with the complete development of the stream. The present diversion through the old mining ditch cannot be changed because irrigation rights have grown up in the vicinity of Murphy and Angels which cannot be set aside. An increase in the amount of water taken through this ditch might set up new rights and make it impracticable to return the waters to the stream in a manner which would provide for the best utilization of the power. It is desired that the board review this situation, investigate the various interests involved, and report to the commission what plan of development will, in its judgment, be best suited to make a complete utilization in the public interest.

## Former Secretary Fall Has Electrified Ranch

Albert B. Fall, former United States Senator and Secretary of the Interior, has just finished installing a hydroelectric plant and power transmission system upon his ranch at Three Rivers, N. M. It is now said to be the most modernly equipped ranch in the matter of light and power in the country. Although the plant was installed primarily for the purpose of furnishing power for pumping water for irrigating a large tract of cultivated land upon the property, the electrical energy is transmitted to the various buildings. The plant is of 75 hp. capacity. The water is diverted about half a mile above the mouth of Three Rivers canyon and then carried two miles through concrete and steel pipe to the power house, where it produces a pressure of 226 lb. at the nozzle of the Pelton wheel. Should the water get low in the river, a big Diesel engine is in reserve to furnish power. The energy is carried to the junction of Three Rivers and Indian Creek, where there are a number of wells. More wells are to be drilled and equipped with modern pumping plants.

## Boston Edison Expansion

### Station Development Problems Debated and Plans Explained at Providence Meeting

ASPECTS of the Edison Electric Illuminating Company of Boston's generating-plant development problem were reviewed at a recent meeting of the Providence Engineering Society by George E. Seabury, superintendent station engineering department. The expansion of the L Street station in South Boston from its original design of 1903 for twelve 5,000-kw. turbogenerator units to a rating of 186,000 kw. in the fall of 1923 marks the limit of this installation unless some of the older units are removed. About eight years ago the company began studying new plant developments, and on the site of the new Weymouth station sixty-three acres will soon be available for future requirements. Present plans provide for about 300,000 kw. at Weymouth, the initial installation to be two 30,000-kw. units.

Brief announcements have been made as to the contemplated use of 1,000 lb. to 1,200 lb. steam pressure in a portion of the Weymouth equipment. Preliminary studies of high-pressure possibilities showed that if a maximum steam temperature of 700 deg. F. were adopted on account of the limitations of the steels now on the market, very attractive economies could be secured with pressures of 1,000 lb. to 1,200 lb. A basic pressure of 375 lb. is contemplated for the 30,000-kw. units at Weymouth. Directly connected to one of these will be a high-pressure turbine to operate at 1,000 lb. or over, exhausting into the 375-lb. main feeding the larger unit. The high-pressure unit will exhaust into a reheater which forms a part of the high-pressure boiler equipment. It is planned to install one boiler to operate at 1,000 lb. to 1,200 lb. pressure and three boilers to operate at 375 lb., the latter serving one 30,000-kw. and the former one 2,000-kw. unit. As is now indicated, the high-pressure boiler will be built for use with a steel-tube economizer. At 1,000 lb. steam pressure it will deliver 110,000 lb. of steam per hour and at 1,200 lb. 133,000 lb. of steam per hour. The Edison company's engineers are of the opinion that it is unsafe to go to a steam temperature as high as 800 deg. F., since above 700 deg. the strength of steel falls off rapidly. It is possible that a maximum of 725 deg. may be attained.

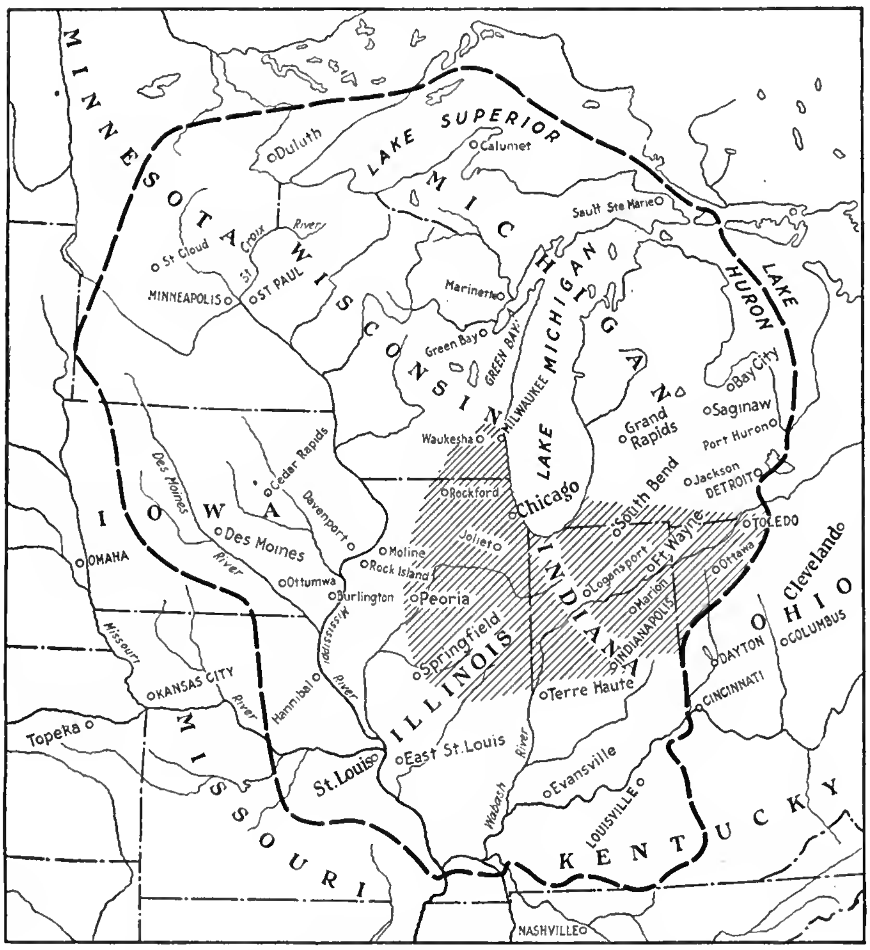
#### ADVANTAGES OF WEYMOUTH SITE

Unusually good facilities for handling heavy machinery and materials in bulk are available at Weymouth. The Fore River shipyard of the Bethlehem Steel Corporation is opposite the station site. The plant will add many million dollars to the taxable valuation of Weymouth. Fresh-water make-up may require separate piping facilities from the system of the Metropolitan District Commission. The coal-storage capacity is being figured on the basis of one ton

per kilowatt of station rating. Two coaling towers of 400 tons per hour rating each will be installed at first, followed by a third. Heavy machinery can be delivered directly to the plant from lighters and then moved into place.

On the electrical side it is planned to use 14,000 volts on the main buses and 2,300 volts for station service. A 2,300-volt steam turbo-generator will be provided for emergency service, but auxiliaries will be motor-driven and the heat balance maintained by bleeding steam from the main units. These are to be of 85 per cent power factor, and the switch house will be built with a closed-ring bus layout, sectionalizing by bus tie switches and providing for a transfer bus. Vertical separated phases will be used. The site affords ample room for switching equipment, and the completion of the station will probably be associated with the addition of a high-voltage loop system of transmission lines connecting the more important substations at the west of Boston with Weymouth and L Street. Before construction work was begun an exhaustive study was made of fuel oil and pulverized coal for possible use at Weymouth, but the present status of the market, outlook for future supply, cost of auxiliary apparatus and installation expense, uncertainty as to maintenance costs and positive experience of the company as to the performance of underfeed stokers burning bituminous coal contributed to the decision to pass by these other methods for the present.

## Development Plan of Great Lakes Sections, N. E. L. A.




MAP OF PROJECTED NINE-STATE POWER SURVEY, SHOWING PORTION TO BE FIRST DEVELOPED

THE first report of the power survey committee of the Great Lakes Division, N. E. L. A., noticed in the ELECTRICAL WORLD for May 19 (page 1166) and now available for distribution, gives, as stated in that issue, the outlines of general development which would supply the future power needs of the Great Lakes territory most economically, to the end that all extensions planned now and in the future may be in conformity with a comprehensive plan.

The method of procedure to be followed is somewhat as follows: Growth both in population and industrial development will be estimated for the various portions of the area, all economic conditions, such as rail and water transportation and accessibility to coal fields, receiving due weight; the general locations of "capital stations"—plants with a capacity of 200,000 kw.—will then be planned and trunk lines and secondary distribution circuits will be considered. The committee is looking into the future up to 1950.

The general territory under consideration reaches from Detroit on the east to the southern watersheds of the Ohio River, thereby including Louisville; thence extends westward to take in St. Louis, Des Moines and Minneapolis and swings across upper Michigan back to Detroit, including or impinging on nine states. The area for immediate study will have Chicago as a center and include Milwaukee, Peoria, Springfield (Ill.), Indianapolis, Detroit and South Bend. This is the shaded area on the map. H. H. Field has been chosen as engineer-secretary to handle this work, with offices in the Edison Building, Chicago.

## Trip Up Big Horn Canyon

### Interior Department Engineers Report on Its Potential Water Power in Wyoming and Montana

THE potential water power of Big Horn Canyon in Wyoming and Montana and its utilization are considered in a report just prepared by Benjamin E. Jones and David J. Guy, hydraulic engineers of the Department of the Interior. The two engineers made a trip through the canyon in 1921. Their report is based on information obtained on the trip, on topographic maps of the canyon prepared by A. W. F. Koch of Hardin, Mont., engineer of the Big Horn Canyon Irrigation & Power Company; on stream-flow records obtained at Hardin, Mont., for the period 1905 to 1920, and on other information available in the Interior Department.

In the stretches above and below the canyon the Big Horn flows through broad basins in which there are irrigated lands on both sides of the stream and bench lands farther back. The canyon itself lies in a huge fold of the rock beds that form the north end of the Big Horn Mountains. Through this fold the river has cut its winding way in a deep, narrow gorge 50 miles long, which begins 8 miles south of the Montana-Wyoming boundary. A trip on this stream involves real peril.

Big Horn River falls 450 ft. in the canyon and has a flow of 1,500 second-feet for 90 per cent of the time and 2,475 second-feet for 50 per cent of the time. Without storage the potential power for 90 per cent of the time at 70 per cent efficiency is 54,000 hp. and for 50 per cent of the time it is 89,000 hp. Suitable dam sites are numerous and can be developed economically as soon as a market for the power is available.

The Big Horn Canyon Irrigation & Power Company proposes to build a dam near the mouth of the canyon to a height of 480 ft. above the foundation and 450 ft. above the low-water surface of the river. Such a dam would utilize the entire fall in the canyon, and if the upper 200 ft. of the reservoir were used to store water the total flow of the river in years of low water could be equalized and a continuous flow of 3,100 second-feet obtained. The dam would make available 84,600 hp. con-

tinuously. The proposed capacity of the turbines is 165,000 hp. It is also proposed to take water from the reservoir at a point 200 ft. above the river and carry it by canals down both banks to irrigate 60,000 acres of bench land between the canyon and Hardin, Mont.

The report considers plans for developing the potential power of the canyon by one, two and three dams and points out the advantages and disadvantages of each plan.

Its publication may be delayed, and to make the data immediately available to the public manuscript copies have been placed on file at the office of the Geological Survey in Washington, D. C., and at the office of the district engineer in room 52, Montana Bank Building, Helena, Mont., where they are now open for inspection.

## For Interstate Connection

### New York Commission Authorizes Adirondack-New England Tie —Sanctions Hydro Plant

THE Public Service Commission of New York granted permission to the Adirondack Power & Light Corporation on Tuesday to construct a transmission line through portions of the towns of Stephentown, North Greenbush, Nassau and Sand Lake, Rensselaer County. The transmission line is to be constructed under franchises obtained from the town boards of those towns. The order of the commission provides that no electrical energy shall be sold or distributed by the Adirondack Power & Light Corporation either directly or indirectly in any of the towns through which the said line will pass.

The memorandum on which this order was granted shows that the transmission line will furnish a connecting link between the distribution lines of the Adirondack Power & Light Corporation and those of the New England Power Company. The line will be used for the transmission of energy between those two companies as needed.

PERMIT FOR NEVERSINK DEVELOPMENT

The commission also granted to the Oakland Power Company permission to construct a hydro-electric plant on the Neversink River. The plant will be in the towns of Forestburgh, Thompson and Mamakating, Sullivan County, and in the town of Deer Park, Orange County. No transmission line will be constructed by the company as all electrical energy will be sold at its switchboard to other electrical corporations authorized to purchase and transmit it.

The commission approved an application of the Mutual Electric Company and the Hornell Electric Company for consent to the transfer of the franchises and electric plant of the first-named company to the Hornell company. The order also approves an operating contract entered into between the two companies and permits the Hornell company to construct an extension of its electric plant in the towns of Hornellsville and Dansville under franchises which have been received from the local authorities.

## Granite Men to Pay Increased Rate to Montpelier Company

Withdrawal of opposition to a 15 per cent average power-rate increase by granite manufacturers served by the Montpelier & Barre (Vt.) Light & Power Company will, it is thought certain, result in approval of the advanced rate by the Vermont Public Service Commission. For more than a year the company deferred filing increased rates because of unsatisfactory economic conditions prevailing in the granite industry, which is the largest consumer of power in the territory. For some time, however, the company has been barely able to pay its fixed charges and operating expenses, and since July, 1921, it has paid no dividends. It therefore made an increase of half a cent per kilowatt-hour for power service, effective April 1, 1923. At a hearing before the commission the point was made that lack of credit made it impossible for the company to borrow funds to complete the installation of a 2,500-kw. steam turbine unit for which foundations had been prepared and that other important work had to be held in abeyance because of the inadequate net earnings of the company. Following this frank statement came the information that the manufacturers' association was prepared to withdraw its opposition.

## New England Power to Replace Older Units at Vernon

To obtain greater efficiency in the use of water at the Vernon (Vt.) station of the New England Power Company, it has been decided to replace four of the original 2,500-kw. three-runner vertical generating units with 3,000-kw. two-runner units. One of the new units will probably be installed yearly, beginning on the New Hampshire side of the Connecticut River.

When the Vernon station was originally built eight 2,500-kw. units of the three-runner type were installed, the plant being placed in operation in 1909. The operating head was 35 ft. and the flood rise of the river about 30 ft. The three-runner design and the type of gate rigging and control then available for low-head plants led to high cost of maintenance, difficulty in keeping the equipment up to capacity and difficult accessibility at the lowest wheel of each unit. With the growth of the system the maximum short-time peak capacity of the station became needed, with the possibility of operating some units at light load as motors for power-factor correction without water loss, and in 1921 the plant was extended by the installation of two 4,200-kw. single-runner vertical units. These units can be motored with the headgates open and wheel gates closed with minimum leakage and still be ready to supply power on short notice.

## Public Utility Advertising

### First Meeting of New Association Draws Out Excellent Papers at Atlantic City

THE sessions of the first annual convention of the Public Utilities Advertising Association, held at Atlantic City on Tuesday last in connection with the convention of the Associated Advertising Clubs of the World, were attended by representatives of the national utility associations and state committees on public utility information and by delegates controlling the public relations, advertising and publicity departments of many individual public service corporations. A remarkably good program was presented. B. J. Mullaney of Chicago was chairman of the morning session and Frank Leroy Blanchard of New York chairman of the afternoon session.

Mr. Mullaney outlined the needs of advertising in the four major utility industries as follows: (1) Service advertising, to gain volume by exploiting advantages and uses of the service; (2) merchandise and appliance advertising, in the case of electric and gas companies, to sell goods at retail; (3) financial advertising to sell the securities that must be issued to provide extensions and additions to plant and equipment; (4) institutional advertising to lend background to the other three.

Grover C. Maxwell of Columbus, Ohio, former secretary of the Ohio Public Service Commission, emphasized the urgent need of a proper balance between straightforward, honest advertising and authoritative and interesting news articles, together with forceful and truthful public speaking, as the best way of telling the public the real story of the public utilities. James O'Shaughnessy expressed the view that there is an exceptionally valuable opportunity for economic co-operation between the utility companies and the advertising agencies.

W. S. Vivian, director of public relations of the Middle West Utilities Company of Chicago, stressed the great importance of getting the public to realize that the problems of the utility are the problems of the public. J. C. McQuiston, manager of the publicity department of the Westinghouse Electric & Manufacturing Company, laid emphasis on the necessity of friendly relations between the companies and the newspapers.

Francis H. Sisson, vice-president of the Guaranty Trust Company of New York, read a paper on "Public Utilities and Public Relations," dealing with the power of the printed word and the value of good will and advertising as factors in economic education.

W. H. Hodge, of H. M. Byllesby & Company, discussed the practical side of customer-ownership advertising. Chairman Blanchard spoke of the value of the new association and explained the methods and machinery of a well-organized and effectively functioning department of public relations.

## War Department's Tests Rank Moody Draft Tube High

At the suggestion of Hugh L. Cooper, the Corps of Engineers, United States War Department, recently undertook a series of experimental tests of great interest to hydraulic engineers and others concerned with hydro-electric power development. The object of these tests, which have just been completed, was the confirmation of the data upon which the department had based its decision to employ the Moody spreading draft tube in the Muscle Shoals power station, but it was decided to make the tests comprehensive in character, with a view not only to obtaining authoritative data regarding the relative efficiencies of various draft-tube designs, but also to making possible an estimate of the actual capital savings represented by improvements in draft-tube efficiency, and to compare these with the increase, if any, in construction cost which might be incurred by installing the most efficient type.

This latter point was of especial interest to Colonel Cooper, and as the War Department placed the supervision of all the tests in the hands of his firm, the result was the collection of a body of data which not only forms a very important contribution from an authoritative and impartial source to present hydraulic engineering knowledge, but should, it is thought, also result in the possibility of considerable capital savings in forthcoming hydro-electric power enterprises. All the tests were carried out in the I. P. Morris laboratory of the William Cramp & Sons Ship & Engine Building Company at Philadelphia, which was loaned to the War Department by that company for the purpose. In every test, the I. P. Morris representatives announce, the Moody tube showed highest efficiency under all conditions and entirely vindicated Colonel Cooper's judgment in its selection.

The report includes a graphic representation of the tests in a series of curves plotted under varying conditions of effective head, turbine speed and load, showing turbine efficiency and power output for each type of tube. In all, without exception, the Moody type shows a clear lead over any other design. It is understood that a complete report is now in preparation and will soon be published.

## Santee River Project Will Be Pushed

Final plans are being prepared by T. C. Williams, vice-president of the Columbia Railway & Navigation Company, covering the project which involves the diversion of the Santee River through a canal 15 miles long to the Cooper River, near Moncks Corner, above Charleston Harbor, S. C. The plans are being perfected with the aid of engineers of the Foundation Company.

Recent investigations have shown that this project is more attractive than was supposed at first. It has the backing of a very active local sentiment. An application for license will be made in the near future. The tentative plans provide for an initial diversion dam which would develop a head of 55 ft. and an initial installation of 30,000 hp. to 50,000 hp. Provision will be made for the construction later of a dike and a higher dam which would raise the head to 70 ft. and permit of an ultimate development of 150,000 hp. In that connection it is pointed out that there are few points on the flat coastal plane where such a high head could be obtained. The feasibility of the project is enhanced by the progress of hydro-electric development on the upper tributaries of the Santee, such as that of the Southern Power Company on the Catawha and Congeree. These reservoirs in recent years have raised the low flow of the Santee from 3,000 cu.ft. to 10,000 cu.ft. per second. The contemplated development will go much further toward flattening out the high-water flow and raising the low-water discharge.

The success of the project depends to a considerable extent on the amount of flow which the War Department will insist must pass the dam to maintain navigation on the Santee below the point of diversion. The city of Georgetown, on the coast, is vitally interested in keeping this navigation channel open, although it is not used at present. The power company hopes to obtain permission to divert all of the Santee with a proviso that whenever the Secretary of War directs a minimum discharge of 3,000 cu.ft. per second will be allowed to pass. It is believed that this proviso would meet the requirements of navigation were it established.

# A. S. M. E. Hears of Canada's Water Power

### Hydro-Electric Possibilities of Quebec Are Put at 13,000,000 Kw. and Those of Ontario at 6,000,000 Hp.—A New Fuel Described—Proposed Steam-Boiler Code

A GLOWING outline of the vast potential water powers of Quebec and Ontario was exhibited to the Montreal spring meeting of the American Society of Mechanical Engineers last week by Julian C. Smith, general manager of the Shawinigan Water & Power Company, who spoke for Quebec, and Frederick A. Gaby, chief engineer Hydro-Electric Power Commission of Ontario, who represented the latter province.

Pointing out that Quebec's area of 706,804 square miles is about one-fifth that of the United States, Mr. Smith said the province contained actual possibilities for developing 13,000,000 kw. to 15,000,000 kw. continuously. At present the economic possibility for development is 5,250,000 continuous kilowatts, of which 800,000 kw. is now available. The principal water powers are on the Ottawa, St. Lawrence, St. Maurice, Saguenay and St. Francis Rivers. Cedars Rapids will develop 229,000 hp. in the near future, and Shawinigan and other stations now supply 157,000 electrical horsepower to the paper industry. Mr. Smith described the Duke-Price project on the Saguenay, where Lake St. John, at the head of the river, serves to control flow and act as a reservoir. The watershed is over 30,000 square miles in area, and there is a 300-ft. fall in a distance of 25 miles. Four hundred thousand horsepower will be eventually developed at the source of the Saguenay and 800,000 hp. farther down. A 400,000-hp. plant will be in operation in two or three years. On the St. Maurice the Shawinigan company is installing 65,000 hp. in four units, and on the Ottawa River 600,000 hp. will be available before 1924. Quebec has a total of 1,070,000 electrical and hydraulic horsepower developed, and growth curves indicate the need for the entire 7,000,000 possible horsepower within twenty-five years. Philip S. Gregory, who read the paper for Mr. Smith, said that surplus water power was used for electric boilers in several plants, but that energy would have to sell at about 2 cents a kilowatt-hour before it could compete with ten-dollar coal for such purposes.

#### Ontario Water Power

Mr. Gaby put the potential water power of Ontario at 6,000,000 hp., of which 1,300,000 hp. has been developed. He said that estimated ultimate development was only approximate because of the many variable factors encountered and the incomplete data. In Ontario, with an area of 400,000 square miles, the St. Lawrence and the Niagara afford the greatest power, with some on the Nipigon and some on the smaller rivers in the north and central portions. The Hydro-Electric Power Commission, which acts as trustee for 350 municipalities, has developed 625,000 hp. and operates 3,500 miles of transmission lines. Mr. Gaby said. The longest line is 254 miles to Windsor, and 110,000 volts at 25 cycles is the system voltage. At the present rate of growth the system needs 100,000 hp. to 150,000 hp. more capacity each year. The commission operates interconnected districts in central Ontario and one system on the Nipigon. On the Niagara system there is at present 540,000 hp. and will be ultimately 820,000 hp. In the Severn district there is 6,000 hp. and the same amount in the Eugenia district. In central Ontario 40,000 hp. is in operation, and in the Nipigon region there is an ultimate possibility of 200,000 hp. On the St. Lawrence there are two possible sites, in the opinion of Mr. Gaby—at Morrisburg, where 600,000 hp. to

800,000 hp. can be obtained, and at Cornwall, where 1,200,000 hp. can be developed. On the Nipigon 200,000 hp. can be obtained from sites at Virgin Falls, Cameron Falls and Alexander Landing.

The commission now has 628,000 hp. in operation and has utilized the capacity available from the streams without storage. The system is well loaded and as a result steps are being taken to arrange for storage capacity to insure more power. Another million horsepower is expected from Niagara and 1,500,000 hp. from the St. Lawrence, but the load curve indicates that this power will be used at the end of ten years.

#### LOAD DOUBLES IN SIX YEARS

In discussing the papers W. M. White, Allis-Chalmers Manufacturing Company, pointed out that standards of living and wages were fixed by the per capita use of power and that all possible power should be used immediately by those ready for it. Fred Darlington, Westinghouse Electric & Manufacturing Company, observed that interconnection and steam supplementary stations were needed to give economical power to industry and advocated the immediate development of water powers in order to avoid waste of energy and to conserve fuel. John R. Freeman thought that statesmanship and foresight were needed to anticipate power demands and complimented the Dominion government on the foresight shown by the water-power department. Mr. Gregory, in closing, stated that the load doubled every six years in Quebec and that interconnection helped greatly in obtaining better system operation by taking advantage of stream-flow variations in different sections.

#### A NEW FUEL

A paper on "Lignite Char" was read by O. P. Hood of the United States Bureau of Mines. Mr. Hood explained that lignite char is a lignite which has been dried and distilled in an oven especially designed for this purpose. About 2½ tons of raw lignite reduce to one ton of char, the heat value of which is about 12,000 B.t.u. per lb. Unlike the German brown coal, the American lignites do not briquet well without the addition of a binder, and the Bureau of Mines has therefore been led to investigate the possibilities of an inexpensive carbonizing process and the use of the resulting char direct without briquetting.

The boiler code committee held public hearings for the discussion of proposed rules for the care of steam boilers in service and a proposed code for the inspection of steam boilers. As in the case of the power-equipment code and the internal-combustion-engine code referred to last week, co-operation with the appropriate committee of the N. E. L. A. will be sought.

About 250 engineers from the United States attended the convention, which was held in conjunction with the Engineering Institute of Canada. A number of interesting trips of inspection were made. Fred R. Low, editor of *Power*, was nominated as president for the ensuing term.

## Powerdale Plant Starts

**New Power House of Pacific Power & Light Company at Hood River, Ore., Goes Into Service**

THE new Powerdale hydro-electric plant of the Pacific Power & Light Company at Hood River, Ore., was started with appropriate dedicatory exercises on May 10. President Guy W. Talbot in welcoming the visitors said that about 25 per cent of the capital invested in the plant came from the sale of securities in the local market.

The plant is built in a beautiful canyon on the Hood River, just outside the city of Hood River. The intake work for the pipe line is 3 miles farther upstream. About 3 miles above the generating station a concrete diversion dam is constructed across the river. The 8,700-hp. vertical-type turbine, designed for 180 ft. head and 360 r.p.m., was manufactured by the I. P. Morris Department of William Cramp & Sons. The upper end of the turbine shaft carries the Westinghouse three-phase, 60-cycle, 7,200-volt generator and its exciter. A Kingsbury bearing above the generator carries the weight of the unit. Lubrication is provided by means of a water-cooled, forced-circulation oiling system. The output of the unit is rated at 6,000 kw. at 80 per cent power factor, or 7,500 kva. The switching is handled by a twelve-panel, remote-control switchboard supplied by the General Electric Company.

The generating and switching equipment are housed in a remarkably small building. The power house is only 47 ft. x 82 ft. x 17 ft. high and is constructed of hollow-tile concrete plastered. To facilitate repairs to the turbine and generator unit, two large hatches are provided in the roof, one directly over the generating unit and the other over a spare room where repair work can be carried on. A large 40-ton gantry crane straddles the power house and serves to lift the heavy equipment through the roof hatches.

An outdoor type of transformer substation is used, three 2,500-kva. self-cooled, oil-insulated, radiator-type Westinghouse 6,600/66,000-volt transformers being mounted on a raised concrete platform adjacent to the power house.

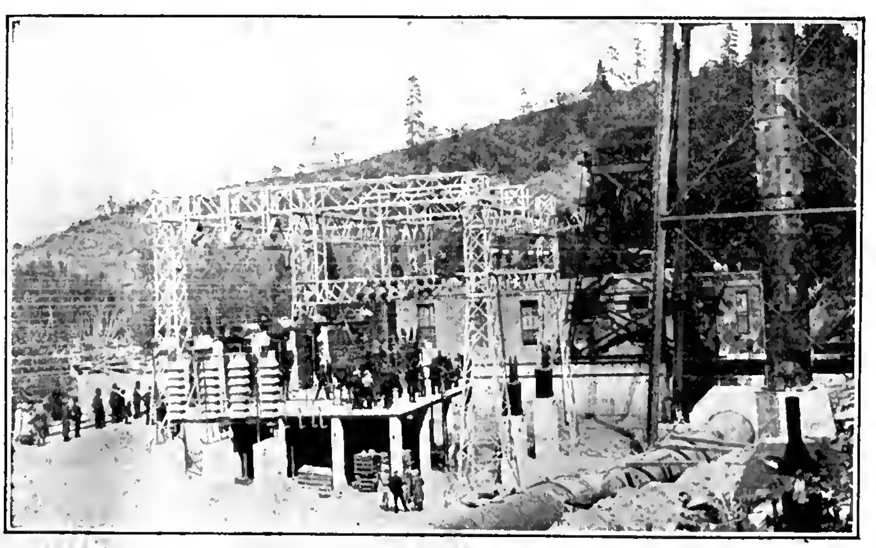
Final surveys for this plant were made in May, 1922, and actual construction work started about June 1. Credit for its rapid completion is due in a large measure to H. H. Schoolfield, chief engineer for the Pacific Power & Light Company, and J. E. Shinn of the Phoenix Utility Company, who was superintendent of construction on this work.

## New York to Have Electrical Board of Trade

The Electrical Board of Trade of the City of New York, representing every branch of the electrical industry, was formally organized last week in the office of Arthur Williams, general commercial manager of the New York Edison Company. Mr. Williams is president and the chairman of the board is Charles L. Eidlitz, the recently appointed "Czar" of the electrical contracting business in Greater New York.

The Electrical Board of Trade was organized as the result of conferences of representatives of the electric light and power companies, telephone and telegraph companies, manufacturers, jobbers, contractors, distributors and dealers. It will act as a clearing house for credits and other information desired by the trade, but, it is announced, will not in any way deal with prices.

The officers elected, besides Mr. Williams and Mr. Eidlitz, were: Vice-presidents, Walter J. Drury of the Western Electric Company, William C. Peet of the Peet & Powers Company and Theodore Beran of the General Electric Company; treasurer, John P. Ryan, Cleveland & Ryan, and secretary, John MacIntyre.



OUTDOOR SUBSTATION, VENTURI METER AND SURGE PIPE IN FOREGROUND; GENERATING STATION IN BACKGROUND

## Pressure at 3,200 Pounds

### This Will Be Feature of a Plant Now Being Built at Rugby for English Electric Company

AN EXPERIMENTAL superpressure steam plant now nearing completion, designed by the Benson Engineering Company of London and soon to be erected in the works of the English Electric Company at Rugby, England, is to employ a pressure of 3,200 lb. per square inch and will have a temperature of 706 deg. F. The heating elements are of very small section and have no steam drums or chambers. Steam will be generated at a pressure above that named, then throttled to 1,500 lb. and, after being superheated to 788 deg. F., will be passed through a high-pressure turbine exhausting at 200 lb. per square inch. The exhaust of the high-pressure turbine is to be reheated to 662 deg. F. and then expanded in a standard normal-pressure turbine to 29-in. vacuum.

The builders of the plant predict not only that it will consume about 28 per cent less fuel than a high-grade plant of the same capacity operating at 250 lb. pressure, but that it will also be cheaper to build and maintain. The plant is declared to be equivalent to a 1,000-kw. commercial plant. The great jump from 1,500 lb. pressure, the highest previously employed, to 3,200 lb. is due entirely to the fact that at any pressure below 3,200 lb. latent heat must necessarily be added, with consequent troubles from boiling and priming.

## Brief News Notes

**Another Metermen's Course.**—The third short course for metermen conducted by the electrical engineering department of the University of Illinois is to be held on June 11-16. Two courses of instruction have been prepared, one for men who have had little or no experience in meter work and one for more advanced men.

**Brookfield Rejects Municipal Ownership.**—The people of Brookfield, Mo., had an opportunity to express themselves last month on the question of substituting a municipal electric plant for the privately owned central-station plant of the North Missouri Power Company. The result was overwhelmingly in favor of continuance of the privately owned plant, the vote standing: For municipal ownership, 250; against, 1,042.

**Denver Tramway Purchases Two 10,000-Kw. Turbines.**—The Denver Tramway Company has purchased two 10,000-kw. turbines from the government which will be installed in its steam plant at Denver. The machines are to be ready for operation by Aug. 15. The installation of these two new units will bring the company's generating capacity up to 30,000 kw., and it will no longer need to purchase power from a local power company.

**Shooting Holes in a Smokestack.**—Nowhere is the resourcefulness of the public utility operator more often shown than in the small community. The Richmond (Ky.) plant of the Kentucky Utilities Company has one smokestack for three boilers. A windstorm crumpled the stack so that smoke could not pass through it, and to maintain service it was necessary to create a draft in some manner until such time as the hanging portion of the stack could be removed. The problem was

solved by Manager George Fawkes, who procured a shotgun and riddled the top of the erect portion with holes skillfully drilled where they would do the most good.

**University to Install 30-Hp. Turbine Wheel.**—The University of California has recently ordered from the Pelton Water Wheel Company of San Francisco a 30-hp. impulse turbine for use in the hydraulic laboratory of the College of Mechanics at Berkeley. The turbine, which will be installed before the opening of the fall semester, will operate under heads up to 300 ft. It will be provided with a hand-operated needle nozzle and governor-controlled jet deflector.

**Metermen's School Held at University of California.**—A short course for metermen was given from May 14 to 19 at the University of California at Berkeley. The course was arranged through the co-operation of the meter committee of the Pacific Coast Electrical Association, the power companies and the extension division of the university. The course included technical lectures, recitations and laboratory work. It will be made an annual event.

**Los Angeles Company's New Office Building.**—A site for the new office building of the Los Angeles Gas & Electric Corporation has been purchased by the company. According to William Baurhyte, vice-president and general manager, the building, which is to cost $1,250,000, will be of sufficient size to accommodate the company for many years. It will contain an assembly hall for meetings between officials and employees and for employees' organizations. Construction is to be pushed.

**Pacific Power & Light to Build Interstate Line.**—One of the important construction jobs to be undertaken by the Pacific Power & Light Company this year is a transmission line from Kennewick, Wash., to Umatilla, Ore., and thence on to Pendleton, Ore. Power will be wholesaled to the Hermiston Light & Power Company, operating in northeastern Oregon. Surveyors are now in the field locating the line.

**Dothan's Municipal Plant Meets Obstacle.**—Court action threatens to hold up the erection of a municipal hydroelectric plant at Dothan, Ala., the allegation being made that a sale of bonds was illegal. Pending the hearing of the petition for an injunction work is proceeding on the plant, which is being erected on the Choctowhatchee River, about 20 miles from Dothan, and will, it is said, cost $900,000. Dothan has a population of 12,500 and is in the extreme southeast of Alabama.

**Lighting Alleys Reduces Burglaries in Denver.**—Lighted alleys, made possible through a new city ordinance, are gradually decreasing the number of burglaries and hold-ups in the downtown district of Denver and are giving protection to the policemen on downtown beats. "Before the lights were installed there was an average of two burglaries a night in the business district," declares a high police official, "but in the week after the lights were installed we had only two burglaries in the section." The lights are 100 ft. apart.

**Use of Kilocycles in Radio.**—In accordance with the recommendation of the second national radio conference, the Department of Commerce and other government departments will hereafter follow the practice of specifying radio waves in even values of kilocycles rather than in meters. The relation between the two is indicated by the following rule: "To obtain kilocycles, divide 300,000 by the number of meters; to obtain meters, divide 300,000 by the number of kilocycles." The reason that kilocycles are coming into use and displacing meters is that the necessary separation of the frequency of transmitting stations to prevent interference is the same, no matter what the frequency may be. This necessary separation is variable and quite misleading when expressed in meters.

**Okanogan Power Line Completed.**—Completion of the power line connecting the Washington Water Power Company's main system with its new field in the Okanogan territory has been anounced. This construction includes 58 miles of 60,000-volt main transmission line, running from Coulee west to the Columbia River and north along the west bank of the river to Brewster. It will convey power from the main system of the Washington Water Power Company into the 33,000-volt lines of the Okanogan Valley Power Company, acquired by the Washington Water Power Company the first of the year. In addition to the 60,000-volt line 18 miles of 13,000-volt distribution line

was built into the Lake Chelan district, with arms extending on both sides of the lake.

**Five New Jersey Companies Are Consolidated.**—The merger of five corporations into the Central Jersey Power & Light Company, having an appraised valuation of $6,275,800 and serving 100,000 population in forty-two cities and municipalities, has been announced by the A. E. Fitkin Company of New York. In the amalgamation are the Morris & Somerset Electric Company, the Lakewood & Coast Electric Company, the Toms River Electric Company, the Lakewood Water Company and the Commonwealth Electric Company of Summit. J. H. Drake will be vice-president and general manager, with headquarters at Boonton, N. J.

**Mining Helps Hydro-Electric Expansion in Utah.**—That railway and metal-mining expansion in Utah will bring about a rapid development in hydro-electric projects is indicated by activity already under way in the southeastern part of the state. The Dixie Power Company is planning the construction of two new water-power plants and one steam plant to take care of an anticipated increased demand. The new sites, already in the company's control, are in the Pine Valley Mountains. It is believed that the present capacity of plants in operation, which is about 1,000 hp., will be entirely inadequate when the iron smelters now being constructed begin production. The new plants will bring the total capacity to about 6,000 hp. This will provide sufficient power to meet the present and future needs of the Cedar and Parowan Valleys.

**Diesel Electric Tanker Successful.**—Trials of the Standard Oil Company's first Diesel electrically driven tanker were completed off San Francisco last month and were eminently successful. The normal speed of the propeller is 130 r.p.m., but during the trial it was operated at about 145, and the load was less than 1,000 amp., whereas full load rating on the motors is 1,065 amp. The change from full speed ahead to reverse took from ten to twelve seconds. The tanker's propelling units consist of two General Electric 300-hp. motors mounted on the same base and with a common shaft and driving a single propeller. Energy is supplied by two General Electric 245-kw. direct-current generators with a 30-kw. exciter connected to each, each generator and exciter being directly connected to a 400-hp. six-cylinder Diesel engine.

**For Better Lighting in the Schools.**—Announcement of the personnel of the sectional committee which is to prepare a lighting code for the nation's schools under the auspices of the American Engineering Standards Committee, with the American Institute of Architects and the Illuminating Engineering Society as joint sponsors, is made by the Federated American Engineering Societies. Among the members are C. E. Clewell, representing the American Institute of Electrical Engineers; Ward Harrison, the National Electric Light Association; W. S. Little and M. Luckiesh, the Illuminating Engineering Society; M. G. Lloyd, the United States Bureau of Standards, and G. H. Stickney, the National Safety Council. Surveys and investigations are under way by various bodies. "Eyesight Conservation Day" has been inaugurated in several cities and systematic lectures to school children, particularly in New York and New Jersey, have been made a feature of the general plan.

# Associations and Societies

**New York Electrical Society.**—Officers of this society for the coming year, as unanimously selected by the nominating committee, will be: President, Philip Torchio; vice-presidents, Alfred Cane, E. H. Clarke and Harry E. Kidder; secretary, T. C. Martin; treasurer, T. F. Honahan.

**Los Angeles Section, A. I. E. E.**—The annual field day of the Los Angeles Section of the American Institute of Electrical Engineers was held Saturday, May 19. The party was taken by automobile on a trip of inspection to the new Laguna Bell 220,000-volt substation of the Southern California Edison Company and the Arcadia automatic substation of the Pacific Electric Railway. Following a dinner in the evening at the California Institute of Technology, the visitors visited its electrical and physical laboratories.

**Lehigh Valley Section, A. I. E. E.**—On May 24 Prof. Vladimir Karapetoff of Cornell University spoke before this section at Bethlehem, Pa., on "Recent Electrical Research." He emphasized the necessity of "continuity of effort" in order to obtain results that are worth while and the importance of having research workers who are employed not to solve this or that particular problem, but to become specialists in a certain class of phenomena, so that they can skillfully and intelligently handle any problem within that domain.

**Engineers' Club Formed at Hartford.**—With 908 charter members "signing up" during a short period of work devoted to organization, the Hartford (Conn.) Engineers' Club has been formed to promote friendly intercourse and professional advancement. A committee is at work on the problem of permanent quarters, and the following officers have been elected: President, Hiram Percy Maxim; vice-presidents, Frank P. Gilligan and Edward W. Bush; secretary, Kenneth B. Warner; treasurer, Henry R. Buck; councilors, Robert Charles Cole, William F. Brooks, F. C. Moore and S. F. Jeter.

**National Safety Council.**—The Engineering Section of the National Safety Council will hold its second meeting of the year at Detroit, in co-operation with the Detroit Safety Council, on June 12. In the morning the subject of safety in welding and cutting will be discussed by experts representing the three modern methods—electric, gas and and thermit—followed by a practical demonstration of the use of goggles to protect against the injurious visible and invisible rays and a general discussion in which the industrial safety engineers in the audience will have opportunity to get information on their own particular problems.

**Insull Addresses Chicago Electric Club.**—Before a well-attended luncheon of the Electric Club of Chicago on May 29 Samuel Insull, president Commonwealth Edison Company, gave a comparison of the central-station industry in 1902 and 1922. Whereas the total investment of all central stations in the United States in 1902 was $650,000,000 with an annual income of $85,000,000, the respective figures for 1922 were $5,000,000,000 and $1,000,000,000, he said. The energy output for the same period had increased from 2,500,000,000 kw.-hr. to 52,000,000,000 kw.-hr. President Insull also dealt with the power development in the northeastern section of Illinois, which he estimated would require by 1927 a maximum demand of 1,300,000 kw., since the present demand is about 789,000 kw. He earnestly advocated the spread of customer ownership of securities.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

North Central Division, N. E. L. A.—Minneapolis, June 20-22. H. E. Young, Minneapolis General Electric Company.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 21-23. Louis Kon, 65 McGill College Ave., Montreal.

Southern Appalachian Water Power Conference — Asheville, N. C., June 25-27. J. A. Switzer, Knoxville, Tenn.

American Institute of Electrical Engineers —Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Iowa Section, N. E. L. A. — Mason City, June 26-29. M. A. Linn, Des Moines Electric Co., Des Moines.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Michigan Electric Light Association—Grand Rapids, Sept. 11-13. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Iron and Steel Electrical Engineers — Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

# Recent Court Decisions

**Judge's Characterization of Electrical Installation as "Mantrap" Not Prejudicial.**—A boy bathing was killed by contact with a live electric wire stretched on scows across a river for the use of a sand-pumping company, and the trial jury (Followill vs. Kansas Construction Company and Kansas Gas & Electric Company) found both the pumping company and the central-station company which furnished the energy guilty of wanton negligence. This verdict has been upheld by the Supreme Court of Kansas, which overruled exceptions taken to the charge of the trial judge and held that his colloquial characterization of an unguarded switch and uninsulated and sagging wires as a "mantrap" was not prejudicial to the defendants. (214 Pac. 430.)*

**May Taxes Be Levied to Distribute Electricity to Rural Community?**—Sustaining the lower court (Supervisors of Maricopa County vs. Faust) in finding unconstitutional an attempt of "Roosevelt Electrical District No. 3" to issue bonds under a defective state law intended to supersede others set aside by the courts, these bonds being for the alleged purpose of building transmission lines to supply residents of the district with electricity, the Supreme Court of Arizona refused to answer a question whether the distribution of electrical energy for domestic and power purposes to residents of a rural community fulfills such a public purpose that it may be done by means of funds provided by taxation. "An answer to that question in this case would settle nothing," the court said, "because it is not raised by the pleading and could not arise under the statute in question. Neither the act under which this district was organized nor the later one, under which it now assumes to act, deals with the distribution of electricity alone or even chiefly. None of these acts clearly and definitely defines the purpose for which districts are to be organized nor definitely limits the powers which are to be exercised." (214 Pac. 316.)

**Police Power and the Fourteenth Amendment.**—In Southern Bell Telephone & Telegraph Company vs. Town of Calhoun, a suit to restrain the enforcement of a state law requiring the installation of certain exchanges, the Federal District Court for the West District of South Carolina made a number of observations on the police power of the state in its relation to the Fourteenth Amendment of the United States Constitution, prohibiting confiscation. Among other things the decision said that the amendment does not prevent the state from exercising very extensive power in the regulation, taxation and policing of the business of a corporation, but permits a single foreign corporation to be expelled from the state by a special act and permits classification for the purposes of taxation to be resorted to; that in the matter of police regulation the powers of the state are exceedingly broad, and laws enacted for that purpose may be impolitic, harsh and oppressive without contravening the constitutional inhibition; that, however, a state legislature cannot single out a corporation, any more than a natural person, and subject it to burdens and liabilities which are not cast on others similarly situated, and that a joint resolution requiring a company to maintain telephone exchanges which it was not required to maintain by any provision of its charter or by any contract took the property of the corporation without just compensation. (287 Fed. 381.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**Complicated Rates Should Be Avoided in Small Communities.**—In fixing rates for the Lapeer Gas-Electric Company, which combines steam heating with electric light and power service, the Michigan Public Utilities Commission dwelt upon the necessity of taking care not to make demand or connected load schedules for electric light and power in small communities so refined as to be unwieldy relative to the benefit secured by such refinement, where the cost of demand and connected load records will probably overbalance any benefit that might be gained as compared with a simpler rate schedule.

**Commission Champions Right to Fair Return.**—The Vermont Public Service Commission came out emphatically in its adjudication of an appeal brought by the city of St. Johnsbury against the New England Telephone & Telegraph Company against any contention that public utilities should be compelled to operate for less than a fair return. "That claim," the commission said, "if carried out, would result in the utter demoralization of all public service business and end in state ownership, a consummation devoutly to be avoided. Moreover, in considering whether a public service corporation is entitled to a return regard should be had for the people who have invested their money in the enterprise. Such a corporation may seem to be a great entity without soul or conscience, sucking the financial blood of its patrons for the mere pleasure derived from that process; but on further examination it will be found that the supposed sanguinary monster is but a legislative creation acting through its officers and agents for a large number of people in many walks of life who have paid into the corporation by way of stock investments sums of money for the double purpose of obtaining a revenue and aiding the enterprise. How long would the public continue to render such necessary financial assistance after a return was denied?" It was said further, in allowing a return of 6 per cent, which the commission termed moderate and conservative, that the maximum rate of return ought to be somewhat above what would be a fair average return, since the stockholders must stand their losses during poor years.

**Rate Base Should Include Cost of Construction in Progress.**—In defense of its inclusion in the rate base of the Pacific Telephone & Telegraph Company of a sum representing construction work in progress, the Department of Public Works of the State of Washington said: "Funds employed in construction work are as fully devoted to the public service as are funds invested in completed plant, in materials and supplies, or in the cash required to meet current expenditures. The necessity of an allowance for cash, materials and supplies and other items of working capital is recognized by all regulatory bodies and there is no question as to the propriety of permitting an earning upon these items in their final form when they appear as additions to the fixed capital accounts. Since 'construction work in progress' represents nothing more or less than cash and materials and supplies in their transitional stage between working capital and completed plant, it seems as clearly entitled to inclusion in the rate base as it was as working capital or as it will be as completed plant. There is, however, a further factor in this consideration, which is 'interest during construction.' Funds employed in construction work are entitled to a fair earning. If the funds be borrowed, the creditor is receiving an earning and the utility is suffering no loss since it is permitted to capitalize the interest it pays out. This capitalization creates a value upon which the utility is permitted to earn and which presumably can be sold if the plant changes owners. If the utility capitalizes interest on its own funds, there is an actual increase in its surplus. These facts must be recognized when considering the propriety of including 'construction work in progress' in the rate base. The rate of return from operations seldom coincides with the rate at which interest during construction is capitalized; furthermore, the applicant does not capitalize interest upon routine construction work requiring less than one month for completion. Therefore, the most equitable method of treatment appears to be to include 'construction work in progress' in the rate base and to include the interest accretions with operating income, which method acts as an automatic governor to compensate the ratepayer, if the rate of capitalization of interest be more, and the company if it be less, than the rate of return from operations."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## B. C. Adams in Toledo

Benjamin C. Adams, vice-president and general manager of the St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo., operated by Henry L. Doherty & Company, has been made vice-president and general manager of the Toledo Edison Company and president and general manager of the Community Traction Company at Toledo, Ohio. Mr. Adams is succeeding Frank R. Coates, who was president and general manager of both companies. Mr. Coates is retaining the presidency of the Edison company. The change marks the withdrawal of Mr. Coates from most of his active duties with the Toledo properties in the assumption of larger duties with Doherty and the Cities Service Company in New York.

Mr. Coates came to Toledo on Dec. 5, 1911, and ever since then has been in charge of the Doherty interests in Toledo. Mr. Adams is a comparatively young executive and has come up through the Doherty organization, having been in St. Joseph about five years. He has worked on a number of other properties.

**T. B. Wilson**, treasurer and assistant general manager of the Louisville Gas & Electric Company, has been elected a vice-president of the company.

**R. F. Mullen**, superintendent of the meter department of the Indiana General Service Company at Muncie, has been promoted to the office of commercial manager.

**W. W. Finch**, with office at Indianapolis, is to supervise and direct the appliance and merchandise sales of all the subsidiaries of the Central Indiana Power Company.

**Charles Adams**, assistant chief engineer of the El Paso (Tex.) Electric Company, has been transferred to the Columbus (Ga.) Electric & Power Company as chief engineer.

**E. D. Freeman**, district superintendent of the Oklahoma Gas & Electric Company at Sapulpa, Okla., has been transferred to Oklahoma City to assist J. M. Brown, district superintendent there.

**W. S. Hodgson**, formerly assistant secretary and treasurer of the Utah Power & Light Company, is now in New York with the Electric Bond & Share Company. R. H. Jones succeeds Mr. Hodgson with the Utah company.

**G. W. Faller**, for several years general manager of the City Light & Water Company of Amarillo, Tex., a Doherty subsidiary, has been transferred to Denver to head the Doherty Training School, which is directed by the Denver Gas & Electric Light Company. Mr. Faller was formerly connected with the Denver company, and his recent transfer carries with it the title of assistant general manager. He has been succeeded at Amarillo by Ross Philips, formerly secretary of the Lincoln (Neb.) Gas & Electric Light Company.

## C. H. Champlain Works Manager at Sharon

C. H. Champlain, who has been assistant works manager at the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company, has been appointed works manager of the Sharon plant, which the Westinghouse company has recently acquired from the Savage Arms Corporation. Mr. Champlain entered the employ of the Westinghouse company in 1895 and has devoted his time continuously to works management. During the world war he had charge of the manufacture of shells. On Jan. 1, 1916, he was transferred to the Springfield works of the Westinghouse Electric Company as general superintendent, in which position he had direct charge of the manufacture of Russian rifles and Browning machine guns. In August, 1919, he was transferred back to East Pittsburgh, being appointed general superintendent of those works, and in February, 1920, he was appointed assistant works manager, in which position he continued until his present appointment.

C. H. CHAMPLAIN

M. L. Fawcett, general foreman of the transformer department, has been made superintendent of the new works. Mr. Fawcett has been associated with the Westinghouse company for twenty-four years.

**A. L. Johnston**, formerly associated with the electrical engineering department of the West Penn system at Pittsburgh, is now connected with the Electric Bond & Share Company, New York.

**B. E. Torpen** has been appointed to the engineering staff of the city of Tacoma to fill the post of hydraulic engineer in connection with that city's Lake Cushman hydro-electric project.

**Roy H. Skill** has been made district manager for the Pacific Power & Light Company at Pomeroy, Wash. Mr. Skill has been associated with the company since 1917.

**L. A. Fiorani** has been appointed commercial manager of the utilities under the management of C. D. Parker & Company, Inc., Boston, with headquarters at the offices of the Union Light & Power Company, Franklin, Mass. Mr. Fiorani has been with the Union company for the past nine years.

**W. W. Arnett, Jr.**, has resigned his position of commercial engineer in the power department of the Monongahela-West Penn Public Service Company, Fairmont, W. Va., to join Brooke, Stokes & Company, bankers of Philadelphia. C. R. Huffman, local sales representative of the General Electric Company, has succeeded Mr. Arnett.

**Franklin N. Fernald** has been elected vice-president and treasurer of the Central Connecticut Power & Light Company, East Hampton, Conn., succeeding L. P. Perry, who recently resigned to become general commercial manager of the United Hudson Electric Corporation, Poughkeepsie, N. Y. Mr. Fernald was formerly a member of the power sales engineering staff of the Narragansett Electric Lighting Company, Providence, R. I.

**Herbert G. MacMurchy**, who formerly was in the engineering department of the Aluminum Company of America at Pittsburgh, has resigned and is now connected with the Phoenix Utility Company of Allentown, Pa. Mr. MacMurchy is electrical construction engineer in charge of the installation of electrical equipment in the new Fourth Street steam-electric station for the Memphis (Tenn.) Power & Light Company.

**E. E. Carpenter**, a member of the firm of Baker & Carpenter, engineers, of San Francisco, has been appointed chief electrical engineer for the British Columbia Electric Railway Company, Vancouver, B. C. Mr. Carpenter followed railway engineering for about seven years after his graduation from Stanford University in 1898. Subsequently he was chief construction engineer for Sanderson & Porter, on the Stanislaus River power development of the Sierra & San Francisco Power Company and chief engineer for the same firm in charge of design and construction of power development installation for the British Columbia Electric Railway Company at Jordan River, on Vancouver Island. As a member of the firm of Baker & Carpenter he has engaged in general consulting and executive practice.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Need of a Climate Rating for Cities

**Standardization Greatly Affected by Atmospheric Conditions—An Important Factor in the Manufacture and the Purchase of Outdoor Equipment**

By J. R. Kearney

Sales Manager W. N. Matthews Corporation, St. Louis

IT IS a very difficult thing to develop standardization on a national basis when it comes to the construction of equipment that is used out of doors and is affected by atmospheric conditions. Utility men, in co-operation with electrical manufacturers, have been at work on this problem for years and have made material progress. Much has been learned, for instance, about the resisting qualities and the endurance of pole-line hardware, outdoor switches and other equipment. A very large amount of money has been spent each year in this development. But I doubt if any ten men from different sections of the country will agree on 50 per cent of this standardization. Each man feels that his conditions are different and that he must have more or can do with less protection than the standard provides, and in many cases he is right.

In other words, the life and performance of materials in outdoor service is more than anything else dependent upon the conditions in the air in the cities where they are used. And these conditions vary with the location of the city in relation to altitude, to the sea, and in regard to the atmospheric conditions which are caused by the effects of different classes of industries. It is impossible, for instance, to obtain the same results from the same equipment in Boston, Cleveland, Pittsburgh, Chicago, Minneapolis, Kansas City, St. Louis, New Orleans, Dallas, Denver, Salt Lake, Butte, Seattle, Portland, San Francisco and Los Angeles. But I believe that it would be a comparatively easy matter to decide upon standards for both materials and methods if these different cities were zoned or classified on the basis of the atmospheric or climatic conditions that obtain.

Consider Cleveland, for example. Atmospheric conditions are severe, owing apparently to the presence of many foundries, brass works and other industries which pour smoke and gases into the air. Rust is as active as in salt air. Aluminum can-

J. R. Kearney

not be used, say, in fuses, whereas in Kansas City or Minneapolis there is no trouble. Dampness from the lake also probably contributes to this condition; but, on the other hand, Buffalo is far easier on wood and metals, because, I assume, Buffalo has fewer industries that affect the atmosphere.

St. Louis would also be classified as severe. Aluminum can be used there fairly well, but galvanized-steel brackets will not stand up. There seems to be an acid in the air due to soft coal. New Orleans, Boston, Pittsburgh, Seattle and San Francisco would also be grouped in the same severe zone, because salt air or smoke or other conditions make them hard on outdoor equipment. In Pittsburgh there is an iron dust from the steel mills that settles on everything and makes a most severe condition. It causes a metallic coating to form on insulators, for instance, and makes necessary the use of oversize insulators. On 660-volt circuits common use is made of 3,300-volt material.

These cities are very hard on aluminum and galvanized steel, for they will last only a year under conditions where in many other cities they will stand up for twenty years. Brass cannot be used with any success at all, for it quickly becomes crystallized and brittle. In St. Louis there seems to be a very active electrolytic action. Wood also breaks down quickly.

Detroit, Memphis, Chicago, Columbus, Buffalo and Philadelphia would be classed as in an intermediate zone. Here brass suffers quickly by corrosion, but aluminum or galvanized steel will last, say, five years, and nothing like the difficulties that obtain in cities of the severe zone are experienced. Minneapolis, Denver, Salt Lake and Kansas City would be grouped in a mild zone, where aluminum is all right, and brass will stand up fairly well, and galvanized steel is good for ten years.

Based on the known record of the various materials used in outdoor equipment, practically every city in the country could be classified under one of three or more climatic zones, and standards could be developed to suit the several zone conditions and made very definite. The result would be that every utility company would know in just which zone it belonged and therefore just which class of materials it must buy to get good service and economy. Protection would come from a knowledge of zone conditions and men would buy to suit these conditions. It would save many lives, for many accidents come from the breakdown of some part that under the influence of a severe atmosphere some day turns what has always been a safe point into a point of danger. It would save much money in replacements and in labor. It would save many failures in service which are hurtful in public relations.

There are many people who are manufacturing equipment of this kind merely to sell and not for service. Under the plan proposed, whereby each buyer would know his zone and the standard demanded for it, a manufacturer of this type could not get a clearance for his goods that they did not measure up to. He could not sell in a zone where they did not qualify. It would save a large amount of waste and disappointment.

At present the manufacturer is free to urge his goods wherever there is a market. The location of Buffalo, Cleveland and Detroit along the lakes would seem to argue that what is good in one is good in all. Yet unseen chemical conditions in the air of Cleveland make it much harder on such equipment than the other two towns. If cities were rated, all this would be clear.

I think the manufacturers would welcome such a plan as they could then build their equipment to meet the different zone conditions. If this could be accomplished, the utilities in the different zones would pay the price for their materials in proportion to the mild or extreme zone condition which must be met. This would save many of the utilities a large amount of money and would not cause any more expense than at present in the more severe zones. If zoning was approved by the national standardization committees, the cities that would be placed in the severe zone would be willing to pay more money for their equipment than those situated in the milder zones.

I do not believe more than four zones would be required to cover the entire country, and possibly this could be well accomplished in three zones.

# Guiding Exports by Past Performances

**New Statistical Pictures Show the Changes in Demand by Foreign Countries for Seasons—How Manufacturers May Use Figures Advantageously**

BY S. H. DAY

Electrical Equipment Division, Bureau of Foreign and Domestic Commerce

BEGINNING with the first of January of this year, we started in the electrical equipment division of the bureau a system of tables or accounts on which are being recorded monthly figures showing both the quantity and the value of electrical exports from the United States by countries of destination.

A separate table is being made up for each of the sixty-five classes of electrical materials which find their way into foreign markets. The figures are being combined cumulatively so that in addition to showing the changes from month to month the latest entries give the total for the year up practically to the current month. This gives us a picture, so to speak, of the actual extent of the electrical business being done by American exporters in any foreign country with respect to all classes of materials, or, taking it from another angle, we can study the situation from the standpoint of a particular class of appliances or apparatus in all the foreign markets of the world. Thus a manufacturer of one single line of electrical appliance will be interested in the export business being done in his product in all countries of the world, and he may also want to know something about the electrical import business generally in some country where he has exceptionally good representation with a view to expanding his export line, undertaking an advertising campaign or possibly studying the bearing of sales of other materials upon the demand for his own product.

The two groups, motor-driven household devices and domestic heating and cooking appliances, have followed a similar trend during the last seven months. The total shipments increased last fall until the peak was reached in November, followed by a steady decline extending through January of this year. There was a holiday demand for these lines in 1922, which can undoubtedly be counted on regularly in the future. I wonder how many manufacturers of vacuum cleaners, washing machines, electric hair driers, vibrators, etc., take special steps to bring their product to the attention of foreign consumers during the December buying period. This may suggest a number of ways in which product can be pushed to take advantage of the holiday seasonal trade for these appliances.

From the standpoint of particular foreign markets, American motor-driven household devices were in steady demand in eight different foreign countries during the last seven months, while shipments of domestic heating and cooking appliances in substantial numbers reached twenty-five foreign markets during each month of the same period. Less seasonal variation is shown in our exports of domestic heating and cooking appliances for the reason that both hemispheres are included in the wide distribution of markets. Thus the absence of demand for heating appliances below the equator during the period from September until March is balanced by the need for them at this time of the year in the northern half of the world.

In motor-driven household devices Canada is our best foreign market, with Great Britain a close second. The Netherlands came next in importance, followed by Japan, Australia and Switzerland. The Latin-American countries took small amounts only, Mexico being the best customer. Cuba and one or two others are receiving small but fairly regular shipments of this class each month. Some other countries were intermittent buyers of rather large quantities, France being one of these. The same kind of demand is also apparent in Norway and South Africa.

There is a much broader range of foreign markets for domestic heating and cooking appliances. The figures for the last seven months show the seasonal demand in the Northern Hemisphere for heating equipment and, of course, reflect conversely the lack of need in the countries below the equator at this time of the year. The export business went first to Canada and second to Great Britain, the same as with motor-driven devices.

### SEASONAL DEMAND FOR FANS

A study of the foreign markets for electric fans on the basis of actual exports during the fall and winter months must at once take into consideration the seasonal nature of the demand for this appliance. The figures, therefore, show primarily the market possibilities of the Southern Hemisphere, together with the tropical regions where electric fans are used extensively throughout the year.

British India, which is our leading foreign market for electric fans, received more than $500,000 worth during December and January, the shipments during December being the largest for any of the seven months under consideration. The

market for fans in India is capable of almost indefinite expansion, although the question of sales channels is a difficult one and probably cannot be solved until enough business men settle in India to provide facilities for handling all American lines. The bureau is contemplating more extensive trade-promotion work in India, and American manufacturers of electric fans should receive direct benefit from this.

The increasing use of electrical appliances is following the rise in standards of living that is taking place in almost all countries of the world. This is evident even in those nations which are struggling with the after-effects of the war as well as in the more backward countries of the Orient. In fact, the war-torn regions are turning to electrical appliances as a means of economizing human effort, and labor-saving devices are beginning to play an important part in restoring the normal productivity of all those foreign countries.

American products since the war have achieved a splendid reputation in foreign markets, especially for quality and service, and I believe that American manufacturers of electrical appliances have a great opportunity before them if they will establish and perfect their selling channels in the important markets of the world and prepare for the permanent demand for their product which is sure to come.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

BUSINESS in the present electrical market has the appearance of much steadiness, with little indication of change within the next two weeks. For this week there are no spectacular price decreases or advances to report with the exception of a slight raise in motor prices in the Pacific Coast and Chicago territories and a 10 per cent marking up of porcelain in the East.

## New England Farm-Lighting Business Is on Gain

SALES of farm-lighting sets show healthy gains for May in the New England district, a representative distributor stating that this was the best month this year in that territory. Road conditions are now so close to normal that sales activities are no longer impeded by poor highways.

Deliveries are being made regularly out of Boston stocks, and prices are reported firm, with some tendency toward stiffening on account of increased material costs. Manufacturers of this class of equipment are working close to the full rating of their present plants. Expressed in number of units going into the field, probably at least one-third more are being shipped than was the case a year ago, and some distributors are probably exceeding this figure.

## Slight Improvement Shown in Eastern Purchases

A SLIGHT improvement in orders placed with jobbers was noted last week in the Eastern territory. There is an immense volume of electrical business under way, notwithstanding a continuance of the tendency toward a quieter market. Stocks are meeting current demands readily and prices are firm. A 10 per cent increase in porcelain was announced last week. Jobbers are gradually rounding out deficiencies in their stocks, although conservatism in buying is evident in long-time views. Railroad embargoes which have hampered Eastern electrical shipments are virtually lifted at the present time. General business is active, although labor troubles in the shoe industry and heavy pressure upon textile mills, due to higher wage scales, are causing some curtailment of production. Motor business reflects very keen competition at present, with some factory capacity idle and uneasiness as to prices. Appliances are moving fairly well, washers and cleaners being active.

## Street-Lighting Business Showing Healthy Growth

POPULAR demand for improved street lighting in many parts of the country is being reflected in a gratifying growth of business taken by representative manufacturers. This growth since the war has not been spectacular, although a reported appropriation of eight million dollars for municipal improvements, including street lighting at St. Louis, seems likely to cause a sudden jump in the equipment production curve in the near future.

Factory stocks are rather low at present, and the market for this class of apparatus is sufficiently active to absorb most of the production as it leaves the manufacturing departments. Prices are on the whole steady, and the supply of labor is not subject to the severe fluctuations experienced in many other lines.

Raw-material deliveries are somewhat slow and require close attention from the manufacturing angle. Full-time operation is meeting current requirements nicely, and the demand for the larger sizes of arc-lighting equipment keeps pace with the growth of series incandescent equipment sales, bearing in mind the adaptability of each to particular fields of service. Orders of representative street-lighting equipment makers appear to be well distributed throughout the country, the expiration of municipal contracts with central stations often furnishing occasions for the introduction of new and improved equipment.

## Motor Sales in San Francisco Are Excellent

BUILDING conditions are excellent save for an occasional shortage of building material. Permits totaled $4,928,986 for May as against $4,377,066 for May last year. Export business is at a low ebb with signs of even further depression. However, this condition is general and beyond the power of the community to correct. Crop indications are excellent. Plenty of new rolling stock has been ordered to prevent last year's losses from delayed shipments. Dealers' business is decidedly better. Refillable-fuse sales in smaller sizes seem to have been affected by sales of non-refillable, non-indicating types. Standardization of 40-deg. motors has necessitated careful handling of stock, for sales are excellent and apparently well distributed.

## Chicago Jobbers and Dealers Report Steady Business

CHICAGO electrical dealers and jobbers report a steady but quiet week of trade. Price advances announced this week included one from a manufacturer who increased motors of certain types 10 per cent. These motors were not included in the increase several weeks ago. The contracting game has slowed up, which accounts for the temporary lull in business. Building permits issued this week were 287, as against 294 for the same week last year. For May, 1923, the building permits totaled $33,721,330, as against $27,029,650 for May, 1922. Wage increases for fourteen open-shop building trades operating under the Landis award went into effect June 1 with increases ranging from 10 to 20 cents.

Sales of flatirons, vacuum cleaners and washing machines have been normal. Although numerous advertising sales campaigns are being started, no important increases in the sales of these commodities have been felt.

According to the Federal Reserve Bank of Chicago in its June report, labor shortage is reported by a number of firms. "Prompt deliveries of steel and steel products were hard to obtain," the report says, "with a few firms including lumber in the products not readily available. The steady increase in prices of raw materials, together with increased wages, has caused some firms to increase the price of their

goods. The demand for agricultural machinery and equipment was reported fairly good, but manufacturers express concern as to the future owing to increased prices."

### Conditions in Philadelphia Market Satisfactory

ACCORDING to reports from Philadelphia, dealers in electrical supplies are continuing to enjoy good business, except in the case of radio equipment, in the sales of which there has been a seasonal decline. The majority of orders are for immediate delivery, and in practically all cases it is possible to meet the demand.

Stocks generally are moderate and are decreasing. Some jobbers are having difficulty in obtaining delivery on equipment bought in New England, because of the freight situation there, and others report slow delivery on their orders for copper wire and conduit.

Prices are rising on many materials, and lists are higher than they were last month and a year ago. Quotations on specialties, however, have changed but little recently. Electrical contractors are busy on work placed some time ago, but they report that, while they are receiving numerous inquiries, few contracts are being closed at this time.

Collections in practically all cases are fair, and although they are little changed from last month, in some instances they are slower than they were last year.

### Electrical Goods Took Largest Part of 1922 Copper

COPPER consumed in the United States during 1922 is estimated by the American Bureau of Metal Statistics at 1,091,397,000 lb., compared with 904,753,000 lb. in 1921, 1,346,090,000 lb. in 1920 and 1,224,710,000 lb. in 1919. This consumption was divided as follows, the figures indicating the thousands of pounds:

| | 1922 | 1921 |
|---|---|---|
| Electrical goods*........ | 269,000 | 260,000 |
| Telephone and telegraph | 120,000 | 108,000 |
| Light and power lines†. | 97,500 | 66,000 |
| Wire and rods......... | 91,000 | 77,000 |
| Automobiles‡ .......... | 144,000 | 92,000 |
| Auto brake lining...... | 1,600 | 1,400 |
| Buildings§ ............ | 73,900 | 44,300 |
| Locomotives ........... | 5,030 | 5,890 |
| Railway cars .......... | 7,470 | 5,480 |
| Air brakes ............ | 5,600 | 3,350 |
| Ships, commercial§ .... | 6,180 | 38,000 |
| Ships, naval§ ......... | 170 | 9,900 |
| Bearings and bushings.. | 42,000 | 28,000 |
| Valve and pipe fittings.. | 20,000 | 11,500 |
| Ammunition ........... | 14,500 | 16,500 |
| Lubricators ........... | 5,500 | 1,600 |
| Condensers ............ | 4,800 | 4,000 |
| Fire-fighting apparatus.. | 3,100 | 2,300 |
| Agricultural machinery. | 500 | 720 |
| Cash registers ......... | 1,000 | 400 |
| Copper-bearing steel.... | 1,900 | 1,700 |
| Coinage ............... | 475 | 2,930 |
| Other uses¶ ........... | 95,000 | 72,000 |
| Manufactures for export. | 81,172 | 51,783 |
| Total ............... | 1,091,397 | 904,753 |

*Generators, motors, switchboards, lamps, etc., exclusive of telephone and telegraph purposes.

†Outside wiring only; does not include trolley lines.

‡Does not include electrical manufactures.

§Does not include electrical generators, motors, etc.

¶Includes rods, wire, sheet, tubes and all similar fabrications of copper for export.

### General Business Conditions Are Called "Spotted"

BUSINESS conditions in manufacturing and agricultural lines are characterized as "spotted" by the mercantile agencies. The situation is decidedly irregular, with the general trend, as regards new buying, in the direction of increased quiet, according to *Bradstreet's*.

In regard to the jobbing and retail trades "the increased quiet seems most marked in the eastern half of the cotton belt and in some West Central States," says the agency, "and is due mainly to weather conditions. In the eastern half of the South almost continuous rains were complained of as preventing crop work, retarding retail buying and rendering an already late season later still. Industry, owing to activity on old orders and the pushing to completion of building already planned, is relatively most active of all the great trade branches, but growing quiet in cotton goods manufacturing is noted East and South, and Eastern shoe manufacturing is also among the lines noting a seasonal shading off of industry. Mail-order trade continues active, an indication of farmers' ability to buy."

### Range Business Good in West and South

MANUFACTURERS of electric ranges report a decided increase in their total volume of business this spring as compared with last year, although trade in the East is somewhat spotty. One representative house is selling at least 33 per cent more ranges than a year ago, and the outlook for the summer is better than for some time. In some circles complaint is heard as to the lack of interest of central stations, especially in the East, in the electric range as a load builder, and one manufacturer said to the ELECTRICAL WORLD that the lack of experienced range users and salesmen in utility organizations is severely handicapping this development.

This producer feels that in the older sections of the country there is too much of a disposition to remain satisfied with the normal growth of central-station business; that the revenue possibilities of electric cooking are little realized in these quarters, and that too few utility men appreciate the fact that recent designs of ranges are being marketed at prices which compare very favorably with the retail prices of first-class gas ranges—a condition which has not obtained formerly and which has been long in coming, but which bids fair to remain permanent.

Orders from the West and South reflect the brighter spots on the sales manager's map in the range factory. No spectacular shipments are going forward at the moment, but buying is steadily increasing and it is difficult at this time to build up much in the way of factory stocks.

A disposition on the part of retailers to purchase ranges in lots of half a dozen rather than in single units can be seen here and there. Demonstration work is very active, and excellent results have come from recent fairs and exhibitions in which electric cooking has been thoroughly exploited.

Aggressive development of the heavier appliance business has not been generally characteristic of municipal lighting departments, but Reading, Mass., sold fifty ranges in eight weeks after a two-day electrical show. Factory conditions reflect good supplies of raw material and labor, broadly speaking. Manufacturers report they are ready to render a greatly increased service to the utility industry with this product, and current opinion has it that if the distributor and retailer will quicken the merchandising pace, a fine year's business will be recorded.

### English Electrical Exports Fell £21,801 in April

THE following are official values of electrical machinery, apparatus and material exported from England (a) during April, 1923, and (b) the aggregate figures from Jan. 1 to April 30, with the increase or decrease compared with the corresponding periods of 1922:

The total exports of electrical machinery, apparatus and material, other than insulated wire, were £1,022,779 during April, a decrease of £21,801 from April of 1922.

Electrical machinery, (*a*) £311,699 (decrease £138,790), (*b*) £1,327,415 (decrease £359,468); including railway and tramway motors, (*a*) £19,006 (increase £13,908), (*b*) £85,660 (increase £26,952); other generators and motors, (*a*) £171,000 (decrease £31,263), (*b*) £697,949 (decrease £303,504); and other electrical machinery, (*a*) £121,693 (decrease £121,435), (*b*) £543,806 (decrease £282,916); telegraph and telephone cables, submarine, (*a*) £37,128 (increase £14,108), (*b*) £186,804 (increase £81,533); other than submarine, (*a*) £100,606 (increase £38,793), (*b*)

### Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.034 | $0.0326 | $0.0236 |
| Cold finished shafting, per lb. | 0.042 | 0.0406 | 0.032 |
| Brass rods, per lb. | 0.1850 | 0.1913 | 0.1466 |
| Solder (half and half), per lb. | 0.2862 | 0.2987 | 0.21 |
| Cotton waste, per lb. | 0.1231 | 0.1231 | 0.104 |
| Washers, cast iron (½-in.), per 100 lb. | 4.66 | 4.66 | 4.00 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 2.96 | 2.96 | 3.11 |
| Machine oil, per gal. | 0.349 | 0.349 | 0.40 |
| Belting, leather, medium, off list | 42½% | 42½% | 48½% |
| Machine bolts, up to 1-in. x 30-in., off list | 44¼% | 44¼% | 62¼% |

£320,991 (increase £113,442); telegraph and telephone apparatus, (a) £175,178 (increase £8,269), (b) £637,391 (decrease £70,587); other electrical wires and cables, rubber insulated, (a) £78,-935 (increase £29,004), (b) £375,461 (increase £179,957); with other insulations, (a) £81,557 (decrease £2,010), (b) £350,955 (decrease £70,071); carbons, (a) £1,151 (decrease £1,699), (b) £18,493 (increase £3,035); glow lamps, (a) £29,735 (decrease £9,443), (b) £105,768 (decrease £30,352); arc lamps and searchlights, (a) £576 (increase £167), (b) £2,265 (decrease £989); parts of arc lamps and searchlights (other than carbons), (a) £49 (decrease £497), (b) £295 (decrease £1,643); batteries, (a) £37,670 (decrease £4,320), (b) £181,127 (increase £33,224); electrical instruments (commercial and scientific) and electricity meters, (a) £29,585 (increase £1,038), (b) £107,902 (decrease £26,586); switchboards, (a) £18,504 (increase £5,319), (b) £45,484 (decrease £93,-566); other electrical goods and apparatus, (a) £120,406 (increase £38,-260), (b) £444,457 (increase £25,462).

## The Metal Market

CONDITIONS continue extremely quiet in the non-ferrous metal market, and prices generally are stationary or decreasing. Consumption continues as great as ever, with practically all metal users operating their plants at as near capacity as labor conditions will permit, but the unfilled orders on their books are not so great as they were a few months ago.

This is due not so much to an anticipated slackening in the demand for the ultimate product as to a feeling that commodity prices generally are likely to exhibit a downward trend and that it will be wise not to book orders for raw material farther ahead than necessary to insure deliveries in ample time for requirements.

Copper has been practically unsalable all week, and the larger producers almost without exception have done little or no business. Offers have been made at constantly decreasing prices day by day without tempting consumers in the least.

NEW YORK METAL MARKET PRICES

| | May 29, 1923 Cents per Pound | June 7, 1923 Cents per Pound |
|---|---|---|
| Copper, Electrolytic | 15.25 | 15.00 |
| Lead, Am.S.& R. price | 7.25 | 7.25 |
| Antimony | 8.00 | 8.00 |
| Nickel, ingot | 28.00 to 31.00 | 27.00 to 30.00 |
| Zinc, spot | 6.60 | 6.35 |
| Tin, Straits | 43.00 | 42.20 |
| Aluminum, 98 to 99 per cent | 26.00 | 26.00 |

Copper exports from United States in March totaled 67,122,745 lb. The principal items were: Refined ingots, bars, etc., 57,185,756 lb.; plates and sheets, 724,648 lb.; rods, 5,639,241 lb.; bare wire, 521,337 lb.; insulated wire and cable, 1,839,215 lb.; other manufactures, including pipes and tubes, 890,-801 lb.

# Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## General Electric May Sales Were Heaviest in Company's History

May sales by the General Electric Company broke all previous records. Its bookings for the first quarter of this year are at the annual rate of about $320,000,000, while billings are averaging about $25,000,000 monthly. At a basis of $300,000,000 for the year, sales billed would exceed the total of last year by nearly $100,000,000. Bookings in that period totaled $242,739,527.

Unfilled orders amount to about $100,-000,000, as compared with $76,220,000 at the end of last year. This total shows the tremendous volume of business which the company was offered in the first five months.

The company's cash position shows little change from Dec. 31, when its cash and government securities amounted to $85,341,539. Inventories have shown a disposition to increase owing to the larger orders. These footed up $75,334,-562 on Dec. 31.

Earnings during this year are expected to run ahead of the preceding twelve months, when $14.86 a share was shown on the $175,624,746 outstanding common stock.

## Link-Belt Company Changes

The Link-Belt Company of Chicago and Philadelphia announces that L. M. Dalton has succeeded E. J. Burnell as manager of the Boston branch office. Mr. Burnell resigned his post to enter business.

The Cleveland office of the Link-Belt Company has moved from room 429 to room 329, and the building in which it has so long found quarters has again changed hands and name. In the future the address of the Link-Belt Cleveland office will be 329 Rockefeller Building.

## Steiner Electric Changes Location

Upon the consolidation with the Faden Electric Company on May 1, the Steiner Electric Company moved from 115 North Wells Street to 210 South Desplaines Street, Chicago. Upon this consolidation the company was incorporated for $100,000, since the former organization had been a partnership. The new officers are: Harold W. Steiner, president; Alex Faden, vice-president; George F. Steiner, sales manager and secretary, and M. Loehr, assistant secretary.

George F. Steiner says this new location affords the company double the floor space it had previously, and that upon the acquisition of the Faden company's stock electrical fixtures will be handled. For this he has been arranging a display room comprising one-eighth of the entire floor space of the company. A new arrangement of stock layout has been made to facilitate the disposal of electrical goods for city trade.

## Wagner Motor and Control Apparatus Prices Increased

The Wagner Electric Corporation, St. Louis, on May 21 increased its prices of motors and control apparatus as follows:

| | Increase, Per Cent |
|---|---|
| All single-phase motors larger than 3 hp. | 10 |
| All "Bw" type motors | 5 |
| Twenty-five-cycle motors, types "BP," "RP," "BM" and "BR" | 10 |
| Slip-ring control apparatus | 10 |

All dealers and agents were notified that these prices were to be effective immediately.

## Westinghouse Acquiries Savage Arms Plant at Sharon

Announcement is made of the recent acquisition of the plant of the Savage Arms Corporation at Sharon, Pa., by the Westinghouse Electric & Manufacturing Company. A large force of workmen is now engaged in remodeling and equipping the plant for the manufacture of transformers. It is expected that the plant will begin operation next fall.

The transformer division of the East Pittsburgh works of the Westinghouse company will be transferred to Sharon, according to officials of the Westinghouse company, and three thousand persons, including a large number of girls and women, will be employed in the new Westinghouse plant when it begins operation. The acquisition of the Sharon plant was necessitated by the increasing business in transformers and the need for extending the facilities of production and manufacture of this type of electrical apparatus.

C. H. Champlain, who has been assistant works manager at the East Pittsburgh works, has been appointed works manager of the Sharon plant, and M. L. Fawcett, general foreman of the transformer department, has been made superintendent of the new works. Both officials are now engaged in directing the work of fitting the new plant for the manufacture of transformers.

All types of transformers, from the very smallest to some of the largest in the world, eventually will be made at the Sharon plant, and this will involve the transportation and installation of a large amount of machinery and testing equipment. Among the operations to be performed in the construction and

assembly of transformers are the drawing and forming of steel for tanks, the winding of coils, stamping of metal for cores, the manufacture of insulating bushings and the testing of the complete units.

### Black & Decker Make Second Price Reduction This Year

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, announces a further reduction in prices, effective June 1, as follows:

| | Former Price | Present Price |
|---|---|---|
| ½-in. portable electric drill | $82 | $75 |
| Heavy-duty ½-in. electric drill | 100 | 90 |
| ⅝-in. portable electric drill | 105 | 95 |
| 9/16-in. portable electric drill | 105 | 95 |
| ⅞-in. portable electric drill | 125 | 110 |

This makes the second reduction in prices that this concern has made this year. Its reduction on Jan. 13 was as follows:

| | Former Price | Present Price |
|---|---|---|
| ¼-in. portable electric drill | $49 | $28 |
| Special ½-in. electric drill | 106 | 88 |
| Bench drill stand | 45 | 38 |
| Post drill stand | 50 | 44 |
| 6-in. electric bench grinder | 70 | 48 |

### Makers of "Chromalox" Win Heating-Element Equipment Suit

The United States District Court for the Northern District of Ohio, Judge D. C. Westenhaver presiding, on May 11 rendered a decision in the patent controversy between Edwin L. Wiegand of Pittsburgh and the Dover Manufacturing Company, Dover, Ohio. In this decision the court upheld thirteen of the fourteen claims of the Wiegand patent, covering equipment used in the manufacture of embedded heating elements. The court also refused to hold invalid the Wiegand article and process patents 1,154,953 and 1,136,076 respectively.

The court held that the Dover Manufacturing Company has a limited shop right to manufacture and sell electric sadirons containing certain of Wiegand's inventions made during his employment by the Dover Manufacturing Company from 1911 to 1914. This, however, does not permit the Dover Manufacturing Company to use the Wiegand patents on the improved processes and equipment subsequently developed and used by the Edwin L. Wiegand Company in the manufacture of its line of "Chromolax" heating units, of which it is the only authorized source.

### George Drake Smith Resigns from Steinmetz Vehicle

George Drake Smith has announced his resignation as sales manager of the Steinmetz Electric Vehicle Company. Mr. Smith has organized an investment business in New York City and will specialize in public utility securities. He has recently been elected a director of the American Drawn Steel Company, Erie, Pa.

### Uehling Instrument Appointments

The Uehling Instrument Company, Paterson, N. J., manufacturer of $CO_2$ recorders and draft and vacuum gages, has just made two agency appointments, namely the Amsler-Morton Company, Fulton Building, Pittsburgh, for western Pennsylvania, and John A. MacDowell, 2039 Railway Exchange Building, St. Louis, for eastern Missouri and southern Illinois.

H. R. N. Johnson, who formerly represented the Uehling Instrument Company in Minnesota and the Dakotas, has joined the W. P. Nevins Company, 120 South Ninth Street, Minneapolis, Minn., which company is now the official Uehling representative in the territory mentioned.

### W. N. Matthews Reorganization Is Effected Under Missouri Laws

The W. N. Matthews Corporation, St. Louis, manufacturer of electrical specialties, has just been organized under the laws of Missouri to take over the business of W. N. Matthews & Brother, Inc., a New Mexico corporation. The capital stock of the Missouri corporation will consist of 5,000 shares of $100 par value 7 per cent cumulative preferred stock and 100,000 shares of $1 par value common stock. The business of W. N. Matthews & Brother, Inc., will be taken over in its entirety by the W. N. Matthews Corporation and the old company dissolved.

The officers of the new company are: W. N. Matthews, president; Claude L. Matthews, secretary and treasurer, and C. C. Fredericks, vice-president and general manager. James R. Kearney will be manager of sales for the electrical division, and Louis P. Murray manager of sales for the mechanical painting division.

W. N. Matthews & Brother, Inc., was established in 1899 by W. N. Matthews, who prior to that time was in the electrical supply jobbing business and was one of the organizers of the Electrical Supply Jobbers' Association. Claude L. Matthews became the junior partner in 1901, after spending a year and a half in the employ of the Packard Electric Company, Warren, Ohio. James R. Kearney joined the organization in 1905 as a salesman, after resigning his position as superintendent of construction of the Topeka Edison Company.

Mr. Kearney of the electrical division has a sales organization of fifteen representatives reporting to him. These men are: W. J. McIlvane, 30 Church Street, New York City; George G. Young, Bourse Building, Philadelphia; H. Van Rosen, 294 Washington Street, Boston; H. B. Parke and J. A. Jaques, 305 Seventh Avenue, Pittsburgh; H. C. Biglin, Atlanta; D. C. Griffiths and D. B. Graze, Marshall Building, Cleveland; J. T. Pearson, 1525 Dime Savings Bank Building, Detroit; H. L. Brueck, 29 South Desplaines Street, Chicago; J. E. Sumpter, 222 Security Building, Minneapolis; W. M. Watters, 1319 Main Street, Kansas City, Mo.; O. H. Davidson, 1633 Tremont Street, Denver; R. S. Wakefield, 324 Interurban Building, Dallas; D. Schneider, Kenyon Building, Louisville, and Ben C. Holst, Furniture Exchange Building, San Francisco.

### National Lamp of Cleveland Has Arranged to Close Warren Plant

The National Lamp Works of the General Electric Company, Cleveland, have arranged for the closing of their plant at Warren, Ohio, and operations will be transferred to the main works at Cleveland. It is proposed to remove equipment also to this location. The change is expected to be made on July 16. The Warren plant has been giving employment to about four hundred operatives. It was started twelve years ago.

The company recently shut down its plant at Shelby, Ohio, previously operated as the Shelby Lamp Division, after twenty-five years' continuous service. The Youngstown and Niles (Ohio) plants, it is said, will be continued as heretofore, the latter works being devoted to bulb production.

**The Bakelite Corporation**, 8 West Fortieth Street, New York City, manufacturer of electrical insulation products, has acquired the former plant of the Lake Erie Foundry Company, Painesville, Ohio, for new branch works.

**The Gifford-Wood Company**, conveying machinery, Hudson, N. Y., announces the removal of its Buffalo office to Pittsburgh, People's Bank Building.

**The Simplex Wire & Cable Company**, 201 Devonshire Street, Boston, has awarded a contract for a one-story, 51-ft. x 36-ft. factory on Pacific Street, Cambridge, Mass.

**The Fulton Container Company**, Nitro, W. Va., recently organized by Charleston (W. Va.) interests, will build a plant for the manufacture of electric battery containers, under a special process, and kindred equipment. It will cost $40,000. David A. Jayne is president of the company.

**The American Insulator Corporation**, New Freedom, Pa., is installing machinery and other equipment in a manufacturing plant recently leased from the Danbury Industrial Corporation, Danbury, Conn.

**The Western Electric Company**, 195 Broadway, New York City, will soon take bids on a general contract for the initial unit of its new cable and instrument plant on property recently acquired on the Newark Meadows, Kearney, N. J., to cost approximately $500,000.

**The Electric Apparatus Company**, Parkesburg, Chester County, Pa., has been organized to manufacture electrical apparatus. Plans for the future are not definitely formed. Horace A. Beale, Jr., is president, H. B. Wiese secretary, and E. H. Brodhead vice-president and general manager.

## Foreign Trade Notes

NEW ELECTRIC PLANT IN SOUTH AFRICA.—The construction of a large power plant near the Witbank station is contemplated by the Victoria Falls & Transvaal Power Company, to cost about £1,000,000. The proposed station will be equipped with three electric generating units of 20,000 hp. each.

ELECTRIC PUMPS PROPOSED FOR GALICIAN OIL FIELDS.—Developments are in progress in the Galician oil fields looking to the substitution of electricity for steam for operating pumps. A power station has already been erected by the Premier Oil Company (French) at Boryslaw with this end in view. If the present experiments show economy of operation, it is expected that the change will become general.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN LATVIA.—The construction of a hydro-electric power plant on the Dunn River at Kokenhusen for the distribution of electricity in Lettonia is under consideration by the government.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in London, England (No. 6,649), of head sets, radio equipment, etc.

Purchase is desired in Nancy, France (No. 6,658), of power-plant specialties and electrical maintenance supplies.

Purchase or agency is desired in Havre, France (No. 6,600), of enameled wire.

An agency is desired in Bayamon, Porto Rico (No. 6,634), of wire sockets, etc.

Purchase is desired in Bergen, Norway (No. 6,654), of pyrometers for ovens for malleable works.

Agency and purchase is desired in Santos, Brazil (No. 6,642) for electric washing machines.

TRANSFORMERS FOR MELBOURNE, AUSTRALIA.—Tenders will be received by the Victorian Electricity Commission, Melbourne, Australia, until Aug. 25 for thirty-one 22,000-volt transformers ranging from 15 kva. to 750 kva.

ELECTRIC EQUIPMENT FOR ALLAHABAD, INDIA.—Tenders will be received by the Public Health Department, Allahabad, India, until July 3 for equipment for pumping plant, consisting of oil engines, generators, motors and centrifugal pumps, at Fyzabad in connection with the water-supply scheme.

STORAGE BATTERIES, SWITCHES, ETC., FOR SYDNEY, AUSTRALIA.—Tenders will be received by the City Council, Sydney, Australia, until Nov. 19 for storage batteries, regulating switches, copper connections, charging boosters and switchgear, under Specification 736.

## New Apparatus and Publications

ELECTRIC POLE AND LINE HARDWARE.—The St. Louis Malleable Casting Company, St. Louis, is distributing catalog No. 500, covering its pole and line hardware and electrical specialties for railway, lighting, power, telephone, telegraph and mining companies.

ELECTRIC LANTERN.—The Embury Manufacturing Company, Warsaw, N. Y., has placed on the market the "Embury Supreme" electric lantern. It carries three standard unit-cell batteries.

INDOOR EQUIPMENT.—Bulletin No. 222 issued by Schweitzer & Conrad, Inc., 4431 Ravenswood Avenue, Chicago, describes and list its indoor equipment, including high-voltage apparatus.

LIGHTING UNIT.—A new lighting unit, "Glassteel Diffuser," for commercial and industrial lighting has been developed by the Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago.

CIRCUIT BREAKERS.—Bulletin No. 313 issued by the Automatic Reclosing Circuit Breaker Company, Columbus, Ohio, covers its automatic reclosing sectionalizing circuit breakers for direct-current distribution systems.

GASOLINE DRILL.—A gasoline impact drill of the air-hammer type is now manufactured by the Pennsylvania Gasoline Drill Company, Land Title Building, Philadelphia.

SELF-STARTERS.—Bulletin No. 6,106 issued by the Cutler-Hammer Manufacturing Company, Milwaukee, covers its time-limit acceleration type of direct-current self-starters, up to and including 200 hp.

ELECTRIC WASHING MACHINE.—The Apex Electrical Distributing Company, Cleveland, has placed on the market a new electric washing machine, known as the "M-2 Rotarex" washer.

CARBON BRUSHES.—The Universal Carbon Company, Dundee, Ill., is distributing a bulletin listing the prices of its carbon brushes. It also contains specifications as to the use of the various brush grades.

STEAMER AND THERAPEUTIC LAMP.—A therapeutic lamp which can be used in hairdressing establishments for facial and scalp treatment has been developed by the R-No-Mae Company, Inc., 57 Fifth Avenue, New York City.

PORTABLE ELECTRIC DRILL.—The Independent Pneumatic Tool Company, 600 West Jackson Boulevard, Chicago, has brought out a portable electric drill, "Thor," of $\frac{3}{16}$-in. capacity.

VIOLET-RAY MACHINES.—The Parco Manufacturing Company, 211 High Avenue, Cleveland, has placed on the market a line of violet-ray machines, consisting of four models.

BELL-RINGING TRANSFORMER.—The Thordarson Electric Manufacturing Company, 500 West Huron Street, Chicago, has placed on the market a bell-ringing transformer with a steel case.

INSULATING COMPOUND.—An insulating compound especially adapted for radio parts has been developed by the Marlanite Company, Barberton, Ohio.

ELEVATOR CONTROLLERS.—The Cutler-Hammer Manufacturing Company, Milwaukee, has issued bulletins Nos. 9,843 and 9,872, covering its elevator controllers for two-speed alternating-current motors, the former for squirrel-cage-type motors, and the latter for slip-ring-type motors.

PUSH-BUTTON.—A line of push-buttons in which all parts are made of metal except the terminal piece and button has been brought out by the Danbury Electric Manufacturing Company, Danbury, Conn.

MOTOR-GENERATOR SET.—The Commercial Electrical Supply Company, St. Louis, has placed on the market a motor-generator set for operating bells, horns and mine signals and for charging storage batteries.

SIGN RECEPTACLE.—The Gordon Electric Manufacturing Company, Waterville, Conn., has placed on the market a sign receptacle for ceiling holder work.

THERMAL RELAY.—The Automatic Reclosing Circuit Breaker Company, Columbus, Ohio, is distributing bulletin No. 402, describing its type "TR" thermal relay for control circuits not exceeding 6 amp. at 125 volts or 3 amp. at 250 volts. The company has also issued instruction sheet No. 36, giving instructions and part list for the type "J" reverse-current relays.

BOX-TOE STEAMER.—An electric box-toe steamer for treating leather in shoe factories has been placed on the market by the Watlow Electric Manufacturing Company, 1409 Pine Street, St. Louis.

PLATE HEATER.—The Even Heat Electric Company, 2429 Canton Avenue, Detroit, has added a single-plate heater for either 600 watts or 1,000 watts to its line of electrical appliances.

## New Incorporations

THE MISSISSIPPI POWER & LIGHT COMPANY, Calvert Building, Baltimore, Md., has been incorporated by George S. Newcomer, Douglas H. Rose and James Cary, 3d.

THE ARKANSAS-MISSOURI POWER COMPANY, St. Louis, Mo., has been incorporated with a capital stock of $350,000 by J. M. Moore, E. J. Badman and others.

THE INLAND POWER & LIGHT COMPANY, Portland, Ore., has been incorporated with a capital stock of $100,000 by Henry S. Gray, C. Larison and D. A. Evkman.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

PRESQUE ISLE, ME.—Plans, it is understood, are under consideration to increase the output of the electric plant of the Gould Electric Company.

GORHAM, N. H.—Work will soon begin on the foundations for the proposed two-unit hydro-electric plant to be built on the Androscoggin River by the Twin State Gas & Electric Company, to cost about $275,000.

BOSTON, MASS.—The Boston Insulated Wire & Cable Company plans to built an addition to its power house.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company has issued $468,000 in capital stock, the proceeds to be used for extensions and improvements.

NEW BEDFORD, MASS.—The New Bedford Gas & Edison Light Company has secured permission to issue $1,145,000 in bonds, part of the proceeds to be used for extensions and improvements.

WORCESTER, MASS.—The New England Power Company has issued $1,800,000 in bonds, part of the proceeds to be used for its proposed hydro-electric power project on the Deerfield River.

NEW BRITAIN, CONN.—The Board of Public Works contemplates the purchase of material for the underground conduit system on Broad Street, consisting of 25,000 ft. of 3½-in. single-tile duct, 25,000 ft. of 4-in. and 15,000 ft. 3½-in. fiber duct, fifty manhole fromes and 1,600 barrels of cement. The cost of the material is estimated at $25,000.

NEW HAVEN, CONN.—A permit has been issued to the Connecticut Company for an addition to its power house on Grand Avenue, to cost about $20,000.

## Middle Atlantic States

BATAVIA, N. Y.—The Western New York Utilities Company has taken out a new charter with capital stock of $950,000, allowing it to consolidate the company of the same name with the Genesee Light & Power Company. Extensions will be made in present power plants and systems.

FORT TOTTEN, N. Y.—Bids will be received by the Quartermaster, Torpedo Depot, until June 20, for 10 miles of submarine cable, one-conductor rubber-insulated and armored. (Post Artillery Specification 48-3.)

WESTVILLE, N. J.—Bids will be received by the Borough Council until June 20 for construction of a sanitary sewerage system, including an electrically operated sewage-pumping station.

CHESTER, PA.—A power house and machine shop will be erected in connection with the proposed brick-manufacturing plant to be erected at Bethel Road and the Baltimore & Ohio Railroad Company by a company now being organized by Samuel Addis, an official of the Chester Lumber & Coal Company. The cost of the plant is estimated at about $100,000.

FREEMANSBURG, PA.—The Pennsylvania Power & Light Company plans to build substation near here, to cost about $250,000, to supply electricity at Bethlehem and vicinity. A steel-tower transmission line will also be built.

HONESDALE, PA.—The Consolidated Power, Heat & Light Company, it is reported, is planning extensions and improvements to its system. The property was recently taken over by N. M. Seabrease & Company, Land Title Building, Philadelphia.

KINGSTON, PA.—The Glen Alden Coal Company, West Pittston, plans to build power house, 85 ft. x 90 ft., at its local Pettebone Colliery.

MILLERSTOWN, PA.—The Millerstown Borough Electric Corporation has been granted a franchise to install an electric light and power system.

PHILADELPHIA, PA.—The La France Textile Company, 4423 Frankford Avenue, plans to erect a power house at its mill.

PHILADELPHIA, PA. — Bids will be called for at once by the local supply officer, Navy Department, for four induction motors. (Aero Req. 1234.)

TWIN ROCKS, PA.—The C. A. Hughes Coal Company, Altoona, contemplates the installation of electric power equipment at its local properties, recently acquired from the Quality Coal Company.

LONACONING, MD.—The Georges Creek Coal Mining Company contemplates the installation of electric power equipment, with additional mining machinery, at the former properties of the American Coal Company, recently acquired, to cost $200,000. L. F. Gerdetz is engineer.

WESTON, W. VA.—The Weston Electric Light, Power & Water Company contemplates extending its transmission lines to furnish service at Halesville and vicinity.

WHEELING, W. VA.—The West Virginia Match Company, recently organized, plans to erect a power house at its proposed local plant, to cost about $100,000.

NEWSOMS, VA. — Contract has been awarded by the Newsom Light Company to construct a distributing system in the town and a transmission line.

NORFOLK, VA.—Plans are under way for the installation of an ornamental lighting system on Plume Street, consisting of thirty-four standards, to cost about $7,000.

YORKTOWN, VA.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 20, for power-plant equipment for the Yorktown naval station. (Specification 4826.)

WASHINGTON, D. C.—Bids will be received by the Department of Agriculture until June 12, for one transformer.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until June 15, for sixty dynamotor units (Proposal 14739-1 CP); also, until June 13, for 32,000 ft. submarine cable and cable reels (proposal 14623-1 CP).

## North Central States

DETROIT, MICH.—The Detroit Edison Company has issued $8,000,000 in bonds and $9,000,000 in capital stock, part of the proceeds to be used for extensions to its system. A transmission line will be erected to connect with the system of the Great Lakes Power Company.

GRAND RAPIDS, MICH.—The La Mar Pipe & Tile Company contemplates the installation of a power house at its proposed plant at La Mar, near Grand Rapids. J. Kent Wilson is general manager.

LIMA, OHIO.—The Ohio Power Company has purchased a site in Bath Township, where it will erect a substation, to cost about $100,000.

ORIENT, OHIO.—Bids will be received by the Department of Public Welfare, Administration Building, Columbus, until June 16 for furnishing material for a tunnel, piping and electric conduit in tunnel at the Institution for Feeble-Minded at Orient.

TORONTO, OHIO. — Preliminary work has been started for the proposed electric power project of the Pennsylvania-Ohio Power & Light Company on the Ohio River, near Toronto, to cost about $6,000,000. James D. Andrew, engineer, representing Stevens & Wood, Inc., is in charge of the work.

ELIZABETHTOWN, KY.—The Kentucky Utilities Company, Louisville, plans to extend its transmission line from Elizabethtown to Camp Knox., to cost about $25,000. G. T. Bogart is engineer for the company.

PINEVILLE, KY.—The Kentucky Utilities Company has awarded a contract to the Foundation Company, New York, for foundations and superstructure for its proposed local generating plant, to cost about $250,000.

GOSHEN, IND.—The Interstate Public Service Company, which controls the Hawks Electric Company, plans to double the capacity of the generating plant, at a cost of about $200,000. Arrangements are being made by the company to erect a transmission line to the proposed hydro-electric plant to be built at Mottville, Mich.

INDIANAPOLIS, IND.—Electric power equipment will be installed in the proposed milling plant to be constructed by the Perins Mills, Inc., Emerson Avenue to cost about $250,000.

MOUNT VERNON, IND.—The Southern Indiana Gas & Electric Company has applied to the Public Service Commission for permission to purchase the property of the Mount Vernon Electric Light & Power Company.

PEORIA, ILL.—The Illinois Central Light & Power Company has awarded a contract to the Foundation Company, New York, for foundations and superstructure for a local generating plant, to cost about $600,000.

ROCKFORD, ILL.—Extensions are being made to the plant of the Rockford Electric Company, to cost about $700,000. The work will include an addition to power station, installation of a new boiler, a 3,000-kw. generator, 3,500-hp. engine, switchboard, etc.

ASHLAND, WIS.—Steps have been taken by the Lake Superior District Power Company to secure the right-of-way for the erection of its proposed high-tension transmission line from Ashland to Hurley, a distance of about 35 miles.

FOND DU LAC, WIS.—Preliminary plans are being prepared by R. E. Schmidt, Garden & Martin, engineers, 104 South Michigan Avenue, Chicago, for power house and equipment, to cost about $45,000, for the St. Agnes Hospital.

MADISON, WIS.—Plans are being prepared by the Chicago & Northwestern Railway for a power house and machine shop, to cost about $150,000. A. W. Bowers, 201 South Blair Street, is divisional agent.

MASON, WIS.—The Mason Light & Power Company is planning to change its distribution system from direct to alternating current. Improvements will also be made to the power house, dam, etc.

MENASHA, WIS.—The City Council is considering the installation of an ornamental lighting system for a distance of 3 miles along the state highway from Menasha to Appleton. It is proposed to have the cities of Menasha and Appleton and the town of Menasha co-operate in connection with the installation and upkeep of this system.

SHEBOYGAN, WIS.—Extensive improvements are being made to the local electric plant by the Eastern Wisconsin Electric Company, to cost about $180,000. The work will include an addition to power station, the installation of a new boiler and accessories. Orders, it is understood, have been placed for the equipment.

CAMERON CITY, MO.—The City Council is considering calling an election to vote on the proposal to issue $150,000 in bonds, of which the proceeds of $133,300 will be used for improvements to the electric light and water systems.

JOPLIN, MO.—A special election will be held on June 19 to vote on the proposal to issue $80,000 in bonds for improvements to the street-lighting system and the city fire department.

STOCKTON, MO. — G. B. Steward and associates are organizing a company to construct and operate a hydro-electric power plant on the Sac River, with transmission system for service in this district. Russell & Axon, 404 McDaniel Building, Springfield, Mo., are engineers.

MADISON, S. D.—Steps have been taken by the Kiwanis Club for the erection of a transmission line from the city to Lake Madison to supply electricity to the Chautauqua camping grounds.

ADAMS, NEB.—The proposal to erect a transmission line has been approved by the voters. The Town Council will enter into a contract with the Blue River Power Company, Seward, to furnish electricity to operate the municipal electric system.

OMAHA, NEB.—The Metropolitan Utilities District will build an addition to its power house at Florence, including the installation of additional equipment.

WINFIELD, KAS.—The installation of electrically operated pumping machinery in connection with extensions to the municipal waterworks is under consideration by the City Commission, and $112,000 in bonds have been voted.

## Southern States

LENOIR, N. C.—The State Legislature has appropriated $300,000 for improvements to the Appalachian Training School, to include a larger power plant, a laundry, cold storage, building for physical educational work, etc.

SPARTANBURG, S. C.—The Arcadia Mills., Inc., plan to build a power house in connection with their proposed new textile mill, to cost about $200,000.

SUMTER, S. C.—The O. L. Williams Veneer Company contemplates the construction of a power house at its proposed local factory, to cost about $100,000.

BLOUNTSTOWN, FLA. — The Florida Orchard & Packing Company, Thomasville, Ga., plans to build a power house in connection with a new fertilizer manufacturing plant near Blountstown, to cost about $100,000.

GROVELAND, FLA. — The Groveland Light, Power & Ice Company has completed plans for the construction of a power plant to cost about $80,000.

ATHENS, TENN.—The Tennessee Electric Power Company, Chattanooga, has been granted a franchise to construct an electric power plant and distributing system in Athens.

CHATTANOOGA, TENN. — The City Water Company plans to install electrically driven pumping machinery, auxiliary apparatus and new automatic stokers at its plant at Citico, near Chattanooga.

KNOXVILLE, TENN.—Plans are being prepared for a new power house for the Tennessee School for the Deaf and Dumb, to cost about $55,000.

MEMPHIS, TENN.—Plans for extensions and improvements to the municipal waterworks, for which $1,500,000 in bonds have been voted, include electrically operated pumping machinery.

MONTEREY, TENN.—The Putnam Mining Company, Cookeville, Tenn., contemplates the installation of electric power equipment at its local properties.

BESSEMER, ALA. — Steps have been taken for the installation of an ornamental lighting system in the business district.

CHILDERSBURG, ALA.—The Childersburg Brick Company, recently formed, plans to build a power house at its proposed local plant, to cost about $100,000.

ELBA, ALA.—W. H. Cauley is planning to rebuild his power house and sawmill, recently destroyed by fire.

HATTIESBURG, MISS.—The Acme Oak Flooring Company contemplates the installation of a power house at its proposed local mill, to cost about $100,000. D. P. N. Hackney is head.

LITTLE ROCK, ARK.—The Arkansas Central Power Company has plans under way for the construction of an addition to its power plant, to cost about $75,000.

TILTON, ARK.—The T. J. Moss Tie Company, Security Building, St. Louis, contemplates the installation of a power house at its new lumber and sawmill at Wrape's Spur, near Tilton.

SHREVEPORT, LA. — Plans have been abandoned for the proposed municipal electric power plant.

McALESTER, OKLA.—The installation of electrically operated pumps in connection with extensions to the municipal waterworks is under consideration, and $375,000 in bonds have been voted.

COLORADO CITY, TEX.—The Tubbock Cotton Oil Company will install electric power equipment at its proposed new plant, to cost about $200,000.

DALLAS, TEX.—Plans have been approved for an ornamental lighting system on Knox and Travis Streets, for which bids will soon be asked.

SAN ANTONIO, TEX.—Tentative plans have been prepared by the San Antonio & Rio Grande Valley Traction Company for the construction of a hyro-electric plant on the San Miguel River, to cost about $300,000.

WILLS POINT, TEX.—Bonds to the amount of $25,000 have been voted for improvements to the electric light system. L. Gilmore is city secretary.

## Pacific and Mountain States

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 12, for two transformers (Schedule 880), and for one switchboard (Schedule 881), for the Puget Sound Navy Yard.

SEATTLE, WASH.—The City Council has authorized an issue of $2,500,000 in bonds for extensions and improvements to the City Lighting Department as follows: Line extensions in residence districts, $385,000; installation of new services, $727,000; placing wires underground in the business district, $200,000; replacing four small generators with one 12,500-kw. generator at the Cedar Falls plant, $400,000; building warehouse, $250,000; substation at Spokane Street, $318,000; sealing operations at Cedar River basin, $100,000. The Council also authorized the sale of $1,000,000 of the Skagit bonds to complete the first unit of the hydro-electric project and also voted an appropriation of $40,000 to purchase the site for the substation on Spokane Street and Fourth Avenue.

OREGON CITY, ORE.—Contract has been awarded by the Hawley Pulp & Paper Company for the construction of an additional power plant, to have a capacity of

1,200 hp. The cost of the building is estimated at $100,000.

PORTLAND, ORE.—Grant Smith & Company, Portland, have filed two applications with the state engineer covering two power sites on the Deschutes River, one in Sherman County and the other in Wasco County. At the Sherman County site it is proposed to develop 40,000 hp., and about 29,000 hp. will be developed at the Wasco County site. The cost of the two projects is estimated at $8,000,000.

ANTIOCH, CAL.—The Pacific Gas & Electric Company has authorized an appropriation of $227,350 for the construction of the South Tower and Herdlyn transmission lines in Contra Costa County.

LIVERMORE, CAL.—The Pacific Gas & Electric Company has authorized the construction of two new transmission lines in Livermore Valley.

LOOMIS, CAL.—The Pacific Gas & Electric Company, San Francisco, contemplates the installation of an electric distributing in Loomis, to cost about $25,000.

LOS ANGELES, CAL.—Ordinances have been passed providing for the installation of ornamental lighting systems on Canal and Cahuenga Avenues, for which bids will soon be called.

OILDALE, CAL.—Steps have been taken by the Oildale Improvement Club toward the formation of a lighting district.

SAN DIEGO, CAL.—The Consolidated Gas & Electric Company plans to issue $1,438,000 in bonds and $674,400 in capital stock, part of the proceeds to be used for extensions and improvements.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company is planning to erect a large substation, known as "J," in the heart of the financial district. It will eventually be equipped with eight 2,600-kw. rotary converters.

SAN JOSE, CAL.—Bids will soon be called for the construction of a power plant at the Santa Clara County Hospital, to cost about $90,000. Binder & Curtis, South First Street, are architects.

LOGAN, UTAH.—Bonds to the amount of $300,000 have been voted to rebuild the municipal electric light plant in Logan Canyon.

## Canada

NELSON, B. C.—Surveys are being made for the proposed transmission line extension of the municipal electric system from Nine-Mile on the Ainsworth to the Florence Silver Mining Company. The cost is estimated at $25,000.

SMITHERS, B. C.—The Federal Mining & Smelting Company, 120 Broadway, New York, contemplates the installation of electric power equipment at its local properties.

VANCOUVER, B. C.—Preparations are being made to make surveys of the Squamish, Cheakamus, Pitt, Lillooet, Chehalis, Chillwack and Bridge Rivers and the Harrison Lake district with a view of securing estimates of cost of establishing a municipal hydro-electric plant.

LARDER LAKE, ONT.—The Associated Canadian Goldfields Company, Ltd., according to *Commerce Reports*, contemplates the construction of a hydro-electric plant at Wendigo Falls. Plans for the initial installation provide for 2,500 hp.

SHEFFIELD, ONT.—The Hydro-Electric Power Commission is planning to erect a transmission line from Lynden to Sheffield.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario has applied to the City Council for permission to erect a new steel-tower transmission line along the water front from Humber River to Strachan Avenue.

TORONTO, ONT.—The Provincial Government has appropriated $12,687,000 to cover work planned for the year by the Hydro-Electric Power Commission of Ontario as follows: Niagara System, for completing the Queenston plant and new transmission lines, $9,850,000; Muskoka system, additions to plants and new equipment, $360,000; Rideau system, maintenance and repairs, $20,000; Thunder Bay system, new units at Cameron Falls; Nipigon River, transmission lines, etc., $1,086,000; Central Ontario system, largely to cover new plant at Dam 8 on Trent River, $375,000; Nippissing system, storage works and auxiliary, $17,000; Essex system, transmission line, $50,000; investigation of second Queenston-Chippewa development, $50,000. F. A. Gabey is chief engineer.

MONTREAL, QUE.—The Southern Canada Power Company is planning the construction of an additional hydro-electric plant on the St. Francis River at Hemmings Falls, to develop 30,000 hp.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued May 15, 1923)

1,455,462. ELECTRIC RESISTANCE; O. Weeber, Berlin, Germany. App. filed April 10, 1918. For wireless tubes.

1,455,467. STREET INDICATOR; W. A. Wilson and S. Wilson, Vancouver, B. C. App. filed July 15, 1921. For trolley cars.

1,455,476. HOLDING OR SUPPORTING MEANS FOR RADIUM APPLYING MEANS; W. H. Cameron, Pittsburgh, Pa. App. filed Feb. 21, 1922.

1,455,572. ELECTRICAL SYSTEM; C. S. Cook, Pittsburgh, Pa. App. filed Oct. 30, 1916. Automatic railway substation.

1,455,578. TROLLEY COLLECTOR; P. T. J. Estler, London, England. App. filed May 2, 1922. Two trolley poles, one mounted above the other, for trackless cars.

1,455,592. PORTABLE LAMP; W. F. Lent, New Haven, Conn. App. filed March 24, 1921.

1,455,618. MOTOR-CONTROL SYSTEM; H. D. James, Edgewood Park, Pa. App. filed March 13, 1920. Dynamic braking.

1,455,638. FIRELESS COOKER AND HEATER; M. J. McFarlane, New Orleans, La. App. filed March 8, 1921. Has electric element.

1,455,668. MOTOR-CONTROL SYSTEM; G. B. Scheer, Berkeley, Cal. App. filed June 22, 1922. Insures dynamic braking upon failure of power supply.

1,455,717. ENGINE-STARTING SYSTEM; J. K. Delano, New York, N. Y. App. filed May 11, 1918. Motor-generator for automobiles.

1,455,735. RHEOSTAT; F. A. Rojas, New York, N. Y. App. filed March 23, 1922. Compressible resistance type.

1,455,747. ELECTRIC PROCESS OF CONTINUOUSLY HEATING METAL; A. E. Greene, Seattle, Wash. App. filed April 22, 1920. Superheating molten metal by passing through electrically heated furnace chamber.

1,455,748. ELECTRIC INDUCTION FURNACE; A. E. Greene, Seattle, Wash. App. filed Feb. 24, 1920.

1,455,767 and 1,455,768. WIRELESS RECEIVING SYSTEM; J. Slepian, Swissvale, Pa. App. filed Jan. 20, 1922. Responsive to signal from damped or undamped systems without heterodyning step.

(Issued May 22, 1923)

15,613 (reissue). SIGN FLASHER; J. H. Wheelock, Fitzwilliam, N. H. App. filed May 11, 1917. Contactors on motor shaft.

1,455,769. MACHINE SWITCHING TELEPHONE SYSTEM; R. C. Arter, Galion, Ohio. App. filed June 7, 1920. Relates to telephone systems, and particularly to the selecting and switching circuits.

1,456,781. ELECTRICAL CONDENSER; W. Dubilier, New York, N. Y. App. filed Dec. 7, 1921. One microfarad condenser composed of twenty units.

1,456,795. MEANS FOR CONTROLLING A PRODUCTION PROCESS; L. Logan, Pittsburgh, Pa. App. filed Dec. 20, 1920. Control scheme involving light cell to actuate a relay.

1,456,811. METHOD OF UNITING METAL PLATES; J. C. Sander, Lynn, Mass. App. filed May 10, 1920. Welding a thick and thin plate.

1,455,817 and 1,455,818. TELEPHONE OR OTHER SOUND RECEIVER; L. Steinberger, Brooklyn, N. Y. App. filed Jan. 21, 1921. Equalization of air pressure on both sides of diaphragm.

1,455,827. SELECTIVE CIRCUIT FOR MULTIPLEX TRANSMISSION; H. A. Affel, Brooklyn, N. Y. App. filed Sept. 24, 1919. Several signals transmitted over grounded conductor such as submarine cable.

1,455,842. IMPLEMENT FOR WRITING; W. F. Kelly, Greenwood, Miss. App. filed March 23, 1922. Heated marking element.

1,455,843. SYSTEM FOR MEASURING DISTORTION; M. Kirkwood, East Orange, N. J. App. filed Feb. 7, 1920. For telephone systems.

1,455,845. MODULATED SIGNALING SYSTEM PARTICULARLY APPLICABLE TO WIRELESS SIGNALING; N. Lea, London, England. App. filed May 2, 1921. Amplifying apparatus.

1,455,895. ELECTROMECHANICAL BRAKE; E. B. Thurston, Toledo, Ohio. App. filed Nov. 12, 1923. For elevators.

1,455,896. WIRELESS TELEGRAPH RECEIVER; L. B. Turner, Cambridge, England. App. filed Feb. 9, 1921. Method of increasing speed of receiving telegraph signals.

1,455,903. RHEOSTAT; W. G. Clark, Oak Park, Ill. App filed May 9, 1921. For railway motors.

1,455,909. ELECTRIC COOKER AND HEATER; G. O. Ditton, Lanoka, N. J. App. filed Aug. 16, 1921.

1,455,938. SIGNAL LANTERN; F. J. Rode R. I. Frost and J. L. Liston, Augusta, Kan. App. filed April 21, 1921. Any one of several different colored lights may be projected.

1,455,951. SEMI-AUTOMATIC TELEPHONE SYSTEM; B. D. Willis, Chicago, Ill. App. filed May 31, 1919. Two-way trunk circuit between manual and automatic exchanges.

1,455,954. TELEPHONE SYSTEM; G. A. Yanochowski, Chicago, Ill. App. filed April 25, 1917. Link circuits having automatically ringing secret service.

1,455,957. REPEATER SYSTEM; E. D. Johnson, East Orange, N. J. App. filed Jan. 18, 1918. One-way repeater reversibly connected for two-way transmission of signals.

1,455,958. SIGNALING SYSTEM; E. D. Johnson, East Orange, N. J. App. filed Jan. 24, 1918. Automatic repeater for telephone lines.

1,455,998. CALLING DEVICE ATTACHMENT; F. W. Fahrenfeld, Chicago, Ill. App. filed May 1, 1920. Dial for automatic telephone system.

1,456,033. ELECTRIC STARTING AND GENERATING APPARATUS; W. B. Moses, Portland, Me. App. filed March 30, 1917. For automobiles.

1,456,059. SIGNALING SYSTEM; E. D. Johnson, East Orange, N. J. App. filed Jan. 18, 1918. Automatic repeater for telephone lines.

1,456,076. MEASURING AND TESTING OF INDUCTANCES; C. W. Robbins, La Grange, Ill. App. filed June 18, 1921. Apparatus for measuring telephone loading coils.

1,456,081. ELECTRIC REGULATOR; W. A. Turbayne, Niagara Falls, N. Y. App. filed July 17, 1919. Dead-beat and sensitive to small changes.

1,456,082. MOTOR DRIVE; H. E. Warren, Ashland, Mass. App. filed Sept. 1, 1920. For synchronous motor-driven secondary clocks.

1,456,084. SUPPORT FOR OVERHEAD WIRES OF ELECTRIC RAILWAYS; H. Westphal, Berlin, Germany. App. filed Oct. 7, 1922. Clamping car.

1,456,091. ELECTRICAL APPARATUS FOR ILLUMINATING AND DECORATING CHRISTMAS TREES AND SIMILAR USES; J. H. Betts, Brightwater, N. Y. App. filed Feb. 12, 1919.

1,456,092. DYNAMO-ELECTRIC MACHINE; J. L. Burnham, Schenectady, N. Y. App. filed Oct. 30, 1920. Provided with anti-sparking windings.

1,456,100. TIME-ELEMENT CIRCUIT CONTROLLER; J. Eaton, Schenectady, N. Y. App. filed Jan. 15, 1920. If voltage fails device holds motor switch in until motor speed drops to predetermined value.

1,456,104. DEMAND METER; C. I. Hall, Fort Wayne, Ind. App. filed Oct. 6, 1919. Mechanical means for resetting pointer.

1,456,107. ELECTRIC RESISTANCE FURNACE; C. L. Ipsen, Schnectady, N. Y. App. filed May 28, 1921. Support for ribbon elements.

1,456,108. COIL AND SPOOL CONSTRUCTION; S. E. Johannssen, Pittsfield, Mass. App. filed Feb. 6, 1920. Method of forming coil on spool.

1,456,110. SEAL FOR ELECTRIC DEVICES; G. M. J. Mackay, Schenectady, N. Y. App. filed Jan. 21, 1921. Lead-in terminal for airtight apparatus.

1,456,120. MAGNET FRAME; J. Burke, Erie, Pa. App. filed Nov. 6, 1919. Frame to hold field coils for electrical machinery.

1,456,141. ELECTRIC HEATER; C. H. W. Morrison, London, England. App. filed July 10, 1922. For heating small quantities of liquid or semi-liquid substances.

1,456,148 and 1,456,149. RECORDING APPARATUS FOR VALVES AND THE LIKE; C. E. Renshaw, East Orange, N. J. App. filed July 29, 1919. Apparatus to show whether valve is opened or closed.

1,456,172. TELEPHONE SYSTEM; G. A. Yanochowski, Chicago, Ill. App. filed Jan. 16, 1919. Apparatus and circuits for connecting links.

1,456,194. COMBINATION FLOOR LAMP, TABLE LAMP AND PEDESTAL; J. Rosenberg, Chicago, Ill. App. filed Jan. 9, 1922.

1,456,223. ELECTRICAL BLANKET AND THE LIKE; W. F. Craddock and C. M. Uhlig, Chicago, Ill. App. filed April 7, 1922. Element woven into blanket.

1,456,267; VARIOMETER; H. P. Donle, Meriden, Conn. App. filed Feb. 17, 1922. Two coils on same axis rotatable in regard to each other.

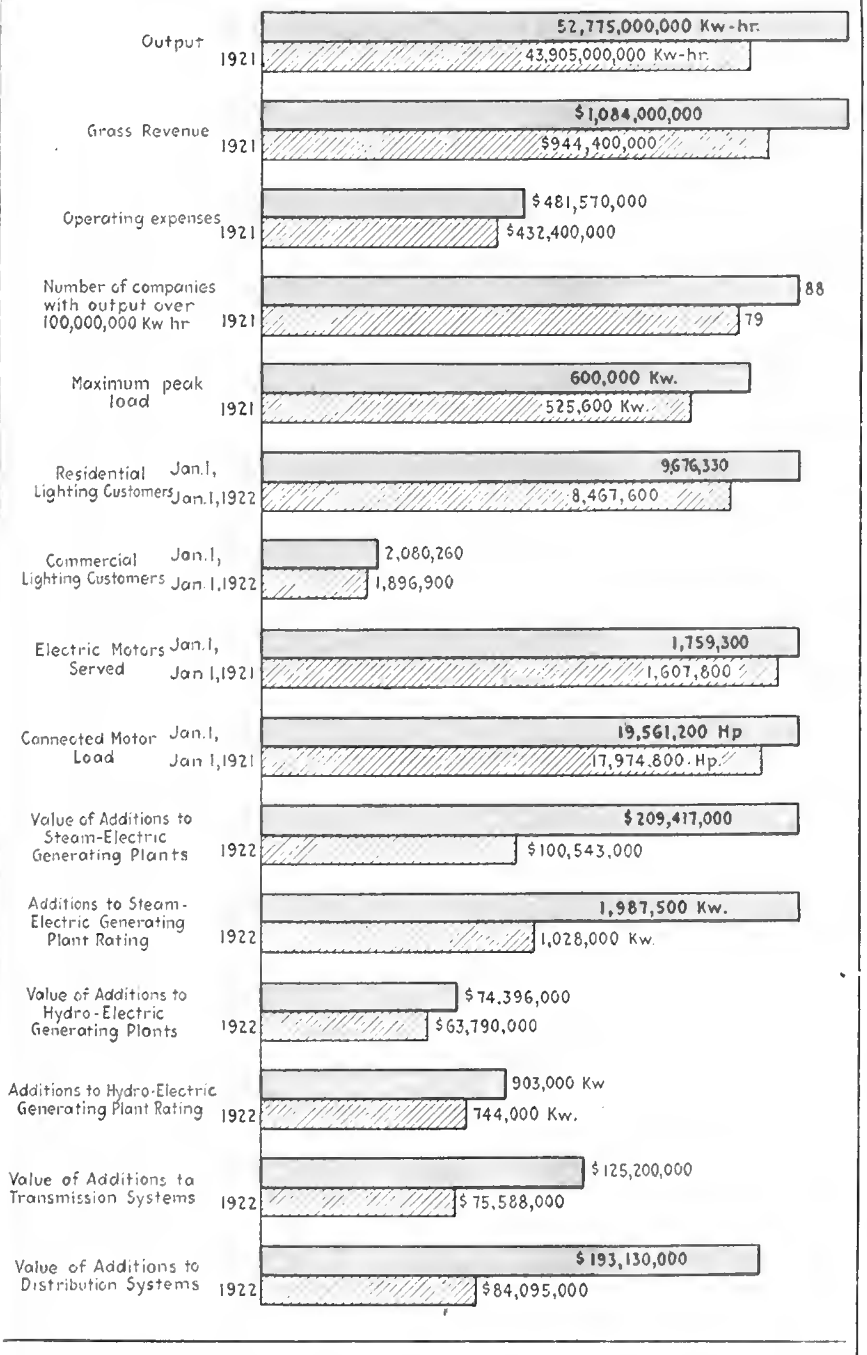
1,456,282. ALTERNATING-CURRENT ELECTRIC BELL; C. J. Rohland, Seekonk, Mass. App. filed April 12, 1916.

1,456,285. THERMOSTATIC LAMP-DIMMING PULL SOCKET; R. D. Smith, Milton, Mass. App. filed Nov. 3, 1920.

# Business Facts for Electrical Men

Selected Statistics Presented Graphically for
the Use of All Interested in Analyzing the
Trend of the Electrical Business

## High Lights in the Central Station Industry




Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those using these statistics would credit the ELECTRICAL WORLD.

## The Vision of the Future

*"We will not anticipate the past. Our retrospection will be all to the future."*

THE electric light and power industry is essentially an industry with all the future anticipations of youth—of a young athlete fresh from a long period of intensive training and brilliant accomplishments, fully ready and anxious to conquer the problems of the future with every expectation of a successful issue.

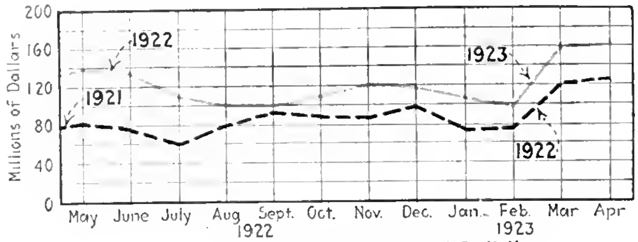
The group of America's servants which met in convention during the past week represented every phase of the industry and every section of the country. They are proud of their past—of the way they have kept faith with the public, of their accomplishments in overcoming inefficient generation, transmission and distribution of electrical energy, of the enviable place which the industry has assumed in the financial world, and of the general growth in operations during the first forty years of the industry's life. They feel themselves standing upon a foundation which is as solid as the very nation itself.

But while these men and the great industry they represent feel a legitimate pride in that which has been accomplished, it is on the future that all eyes are focused. What of it? What are the problems which will have to be met and solved if the industry is to continue triumphant on its way? Will the present rate of growth continue, and, if so, how long?

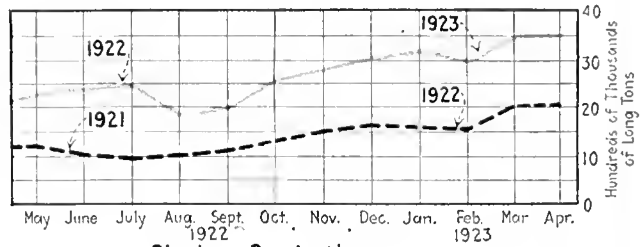
The answers to these questions are shrouded in the uncertainty of human events and the adaptation of electrical energy to new fields of usefulness. But much may be judged by a retrospective glance at the industry's growth. The theory of probabilities can be brought into play and the future to a certain degree can be foretold. Such prophecies, if not extended too far into the future, are permissible. Indeed, they are necessary if effort is to be crowned with success.

The industry should without doubt live in the future, but the past should ever serve as a guide to the unseen problems which are sure to be encountered as history unrolls.

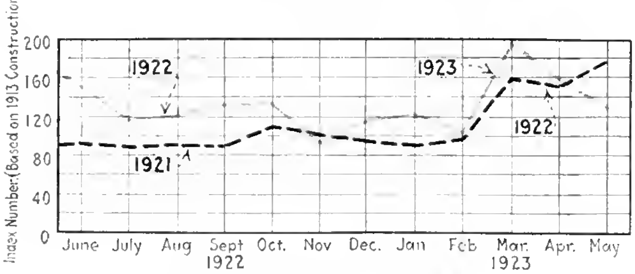
# How the Primary Industries Are Trending



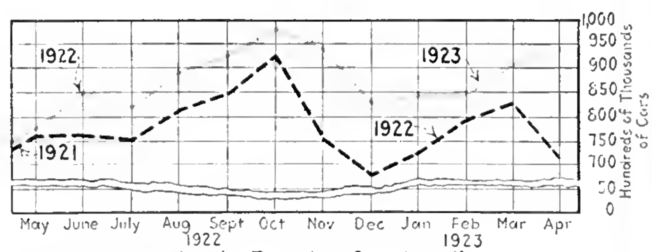

Contracts Awarded for Residential Buildings



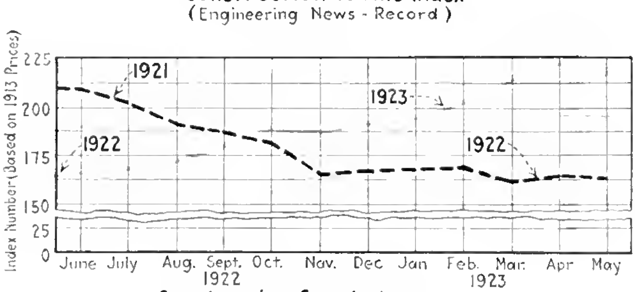

Pig-Iron Production



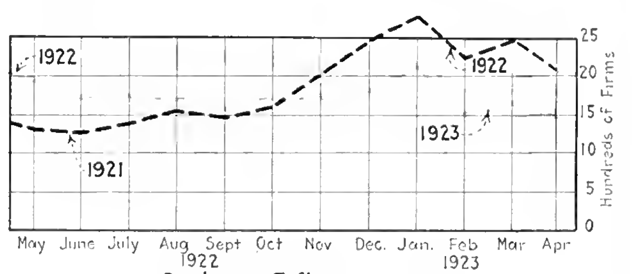

Construction Volume Index
(Engineering News - Record)



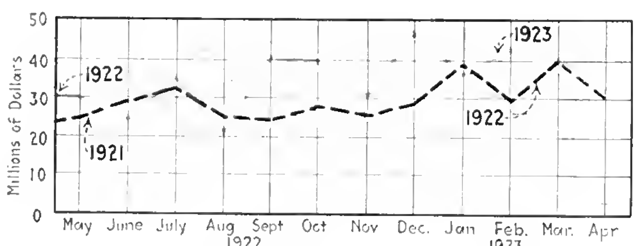

Total Average Weekly Freight-Car Loadings



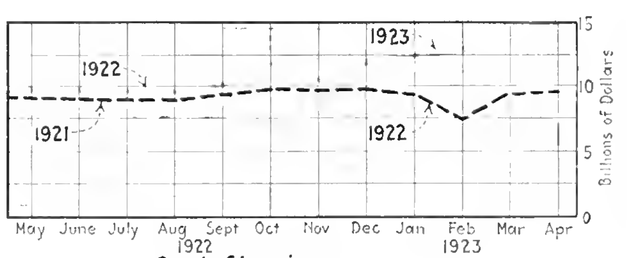

Construction Cost Index
(Engineering News-Record)



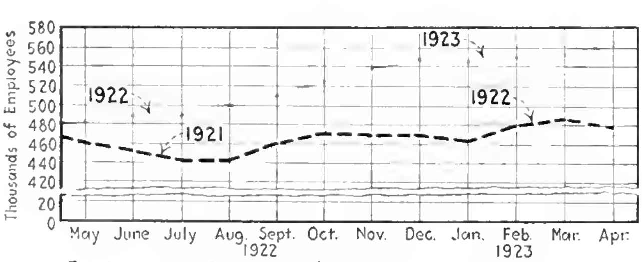

Business Failures



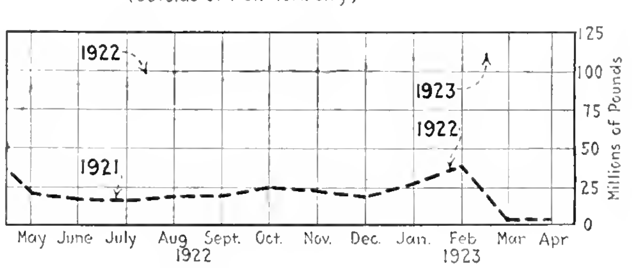

Fire Losses



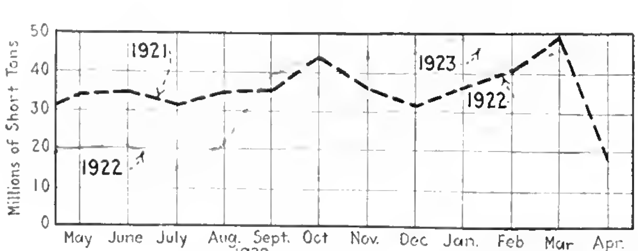

Bank Clearings
(Outside of New York City)




Employees in Factories of New York State




Copper Production




Bituminous Coal Production

## Volume of Construction on the Decrease

High cost of materials and increased wage demands of labor are very definitely reflected in the slump in the volume of new construction reported during March and April. Reports are that this slump will be even more emphasized during May. Decreased cost of materials during April was the natural result of a decreased volume of construction. In other words, the holding back of new construction seems to be obtaining the desired results—decreased construction cost.

# Electrical World

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# Public Relations—Close Up

THE topic upon everybody's tongue at the great convention in New York was public relations. Public utility men, central-station executives were all talking about it. The problem of serving the public heartily and of intelligently interpreting this service to the public received the most conspicuous attention.

Public relations has come to be a very big thing in the light and power business. But really public relations is not one big thing at all. It is a very great many little things.

OUT in Omaha, as an example, the Nebraska Power Company believes that the secret of public relations is to take care of customers when they are in trouble. And so it maintains a staff of motorcycle men to answer trouble calls, just as many other companies do. But as Vice-president J. E. Davidson puts it: "It isn't so much what you do as the way the thing is done that registers with the public." Therefore the Omaha company has made it the objective in these trouble calls not only to go and straighten out the troubles but to surprise and please the customer with the spirit of the service.

A telephone call comes to the Nebraska Power Company's switchboard. Mrs. Ray is giving a party and the lights have gone out. "I'm awfully sorry!" says the girl; "I'll send a man at once"—a sympathetic and personal response.

The two best troublemen are on duty at night, so placed and trained that any residence in town can be reached within ten minutes. In five minutes perhaps a motorcycle thunders up, the doorbell rings, and the Nebraska Power man is there, expresses sympathy, renews the fuse, asks if there is anything else that he can do and leaves.

He makes the same fast time back to his post and reports to the switchboard girl. In, say, about eight minutes after Mrs. Ray has thanked him and closed the door her telephone rings. It's the Nebraska Power girl, still much concerned. "Has our man arrived? He has? I'm so glad! Is everything all right? Can we do anything more?" In short, within, say, twenty minutes the man has come and gone and all is well and a sweet voice from the company has followed up, full of concern. And every call makes one more friend.

SUCCESS in building up good public relations is the good relationship between the individual representatives of the company and the individual customers. But we the public utility employees are naturally absorbed in our own work and apt to be forgetful of these little incidental courtesies. And we the people are no less absorbed in our own affairs and apt to accept these services as a matter of course and also to be supercritical. The maintenance of harmony in all these contacts is therefore not only an important but a very difficult responsibility.

Public relations everywhere and every day depend on putting extraordinary heartiness and helpfulness into the ordinary human intercourse between all the men and women of the company and all the men and women of the city. It is not done, it never will be done, unless the chief executive of the utility makes it his own concern and leads and guides in both the planning and the performance of it.

# Ray Palmer

*A man who as consulting electrical engineer, head of metropolitan department and president of a great central-station system has achieved a triple success.*

RAY PALMER, president of the New York & Queens Electric Light & Power Company, which serves 108 square miles of territory in New York City, was formerly Commissioner of Gas and Electricity of Chicago and in that capacity evolved and completed what has been termed the most nearly perfect system of municipal lighting in the world. In addition he reorganized the Department of Gas and Electricity into separately working divisions of electric wiring and repairs, operation and maintenance, engineering and construction, lighting, fire alarm and electrical inspection, which resulted in a large saving to the city. Mr. Palmer fought incessantly for the passage of an ordinance to combat electrolysis which was opposed by the street and elevated railways but was finally passed. It conferred many benefits and saved the city and the public utilities, as well as the owners of steel structures, a large sum of money each year. He also fought for reasonable regulation of public utility rates. After resigning from the position of Commissioner of Gas and Electricity, Mr. Palmer practiced as an electrical engineer in Chicago for a short time until on Nov. 1, 1915, he was chosen vice-president and general manager of the New York & Queens company. He was advanced to the presidency Sept. 19, 1916.

Mr. Palmer was born in Sparta, Wis., March 29, 1878, and was graduated from the University of Wisconsin in 1901 as an electrical engineer. He was for a time assistant superintendent for J. G. White & Company on substation installation work in New York City, and after the completion of this work he continued on the firm's engineering staff in London, England. He was later appointed electrical engineer of the Union Traction Company of Chicago, but left that organization to open an office as a consulting engineer in Chicago and Milwaukee and continued in private practice until his appointment by Mayor Carter Harrison to head the Chicago Department of Gas and Electricity. This appointment was entirely unsolicited and came as a surprise to Mr. Palmer, who had had no thought of holding public office and was able to work for the good of the city as he saw it without being trammeled by political obligations.

Mr. Palmer is a fellow of the American Institute of Electrical Engineers and a member of the Illuminating Engineering Society, the National Electric Light Association, the New York Electrical Society, the Engineers' Club of New York, the Engineers' Country Club, the Flushing Country Club and the Bayside Yacht Club.

# Editorial Comment

Electrical World, June 16, 1923

Volume 81 Number 24

### A National Survey of Electric Service

AN EXCELLENT suggestion for satisfying the millions of users in this country that the electric light and power companies mean to give the best possible service was made by M. H. Aylesworth at the convention of the National Electric Light Association last week. Carried out in the right spirit, a country-wide survey ought to work wonders for the industry nationally just as it has locally whenever and wherever it has been tried. To get acquainted with each customer, ascertain his wants, and to show by word and deed an interest in him cannot but result in fostering a spirit of good will. Of course, all depends on how the thing is done. The idea will "go over big" if the utilities go about it frankly and honestly for the good of the service. The value of good public relations is generally conceded, and Mr. Aylesworth's suggestion not only comes at an opportune time but has advantages that loom greater and greater the more one considers it. We are glad that the plan is to be carried out under the direction of the Public Relations National Section of the N. E. L. A. and with the active co-operation of the Commercial Section. It is worth all the effort that can be put in it.

### One Million Words! How Many Will Be Effective?

A FAIR estimate of words spoken in the regular convention program last week would surely approach the million mark. Think of the stenographic service—to say nothing of the mental effort of the speakers! Is it all to good purpose? That depends on how many words were caught—how many ideas will be applied. It behooves every one to utilize them to the utmost!

### The Medal of the Southern California Edison Company

IT IS particularly gratifying that the first medal awarded by the Coffin Foundation should be given to the Southern California Edison Company of Los Angeles. We doubt whether in the short time at its disposal the committee could have reached such a decision were the company not generally recognized as one of the most progressive and enterprising in the world. This applies to its executive, engineering, operating and business departments. The company's program for water-power development is far-sighted and mapped out ten years in advance. Its transmission lines operate at the highest voltages in use. In the matter of public relations the Southern California Edison Company has been a leader in the industry, and as for popularizing the use of electricity few companies can approach its record for household saturation. Its customers as well as its employees have bought freely of its securities and in the last election fought valiantly in its defense. This, after all, is the best evidence of a company's standing and worth in the community.

The Southern California Edison Company has shown commendable faith in the people of California and has well deserved the honor bestowed on it. The whole industry takes pride in its accomplishments.

### On a Partnership Basis

A PREDICTION that within three years' time a million of their customers will own securities of the light and power companies was made in the report of the customer-ownership committee of the National Electric Light Association. With more than 425,000 customer-owners added as investors in these securities, and with the astounding growth and popularity of the movement, such a prediction would seem to be conservative. What a remarkable vista opens to the utilities under these conditions! Financing from local territories in quantities as needed and at low rates is only the least of the things gained. Public relations are sure to be improved by the association of customers with the utilities, and the utilities to be inspired to new heights of efficiency by the knowledge that, through security ownership, their customers are part and parcel of the organization and will, as partners, keenly scrutinize its work.

This whole movement is one of those miracles that occur in the electrical industry at needed intervals to revive and reinspire it and further its progress toward the goal of an electrified America with all the incidental high standards of living that this implies. The leadership that grasps these constructive ideas and carries them through to success cannot fail to safeguard the movement and guide it along proper channels. Vision is lacking to predict the ultimate consequences of the great partnership now under way, but its conception is sound, its principles are correct and its ideal is good. The industry will reap as it sows.

### "Electrifying" a River

WHEN the Davis Bridge hydro-electric plant of the New England Power Company shall be placed in operation some months hence another important step will have been taken in conserving the waters of the Deerfield River for the benefit of power users within transmission distance of this noted little stream. Readers of the article by Messrs. Eaton and Collins which describes this development will do well to study the profile diagram of the Deerfield and to note how logically the hand of the engineer is carrying forward what might be called the "electrification" of the river. Running south from the hills of Vermont and east from

the Berkshires of Massachusetts, this representative "flash" stream is being made to yield energy at every strategic point, so that when the program is completed no less than 110,000 kw. will be produced in a watershed of 550 square miles. Stabilization of flow through large reservoir construction at two places, combined with skillful development of heads on the way down the valley, tells the story.

The Davis Bridge station will be the largest on the system, surpassing even the Vernon plant on the Connecticut River. Instead of being regularly tied in with the adjacent 66,000-volt transmission lines of the company, it will be directly connected with the load center of the system near Worcester, Mass., by a 110,000-volt trunk line nearly 80 miles long. Flexibility and efficiency of operation, however, will be increased by autotransformer interconnection at Davis Bridge with the 66,000-volt ring transmission lines into which the other hydro-electric stations regularly feed. The hydraulic and electrical features of the development contain many points of interest, but in considering these details the relation of the development to the system as a whole and to the river itself should not be overlooked. The Deerfield program as a whole, when completed, will save New England about half a million tons of coal a year—an example of conservation reflecting great credit upon the financial and engineering interests which are working out this praiseworthy achievement.

## Know the "Curbstoner" Better and Lift Him Up

IT IS said that 60 per cent of the wiring that is done in America is installed by small contractors who are not really organized into the electrical industry through membership in any association. They are "curbstoners" and other small contractors who have not felt the responsibility and the opportunity of the industry in the mass sense. They have not felt the impulse to affiliate with other contractors to promote co-ordination and co-operation in their calling. Here is a matter that deserves the very serious consideration of every one who is working to strengthen and build up at some point progressive organization among electrical men.

These small contractors are vitally important. They form the skirmish line for both the manufacturer and the jobber whose products must ultimately be sold to and installed in the homes and business places of the people. They provide a most intimate contact between the electrical industry and the public, but they are for the most part concerning themselves but little with any of the broader purposes of the industry. They are not thinking with the rest of us. They are not working with the rest of us. And so this great, active force of workers is not tied in and is not being applied.

There is much to be done in the interpreting of electric service to the people. Much is already being done to inform and educate and guide public opinion toward a clearer conception of the part that electricity is playing in our modern community and household life. It is a pity that all the influence of this small army of electrical workers whom the people know so well is not directed to the support of the central station and the promotion of the ideals of the industry.

But it is not a matter to be dismissed with a lament. Real progress can be made if the electrical family of each community will assume responsibility for meeting the condition in its own town by an active effort to know this small local wiring contractor better and to influence him to become a working member of the local family and to join his national association. The central-station commercial executive can well afford to take the initiative in such a work.

## A Promising Co-operative Method That Is Often Neglected

CONSTRUCTIVE suggestion is better than destructive criticism, affirmation than negation, and sometimes it is speech, not silence, that is golden. Sight of these truths, however trite they may be, is lost by operating engineers and users of equipment who condemn manufacturers for not keeping designs of specified apparatus up to service requirements but do not take the trouble to point out to the makers the things that need remedy. Merely to discontinue the use of inadequate apparatus, saying nothing, is not the best way to bring about its improvement. Such a course denotes dissatisfaction no doubt, but affords the designer no clew as to its cause. To denounce a type of equipment in general terms is scarcely more helpful and does not prove that the fault is with the tool and not with its user.

Is not the right method—the only one that brings results—to make known to the manufacturer what the defects of his products, as manifested by operating experience, are? Of course, users of equipment cannot be expected to carry on research work for the manufacturers or to design equipment. That is not the idea, but simply that the results of their operating experiments and investigations be not locked in their own bosoms, as if these efforts were among the blunders worse than crimes, but told to the maker of the equipment concerned. Indeed, why should they not be freely and widely published? No individual manufacturer could then possibly profit by them at the expense of his own competitors, and the improved construction that would in many cases follow this public-spirited course would redound to the benefit of the entire industry.

## Order Evolving in Reactive Metering

ORDER is gradually evolving from the efforts of the industry to provide a practical metering basis for either kilovolt-ampere-demand charges or power-factor rate adjustments. Whether clarification of the situation can be considered complete before a single standard practice has been adopted is an open question. Viewed from the angle of the lay consumer, however, a multiplicity of methods can hardly be conducive to easy progress of the tendency to differentiate in the bill between fixed and variable charges. Again, from the consumer's standpoint there should be as thorough simplicity of metering methods as of rate schedules. Simplicity obtained at the expense of certainty would, however, be false progress. It is unfortunately true that there are managers who will provide their billing clerks with adding machines and other appliances to insure 100 per cent accounting accuracy, but will, on the other hand, be content with mediocre meter accuracy.

Expediency has thus prompted the adoption of several of the reactive metering schemes now in vogue. Some of the common schemes involve inherent errors under conditions of unbalanced loads or voltages, and

these are not generally appreciated. The results of an investigation of metering methods by one of the large utilities show that the errors range from less than 2½ per cent for favorable load conditions to as high as 50 per cent under extreme unbalance, a true power factor of 50 per cent being indicated as 75.6 per cent by one of the reactive metering methods.

There remains, therefore, great room for improvement before reactive metering schemes can be used without a great deal of engineering skill, and a simple metering system which eliminates the errors is needed badly. Some very encouraging features of a new system appeared in the article by R. D. Evans in the Feb. 10 issue.

## Reliable High-Voltage Cables Still in the Future

RARELY does an engineering problem resist the efforts of the specialists when an imperative demand exists for its solution, but in the case of the high-voltage cable for underground service long-continued effort has not yet produced a satisfactory answer. Operating companies could use this type of cable to advantage in overcoming existing distribution handicaps. Streets are becoming more congested with underground installations; power demands are increasing in magnitude; power plants are becoming larger and the cost of the low-voltage cable installations greater. Even now manhole fans, forced-air ventilation and water cooling are expedients forced on central-station companies in their effort to supply the power demanded by using available methods and equipment.

Of course, progress has been made and is still being made in the manufacture of cables. Several installations are now under way which use three-conductor cables rated from 30,000 volts to 35,000 volts, and in one instance operation is contemplated at 88,000 volts to ground. In one locality several miles of single-conductor, 66,000-volt cable is being installed. Such voltages are much higher than were considered practicable three years ago, and the improvement has been brought about by very skillful research work. Not only have dielectric losses been reduced and the dielectric strength increased, but manufacturing technique has been improved and a better knowledge exists of the phenomena of dielectric breakdown. On an operating basis for average temperatures and dielectric strengths, cables of still higher voltage are possible, but service reliability is jeopardized by the fact that local hot spots and mechanical imperfections may occur very frequently.

The report of the underground-systems committee of the N. E. L. A. shows that there has been a great deal of improvement in the mechanical perfection of cables and in methods of cable testing, but data compiled from representative installations shows that going to high voltages is accompanied by increased risks. On cables operating from 6,000 volts to 15,000 volts there were 10.8 failures per year per 100 miles of cable as compared with 15.7 failures on those operating between 10,000 volts and 33,000 volts. These data were taken over a five-year period and do not support any positive conclusions to the effect that the reliability of cables has been bettered since 1918.

Another interesting bit of data shows 3 and 7.8 as the average number of joint failures and cable failures respectively in the 6,000-volt to 15,000-volt class per 100 miles of cable and 7.1 and 8.6 for the same type of failures in the 20,000-volt to 33,000-volt class. Thus joint failures occur more frequently in the high-voltage type, and in both classes the cables fail more frequently than the joints.

An exact knowledge of the basis of breakdown for solid or semi-solid insulation made up of several constituents is as yet unknown to the specialists. Apparently it is physically impossible to eliminate the presence of air spaces between the conductors and the sheath, and the desired cable cannot be produced until the requisite fundamental knowledge and mechanical technique are available. We are told that European cable manufacturers make a product superior to that found in this country, but investigation shows little to support this conclusion. Comparisons show that American cables are more than equal in quality to the European, and American engineers have concluded that the solution of the problem rests with American and not with European manufacturers.

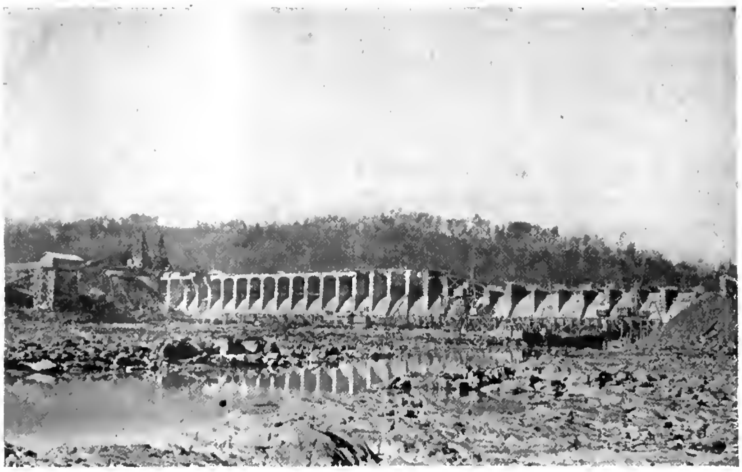
## Further Insulator Research Is Needed

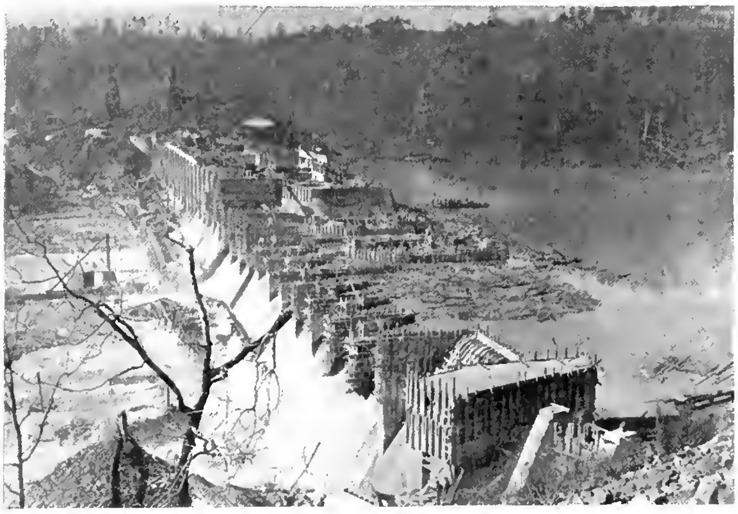
GRATIFYING progress in the testing of insulators on live lines is indicated in the article by F. C. Doble, published in this issue. Interest in this general subject has been mounting within the industry for several years, and as the importance of particular lines has increased the desirability—indeed, the necessity—of being able to test without shutting down has become compelling. Thus far this method has shown remarkable flexibility in its range of usefulness when applied to both pin-type and disk insulators and has effectively "weeded out" insulators secretly "planted" on tested lines, besides detecting others which have deteriorated in service toward the point of hazard to continuous line operation. The attention of safety experts may well be directed to the method described, which seems remarkably free from the limitations that have given trouble in the past.

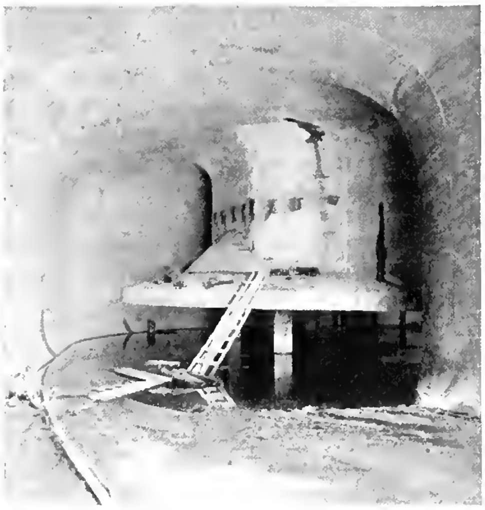
Mr. Doble's investigations have been pursued over several years, the later of which have been actively employed in field tests on commercial transmission lines illustrating typical Eastern and Middle Western conditions. They already indicate that the values of voltage distribution over insulators differ from the assumptions that have formerly been regarded as reasonably accurate. As this method is further utilized interesting data along this line may be expected.

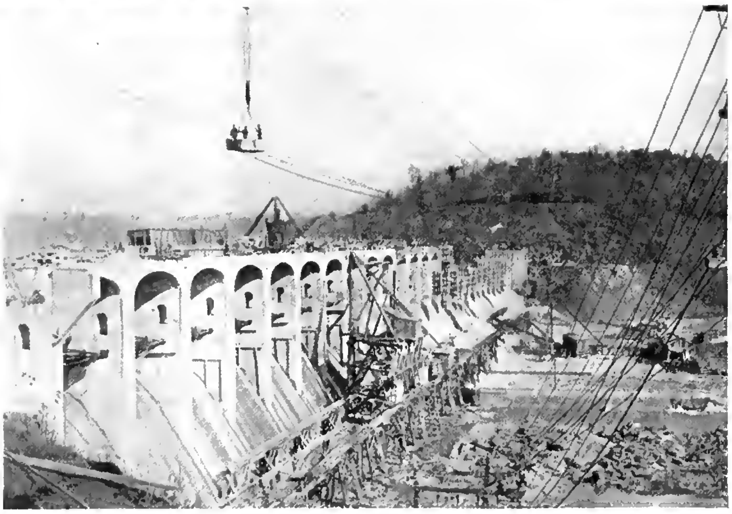
It is very much to be desired that some co-operative research be launched in the near future to determine the insulator conditions of deterioration which warrant removal of defective units from active lines. Tests show that many of these insulators are giving good service notwithstanding their deterioration from initial quality, and thus far operating men are obliged to use their own judgment, supplemented by that of testing engineers, in regard to the withdrawal of units from service. It is possible to magnify these telephonic indications very effectively by the use of the vacuum tube and loud speaker, and there may be potentialities of semi-quantitative measurement of leakage sounds along this line. The importance of continuous and reliable service on transmission lines is so great that the central-station industry will do well to consider the early establishment of a research the progress of which can be published and discussed as it goes forward for the benefit of distributors and users of energy.

# Unique Mitchell Dam Plant Now in Operation Twelve Weeks









ELECTRICITY has now been generated about three months at Mitchell Dam, the unique hydro-electric station of the Alabama Power Company on the Coosa River. The water was first turned through the wheels on March 26. The plant, which will have an ultimate rating of 120,000 hp. in five units, is unusual in several features, as explained in detail in the June 10, 1922, issue of the ELECTRICAL WORLD. Its waterwheels and generators are separately mounted in concrete islands along the up-stream face of the dam, and water flowing over the spillway, which occupies the entire length of the dam, is utilized to force the discharge of the draft tubes down stream. Thus during high water the back-water elevation is greatly suppressed. Besides, this plant has the distinction of having no generator room, each unit being housed under a small roof, which can be opened for handling equipment with an outside crane. All transformers and switching equipment are mounted outdoors on the deck of the dam. The cost of the plant is said to be no more than for a conventional plant of the same rating. Furthermore, the capacity during high water and the energy output possible per year are in excess of the amounts obtainable in conventional designs.

# Progress in Field Testing of Insulators

## Importance of Periodical Investigations—Problem of Detecting Conditions Which May Lead to Failure—Results from Practice—Flexibility of Method Pursued

By FRANK C. DOBLE
*Doble Engineering Company*

THE inherent properties of porcelain insulators of even the best designs now manufactured make the completed unit subject to deterioration. This deterioration may be due to cracks from the unequal expansion of the materials in the insulator unit, to rough handling or shooting, to lightning or power arcs. It may also be caused by leaks due to porosity, although modern manufacturing methods have nearly eliminated this defect. Two field testing problems confront the operating engineer—(1) how to find insulators in stock which warrant rejection before putting them into service, and (2) how to locate insulators in service which have depreciated before they have become too serious a hazard.

Certain general requirements for the solution of the first problem at once call for a more effective method than merely visual inspection in order to show such defects as internal breakage, porosity and so forth. A method employing a voltage stress across the insulator will make possible other indications of deterioration.

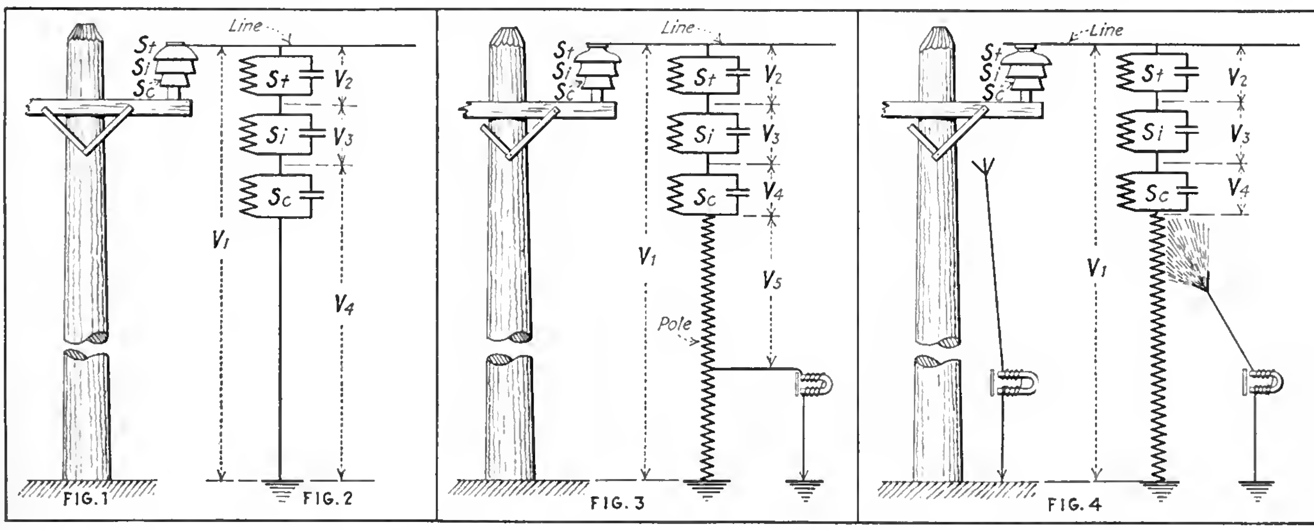
Any method for the solution of either problem must necessarily be simple to operate, definite as to indication and should be applicable to live lines. It should also be capable of indicating defective insulators at predetermined points of deterioration, in order that they may be detected and discarded before installation on the line or detected and removed from service before causing too serious a hazard.

A proper insulator-testing device must first be safe to use under all conditions of insulator deterioration, and it must be capable of indicating defective insulators at predetermined points of deterioration and on widely different types of construction.

From the standpoint of safety the testing device when applied to an insulator must not short-circuit the whole or any part of the insulator, it must not reduce the resistance of the leakage path over any part of the insulator nor raise the voltage on the whole or any part of the insulator, because if any of these things take place on a very bad insulator under test it will fail and cause a short circuit or ground.

As an insulator deteriorates there will be a variation in the leakage or charging current, or in the proportion of the voltage stress division over the insulator, and a device which will give some sensible indication of abnormal variations in this current or voltage stress distribution will show some measure of its deterioration.

Fig. 1 represents a conventional three-shell, pin-type, insulator and Fig. 2 is a diagrammatic representation




FIGS. 1 AND 2—POTENTIAL DISTRIBUTION OVER PIN-TYPE INSULATOR IN GOOD CONDITION. FIGS. 3 AND 4—POTENTIAL DISTRIBUTION WITH NON-INSULATED TYPES OF TELEPHONIC TESTING EQUIPMENT. VALUE OF INSULATION UNCHANGED

of the same insulator with each shell represented as a resistance and a capacity in parallel and the three shells in series between line and ground. The three shells of the insulator are named top, intermediate and center, and in the diagram are designated by *St*, *Si* and *Sc* respectively. The total potential $V_1$ over the insulator is shown as subdivided into the values $V_2$, $V_3$ and $V_4$ over the various shells as a normal condition.

The apparatus which has so far been developed for testing insulators in service on live lines may be generally classified under three types:

1. Non-insulated telephonic type.—Two forms, both of which are adaptable only to non-grounded construction.

2. Short-circuit type.—Two forms, known as metallic short-circuit method for pin-type and suspension-type insulators and spark-gap short-circuit method for pin-type insulators.

3. Insulated telephonic safety type.—Two forms,

known as Doble safety method, type A, for pin insulators, and Doble safety method, type B, for suspension insulators.

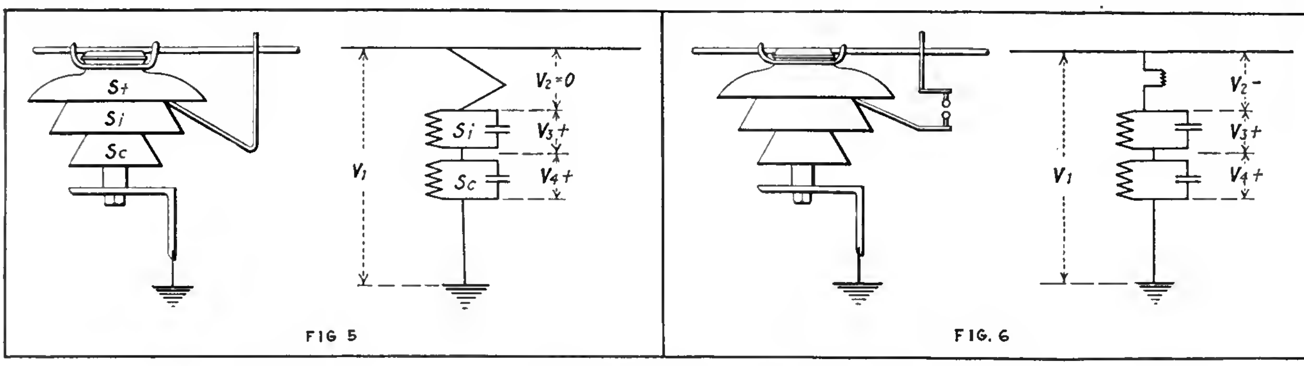
The operation of the non-insulated telephonic type of apparatus depends upon the leakage current, and its use is limited to the special condition of a non-grounded support such as a wooden pole, which acts as a very high resistance in series with the insulator, as in Fig. 3. A pair of high-resistance telephone receivers are connected in parallel with a considerable section of the pole, and a part of the leakage current flowing down the pole is shunted through the receivers; or the upper connections may be an arrangement of sharp points to collect energy from lines of stress emanating from the pole or insulator as in Fig. 4. In either case the indication is a comparative one, since a good insulator gives some noise. Great care must be used not to bring either terminal of the circuit too near any live line, since there is a direct metallic connection to the operator. The operating conditions of the line are not changed by these tests, and the test results are limited.

The operation of the short-circuit type of tester depends upon the voltage stresses as distributed over the various shells. The apparatus is applied directly to an insulator. By the metallic short-circuit method the top shell may be short-circuited as shown in Fig. 5, and then the short-circuit broken and an arc drawn from one of the contacts, provided sufficient potential exists across the shell under test. The length or strength of this arc is noted and compared, in the judgment of the operator, with the similar arc given by a known good insulator.

By the spark-gap short-circuit method the top shell may be short-circuited as shown in Fig. 6 with an air gap in series to act as a measure of the voltage. The maximum gap which will be jumped by the voltage across the top shell of a good insulator is found, and the deterioration of other insulators is judged from the lesser gap which the stress across their top shell will jump.

It will be noted from Figs. 5 and 6 that a short-circuit type of tester changes the operating condition of the line by actually removing a part of the insulator under test from service, by virtue of the short circuit. When a short-circuit method is applied to suspension insulators the same condition takes place, in that a portion of the insulator under test is short-circuited and the operating conditions are actually changed.

The operation of the Doble safety method depends upon the voltage stresses as distributed over the various shells of a pin-type insulator with the "type A" tester, or over the units of a suspension string with the "type B" tester.




FIGS. 5 AND 6—POTENTIAL DISTRIBUTION WITH SHORT-CIRCUIT TYPES OF TESTER. VALUE OF INSULATION GREATLY REDUCED

Fig. 7 diagrams the theory of operation of the "type A" tester when applied to the upper cement of a three-shell insulator in order to test the top shell, as illustrated, for non-grounded type of construction, and Fig. 9 illustrates a similar condition of application on grounded construction of the line. The electrical connections of the "type A" tester consist of an air gap in series with a resonated local circuit and a capacity to ground with one terminal only brought out to a point which may be applied to the insulator under test. A sound is produced in the telephone if the potential above ground at the point of contact is sufficient to jump the gap and charge the telephone circuit, and the length of the gap indicates the value of such potential.

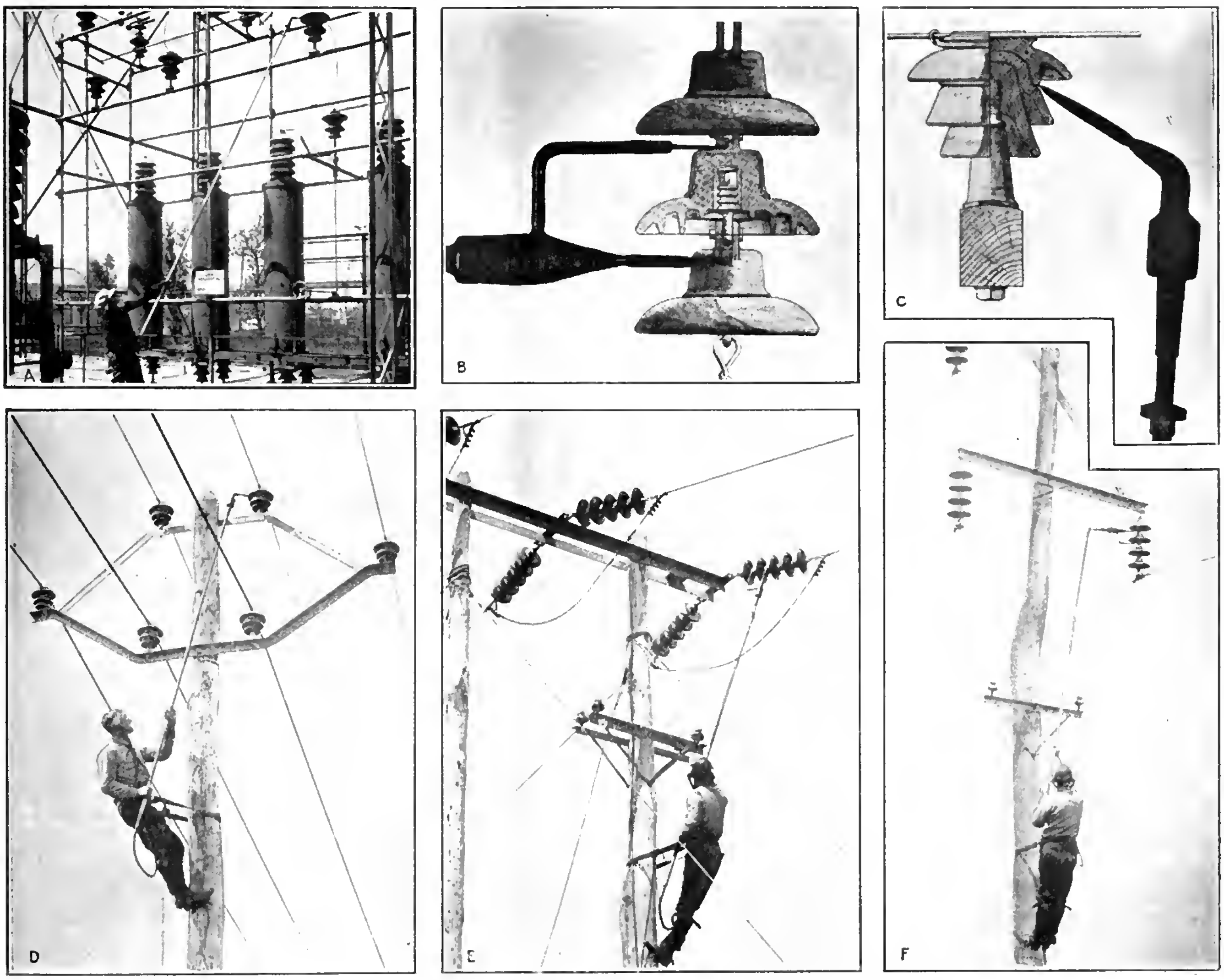
The application of the "type B" tester is shown in Fig 8. It is applied to the terminals of a disk-type insulator so as to test its condition when located in the middle position of a three-disk string. A sound is produced in the tester provided the potential across the disk under test is sufficient to jump the gap and charge the telephone circuit, and the length of the gap is an indication of the value of such potential. Fig. 10 illustrates a similar condition of application to a string of disk insulators on grounded construction, and the indication is the same as above.

The two types of the Doble insulated telephonic tester are each based on the same general principle of protection to the operator while listening, but they differ from each other in essential points of construction and application to an insulator under test. The "type A" outfit makes but a single contact with the insulator and is most widely used on pin-type insulators. The "type B" outfit is primarily designed for testing suspension or disk-type insulators.

In the "type A" tester a telephone circuit is inclosed in a case of hard rubber or other insulating material, and one side of this circuit is brought out through an air gap having a micrometer adjustment to a metal point which may be applied to a pin-type insulator. The other side of this circuit is a capacity effect to ground. The metal contact is the only part of the circuit which can be applied directly to the transmission line or live parts of the insulator under test. All other parts of the circuit are surrounded by an insulating medium having a higher dielectric strength than air. The introduction of the apparatus into the field around an insulator does not reduce the resistance of the leakage path over the insulator, and further, on account of the high insulation in the casing of the tester, it will not cause a short circuit or ground even on a very bad insulator.

A hollow tube of impregnated wood extends from the rubber case to any desired length, and a flexible rubber

hose connects the far end of this tube to a suitable head device for an operator. A continuous air column extends from the receiver diaphragm in the rubber case through the wooden tube and rubber hose to earpieces, which enable the operator to listen as with a stethoscope. A sound is produced in the telephone when the point is applied to a given part of an insulator, provided that the electrical conditions at this point are greater than some predetermined value. The air column through the insulating tube and the rubber hose conducts the sound to the ear of the operator in the manner



NEW METHODS OF TESTING INSULATORS ON LIVE LINES

Rapid advances in the testing of insulators under operating conditions in the field is indicated by the above illustrations.

A shows the short-circuit, air-gap method, in which the length of the gap across which the voltage stress will pass when a shell is "shorted" is compared with the voltage gap necessary to jump a normal insulator (see Fig. 6).

C shows the application of the Doble insulated telephonic tester to a pin-type insulator, the telephone indications being transmitted to the operator via air column through an insulated stick rubber tubing and ear pieces (see Figs. 7 and 9).

D is a field view of the above insulated telephonic tester as applied to a 25,000-volt, pin-type line forming part of the Boston Edison-New England Power Company interconnection trunk.

B shows an application of the Doble tester to the disk of a suspension type insulator, with air column transmission of telephonic indications as in B (see Figs. 8 and 10).

E shows the last-named equipment as applied to a 66,000-volt line equipped with disk-type insulators, in field service, and F shows this equipment as adapted to testing at different angles.

of a combination speaking tube and stethoscope, with perfect safety to the operator.

In operation no metallic connection exists between the telephone in the hard-rubber case and the operator. The impregnated wood tube is paraffine-treated for several hours and may be several feet long, depending principally upon the physical limitations of handling it and accurately applying the point to the desired part of the insulator. The rubber hose is made of 70 per cent Para rubber vulcanized like an automobile tire casing. Short sections of metal hose are inserted at either end of the rubber hose for added stiffness where the greatest wear occurs, owing to bending in use. This metal is not objectionable from an electrical safety standpoint when the set is in use, since it is not necessary to insulate the air column above or below the point at which the operator grasps the tube in order to manipulate the apparatus.

There is a very high insulation between the operator's headpiece and the hose coupling to the wood tube, owing to several feet of rubber hose without metal lining—a construction purposely adopted on account of the possible accidental contact of the hose coupling with live parts when the headpiece is in place on an operator while he is climbing up through other wires or working over other live circuits. This point of safety is not intended to encourage carelessness in the operator, but rather to be an added safeguard in the case of an unavoidable slip.

In operation the apparatus may be regarded in the same light as an impregnated switch stick and similar limitations may be put upon its use as regards the

length of tube necessary for a given voltage on account of separation and weather conditions. If grounding the tube at some point beyond the part normally grasped in use is thought to increase the safety of operation, this may be done without detriment to the efficiency of the tester, provided that a reasonable distance is left between the ground connection of the stick or tube and the telephone proper.

The electrical connections of the "type B" tester consist of an air gap *G* in series with a telephone circuit and a capacity with both terminals brought out to points which may be applied to an insulator under test. Fig. 8, as above described, shows the theory of operation of the "type B" tester, and the method of insulating and protecting the operator is the same as for the "type A" tester.

The value of the current in the "type B" tester is less than the charging or leakage current of an insulator under test, even though its condition is normal. This means that the tester in operation is an open circuit in terms of power current since every insulator on the line is leaking to ground at all times more current than passes through the tester even under maximum conditions.

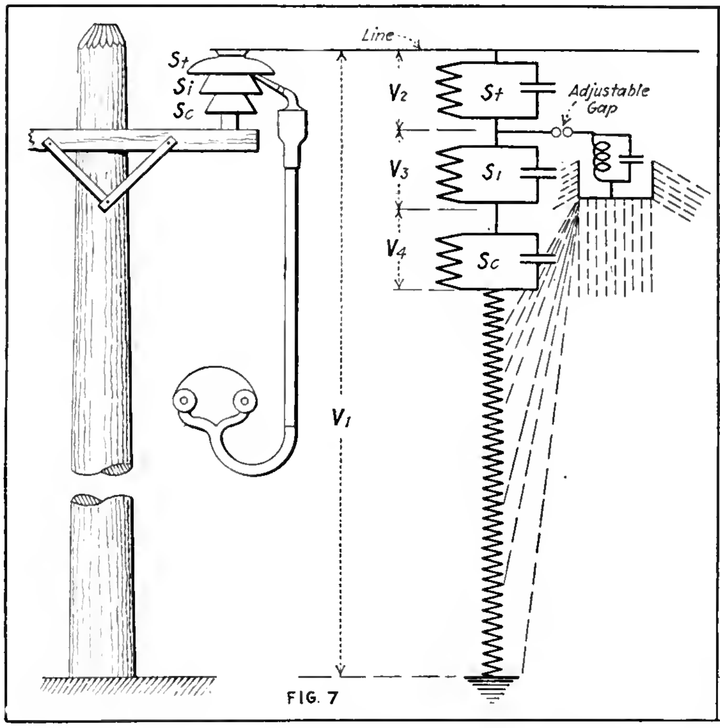
### Examples of Experience in Insulator Testing

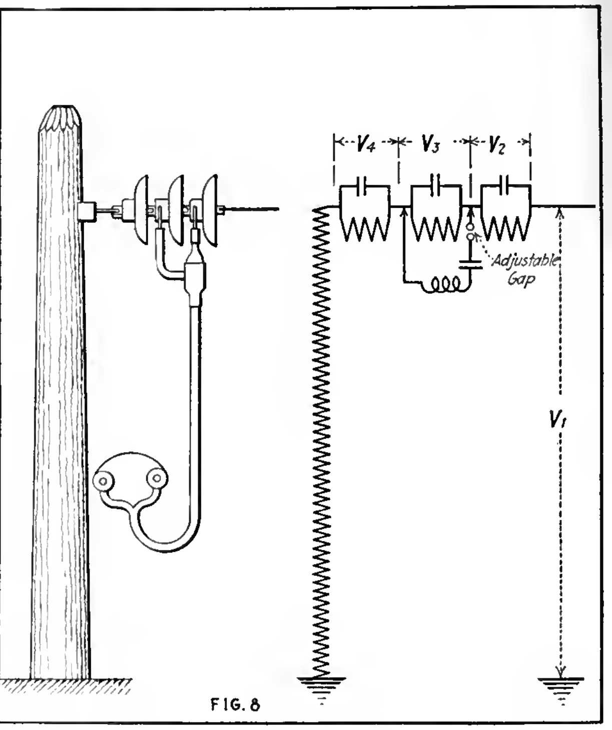
The following examples have been obtained from specific cases of testing:

1. A company operating several miles of 22,000-volt transmission line on fifteen-year-old insulators experienced eleven insulator failures over a period of eleven weeks, or an average of one per week. One test with the "type A" insulated telephonic tester showed about $33\frac{1}{3}$ per cent of the insulators to be bad. These bad insulators were replaced by good ones, and with the other two-thirds of old insulators still in service there were no failures during the nine months following, including three months of severe lightning.

2. *Case* 1—*On New Line.*—Tests made on a new 25,000-volt transmission line before putting it into regular service revealed that about 7 per cent of one type of insulators were bad.

*Case* 2—*Old Line Replacements.*—Tests were made on an entire system with the "type A" tester and several hundred insulators which were unquestionably bad were indicated and removed. The tests appeared satisfactory, but insulator trouble was not eliminated. Investigation revealed that a large percentage of the replacing insulators became very bad within a few months of installation. The insulators which had been taken from stock were not tested before being put on the line, and as a consequence the value derived from testing was greatly impaired. Several cases have proved the necessity for testing stock insulators before putting them in service.




FIGS. 7 AND 8—TESTING PIN AND DISK TYPE INSULATORS ON UNGROUNDED SYSTEMS

Fig. 7—Potential distribution over pin-type insulator with insulated telephonic type of tester and non-grounded type of construction. Value of insulation unchanged.

Fig. 8—Potential distribution over disk-type insulator with insulated telephonic type of tester applied around shell, non-grounded construction. Value of insulation unchanged.

3. *Case* 1.—Check tests on quite a number of three-shell, pin-type insulators were made in the field with the "type A" tester and the spark gap short-circuit method previously described and shown by Fig. 6. Several insulators checked as good or bad with both types of testers. One insulator indicated as follows: "Good" by five consecutive tests with the short-circuit tester; "bad" by five consecutive tests with the "type A" tester. This insulator was removed from service, and even though it was visually perfect, the top shell punctured in air at 21,000 volts when a good insulator should have required about 90,000 volts for puncture.

*Case* 2.—Tests on a 25,000-volt transmission line of three-disk strings were made with a "type B" tester by a power company's own lineman, to whom the tester was new and unfamiliar. Several insulators were indicated as bad and removed from service. At the test

laboratory all but three of these insulators were also indicated as bad by other tests. The other three insulators by every available test except high potential appeared to be good. Subsequently all three insulators punctured in air before they flashed over, which showed that the "type B" tester will indicate degrees of serious defect which can be detected by no other safe method.

4. *Case* 1.—Tests made on a 66,000-volt transmission line on several hundred pin-type insulators mounted on steel structures indicated about fifty insulators to be defective. Seven samples were picked at random from the fifty noted as defective in order to study them by laboratory test. Some of these showed visual cracks in the top shells, while others were visually perfect as a whole. Under high-potential test certain of these insulators immediately punctured the top shell and flashed the other shells, while other insulators which showed visual cracks appeared to flash over the whole insulator.

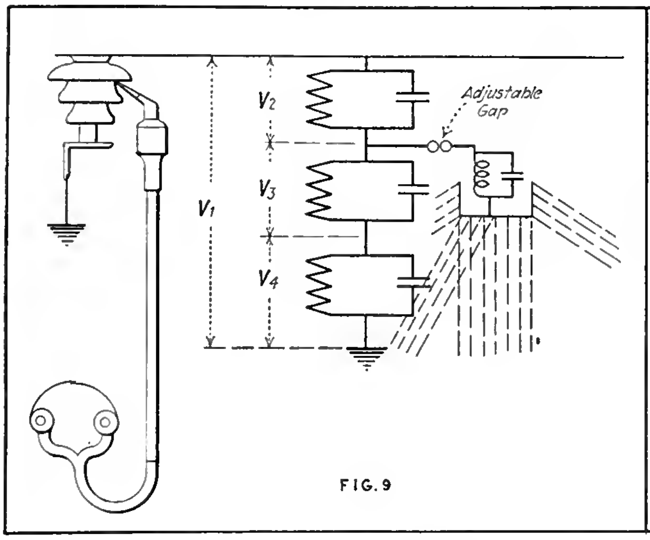


FIG. 9

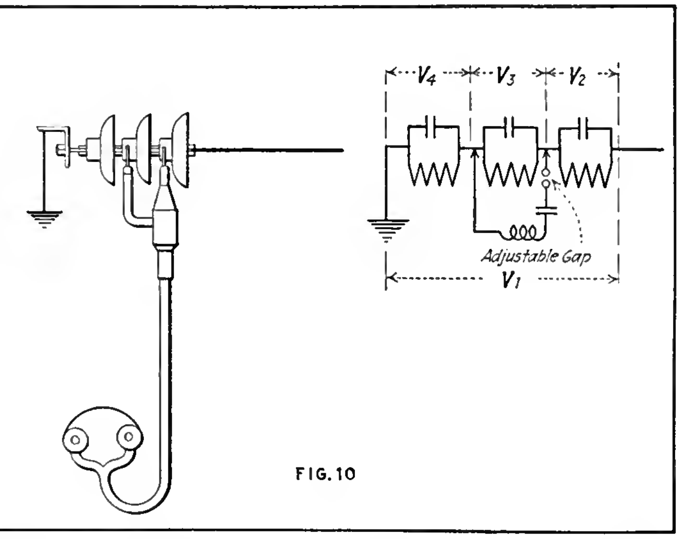


FIG. 10

FIGS. 9 AND 10—TESTING PIN AND DISK TYPE INSULATORS ON GROUNDED SYSTEMS

Fig. 9—Potential distribution over pin-type insulator with insulated telephonic type tester, grounded type of line construction. Value of insulation unchanged.

Fig. 10—Potential distribution over disk-type insulator, grounded type line construction, with insulated type telephonic tester. Value of insulation unchanged.

Owing to the fact that many companies accept their insulators by visual flashover tests, these results appeared to be seriously at fault. Further investigation revealed that the insulators which had cracked top shells and apparently flashed over actually punctured the top shell first and then flashed over. This was proved by taking one of these insulators and breaking out a considerable piece of the top shell, and then two or three inches of the tie wire was exposed directly to the first intermediate shell. With this piece broken out, the insulator flashed over at the same value as previously, namely, the normal flashover value for the intermediate and center shells without the top. This proves that visual flashover without reference to voltage is not an absolute criterion for judging deterioration.

*Case* 2.—Tests made by a power company on a 25,000-volt transmission line with "type A" tester on 17,000 insulators indicated about 2 per cent as defective. When removed from service many of these insulators were visually perfect and under high potential test apparently flashed over. Further study revealed that every insulator indicated as defective by the "type A" tester was unquestionably bad and that the apparent flashover was in reality the same misleading effect just described.

The question has been raised whether any danger exists of causing a short circuit in the presence of the operator while applying the "type B" tester to the controlling good disk in a string of suspension insulators. The chances of such trouble are practically nil. To produce a flashover arc in this way the test apparatus would have to be broken down inside without the knowledge of the operator. This is a remote possibility as the normal operation of the test apparatus gives a continuous check upon its condition. There is really no more chance of a flashover from the above cause than there is of a flashover in the face of an operator who has occasion to approach a live line with all outward indications of normal operating conditions upon the circuit.

On low voltages there is a remote possibility of a crack defect which will not change the voltage distribution over a perfectly dry insulator in any measurable amount and yet the crack may be plainly apparent to the naked eye. No known testing apparatus will locate such a defect except by impressing a potential on the insulator about normal working value. Any such high-potential method is very dangerous if used on a live line.

## CONCLUSIONS

Every transmission-line insulator should be tested in the field before being placed in service and every insulator in service should be tested periodically, say every six months to two years, according to the line voltage, age and condition of the insulators.

Live-line testing is most satisfactory from standpoint of cost and efficiency. It should meet the following safety requirements: Protection to operator from direct shock; protection to insulator under test from short circuit of its parts; reduction in leakage path; potential in excess of normal operating value.

Results in the field show that insulated telephonic testers will indicate defective insulators on live lines, and that some standards for testing must be agreed upon to determine when an insulator is bad enough to warrant its removal from service. This is difficult but essential if uniformity is desired.

# Why Electric Heat Treating Is Economical*

## Actual Comparisons Show an Economical Field for Application of Electric Heat to Industrial Processes Even with Present-Day Relative Costs of Fuel and Electricity—Energy Cost Is Not the Only Consideration, However

By E. F. COLLINS
*Consulting Engineer Industrial Heating Department, General Electric Company*

MANY manufacturers, engineers and executives unfamilar with the possible economies of industrial electric heating dismiss it from serious consideration on the theory that it is expensive and impracticable. However, such is not the case. Electric furnaces designed for 1,600 deg. F. operation, when properly constructed and applied, give thermal efficiencies around 80 per cent so that 16 per cent of the B.t.u.'s in coal burned to generate the electrical energy could be effective in heating the metal if the power is generated in a large central station. Furthermore, electric forge furnaces operating around 2,300 deg. F. can utilize 10 to 12 per cent of the B.t.u.'s in the coal used to generate electrical energy, since the efficiency of the furnaces alone is 50 to 60 per cent. These thermal efficiencies compared with 9 per cent for a fuel-fired forge are worth serious consideration. When the electric furnace or oven is used for drawing at lower temperatures its efficiency may easily be above 80 per cent, hence showing still greater economy over the smithy forge than indicated above.

Passing from the smithy forge to the more modern type of furnace, it may be interesting to look at some efficiencies which may be obtained in the consumption of fuel by the direct-burning process—that is, utilizing it direct in the furnace in which the material is to be treated—and, on the other hand, burning it under the central-station boiler and finally heating the furnace in which material is being heat-treated by electric heat properly applied. The accompanying charts illustrate what may be accomplished in this way as between electricity produced by the central station burning coal and the furnace burning oil directly in the chamber in which material is being heat-treated.

Fig. 1 shows the B.t.u. costs for an electric as against an oil-fired furnace for heat treating. The left-hand square represents 20,000 B.t.u. which may be purchased with oil at 7 cents per gallon. With an oil furnace having an efficiency of 16 per cent, which is better than the average, it may be expected to put 3,400 B.t.u. of the 20,000 B.t.u. into the charge. Now, with coal at $5 per ton, the central station may expect to get 1 kw.-hr. from 1.5 lb. of coal, or a coal cost of 0.425 cent. Adding the overhead charges of the central station, there results about 3,840 B.t.u. in electricity for 1 cent. If this electricity be used in the electric furnace with 80 per cent efficiency, there will be utilized in heating the charge 3,400 B.t.u. In other words, with oil costing 7 cents at the burner and coal $5 at the boiler, one just about breaks even on a B.t.u. cost basis with electric heat and with oil when prices as given for coal and oil prevail. The above is for furnace temperatures of about 1,600 deg. F., such as are required for heat-treating steel.

*Based on paper read in Boston before the American Society for Steel Treating.

It is likewise interesting to compare costs for baking enamel at 450 deg. F. in the electric oven and by a process which is at present being promoted, namely, the so-called "indirect-oil" heating scheme. In this "indirect-oil" baking process the oil is burned under or outside a muffle. Through the muffle air is forced and heated to about 800 deg. F. and passed into a japanning oven over the work, so baking it.

In Fig. 2 one square represents the cost of 17,000 B.t.u. when oil is selling for 8 cents per gallon. The efficiency of the oil heater is 75 per cent, and hence 12,800 B.t.u. is sent to the oven in the heated air. The oven efficiency for this method of heating is by test 12 per cent. Hence 1,540 B.t.u. is actually effective in heating the charge at a cost of 1 cent, neglecting the overhead cost of burning the oil. The above cost represents cost of oil at the burner as 8 cents. Fig. 3 shows the relative cost of upkeep of the electric oven as compared with the "indirect-oil" system. Correction must

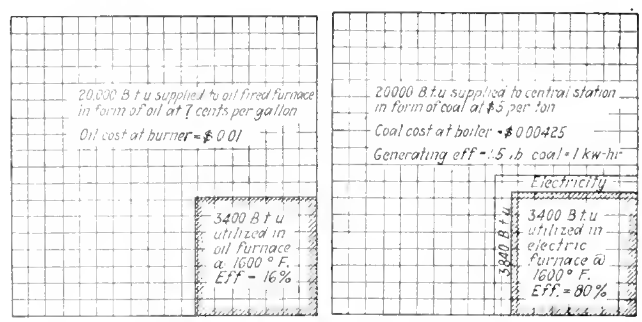



Fig. 1

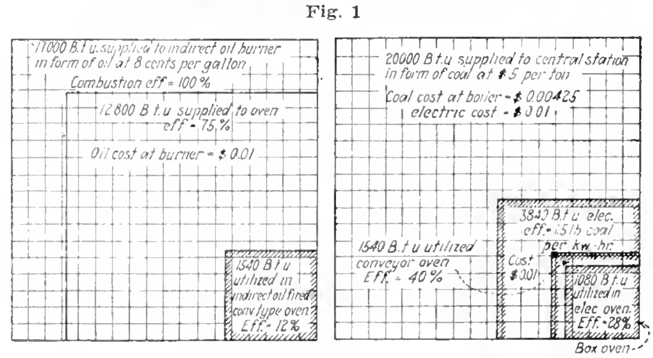



Fig. 2

FIGS. 1 AND 2—B.T.U. COSTS OF HEAT TREATING, ELECTRIC VERSUS OIL-FIRED FURNACE

be made for this overhead to get comparative costs of electricity and of oil heat for baking.

Referring again to Fig. 2, the right-hand square represents 20,000 B.t.u. in coal at the boiler of the central station, costing 0.425 cent with coal at $5 per ton. Assuming an average overhead for the central station, the cost of electricity may be taken at 1 cent per kilowatt-hour, or 3,840 B.t.u. for 1 cent. Using this 3,840 B.t.u.

in the electric japanning oven, one actually utilizes 1,540 B.t.u. in baking the charge at a cost for power of 1 cent. Hence on a B.t.u. basis it may be expected that one will break even on cost when the above conditions exist. The above has been said to show why the actual test results recorded in Fig. 3 are so greatly different from the sixteen-to-one rates arrived at by the offhand reasoning mentioned above.

It will be seen that the actual test results of Fig. 3 are to be expected after analyzing the problem as per Figs. 1, 2 and 3. For in Fig. 3 oil costing 8 cents at the burner gives the same over-all cost on a B.t.u. basis as electricity at 1 cent per kilowatt-hour gives for baking japan at 450 deg. F.

It must not be forgotten that the efficient generation and utilization of a heat unit is usually quite different for the electric and the fuel-fired furnace under starting conditions, and it must also be remembered that, even with perfect combustion of fuel, which seldom exists, a large percentage of generated heat leaves the metallurgical furnace as flue gas without doing useful work. In practice 50 per cent excess air is not unusual, and this increases the flue-gas loss and lowers the combustion efficiency to a very remarkable degree as one passes from low to high temperatures.

### Over-All Cost and Not Heating Cost Is Important Factor

While these illustrations show that there is a field for electric heat with present-day relative costs as between fuel and electric heat, it is not intended here to contend that electric heat under all conditions and in all places is suitable to replace fuel heating. However, it is a matter of no distant time when the use of electric heat for important thermal and metallurgical processes will be adopted with no more hesitation than now occurs when the householder decides in favor of the electric light for his home as against the gas lamp, even though the cost of energy consumed be greater than that of gas.

It matters little what the cost per B.t.u. for a given heating process is so long as the over-all cost of manufacture, quality of product and working conditions are unaffected. If process conditions, quality of product and production were increased by using electric heat, one would be justified in accepting generally a higher B.t.u. cost for the sake of gaining these advantages. Fortunately for electric heat, many such advantages are inherent in its use. These will, of course, vary with the application and local conditions. Hence a study of all the factors involved should be made when deciding whether electric heat or fuel heat should be used. That these factors are of extreme importance is proved by the very fact that industrial electric heating is rapidly increasing in the face of the widespread misunderstanding previously noted.

Many times a single factor contributes savings sufficient to overbalance any possible higher cost of electrical energy. In some extraordinary cases a rate of 75 cents per kilowatt-hour would still leave the electrically heated equipment superior to the fuel-fired equipment.

### Perfect Heat Generation

The cost of burning fuels varies widely, depending upon the amount of air admitted to the furnace and the resultant combustion; for example, the cost of city gas per 100,000 B.t.u. effective rises to double its value with an increase of 50 per cent in air, and such excess percentage of air is by no means rare. Fuel oil likewise increases its cost roughly four times at the same temperature (2,800 deg. F.) and the same excess of air (50 per cent). Hence it is seen to how great an extent the economic operation of the fuel furnace is in the hands of the operator. This handicap does not exist with the electric furnace, where the ratio of conversion from power to heat is 100 per cent perfect and the operator cannot affect this efficiency of conversion.

A brief outline and summary of some of the more important features of electric heating which distinguish it from fuel-fired equipment follows:

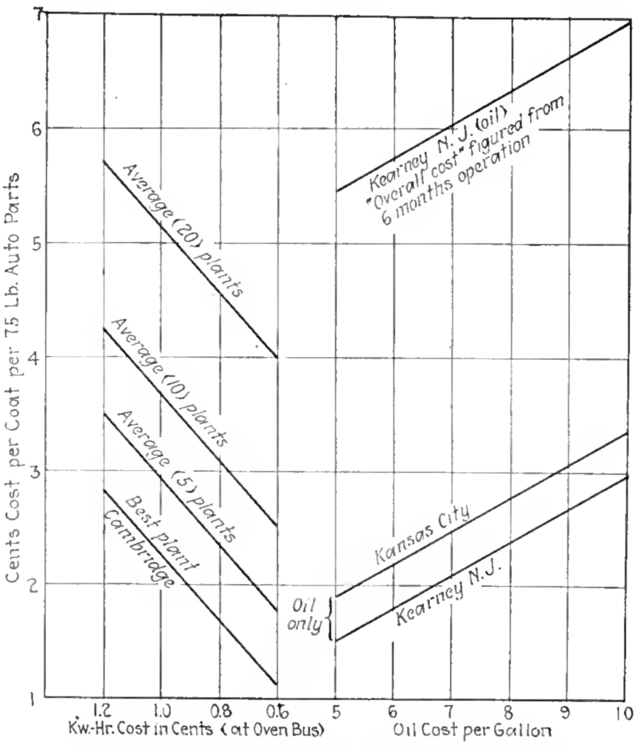



FIG. 3—COMPARISON OF UNIT PRODUCTION EXPENSES WITH ELECTRIC AND OIL FURNACES

1. *Heat Generation:*
   (a) Released at points to give uniform or non-uniform temperature.
   (b) Heat generation balanced against heat absorption.
   (c) Heat generated at or near potential of heating chamber.
   (d) Generated in inactive or dead atmosphere; no contamination of charge. Heating chamber may be a vacuum or under heavy pressure. Artificial atmosphere possible, as hydrogen gas, nitrogen gas and non-combustion gases.
2. *Heat Conservation Resulting in High Thermal Efficiency:*
   (a) High heat lagging, no local high temperatures.
   (b) Small heating chamber and no combustion chamber.
   (c) No hot gases leaving furnace, save for ventilation when necessary.
   (d) Automatic control of temperature so that supply balances demand.
3. *Method of Electric Heat Transmission and Delivery to Charge:*
   (a) Convection of liquids and gases (natural).
   (b) Circulation of liquids and gases (forced).
   (c) Radiation and convection in air.
   (d) Direct radiation to work.
   (e) Direct and reflected radiation to work.
   (f) Heat generated directly in charge by current flowing through it.
   (g) Complete heat saturation of charge without surface overheating, due to perfect automatic heat control.

Many successful working installations of electric heat exist today, and it is predicted that many more industrial processes will be improved and made more economically productive by its application.

A considerable demand comes from manufacturers of automobile parts, such as gears, crankshafts, bearings, axles, etc., which are produced in large quantities and all of which require heat treatment. Many tons of steel are heat-treated each day; therefore the demand for furnaces of large productive capacity and high efficiency. Electric furnaces have long been recognized as ideal for this purpose, but until the last few years they have not been available in such size and of such rugged design that they could be considered for carrying unassisted their regular production load.

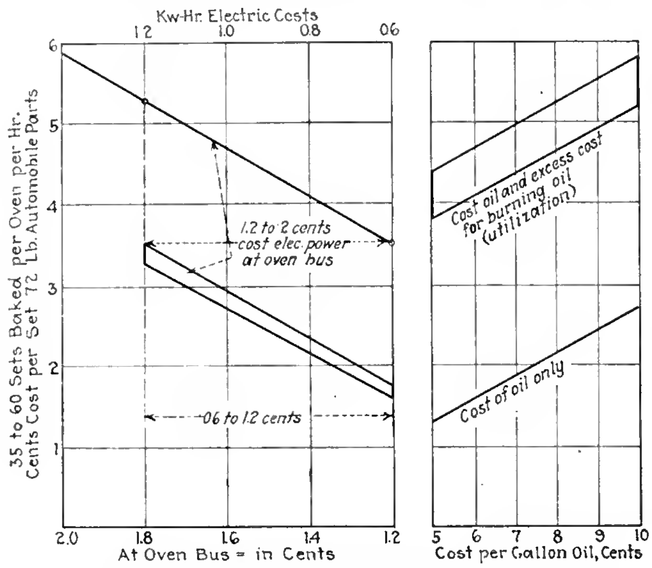



FIG. 4—COMPARATIVE COSTS OF OPERATION USING ELECTRIC AND OIL FURNACES

Several manufacturers now appreciate the possibilities of the industrial electric heating field and are making installations at an increasing rate. Equipment is available in practically all capacities for temperatures up to and including 1,800 deg. F. and suitable for many industrial processes.

A type of metallic resistor furnace entered the industrial field in 1917 and 1918, and its use has been attended with unusual success in regular manufacturing production. It was first tested under the rigorous conditions attending gun making in war time, and the results produced were phenomenal.

A basic idea incorporated in the design is the location of the resistor ribbon, unmuffled, in the open heating chamber so that it can directly radiate the heat generated within it.

These ribbons are very rugged mechanically. They are sometimes as much as 1½ in. wide by ⅛ in. thick and are formed into loops. They are supported on refractory insulating members projecting from the walls of the heating chamber, the body portion of the support being embedded in the wall.

The resistor is thus free to deliver its heat by radiation to the charge without the necessity of first forcing the heat through the walls of a muffle, as has been the practice in most metal resistance furnaces heretofore constructed.

In order to force heat through a muffle at high rate and insure rapid heating of the charge, a high temperature gradient and therefore high resistor temperature are necessary. Hence the unmuffled furnace has inherently a lower temperature resistor, produces quicker heating and is much less sluggish in point of temperature regulation than the muffled or screened furnace doing the same work. The unmuffled furnace uses direct and reflected radiant heat.

There are many small installations the importance of which to many shops cannot be overlooked. There is a large growing demand for small self-contained tool-room ovens and furnaces for tempering and hardening tools, cutters, etc.

## ADVANTAGES OF ELECTRIC FURNACES

The electric furnace is suited to any heating requirements where the charge does not require that more than 1,800 deg. F. be available. Some of its advantages over fuel-fired unmuffled furnaces are as follows: (1) Radiant heat; (2) satisfactory heat distribution; (3) automatic control of temperatures if desired; (4) small amount of heat given off to the room; (5) no products of combustion or obnoxious gases given off to heating chamber or room; (6) ratio of heat generation to heat absorption by charge correctly maintained; (7) uniform and complete penetration of heat through charge without overheating of corners, fins or surfaces; (8) ability to repeat desired heat cycles, giving uniformity of product; (9) a reduction, generally, in labor; (10) a better over-all economy and the production of higher quality product at the same or slightly higher cost and often of the same quality at a lesser over-all cost.

The accompanying table shows what may be done with the electric furnace in moderate scale operations. The time required to heat these charges was five and one-half to six hours, and the maximum diameter of forgings was 16½ in. The furnaces were 24 ft. high by 6 ft. diameter inside dimensions, the connected load being 400 kw. each. The ultimate or minimum radiation from test was found to be 70 kw. The predicted radiation from design was 75 kw., which is a satisfactorily close agreement.

The actual operating results for four furnaces for the month of October, 1918, when production was at the maximum rate, including both hardening at 1,450 deg. F. and drawing at 1,150 deg. F., was \$2.76 per ton, based on the power rate of \$0.0085 per kilowatt-hour.

The specifications for drawing did not allow the charge to enter a furnace at full drawing temperature. It was therefore necessary to cool the furnace somewhat and then raise the temperature of furnace as well as charge. It was also required that the charge be held at the drawing temperature for several hours. This of course did not allow of the highest efficiency in pounds of metal heated per kilowatt-hour.

If work at 250 deg. F. to be drawn at 1,100 deg. F. enters a furnace at 1,100 deg. F., a yield of approximately 24 lb. per kilowatt-hour would be realized. This

RESULTS OF TESTS RUN ON AN ELECTRIC FURNACE INSTALLATION INVOLVING THE METALLIC TYPE OF FURNACE

Heating to 1,450 deg. F. Furnaces hot when charged. Furnaces 6 ft. in diameter by 24 ft. high; voltage, 440, 60 cycles, capacity 400 kw.

| Charge | Total Weight, Including Holding Fixtures, Lb. | Energy, in Kw.-Hr. |
|---|---|---|
| Twelve 3-in. gun tubes | 21,900 | 1,874 |
| Seven 4-in. gun tubes | 22,300 | 1,880 |
| Three 4-in. jackets | 21,700 | 2,088 |
| Total | 65,900 | 5,842 |

Average pounds per kw.-hr. (65,900 ÷ 5,842) = 11.25
Kw.-hr. per ton (2,000 ÷ 11.25) = 173
Energy cost per ton at \$0.0085 per kw.-hr. = \$1.52

would give 2,000 ÷ 24 = 84 kw.-hr. per ton for drawing to 1,100 deg. Fahrenheit.

Therefore the over-all operation required: To harden, 178 kw.-hr per ton for heating to 1,450 deg. F.; to draw, 84 kw.-hr. per ton for heating to 1,100 deg. F., making a total of 262 kw.-hr. per ton.

The cost of $0.0085 per kilowatt-hour is $2.23 per ton. The cost of $2.76 per ton actually achieved during the month of October, 1918, indicates that the furnaces performed exceptionally well.

It is not to be inferred that electric heat is without a competitor in all places and under all conditions. There are, however, a very great number of applications which may be carried out electrically with advantage. These applications in various processes occur with so great frequency that it behooves the user of furnaces to question his engineer thoroughly concerning the possibilities of electric heating before revamping existing installations or adding new heating equipment which employs fuel-fired heating methods.

## Increased Activity During April

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate another record operation within the industry during April. Activity in the building trades continues to characterize April business as it did that of March, and pig-iron production, generally regarded as the most accurate single indicator of productive activities, made a new high record in that month, exceeding the previous record production reported during March.

The basic data upon which the "ELECTRICAL WORLD Barometer" is based indicate an increase of 3.2 points on the barometer scale as compared with March activities. During this interval the industry has grown 1.5 points, leaving a net increase in activity of 1.7 points on the barometer scale as compared with March. The electrical industry, as a whole, was operating in April at 29.6 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In March it was operating at 27.9 points or per cent above the point of normal demand.

# Large Use of Diesel Engines by Arizona Mining Company

### Twenty-four, Aggregating 33,000 Hp., on Properties of Phelps-Dodge Corporation, Show Good Operating Economy

BY C. LEGRAND
Consulting Engineer Phelps-Dodge Corporation, Douglas, Ariz.

DIESEL engines are comparatively new in this country and while they may not be regarded as entirely past the experimental stage, still at the same time they are being successfully operated in many large plants. One of the largest single users of Diesel engines is the Phelps-Dodge Corporation, which employs them in its various mining properties in Arizona and New Mexico. So satisfactory has been this company's experience with Diesel engines that early last year a large part of the power load of the Bisbee district was taken over by a battery of these engines in the power plant near the site of the new concentrating mill.

At the present time there are five installations, as follows:

*Tyrone.*—Four five-cylinder, 1,250-hp. engines, direct-connected to 60-cycle, three-phase, 850-kw. generators; two three-cylinder, 750-hp. engines, direct-connected to 3,700-cu.ft., 95-lb. air compressors.

*Morenci.*—Three five-cylinder, 1,250-hp. engines, direct-connected to 60-cycle, two-phase, 850-kw. generators; one five-cylinder, 1,250-hp. engine, direct connected to a 6,400-cu.ft., 100-lb. air compressor.

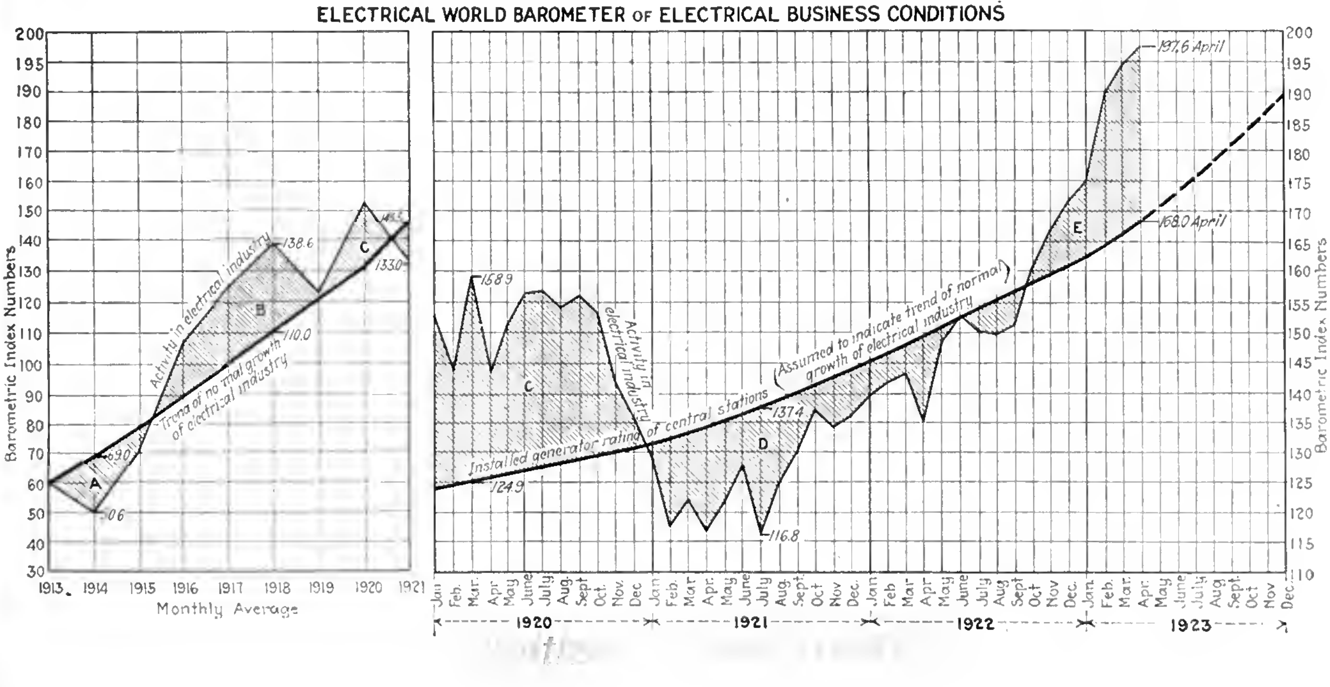
*Nacozari.*—Two four-cylinder, 2,000-hp. engines, direct-connected to 60-cycle, three-phase, 1,500-kw. generators; four five-cylinder, 1,250-hp. engines, direct-connected to 60-cycle, three-phase, 850-kw. generators; two three-cylinder, 750-hp. engines, direct-connected to 4,000-cu.ft., 95-lb. air compressors.

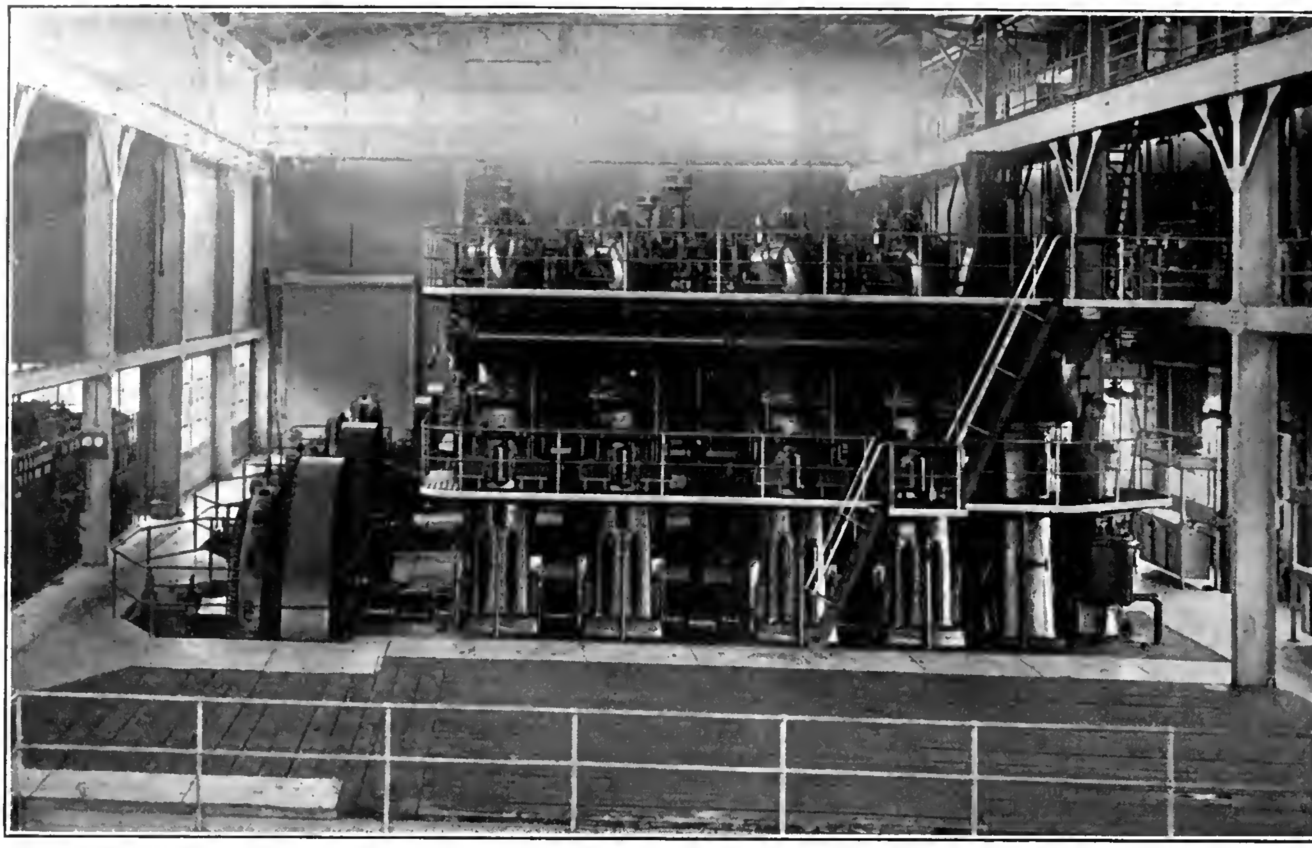
*Bisbee.*—Two four-cylinder, 2,000-hp. engines, direct-connected to 60-cycle, three-phase, 1,500-kw. generators; two five-cylinder, 1,250-hp. engines, direct-connected to 60-cycle, three-phase, 850-kw. generators.

*Globe.*—Two five-cylinder, 1,250-hp. engines, direct-connected to 60-cycle, three-phase, 850-kw. generators.

These ratings are for sea-level conditions, and the actual power is slightly reduced at the elevations where the engines are used, which vary from 3,500 ft. to 6,000 ft.

ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS





DIESEL ENGINES AT THE POWER PLANT OF THE PHELPS-DODGE CORPORATION, BISBEE, ARIZ.

A double system of fuel-oil pipe is used, one supply for starting oil, which has to remain fluid at the lowest temperature liable to be reached in the power plant, and the other for running oil, which can be any oil that will be fluid at the temperature to which it is practicable to heat it. The piping for both oil systems is arranged with an internal heating pipe through which hot water is circulated to heat the fuel oil, and by using the discharge water from one of the exhaust-pipe cooling jackets there is no difficulty in keeping the oil at 140 deg. F. when the engine is operating at one-half load or over and the piping is properly insulated.

### Each Unit Is Self-Contained

Each engine drives its scavenging pump and a high-pressure air compressor for fuel injection and is a complete unit in itself except that the cooling water goes to a common pump and is repumped to a cooling tower by one or more pumps independent of the engine. The 250-hp. cylinders have 20¾-in. bore and 26-in. stroke and operate at 180 r.p.m. The 500-hp. cylinders have 28-in. bore and 44-in. stroke and operate at 120 r.p.m.

Since the plants were put in operation California 14 deg. Baumé fuel oil or Mexican 14 deg. Baumé oil has been used for running oil except for a short period when Mexican oil deliveries were stopped. The Mexican oil contains as much as 4½ per cent sulphur and averages about 3¾ per cent. This increases the difficulties of cylinder lubrication and the maintenance cost of the cylinders and piston rings.

The cooling water has an important bearing on the running costs of the engines. If the water carries scale-forming impurities, the scale formed in the cylinder heads and pistons increases considerably the cracking of these parts, not only through the heat-insulating properties of the scale but also by the loose scale plugging water passages and stopping the circulation of water.

### Fuel Economy

The fuel economy of the engines is good. Including the exciter losses for the generator, a 1,250-hp. engine delivers a kilowatt-hour at the switchboard with a consumption of 0.69 lb. of fuel oil at loads between 600 kw. and 700 kw. The 2,000-hp. engines use 0.67 lb. of fuel oil per kilowatt-hour at loads between 1,200 kw. and 1,500 kw. On the basis of 14 deg. Baumé Mexican fuel oil averaging 18,500 B.t.u., which was used in these engines, the fuel economy of the 1,250-hp. engines is 12,800 B.t.u. per kilowatt-hour, and on the 2,000-hp. engines it is 12,400 B.t.u. per kilowatt-hour. The power required to operate the auxiliaries of the plant such as water-circulating pumps, fuel-oil-handling pumps, lighting, etc., is from 2 per cent to 5 per cent of the total output according to the local conditions.

In practice the fuel consumption is from 5 per cent to 20 per cent higher than shown on test runs for the load corresponding to average load on the engines, depending upon the load factor on the engines and the plant and on the number of times the engines are stopped and started. For example, at Globe during the first five months of last year the average load per engine running was 587 kw.; the peak load carried exceeded 900 kw. per engine, and the fuel consumption was 0.763 lb. per kilowatt-hour generated. In this case the test curve showed a consumption of only 0.695 lb. of oil per kilowatt-hour for a load of 587 kw. At Morenci, after making proper allowance for excitation of generators, the fuel consumption in the same period was 0.795 lb. per kilowatt-hour, generated with an average load of 511 kw. per engine running, the test curve showed 0.72

lb. per kilowatt-hour. At Tyrone, with a very steady load, but where one engine is running only eleven hours per day, the fuel consumption is 1.25 lb. per kilowatt-hour for an average load of 236 kw., the test curve showing 1.04 lb. for this load.

### OPERATING COSTS

The cost of power obtained from these plants is encouraging and justifies the use of the Diesel engine where fuel is expensive and the load on the plant does not exceed 5,000 kw. The maintenance costs of these Diesel plants is high, but they were started at a time when all costs were high. It has been necessary to train operating crews, as none were available, and the cost of this training is reflected in the maintenance costs.

A Diesel plant reaches its average maintenance cost quickly, probably in about three years, while steam plants do not reach their average condition for about fifteen years. In making comparisons between the two types of plants this point must not be overlooked, nor the fact that the Diesel plant is comparable to a complete steam plant, including condensers, boilers, economizers, etc. There is no doubt that with more experience, with a greater supply of trained operating labor, and with the cost of repair material coming down, maintenance costs will be reduced.

The operating costs for the first five months of last year at Globe and Morenci, which are the only two plants running under a fair load condition, and at Tyrone, which shows a non-producing plant running under very unfavorable conditions, are as follows:

*Globe.*—Total cost per kilowatt-hour distributed, $0.00878, of which operating labor is 17 per cent and fuel oil 69 per cent.

*Morenci.*—Total cost per kilowatt-hour distributed, $0.00877, of which operating labor is 18 per cent and fuel oil 60 per cent.

*Tyrone.* — Total cost per kilowatt-hour distributed, $0.01968, of which operating labor is 41 per cent and fuel oil 47 per cent.

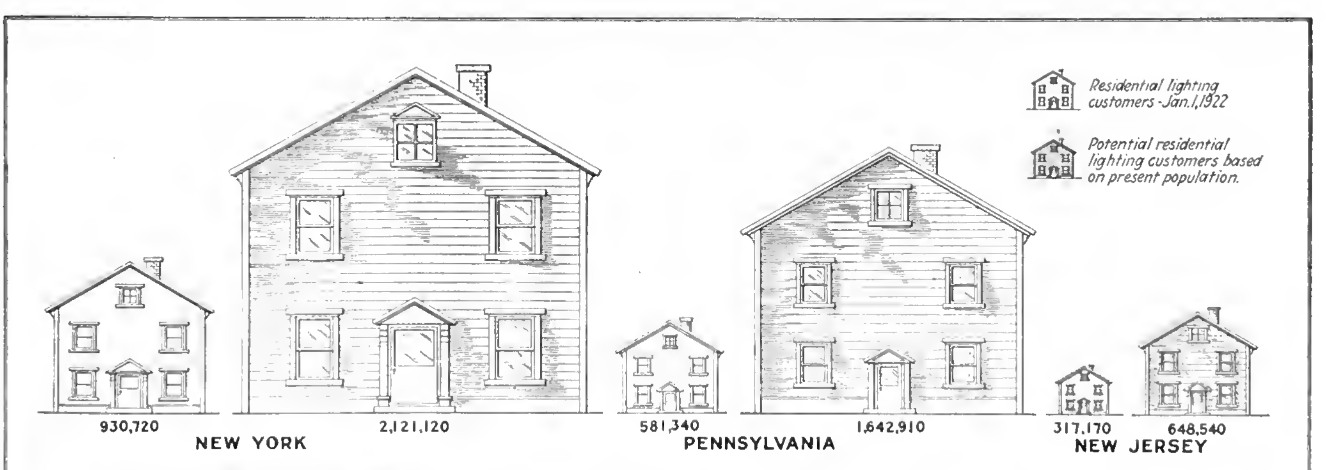
These costs include no taxes or general overhead expense, but all supplies and labor include the overhead expense of supply and mechanical departments. They are per kilowatt-hour available outside the power house for distribution to power users. They are low as regards repairs, which, at present prices of repair materials and taken over a sufficiently long period of time to cover major periodical repairs, would probably be increased $0.001 per kilowatt-hour distributed from the switchboard.

# Almost Six Million Potential Customers in Middle Atlantic States

### "Electrical World" Estimate by Counties of Present and Possible Future Consumers of Electricity in the Middle Atlantic States Indicates that There Are More than Two and One-half Million Homes in This Section Yet to Be Electrified

NEW YORK, New Jersey and Pennsylvania, comprising what is commonly termed the Middle Atlantic Section of the country, present perhaps the most concentrated field for the future growth of the electric light and power industry to be found in this country or in the world. In 1920 this section, comprising only 3.4 per cent of the total area of the United States, had a population of 22,261,144, or 21.1 per cent of the total population. This gave the section a population of 222.6 persons per square mile, or double that of any other section. Almost three-quarters of these people live in cities and towns, and the section contains seven cities with a population in excess of 250,000.

The distribution of the present number and the potential number of central-station customers among the various counties of these three states is given in the accompanying tabulation. This study is based upon




THE LARGER CITIES OF THE MIDDLE ATLANTIC STATES OFFER A LARGE FIELD FOR THE SUBSTITUTION OF ELECTRIC LIGHT FOR GAS LIGHT IN DWELLINGS

# Present and Potential Central-Station Customers in the Middle Atlantic States by Counties

| State and County | Population (Census of 1920) | | | Domestic Lighting Customers | | Commercial Lighting Customers | | Industrial Power Customers | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Urban* | Rural | Total (Jan. 1, 1922) | Total Potential (Including Present Customers) | Total (Jan. 1, 1922) | Total Potential (Including Present Customers) | Total (Jan. 1, 1922) | Total Potential (Including Present Customers) |
| NEW YORK | 10,385,222 | 8,890,049 | 1,495,173 | 930,720 | 2,121,120 | 261,050 | 560,900 | 33,890 | 65,810 |
| Albany | 186,106 | 159,908 | 26,198 | 19,420 | 43,020 | 3,410 | 7,540 | 550 | 860 |
| Allegaoy | 36,842 | 9,786 | 27,058 | 2,460 | 7,050 | 280 | 800 | 60 | 120 |
| Bronx | 732,016 | 732,016 | 0 | 62,800 | 166,300 | 8,780 | 17,600 | 1,390 | 4,400 |
| Broome | 113,610 | 93,908 | 19,702 | 11,770 | 25,960 | 2,070 | 4,560 | 170 | 360 |
| Cattaraugus | 71,323 | 39,659 | 31,664 | 6,220 | 14,980 | 960 | 2,320 | 130 | 310 |
| Caynga | 65,221 | 39,937 | 25,284 | 5,840 | 13,930 | 920 | 2,190 | 140 | 400 |
| Chantanqua | 115,348 | 77,409 | 37,939 | 11,300 | 26,110 | 1,810 | 4,180 | 300 | 660 |
| Chemung | 65,872 | 51,659 | 14,213 | 13,500 | 15,340 | 500 | 2,540 | 400 | 600 |
| Chenango | 34,969 | 14,480 | 20,489 | 2,600 | 7,130 | 330 | 910 | 90 | 180 |
| Clinton | 43,898 | 13,749 | 30,149 | 3,000 | 6,660 | 500 | 960 | 100 | 300 |
| Columbia | 38,930 | 17,675 | 21,255 | 3,180 | 7,920 | 480 | 1,200 | 80 | 160 |
| Cortland | 29,625 | 17,761 | 11,864 | 2,700 | 6,650 | 380 | 930 | 40 | 190 |
| Delaware | 42,774 | 9,263 | 33,511 | 2,610 | 7,650 | 320 | 940 | 80 | 160 |
| Dutchess | 91,747 | 54,356 | 37,391 | 6,200 | 18,500 | 1,600 | 2,500 | 140 | 300 |
| Erie | 634,688 | 572,729 | 61,959 | 93,000 | 150,000 | 17,000 | 26,550 | 4,000 | 7,000 |
| Essex | 31,871 | 11,752 | 20,119 | 2,210 | 5,780 | 340 | 890 | 30 | 60 |
| Franklin | 43,541 | 18,311 | 25,230 | 2,890 | 7,450 | 480 | 1,240 | 40 | 80 |
| Fulton | 44,927 | 34,173 | 10,754 | 5,080 | 11,420 | 770 | 1,730 | 270 | 560 |
| Genesee | 37,976 | 19,166 | 18,810 | 3,040 | 7,580 | 460 | 1,150 | 50 | 120 |
| Greene | 25,796 | 8,693 | 17,103 | 1,920 | 5,180 | 240 | 650 | 50 | 100 |
| Hamilton | 3,970 | 0 | 3,970 | 90 | 460 | 10 | 50 | 10 | 20 |
| Herkimer | 64,962 | 44,216 | 20,746 | 8,590 | 10,850 | 1,210 | 1,550 | 310 | 650 |
| Jefferson | 82,250 | 43,338 | 38,912 | 9,410 | 12,470 | 1,750 | 2,300 | 270 | 360 |
| Kings | 2,018,356 | 2,018,356 | 0 | 171,400 | 453,500 | 43,440 | 115,000 | 6,880 | 13,600 |
| Lewis | 23,704 | 3,127 | 20,577 | 1,420 | 4,130 | 180 | 520 | 60 | 120 |
| Livingston | 36,830 | 15,006 | 21,824 | 2,540 | 6,710 | 390 | 1,030 | 480 | 960 |
| Madison | 39,535 | 17,724 | 21,811 | 3,350 | 8,480 | 460 | 1,170 | 60 | 120 |
| Monroe | 352,034 | 311,055 | 40,979 | 35,430 | 78,360 | 6,660 | 14,750 | 1,250 | 2,400 |
| Montgomery | 57,928 | 42,363 | 15,565 | 5,590 | 12,620 | 980 | 2,210 | 180 | 310 |
| Nassau | 126,120 | 77,205 | 48,915 | 9,840 | 23,790 | 1,700 | 4,100 | 130 | 260 |
| New York | 2,284,103 | 2,284,103 | 0 | 131,000 | 400,000 | 115,000 | 240,000 | 10,000 | 16,000 |
| Niagara | 118,705 | 92,779 | 25,926 | 11,180 | 24,990 | 2,070 | 4,620 | 520 | 710 |
| Oneida | 182,833 | 138,163 | 44,670 | 16,610 | 37,670 | 3,020 | 6,850 | 380 | 960 |
| Onondaga | 241,465 | 196,309 | 45,156 | 32,260 | 8,500 | 5,770 | 7,500 | 640 | 1,900 |
| Ontario | 52,652 | 28,698 | 23,954 | 4,340 | 10,760 | 660 | 1,640 | 130 | 200 |
| Orange | 119,844 | 70,296 | 49,548 | 10,080 | 24,060 | 1,680 | 4,010 | 300 | 400 |
| Orleans | 28,619 | 12,319 | 16,300 | 2,410 | 6,010 | 340 | 850 | 60 | 120 |
| Oswego | 71,045 | 41,647 | 29,398 | 6,170 | 15,020 | 950 | 2,320 | 70 | 380 |
| Otsego | 46,200 | 18,072 | 28,128 | 3,650 | 9,710 | 460 | 1,230 | 60 | 120 |
| Putnam | 10,802 | 1,433 | 9,369 | 690 | 1,960 | 90 | 260 | 10 | 20 |
| Queens | 469,042 | 469,042 | 0 | 70,000 | 110,000 | 9,250 | 14,500 | 1,490 | 3,760 |
| Rensselaer | 113,129 | 90,947 | 22,182 | 11,980 | 26,630 | 2,010 | 4,470 | 150 | 480 |
| Richmond | 116,531 | 116,531 | 0 | 9,000 | 24,000 | 1,640 | 4,400 | 260 | 700 |
| Rockland | 45,548 | 26,042 | 19,506 | 4,850 | 7,990 | 1,780 | 2,970 | 300 | 460 |
| St. Lawrence | 88,121 | 34,793 | 53,328 | 5,890 | 16,410 | 1,000 | 2,780 | 110 | 230 |
| Saratoga | 60,029 | 35,046 | 24,983 | 5,120 | 12,450 | 800 | 1,950 | 70 | 140 |
| Schenectady | 109,363 | 88,723 | 20,640 | 10,440 | 23,250 | 1,870 | 4,160 | 120 | 240 |
| Schoharie | 21,303 | 5,195 | 16,108 | 1,610 | 3,580 | 160 | 360 | 30 | 60 |
| Schuyler | 13,098 | 1,560 | 11,538 | 620 | 2,210 | 50 | 180 | 10 | 20 |
| Seneca | 24,735 | 10,198 | 14,537 | 1,680 | 4,510 | 240 | 640 | 30 | 60 |
| Steuben | 80,627 | 45,579 | 35,048 | 7,010 | 17,250 | 1,030 | 2,540 | 130 | 340 |
| Suffolk | 110,246 | 54,351 | 55,895 | 12,900 | 19,010 | 2,220 | 3,300 | 70 | 80 |
| Sullivan | 33,163 | 6,502 | 26,661 | 1,930 | 5,690 | 240 | 710 | 90 | 180 |
| Tioga | 24,212 | 9,417 | 14,795 | 2,170 | 5,500 | 280 | 710 | 30 | 60 |
| Tompkins | 35,285 | 20,250 | 15,035 | 4,750 | 10,000 | 600 | 800 | 160 | 200 |
| Ulster | 74,979 | 37,710 | 37,269 | 6,020 | 15,150 | 890 | 2,240 | 160 | 320 |
| Warren | 31,673 | 18,638 | 13,035 | 2,940 | 6,940 | 460 | 1,090 | 50 | 180 |
| Washington | 44,888 | 21,381 | 23,507 | 3,340 | 8,660 | 490 | 1,270 | 40 | 80 |
| Wayne | 48,827 | 18,740 | 30,087 | 3,940 | 10,170 | 540 | 1,390 | 200 | 400 |
| Westcheater | 344,436 | 307,019 | 37,417 | 32,320 | 71,450 | 6,560 | 14,500 | 400 | 1,130 |
| Wyoming | 30,314 | 14,131 | 16,183 | 3,080 | 6,070 | 330 | 650 | 50 | 100 |
| Yates | 16,641 | 5,660 | 10,981 | 1,340 | 3,580 | 160 | 430 | 30 | 60 |
| NEW JERSEY | 3,155,900 | 2,658,047 | 497,853 | 317,170 | 648,540 | 68,120 | 151,430 | 16,490 | 44,370 |
| Atlantic | 83,914 | 70,313 | 13,601 | 8,390 | 18,970 | 1,760 | 3,980 | 310 | 970 |
| Bergen | 210,703 | 166,533 | 44,170 | 32,190 | 42,190 | 4,320 | 9,940 | 1,110 | 1,670 |
| Burlington | 81,770 | 33,766 | 48,004 | 4,680 | 13,130 | 860 | 2,410 | 110 | 550 |
| Camden | 190,508 | 157,158 | 33,350 | 17,530 | 40,650 | 3,880 | 9,000 | 440 | 2,360 |
| Cape May | 19,460 | 14,128 | 5,332 | 2,180 | 4,980 | 420 | 960 | 50 | 250 |
| Cumberland | 61,348 | 40,869 | 20,479 | 5,210 | 12,780 | 1,030 | 2,490 | 240 | 1,250 |
| Essex | 652,089 | 644,066 | 8,023 | 66,000 | 125,000 | 15,630 | 34,700 | 4,490 | 6,000 |
| Gloucester | 48,224 | 24,923 | 23,301 | 3,600 | 9,290 | 670 | 2,400 | 70 | 350 |
| Hudson | 629,154 | 585,159 | 43,995 | 62,000 | 137,600 | 14,150 | 31,400 | 4,430 | 12,700 |
| Hunterdon | 32,885 | 10,149 | 22,736 | 2,220 | 6,240 | 360 | 1,000 | 90 | 450 |
| Mercer | 159,881 | 132,694 | 27,187 | 13,800 | 31,990 | 3,250 | 7,540 | 750 | 1,990 |
| Middlesex | 162,334 | 141,683 | 20,651 | 20,000 | 32,380 | 5,000 | 7,860 | 370 | 2,070 |
| Monmouth | 104,925 | 70,412 | 34,513 | 15,000 | 23,510 | 2,500 | 4,610 | 400 | 1,300 |
| Morris | 82,694 | 64,810 | 17,884 | 7,680 | 17,530 | 1,780 | 4,060 | 140 | 680 |
| Ocean | 22,155 | 9,524 | 12,631 | 1,780 | 4,640 | 310 | 810 | 50 | 250 |
| Passaic | 259,174 | 227,442 | 31,732 | 24,610 | 55,590 | 5,540 | 12,520 | 2,680 | 7,720 |
| Salem | 36,572 | 17,719 | 18,853 | 2,690 | 7,110 | 470 | 1,240 | 60 | 300 |
| Somerset | 47,991 | 26,349 | 21,642 | 3,380 | 8,610 | 700 | 1,790 | 60 | 300 |
| Sussex | 24,905 | 10,549 | 14,356 | 1,720 | 4,630 | 300 | 810 | 50 | 250 |
| Union | 200,157 | 182,668 | 17,489 | 18,750 | 42,380 | 4,480 | 10,150 | 470 | 2,290 |
| Warren | 45,047 | 27,133 | 17,924 | 3,760 | 9,340 | 710 | 1,760 | 120 | 670 |
| PENNSYLVANIA | 8,720,015 | 6,034,813 | 2,685,202 | 581,340 | 1,642,910 | 159,940 | 365,590 | 28,050 | 68,050 |
| Adams | 34,583 | 7,791 | 26,792 | 1,430 | 5,400 | 130 | 490 | 90 | 180 |
| Allegheny | 1,185,808 | 1,017,046 | 168,762 | 105,000 | 238,140 | 14,500 | 33,800 | 1,400 | 5,350 |
| Armstrong | 75,568 | 22,672 | 52,896 | 4,500 | 10,800 | 500 | 1,150 | 100 | 200 |
| Beaver | 111,621 | 81,494 | 30,127 | 12,000 | 21,970 | 1,500 | 2,750 | 160 | 340 |
| Bedford | 38,277 | 5,196 | 33,081 | 1,050 | 5,020 | 80 | 380 | 100 | 200 |
| Berks | 200,854 | 133,570 | 67,284 | 14,780 | 40,060 | 1,780 | 4,820 | 960 | 2,360 |
| Blair | 128,334 | 89,266 | 39,068 | 8,960 | 24,410 | 1,080 | 2,940 | 80 | 270 |
| Bradford | 53,166 | 21,555 | 31,611 | 3,050 | 9,820 | 600 | 1,000 | 90 | 180 |
| Bucks | 82,476 | 32,010 | 50,466 | 4,710 | 14,690 | 530 | 1,650 | 260 | 790 |
| Butler | 77,270 | 28,148 | 49,122 | 4,500 | 12,310 | 1,200 | 1,500 | 200 | 350 |
| Cambria | 197,839 | 129,289 | 68,550 | 12,800 | 26,000 | 1,850 | 2,050 | 330 | 400 |

## Present and Potential Central-Station Customers in the Middle Atlantic States by Counties—(Continued)

| State and County | Population (Census of 1920) | | | Domestic Lighting Customers | | Commercial Lighting Customers | | Industrial Power Customers | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | Urban* | Rural | Total (Jan. 1 1922) | Total Potential (Including Present Customers) | Total (Jan. 1, 1922) | Total Potential (Including Present Customers) | Total (Jan. 1 1922) | Total Potential (Including Present Customers) |
| PENNSYLVANIA—(Continued) | | | | | | | | | |
| Cameron | 6,297 | 3,036 | 3,261 | 510 | 3,500 | 120 | 210 | 20 | 40 |
| Carbon | 62,565 | 42,050 | 20,515 | 4,140 | 11,100 | 600 | 1,610 | 70 | 140 |
| Centre | 44,304 | 10,301 | 34,003 | 1,870 | 6,660 | 200 | 710 | 110 | 220 |
| Chester | 115,120 | 61,940 | 53,180 | 7,230 | 21,090 | 920 | 2,680 | 160 | 370 |
| Clarion | 36,170 | 4,455 | 31,715 | 660 | 4,670 | 400 | 2,000 | 40 | 80 |
| Clearfield | 103,236 | 38,686 | 64,550 | 11,350 | 15,460 | 640 | 2,000 | 350 | 450 |
| Clinton | 33,555 | 17,895 | 15,660 | 2,090 | 6,080 | 260 | 760 | 80 | 160 |
| Columbia | 48,349 | 29,873 | 18,476 | 3,410 | 9,480 | 420 | 1,170 | 120 | 240 |
| Crawford | 60,667 | 25,678 | 34,989 | 3,920 | 12,270 | 390 | 1,220 | 180 | 330 |
| Cumberland | 58,578 | 29,519 | 29,059 | 3,920 | 11,620 | 430 | 1,280 | 150 | 300 |
| Daupbin | 153,116 | 115,163 | 37,953 | 15,000 | 32,560 | 3,000 | 3,820 | 900 | 1,400 |
| Delaware | 173,084 | 117,863 | 55,221 | 11,320 | 30,990 | 1,470 | 4,030 | 280 | 490 |
| Elk | 34,981 | 19,453 | 15,528 | 1,980 | 5,710 | 280 | 810 | 60 | 120 |
| Erie | 153,536 | 112,179 | 41,357 | 12,160 | 71,870 | 220 | 1,300 | 500 | 870 |
| Fayette | 188,104 | 63,510 | 124,594 | 7,840 | 26,480 | 2,970 | 10,400 | 570 | 1,320 |
| Forest | 7,477 | 0 | 7,477 | 110 | 800 | 20 | 150 | 10 | 20 |
| Franklin | 62,275 | 26,825 | 35,450 | 6,000 | 10,870 | 1,500 | 2,100 | 490 | 1,310 |
| Fulton | 9,617 | 0 | 9,617 | 150 | 1,100 | 30 | 220 | 30 | 60 |
| Greene | 30,804 | 3,332 | 27,472 | 730 | 4,070 | 270 | 1,350 | 40 | 80 |
| Huntingdon | 39,848 | 11,795 | 28,053 | 1,710 | 6,050 | 190 | 670 | 120 | 240 |
| Indiana | 80,910 | 24,179 | 56,731 | 3,920 | 11,490 | 430 | 850 | 220 | 450 |
| Jefferson | 62,104 | 24,797 | 37,307 | 2,760 | 9,320 | 330 | 1,110 | 90 | 250 |
| Juniata | 14,464 | 1,083 | 13,381 | 470 | 2,050 | 40 | 170 | 50 | 100 |
| Lackawanna | 286,311 | 275,248 | 11,063 | 24,040 | 58,000 | 3,320 | 8,000 | 570 | 1,160 |
| Lancaster | 173,797 | 84,239 | 89,558 | 11,460 | 33,090 | 1,240 | 3,580 | 1,230 | 1,920 |
| Lawrence | 85,545 | 55,313 | 30,232 | 5,860 | 16,210 | 760 | 2,100 | 90 | 290 |
| Lebanon | 63,152 | 34,841 | 28,311 | 4,470 | 12,540 | 540 | 1,520 | 120 | 670 |
| Lehigh | 148,101 | 93,619 | 54,482 | 10,210 | 28,130 | 1,190 | 3,280 | 40 | 900 |
| Luzerne | 390,991 | 289,973 | 101,018 | 30,000 | 67,320 | 5,000 | 9,370 | 590 | 1,300 |
| Lycoming | 83,100 | 54,020 | 29,080 | 6,050 | 16,900 | 720 | 2,010 | 290 | 690 |
| McKean | 48,934 | 24,302 | 24,632 | 2,880 | 8,880 | 330 | 1,020 | 170 | 350 |
| Mercer | 93,788 | 60,131 | 33,657 | 6,420 | 17,820 | 820 | 2,280 | 100 | 290 |
| Mifflin | 31,439 | 14,159 | 17,280 | 1,930 | 5,570 | 210 | 610 | 50 | 100 |
| Monroe | 24,295 | 10,133 | 14,162 | 1,260 | 4,160 | 140 | 460 | 60 | 120 |
| Montgomery | 199,310 | 96,413 | 102,897 | 11,340 | 33,690 | 1,330 | 3,960 | 520 | 1,170 |
| Montour | 14,080 | 6,952 | 7,128 | 720 | 2,240 | 90 | 280 | 30 | 60 |
| Northampton | 153,506 | 121,746 | 31,760 | 12,130 | 31,450 | 3,000 | 5,000 | 350 | 900 |
| Northumberland | 122,079 | 80,092 | 41,987 | 7,830 | 21,820 | 960 | 2,790 | 180 | 480 |
| Perry | 22,875 | 5,528 | 17,347 | 1,080 | 3,850 | 110 | 390 | 70 | 140 |
| Philadelphia | 1,823,779 | 1,823,779 | 0 | 100,500 | 360,000 | 88,000 | 184,000 | 11,400 | 31,000 |
| Pike | 6,818 | 1,535 | 5,283 | 610 | 1,500 | 60 | 110 | 30 | 60 |
| Potter | 21,089 | 2,836 | 18,253 | 620 | 2,970 | 40 | 190 | 50 | 100 |
| Schuylkill | 217,754 | 149,254 | 68,500 | 14,140 | 38,020 | 1,920 | 5,150 | 150 | 970 |
| Snyder | 17,129 | 1,937 | 15,192 | 690 | 2,730 | 60 | 240 | 50 | 100 |
| Somerset | 82,112 | 24,215 | 57,897 | 3,710 | 13,460 | 360 | 1,300 | 110 | 220 |
| Sullivan | 9,520 | 1,250 | 8,270 | 440 | 1,430 | 50 | 160 | 30 | 60 |
| Susquehanna | 34,763 | 13,810 | 20,953 | 1,990 | 4,000 | 500 | 670 | 80 | 100 |
| Tioga | 37,118 | 7,094 | 30,024 | 1,420 | 5,950 | 110 | 460 | 60 | 120 |
| Union | 15,850 | 4,948 | 10,902 | 790 | 2,850 | 70 | 250 | 30 | 60 |
| Venango | 59,184 | 31,244 | 27,940 | 3,640 | 10,840 | 430 | 1,280 | 100 | 210 |
| Warren | 40,024 | 15,822 | 24,202 | 4,100 | 7,000 | 350 | 710 | 300 | 500 |
| Washington | 188,992 | 93,978 | 95,014 | 9,580 | 30,340 | 3,940 | 12,480 | 630 | 1,280 |
| Wayne | 27,435 | 6,237 | 21,198 | 1,160 | 4,430 | 110 | 420 | 110 | 220 |
| Westmoreland | 273,568 | 132,107 | 141,461 | 14,820 | 42,690 | 5,240 | 15,100 | 700 | 1,460 |
| Wyoming | 14,101 | 1,736 | 12,365 | 730 | 2,570 | 70 | 250 | 30 | 60 |
| York | 144,521 | 64,673 | 79,848 | 8,690 | 26,550 | 990 | 3,020 | 1,320 | 2,140 |

* Cities and towns over 1,000 population.

reports which have been received by the ELECTRICAL WORLD from operating companies representing about 70 per cent of the installed generator rating of the country, supplemented by population and industrial power data issued by the United States Census Bureau. The data obtained in this way were in each case referred to a representative company operating in the county concerned with a request that an opinion be given as to whether the data represented with a fair degree of accuracy conditions existent in that county. In the few cases where the company to which the figures were sent indicated that the ELECTRICAL WORLD figures were at variance with conditions in the county a new study was made and the data were corrected accordingly. The figures for the various counties, although estimates, are believed to indicate very clearly the present and future potentialities of the counties as ultimate purchasers of electrical apparatus, appliances and supplies.

A similar tabulation showing the distribution of the central-station customers in New England was published in the April 28, 1923, issue of the ELECTRICAL WORLD, and studies are under way covering other sections of the country.

## Radio Telephony in South America

IN SANTIAGO, Valparaiso, and several smaller Chilean cities interest in radio telephony is growing steadily, and its fuller development only awaits the establishment of a broadcasting station within the country such as those now in operation on the east coast of South America, says Assistant Trade Commissioner W. E. Embry in a report to the Department of Commerce.

It is reported that broadcasting stations recently erected in Buenos Aires, Montevideo and Rio de Janerio are giving very satisfactory results, and large numbers of amateur receiving sets have been sold in these countries. This is especially true of the Argentine, where conditions for broadcasting programs are almost ideal as the land generally is flat and radio transmission carries all over the River Plate district, Uruguay and in southern Brazil on the north and as far as the Andes on the east. For this reason the sale of radio equipment has met with great success in that country, and it is now estimated that there are approximately twenty-five thousand sets in the Argentine Republic, in comparison with about one hundred less than one year ago.

# Davis Bridge Development of the New England Power Company

## Another Step in "Electrification" of Deerfield River—Ultimate Yield of Watershed 200 Kw. per Square Mile—High-Voltage Trunk Line to Load Center of System—Flexible Double Switching Yards

By A. C. EATON* and E. B. COLLINS†
*New England Power Company, Worcester, Mass.*

THERE is under way at present in New England a project involving the eventual complete utilization of the hydro-electric possibilities of the Deerfield River. Back of it stands the New England Power Company. Nine generating stations will be placed along the river ultimately, which will have an installed capacity of 110,000 kva. and an annual output of nearly 400,000,000 kw.-hr. Yet the river is small, having a drainage area of only 550 square miles.

Of the planned number, four stations are completed and the Davis Bridge development is nearing completion. The last named project is at Whitingham, Vt., and will consist of a storage reservoir having a usable capacity of 111,000,000 acre-feet and a plant with an installed capacity of 60,000 hp., operating under a mean head of 350 ft. The reservoir, together with the completed Somerset reservoir, with its 58,000 acre-feet, will regulate the river flow for the Davis Bridge plant, the four completed plants and the four projected plants.

The Davis Bridge development extends fourteen miles along the river and its dam is built about 3 miles above Readsboro. The dam will impound water for 9 miles, causing about 2,200 acres of land to be flooded. A tangent, concrete-lined tunnel 2½ miles long and the equivalent of 14 ft. in diameter extends through rock to the power house below Readsboro. The earth dam, when completed, will be 200 ft. high, 1,200 ft. long and about 1,200 ft. wide at the base. With its 2,000,000 cu.yd. of earth it will be a mammoth structure and will be one of the highest dams of this type, if not the highest, in the world.

A tunnel with a diameter equivalent to 22½ ft., with a capacity of 20,000 sec.-ft. and 1,200 ft. long, was constructed under the left bank of the river to carry the water while the dam was under construction. Because of the narrow valley, a circular spillway is being constructed about 350 ft. upstream from the center line of the dam. This spillway is 160 ft. in diameter and discharges into a vertical shaft 22½ ft. in diameter and 180 ft. deep. The shaft in turn discharges into the lower end of the temporary bypass tunnel, which will be plugged at its upper end upon completion of the dam. A model of the spillway was made and tested to verify design calculations and to determine certain details of the design.

### USE OUTLET CONTROL TOWER

The flow of water to the power tunnel will be controlled by a concrete tower, 125 ft. high, built about 300 ft. above the dam. This tower will permit the reservoir to be lowered 90 ft. during a normal season's operation and will have a clear section at all times through the use of racks placed on one side and extending to the top. In the base of the tower two Morgan Smith disk-arm-type valves can be used to shut off the water.

At the lower end of the power tunnel a 10-ft. side connection leads to a Johnson differential surge tank made by the Riter-Conley Company. This tank is made of steel plate and is 34 ft. in diameter and 184 ft. high. Just below the side connection to the surge tank is a

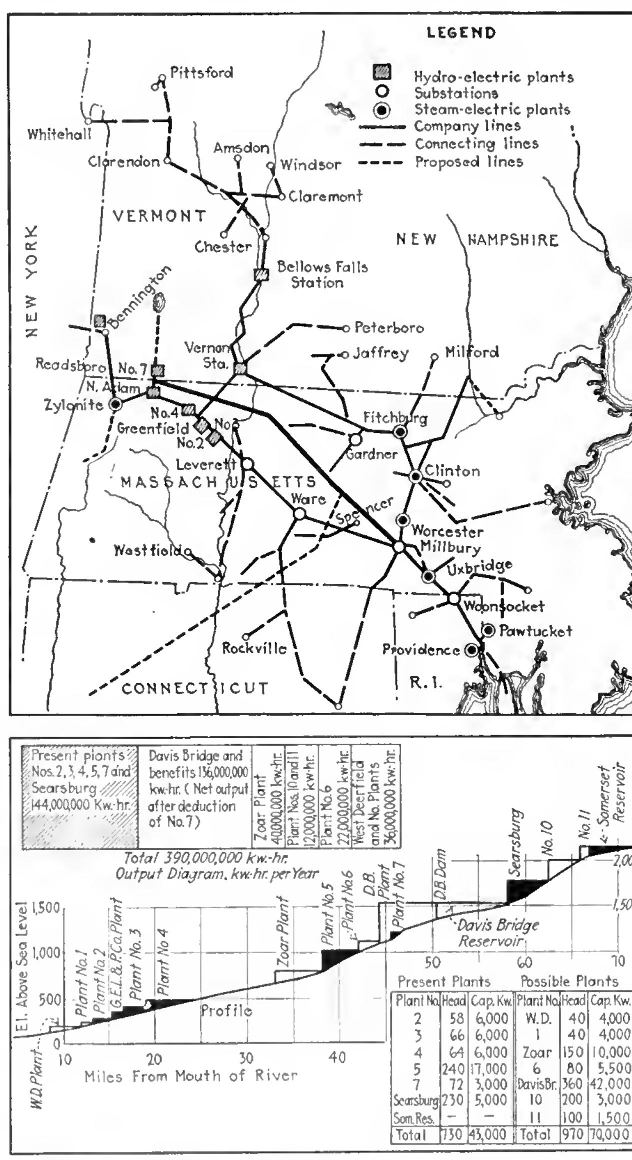



FIG. 1—DRAINAGE AREA OF ONLY 550 SQUARE MILES TO YIELD 110,000 KW.

*Hydraulic engineer. †Assistant electrical engineer.

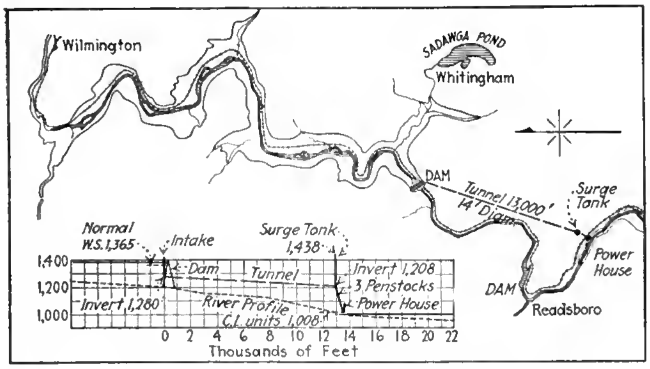



FIG. 2—POWER TUNNEL HALF AS LONG AS RIVER BETWEEN DAM AND PLANT

manifold with three branches leading through Coffin 8-ft. disk-arm valves to the 9-ft. penstocks furnished by the Lancaster Iron Works. The penstocks conduct the water to the power house, which is about 60 ft. by 110 ft. in plan and has a concrete substructure and a brick-steel superstructure. The turbines will operate with a maximum head of 390 ft., a minimum head of 300 ft. and a mean head of 350 ft.

### Station Electrical Arrangements

The initial electrical installation will consist of two General Electric 16,000-kva., 6,600-volt, three-phase, 60-cycle, 360 r.p.m. vertical waterwheel-driven generators, completed, with 90-kw., 250-volt directly connected exciters. The waterwheels are rated at 20,000 hp. and, together with the inlet valves, were furnished by Allis-Chalmers. Provision is made for the installation of a third unit in the future.

On the main floor of the station are the 16,000-kva. generators, each supported by a concrete pedestal which raises the generator about 5 ft. above the floor. Each generator is inclosed in a sheet-iron envelope which forms a housing, so that the hot air from the machines is discharged outside of the building. There are several doors in the envelopes, which make it possible to use this air for heating the building if desired.

### Unit Plant Design

Energy is taken from the generators by means of three 700,000-circ.mil single-conductor cables per leg to the main bus structure, where by suitable oil switches it is fed to the bus or to the power transformers. The station is laid out on the unit basis; one exciter, generator and transformer making up a unit. It is intended that only one machine at a time shall be connected to the main bus, and this bus is primarily used for carrying the station auxiliary transformers and local feeders. It is, however, of sufficient size to allow any generator to be used with any transformer. The auxiliary bus is connected to the main bus through a 1,500-kva., 3 per cent reactor (Fig. 3), thus allowing the use of small switches for station and local feeders. The main bus is separated by barriers, and the whole, together with the three-phase reactor, is inclosed between concrete barrier walls with all blade switches so arranged that they may be operated without entering the bus chamber. Complete duplicate station service transformers and switching equipment are provided, separated by a barrier wall. The auxiliary 6,600-volt bus and local 2,300-volt bus are run in fiber duct embedded in the barrier wall and exposed only at points where connections are made to them. They consist of No. 4/0 solid 13,200-volt varnished-cambric conductor.

The outgoing conductors from the transformer oil switches to the transformers consist of three three-phase, 700,000-circ.mil, 7,500-volt, varnished-cambric, lead-covered cables per transformer, one leg of each phase being carried in each cable in order to eliminate sheath current.

The oil switches are all cell-mounted, the back wall of the cells being carried up to the under side of the switchboard gallery, and the switches located on the side of this wall away from the station, thus eliminating any possibility of switch trouble endangering the generators. The operating solenoids and control relays for the switches are mounted on the mezzanine floor and on the side of the above wall, adjacent to the generators, where they are readily accessible for inspection and free of danger from switch trouble.

### Auxiliary Panels Carry Terminal Blocks

The switchboard is of the vertical type, and for each panel there is provided an auxiliary panel mounted in back of the main panel and 6 ft. from it. All control and meter wires are first brought to the auxiliary panels, where, after passing through terminal blocks, they go to the indicating meters on the main panels and then to the watt-hour meters and relays, which are installed on the auxiliary panels.

On the main floor by each generator is a panel on which are mounted the solenoid-operated field switches and signal boxes. By means of these the governor man receives orders from the operator for starting and stopping the machines. There are also mounted on these panel push-button stations for signaling the operator and for emergency stopping. The generator fields are provided with amortisseur windings, and the generator panels are so wired that phasing may be done in the regular way, or the operator may, by closing a control switch, cause the generators automatically to phase in. This is accomplished by means of speed switches on the generator, which close when the generator has attained 95 per cent of synchronous speed.

The 6,600-volt energy from the generators will be

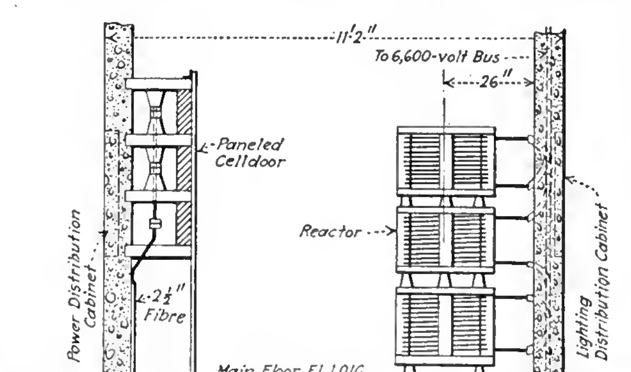



FIG. 3—REACTOR CONNECTIONS ARE MADE THROUGH WALL CONDUITS

stepped up to 110,000 volts by means of two General Electric 16,000-kva. outdoor water-cooled, conservator-type transformers connected delta on the low side and Y on the high. The energy is delivered to outdoor duplicate high-tension buses. Energy from other nearby stations at 66,000 volts will be brought to the Davis

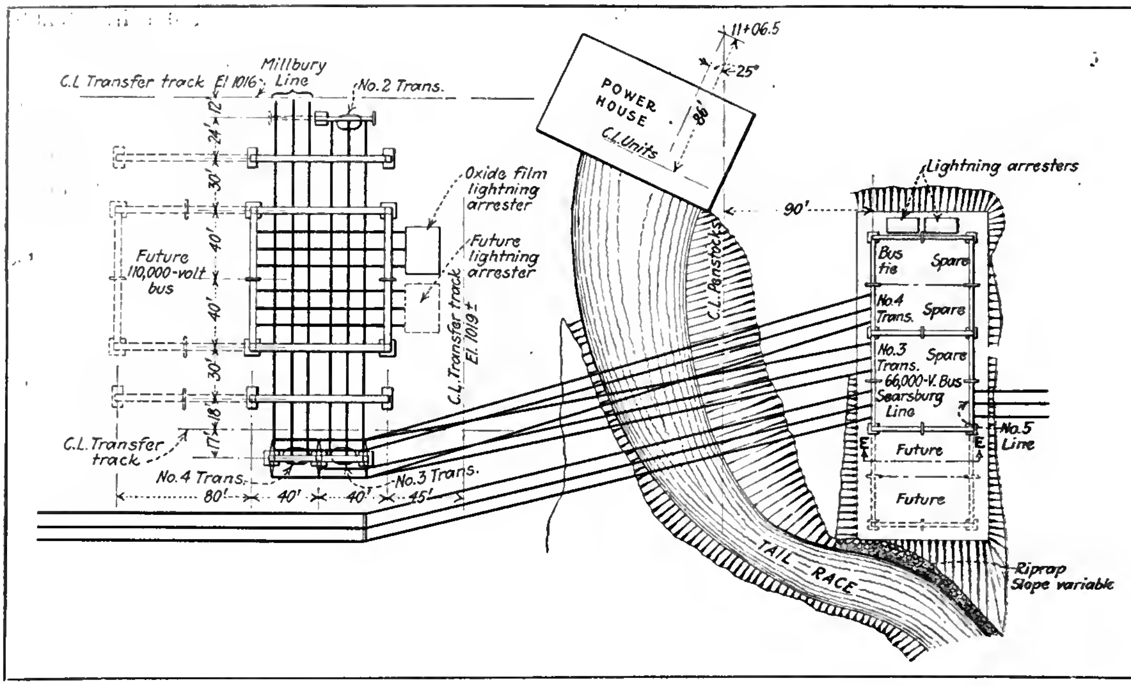



FIG. 4
PROVISION FOR FUTURE DEVELOPMENT HAS BEEN MADE IN 66,000-VOLT STRUCTURAL STEEL BAYS

Bridge station and stepped up to 110,000 volts by means of a 15,000-kva. water-cooled auto-transformer. As a reserve, in case of failure of the auto-transformer, one of the 16,000-kva. units is provided with a full capacity auto-transformer connection on the high-tension winding. On the 66,000-volt and 110,000-volt windings of all transformers taps are provided for voltages 5 per cent and 10 per cent above and 5 per cent below the rated value. Ratio adjusters are installed so that the taps may be changed without entering the transformer tanks.

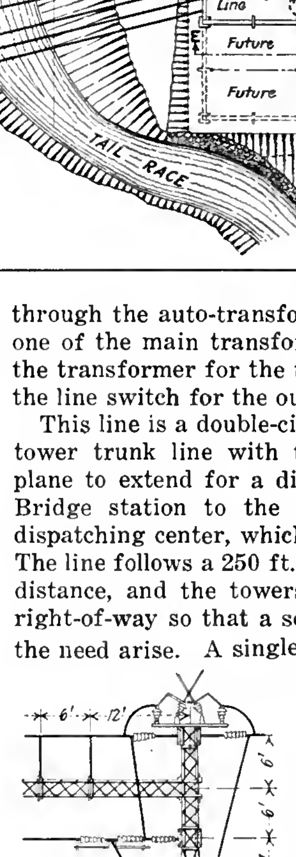
The transformers are mounted on wheels and may be rolled into the station, where pit and crane facilities are provided. In addition a 7,500-gal. oil-storage tank, with filter and piping system, is provided, together with a compressor for forcing the oil through the system to the filter press pump.

### Two-Voltage Switching Facilities

There will be two complete outdoor double-bus, galvanized-steel switching stations (Fig. 4), one for 66,000 volts (Fig. 5) and one for 110,000 volts (Fig. 6), separated by the tailrace, as may be seen by the accompanying plan view. Both stations will be equipped with oxide-film lightning arresters, one being connected to each of the buses rather than one for each line, and suspension-type choke coils will be installed in all high-tension leads to the transformers. The main buses in the 110,000-volt yard are medium-hard-drawn 400,000-circ.mil copper, and the taps are No. 4/0, while the main 66,000-volt buses are No. 4/0 medium-hard-drawn and all taps No. 2/0. The present 110,000-volt structure consists of two bays arranged for two circuits per bay, with provision for four additional bays. The 66,000-volt bus structure consists of four bays arranged for two circuits per bay, with provision for two additional bays.

All transformer and line oil switches are provided with bus selector switches and also shunt air-break switches, so that any oil switch may be taken out of service at any time for inspection and adjustment without disturbing the circuit. The 66,000-volt yard is connected to the 110,000-volt yard by two No. 2 tie circuits through the auto-transformer or the auto-connection on one of the main transformers. At present the bay for the transformer for the third generator will be used for the line switch for the outgoing 110,000-volt line.

This line is a double-circuit No. 4/0 110,000-volt steel-tower trunk line with the conductors in a horizontal plane to extend for a distance of 77 miles from Davis Bridge station to the Millbury substation and load-dispatching center, which is 7 miles south of Worcester. The line follows a 250 ft. private right-of-way the entire distance, and the towers are built on one side of the right-of-way so that a second line may run later should the need arise. A single circuit is being put in at present, but the second will probably be run when the third unit is installed. In order to facilitate the outdoor switching, telephone booths will be installed in both the 66,000-volt yard and the 110,000-volt yard.




No.5 Line
Section E-E

A private telephone line on wooden poles follows the right-of-way, giving direct communication between the station and the dispatcher at Millbury. This means of communication will be supplemented by a carrier-current

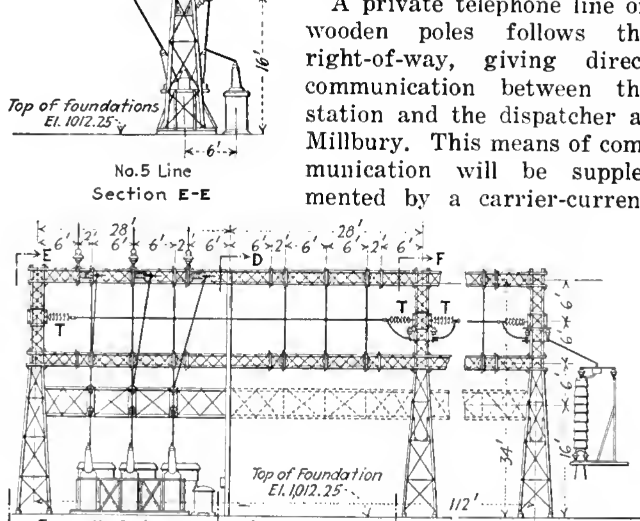



FIG. 5—SYMMETRICAL DESIGN FACILITATES OPERATION OF 66,000-VOLT EQUIPMENT

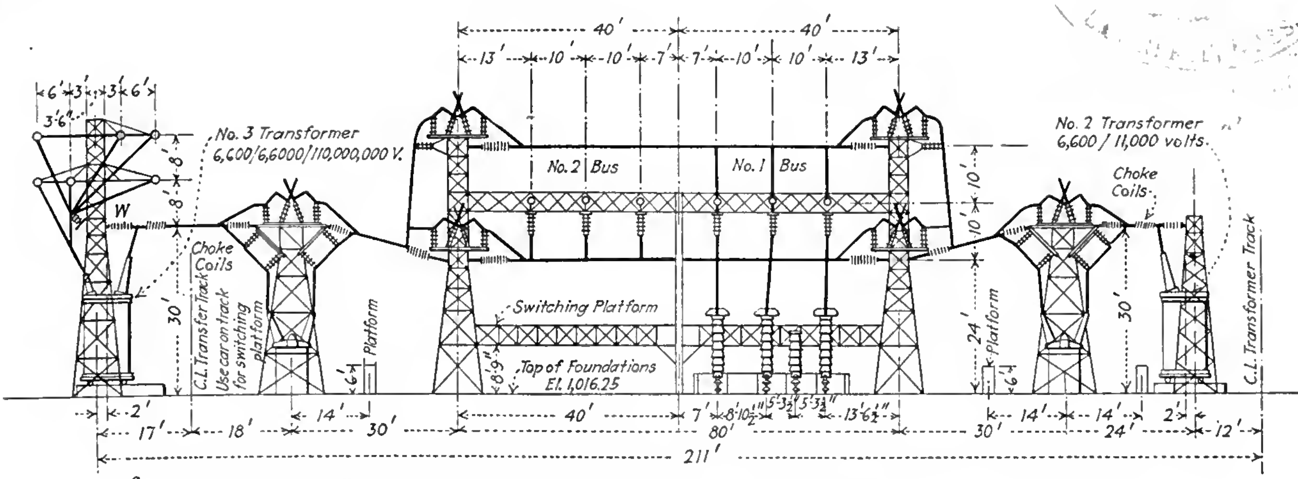



FIG. 6—THOROUGH MECHANICAL DESIGN, COMBINED WITH CLOSE ATTENTION TO INSULATION PROBLEMS, YIELDS ATTRACTIVE 110,000-VOLT EQUIPMENT LAYOUT

telephone outfit similar to that which is already in use elsewhere on the system.

The New England Power Company, through its engineering and construction department, the Power Construction Company, is handling this work. The by-pass tunnel contract was let to the Rollin Construction Corporation, the dam to the W. F. Carey Company, the power tunnel to the Mason & Hanger Company, and the power-house substructure to the L. H. Shattuck Company. With its own forces the Power Construction Company is clearing the reservoir basin, relocating highways, building 8 miles of relocated railroad, building the 77 miles of new 110,000-volt transmission line and handling many other items of lesser magnitude.

## Attendance at Technical Schools in1923 More than 70,000

THE following table, compiled by Walton C. John of the United States Bureau of Education, presents an interesting epitome of the attendance at technical colleges and schools this year, with the total figures for 1922 included for comparison:

ATTENDANCE IN ENGINEERING AND MINING SCHOOLS IN THE UNITED STATES

| Courses | Freshmen and Sophomores | Juniors | Seniors | Total | Specials | Candidates for Advanced Degrees |
|---|---|---|---|---|---|---|
| Civil engineering | *11,204 | 2,433 | 2,018 | 12,167 | 492 | 313 |
| Mechanical engineering | *6,027 | 2,637 | 2,481 | 13,682 | 160 | 95 |
| Electrical engineering | *7,661 | 2,658 | 2,360 | 13,630 | 77 | 123 |
| Chemical engineering | 2,427 | 1,082 | 1,097 | 4,606 | 23 | 111 |
| Mining engineering | 752 | 438 | 536 | 1,726 | 85 | 49 |
| Architectural engineering | 768 | 172 | 165 | 1,115 | 20 | 2 |
| Textile engineering | 227 | 97 | 93 | 417 | 41 | 1 |
| Industrial engineering | 225 | 165 | 69 | 459 | 1 | 1 |
| Aeronautical engineering | 21 | 21 | 23 | 65 | 1 | 18 |
| Sanitary engineering | 16 | 9 | 10 | 35 | 1 | 14 |
| Geological engineering | 13 | 25 | 59 | 97 | 2 | 10 |
| Ceramic engineering | 84 | 37 | 20 | 141 | 2 | ... |
| Agricultural engineering | 81 | 31 | 21 | 133 | 3 | 7 |
| Engineering, general and unclassified | 386 | 142 | 105 | 633 | 6 | ... |
| Miscellaneous | 348 | 242 | 157 | 747 | 2 | 6 |
| Chemistry | 317 | 170 | 223 | 710 | 9 | 108 |
| Physics | 19 | 7 | 39 | 65 | ... | 13 |
| Architecture | 469 | 149 | 154 | 772 | 32 | 6 |
| Metallurgy | 65 | 76 | 66 | 207 | 3 | 6 |
| General science | 6 | 6 | 9 | 21 | ... | 2 |
| Six courses at Massachusetts Institute of Technology | 291 | 140 | 224 | 655 | 37 | 35 |
| Total in 1923 | 31,407 | 10,747 | 9,929 | 52,083 | 997 | 920 |
| Total in 1922 | 32,178 | 11,446 | 8,520 | 52,144 | .... | .... |

*The figures show the enrollment, based upon the undifferentiated courses of the freshman-sophomore years.

# Some Effects of Current in Metallurgical Operations

### Superior Physical Properties of Alloys Produced in Electric Furnaces May Be Due to Electrical Field Effect on Molecular Structures

BY B. D. SAKLATWALLA
General Superintendent Vanadium Corporation of America

IN THE course of a discussion of electric furnaces at the last spring meeting of the American Institute of Electrical Engineers the author made the suggestion that other effects of the electric current besides the thermal one should be taken into consideration in electric furnace work. The effect of the current on the molecular structure of the molten metal was hinted at. As this idea seems to have found accord it appears opportune to discuss such effects a little more fully.

It has been a generally accepted metallurgical fact that alloys, ferrous or non-ferrous, produced in the electric furnace possess physical properties superior to those of the same alloys produced in combustion furnaces. This superiority has been ascribed to the apparently higher temperature and absence of combustion gases in the electric furnace. The possibility of refinement through the electrical or magnetic effect produced by the current on the material in the molten state has been totally overlooked. Such effect, however, is undoubtedly present. The passage of heavy currents through a molten mass between the arcs is surely accompanied by electrical and magnetic phenomena in that mass producing mechanical effects. Besides, at the points where the arcs are at play there will be some violent stirring and probably a disintegration of the bath material accelerating ebullition and volatilization. In the induction furnace this disintegrating effect might be absent, but the stirring or swirl effect might be more pronounced. These apparent effects have been noticeable to every furnace operator.

There are, however, other effects which may not be externally apparent and may partake more or less of a molecular nature. The metallurgical art aims at elimination of undesirable constituents from a bath of molten metal by chemically slagging off such constituents and thus separating them from the metal. This separation, after completion of the chemical reactions, in the combustion furnaces is dependent only on the difference

in specific gravity of the constituents. In the electric furnace it is possible that the different molecules of the molten bath, finding themselves in an electric or magnetic field, follow a separation dependent on the difference of their electric characteristics, such as conductivity, permeability, etc. Further, the electric alternating tension present may cause a molecular vibration, thus aiding gravitational separation of the metallic and non-metallic constituents, either solid or gaseous. This idea of alternating vibrations leads to the question of frequency and its effect in setting up such molecular motion. As commercial experience in electric furnaces has been in the ranges of low frequencies of 25 cycles or 60 cycles, knowledge as to its effect is virtually absent. The high-frequency induction furnace of the Northrup type, developed on a comparatively small scale, has nevertheless shown excellent results as to quality of product. During the process of melting down or refining in such a furnace the high frequency may contribute to the quick disintegration of the cohesion bonds between the molecules, thus accelerating their liquefaction, or the molecular vibrations set up may facilitate separation of impurities, enhancing the quality of the product. With the advent of the electron vacuum tubes and the comparatively easy method of producing high-frequency currents by their aid, study of this effect and the commercial application of its results appear near at hand.

The molecular electrical effects which help to refine molten metals in the furnace can also be usefully applied to refine the structure of metals during the period of their solidification in a mold. The physical properties of the metal are dependent to a very large extent on the structure of the solidified ingot, on the size of the crystal aggregates and their arrangement and relation to each other. Solidification under ordinary circumstances takes place, depending on the size and shape of the mold, at a more or less uncontrolled rate and in a manner not influenced in any way by the will of the operator. A study of cooling of a metal ingot under electrical conditions produced around or in the ingot might lead to means of controlling the crystallization of the ingot and the physical properties of the finished metal. Crystal growth or solidification in an ingot is the tendency of the atoms to form stronger cohesion bonds among themselves and to ordinate along definite geometrical directions. The assumption that such cohesion bonds are of an electromagnetic nature seems to be gaining ground. If this is true and the solidification process takes place in an electrical or magnetic field, it will undoubtedly be influenced by this field, depending on its intensity. As it would be an easy matter to regulate the electrical or magnetic characteristics of the field at will, it can readily be seen that by this means the process of solidification or crystallization of a metal ingot can be controlled. Not only this change in crystal growth rate can be brought about, but also mechanical effects, such as a molecular stirring or vibration, can be set up which may eliminate excessive primary crystal growth, or gas blowholes, or non-metallic inclusions. For the elimination of these defects, at present, chemical means are employed, such as additions of alloying elements, which tend to refine structure, or scavenging agents, which tend to remove gases and solid non-metallics.

The methods of creating electrical or magnetic conditions in the solidifying ingot can be several and varied. An induced field can be produced by means of extraneous coils, or a direct electrolyzing current can be sent through the body of the metal, or an alternating current can be used in the same manner, this current being of low or high frequency. Undoubtedly each of these means will produce a different result.

Investigations along these lines will probably reveal results of a very striking character and may very radically alter some aspects of alloy metallurgy. Moreover, such investigations afford another substantiation of the utility of electrical energy in achieving remarkably useful results by comparatively simple means.

## Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

### "Did It Happen on the Wire?"

*To the Editors of the* ELECTRICAL WORLD:

The writer enjoyed reading in your issue of May 26 the letter by Walter C. Hecker relative to careless business methods of the central-station interests. A person familiar with the lax methods and the lack of system prevailing in the average business organizations, except the extra-large corporations and the national banks, would not be at all surprised at Mr. Hecker's complaint even though his method of making it might cause an inward chuckle at the expense of the central station.

The exigencies of the time have replaced days and weeks by minutes, and the ever-handy telephone is turning many a black hair gray. Not so long ago we would not think of attempting installations of even minor importance until all details were shown over somebody's signature, but the mad scramble for orders now in vogue has brought in the telephone and the unstable human brain to supersede the written record.

I venture to say that the gist of the motor transaction mentioned by Mr. Hecker consisted of a few telephone inquiries by his customer or his salesman from some overworked employee of the contracting department of the central station. This employee, probably attending to several customers at the same time, simply collected his thoughts as best he could and answered "Three-phase," when, as a matter of fact, the entire situation should have been checked by one of the commercial engineers before any attempt was made to answer the question. I know from experience that such transactions occur hourly, and if the people demanding this immediate telephone service only knew what a proper answer really meant to them, they would prefer to get their rulings in writing. They should wait their turn in line and not expect to be treated on a preferential basis by telephone.

The telephone is one of our greatest conveniences, but when used to transact business that requires time and investigation to reach a proper decision it becomes an instrument of imposture. The writer has made it a rule never to give official rulings over the telephone, and when the case demands careful study never to give important information orally.

The telephone query is assumed to be a part of the procedure that Mr. Hecker leaves between the lines.

GEORGE WELMAN,
Chief Electrical Inspector.
Louisiana Fire Protection Bureau, New Orleans, La.

# Central Station and Industrial Practice

**Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants**

## Interstation Communication Developments

**Wire, Space and Carrier-Current Systems Analyzed—Combination of Space and Carrier-Current Methods Ideal System—Advantages and Disadvantages of Each**

EXTENSIVE progress in the development and perfection of radio-communication methods and equipment applicable to power company needs is anticipated in the report of the sub-committee on communications of the Pacific Coast Electrical Association to be presented June 19 to 22. Many power companies are, besides, carrying on their own research investigations and meeting with considerable success. Some of the general conclusions of the report are given below.

Wired communication for ordinary routine and load-dispatching communication requirements is, the committee says, usually to be preferred to radio, mainly on account of its present high degree of perfected simplicity. However, it should be supplemented by some means of reliable auxiliary communication, such as "space" radio or "carrier-current" radio, in order to be of the maximum value to power companies in cases where almost uninterrupted communication is a requisite.

Space radio functions very satisfactorily in such instances under many conditions, the report goes on, and where the distances to be spanned do not greatly exceed 100 miles of average topographical features and the stations are not near a large commercial or government station, reliable communication service can be effected at practically all times, without prohibitive installation costs. Before making space radio communication installations in a mountainous country, careful preliminary tests should be made to determine the approximate size of transmitter that is actually required to guarantee reliable communication under the existing topographic conditions. Careful consideration also should be given to the choice of proper wave lengths to reduce outside interference to a minimum.

The fact that the stations are required to be licensed and operated only by licensed operators is a slight objection in some respects, it is admitted, but this feature usually insures a competent man who can be trained for other duties in addition to those of being a radio operator.

Carrier-current radio makes use of transmission-line conductors as "carriers" for the radio-frequency communication energy, besides effecting a marked saving in transmitter energy consumption during normal operating conditions. This system is not affected by the topographical nature of the intervening country, thus making the carrier-current system particularly desirable for application to transmission lines through mountainous sections, where the efficiency of "space" transmission is usually very severely attenuated.

The "carrier" type installation, however, cannot, the report points out, effect communication properly when all conductors of the "carrier" line are grounded, when all conductors of the "carrier" line are severed, or when "carrier" line-sectionalizing switches are opened, unless such switches are properly bypassed by some type of bypassing antenna or other device.

In the event of two or more transmission circuits being carried along the same tower line or right-of-way and being used as a part of the carrier system, the chances for all conductors being grounded or severed are somewhat remote. In the case of the single-circuit transmission line this condition is apt to occur,

### Summary of Advantages and Disadvantages of Different Types of Communication Systems

#### Wire Communication

ADVANTAGES

1. Simplicity of operation.
2. Permits simple duplex communication.
3. Operation independent of topography.
4. Privacy of communication.
5. No station license required.
6. Calling system available.

DISADVANTAGES

1. Service interruptions from line failures, particularly during severe storms.
2. Service interruptions due to trouble on power line, which the communication line closely parallels, causing intense inductive interference.
3. Repairs of line failures often effected very slowly and with difficulty because of remoteness.

#### "Space" Radio Communication

ADVANTAGES

1. Entirely independent of all interconnecting lines and their possible failures
2. Equipment all located at points of operation and thus always readily accessible for repairs when necessary.
3. Usually affords means of communication with commercial or government radio stations in an emergency.

DISADVANTAGES

1. Transmission efficiency subject to intervening topographical conditions.
2. Somewhat subject to outside interference from other stations in some locations.
3. Subject to severe atmospheric interference in some localities for certain periods of season.
4. Duplex communication expensive and somewhat complicated.
5. Lack of privacy of communication.
6. Station must be licensed and operated by licensed operator.

#### "Carrier-Current" Radio

ADVANTAGES

1. Independent of intervening topographal features.
2. Much less power required to cover a given distance than with "space" radio.
3. Greater freedom from external disturbances, such as static, and interference from other radio stations.
4. Privacy of communication.
5. Station license and licensed operator not required.
6. Call-bell system available, not necessitating operator to be listening in to receive calls.
7. Expensive antenna supports and elaborate ground system not required.
8. Little interference created in outside communication systems.
9. Operator may listen to power-line conditions.

DISADVANTAGES

1. Communication subject to interruption when "carrier" line conductors all become severed or grounded owing to line failure.
2. Necessary to "bypass" line switches, auto-transformers, etc.
3. Necessitates use of large transmitter when applied to a "carrier" system composed of a large network of lines or to a transmission line with a very large number of tap feeders or substations.
4. Duplex communication rather complicated and expensive at the present time when applied to telephony.
5. Somewhat more subject to interference from transmission line disturbances, such as discharging insulators arcing grounds, etc., than "space" radio.

but the possibilities for continuous operation are much in favor of the carrier system, even in this case, as compared with the wire-communication line, when it is remembered that a short circuit, ground or break of either of the two conductors of the wire line will cause an interruption to communication service.

A number of data have been reported in the past relative to the ability of the carrier-current radio system to effect communication through open line switches, past severe breaks in the line and through solidly grounded lines. It is the conservative opinion of the committee that such cases are misleading, since it is believed that if they are carefully analyzed it will be found in each case that communication was really effected by space transmission, if the distance between the two stations was comparatively short, or else there has been a means of bypassing the carrier radio energy past the fault that was not realized at the time of the incident.

### Bypassed Transmission Line

For example, there may be a twin-circuit and single-circuit transmission line connecting two points of operation separated a hundred miles or more. If line-sectionalizing switches opening both circuits of the twin lines are operated and tests made, the impression might be gained that the carrier system was jumping the switch, whereas in reality it is being routed over the single-circuit line. Similar reasoning will apply in the case of solid grounds on all conductors of the twin-circuit line, or even in the extreme case of all conductors of the twin line being severed and grounded. Moreover, a near-by communication or low-tension power line may possibly serve as a bypass if it parallels the carrier line at the point of open switches or severed conductors.

Actual tests have been made by some power companies which prove that the antenna of the carrier system is a fairly efficient space radiator, even when being used as a carrier antenna and placed very near the transmission-line conductors. This fact may have been overlooked during certain carrier tests with open-line switches, grounds, etc., and reported reception through such faults may have been accomplished in reality by space transmission.

Carrier-current radio functions well, the report goes on to say, but its efficiency should not be overestimated, and its advantages and disadvantages should be relatively weighed and compared with those of the other means of communication.

The ideal auxiliary communication system in most cases would, it is concluded, be a combination of the space and carrier current systems. The logical use of such a combined installation would be to utilize the carrier system at all possible times (for reasons apparent from reviewing the advantages under carrier-current radio in the accompanying summary); then, in the event of failure of the carrier system due to severe transmission line trouble, it is possible to throw over to the space radio antenna, increase power output of transmitter, retune the transmitter if necessary and continue operations.

Naturally, the size of the transmitter in this case must be several times what it would be for straight carrier service, particularly in mountainous sections. In some cases intermediate stations could be utilized to relay the communication through if necessary, thereby permitting the size of the transmitters to be smaller than they would otherwise necessarily have to be to guarantee dependable space transmission over comparatively long distances.

The principal disadvantage of this combined system would be that under the present regulations of the Department of Commerce stations of this character utilizing a space antenna would be subject to the rules and regulations applying to a limited commercial radio system. This, the committee says, would necessitate the station being licensed and operated by a licensed operator.

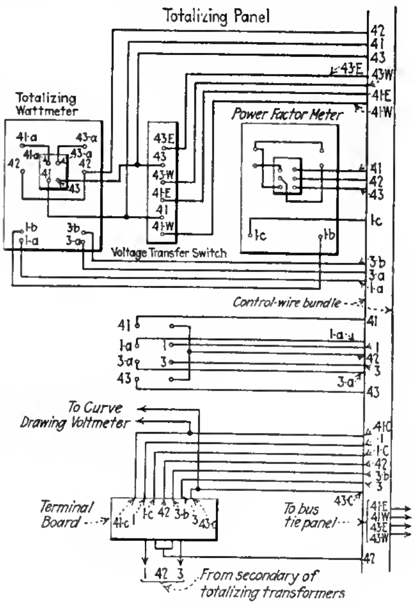
FIELD EDITOR ELECTRICAL WORLD.
San Francisco, Cal.

## Identifying Control Wires

IN TRACING control wiring to check an actual installation against the wiring diagram it is usually difficult to follow any specific circuit amid a maze of other wiring. This may delay installation work or changes when time is an important factor. Furthermore, some error may be made which may be difficult to discover.

To avoid these objections the Alabama Power Company has adopted a very simple numbering and tagging system for all control wiring. All secondary leads from current and potential transformers are brought into a terminal board mounted at the base of each panel several inches back of it. On this terminal board are short single-pole knife-blade switches without any handles but having lugs which facilitate their being operated and closed when tests must be conducted. From this board the control wiring to instruments on the panel as well as the wiring between instruments is run in a bundle up the middle of the panel but at several inches from it, with laterals running off where necessary.

To each wire from an instrument transformer is given an identifying number which is the same on all panels. After it runs through an instrument a letter is appended to the number, starting with *a* and changing to the next letter in the alphabet each time the circuit passes through an instrument.




IDENTIFICATION PLAN FOR LEADS

Tag system combined with successive lettering of leads as they pass through instruments an advantageous method.

For example, consider circuit No. 1 at the bottom of the accompanying illustration. It runs to the cable bundle and emerges a slight distance above, goes through the totalizing watt-hour meter and emerges as No. 1a. It again enters the cable bundle and emerges again above, going to the totalizing wattmeter, from which it comes out as No. 1b and goes to the bus power-factor meter. From this it emerges as No. 1c and enters the cable bundle. At the bottom it comes out again and returns to the test block as No. 1c.

At each terminal a round fiber tag (½ in. in diameter) is attached bearing the identifying number stenciled in its surface. The tags are very durable and not easily defaced.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Analyzing Interruption to Hydro-Electric Service*

ANALYZING interruptions to service calls for a standard of measurement that should be quantitative primarily and qualitative only when there is no way to express quality except by comparison with the general service experience familiar from steam practice. Quantitative measurements refer to the duration of a disturbance in minutes and seconds, to the amount of load lost, and to the extent of fluctuations of voltage and frequency at times when no load is visibly lost, but when, nevertheless, service is not perfect.

The standards that are referred to in the classification of disturbances (Table 1) are those developed during the past ten years of combined hydro-steam operation in the Baltimore-Lancaster load centers, where the Pennsylvania Water & Power Company furnishes the hydro-electric power from a development on the Susquehanna River at Holtwood, Pa. Naturally these records will refer only to the few minutes and seconds and fractions thereof when service was not 100 per cent perfect, regardless of whether trouble originated on the hydro-electric system proper, or at the steam plants operated in parallel, or on the general distribution system.

Public utilities intrusted with the supply of power to the large cities assume as a matter of course that power must be continuous and first class in every respect all the time and that a strict accounting must be given for every second when, for any reason, the 100 per cent standard is not maintained. Such an analysis will inevitably include a study of the original cause of each disturbance, of the various secondary events, the functioning of relays and other automatic devices, the manipulations carried out by attendants in response to the indications of switchboard instruments, and, lastly, a study of the ultimate effect of each disturbance on service. The natural consequence will be that all possible corrections of conditions responsible either for the original cause or for subsequent undesired secondary effects will be carried out, and that improved operating methods will be adopted that will reduce or eliminate the chances of such causes recurring.

Under the standard adopted for the Holtwood-Baltimore-Lancaster system a total loss of load, be it for only a second, is classified as a total interruption; a partial loss of load, provided that it can be traced on the main station instruments, is classified as a partial interruption, and

TABLE I—SUMMARY OF SERVICE DISTURBANCES COMPARED FOR FIVE-YEAR PERIODS, 1913-1917 AND 1918-1922

| Causes | Total Interruptions | | | Partial Interruptions | | | Voltage Disturbances | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1911 and 1912 | 1913–1917 incl. | 1918–1922 incl. | 1911 and 1912 | 1913–1917 incl. | 1918–1922 incl. | 1911 and 1912 | 1913–1917 incl. | 1918 1922 incl. |
| 1 Ice | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 2 Breakdown of power-house equipment | 3 | 1 | 0 | 5 | 2 | 1 | 2 | 19 | 2 |
| 3 Excitation system, regulators, etc. | 0 | 1 | 0 | 0 | 1 | 0 | 5 | 23 | 7 |
| 4 Gates and governor system | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 6 | 1 |
| 5 Holtwood mistakes | 2 | 5 | 1 | 4 | 7 | 1 | 12 | 35 | 20 |
| **Totals, 1 to 5** | 6 | 7 | 1 | 9 | 11 | 2 | 40 | 83 | 30 |
| 6 Lightning on transmission line | 26 | 7 | 4 | 19 | 47 | 33 | 14 | 38 | 48 |
| 7 Brick on transmission line | 1 | 2 | 0 | 0 | 3 | 0 | 0 | 12 | 5 |
| 8 Mechanical trouble on line (sleet) | 0 | 5 | 0 | 0 | 9 | 0 | 0 | 14 | 7 |
| 9 Transmission-line mistakes | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| **Totals, 6 to 9** | 27 | 14 | 4 | 19 | 60 | 34 | 14 | 64 | 60 |
| 10 Highlandtown equipment | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 5 |
| 11 Highlandtown mistakes | 0 | 1 | 2 | 0 | 3 | 4 | 0 | 1 | 26 |
| **Totals, 10 and 11** | 0 | 1 | 5 | 0 | 3 | 5 | 0 | 1 | 31 |
| 12 Distribution system and customers' equipment | 6 | 4 | 1 | 21 | 134 | 238 | 1 | 74 | 273 |
| 13 Overload | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 18 | 63 |
| 14 Lancaster system | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 65 |
| 15 Miscellaneous | 2 | 0 | 0 | 0 | 1 | 0 | 4 | 3 | 9 |
| 16 Tests | 3 | 3 | 0 | 3 | 5 | 11 | 3 | 26 | 114 |
| 17 Man in contact with line conductor | 2 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 1 |
| **Totals, 12 to 17** | 13 | 8 | 1 | 25 | 142 | 249 | 14 | 157 | 525 |
| **Totals, 1 to 17** | 46 | 30 | 11 | 53 | 216 | 290 | 68 | 305 | 646 |
| **Location of trouble** | | | | | | | | | |
| Holtwood power house | 6 | 10 | 1 | 4 | 8 | 2 | 45 | 109 | 39 |
| Baltimore high-tension line | 27 | 15 | 4 | 19 | 58 | 34 | 14 | 65 | 61 |
| Highlandtown substation | 5 | 2 | 5 | 1 | 6 | 6 | 5 | 2 | 37 |
| Baltimore distribution system, including customers' equipment | 8 | 3 | 1 | 29 | 141 | 250 | 4 | 94 | 446 |
| Lancaster system | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 37 | 65 |
| Unknown | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Totals | 46 | 30 | 11 | 53 | 216 | *292 | 68 | 305 | *649 |
| **System of original trouble** | | | | | | | | | |
| Pennsylvania Water & Power Co. | 39 | 27 | 10 | 29 | 95 | 59 | 65 | 182 | 155 |
| United Railways Company's system | 3 | 0 | 0 | 5 | 28 | 37 | 1 | 17 | 32 |
| Consolidated Gas, Electric Light & Power Co.'s system | 4 | 3 | 1 | 19 | 90 | 210 | 2 | 69 | 396 |
| Lancaster Edison Co.'s system | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 37 | 65 |
| Unknown | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Totals | 46 | 30 | 11 | 53 | 216 | *306 | 68 | 305 | *649 |

* Figures do not check on account of some being classified in two places.

TABLE II—DISTURBANCES DURING 1922 CLASSIFIED ACCORDING TO CAUSE AND EFFECT ON SERVICE

| Effect on Service | Causes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ice | Breakdown of Mechanical Equipment | Breakdown of Electrical Equipment | Lightning | Sleet | * Accidental Interference. | Mistakes | Overload | Tests | Miscellaneous | Unknown | Totals |
| Trouble which interferes with generating ability—but no disturbance | | | 4 | | | 1 | | | | | | 5 |
| Relay action on 25-cycle system, frequency disturbance, voltage disturbance; no load lost | | 2 | 9 | 26 | | 4 | 7 | | 4 | 2 | | 64 |
| Relay action on feeder in trouble; no load lost | | | 16 | 3 | | 1 | 1 | 1 | | | | 12 |
| Low-voltage releases tripping; no load lost | | | | | | | | | | | | 0 |
| Additional primary relay action; no load lost | | | 2 | | | | | | | | | 2 |
| Separation and out-of-step condition; no load lost | | | | 1 | | | | | | 1 | | ... |
| Small load lost due to intentional reduction, by orders or by switching | | 2 | | | | | | | | | | 2 |
| Small load lost on feeder in trouble | | | 18 | 17 | | 5 | 1 | | | | | 41 |
| Small load lost due to low-voltage releases tripping | | | 13 | 3 | | 1 | 1 | | 3 | | | 21 |
| Small load lost due to additional primary relay action | | | 7 | 1 | | 3 | | | | | | 11 |
| Small load lost due to separation and out-of-step condition | | | 1 | 1 | | 2 | | | | | | 4 |
| Moderate load lost due to intentional reduction, by orders or by switching | | | | | | | | | | | | 1 |
| Moderate load lost on feeder in trouble | | | 2 | 1 | | 2 | | | | | | 5 |
| Moderate load lost due to low-voltage releases tripping | | | | | | | 1 | | | | | 1 |
| Moderate load lost due to additional primary relay action | | | 2 | 2 | | | | | | | | 4 |
| Moderate load lost due to separation and out-of-step condition | | | | 1 | | 1 | | | | | | 2 |
| Large load lost due to intentional reduction, by orders or by switching | | | | | | | | | | | | 0 |
| Large load lost on feeder in trouble | | | | 1 | | | | | | | | 1 |
| Large load lost due to low-voltage releases tripping | | | 1 | | | | | | | | | 1 |
| Large load lost due to additional primary relay action | | | | | | | | | | | | 0 |
| Large load lost due to separation and out-of-step condition | | | | | | | | | | | | 0 |
| Total interruption of less than five minutes | | | | | | | | | | | | 0 |
| Total interruption of five minutes or more | | | | | | | | | | | | 0 |
| Total | 0 | 4 | 75 | 57 | 0 | 20 | 12 | 1 | 7 | 3 | 0 | 179 |

*Wind, flood, men, heat, cold, moisture, tools, trees, birds, other animals, kite strings, etc.

*Excerpt from address before a joint meeting of the A. I. E. E., A. S. M. E., A. S. C. E. and A. I. M. E. at New York, March 21, 1923.

irregularities in voltage or frequency exceeding 4 per cent in voltage and 2 per cent in frequency are classified as disturbances, although no visible loss of load can be traced on the graphic wattmeters.

The statistics (Table I) illustrate more convincingly than can be done by general statements that hydro-electric plant troubles as such—i.e., causes numbered 1 to 5 on the tabulation—ceased to be the cause of interruption after a few years, although they were responsible for a few serious disturbances during the early period of operation at Holtwood. For example, ice caused a complete shutdown in 1912, about one year after commencing operation. Up to that time the general belief was that a plant built almost at the Mason-Dixon line with a storage lake 9 miles long would be immune from frazil ice. The tabulation shows only one other instance of trouble from this cause (in 1914), and in this case frazil ice was combined with ordinary ice. Only a partial reduction in service resulted. All the other sources of trouble at the hydraulic plant (causes 2 to 5) show a similar tendency to disappear.

Lightning in the first year of operation, 1911, caused twenty-three total interruptions of a few seconds or a minute each, none of them causing any permanent disabling of the line. Chiefly because of the use of the Nicholson are extinguisher, this number was reduced in the following year, 1912, to three; in the next five-year period these interruptions were reduced to an average of 1.4, and in the last five years to an average of 0.8. There have been no interruptions during the past three years.

Distribution trouble, chiefly that originating on the city distribution system and at the interconnected steam plants, shows a trend in the opposite direction, at least as regards partial interruptions. The number of partial interruptions from this cause rose to 238 in the past five years from a total of 134 during the preceding five-year period. Minor disturbances to voltage and frequency have increased to 273 from 74. This condition has caused the operating engineers to concentrate their studies in more recent years on the distribution problem as the principal field for possible service improvements. This study has been aided by means of a detailed tabulation (Table II) where disturbances are classified as to cause and effect on service.

F. A. Allner,
General Superintendent.
Pennsylvania Water & Power Company,
Baltimore, Md.

# Extracts from an Operating Code

By Field Editor Electrical World
New York, N. Y.

## Commutator and Brush Operation

Brushes should be so fitted to the commutator that the entire brush surface is effective, thereby reducing heating of the brushes or any tendency to spark caused by improper contact. The spring tension on the brush should be sufficient to prevent chattering and to make proper contact with the commutator, but not sufficient to cause undue friction between the brushes and commutator. Care must be exercised not to apply too large a quantity of lubricants, as this, while it may reduce friction, will cause poor contact.

The commutator of the machines should be wiped off frequently to remove the dirt, which in a short time would cut the commutator surface. As occasion demands, especially when sparking is caused by a very dirty commutator, the commutator may be cleaned by using very fine sandpaper and then wiped clean with a rag.

With slip rings the same precautions must be taken as with commutators to prevent cutting of the surfaces by the brushes and also to insure good contact between the surface and the brushes.

The following rules applying to commutators, brushes and slip rings have been abstracted from the operating code of the Philadelphia Electric Company:

### Commutator and Brushes

1. If machines are installed in dusty, dirty or poorly ventilated places, the commutator should be wiped every half hour. When machines are in more favorable places, this time may be extended to two or even three hours.

2. Lubricant consisting of commutator oil is to be used once every half hour to every two hours on commutators having copper brushes. In no other case is a lubricant of any kind to be used. However, if the commutator shows a tendency to cut, this may be stopped by cleaning once every half hour or hour with paraffine. Paraffine should not be allowed to remain, but should be wiped from the commutator immediately after it has been applied. Both paraffine and lubricant should be used sparingly. For cleaning the commutator or applying lubricant a standard commutator stick should be used. No lubricant is to be used on slotted commutators under any circumstances.

3. On machines equipped with brush-shifting mechanism adjust the brush position to give minimum sparking.

4. Brushes which have stuck in the holders may be loosened, or dirt may be removed, but in making these adjustments while the machine is running the brush must never be entirely removed from the holder.

### Slip Rings

1. Do not use lubricants or wipe the rings where they are made of brass or steel and the brushes are either carbon or a graphite-copper alloy.

2. Where oil from adjacent bearings is thrown on slip rings, they should be wiped once every one hour or two hours with a standard wiping stick.

3. If there is a tendency to cut, a slightly oiled instead of a dry cloth may be used on the stick for wiping.

4. If the rings are brass and the brushes leaf copper, commutator oil or vaseline should be used for lubricating once every hour.

## Boring Boiler Tubes

When boring boiler tubes care must be taken not to allow the boring machine to remain at any one place, as it will cut the metal and weaken the tube. First of all, the boiler should be taken off the line, following the rules published on page 811 of the April 7 issue of the Electrical World. The rules given below for boring tubes, taken from the operating code of the Philadelphia Electric Company, should then be followed:

1. When the scale can be removed with the cone cutter, the hammer must not be used.

2. See that the mud drum is open, and remove at least one cap from the back header.

3. Block the blow-off pipes at the mud drum to prevent scale from going into the blow-off piping.

4. Insert the machine in the end of the tube before starting.

5. Signal the helper operating the air valve to turn on the air.

6. After the machine has started, feed it slowly into the tube and do not allow it to remain stationary at any point.

7. After the machine has entered about one foot, water should be fed into the tube behind the machine.

8. If hard scale is encountered, preventing the machine from being fed through at uniform speed, the machine should be drawn backward and fed forward again until the obstruction is removed; the machine must not be allowed to remain cutting at one spot.

9. Repeat the operation until the tube is bored to gage.

10. Oil the boring machine after boring every four tubes.

11. After all the tubes have been bored to gage, wash out the tubes with water.

12. Remove the scale from the mud drum.

## Cost of Installing Street-Lighting Equipment

DURING 1922 a Massachusetts central-station company added 223 series brackets, eighty-four ornamental posts, twenty-nine mast arms and incidentals to its street-

STREET-LIGHTING EQUIPMENT COSTS FOR 1922

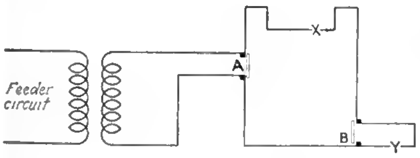
| Items | No. of Units | Price per Unit | Totals |
|---|---|---|---|
| Series brackets | 223 | $9.807 | $2,187 |
| Series brackets less hoods | 139 | 1.977 | 275 |
| Span suspensions | 4 | 14.092 | 56 |
| "Jupiter" cut-outs | 27 | 14.020 | 378 |
| "Novalux" fixtures | 69 | 12.530 | 865 |
| "Bishop" fixtures | 144 | 14.538 | 2,093 |
| Cut-outs | 13 | 10.108 | 131 |
| "J134Y" cut-outs | 32 | 12.588 | 403 |
| "Bishop" crook brackets | 21 | 4.105 | 86 |
| "Form 10" fixtures | 20 | 10.864 | 217 |
| Ornamental posts | 84 | 37.594 | 3,158 |
| Brady mast arms | 29 | 16.781 | 487 |
| Miscellaneous material, bolts, insulators | | | 1,781 |
| Teaming | | | 27 |
| Street-light location cards | | | 23 |
| Making wrenches | | | 5 |
| Miscellaneous small items | | | 5 |
| Transportation by utility company | | | 311 |
| Payroll labor | | | 1,821 |
| Total (cents omitted) | | | $14,309 |

lighting equipment, at a total cost, including transportation and labor, of $14,309. From the work sheets of the company the accompanying tabulation of these costs is printed, with unit prices met by the utility.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

## Locating Open Circuit on Series Systems

THE problem of quickly locating open circuits on series systems due to broken lamps or trouble on current transformers has always been a bugbear, but the method used on the writer's lines has reduced the time thus lost considerably. Assuming that the lines are laid out as shown in the diagram, fuse blocks




JACK PERMITS LOCATING OPEN CIRCUIT IN SERIES SYSTEMS

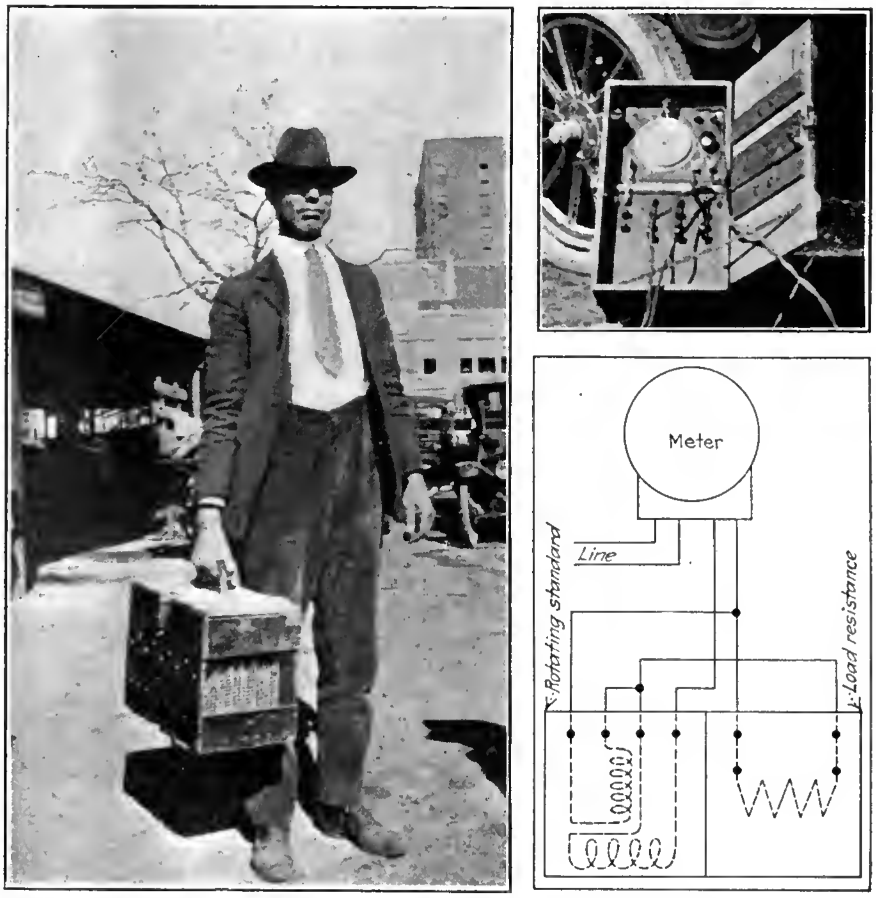
Inserting jack *A* or *B* in the fuse blocks furnishes current for all but one section while the trouble is repaired along the line.

with the jacks left out are connected at places *A* and *B*. The jacks are not fused but are strapped across with a piece of copper wire and are left out unless an open circuit is being hunted. Should there be an open circuit somewhere on the line, say at *X*, the "trouble shooter" can go directly to *A* and insert his jack. If the circuit is closed to his left, all the lamps will be burning and this will indicate that the open circuit is further along the line. He then travels to *B* and repeats the operation. If the lamps do not burn, he knows that his open circuit is behind him; but should there be an open circuit as shown at *Y*, all the lamps to his left will be burning, and this will indicate that the open circuit is on the one remaining section of the line.

This method of completing the circuit prevents an entire district of the town being without lights because there is an open circuit in one small section, since the jack can be left in position, thereby furnishing current to the rest of the system until the open circuit at *Y* has been fixed.

RAYMOND H. FORKNER,
General Manager.
Madisonville Light & Power Company,
Madisonville, Tenn.

## Rotating Standard Combined with Load Resistance




COMBINED TEST SET THAT HAS PROVED VERY SATISFACTORY

Left—Rotating standard and resistance load mounted in box conveniently arranged for carrying.
Upper right—Box opened, showing combined set.
Lower right—Diagram showing how meter is connected to throw the shunt loss on both the standard and the meter under test. This arrangement has worked out very satisfactorily.

BY MOUNTING a rotating standard watt-hour meter and load resistor in a box arranged for convenient carrying meter testers of the San Antonio (Tex.) Public Service Company have averaged as high as forty tests a day. Two views of this box are shown above.

The connections are all permanent so that no time is lost on the job. All that is necessary is to replace the two load wires of the customer's meter with those of the box and then proceed with the test. The wiring diagram shows how the standard is connected so that the shunt loss of the meter is measured on both the standard and the meter under test. The box complete with tools and wiring weighs 35 lb. The box and circuit were developed by Grover Lee of this company and after several months' service have proved satisfactory and a great improvement over the system of separate load and standard.

H. T. POWELL,
Meter Department.
San Antonio Public Service Company,
San Antonio, Tex.

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## Appliance Selling in Small Communities

**How One Central-Station Company, Serving Sixty-four Cities and Towns, Has Organized and Operated a Selling Staff and Put the Merchandising Business on Its Feet**

By P. D. Kline
Vice-President Wisconsin-Minnesota Light & Power Company, Eau Claire, Wis.


AT LEFT—SALESROOM IN THE LA CROSSE OFFICE. AT RIGHT—AN OUTDOOR DEMONSTRATION IN BLAIR

CENTRAL-STATION companies that are facing today the problem of organizing and developing the market for electrical appliances among smaller communities may perhaps find something of interest in the recent experience of the Wisconsin-Minnesota Light & Power Company. This company serves sixty-four communities in the region lying to the east of St. Paul and Minneapolis. The principal towns and their population are: LaCrosse, 35,000; Eau Claire, 21,000; Winona, 21,000; Chippewa Falls, 11,000; Red Wing, 9,000; Sparta, 5,000; Rice Lake, 5,000, and Menomonie, 5,000. Headquarters are in Eau Claire, and several stations, both hydro-electric and steam, are interconnected in a loop. We maintain twenty district offices and serve a total population of 125,000.

Two years ago the merchandising of gas and electric appliances in this country was flat. Industries as well as the farmers in the surrounding community experienced bad times and transmitted that depression to all lines of business. We lost money in our merchandising during 1921, and our organization dwindled to almost nothing so far as the appliance sales department was concerned. In 1922 we, like many other organizations, decided that business was to be had if sufficient effort were put forth; therefore, even though it was necessary for us to start from the bottom to build up a sales organization and develop an appliance sales business, we set about doing that thing. Price cutting had been indulged in and war-time appliances got into the hands of the consumers with a good deal of grief and dissatisfaction as a result. We, therefore, realized that we had these conditions to live down and overcome.

At the very outset, therefore, we set about to do two things—to make a complete survey of all of the appliances then in use in the homes of our customers in order to obtain an idea of the field before us, and to test out the different lines of appliances offered by the market, aiming to eliminate unworthy goods and thereby re-establish quality and price level based upon quality merchandise. To accomplish this, we made a careful house-to-house survey of the customers in the principal towns, and by calling meetings of the managers of the various districts and getting their combined opinion upon the quality and practicability of various appliances we soon had a working basis on which to proceed with the building of our merchandising business.

We procured a number of good salesmen, schooled them, and then started to do business. We began to run campaigns, covering first one appliance and then another, supporting each of these campaigns by dealer helps, newspaper advertising, window displays and special price, offering an inducement as the character of the appliance indicated that such inducement would be a sales help. We tried particularly to impress upon our men the importance of calling back on every customer, and while it has been difficult to have this idea carried out in a 100 per cent manner, we are improving continually and the salesmen are realizing more and more the

AT LEFT—ANOTHER VIEW OF THE BLAIR DISPLAY. AT RIGHT—A WINDOW IN SPARTA

value of a satisfied customer. Based upon our survey, which indicated that the present saturation of the more common appliances, such as the washer, cleaner, flatiron, toaster, and so on, was approximately 25 per cent, it was seen that if we could increase this saturation to a 75 per cent point, it would result in an increase of revenue amounting to about $300,000 per year, showing conclusively that we had a goal and that it was worth strenuous effort to reach.

We then worked out a sales bogey, or quota, for each district and advised the district manager of the amount of his bogey, which constituted the net sales that he was expected to realize to keep up his portion of the total amount anticipated as the year's business.

### PLACING THE STAFF

We built up our selling staff until it numbered fourteen men, all established in the larger towns and doing general selling. In addition, we have one expert industrial engineer who helps on big jobs. We figure roughly that from 5,000 to 6,000 population will support one salesman. We group the smaller towns with larger ones to make a territory, because four or five towns of 1,000 inhabitants can be made to produce business no less than one town of 5,000. In the large towns and many of the small ones we have an office. Girls are employed to sell on the floor. All the towns are working along standard lines as to price and policies, and we are impressing on all our people that they must not fear price competition, that our prices are right for our quality and that our quality is right for our customers.

We are trying also the experiment of employing a few middle-aged men and some women for outside selling, believing that they can call at the homes and get a more considerate reception than might be accorded to young men. So far the plan is working out well. These salespeople make fewer calls, but seem to be able to tell their story better and to get results.

We had, of course, worked out a compensation plan for the salesmen, some of whom were paid on the basis of $100 per month and a 10 per cent commission on all sales over $1,200 per month; others were paid on a straight 10 per cent commission covering all sales, while still others were placed on the basis of $100 per month drawing account and 10 per cent on all sales. If any man goes below $1,000 per month for three consecutive months, we feel that he is not doing a satisfactory business, and he is replaced. In addition to the commission on sales, a bonus was paid for all new services, either gas or electric, procured by the salesmen, and a bonus was paid for all appliance "prospects" turned in by any member of the organization if the "prospect" resulted in a sale. This bonus, however, was paid only where the new customer had not been canvassed by a salesman previous to the time that the name was turned into the commercial department.

### SELLING ON TRIAL

We have a large foreign-born population—German in La Crosse, Norwegian around Eau Claire. The easy payment seems to appeal to them, and we have no difficulty in collecting. We demonstrate appliances freely and leave them on trial in many cases. The Norwegians are very heavy coffee drinkers and we anticipated a large sale of percolators, but to our surprise found it almost impossible to interest them. They are accustomed to keeping a pot of coffee boiling on the stove all the time and to drink it strong, and they will not make it the electric way.


AN EAU CLAIRE WINDOW DISPLAY FEATURING LADY KILLERS VERSUS ELECTRICAL EQUIPMENT

AN UNUSUAL CLEANER WINDOW IN EAU CLAIRE

This is just a little sidelight on the way that local influences sometimes affect the appliance market. In our effort to re-establish "quality" merchandise in the cities we serve we have tried in every case, in adopting an appliance, to secure the same price and profit for one or more dealers in the town, and then we have advertised their names along with ours. Salesmen of competitive brands have naturally complained, saying that we have bottled up the towns; but we believe that the public is benefited by the elimination of riffraff appliances and that the dealers are benefited by having an established market and a sure profit.

### WIRING BUSINESS

We have supported the contractors well in wiring also. In some small communities where there is no city inspection and the wiring has not been up to code, and where it has been found impossible to raise the standard of wiring through suggestion in the public interest, the company has gone into the wiring of houses itself. But this has been entirely conditional on the kind of job the local contractors were doing. In larger towns in co-operation with the contractors we have developed a flat-rate wiring schedule based on a price per outlet and are actively selling wiring which the contractors install, paying a commission to our salesmen no matter who wires the house. At the present time we have about 24,500 residence meters in service. Last year approximately 700 houses were wired. We are trying to influence the installation of more convenience outlets and are working with the architects and builders to try to "sell" the idea.

All our salesmen are working continually on both store and window lighting, and we have installed some colored lamps and with good results. The power field is limited, but we are constantly after the blacksmith shops, condensories, creameries, machine shops, garages and so on.

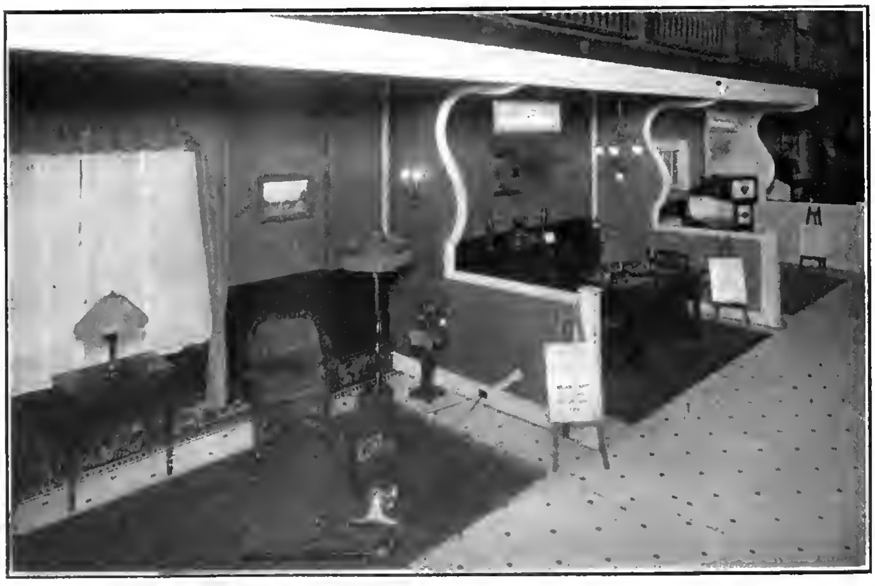
We have done a considerable amount of advertising in local papers and direct by mail and have made a feature of our store-window displays and demonstrations. The purpose in it all, however, has been primarily to sell the idea of the quality of electrical goods and the importance of the central station to the community. Our own organization is thoroughly imbued with this point of view. We tell our customers that if an appliance is broken it should not be put on a shelf but brought to us. We try to keep every appliance in use. We have run a school of home economics in five of our larger towns and have given many lectures and talks before Kiwanis and Rotary clubs and shown a motion-picture film showing our plant and construction. In one of our offices we are setting up a model kitchen and laundry.

In fact, in the small communities we are serving we realize that we have the same fundamental social structure that exists in the big cities. We have families living in houses, and no matter where families live they have the same general desires and needs. Thus we have simply gone to work to try to satisfy those needs and develop those desires through education in so far as the comforts, conveniences and utilities of electric service are concerned.

While it is true that our plan has not materialized to the 100 per cent point, the close of 1922 found the commercial department self-sustaining with a small profit as compared with a deficit in the previous year, and the first four months of 1923 have shown approximately double the volume of the same period a year ago; therefore, we conclude that our efforts have produced some result, that by the experience of the past year we are going to profit materially during this year, and that our consumers are likewise going to profit by maintaining and following out a sales plan which embodies "quality" merchandise and service.

## A Practical Layout of Electrical Home Needs

THE Utah Power & Light Company has adopted this very pleasing and effective way of displaying electrical appliances for the home. The south wall of the company's large electric store in Salt Lake City has been partitioned into three rooms —a living room, a dining room and a kitchen—representing an electrically equipped home. These rooms are not "overdone" with electrical appliances, but each contains equipment appropriate to the use of the modern housewife. The display is attractively arranged and receives the attention of most of the people who enter the company's electric store.



A ROOM OF ELECTRICAL APPLIANCES

## "Business Builder" Helps Employees' Interest

By A. M. Frost
Manager of Sales San Joaquin Light & Power Corporation, Fresno, Cal.

IT IS the intention of the San Joaquin Light & Power Corporation to make every employee of the company a salesman and a reporter of complaints. A blank book, the "Business Builder," has been issued to every member of the operating force, and in circular letters and meetings all have been instructed how to use the books. The line cut shows a sheet out of one of the books, on the cover of which the following instructions are printed:

| Form 2149 | SAN JOAQUIN LIGHT & POWER CORPORATION BUSINESS BUILDER |
|---|---|
| Name | Name ........ District |
| Address | Address |
| Complains of / Interested in | Complains of / Is interested in |
| Date | Date ........ Signed ........ Dept. |

BLANK AND STUB ON WHICH EMPLOYEES REPORT PROSPECTS OR COMPLAINTS

> With this book you can render valuable assistance to the management in improving our service and building our business.
>
> If you hear of a complaint about service, make out a form and scratch out the line "Is interested in."
>
> If you hear of a prospect for additional load or appliance sales, make out a form, scratching out the line "Complains of."
>
> Turn in to manager of your district through your department head.
>
> Fill out the stub for your record. A report will be made to you about each form you turn in.
>
> I thank you for your co-operation.
>
> A. M. Frost, Manager of Sales.

Each district manager is charged with the responsibility of seeing that the employees use these books. In adopting this practice the company is going on the theory that every employee has a great many friends and personal acquaintances who look upon him as a representative of the power company. The use of the book enables employees to report complaints they hear of and to turn in prospects for additional business. It has been found that meter readers, collectors, linemen and office employees are all in a position to use the "Business Builders" to the advantage of the company as well as to their own advancement. The company hopes to be able to recruit salesmen from within the organization, and the use of these forms will give a line on good men by the number of reports turned in and the intelligence with which they are used.

During the short time the system has been in use it has produced satisfactory results. Employees who are not actually engaged in sales work feel that through the use of these books they have been given some part in the devolopment of the company's business and its management. The plan will not only conduce to harmonious public relations but will actually help in increasing the company's earnings.

## Illinois Company's Sales Show Big Gain

THE income to be derived from the sale of appliances by public utility companies and the extent to which this branch of the business can be developed is strikingly illustrated by the accompanying tabulation of the sales of the Central Illinois Public Service Company of Springfield for the first four months of this year as compared with the same months of the year previous.

GAIN IN CENTRAL ILLINOIS COMPANY'S SALES

| | 1922 | 1923 | Increase in Sales | Per Cent Increase |
|---|---|---|---|---|
| Jan. | $18,953.15 | $24,907.92 | $5,954.77 | 31.4 |
| Feb. | 14,260.46 | 32,537.56 | 18,277.10 | 128.1 |
| March | 19,297.46 | 33,242.00 | 13,944.54 | 72.0 |
| April | 20,060.90 | 39,647.77 | 19,586.59 | 97.5 |
| Total | $72,571.97 | $130,335.25 | $57,763.28 | 80 |

While this remarkable increase in sales can be attributed partly to improved business conditions and to the increasing popularity of electrical devices, it is none the less true that the principal contributing factor to the increase has been the intensive effort made to develop this branch of the business.

As indicative of the class of appliances sold during one week, the sales included twenty-one vacuum cleaners, ninety-one irons, nine electric ranges, thirty-six washing machines, four sets of fixtures, four motors and eight fans. These, with other miscellaneous items, represented sales for the week to the value of $12,279.

## What Other Companies Are Doing

**Seattle, Wash.**—The Puget Sound Power & Light Company is issuing an illustrated handbook, primarily for the use and information of employees interested in the sale of company securities. A number of copies are going into the hands of the public and will provide those of an inquiring mind with the facts that will go far toward removing any prejudice they may have against the company.

**Worcester, Mass.**—A motor installation of about 4,000 hp. rating is planned as a means of reducing steam-power costs at the local mills of the American Steel & Wire Company, a subsidiary of the United States Steel Corporation. Power will be supplied by the New England Power Company. Hugo Rocktashel is commercial manager.

**Pine Bluff, Ark.** — On April 24 the Rotary Club of Pine Bluff turned over its luncheon to the Arkansas Light & Power Company. William Crooks, chief engineer, and C. S. Lynch, purchasing agent, presented a graphic story of their organization by the use of an electrical map showing the value of interconnection with their three generating plants. The Arkansas company now has 1,000 stockholders, and the Pine Bluff company has 350, of whom 150 are residents of Pine Bluff.

**Lake Geneva, Wis.**—Seventy-two people composed of executives and employees of the Southern Wisconsin Power Company and local newspaper men were guests at a banquet tendered by the company to its employees on the occasion of their regular monthly meeting for May. Employees gathered here from the various sections served by the company. The principal address was given by W. S. Vivian, public relations superintendent of the Middle West Power Company, Chicago, who spoke on the promotion of better public relations between public utility companies and the public through the medium of the greatest point of direct contact, the employees.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Generation, Control, Switching and Protection

*Mechanical Forces in Knife Switches.*—O. EDELMANN.—For the proper design of a mechanical testing machine for knife switches it became necessary to determine the pressures which occur during the regular closing and opening of such switches. As an average switch a double-pole 200-amp. model has been chosen. More than two-thousand tests were made with twenty-two operators, of various heights, with the switch mounted at five different heights. The results were tabulated and give valuable information for the design of such switches from the purely mechanical standpoint. — *Elektrotechnische Zeitschrift*, March 29, 1923.

## Hydro-Electric Development and Steam Equipment

*Boiler Furnace Design.*—E. B. RICKETTS.—The author considers the factors governing furnace volume and construction of boiler-furnace walls, discussing types of fuel-burning equipment, pulverized-fuel systems, shape of combustion chamber, mixing arrangements, etc. He holds that there is a tendency in modern power stations toward larger combustion space.—*Mechanical Engineering*, May, 1923.

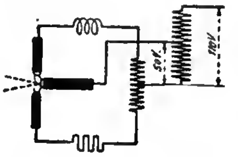
*Water Power in Netherlands East India.*—In a territory about one-fifth the size of the United States, with approximately fifty million inhabitants, a large number of small rivers offer many opportunities for hydro-electric development. A total theoretical capacity of 757,000 hp. was found on the island of Java. A report on Sumatra shows a possible development of 250,000 hp. on the Asahan River.—*Fourth annual report of the Government Service for Water Power and Electricity, Netherlands East India.*

*Hydro-Electric Power on the River Bès, in France.*—G. LEFÈVRE.—The author gives an interesting account of the equipment of a 12,000-kva. hydro-electric power station which supplies an electrometallurgical plant manufacturing iron alloys. Three Francis-type turbines of 4,600 hp. each operate under a head of 144 m. and drive 4,000-kva., three-phase, 50-cycle generators at 630 r.p.m. Two separate 120-kw. excitation sets, driven by two auxiliary Pelton-type turbines and a storage battery, furnish the field current for the generators. The machine voltage is stepped up in three 4,000-kva. oil-insulated and water-cooled transformers from 8,200 to 30,000. A double transmission line of about 10 miles, using reinforced-concrete poles entirely, connects the station to the smelting plant. Three step-down transformers, identical with those in the power station, reduce the incoming voltage again to 8,200, and to these buses are connected three banks of special water-cooled furnace transformers, each bank consisting of three 1,250-kva., single-phase machines with a ratio of 8,200 to 60/120 volts and taps for ± 11 per cent regulation. There are at present five single-phase, 1,000-kw. furnaces, three three-phase, 3,000-kw. furnaces and one rocking furnace in operation.—*Revue Générale de l'Electricité*, April 21, 1923.

## Illumination

*Alternating-Current Projection Arc Lamps.*—B. SCHÄFER.—An arc lamp for motion-picture projectors is described. The author uses a combination of three carbon electrodes, two arranged vertically, one above the other, and a third horizontally. With the aid of a resistor and an iron-core choke coil the two vertical electrodes receive almost 90 deg. phase displaced current, so that the time intervals, during which the light emission is almost zero, are much shorter than with an ordinary two-electrode arc lamp. This avoids any possible interference between the light of the lamp and the speed of the projector shutter. The light output is greatly increased. For a lamp current of 32 amp. a two-carbon type gives 600 cp., while it is claimed that the three-electrode lamp measures 1,400 cp. Practical tests with this lamp in a motion-picture theater gave a very satisfactory performance. — *Elektrotechnische Zeitschrift*, April 12, 1923.

THREE-ELECTRODE LAMP SAID TO GIVE OVER TWICE THE LIGHT OF ORDINARY ARC LAMP



## Transmission, Substations and Distribution

*High-Voltage Submarine Cable in Norway.*—F. HANFF.—To supply fourteen small islands off the Norwegian coast with energy from the power station in Aalesund a large number of cables had to be laid out to connect these islands. The individual lengths of the cable pieces varied from 3,000 m. to 500 m., and the depth of the sea ranged between 10 m. and 360 m. Three-phase cables were designed for 22,000 volts and have a copper cross-section of 3 mm. x 25 mm. or even 3 mm. x 50 mm. The lead sheath is 4 mm. thick and is armored with an outer layer of galvanized-steel wires. The total length of all the cable laid was 30 km., with a weight of 653 tons. No joints under water were permitted, and for each stretch between two islands the proper length of cable was manufactured in one piece. Before shipment each cable was tested with 55,000-volt alternating current and after laying each length was again tested with 85,000-volt direct current for one-half hour. Including all auxiliary work, such as making all pothead connections on land and testing, the entire undertaking was accomplished in twenty-eight calendar days. The article contains a very interesting and detailed account of the many difficulties encountered during this unusual work.—*Siemens Zeitschrift*, April, 1923.

*Endangering of the Bare Direct-Current Neutral.*—C. MICHALKE.—A detailed account of the relative advantages and disadvantages of various methods employed to counteract chemical and electrolytical effects upon direct-current neutral conductors laid under ground without insulation. The paper compiles the answers from a questionnaire sent out to a great number of direct-current plants. The great importance of the proper choice of the conductor and its surroundings, depending upon the chemical nature of the soil and possible stray currents, is emphasized and illustrated from practical experiences. — *Elektrotechnische Zeitschrift*, April 12, 1923.

*Automatic Substations.*—L. C. GRANT.—The author describes the functions of the control apparatus in automatic operation as applied to substations in England and gives some interesting features of cost.—*Electrician (London)*, April 20, 1923.

## Motors and Control

*Large Blooming-Mill Drive.*—A. HARTMANN.—A heavy reversing mill drive is described that is used primarily for the production of 47-kg./m. grooved street-railway rails. It consists of a direct-current double motor and the necessary starting machines. The rating of the motor is 13,250-kw. maximum output at 0 to 60 to 150 r.p.m. in either direction with a maximum torque of 215 meter-tons. Accelerating each time to full speed, the motor can be started, stopped and reversed twenty times per minute. Ingots weighing 2,860 kg. are rolled with twenty-one passes into a rail of 47 kg./m., representing an elongation of thirty-three times. The starting set comprises two symmetrical halves, each with one three-phase induction motor of 2,100 kw. at 6,000 volts (50 cycles), two direct-current generators each of 1,560 kw. at 460 volts, and one 30-ton flywheel. The set revolves at 750 r.p.m. The flywheels are of cast steel and reach the rather high peripheral speed of 141 m./sec. To minimize windage loss they are inclosed in snug-fitting sheet-iron casings. A water-cooled brake with wooden shoes, capable of stopping the converter within six minutes, can be brought into operation. The mill

motor is driven with two or three of the direct-current generators in series, using Leonard connection. The speed regulation from 0 r.p.m. to 60 r.p.m. is obtained by changing the voltage of the starting generators, while from 60 r.p.m. to 150 r.p.m. the field of the motor itself is weakened. This rolling set has a capacity of up to 75 tons of rails per hour.—*Brown-Boveri Mitteilungen*, May, 1923.

*Types of Motor Protection.*—GORDON FOX.—The author considers location of protective devices, National Electrical Code revisions, undervoltage protection, time-element features, phase-failure protection, shunt-field relays, limit switches and overspeed trips and interlocks.—*Power*, May 8, 1923.

*Winding Two-Phase and Three-Phase Induction Motors.*—A. C. ROE.—The author gives practical details and tables for laying out unequal groupings of coils in induction motors having from four to forty-eight coils, two-phase or three-phase. The article gives the reader a clear insight into the possibilities of unequal grouping and an understanding of balance in a winding. —*Industrial Engineer*, May, 1923.

*Electrical Equipment in Wire Mills.* —J. E. MCDONALD.—Several new and interesting installations in the rod-rolling and wire-drawing industries are encountered in the new mills of the Whitaker-Glessner Company at Portsmouth, Ohio. Among these are the automatic coiling and conveying systems, slow start for motor-driven wire blocks, continuous wire-drawing machines and the applications of electric motor and control to practically all processes.—*Iron Age*, May 3, 1923.

## Heat Applications and Material Handling

*Electric Trucks.* — A. CANAC. — A French concern is building storage-battery-driven electric trucks for which are claimed considerable advantages over existing American and English designs. Two 7.6-hp., 155-volt motors drive the rear wheels separately, obviating the otherwise required differential. Between each motor and its driven wheel is interposed, as the most conspicuous innovation of the truck, a reduction-gear case with a gear shift lever, similar to the apparatus used in gasoline cars. On level stretches of the road the normal running gear reduction is used between the pinion of the motor and the wheel, while on grades a higher reduction may be used. This will permit running the motors even on grades at the normal and most efficient speed and will also give a much quicker start of the truck up hill. Consequently a lower starting current will be taken from the battery and the motors will not tend to overheat. The lead-plate battery has a capacity of 250 amp.-hr., and is placed in two boxes of forty cells each. Loaded with five tons, the truck can make up to 20 km. per hour and consumes 0.6 kw.-hr. to 1.0 kw.-hr. per kilometer, or 0.12 kw.-hr. to 0.2 kw.-hr. battery-charging current per ton-kilometer. The fully loaded truck is able to climb grades of 12 per cent to 15 per cent at a speed of 4 km. to 5 km. per hour, at a consumption of 1.0 kw.-hr. per ton- kilometer. The radius of operation is 80 km. per charge.—*Revue Générale de l'Electricité*, April 14, 1923.

## Electrophysics, Electrochemistry and Batteries

*Effect of Electrodeposition of Nickel.* —M. R. THOMPSON.—A number of previous investigations are reviewed, and it is concluded that the results may have been influenced by lack of regulation of the hydrogen ion concentration. It is shown that, if the hydrogen ion is properly controlled, the presence of iron in nickel solutions does not necessarily cause cracking or peeling of the deposits, as it has often been supposed to do. Deposited iron has a primary effect upon the crystalline structure of nickel deposits, rendering the latter finer-grained and therefore probably harder, although more brittle. Occluded basic precipitates containing iron may injure a deposit by making it porous or dark in color.—*Paper presented before American Electrochemical Society, New York*, May 3-5, 1923.

## Traction

*French Locomotives.*—Two new types of direct-current, 1,350-volt locomotives were recently turned over to regular service on the Paris-Orléans and the Paris-Lyon-Mediterranée lines, and their electrical details are described in these issues. The "2-D-2" express locomotive is operated with a twin motor geared to each driving shaft, each motor designed for 675 volts. The hourly output of the engine is 2,400 hp., or 3,200 hp. for five minutes. A maximum level speed of 68 miles per hour can be reached. The tractive effort at the rim of the wheels at the hour rating and 31 m.p.h. is 28,600 lb. The over-all length of the engine is 65 ft. 7 in., and the weight complete is 110 tons (67 tons electrical equipment, 43 tons mechanical parts). Pantograph and third-rail collection is provided. The "D" type freight locomotives are equipped with a single-motor gear drive for each of the four shafts. All motors are built for operation on 1,350 volts. The hourly rating of the engine is 1,730 hp., with a tractive effort of 22,900 lb. at 28 miles per hour. The machines measure over all 40 ft. 8 in. and weigh 64 tons (35 tons electrical equipment, 29 tons mechanical parts). —*Bulletin Oerlikon*, February and March, 1923.

*Extensive Electrified Railway System Proposed.*—A permit from the Interstate Commerce Commission for a 1,307-mile electric railway system in Arizona, Colorado, New Mexico and California has been applied for. The article discusses sources of power, traffic to be handled, passenger service, methods of computing revenue and costs, construction schemes, locomotives, transmission systems, etc. Regenerative braking to utilize the potential energy of down-grade load to pull empty cars up the grade on the return trip is an interesting part of the proposal.—*Electric Traction*, April, 1923.

## Telegraphy, Telephony, Radio and Signals

*Measurement of the Electric Intensity of Received Radio Signals.*—J. HOLLINGWORTH.—The first part of this paper is devoted to a discussion of some of the principles on which the measurement of received signals is based, and the practical application of these principles under working conditions is considered. The latter part describes a system recently developed at the National Physical Laboratory (England) which differs in several details from previous systems. Its operation is described in detail, and some of the possible sources of error and inaccuracy are considered.—*Journal of the Institute of (British) Electrical Engineers*, April, 1923.

*High-Power Radio Station at Herzogstand.* — Built primarily for experimental purposes, this Bavarian radio station has as the most striking feature an antenna which is stretched out between two mountain summits, the station itself being in the valley between. The free span of the five antenna wires, made of heavy steel cables, is 1½ miles, and the lowest point of it comes within 300 m. of the bottom of the valley. The anchor plant on one mountain top is solid, while on the other summit the wires go over a stationary pulley to a small car which can ride freely up or down a short inclined track. The car is loaded so as to give the antenna wires the proper amount of tension. The equipment of the station comprises one 200-kw. Poulsen-arc transmitter and one 200-kw. Schmidt high-frequency generator. It is expected to ascertain in this station the relative merits between these two methods of radio transmission.—*Zeitschrift des Vereines Deutscher Ingenieure*, April 11, 1923.

## Miscellaneous

*Standardized Electrical Machinery.*—C. W. DRESCHER.—This paper describes in minutest detail the production of generators and motors on a large scale with such exact dimensions as to guarantee a perfect interchangeability of their parts. Whether it is a small 7½-watt motor or a 60,000-kw. machine, their shafts, bearings, etc., are produced with sufficient accuracy to insure a perfect fit if a new part is ordered to replace a worn-out one. Elaborate jig and caliber systems designed to carry on manufacturing on such a basis are described, and the influence of the method upon the design of the machine types is shown. In particular, examples are given of machines built by one concern which adopted such a system for the various departments in its plant. — *Elektrotechnische Zeitschrift*, May 3, 1923.

# Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

*Conducted by* PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[ PRINTED IN THE THIRD ISSUE OF EACH MONTH ]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

## Research Completed

### Boiler Feed, Measurement of Concentration of Salts in

A new conductivity cell has been developed for direct insertion into a boiler drum in order that the concentration of salts in a boiler may be easily determined. The cell may be safely used on pressures up to 300 lb. per sq.in. The electrodes are made of heavy nickel and the insulating structure is practically unbreakable. The concentration indicator used with the cells may be calibrated in total dissolved solids or chlorine content. The advantages of this new cell are the elimination of sampling and of extra piping.—*Instruments and Measurements Committee of the A. I. E. E.*

### Circuit-Breaker, Oil, Large Resistance Bypass

Current-limiting reactors are coming more and more into use in this country on large systems to limit short-circuit current, thus protecting generators and limiting the duty of the oil switches. Abroad for the same purpose more and more are large bypass resistances used, which are built integral with the breaker and which by a combination of contacts are switched into the circuit before the opening occurs. One of the largest railroad companies in Europe and the firm of Brown-Boveri, Baden, Switzerland, made thorough tests on such breakers. The results obtained showed that with a resistance of four times the short-circuit impedance the duration of the arc is decreased to one-quarter, the energy liberated in terms of heat to one-tenth, the pressure produced during interruption to one-fifteenth, and the quantity of gas produced about to one-fifth of the values without resistance.—*G. Bruehlmann* (from *Brown-Boveri Mitteilungen*).

### Drills, Electric, for Coal Mines

As a result of extensive tests, certain makes of electric drills have been approved for use in gaseous or dust-laden mines. The formal approval of these drills means that the bureau is convinced that if they should be inadvertently operated while immediately surrounded by an explosive mixture of gas or gas and coaldust, as the result of accidental interference with the ventilation or otherwise, the atmosphere surrounding the drill would not be ignited even though an explosion took place within the equipment.—*United States Bureau of Mines, Washington, D. C.*

### Relay for Keeping Power Within Limits

A new induction-type relay has been produced, similar in appearance to an induction watt-hour meter, to indicate when the load exceeds or falls below a predetermined value. These relays are provided with two separate driving elements, each element having a current and a potential coil, which drive two disks mounted on a single vertical shaft. The shaft controls the operation of a set of double-throw contacts, which energize the coils of an auxiliary relay on over-power and short-circuit them on under power, thereby quickly and automatically relieving the main contacts of the relay of the burden of the circuit-breaker tripping current.—*General Electric Company, Schenectady, N. Y.* [Such relays should prove useful where power is sold or purchased on a demand basis, and also where a machine is to be started or stopped, depending upon the load conditions.—EDITOR.]

### Short-Circuits in Power Networks

A miniature three-phase alternating-current generating and transmission system with adjustable resistance, reactance and capacitance units has been constructed and is used for the solution of various network problems, including those of short circuits. —*O. R. Schurig, Schenectady, N. Y.*

### Transformers, Cooling of

A new system of cooling large oil-insulated transformers which must be operated in locations where an adequate supply of cooling water is not available. This system comprises a battery of radiators, installed either on the transformer or in a separate location, and in which the natural flow of oil between the transformer tank and the radiator is accelerated by the external application of low-pressure air currents in numerous small jets.—*General Electric Company, Schenectady, N. Y.*

### Transformer Tests, Current, Lead Resistance in

To obtain accurate results employing current transformers for the measurement of large amounts of power supplied at high voltage, it is very essential that the transformers be tested when connected to a secondary circuit which is identical with or equivalent to the circuit with which they are used. It was found convenient by the calibrating laboratories of the Bureau of Standards to insert in the secondary circuits of the transformers an additional resistance (about equal to the actual resistance of the apparatus which would be installed in the particular installation) for a precise laboratory test.—*Bureau of Standards, Washington, D. C.*

## In Progress or Purposed

### Lightning Arresters for Low-Potential Circuits

Tests with steep wave fronts indicate (a) that a lightning arrester to be most efficient as a protective device should have a minimum impedance to flow of surge current so as to permit a very high current to flow at the instant of lightning discharge; (b) that it is apparently entirely possible to devise an arrester which will have a maximum potential across its terminals that will be less than the primary bushings and the primary windings of line transformers as now constructed for distribution voltages will withstand. It is confidently expected that arresters meeting this requirement will be produced by one or more manufacturers and available for general use within the next few years. When this result is achieved, then disturbances from lightning will be practically eliminated from our low potential distribution circuits.—*A. I. E. E. Sub-Committee on Lightning Arresters.*

### Rope, Hoisting, Non-destructive Magnetic Tests on

It is proposed to prosecute the investigation along three general lines: (1) Laboratory study of the effect on the magnetic properties of the various factors which cause deterioration of a hoisting rope in service; (2) development of methods and instruments for magnetic tests under service conditions; (3) actual field tests to determine the possibility of practical application.—*R. L. Sanford, Bureau of Standards, Washington, D. C.*

### Transmission Lines and Cables, Artificial

An investigation is being made which it is hoped will lead to the possibility of representing a power network artificially. The three-phase artificial line with distributed constants representing 110,000-volt practice with a length of 400 miles has been constructed and its constants checked. In order to be able to represent cable circuits as well, an artificial power cable is being designed along the same lines, so that it will contain inductance as well as capacity and resistance and therefore properly transmit a transient wave front.—*F. S. Dellenbaugh, Jr., Massachusetts Institute of Technology.*

### Welding, Contact Flash Method of

An electric welding machine embodying a new principle will soon be available. The weld is made almost instantly. The nearby metal is not heated and a weld can be handled immediately after being removed from the welder without burning the hands. At present the contact flash process welds stock of 1-in. diameter on an experimental welder, and it is expected to weld stocks 1½ in. in diameter or larger when a final model is built.—*H. A. Woofter, Lynn, Mass.*

### Welding, Electric Seam

Much development work has been carried on within the last two years. Until recently two sheets of No. 20 gage stock was the maximum limit for flat commercial work, while two sheets of No. 18 gage stock could be seamed by previously scarfing the edges. The limit in length of seam for this work was about 2 ft. Now, however, two ⅛-in. sheets have been welded on an experimental machine, and the length of seam can be practically anything that can be procured in commercial stock. This method can be applied to the manufacture of steel barrels, casks, tanks, culverts, smokestacks, ventilators, conveyor tubes, heating and ventilating pipes, etc.—*H. A. Woofter, Lynn, Mass.*

## Apparatus Available

### Phase Advancer for Induction Motors

A small experimental phase advancer has been developed suitable for research. It has the appearance of a three-phase commutator motor with no stator winding. After a phase-wound induction motor is brought up to speed in the usual manner, the brushes of the phase advancer are connected to its slip rings. The power factor of the motor may then be kept at approximately 100 per cent over a wide range of load.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.* [Such a phase advancer is used to some extent in Europe for power-factor correction of large induction motors, and it is desirable to acquaint the oncoming generation of engineers with its theory and possibilities.—EDITOR.]

## Suggestions for Research

### Conduits, Underground, Trenches for

In many places in New Orleans submerged cypress stumps are found which have to be cut through or removed in making trenches for cables or pipes. The wood is perfectly preserved and quite hard. Being in a thickly populated district, it is hardly possible to use the familiar methods for removing stumps, applicable say in an open field. It will be of interest to us to have some machine or method developed which would permit cutting through such stumps at a reasonable speed and at moderate expense.—*F. G. Frost, New Orleans Public Service, Inc.*

### Fuses, High Voltage, for Potential Transformers

On numerous occasions the fuses on the 13,200-volt side of potential transformers opened in service without apparent cause. A microscopic examination in some cases has shown some corrosive chemical action. Tests on 0.004-in. wire used in some of our fuses have shown that at 13,000 volts the wire is entirely surrounded by corona which may cause this deterioration. A further investigation of this trouble is desired; in the meantime it is recommended that such fuses be renewed at fixed intervals.—*A. F. Bang, Pennsylvania Water & Power Company, Baltimore.*

### Monel Metal, Arc Welding of

Attempts to arc-weld monel metal have not been successful in the past, but it seems that better results can be obtained by using a deoxidizing coating and by making the welding rod positive, instead of the work. For some tests in this direction see the *Journal* of the American Welding Society, May, 1922.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## Stratton Inaugurated

**New Head of Massachusetts Institute of Technology Is Welcomed by Distinguished Men**

IN THE presence of a distinguished assemblage of educators, scientists, engineers, publicists and leaders of industry, Dr. Samuel Wesley Stratton was inaugurated as president of the Massachusetts Institute of Technology at Symphony Hall, Boston, on Monday of this week. The dependence of modern civilization upon engineering education and research was the text of the inaugural exercises, led by Frederick P. Fish of Boston. Mr. Fish emphasized the pioneer work of the institute in engineering education and touched upon the value of the broad training given in addition to technical instruction in meeting the intense strain upon modern social and business organization resulting from industrial conditions based upon the most extraordinary development in science that the world has ever seen.

Governor Cox brought the greetings of the state; Major-Gen. George O. Squier, U. S. A., saluted the new president and paid a warm tribute to his work at Washington; Prof. Edward F. Miller voiced the welcome of the institute's instructing staff; President Emeritus Charles W. Eliot of Harvard outlined the pioneering work in education achieved by the institute as a private organization, pointing out that public institutions can never be expected to do the pioneering work of education; Prof. C. E. A. Winslow of Yale spoke on behalf of the alumni and President John C. Merriam of the Carnegie Institution of Washington emphasized the value of training penetrating far beyond superficial technique for the engineer of the future. While there is no limit to the extent to which fundamental research may go, President Merriam said, it is expected that the results shall be used to help in the work of the world.

### Value of Research Laboratories

In his inaugural address President Stratton gave a masterly review of the effect of science in the evolution of industry, sketching the progress of engineering in the fields of physics and electricity for the past century and pointing out the increasing demands of industry for highly trained engineers. Touching upon the value of the research laboratory, the speaker said that one single discovery may be worth many times the cost of such a laboratory, while at the same time it is turning out men trained to analyze and solve difficult problems, whether they are found in engineering, in scientific laboratories or in industry — a product of inestimable value.

## Plans Laid for City Operation of Milwaukee Utility

The latest developments in the controversy between the city of Milwaukee and the Milwaukee Electric Railway & Light Company over a contract whereby the city is to take over and operate the electric light and power and street-railway systems of that company were unfolded by Fred S. Hunt, chairman of the public utilities acquisition committee which has been investigating the public utilities question for the city nearly five years, in a recent semi-public talk. Plans are now being made for the drawing up of a new contract between the city and the company as to rates and service which will be submitted to the Common Council in about a month. This contract must be approved by the State Railroad Commission and then submitted to a referendum of the voters of the city.

The properties to be covered by the contract, including both electric plant and street-railway lines in Milwaukee and vicinity, have been valued at about $50,000,000, Mr. Hunt said, for the purposes of the proposed agreement. The company is now paying taxes of nearly $1,300,000 a year.

The city cannot buy the electric light and power and street railway properties of the Milwaukee Electric Railway & Light Company because of lack of funds, Mr. Hunt continued. He stated that the committee had been given access to the company's books. Under the service-at-cost plan to be proposed the city and company will virtually enter a partnership. The value of the company's property and the rate of return will be agreed upon. All profits over this will be applied toward the purchase of the plants by the city or used for extensions to belong to the city. The city can also use its credit to raise money for extensions and improvements which will belong to the city and be leased to the company for operation. A considerable part of the control now exercised over the company by the State Railroad Commission will be vested in the city, the commission being called in when differences arise.

The city and company will thus become partners, and surplus profits will be applied, according to the plan as expounded by Mr. Hunt, to bring about gradually city ownership of the utilities.

## Franchise Is Refused

**Colorado Springs Electors Reject Proposal to Continue Service from Existing Local Company**

BY THE decisive vote of 2,948 to 866, the electors of Colorado Springs, Col., on Tuesday refused the twenty-five-year license sought by the Colorado Springs Light, Heat & Power Company. The present franchise of that company expires on Sept. 8, and it cannot be predicted whether the city will offer a counter proposal to the company, grant a franchise to some other utility company or seek some way in which to establish a municipal plant.

The last-named project suffered a setback when the report of Gen. George W. Goethals, who, as already stated in these columns, had been employed by the central-station company to report on the situation, made the result of his survey of the Pike's Peak watershed known, declaring that it does not contain enough water to make it possible to serve Colorado Springs through an all-hydro-electric development and that a steam plant for auxiliary service will continue to be necessary. This finding was awaited with much interest by Colorado Springs and the electrical industry of Colorado in view of an earlier report by G. G. Anderson, an irrigation engineer of Los Angeles, declaring that an ample supply of water was available to meet all requirements. In his report General Goethals declared that the cost of water development would be more than $2,000,000, compared with $597,000, the estimate of city engineers.

Under the terms of the old franchise title to the already existing hydro-generating plant at Manitou passes to the city, the reserve steam plant at Colorado Springs being left in the hands of the central station.

## Mississippi Power & Light Company Organized

The Mississippi Power & Light Company has been recently incorporated in Maryland to acquire the property and business of four Mississippi companies—the Delta Light & Traction Company of Greenville, the Jackson Public Service Company of Jackson, the Vicksburg Light & Traction Company of Vicksburg and the Columbus Railway Light & Power Company of Columbus. These companies have been owned and operated by separate interests, most of which were outside the state,

.ne properties have never been in-.sively developed.

The new company will be managed by H. C. Couch and associates, who have operated successfully for the past ten years the Arkansas Light & Power system and are thoroughly familiar with the territory. The engineering firm of Ford, Bacon & Davis has reported that there are unusual opportunities for rapid expansion, both by taking on additional customers in communities now served and by extending lines to adjacent communities.

# Power Club Acts on Temperature Ratings

### Rescinds Its Two Previous Standards and Approves New "Recommended Practice" for 40-Deg. Rise—Year's Trial Proposed—Timmerman Elected President

THE Electric Power Club at its meeting in Hot Springs, Va., this week took a great stride forward in disposing of the old temperature rating question by abandoning both of the former adopted standards and by adopting as "recommended practice" a 40-deg. rating without overload guarantee. The formal statement of the board of governors on this question is as follows:

"The Electric Power Club has rescinded its two 'Adopted Temperature Rating Standards' on general-purpose motors:

"(1) The 50-deg. motor without overload guarantee, and

"(2) The 40-deg. motor with 25 per cent overload guarantee for two hours; and has approved as 'recommended practice' the following:

"'(a) An open-type general-purpose motor shall be capable of carrying full rated load continuously with a temperature rise not exceeding 40 deg. C.

"'Note.—Such a motor should be so designed as to be capable of carrying sustained overloads (in no event exceeding 50 per cent overload) within a temperature of 90 deg. C. (measured by thermometer).

"'(b) That it is the sense of the Electric Power Club at this time that general commercial practice of the ensuing year will probably lead to the unanimous support of the club to the adoption of a single-rating temperature standard for general-purpose motors without overload reference of any character.

"'(c) That within a year the "recommended practice" referred to in paragraph (a) be submitted to the Electric Power Club for vote as an "adopted standard."'"

By this action the club has solved one of the troublesome commercial engineering problems which have been continuously before the industry in one form or another for seven years.

Sessions of the convention, which was the largest the club has ever had, were held on Monday, Tuesday and Wednesday. President Russell, who closed two years' administration at this meeting, called attention in his address to the constructive work of the various sections and of the club and gave credit for all of this to the men who had devoted so much time to active committee work to bring about agreement on many difficult engineering and commercial questions. He presented actual figures of the number of "man-days" spent, which were remarkable for an organization of the size of the Electric Power Club.

The club authorized a broadening of the scope of the electrical measurement section so that it now includes indicating, integrating and recording meters. Three new concerns were elected to club membership, the Sundh Electric Company, the Wilson Welder & Metal Company and the Sewickley Electric Manufacturing Company.

The club took formal action to become a sustaining member of the American Engineering Standards Committee. Standards for step-up transformers were agreed upon, previous transformer standards having applied principally to step-down transformers. The transformer section also issued at this meeting a published booklet of general instructions for the care and operation of power transformers which is obtainable from member companies. Synchronous motor standards, circuit-breaker definitions and specifications for building equipment-control apparatus were adopted.

#### Trade Association Opportunities

At the dinner on Tuesday evening the principal address was by F. M. Feiker, who spoke on the opportunities of trade associations to be of greater service to their industries by the gathering of statistics, the support of programs of simplification and similar co-operative efforts which have been pointed out as lawful by the Commerce Department.

A. L. Ashby of the Westinghouse Electric & Manufacturing Company addressed the club on Wednesday on the subject of contracts as related to national distribution, showing points to be watched on account of variation in state laws. R. W. Gardner of the Otis Elevator Company addressed the club on methods of preventing waste in manufacture.

J. M. Barr, F. S. Hunting, J. A. Jeffrey and A. E. Waller were elected governors to fill the places of R. J. Russell, C. H. Roth, T. E. Barnum and C. L. Collens, 2d, whose terms had expired and who under the new rules were not eligible for re-election. At a meeting of the new board of governors the following officers were elected: President, A. H. Timmerman of the Wagner Electric Manufacturing Company; vice-president, James K. Bass of the Kimble Electric Company; secretary, J. M. Barr of the Louis Allis Company; treasurer, H. F. Stratton of the Electric Controller & Manufacturing Company.

## Lively Contention Over Pike Rapids, on Mississippi

No decision was made by the Federal Power Commission following a hearing on June 7 in the controversy over the development of Pike Rapids, 12 miles below the town of Little Falls, Minn., on the Mississippi River. The commission directed the Little Falls Water Power Company and the Pike Rapids Power Company to submit financial statements and engineering and legal briefs.

James O. Heyworth, a Chicago engineer, contended that the Pike Rapids company was in a position to put in the development at a cheaper unit cost and with all arrangements made for immediate operations. M. O. Leighton, who represented the Little Falls company, attacked the safety of the works proposed by the Pike Rapids company.

## Edison Visits New York's Truck Show

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THE annual electric truck show under the auspices of the New York Edison Company, held this year during the N. E. L. A. convention last week, was well attended and, as usual, attracted much interest from those concerned in city transportation of materials and merchandise. Among the visitors was Thomas A. Edison, who appears on the left of the picture George B. Cortelyou, president of the Consolidated Gas Company, is in the center and Arthur Williams, New York Edison Company, on the right.

# Supreme Court Decides Many Points

**Prohibition of Extrastate Sale of Gas Unconstitutional—Kansas Industrial Court Deprived of Power—Mennen Verdict Sustained—Other Cases of Import to Utilities**

A NUMBER of decisions with a special bearing on the regulation of public utility companies or the organization of trade associations have been made by the United States Supreme Court in the last eight or ten days. Below will be found digests of five such findings. Under "Recent Court Decisions," on page 1435, are digests of two others—one upholding the finding of a lower federal court in Brush Electric Company vs. Galveston, that a suit cannot be brought on the ground of confiscation before rates have been put into effect and where estimates of income are based on the business of former years, and the other, in the government's suit against the American Linseed Oil Company and others, forbidding the exchange of sales information and quotations through an outside agency.

## Ban on Gas Export Beyond State Boundaries Illegal

A decision of the highest court in the land which involves a possible application to state laws designed to limit the exportation of electrical energy generated within the state was handed down on Monday of this week in a suit brought by the States of Pennsylvania and Ohio against West Virginia. This suit was instituted to restrain West Virginia from putting into effect a law compelling natural-gas companies supplying gas taken from within the state to serve consumers within its borders in preference to those outside the state.

In delivering the majority opinion Justice Van Devanter said: "Natural gas is a lawful article of commerce, and its transmission from one state to another for sale and consumption in the latter is interstate commerce. A state law, whether of the state where the gas is produced or that where it is to be sold, which by its necessary operation prevents, obstructs or burdens such transmission is a regulation of interstate commerce—a prohibited interference. The West Virginia act is such a law. Its provisions and the conditions which surround its operations are such that it necessarily and directly will compel the diversion to local consumers of a large and increasing part of the gas heretofore and now going to consumers in the complainant states and therefore will work a serious interference with that commerce."

The facts that the pipe-line companies are engaged in a quasi-public business and that gas is a natural product of the state and has become a necessity therein do not, Justice Van Deventer said, afford "power to regulate interstate commerce, which is what the act attempts to do. The power is lodged elsewhere." He concluded:

"On full consideration, we reach the conclusion that the act is unconstitutional; that the apprehensions of the complaining states respecting the injury which will ensue from its enforcement are well founded, and that it obviously will operate most inequitably against those states. In this situation the appropriate decree is one declaring the act invalid and enjoining its enforcement."

Justices Holmes, Brandeis and McReynolds dissented, Justice Holmes holding that there was nothing in the commerce clause "to prevent a state from giving a preference to its inhabitants in the enjoyment of its natural advantages. The statute," he said, "seeks to reach natural gas before it has begun to move in commerce of any kind. It addresses itself to gas hereafter to be collected and states to what uses it first must be applied. The gas is collected under and subject to the law, if valid, and that moment it is not yet a matter of commerce among the states. I think that the products of a state,until they are actually started to a point outside, may be regulated by the state notwithstanding the commerce clause."

## Kansas Industrial Court Cannot Fix Wages

The Kansas Court of Industrial Relations received what may prove to be its deathblow when the United States Supreme Court, on June 11, in a unanimous opinion read by Chief Justice Taft, declared that the Industrial Court had no authority to fix wages of employees of the Charles Wolff Packing Company. While the Supreme Court did not directly declare the entire act creating the Industrial Court unconstitutional, the decision greatly limits the activities of the Kansas industrial tribunal and the effect probably will be to nullify the objects for which it was created.

The Kansas act gave the Industrial Court authority to adjust disputes and fix wages and conditions of labor in public utilities and in industries producing food, clothing and fuel. While an employee could not be prevented from quitting his job, concerted action, such as a strike, in the face of a mandate from the court was declared illegal.

In the case at issue the company resisted payment of higher wages and appealed to the United States Supreme Court from a mandamus issued by the Supreme Court of Kansas.

In his decision Chief Justice Taft says: "It [the act creating the Industrial Court] curtails the right of the employer on the one hand and of the employee on the other to contract about his affairs. This is part of the liberty of the individual protected by the guarantee of the due-process clause of the Fourteenth Amendment." No effort was made in the opinion to lay down a working rule by which readily to determine when a business has become "clothed with a public interest."

"It has never been supposed, since the adoption of the Constitution, that the business of the butcher, the baker, the tailor, the wood chopper, the mining operator or the miner was clothed with such a public interest that the price of his product or his wages could be fixed by state regulation," the opinion states.

"To say that a business is clothed with a public interest is not to import that the public may take over its entire management and run it at the expense of the owner. The extent to which regulation may reasonably go varies with different kinds of business. The regulation of rates to avoid monopoly is one thing. The regulation of wages is another. We think the Industrial Court act, in so far as it permits the fixing of wages in plaintiff-in-error's packing house, is in conflict with the Fourteenth Amendment and deprives it of its property and liberty of contract without due process of law."

## Mennen Decision Upheld

On Monday of this week the United States Supreme Court handed down a decision declining to review the finding of the Circuit Court of Appeals in the action brought against the Mennen Company by the Federal Trade Commission. In this case, which was noted in the ELECTRICAL WORLD for March 17, page 646, the Circuit Court held that co-operative or mutual associations, although buying in wholesale quantities, are retailers and that, in a case presenting no circumstances of fraud or monopolistic control or conspiracy, a manufacturer is at liberty to adopt any price schedules which he considers fair to the various branches of trade to which he sells. The commission denied that the manufacturer had this liberty and contended that the manufacturer could vary his price schedules only for quantity, actual differences in cost of transportation and various other elements which the commission inferred from the Federal Trade Commission act and the Clayton act.

## One Utility Wins, Another Loses in Rate Appeals

Two cases involving questions of the valuation of a public utility for rate-making purposes were decided by the United States Supreme Court on Monday last. In Bluefield Waterworks & Improvement Company vs. Public Service Commission of West Virginia, on appeal from the state courts, the Supreme Court held that the rates fixed for water service in 1920 at Bluefield and designed to give a return of 6 per cent were inadequate and confiscatory. The company had alleged the value of its property to be greatly in excess of that fixed by the commission and complained

the commission did not allow for increased costs of replacement between 1915 and 1920.

In the case of the Georgia Railway & Power Company and the Atlanta Gas Light Company the Supreme Court affirmed the decree of the lower courts dismissing a suit against the Railroad Commission of Georgia to restrain reduced rates for Atlanta's gas supply. Although Associate Justice McKenna dissented from the majority opinion, holding that replacement value, as fixed in principle by the court in the cases of the Southwestern Telephone Company and the Bluefield Waterworks & Improvement Company, had not been applied in this case, the majority opinion pointed out that in the case before the court the Railroad Commission had carefully considered replacement value and increased costs, although it did not allow all the claims of the company in this regard; hence the case differed from the others cited as precedents.

## New York Electrical Board

**Activities to Cover Many Phases — Sections to Meet Needs of Investors, Creditors, Bankrupts and Others**

DEFINITE plans for promoting the welfare of the entire electrical industry have been made by the recently organized Electrical Board of Trade of New York City, the formation of which was noted last week (page 1375). Charles L. Eidlitz, the board's chairman, informs the ELECTRICAL WORLD that the board's intended activities cover many phases. These include a special section in the board's offices for an advertising pool as an aid to newspaper advertisers, a legislative section to consider state and federal legislation, a patent bureau where inventors may list their inventions for the purpose of selling them to manufacturers, a credit bureau, registration of bankrupts, a section which will collect information as to excess stocks or shortages on the shelves of its members, an exhibition of new apparatus, historical exhibits for the purpose of creating public interest, advice to those contemplating going into an electrical business, and a special section which will attempt to stop sales and purchases of stolen electrical goods.

The organization will be actively controlled by a board of governors consisting of three representatives elected from each branch of the industry, and it is estimated by Mr. Eidlitz that when in full operation the board will number about thirty-six men, who will represent several thousand corporations, firms and individuals. The temporary officers elected were named in these columns last week. A temporary board of governors consisting of twenty-eight men was also elected.

The constitution of the board says in part:

"The objects of the Electrical Board of Trade of New York shall be to promote generally the interests of the electrical industry, to deal with problems concerning or affecting the industry, to represent the industry in public affairs or legislative matters affecting the industry, to be the central organization and headquarters for the entire electrical industry of the city of New York and territory hereinafter mentioned. Its activities shall be directed only along constructive lines within the industry by the encouragement of sound, ethical and progressive business methods. The board shall not, however, in any way deal with prices nor shall it foster combinations or agreements in restraint of trade."

## Ford License Executed

**He Will Install 18,000 Kva. at High Dam in Hydro Units and About 15,000 Hp. in Steam Plant**

A LICENSE extending to Henry Ford the right to utilize the High Dam on the Mississippi River at St. Paul for a period of fifty years has finally been executed by the Federal Power Commission. The license covers the construction of a power house on the existing substructure at the St. Paul end of the dam. The power house will be equipped with four turbo-generators, each with a capacity of 4,500 kva., or 500 kva. in excess of the minimum figure named in the preliminary permit.

Three-foot flashboards will be placed on the dam so that water may be ponded during off-hours and so that the head may be raised in ordinary high water. Mr. Ford will construct a steam auxiliary on the bank adjacent to the hydro-electric power house. The capacity of this auxiliary has not been determined finally, but presumably it will be 15,000 hp., since there is about that much difference between his firm power and his secondary power at the dam. This steam plant will be designed to burn the plant refuse and to furnish steam for heating the factory.

Mr. Ford's representatives presented to the Federal Power Commission a signed contract with the Northern States Power Company whereby the latter agrees to use all of the available power in excess of the needs of the manufacturing plant at a fixed price of 2½ mills per kilowatt-hour.

It is understood that Mr. Ford is planning to manufacture storage batteries for his cars at this plant. The estimated output of the plant will be 6,000 batteries per day. He desires to establish a barge service between St. Louis and St. Paul to bring the raw materials entering into battery construction up the river and return with the manufactured product.

The license was accepted with the reservation that an argument later may be presented by Mr. Ford's representatives for a reduction in the capital sum being paid for the use of the government structure and for a reduction in the rate of interest. In the report of the Chief Engineer it is suggested that $70,000 per annum would be fair reimbursement to the government. The license calls for a rental of $95,440 per annum.

## Eber Bill Defeated

**Wisconsin House Is 51 to 39 Against a Two-Year Postponement of Electrical Development**

THE Eber water-power bill, providing for a cessation of water-power development in Wisconsin by private interests for a period of two years and appropriating $25,000 for a survey of water-power sites by the Railroad Commission, was killed by the Assembly when it came up for final passage in amended form. As reported in the ELECTRICAL WORLD for May 26, page 1230, this bill originally made the period of delay six years. Its defeat even in the amended form is thought to mark the final downfall of an attempt to stifle hydro-electric progress in Wisconsin. The vote was fifty-one to thirty-nine in favor of the indefinite postponement of the measure.

The proposed plans of Henry Ford with respect to water-power projects in Wisconsin figured prominently in the defeat of the measure. Opponents of the bill said it would prevent Ford from going through with his water-power development program in Wisconsin.

## Pacific Gas & Electric Doubles Business in Six Years

For the year ended Dec. 31, 1922, the Pacific Gas & Electric Company of San Francisco showed, as indicated in its seventeenth annual report, gross operating revenue of $38,593,562 and sales of electricity totaling 1,098,123,000 kw.-hr., as compared with a gross operating revenue of $19,813,381 and total sales of 587,144,000 kw.-hr. in 1917, thus nearly doubling its receipts and its sales of energy in a six-year period. In the nine years beginning with 1914 gross income increased 128 per cent, sales of electricity 142 per cent, number of consumers 70 per cent, and number of stockholders (because of the momentum from the customer-ownership movement) 772 per cent.

Deducting from the gross revenue for 1922 charges for maintenance, operation, taxes, depreciation and interest, a net income of $6,587,159 was shown. Adding the balance at the beginning of the year ($7,946,366) and deducting dividends and miscellaneous adjustments, there was left a balance in sinking funds and unappropriated of $8,593,388.

In its electrical business the company serves eighty-nine incorporated cities, 142 villages and towns and a suburban area of 35,000 square miles with a population in excess of a million and a half, occupying approximately 278,000 houses, of which less than 2,000 are unwired. The total output of energy during 1922 was 1,608,940,735 kw.-hr., an increase over 1921 of about 120,000,000 kw.-hr. Of this, 69.9 per cent represents the output of the company's twenty-eight hydro-electric plants, 15.6 per cent was produced in its four steam-electric plants, and 14.5 per cent represents power purchased from other concerns.

## Colorado River Compact

**League of Southwest Listens to Paper Indorsing It as Drawn—Other Big Plans Discussed**

AT AN open conference called by the League of the Southwest on June 7, 8 and 9 at Santa Barbara, Cal., to discuss Colorado River problems and Indian affairs, earnest discussion was given to the present status of the Colorado River compact, which has thus far been passed upon favorably by the legislatures of all the states involved except Arizona.

Robert Sibley of San Francisco, who had traveled ten thousand miles to make a detailed study of the situation, reported, saying:

"Virtual unanimity prevails among the leaders in the seven states involved that, owing to differences in seasons, crops, soil and physical conditions of climate, it is wise to separate the Colorado River drainage basin into two areas, the upper basin and the lower basin, as defined in the proposed Santa Fé treaty now under consideration. The waters of the Colorado River basin under wise adjudication are ample to bring under cultivation all irrigable lands of reasonable approach from the main waters of the river. The Colorado River basin, involving as it does interstate and international problems of floods, irrigation, power and possible navigation, is a matter requiring the closest co-operation of the seven states involved and the federal government. The raising of funds for the complete development of the river, involving as it will a sum probably exceeding a billion dollars, requires the most thorough co-operation of public and private finance. Hence it would seem that the proposed Santa Fé treaty should be adopted in its present form.

### Permanent Commission Favored

"Immediately thereafter the seven states and the federal government should unite in bringing to life a permanent Colorado River commission, composed of men of brilliant attainment and constructive ideals in problems similar to those to be met with in Colorado River development — men thoroughly representative of the seven states involved and of the federal government. This commission should have full and complete authority to supervise the distribution of the waters and building of dams in the canyon district and the disposition of power franchises to private and business enterprises that may desire them. The continual aim of the commission should be so to encourage all involved in the Colorado River development that broad policies of use for this great public resource may be executed at once and the wealth of water and power it contains be brought to Western homes, farms and industries by the fullest co-operation of federal, state, city and private enterprises."

At the conference two other papers of interest to the electrical industry were presented—one by W. G. Clark, a consulting engineer of New York City, who had prepared a detailed study for power development at Boulder Canyon which would require a dam a thousand feet in height; the other by George H. Maxwell of Phoenix, Ariz., executive director of the National Reclamation Association, who presented a preliminary study of a high-line canal to serve Arizona and southern California, involving two dams 700 ft. in height, the development of a million horsepower and the bringing of the Colorado River power not only to the Imperial Valley of California but also to the Los Angeles, Santa Barbara and San Diego districts.

## Two More Generators Ordered for Holtwood

For supplying power to two new customers, one of which is the Edison Light & Power Company of York, Pa., and the other the Chester Valley Electric Company of Coatesville, Pa., the Pennsylvania Water & Power Company has ordered from the Westinghouse Electric & Manufacturing Company two 15,000-kva., 80 per cent power factor, three-phase, 13,200-volt, 60-cycle, 94.7-r.p.m. waterwheel generators for installation in its Holtwood station. The current will be stepped up at Holtwood to 73,000 volts and transmitted by double-circuit tower lines to both of these customers. The lines will be designed and insulated for an ultimate voltage of 110,000. The construction work at Holtwood will be done by Day & Zimmermann, of Philadelphia, who operate the customer companies at York and Coatesville referred to.

## El Dorado Hydro Plant Will Be Finished This Year

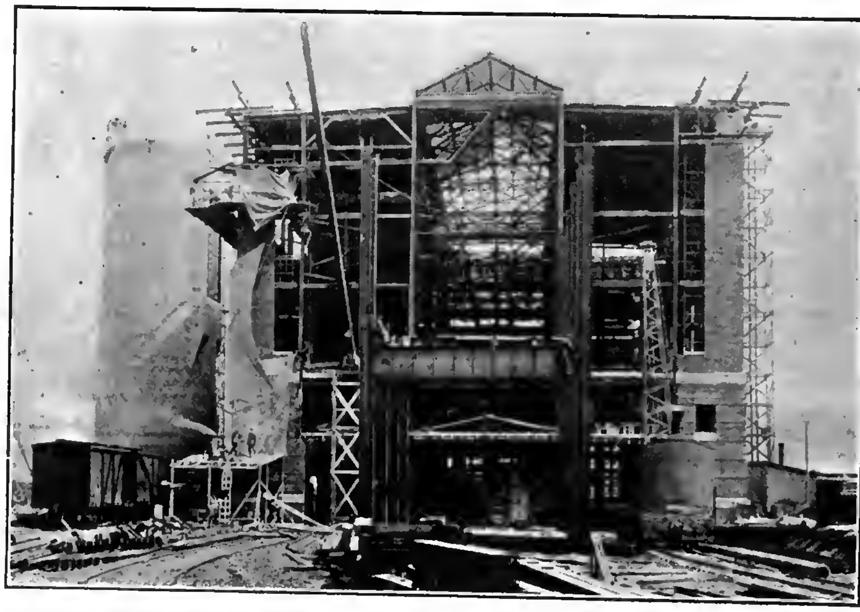
Construction work on the development of the El Dorado hydro-electric project of the Western States Gas & Electric Company is proceeding so well that completion is by December of this year virtually assured, according to F. C. Shenehon, vice-president and general manager of construction and engineering, Byllesby Engineering & Management Corporation, who recently completed an inspection tour of the work in progress on the South Fork of the American River, not far from Placerville, Cal.

"We are busy on all work below the snow line," said Mr. Shenehon. "Construction of the power house is well under way, and work on the flumes, penstock and forebay dam is progressing rapidly. Upward of a thousand men are now employed. By the middle of June it will be possible to resume work in earnest on the construction of the storage dam at the Twin Lakes reservoir site.

"The new station will develop a total of 27,000 electrical horsepower, and available power rights will permit its enlargement to a capacity of 100,000 horsepower as the need arises. The present generating equipment will consist of two units of equal size, driven by impulse wheels operating under a head of 1,750 ft."

The Western States Gas & Electric Company serves a total population of more than 107,000, the principal cities in its territory being Stockton, Eureka and Richmond. About thirty smaller places are supplied.

## Pine Grove Plant Rapidly Nearing Completion



THE first 50,000-kw. section of the East Penn Electric Company's new plant at Pine Grove, Pa., is rapidly nearing completion, considerable progress having been made on the building and the stack since the above photograph was taken. This power house, which was designed and is being erected by the J. G. White Engineering Corporation, is to have an ultimate rating of 300,000 kw. It is a mouth-of-mine plant, being built on Swatara Creek, within four or five miles of anthracite coal fields, permitting the use of "fines" or powdered fuel under the boilers of the station.

## ...ific Coast Men to Discuss High-Rated Apparatus

The annual convention of the Pacific Coast Electrical Association, which is affiliated with the N. E. L. A., will be formally opened Tuesday noon, June 19, when the delegates will be the guests of the San Francisco Electrical Development League at a luncheon. Preceding the luncheon there will be a parade of electrical vehicles now in use in San Francisco under the auspices of the Electric Transportation Club. The convention will be held at the Fairmont Hotel. The program for the technical sessions is as follows:

TUESDAY, JUNE 19

*Afternoon.*—Report of apparatus committee; "Inductive Regulators Versus Synchronous Regulators for Distribution Circuits," by J. E. Woodbridge; "220,000-Kv. Apparatus," by H. Michener; report of prime movers committee; report of power-factor committee; "Kva. Demand Meters," by O. A. Knopp.

WEDNESDAY, JUNE 20

*Afternoon.*—Report of hydraulic power committee; "Water Hammer," by R. J. C. Wood; "Friction Tests on Penstocks," by R. A. Monroe; report of meter committee; report of underground committee; "Underground System of Southern California Edison Company," by N. B. Hinson; "35,000-Volt Cable Installation in Los Angeles," by M. O. Boiser.

THURSDAY, JUNE 21

*Morning.*—Report of safety rules committee; report of overhead-systems committee; "Operation at 220,000 Volts," by H. A. Barre; paper by W. J. Canada (subject not announced); report of inductive-co-ordination committee.

The Commercial Section will run parallel sessions with the Technical Section. The program for these has not been announced. On Thursday afternoon there will be a trip of inspection to the plant of the Pacific Coast Steel Company in South San Francisco. A trip to Mount Tamalpais on Saturday morning will conclude the convention.

## Entertainment Program of A. I. E. E. Swampscott Meeting

An elaborate program of entertainment and inspection trips has been prepared for the annual convention of the American Institute of Electrical Engineers, to be held at the New Ocean House, Swampscott, Mass., in the week beginning June 25. Besides sightseeing trips to Boston and to Lexington, Concord, Salem and Marblehead, all rich in historic interest, trips of inspection will be made each day to places of engineering and manufacturing note. Among these will be the River (Lynn) and West Lynn works of the General Electric Company, the L Street station, Beacon Street substation and service building of the Boston Edison company, Creighton's shoe factory at Lynn, the Naumkeag Mills at Salem, the Simplex Wire & Cable Company at Boston and the Arlington Mills at Lawrence. Arrangements for visits to Harvard University and the Massachusetts Institute of Technology have, of course, been made, and there will be ample provision for golf, tennis, bridge, dancing and concerts.

The technical program as printed in the ELECTRICAL WORLD for May 19, page 1165, has been confirmed without material change. It should have been stated that the paper on the new Weymouth station to be given on Wednesday morning is by I. E. Moultrop and J. Pope.

## Dr. Agnew Pleads for Greater Standardization

"The Industrial Significance of Standardization" was the subject of an address made recently by Dr. P. G. Agnew of the American Engineering Standards Committee at a luncheon of the Metric Association in New York. Dr. Agnew said:

"Standardization tends to stabilize production and employment, since it makes it safe for the manufacturer to accumulate stock during periods of slack orders, which he cannot safely do with an unstandardized product. Moreover, by simplifying the carrying of stocks it makes deliveries quicker and prices lower. It reduces selling costs, a fact which is generally overlooked.

"Unit costs to the public, too, are lowered in that mass production is possible, as has been so strikingly shown in the unification of incandescent lamps and automobiles. Standardization is increasingly important for the maintenance and development of foreign trade. There is strategy in nationally recognized 'American' specifications. And by concentration on essentials, and the consequent suppression of confusing elements intended merely for sales effect, it helps to base competition squarely upon efficiency in production and distribution and upon intrinsic merit of product.

"Another benefit of standardization is that it acts as a powerful stimulus to research and development and is also the principal means of getting the results of research into actual use in the industries. Moreover, it helps to eliminate practices which are merely the result of accident or tradition and which impede development.

"Finally, the joint effort in bringing about standardization within and between industries almost invariably leads to better understanding and to beneficial co-operation along other lines—a step toward the integration of our industries."

## Electrical Leaders to Address Canadian Association

Delegates from all parts of Canada and many from the United States will gather in Montreal on Thursday, June 21, for the thirty-third annual convention of the Canadian Electrical Association, which will continue until Saturday. Headquarters will be at the Mount Royal Hotel. Dr. M. Luckiesh of the Nela Research Laboratories, Cleveland, will give an illustrated lecture on the lighting of the home, and S. G. Hibben of the Westinghouse company will give a talk and demonstration on industrial lighting. President-elect Walter H. Johnson of the N. E. L. A. and H. M. Edwards, auditor of the New York Edison Company, are also expected to address the convention.

There will be two lunches, a dinner, a dance and an "electrical veterans' night." At Thursday's luncheon H. T. Davies, president of the association, will preside, and the speakers will be Jacques Bureau, M.P., and Mr. Johnson. At Friday's luncheon A. Monro Grier, president of the Canadian Niagara Power Company, will preside, and the speaker will be L. A. Hawkins, research laboratories, General Electric Company, Schenectady, who will take the place of Dr. C. P. Steinmetz. J. F. Gilchrist, Chicago, vice-president Commonwealth Edison Company, will be the chief speaker at the dinner on Thursday night. He will talk on the merchandising end of the electrical industry. A dance will follow the dinner. Friday night will be "electrical veterans' night." The usual full committee reports will be presented.

## Iowa Men Prepare Four-Day Program

Meeting at Mason City on June 26-29, the Iowa Section, N. E. L. A., will give the following program:

TUESDAY, JUNE 26

*Morning.*—President's report, C. N. Chubb; secretary-treasurer's report, M. G. Linn; Public Relations Section, F. J. Hanlon; Technical Section, C. A. Sears; Commercial Section, S. C. Dows; Accounting Section, H. Bellamy; membership committee, R. H. Fowler; rate committee, M. G. Linn.

*Afternoon.*—Inductive interference committee, Austin Burt, discussion by A. B. Campbell, J. M. Drabelle, C. G. Johnston and H. F. Boehner; rural-lines committee, A. W. Jones, discussion by V. L. Hein and E. L. Fischer; résumé of activities of national rural-lines committee, Arthur Huntington; "Recent Developments Regarding Rural-Lines Liability Insurance," W. S. Ferguson, discussion by W. A. Woodward; committee on taxation of transmission lines, R. H. Fowler.

WEDNESDAY, JUNE 27

*Morning.*—Address, Frank Hulswit; meter committee, S. M. Cox; "The Meter Instrument Calibration Laboratory at Iowa State College," F. D. Paine; "Sales and Service of Electric Ranges," H. D. Mitchell and V. O. Stafford; "Merchandising," H. L. Green, Waterloo.

*Afternoon.*—Automobile trip.

THURSDAY, JUNE 28

*Morning.*—Legislative committee, F. J. Hanlon; Iowa Committee on Public Utility Information, F. J. Hanlon and Joe Carmichael; address by a member of the Iowa Board of Railroad Commissioners; "Recent Decisions Affecting Fair Value, Depreciation and Rate of Return," John A. Reed; "Observations Regarding Increased Taxation of Public Utility Property," John A. Reed; "Model Power-Plant Design," C. L. Shoemaker; discussion by John M. Drabelle, O. W. Harrod, F. A. Beatty, Austin Burt and F. C. Chambers.

*Afternoon.*—Iowa Electric Railway Association meeting.

*Evening.*—Banquet.

FRIDAY, JUNE 29

*Morning.*—"Installation, Operation and Maintenance of Electric Distribution Transformers," C. R. Stahl, discussion by Charles Clark; "Public Utility Accounting," C. J. Anderson; "Customers' Accounts and Collections," George F. Myers and F. J. Larsh; election of officers.

There will be the usual entertainment features, dances and provisions for lake bathing.

## Consumers' Power Reports Prosperous Year

The net income of the Consumers' Power Company of Jackson, Mich. for 1922, after the payment of all charges, depreciation, interest on bonds and preferred dividends, was $3,307,388, or $21.06 a share on the $16,175,900 outstanding common stock of the company. This compares with a net income in 1921 of $2,494,044.

Business conditions, the annual report says, were much more favorable than in the previous year and brought greatly increased service demands upon the company. Electric sales increased 31,741,061 kw.-hr., or 17.57 per cent over 1921. Total electric sales for 1922 were 346,149,671 kw.-hr. to 149,124 customers. The company expended $3,784,445 for extensions, additions and improvements in 1922 and now has plans under way for the expenditure of another $10,000,000 during 1923 for improvements.

Items on the income report, comparing with those of 1921, follow:

| | 1922 | 1921 |
|---|---|---|
| Gross earnings ..... | $15,067,116 | $14,073,292 |
| Operating expense.. | 8,302,989 | 8,373,210 |
| Balance .......... | 3,307,388 | 2,494,044 |

# Brief News Notes

**Work on Boulder Lake Plant Started.**—Work on the twelve-million-dollar power plant to be erected by the Cities Service Company at Boulder Lake, Col., where a great artificial reservoir is to be made, was begun on June 1.

**Western New York Companies to Merge.**—Stockholders of the Genesee Light & Power Company, the Western New York Public Utilities Company and the Le Roy Hydraulic Gas & Electric Company have voted to merge, and the combined company will be known as the Western New York Public Utilities Company, Inc. The general offices will be in Batavia.

**Waukesha Company Absorbed.**—A long-talked-of transfer of the Waukesha Gas & Electric Company to the Wisconsin Gas & Electric Company, Racine, of which the Milwaukee Electric Railway & Light Company is also a subsidiary, is now completed. The first effects of the transfer will be a reduction of rates July 1 or earlier. There will be no change in the management.

**Virtually All Utah Coal Mines Electrified.**—A contract has been signed between the Utah Power & Light Company and the Utah Fuel Company whereby the former will furnish electric power to the principal mines of the fuel company in Carbon County, Utah. The signing of this contract marks the last step in the electrification by purchased hydro-electric power of virtually all the coal mines in Utah. The Utah Fuel Company formerly used its own steam-generated electric power.

**Sioux City to Have Electrical Show.**—An electrical exposition will be staged in Sioux City, Iowa, in the fall under the auspices of the Sioux City Electrical Club. Plans are being made to make it one of the best electrical shows ever held in the Middle West, according to C. C. Murphy, president of the club.

**Teaching Resuscitation Method to Police and Firemen.**—The illustration shows a practical demonstration given to city employees by Levi Bryant of the Dayton Power & Light Company of the prone-pressure method of resuscitation from electric shock, which is also

applied to those apparently asphyxiated or drowned. By arrangement with the Safety Director of Dayton Mr. Bryant, who is an expert in the use of this method, has conducted classes for the purpose of instructing policemen and firemen in its use.

**Duncan Riffle Plant Almost Complete.**—The eight-million-dollar hydro-electric power plant of the Alabama Power Company at Duncan Riffle, on the Coosa River, will be running at full capacity within sixty days, according to information given out. Two 30,000-hp. units are now going, a third one will be operating within thirty days, and at the end of two months the fourth and last one will start. Even with this additional 120,000 hp. the company will not be able to supply the demand for power.

**Pit River No. 3 Construction Starts.**—The Mount Shasta Power Corporation, the construction division of the Pacific Gas & Electric Company, has been authorized by the Railroad Commission of California to spend $12,312,600 on power development on the Pit River, to be known as Pit River No. 3. Construction work is already under way. The new plant involves the digging of a 19-ft. pressure tunnel 22,700 ft. long with a capacity of 3,000 sec.-ft. Three penstocks will deliver the water to the power house under a head of 313 ft., developing 108,000 hp.

**Louisville Waterside Plant Near Completion.**—The steel-skeleton framework of the addition to the Waterside station of the Louisville Gas & Electric Company is now so near completion that the 20,000-kw. turbine is expected to be placed in operation before fall. The total capacity of the plant will then be 67,800 kw. This new extension will include two boilers and allow room for a future turbine. The present rate of growth for the Louisville territory may be gaged from the 8,060 kw. in new power contracts secured during the first four months of this year as compared with 3,730 kw. during the same period in 1922.

**Southern Sierras Orders Largest Turbine of Type.**—The Southern Sierras Power Company has awarded a contract to the Pelton Water Wheel Company for furnishing a 14,000-hp. single-runner, single-nozzle impulse turbine. This unit will be installed at the power company's Leevening Creek plant No. 1 and will operate under an effective head ranging from 1,531 ft. to 1,622 ft. This, it is announced, will be the largest capacity single-runner impulse turbine in the United States.

**Marshall, Tex., Has New Central Station.**—The new central power station of the Marshall (Tex.) Electric Company was formally opened recently. The station was built to supply electrical energy for lighting and power purposes to Longview, Jefferson, Hallsville, Kilgore and Woodlawn. The plant and the distribution systems are owned by the American Public Service Company, an Insull property. The formal opening of the plant took the form of a community gathering to inspect the plant and see it in operation. The American Public Service Company has an investment of more than $2,000,000 in east Texas utilities.

**Alabama Power's Opelika Line.**—The Alabama Power Company is preparing to build a high-tension transmission line from the Coosa River power developments to Opelika at an approximate cost of more than $1,000,000, according to a recent announcement by Thomas W. Martin, president of the company. A primary substation similar to the largest one now in operation by the company and capable of great expansion will be built at Aubrey, on the outskirts of Opelika. At this station the power will be stepped down and transmitted over 44,000-volt lines from Opelika to Lafayette, Roanoke, Auburn, Notasulga Tuskegee, Waverly, Dadeville, Camp Hill and Alexander City.

**Philadelphia Electric Schools Merge.**—Announcement is made by Provost Penniman of the merger of the Moore School of Electrical Engineering—provided for in the will of Alfred F. Moore—and the School of Electrical Engineering at the University of Pennsylvania. The new school will be known as the Moore School of Electrical Engineering and will have the income from a fund of $1,500,000 left by Mr. Moore, in addition to the funds hitherto at the disposal of the university's electrical engineering department. It probably will be ready for operation next fall. Provost Penniman says that ample space and equipment for the new school are available in the Engineering Building of the university.

**Citizen-Aided Development Near Lebanon, Mo., Under Way.**—A 2,400-hp hydro-electric development of the Missouri Water Power Company on the Niangua River near Lebanon, Mo., is progressing rapidly, and as the capital for this development has to a great ex

...en supplied by citizens of Leb... that city is much interested in project. A dam is being built across the Niangua and a tunnel has been drilled through the rock to the level of the lower channel. The power house will be at the dam. The electric plant at Lebanon has already contracted for energy from this plant and poles have been erected between the dam and the city, a distance of 25 miles. An important result of this development will be the creation of a large lake in one of the best fishing districts in Missouri.

**Norway Plant in Operation.**—The first unit, rated at 2,300 kva., of the new hydro-electric plant of the Indiana Hydro-Electric Power Company at Norway was placed in operation the last of May. Within a short while three other units, also rated at 2,300 kva., will be placed upon the line. This company is a subsidiary of the Middle West Utilities Company and is operated as a unit of the Interstate Public Service Company of Indiana. Transmission lines will tie this plant in with the lines of the Indiana Service Corporation of Lafayette and the Interstate lines supplying power and light for the district surrounding Monticello. An additional transmission line has also been built from Norway to connect with the Central Illinois Public Service Company's lines at a point near the Indiana-Illinois border in the vicinity of Kentland.

**Municipal Plant Opposed in Logon, Utah.**—The Chamber of Commerce of Logan, Utah, in a special report recommends that the city abandon plans to build a new power plant and suggests instead that power be purchased wholesale from the Utah Power & Light Company under an existing contract which has several years to run. The report shows that $5,000 can be saved annually by purchasing power from the central station. A consulting engineer employed by the city to report on the advisability of erecting a new municipal hydro-electric plant estimates that the cost of the development would be approximately $266,000. The present municipal plant is supplying about 40 per cent of the city's requirements. One-half of the power retailed by the city is purchased from the Utah Power & Light Company at a very low rate under a long-term contract.

**Removable Dam Proposed for Snake River.**—A license propably will be granted by the Federal Power Commission to the Burbank (Wash.) Irrigation District to place a removable dam in Snake River during the low-water season. The district recently has constructed a power house, but the water supply during the period of minimum flow is insufficient to permit of its operation. The district is not in a position to finance a permanent dam at this time and represents that it is essential to irrigation that the needed diversion be permitted. The chief of engineers in his report expresses doubt as to the feasibility of putting in and taking out each year such a structure as is proposed. He sees no objection, however, to the plan provided the district puts up a bond to guarantee the removal of the obstruction when required. It is probable that the license will be limited to four or five years so as to give the district an opportunity to establish itself financially, at which time a permanent structure can be substituted.

**Foshay Buys Tri-State Utilities.**—Purchase of the control of the Tri-State Utilities Company by the W. B. Foshay Company of Minneapolis has been announced by Mr. Foshay. The general offices of the company, which operates electric light plants in Iowa, South Dakota and Nebraska, are to be moved to Minneapolis. The company is one which was started by Mr. Foshay in 1917 at Dallas and Winner, S. D. Illness forced him to sell two years later, and the present purchase is the realization of the plans delayed in 1917, he says. This company has total assets aggregating $1,102,607, has two water-power and four steam and Diesel plants and 250 miles of transmission lines. It serves a population of 26,000 persons. A transmission line to connect Nebraska and South Dakota cities with those of the Minnesota electrical distributing company in the southeastern part of the state will be built. The combined companies serve eighty-four cities and have more than 1,100 miles of transmission lines. The total value is estimated at $1,942,000.

# Associations and Societies

**San Francisco Section, A. I. E. E.**—The annual meeting of the San Francisco Section, A. I. E. E., was held May 25. J. H. Anderton, consulting engineer of San Francisco, spoke on "Some Hydro-Electric Developments of Japan" and showed four reels of motion pictures.

**Utah Engineers Elect Officers.**—At the annual banquet of the Utah Society of Engineers on May 26 the following officers were declared elected: President, Hugh C. Lewis; vice-president, Ernest Gayford; secretary, J. A. Hale; treasurer, R. K. Brown; member of the executive committee, L. D. Anderson. The society has a membership of two hundred.

**Newark Has I. E. S. Chapter.**—A chapter of the Illuminating Engineering Society has been formed at Newark, N. J., of which William T. Blackwell is chairman and H. C. Calahan is secretary. A meeting in conjunction with the Newark Master Electricians' Association was held on Monday of this week, when S. G. Hibben spoke on "Practical Electric Lighting."

**Electrical Manufacturers' Agents' Association.**—At a meeting held in New York on June 5 the Electrical Manufacturers' Agents' Association was brought into being. The officers elected were: President, W. S. Brown of the W. S. Brown Company; treasurer, C. W. Boynton of the Electric Products Company; secretary, E. S. White of the Corey Company. The three officers were designated as representatives to the board of governors of the Electrical Board of Trade.

**Utah Section, A. I. E. E.**—At the last meeting of this section for the season, held on May 31 in the Terminal substation of the Utah Power & Light Company, a resolution was passed favoring a proposed extension of the activities of the Engineering Council of Utah by employing a secretary who will devote his entire time to engineering society affairs. These section officers were elected: Chairman, C. R. Higson; secretary-treasurer, Hiram W. Clark.

**Empire State Gas and Electric Association.**—A meeting of the Commercial Section of this association will be held at Briarcliff Lodge, Briarcliff Manor, N. Y., on June 28 and 29. On the first day purchasing and storeroom matters, the merchandising of service, of appliances and of street lighting, street-lighting development, advertising appliances, advertising service, advertising good will, and public relations will be discussed. On the second day the topics will be "Investigation of Service Inquiries and Routine," "Rural Service," "Industrial Engineering," commercial, factory and domestic; "Refrigeration," "Commercial Department Accounting" and "Service of the Utility Company from the Viewpoint of an Outsider."

### Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

North Central Division, N. E. L. A.—Minneapolis, June 20-22. H. E. Young, Minneapolis General Electric Company.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 21-23. Louis Kon, 65 McGill College Ave., Montreal.

Southern Appalachian Water Power Conference — Asheville, N. C., June 25-27. J. A. Switzer, Knoxville, Tenn.

American Institute of Electrical Engineers —Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Iowa Section, N. E. L. A. — Mason City, June 26-29. M. A. Linn, Des Moines Electric Co., Des Moines.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Michigan Electric Light Association—Grand Rapids, Sept. 11-13. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Association of Iron and Steel Electrical Engineers — Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

# Recent Court Decisions

**Suit Brought on Ground of Confiscation Where Rates Have Not Been Put Into Effect Is Premature.**—The United States Supreme Court on June 4 affirmed the action of the District Court in dismissing a suit brought by the Brush Electric Company against the city of Galveston, Tex., to enjoin a reduction in rates. The company supplies light and power in Galveston under a franchise granting the city authorities power to regulate rates. In 1918 an ordinance was adopted increasing rates. In 1919 another ordinance sought to reduce the rates made effective in 1918. The company sued to test both ordinances, alleging that the 1919 rates were so low as to be confiscatory. A special master made a report on valuation to which both sides excepted. The District Court changed the master's report and then entered an order dismissing the suit on the ground that, inasmuch as the 1919 ordinance rates had not been put into effect and estimates of probable income under its rates were based on business volume several years before, it could not be determined whether the rates were confiscatory or not.

**Allowance of Element of Going Value Proper, Though Business Had Been Operating at a Loss.**—Reversing an order of the lower court which set aside rates fixed by the Missouri Public Service Commission for steam heat supplied by the Kansas City Light & Power Company (State ex rel. Case vs. Commission), the Supreme Court of Missouri held that because the business of the company in furnishing steam heat had been conducted at a loss for three successive years owing to the great increase in the cost of fuel, labor and material during those years an allowance by the Public Service Commission of "going-value" or intangible value of the plant as a going concern was not therefore unlawful, where there was no evidence that the business when on a normal basis had not been a feasible or practicable business and no showing that the demand for the commodity furnished had in any manner decreased. Allocating and apportioning the valuation and operating expenses of the plant on the basis of 85 per cent chargeable to steam heat and 15 per cent to electricity was proper under evidence showing the primary use of the plant concerned to be for the furnishing of heat, and that to use the plant for producing electricity only would make the expense of the electrical energy prohibitive and the operation of the plant unprofitable. The court further held that a finding of the commission as to the value of the property of the company was not void for failure to itemize or separately state the "going-concern" or "intangible" value of the plant, where no evidence was introduced to show such value separately from the physical value of the plant. (249 S. W. 955.)*

**Exchange of Sales Information and Quotations Through Outside Agency Forbidden.**—Manufacturers in the same industry cannot exchange information as to sales and prices virtually as a unit controlling the business of the industry without coming into conflict with the Sherman law, even though the information be cleared and distributed by an independent agency, the United States Supreme Court held in its decision reversing the action of the District Court for Northern Illinois in holding for the defendants in the government's suit against the American Linseed Oil Company and eleven other manufacturers and the Armstrong Bureau of Related Industries. The opinion directed the District Court to grant the government the injunction it had sought. The twelve linseed-oil manufacturers were subscribers to the Armstrong bureau. They are alleged to have controlled a large part of the business of their industry. They agreed to turn over to the bureau full reports of sales, quotations, offerings and other information. They were to receive through the bureau data on the market, trade and manufacturing conditions in the industry and on economies in manufacture and salè, information regarding credit of buyers, uniform cost accounting systems, fair freight rates, standardization of products and other matters.

**California Commission Sustained in Southern California Edison Case.**—The California Supreme Court has sustained the action of the Railroad Commission in ordering a reduction of 10 per cent in the rates of the Southern California Edison Company and in refusing to open the proceedings involving the 10 per cent rate reduction to include a general rate investigation. Sidney E. Saunby, C. A. Melcher and the California Farm Bureau Federation had contended that the order of the commission was unlawful in so far as it operated to continue in effect the former order of the commission as to the amount of taxes to be estimated and allowed the corporation as operating expenses and also as to the allowance of any portion of the sum paid by the corporation as United States income taxes as operating expenses. The commission in its order denying a petition for rehearing had set forth its reason as follows: "Case No. 1710 was in the nature of an emergency proceeding and limited in its scope in order that certain reductions in rates might be made effective immediately. This course was agreed to in general by attorneys in the proceeding and was taken with the specific understanding that the commission would, on its own motion, institute a further proceeding to investigate fully the rates, rules and practices of the Southern California Edison Company. Pursuant thereto the commission has instituted a proceeding into the entire question of the reasonableness of the rates, rules and practices of the Southern California Edison Company (Case 1759), and in view of this fact and the limitations of the scope of Case No. 1710 it does not appear that there is any justification for granting a rehearing on the grounds set forth in the petition herein."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**Companies Must Stand by Representations of Authorized Employee.**—The Wisconsin Railroad Commission has ordered the Burkhardt Milling & Electric Power Company to discontinue a standby or demand charge made to a creamery association during months of the year when the association's motor was out of service. The commission found that the power company's interpretation of the rates was correct, but that it had been wrongly interpreted to the customer by the employee who solicited the business and that the company must stand by the oral statements of its authorized representative despite the fact that to do so involved a slight degree of discrimination.

**Exchange Value Different from Condemnation Value.**—In the case of the Pacific Gas & Electric Company, which desired to exchange certain properties with an affiliated company to eliminate duplication and competition, the California Railroad Commission approved a value which represented the historical cost of the property less the reasonable depreciation accrued in the case of each company in the normal operation of its business. The facts that both parties were public utilities whose rates were subject to regulation and that the existing duplication would result in the taking down of certain lines, thus reducing them to a salvage value, were those on which the commission based its ruling.

**Rates for Electric Cooking.**—In substituting for a minimum charge plus an energy charge a monthly service charge plus an energy charge in the electric cooking rates of the Sauk City municipal plant, the Wisconsin Railroad Commission said: "While it is desirable to offer as low a rate as is consistent with the cost of service for furnishing energy for cooking purposes, it must be borne in mind that, especially in small communities, the fixed charges involved in furnishing this service are quite material. Oftentimes special transformers have to be provided for cooking installations; heavier secondaries are required, together with special metering equipment. These cause a substantial burden of fixed costs in connection with this service which may properly be met by a service charge corresponding to the very generally accepted practice with reference to power rates."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

### S. B. Irelan Leaves Montgomery

S. B. Irelan, vice-president and general manager of the Montgomery (Ala.) Light & Water Power Company, has been appointed vice-president and manager of the St. Joseph (Mo.) Railway, Light, Heat & Power Company, succeeding B. C. Adams, who, as was announced in the June 9 issue of the Electrical World, goes to Toledo. Mr. Irelan has been in Montgomery since 1919, when he was transferred from Sedalia, Mo., where he was vice-president and general manager of the City Light & Water Company. He became identified with the Doherty interests following his graduation from Purdue University, when he enrolled in the engineering school of Mr. Doherty at Denver. In 1910 he was made secretary and treasurer of the Fremont (Neb.) Gas & Electric Light Company, a Doherty property, and two years later was transferred to the engineering department of Henry L. Doherty & Company in New York. Subsequently he was vice-president and general manager of the Bartlesville (Okla.) Gas & Electric Light Company, going from there to Sedalia.

**J. H. Shearer**, general superintendent of the Penn Central Light & Power Company, has received the title of vice-president.

**C. O. Culver**, general superintendent of the Eastern Shore Gas & Electric Company, with offices at Salisbury, Md., has been made general manager of the company.

**Geoffrey T. Cooper**, who was formerly with the Narragansett Electric Lighting Company of Providence, R. I., is now associated with Stone & Webster, Inc., Boston, as electrical designer.

**L. E. Perry**, formerly superintendent of the East Aurora (N. Y.) Electric Light Company, is now associated as engineer with the Charles M. Kelso Company, Inc., contracting engineers, at Utica, N. Y.

**Harold F. Rice**, formerly associated with the General Electric Company, Schenectady, N. Y., is now in the electrical engineering department of the Denver (Col.) Gas & Electric Light Company.

**C. R. Higson**, assistant to the general superintendent of the Utah Power & Light Company at Salt Lake City, has been elected chairman of the Utah Section of the American Institute of Electrical Engineers. Mr. Higson has been identified with public utilities in Utah since 1911, when he joined the Utah Light & Railway Company at Salt Lake City. The following year, when the Utah Power & Light Company was organized, he entered its engineering and operating department. He is a native of Salt Lake City and a graduate of the University of Wisconsin.

### Britton Elected First Vice-President of N. E. L. A.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, was elected first vice-president of the National Electric Light Association at the convention of the association held last week in New York City. For a number of years Mr. Britton has been an influential factor in association activities, and he is known

J. A. Britton

throughout the country for his contributions as executive-engineer to the building of Pacific Coast utilities. Although born in the East in 1855, he has been associated with California since his thirteenth year. In 1874 he became associated with the Oakland (Cal.) Gas Light Company, steadily advancing to the position of president, and in 1903, when the company sold out to the California Gas & Electric Corporation, he was retained as chief executive of the new organization. It was in 1907 that Mr. Britton was made vice-president and general manager of the Pacific Gas & Electric Company, into which the California Gas & Electric Corporation had been merged. In this capacity he has had charge of all construction work and been responsible for the operating and financial policies of the company, and the success with which he has shouldered these herculean tasks has made him an outstanding figure among the leaders of the industry. Mr. Britton is a regent of the University of California, president of the Bohemian Club of California and a member of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.

**David B. Rushmore**, consulting engineer of the General Electric Company, has received the degree of D.S. from his alma mater, Swarthmore College.

**Gerard Swope**, president of the General Electric Company, was awarded the honorary degree of doctor of science by Rutgers College, at New Brunswick, N. J., on Tuesday, June 12.

**W. A. Carter** of the research department of the Detroit Edison Company spent the latter part of this week in New York City on business for his firm.

**Dr. Irving Langmuir**, assistant director of the research laboratory of the General Electric Company, has received the honorary degree of doctor of science from Union College, Schenectady, N. Y.

**Owen D. Young**, chairman of the board of directors of the General Electric Company, was given the degree of doctor of literature by St. Lawrence University, Canton, N. Y., of which he is an alumnus, on Tuesday, June 12.

**E. N. Willis**, secretary of the Southwestern Public Service Association, attended the National Electric Light Association convention held last week in New York and reported prosperous conditions for the utilities in his section, although the climatic conditions just now are not very favorable for the agricultural interests.

**C. E. Keller**, who has been with the General Electric Company since 1921, has joined the research department of the West Penn system at Pittsburgh.

**W. S. Vivian** has been chosen to direct the public relations work of the properties of the Middle West Utilities Company, with headquarters in Chicago. Mr. Vivian has long been engaged in this work with the telephone industry.

**E. A. Olsen**, superintendent of electric operation of the Alexandria (Va.) Light & Power Company, has been placed in charge of field construction in connection with the building of a 45,000-volt line between Albany, Tifton and Valdosta, Ga., part of which will be for the South Georgia Public Service Company and part for the Valdosta Lighting Company.

**N. Saitoh**, director of the Daido Electric Power Company, Ltd., one of the largest companies of its kind in the Japanese Empire, recently inspected the works of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, where a large part of the electrical apparatus used by the Daido company has been built. The visitor from the Orient was accompanied on his tour of the plant by H. F. Griffith, assistant to general manager of the Westinghouse Electric International Company, and Stephen Q. Hayes, general engineer of the Westinghouse company, who has been working with the Daido Electric Power Company in the extensions of its systems.

**W. B. Lewis**, formerly in the sales department of the San Francisco office of the Western Electric Company, is now in the Los Angeles office of that organization.

**Hoyt Catlin**, advertising manager of the Bryant Electric Company, Bridgeport, Conn., was elected president of the Bridgeport Advertising Club at its annual dinner on May 28.

**C. H. Dahl**, for the last three years statistician of the Winnipeg Electric Railway Company, has been advanced to be one of the assistants to the vice-president, A. W. McLimont.

**Richard J. Johnston**, formerly with the Navy Department at Washington, has been appointed illuminating engineer of the George Cutter Company, South Bend, Ind.

**A. M. Jackson**, Rocky Mountain district representative of the Locke Insulator Company, with headquarters in Salt Lake City, has been transferred to the Chicago office of the company.

**Guy Zinck**, formerly with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., is now in the industrial sales department of the Los Angeles office of that company.

**W. G. Keay**, for the past four years with the Ruud Manufacturing Company, with headquarters at Detroit, has been appointed New England manager of the Eureka Vacuum Cleaner Company, with headquarters at Boston.

**J. C. Jones** of the Los Angeles office of the Westinghouse Electric & Manufacturing Company has been made manager of the central-station division in that territory and will also have charge of the sale of supply apparatus.

**O. M. Bostwick**, for ten years in charge of the advertising division of the Sprague Electric Works of the General Electric Company, is now in charge of the New York office of the advertising department of the General Electric Company.

**W. W. Smith**, electrical and pyrometric engineer with the Chemical Warfare Service, Edgewood Arsenal, Edgewood, Md., has resigned to enter the fan-motor department of the General Electric Company, Pittsfield, Mass., as an electrical engineer.

**B. F. McIntyre** has been appointed branch manager of the Cleveland sales office of the Industrial Controller Company, Milwaukee. Mr. McIntyre was formerly connected with the Canadian branch of the Robbins & Myers Company.

**Carl Whitmore**, formerly division superintendent of plants at Portland, Ore., of the Pacific Telephone & Telegraph Company, is now division superintendent of installations of the Western Electric Company, with headquarters in San Francisco.

**W. P. Jend** has been appointed manager of the merchandising division of the Detroit office of the Westinghouse Electric & Manufacturing Company to succeed F. D. Koebel, who will take up general duties in connection with both the central-station division and the merchandising division.

**H. R. Sargent**, formerly manager of the wiring supplies division of the Bridgeport works of the General Electric Company, has been appointed managing engineer of that division under a development plan which will create several unit divisions at the Bridgeport factory.

**R. K. Evans**, sales engineer with the Remy Electric Company, Anderson, Ind., has been appointed service manager of the company to fill the vacancy created by the resignation of E. E. Eby. Mr. Eby severed his connection with the Remy company to join the sales staff of the Wyatt Roller Bearing Company, Newark, N. J.

**William J. Wooldridge**, manager of the electrical sheet department of the Wheeling Steel Corporation and of its predecessor, the Whitaker-Glessner Company, for almost four years, in charge of manufacture and sales of electrical sheets, recently resigned. Mr. Wooldridge has not announced his future plans.

**C. I. Weaver**, vice-president and general manager of the Springfield (Ohio) Light, Heat & Power Company, has become fiscal agent for the American Gas & Electric Company in the operation of properties recently acquired in Urbana, Mechanicsburg, Mutual, Catawba, Cable and Woodstock, Ohio, from the Northwestern Ohio Light Company, southern division.

**S. S. Sonneborn** has joined the organization of the Splitdorf Electrical Company, with headquarters at the company's factory at Newark, N. J. Mr. Sonneborn was for many years general manager of the Electrose Manufacturing Company and is an expert in the molded and insulation parts field. In his new position he will take charge and supervision of molded parts of shellac, rubber and synthetic compositions.

**Joseph G. Worker**, combustion and stoker engineer, has joined the organization of the American Engineering Company, Philadelphia, manufacturer of the Taylor mechanical stoker. Mr. Worker is secretary of the Stoker Manufacturers' Association of the United States and has spent many years in the study of coal burning by mechanical methods and processes.

**J. O. Case**, formerly local sales manager of the Los Angeles office of the General Electric Company, has recently been appointed assistant local manager of that office. Mr. Case has been associated with the company since 1905, when he went to Schenectady to take the student's apprentice course. He was local sales manager at Los Angeles for two years prior to his present appointment.

**Major R. W. Chandler**, formerly in charge of research work for the Yale & Towne Manufacturing Company, Stamford, Conn., has been placed in charge of industrial electric truck and tractor sales, with headquarters at the factory. J. C. Morgan, formerly sales manager of the industrial truck division, has been made manager of the hoist department, with headquarters at Stamford.

**Parker M. Robinson**, formerly turbine engineer on the Pacific Coast for the Westinghouse Electric & Manufacturing Company, has recently joined Hunt, Mirk & Company, consulting and contracting engineers of San Francisco, entering the firm as a junior partner. Mr. Robinson has been connected with the engineering department of the Westinghouse Electric & Manufacturing Company for more than four and a half years.

**H. G. Bonner**, manager of the Meridian (Miss.) Light & Railway Company, a Doherty property, will leave on July 1 to assume charge of the Ohio Public Service Company, Alliance, Ohio, also part of the Doherty organization. Mr. Bonner became identified with the Doherty interests in 1913, when he became new-business manager of the electric utility in Elyria, Ohio, owned by Henry L. Doherty & Company. W. R. Phipps, who was for a number of years general manager of the Brush Electric Company of Galveston, Tex., and a well-known man in the Doherty service, will succeed Mr. Bonner in Meridian.

**John R. Smith**, formerly estimating engineer with the Freeman-Sweet Company, electrical contractor of Chicago, has been made vice-president and general manager of the recently organized Electrical Industrial Sales Company, Chicago. Mr. Smith was at one time estimating engineer with the Beaver Electric Company at Chicago and was largely instrumental in forming the Electrical Estimator Association in that city, of which he served as secretary in 1918 and president in 1920. The new organization with which Mr. Smith has allied himself is to serve as manufacturers' agents.

# Obituary

**Robert B. Weaver**, owner of the Weaver Electric Company of Denver, Col., died recently of blood poisoning. Mr. Weaver, who was a native of Cuthbert, Ga., went West about twelve years ago. He was thirty-two years old.

**Capt. Alexander B. Guigon** of Richmond, Va., died recently at his home in that city at the age of sixty-five. Captain Guigon, who had been identified with the traction business in Virginia for more than thirty years, was prominent in the merger of the Richmond Traction Company with the Virginia Railway & Power Company and at the time of his death was general counsel for the company.

**Dr. Rudolph Hering**, engineer, died on Wednesday, May 30, at his home in New York. Dr. Hering was formerly a member of the firm of Herring & Fuller, consulting engineers to the New York Department of Water Supply, Gas and Electricity, and had directed the installation of various waterworks and sewerage system in the United States, Canada and South America. He was seventy-six years of age.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Sentiment for Simplification Spreading

### Electrical Manufacturers and Jobbers Indorse the Movement to Eliminate Excess Varieties and Reduce Stock in Supply Lines

THE electrical industry is becoming exceedingly interested in the problem of simplification. Since the Federated American Engineering Societies, at the instigation of Herbert Hoover, Secretary of Commerce, made its survey of industrial efficiency in America, published under the title "Waste in Industry," a great deal of progress has been made in many industries. But electrical men have lagged behind. There is a very wasteful degree of duplication in electrical supply lines, a vast number of obsolete and other excess varieties, because the building up of greater lines through the creation of new types and sizes has been traditional among electrical manufacturers.

Finally the jobbers took the initiative at the recent meeting of their association, at which they listened to an address by W. A. Durgin, chief of the Division of Simplified Practice of the Department of Commerce, himself an electrical man. An urgent appeal was made to the Associated Manufacturers of Electrical Supplies to invite Mr. Durgin to the meeting of that association to be held this month at New London so that something of the same background may be given to the manufacturers also. A committee was appointed to confer with the manufacturers and with Secretary Hoover in the effort to work out a progressive program of simplification which may offer an immediate measure of relief.

The following quotations from letters recently received indicate the unanimity of sentiment:

THE action of the Electrical Supply Jobbers' Association at its recent meeting in Hot Springs, Va., in making definite recommendations for the simplification of various electrical supply lines has led to much discussion. Sentiment in favor of simplification as a matter of principle is almost universal. Difference of opinion lies mainly in the matter of application to the individual line, and here each manufacturer is apt to feel a little hesitancy for fear business will be lost by the dropping of numbers that are selling even in small quantity, although there may be other things and more popular devices available that practically duplicate them.

The accompanying quotations are taken from a large number of letters commenting on the general situation and indicate how universal the belief is becoming that "something should be done" to simplify the electrical supply line.

*By a Wiring-Device Manufacturer.*—Every time we issue a new catalog we eliminate a number of items which have become obsolete or on which the sales are so small as to not justify their being cataloged any longer. By agreeing with competitors, which I believe is not legal, more could be done, but I am not so sure that it would be of much benefit except to ourselves and possibly the jobber. The public would not be so well served.

On surface switches we make an open base a closed base, plain and indicating. Now, as far as breaking the current is concerned, one of those would be all that would be necessary. There are different uses, however, for each of the four kinds and all four kinds sell in reasonable quantities. Obviously, though, it would be an advantage to us to manufacture just one of the four, and for the jobber to carry but one of the four. As you undoubtedly know, we could not exactly do that, because the public would demand the other three and buy them from some one else.

We believe the agitation good and are co-operating and mean to co-operate along the lines suggested.

*By a Tool Manufacturer.*—We have been alarmed at the steadily rising price of labor, material and the products of manufacture. When we remember the distressing effect that followed the rapid rise in all commodities after the war and the collapse in business which followed, from which we are only just recovering, the present condition makes us apprehensive, and it is no doubt causing anxiety and possibly fear in the minds of business men everywhere.

We have given and are giving a great deal of consideration to labor-saving devices and ways and means of reducing costs of production which would enable us to place our line in the hands of the jobber, dealer and user at the lowest possible cost to them.

With this end in view, we have been considering the advisability of reducing the variety or styles of tools made by us, standardizing on those that are most popular and valuable to the trade, and diverting all of the business to them, in this way getting the benefit of quantity production.

We believe that this would result to the advantage of the jobber, dealer, user and ourselves and would surely enable us to reduce the present price on the tools we continue making, whereas under present conditions an advance in price would be absolutely necessary.

*By a Conduit Manufacturer.*—We are eliminating superfluous or excess varieties of fittings and have been doing it for some time. This, of course, would not apply to many of our leading lines, such as rigid conduit armored conductors, non-metallic flexible conduit, rubber-covered wire, brackets, etc., but it does apply to outlet boxes and such fittings, and we heartily agree with the principle at issue that manufacturers should take the initiative in eliminating excess varieties to the fullest extent possible.

We have noted a recent article advocating the elimination of enameled conduit and stating that zinc-treated conduit should answer all purposes as being a better product. In a general way there may be a good deal of truth in this statement, but, as a matter of fact, there are many places where conduit is installed which require an enamel protection—places where the surrounding conditions would readily corrode a zinc-treated conduit.

We merely mention this condition to indicate that on a program of elimination of excess varieties those not thoroughly posted might think that elimination could take place in some lines where conditions would make it impracticble or inadvisable.

*By a Wiring-Device Manufacturer.*—We are and have been strongly opposed to the multiplicity of articles in our line which are not really essential; in fact, the new catalog on which we are working will eliminate a few articles, thus further simplifying our line, and those articles which will be added are for purposes which do not duplicate except in so far as the rulings in some cities—for instance, Chicago—may require.

The only way in which manufacturing costs can be cut down to the minimum is to simplify the line as much as possible, and this, of course, means the elimination of all articles which are really duplicates of others serving practically the same purpose.

Of course as matters stand, the only thing that we can do is to use our best efforts in connection with our own line and in selling our product to induce our customers as far as possible to use standard material, and we believe that if all manufacturers will work with this idea in mind the problem to which you refer will in a large measure be solved in the not far distant future.

*By a Heating Appliance Manufacturer.*—We believe in the importance of standardization and simplification of lines as far as possible. In January, 1920, we had 477 cataloged items in the line. On Jan. 1, 1923, we had 206. This was accomplished by eliminating the manufacture of the same appliances under more than one trade name and by eliminating the sizes of product for which there was little demand. Actual standardization was greater than the figures show, as during this period new items performing new functions or improved functions were added.

In all of our newer product the question of standardization of parts or interchangeability of parts, as, for example, range-heating units or radiant-heater units, has been carefully watched, so that simplification has been carried further than is indicated by the number of cataloged items. This is an aid not only to the manufacturer but also to the entire trade, as it reduces the stocks of repair parts to be ordered or carried by our customers.

*By a Wiring-Device Manufacturer.*—We are in entire sympathy with the simplification idea. In the next reprint of our wiring-device catalog we will eliminate a number of existing devices, all of which are slow movers and were probably added originally to meet apparent competition.

We feel that almost every line is allowed to expand without due consideration of the necessity for various devices. We know as a matter of fact that this is true of many of our controller devices. This matter is constantly receiving consideration even on this line of apparatus, and we are continually removing devices from our standard catalog lines and putting these in semi-standard form in the hands of our engineers to meet special needs.

We feel that anything which the trade papers can do to bring continual pressure on the manufacturers to eliminate unnecessary devices is in the end going to reduce manufacturing costs and simplify the general distribution problem. Pride undoubtedly causes many manufacturers to expand their lines unnecessarily thus putting in the hands of the trade extensive catalogs which, at least from the appearance standpoint, will "stack up" with the catalogs of their competitors. This is economically wrong, and we believe the movement is now progressing in the right direction.

*By a Jobber.*—Owing to the existence of too many manufacturers' styles, if purchasing is not done with the greatest care and judgment today a jobber will find at least 25 per cent of his stock very slow-moving and eventually a great part of the 25 per cent will become dead. In other words, a jobber carrying a stock of $100,000 will actively operate on 70 to 75 per cent of this merchandise. Two years ago we decided on a policy of limitation and elimination of slow movers, but it has been a very hard job to get rid of these slow movers.

I am very glad, indeed, that the manufacturers are coming to an understanding as to excess varieties of goods, for in helping themselves they can certainly help the jobber by reducing his and their investment.

I believe that switch boxes could be simplified. Our purchases at the present time are limited to four styles which take care of more than 90 per cent of our requirements.

As regards pole-line hardware I am of the opinion that 50 per cent of the styles commonly manufactured could be eliminated without working a hardship.

There is another line that few jobbers have been successful in marketing, and that is fixtures. In twenty-two years I have been in and out of it four times and at the end of each discontinuation have found that the leftovers equaled or exceeded the profit which we had made or thought we had made, and it is all caused by manufacturers changing the styles. I have often remarked that the style of lighting fixtures changed about as often as the styles of women's hats.

*By Another Jobber.*—Every jobber and manufacturer in the electrical industry should be glad to help remedy the very poor conditions existing in our business because of the many duplicates and obsolete items manufactured and listed

We feel that conduit-box and porcelain-insulator lines are particularly burdened with obsolete and excess varieties. But it is our firm belief that results of great worth could be accomplished if the manufacturers can be induced to co-operate.

We have felt the burden of listing obsolete and excess varieties in our 800-page catalog, and to help us overcome the difficulties encountered have listed in our salesmen's price books only the catalog numbers which we carry in stock so our salesmen are able to tell their customers whether we have what they want, and the chances are that if we do not list the number called for, they help the customer pick out something we have in stock which will answer his purpose as well This saves time for the customer and ourselves in each department as well as for the ultimate purchaser, who is waiting to have his job finished in a hurry.

*By Another Jobber.*—To my mind the simplification of lines is absolutely essential to the future prosperity of the electrical jobbing business. I am convinced that we probably shall never again enjoy the same margins of profit on merchandise that we have enjoyed in the past; therefore, if we are to do our part in the proposed scheme of reducing the costs of distribution, the reduction of variety and simplifying of lines is necessary to enable us to secure a proper turnover.

It appears impossible, at least for the present, for the electrical jobber to reduce his overhead. A recent analysis of our operating expenses developed the fact that our payroll for the year 1922 was 43⅜ of the total operating expenses. For the first three months of this year it has increased to 47¾ per cent and this does not include the salaries of the executives. Our case is not exceptional by any means, for I find in making a comparison with others that their payrolls exceed 50 per cent of the total expenses.

I think we jobbers at least are all agreed that we are suffering from too great variety in almost every article we handle. The question is who is to do the job. The jobbers of this country have received little support from the manufacturers.

*By Another Jobber.*—I had occasion as far back as 1910 to get into this subject actively in connection with lightning arresters for low-voltage distributing systems, and the reduction in numbers and types not only saved every one concerned a considerable amount of money but also made the sales exploitation of this line much more accurate and intensive.

I should say that line hardware, conduit fittings, lamps or fuses would all give plenty of field for study in the elimination of excess numbers.

We have simplified our business by eliminating duplicate lines, and we are making it a practice to put nothing in the catalogs of our salesmen except what we think they should sell. We should be greatly assisted in our efforts, of course, if manufacturers would discontinue illustrating things that people do not really need but may think they require.

*By Another Jobber.*—With the co-operation of the manufacturers and the simplifying of their lines, the jobbers would release from frozen stocks many thousands and thousands of dollars that should be reinvested in lively fast-moving commodities that would permit the jobber to carry a better stock, to represent the manufacturers better and to serve the consumers better. If the executives would get into this proposition personally themselves, instead of delegating it to one of their understudies, they would marvel at their ignorance and would be amazed at the duplications that would be discovered in the lines they are carrying and at the duplication and obsolesence that creep into their stocks of merchandise at all times.

## Eleven Organizations Aid in Standardization Work

AID of eleven business organizations in the furtherance of the Commerce Department plan for the formulation of purchase standards specifications was pledged on June 11 at a conference of representatives of these bodies with Secretary Hoover at Washington.

Addressing the representatives of the organizations, who are to compose an advisory committee, Mr. Hoover declared it was the idea of the department to make a beginning of the scheme of standardizing purchase specifications by adopting definitions covering all federal government purchases, which would include between 2,500 and 5,000 articles. The scheme, he said, would be broadened to include state and municipal government purchases and public institutions.

Mr. Hoover emphasized that commercial interests would not be required to accept the standards adopted for general use, but was of the opinion that commercial practices would follow the government lead.

The organizations represented at the conference were the American Engineering Standards Committee, the American Society for Testing Materials, the National Association of Purchasing Agents, the American Hotel Association, the United States Chamber of Commerce, the National Association of Manufacturers, the National Business Editors' Association, the Federal Specifications Bureau, the Association for Government Service, the American Electric Railway Association and the Society of Automotive Engineers.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

MORE price decreases in the wiring lines are noted in this week's reports. Despite a slightly stronger copper market last week, prices of flexible armored conductor have fallen 10 per cent. Brass and bronze products for electrical manufacture generally are firm and are subject to the normal demand.

Added use of rubber composition products in the wiring-device line in preference to porcelain specialties is causing some concern among the smaller makers as regards stocks. The latter say stocks of this effective product are noticeably lower, and higher manufacturing costs are feared. However, some leading authorities in the wiring-device field say these fears by the smaller makers have no real foundation and that when purchasers of their different lines have come to accept more composition products in place of porcelain they will manufacture this composition for their own needs and will keep out of the open market.

Business of the electrical industry throughout the United States is continuing at the steady gait of the last three weeks, with normal stocks and slightly lower prices.

## Aspects of Electrical Machinery Exportation

UNBUSINESSLIKE methods as a means of securing profitable orders abroad should be unnecessary, according to opinions advanced at an electrical machinery conference held recently in Boston in connection with the New England foreign trade convention. In an informal discussion of present conditions in exporting it was brought out that in the sale of American electrical machinery overseas deferred payments by the foreign buyer ought not to be inevitable. Such equipment represents a substantial capital investment as compared with ordinary merchandise like haberdashery.

South America is growing fast in inquiries for electrical instruments for the automotive industry. At present, in the machinery field, the competition of Great Britain is acute in textile lines, and through co-ordination of interests British manufacturers are taking machinery business in some cases at very low profits or at actual losses. It was pointed out at this conference that American manufacturers would do well to plant themselves through reliable representation in various countries and to force their competitors to take business at or below cost if necessary. Neither English nor German manufacturers can keep up this kind of competition indefinitely, it was pointed out. It is very desirable for American manufacturers to consider how they can work effectively together in connection with foreign trade, for the association of British manufacturers is pointing the way toward very efficient team play in the overseas trade problem solution.

## Chicago Electrical Business Shows Slowing-Up Tendency

BUSINESS in the Chicago electrical trade continues about the same as last week, with a tendency toward slowing up rather than increasing. No advances in prices were announced, while a reduction of $5 per 1,000 ft. in flexible armored conductor became effective June 7. Although electrical jobbers report that business in general is a trifle slow, they state that the number of anticipated contracts upon which they have been asked to figure this week is increasing. The building situation remains much the same, which accounts for the lack of active buying.

Demand for socket appliances is normal, with noticeable sales at this time of toasters and waffle irons. Hollow-ware and iron sales are also normal. Sales for this year to date are about the same as last year, with very little increase. The warm weather in this territory just after the first of June caused an active demand for fans, and distributors' stocks were depleted temporarily. However, the cold spell which immediately followed stopped the active sale of this material. Fan manufacturers look forward to a very prosperous season this year. One manufacturer, in conjunction with a large distributor in this city, is putting on a novelty advertising campaign. A fan three times the size of the largest one made for sale is to be mounted on a truck, which will carry advertising placards through the residential sections of the city.

## Eastern Sections Report Steady Volume of Trade

GENERAL electrical business holds up well in the Eastern territory, with improving deliveries and well-rounded stocks on jobbers' shelves. Railroad embargoes are no longer causing trouble. Prices of flexible armored conductor fell about 10 per cent last week, and bare and weatherproof wire were weak, although Monday prices were a bit firmer on copper. Appliance sales continue to run far ahead of last year's. Building contracts in New England totaled $37,877,000 for May, a gain of 11 per cent over April and 14 per cent over May of last year. For the week ended June 5 these contracts totaled $7,655,800, compared with $6,666,500 for the same week in 1922. A spurt in fan sales marked the early part of last week. Labor conditions are good in the main, barring an unsettled situation in the telephone operating field and some difficulties in the shoe industry. Money is easy and contractor-dealers are very busy. Central-station outputs are growing steadily. Manufacturers of automatic substations and generating plants are figuring on a number of important "propositions" in this section.

## Safety Switch Sales Compare Favorably with Six Months Ago

SALES of safety switches are said to compare very favorably with those of six months ago. Deliveries are larger than normal, and the outlook for the next six months, according to leaders in the field, is not very good. There have been some recent advances in prices, but manufacturers say they are unable to predict just what further changes may come in the near future.

## San Francisco Appliance Sales Are Reported Brisk

MAY, 1923, building permits in the four principal California cities totaled: Los Angeles, $18,926,881; San Francisco, $4,928,986; Oakland, $2,373,020, and San Diego, $770,515. May, 1922, totals were: Los Angeles, $9,327,504; San Francisco, $4,377,066; Oakland, $2,243,745, and San Diego, $677,580. Despite encouraging increases in permits, building in northern California is rather slow, with comparatively few big jobs for immediate construction.

Sales of large appliances are slower, but smaller appliances are moving faster, principally because of the stimulus of "June Bride Week." Irons and percolator sets are selling well.

Several large orders are reported, such as a fifty-thousand-dollar high-tension insulator order from a California company and orders for several large rubber-covered wire assortments. Prices have apparently reached a temporary equilibrium.

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | $0.034 | $0.0326 | $0.0256 |
| Cold finished shafting, per lb. | 0.042 | 0.042 | 0.0328 |
| Brass rods, per lb. | 0.1850 | 0.1913 | 0.1533 |
| Solder (half and half), per lb. | 0.2862 | 0.2987 | 0.22 |
| Cotton waste, per lb. | 0.1231 | 0.2812 | 0.104 |
| Washers, cast iron (½-in.), per 100 lb. | 4.66 | 4.66 | 4.00 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 3.08 | 2.96 | 3.11 |
| Machine oil, per gal | 0.349 | 0.349 | 0.383 |
| Belting, leather, medium, off list | 42½% | 42½% | 46¾% |
| Machine bolts, up to 1-in. x 30-in., off list | 44½% | 44½% | 62½% |

## Exports of Electrical Glassware, Generators, Arc Lamps, Flashlights, Etc., from the United States During 1922

(Original data supplied by the Bureau of Foreign and Domestic Commerce)

| | | Globes and Shades for Lighting, Dollars | Electrical Glassware, Except for Lighting, Dollars | Electrical Porcelains, Dollars | Carbons for Electrodes and Batteries, Dollars | Generators Direct-Current Under 500 Kw. | Generators Direct-Current 500 Kw. and Over | Alternating-Current Under 2,000 Kw., Dollars | Arc Lamps, Dollars | Incandescent Lamps Carbon-Filament | Incandescent Lamps Metal-Filament | Flashlights, Dollars | Radio & Wireless Apparatus, Dollars | Telegraph Apparatus, Dollars | Telephone Apparatus, Including Telephone Switchboards, Dollars | Copper Rods, Dollars | Wire of Brass or Bronze, Dollars | Poles, Telegraph, Trolley and Electric Light, Dollars | Cross-Arms, for Telegraph, Telephone and Trolley Poles, Dollars | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Dollars | Dollars | | | Dollars | Dollars | | | | | | | | | | |
| 1 | Azores | 17 | | 2,430 | 131 | 4,233 | | | | | 68 | | 110 | 124 | | | | | | Azores | 1 |
| 2 | Belgium | 678 | 2,146 | 13,377 | 23,472 | 691 | | | | | 1,334 | | 7,439 | 146 | 49,355 | | | | | Belgium | 2 |
| 3 | France | 1,398 | 91 | 42,001 | 12,156 | 48,876 | 13,983 | | 28 | 2,889 | 4,746 | 2,175 | 3,018 | 2,688 | 17,890 | | | | | France | 3 |
| 4 | Denmark | 210 | | | 63 | 491 | | | | 853 | 644 | | 2,421 | | 2.408 | 65,252 | 567 | | | Denmark | 4 |
| 5 | Greece | 186 | | 100 | | | | | | 61 | 15 | | | | | | | | | Greece | 5 |
| 6 | Iceland & Faroe Islands | | 15 | | | | | | | | | | | | 333 | | | | | Iceland & Faroe Islands | 6 |
| 7 | Netherlands | 2,045 | 544 | 10,659 | 5,880 | 698 | | | | 15 | 89 | 554 | 9,931 | 14,755 | 24,094 | | | | | Netherlands | 7 |
| 8 | Norway | 1,151 | 185 | 86,560 | 17,587 | 4,777 | 1,760 | 1,260 | 59 | 128 | 854 | 819 | 10,401 | | 5,219 | 448 | | | | Norway | 8 |
| 9 | Spain | 346 | 17 | 134,201 | 59,566 | 2,488 | 27,272 | 5,808 | | 818 | 3,346 | 3,854 | 655 | | 53,871 | | | | | Spain | 9 |
| 10 | Sweden | 624 | 320 | 25,276 | 21,196 | 759 | | | | | 285 | 2,659 | 1,746 | | 28,886 | | 900 | | | Sweden | 10 |
| 11 | Switzerland | 24 | | 9,511 | 902 | 2,863 | | | | | | | 1,839 | 1,200 | 34,799 | | 4,500 | | | Switzerland | 11 |
| 12 | England | 46,738 | 7,700 | 9,009 | 74,991 | 23,203 | 1,775 | 1,078 | 838 | 4,455 | 3,770 | 7,462 | 317,919 | 98,463 | 535,405 | 254,432 | 532 | | | England | 12 |
| 13 | Scotland | 281 | 67 | | 2,525 | | | | | | | 133 | 100 | | 3,048 | | | | | Scotland | 13 |
| 14 | Canada: Maritime Provinces | 2,804 | 3,551 | 5.203 | 486 | 11,868 | | 25 | | 44 | 631 | 480 | 11,260 | 9,241 | 21,481 | 240 | 58 | 1,600 | | Canada: Maritime Provinces | 14 |
| 15 | Quebec and Ontario | 175,248 | 81,678 | 314,768 | 1,239,770 | 83,710 | 125,470 | 11,932 | 862 | 19,794 | 71,209 | 13,023 | 632,476 | 59,961 | 430,873 | 256,416 | 15,831 | | 45 | Quebec and Ontario | 15 |
| 16 | Prairie Provinces | 11,761 | 13,065 | 15.243 | 5,117 | 5.707 | 11,560 | 2,906 | 244 | 95 | 233 | 735 | 14,221 | 11,968 | 96,628 | 76 | | | | Prairie Provinces | 16 |
| 17 | British Columbia and Yukon | 6,679 | 3,397 | 12,882 | 697 | 6,745 | | 715 | 115 | 169 | 5,236 | 1,136 | 32,063 | 5,774 | 14,562 | 320 | 329 | | | British Columbia and Yukon | 17 |
| 18 | British Honduras | 956 | 474 | 729 | 62 | 3,015 | | | | 445 | 2,201 | 780 | 42 | | 3,581 | | | | | British Honduras | 18 |
| 19 | Costa Rica | 2.040 | 172 | 2,526 | 1,757 | 2,373 | | | 23 | 440 | 3,586 | 438 | 410 | 1,683 | 5,332 | | | | | Costa Rica | 19 |
| 20 | Guatemala | 1,052 | 3,488 | 2,194 | 373 | 2,052 | 155 | 850 | 126 | 4,245 | 6,681 | 1,169 | 277 | 4,772 | 6,711 | 31 | | | | Guatemala | 20 |
| 21 | Honduras | 21,266 | 23,303 | 4,008 | 371 | 3,211 | | | | 2,583 | 8,626 | 4,291 | 8,323 | 46 | 14,402 | 17 | | | | Honduras | 21 |
| 22 | Nicaragua | 419 | 320 | 685 | 7 | 2,006 | | | 40 | 47 | 4,155 | 1,157 | 77 | 31 | 9,923 | | | | | Nicaragua | 22 |
| 23 | Panama | 2,512 | 372 | 5,235 | 999 | 1,266 | | | | 402 | 8,801 | 1,019 | 2,734 | 26 | 8,085 | 210 | 210 | | | Panama | 23 |
| 24 | Salvador | 318 | 331 | 464 | 582 | 1,801 | | 97 | | 30 | 7,421 | 330 | 128 | 240 | 1,043 | | 14 | | | Salvador | 24 |
| 25 | Mexico | 20,981 | 11,365 | 60,074 | 4,521 | 41,315 | 12,070 | 14,272 | 357 | 11,787 | 222,248 | 42,012 | 91,926 | 22.474 | 184,554 | 101 | 151 | 655 | 1,433 | Mexico | 25 |
| 26 | Newfoundland and Labrador | 1,271 | 3,149 | 2,699 | 69 | 1,698 | | 28 | | 126 | 13,644 | 822 | 786 | 14,266 | 10.287 | | | | | Newfoundland and Labrador | 26 |
| 27 | Bermuda | 1,267 | 261 | 338 | 60 | 3,518 | | | 3 | 629 | 1,169 | 827 | 265 | 394 | 3,406 | | | | | Bermuda | 27 |
| 28 | Jamaica | 582 | 181 | 2,110 | 150 | 527 | 675 | | | 597 | 6,003 | 3,524 | 55 | 609 | 5,101 | | | | | Jamaica | 28 |
| 29 | Trinidad and Tobago | 787 | 248 | 572 | 625 | 1,749 | | | | 200 | 10,600 | 2.147 | 121 | 27 | 14,222 | | | | | Trinidad and Tobago | 29 |
| 30 | Other Britiah West Indies | 298 | 217 | 1,879 | | 1,540 | 200 | 75 | | 28 | 6,663 | 1,443 | 7,310 | | 21,140 | 19 | | | | Other British West Indies | 30 |
| 31 | Cuba | 22,029 | 2,023 | 22,896 | 4,541 | 12,347 | 50,770 | 102,946 | 85 | 2,930 | 140,870 | 7,705 | 112,302 | 2,735 | 344,145 | 655 | 1,235 | 1,332 | 581 | Cuba | 31 |
| 32 | Dominican Republic | 479 | 148 | 1,148 | 53 | 4,603 | 102 | | | 99 | 13,751 | 2,197 | 491 | | 3,057 | | 32 | | 863 | Dominican Republic | 32 |
| 33 | Dutch West Indies | 463 | 18 | 84 | | 80 | | | | | 968 | 516 | | | 541 | | | | | Dutch West Indies | 33 |
| 34 | French West Indiea | 56 | | | | | | | | | 107 | 87 | | | | | | | | French West Indies | 34 |
| 35 | Haiti | 447 | 496 | 1,331 | 346 | 98 | | | 74 | 321 | 3,365 | 850 | 106 | | 338 | | 9 | | | Haiti | 35 |
| 36 | Argentina | 5,450 | 8,633 | 15,182 | 2,823 | 11,484 | 1,492 | 11,088 | | 966 | 160,456 | 84,518 | 650,509 | 5,441 | 127,887 | | | | | Argentina | 36 |
| 37 | Brazil | 17,873 | 9,935 | 39,199 | 17,487 | 21,800 | 20,662 | 3,561 | 85 | 9,413 | 36,826 | 4,994 | 82,524 | 21,768 | 325,346 | 20 | 1,363 | | | Brazil | 37 |
| 38 | Colombia | 2,229 | 1,002 | 6,823 | 1,099 | 28,468 | 2,060 | 13,315 | | 1,905 | 42,624 | 6,378 | 26 | | 76,805 | | | | | Colombia | 38 |
| 39 | Ecuador | 702 | 130 | 1,532 | 542 | 780 | 19,475 | 4,973 | 135 | 423 | 3,646 | 618 | 221 | 1,223 | 7,774 | | | | | Ecuador | 39 |
| 40 | Bolivia | 192 | 28 | 177 | 7 | 1,690 | 2,140 | | | | 719 | 17 | | | 765 | | | | | Bolivia | 40 |
| 41 | Chile | 2,207 | 247 | 65,286 | 8,948 | 11,822 | 245,883 | 570 | | 7,668 | 37,411 | 1,655 | 7,095 | | 15,052 | | | | | Chile | 41 |
| 42 | Peru | 651 | 605 | 18,504 | 1,900 | 9,143 | 10,690 | 5,225 | | 544 | 14,920 | 1,457 | 53 | 1,196 | 78,404 | | 1,699 | | | Peru | 42 |
| 43 | Venezuela | 1,937 | 5,110 | 4,180 | 2,260 | 23,789 | 2,195 | 681 | 5 | 631 | 23,644 | 3,153 | 8,340 | | 39,147 | 499 | | | | Venezuela | 43 |
| 44 | Hongkong | 2,806 | | 388 | 3,783 | 2,009 | | | | 10 | 1,420 | 2,790 | 2,039 | | 408 | | | | | Hongkong | 44 |
| 45 | Japan | 7,983 | 1,256 | 94,693 | 95,434 | 52,035 | 420,871 | 61,305 | 1,020 | 85 | 3,470 | 1,842 | 41,638 | 23,185 | 388,582 | | | 4,091 | | Japan | 45 |
| 46 | British India | 14,386 | 602 | 13,098 | 322 | 12,504 | 7,400 | | | 878 | 18,200 | 11,563 | 89 | | 263,234 | | | | | British India | 46 |
| 47 | China | 15,343 | 1,200 | 3,104 | 3,074 | 48,970 | 90,073 | 16,268 | | 45 | 20,124 | 2,856 | 6,898 | | 214,799 | | | | | China | 47 |
| 48 | Philippine Islands | 4,334 | 1,489 | 12,713 | 6,933 | 27,960 | 1,059 | 1,841 | 21 | 496 | 20,469 | 13,670 | 34,166 | 641 | 97,652 | | | | | Philippine Islands | 48 |
| 49 | Siam | 592 | 332 | 9,135 | | | 260 | | | | 1,041 | | 132 | 995 | | | 92 | | | Siam | 49 |
| 50 | British West Africa | 598 | | 229 | | 775 | | | | | 144 | 39 | | | 79 | | | | | British West Africa | 50 |
| 51 | British South Africa | 5,172 | 841 | 675 | 4,911 | 1,239 | | 529 | | 42 | 68,548 | 3,303 | 1,263 | 25,808 | 2,913 | | | | | British South Africa | 51 |
| 52 | Australia | 30,777 | 5,642 | 117,545 | 34,851 | 20,654 | 10,710 | 3,646 | 5,503 | 2,404 | 97,833 | 5,917 | 25,293 | 1,682 | 353,932 | | | | | Australia | 52 |
| 53 | Dutch Guiana | | | | | | | | | | 207 | 233 | | | | | | | | Dutch Guiana | 53 |
| 54 | Turkey in Eurnpe | 60 | | 140 | | | | | | | 240 | | | | 44 | | | | | Turkey in Europe | 54 |
| 55 | New Zealand | 10,675 | 1,178 | 26,846 | 799 | 4,075 | 2,985 | 823 | | 14 | 28,308 | 5,728 | 28,901 | 8,595 | 133,272 | | | | | New Zealand | 55 |
| 56 | Italy | 2,724 | | 12[illegible]14 | 194,668 | 884 | | | | 12 | 389 | | 425 | | 84,518 | | | | | Italy | 56 |

### March and April Heater Cord Sales Exceeded Those for May

PRESENT sales of heater cords are said to be approximately the same as six months ago, although the volume of business handled by manufacturers during March and April was somewhat larger than that for the month of May and the first week of June.

Deliveries are slightly subnormal at the present time, there being a large demand for heater cord, which is likely to continue for at least six or eight months owing to the great number of homes which have been built during the current year and the necessity of having cords for the appliances which will be used in them.

Prices generally have not changed, although the market prices of raw materials have declined within the past five or six weeks. This decline however, has been more than offset by the increase in production costs due to larger wages and the lessened efficiency which invariably exists when labor is at a premium.

### Germany Is No Longer a Serious Competitor

GERMANY is no longer a serious competitor in the machinery field, declared R. A. Lundquist, chief of the electrical equipment division of the United States Bureau of Foreign and Domestic Commerce. Present acute competition is British. American machinery exports last year totaled about $186,000,000 against $50,000,000 before the war. Australia, South America and Asia are expanding their consumption of foreign-made products, and under present conditions the better policy is to "put the soft pedal" on European trade and to concentrate upon these other continents.

The United States should, with proper cultivation, obtain say half the pre-war foreign trade of Germany in machinery lines. Before the war Germany handled about 45 per cent of international trade. Great Britain 25 per cent and the United States 20 per cent. British labor costs are much higher than before; the European situation is complicated by political uncertainties, and disorganizing conditions are being faced by many foreign manufacturers. As the years pass the United States must expect to meet more competition from continental Europe as it recovers equilibrium. In ten years the exportation of high-grade and carefully finished machinery from France is likely to develop. By the terms of the Versailles treaty France received two million more tons of steel than was formerly delivered, and the manufacture of high-grade engineering products is in line with French abilities.

During the conference the point was brought out that a thorough understanding of the terms and principles underlying patent laws in foreign countries is essential to American manufacturers. In South America the laws give priority of application rather than priority of use the preference. A movement has begun, although it is thus far rather weak, to secure uniform patent laws in various parts of the world.

### The Metal Market

THE sentiment in the non-ferrous metal market is somewhat better than a week ago, although business has not been active and prices show little change. The news from Europe seems a bit more encouraging and conditions in that market have been the governing factor recently

The last few days have witnessed some improvement in the demand for copper for the export trade. The surprising thing, according to producers, is that sales are being made at a fraction above the domestic price, which is now quoted at 15 cents a pound. The Copper Export Association is handling most of the business, and while the official price could not be learned, it is understood to range between 15.25 cents and 15.30 cents, c.i.f. European ports. The greater part of the demand at the present time, it was said late last week, is coming from France, but Germany continues a buyer in fair amounts, while other foreign countries are now taking more than they have done in recent weeks.

NEW YORK METAL MARKET PRICES

| | June 7, 1923 Cents per Pound | June 14, 1923 Cents per Pound |
|---|---|---|
| Copper, Electrolytic | 15.00 | 15.00 |
| Lead, Am.S.& R.price | 7.25 | 7.25 |
| Antimony | 8.00 | 7.75 |
| Nickel, ingot | 27.00 to 30.00 | 27.00 to 32.00 |
| Zinc, spot | 6.35 | 6.37 |
| Tin, Straits | 42.20 | 41.90 |
| Aluminum, 98 to 99 per cent | 26.00 | 26.00 |

# Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

### Electrical Industrial Sales Firm Organized in Chicago

The Electrical Industrial Sales Company, Inc., is one of the latest organized Chicago companies to serve as manufacturers' agents. This company was incorporated for $10,000 on June 1, and an office of 960 sq.ft. floor space has been taken in the America Fore Building, 844 Rush Street, Chicago. John R. Smith, vice-president and general manager, said: "Our first connection with a manufacturer is with the Kuhlman Electric Company, of Bay City, Mich., and we will handle its complete line of transformers, including its new series disconnecting street-lighting type. In the meantime we will be on the lookout for other manufacturing connections, but intend to take our time in choosing a specialized line supplementing the street-lighting business."

### Westinghouse Electric Creates New Engineering Department

The creation of a new engineering department in the organization of the Westinghouse Electric & Manufacturing Company has been announced by R. S. Feicht, director of engineering. The new department will be known as the porcelain insulator and transmission engineering department, and C. L. Fortescue, well known in electrical engineering, has been appointed manager.

This new department, according to the announcement, will handle the design of line insulators and other work which may be assigned to it from time to time in connection with transmission problems. "The rapid growth in the porcelain business and the steady increase in the number of problems growing out of the transmission of high voltages for great distances has necessitated the creation of a department to handle these problems," declared Mr. Feicht, who made it plain that, in connection with transmission problems, the new department will make studies and analyses of these problems, but will not be concerned with the design of large transmission systems.

### Anaconda Copper May Acquire National Conduit & Cable

The Anaconda Copper Company is expected to acquire the properties of the National Conduit & Cable Company within the near future. The latter company is now in the hands of the court, and a committee of stockholders and bondholders was organized some time ago for the purpose of endeavoring to rehabilitate or refinance the property. Thus far these efforts have not met with success. The committee recently received an offer of $700 for each $1,000 bond of an issue of $4,168,500 of the 6 per cent bonds outstanding, and it was learned last week that the Anaconda organization had made the bid.

Acquisition of the bonds by Anaconda, it was pointed out, would place it in a favorable position to bid in the property at a sale, while the placing of the entire issue in its hands might be expected to hasten the foreclosure of the mortgage securing the bonds. At $700 per bond the cost to Anaconda would aggregate about $2,900,000, but expenses of foreclosure and liquidation are expected to bring the total to approximately $3,000,000.

The National Conduit & Cable Company has a large copper wire and rod plant at Hastings-on-Hudson, as well as a department which specializes in the

manufacture of brass products. The rod and wire mill will help to round out the plans which the officials of the Anaconda company have had in mind for some years and which began to materialize with the acquisition of the American Brass Company in the early months of 1922 and the Chile Copper Company early this year. The properties which Anaconda contemplates taking over are expected to be reorganized.

The stockholders' protective committee recently increased its efforts to save the organization for the benefit of the interest which it represents. Shortly after the offer of $700 per bond had been made the stockholders requested the bondholders to join with them in efforts to save the properties so that the bondholders might get a hundred cents on the dollar for their interest and the stockholders conserve their property. Since then the greater part of the bonds have been deposited with the National City Bank, which is depositary for the bondholders' committee. Unless the stockholders can muster sufficient funds to outbid the Anaconda at a public sale, the latter is expected to take over the properties.

### Wakefield Brass Expansion

The F. W. Wakefield Brass Company of Vermillion, Ohio, is erecting an addition to its plant which will increase manufacturing space about 20 per cent. This addition is made necessary to take care of increased production of its "Red Spot" hangers and other lighting specialties, the demand for which has grown steadily for twenty months.

### Billings of Allis-Chalmers Reach $2,000,000 a Month

Billings of the Allis-Chalmers Manufacturing Company, Milwaukee, are now running at the rate of $2,000,000 monthly or $24,000,000 annually. While total billings for the first quarter amounted to $5,221,000, April and May billings were approximately $2,000,000 monthly, or a total of $4,000,000, and at the present rate of operations the second quarter's total should approximate $6,000,000. Total billings last year were $20,794,000.

The labor shortage is restricting the higher percentage of operations. Were labor to become more plentiful, Allis-Chalmers would undoubtedly speed up operations as the outlook for continued good business by this company is promising. As it stands, unfilled orders are now around $12,000,000 and provide enough business to keep the plants running until December at the present rate of operations.

Present rate of billings of $2,000,000 monthly is taxing the company's plants less than 75 per cent of capacity. It is estimated that present plant facilities have a potential capacity of handling $36,000,000 worth of business annually. In 1918, the company's banner year, plants of the company billed $35,000,000 worth of goods.

### Hurley Machine Report Is Most Favorable

Edward N. Hurley, chairman of the board of the Hurley Machine Company, Chicago, in submitting his annual report to the stockholders of the company, stated that there is no intention of increasing the price of its product.

The balance sheet and income statement for the year 1922 presents a very favorable report on the operations of the company during that period. The year closed with cash in banks and United States certificates of indebtedness totaling $1,529,786, and the inventories of $1,061,673 at the close of business Dec. 31, 1922, show an increase of but $80,364 over the inventory value of Dec. 31, 1921, although the volume of business in 1922 far exceeded that of 1921.

The current liabilities as at Dec. 31, 1922, consist only of those obligations incurred during December, there being no outstanding bank or other loans. The ratio of current assets to current and accrued liabilities was 4.43 to 1.

The net sales of electric washing and ironing machines for the year 1922 show an increase of 27 per cent over the sales for the previous year. The net income for the year 1922 after all charges, including federal taxes, amounted to $635,942, or an increase over the profit of 1921 of 48 per cent. The net income of 1922 after taxes represents 13 per cent on the net sales, compared with 11½ per cent earned on the net sales in 1921.

No increases in the prices of product were made in 1922. Likewise no increases have been placed in effect this year, nor are any planned.

The prospects for the company during the year 1923 are very promising. Orders for product received during the first four months of the year exceed $3,000,000 in value. For the period Jan. 1 to April 30, 1923, billing to customers amounted to $2,316,002, an increase of $831,030 or 56 per cent, over the shipments billed during the same period in 1922. Owing to this increased volume the net profit for the first four months of this year after providing for federal taxes represents an increase of 108 per cent over the net profit for the same period in 1922.

### Pennsylvania Crusher Company Moves Pittsburgh Office

In order to provide more adequate facilities for its volume of business in the Pittsburgh district, the Pennsylvania Crusher Company has recently moved its offices from the People's Bank Building to more adequate quarters in the Oliver Building, where operations will be continued under the management of H. M. Hallett as district manager.

The business of the Pittsburgh office is largely concerned with "Pennsylvania" coal-preparation machinery for mines, by-product coke plants, central stations and industrial power plants, and with heavy-duty primary and secondary crushers for large cement and lime plants.

### Sturtevant Acquires Large Plant in Wisconsin to Aid Business

The B. F. Sturtevant Company, Hyde Park, Boston, manufacturer of motors and ventilating equipment, announces that it has acquired the plant of the Wisconsin Engine Company, Corliss, Wis. This new acquisition covers nearly ten acres and the buildings have approximately 150,000 sq.ft. of floor space.

A full manufacturing and engineering staff will be maintained and closer co-operation given to Western customers. The situation at Corliss will make a substantial reduction in transportation costs.

Shipping facilities are ample as Corliss is on the main line of the Chicago, Milwaukee & St. Paul Railway and is the junction through which trains pass almost every hour between Chicago and Milwaukee. It is also the only express stop on this 85-mile run. Racine also, with her lake ports, is only 6 miles east. Connection may be easily made with all the principal lines east and west, thereby making Corliss ideal from a shipping standpoint.

The new plant will be under the same direction as the other factories at Hyde Park, Galt, San Francisco and Philadelphia with E. N. Foss as president. Harry W. Page has been selected as general manager and will be in entire charge of the Wisconsin plant.

The C. M. Hall Lamp Company, 1035 East Hancock Avenue, Detroit, manufacturer of electric lamps, has plans for a two-story addition, 80 ft. x 172 ft., estimated to cost $80,000.

The Semegra Manufacturing Company, Inc., Utica, N. Y., recently incorporated under the laws of New York State for $6,000, announces that it will engage in the manufacture of electrical fixtures. Directors of the company are Gay H. Brown, M. C. Halsey and M. G. Hubbard, Jr., all of Utica.

The Keps Electrical Supply Company, 961 Liberty Avenue, Pittsburgh, has leased two floors in the building at 967 Liberty Avenue for proposed expansion in operations.

The Pickett Storage Battery Company, Greensboro, N. C., plans for the rebuilding of the portion of its works recently destroyed by fire with loss estimated at about $40,000. including machinery and equipment.

The Ray Battery Company, Ypsilanti, Mich., has been purchased by Arthur Jordan, Indianapolis, owner of the Detroit Battery Company, and the Disco Electric Manufacturing Company, Detroit. The Detroit Battery Company will become affiliated with the Ray Company, and the merged concerns will be known as the Arthur Jordan Battery Company, Ypsilanti, under the management of T. H. Lavier.

## Foreign Trade Notes

PROPOSED WATER-POWER DEVELOPMENTS IN ITALY.—A concession to develop 8,577 hp. from two waterfalls and to erect two power houses on the River Serio, in the Province of Bergamo, has been granted to the Società Italiana Ernesto de Angeli, Milan. The Società Anonima Industrie Reunite di Filati of Bergamo has been granted a concession to develop 2,502 hp. from the same river. Other concessions for water-power developments have been granted as follows: To the Società Marchigiana di Elettricità of Recanati, to develop 3,784 hp.; the Società Unione Esercizi Elettrici, Province of Pesaro, 1,712 hp.; the Società Anonima Idroelettrica Rivallese, Province of Potenza, 5,000 hp., and the Consorzio Intercomunale Destra Piave, Nervesa, Province of Treviso, 2,652 hp., from two waterfalls on the Piave River.

PROPOSED ELECTRICAL PROJECTS IN FRANCE.—Application has been made by the Syndicat Intercommunal de Saint André de Corcy for a concession to distribute electricity in seventeen communes of the department of the Ain. Petitjean Frères, Montagney (Doubs), manufacturers, have petitioned for a concession to furnish electricity to twenty-four communes, four of which are located in the department of Haute Saône. Plans are now being prepared to supply electricity in fifty-seven communes in the department of the Allur. Energy will be supplied to thirty of these communes by the Scieries et Usines Hydro-électriques de la Sioule; the remainder will be served by the Société d'Electricité Générale de Saint-Etienne.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Stockholm, Sweden (No. 6,739), for electrical appliances. An agency is also desired in Stockholm (No. 6,741) for electric and gas lighting appliances.

Purchase is desired in Habana, Cuba (No. 6,794), for equipment for lighting plant.

An exclusive agency is desired in Johannesburg, South Africa (No. 6.784), for radiophone sets and equipment.

Purchase is desired in Brussels, Belgium (No. 6,713), of leaded iron strips for insulation tubes and for red rolled-copper wire.

Purchase is desired in Aguascalientes, Mexico (No. 6,754), of bare copper wire.

Purchase is desired in London, England (No. 6,723), of vacuum cleaners, etc.

ELECTRIC EQUIPMENT FOR POWER STATION, WORCESTER, SOUTH AFRICA.—Tenders will be received until Aug. 2 by the City Council of Worcester, South Africa, for an additional electric generating plant for the municipal power station.

ELECTRIC PLANT FOR RIVERSDALE, SOUTH AFRICA.—Tenders will be received by the Municipal Council of Riversdale, Cape Province, South Africa, until July 31 for an electric generating plant, distribution material, meters, etc.

## New Apparatus and Publications

ALLOYS.—"Alloys for Electrical Resistance" is the title of data book R-23 issued by the Driver-Harris Company, Harrison, N. J., in which it describes its alloy products and their use. It contains charts showing temperature-resistance curves and also charts showing change in resistance with temperature.

LAMP GUARDS.—The Flexible Steel Lacing Company, 4607 Lexington Street, Chicago, has added two new numbers to its "Universal" line of lamp guards, "Flexco" No. 220 and "Flexco-Lok" No. 420R.

AUTOMOTIVE INSTRUMENT.—The Celtokay Manufacturing Corporation, 175 Fifth Avenue, New York City, has developed an automotive instrument "Cell-O-Meter," which gives the exact electrical condition of the storage battery under any conditions.

INSTRUMENT STERILIZER.—The Walter Electric & Manufacturing Company, Mansfield, Ohio, has brought out the "Perfect" electric instrument sterilizer.

VACUUM CLEANER.—The Clements Manufacturing Company, 616 Fulton Street, Chicago, has placed on the market an electric "Cadillac" vacuum cleaner.

METER-TESTING SWITCH.—The Aurora Steel Products Company, Aurora, Ill., has added a meter-testing switch to its line of switches.

PORTABLE HANDLAMPS.—The Oliver Electric & Manufacturing Company, St. Louis, has brought out a line of portable handlamps with and without reflectors.

AIR COMPRESSOR.—A two-stage compressor mounted on and piped to a 32-gal. tank for stationary installation has been brought out by the Brunner Manufacturing Company, Utica, N. Y.

FIRE-ALARM SIREN.—The Erick Siren Company, Inc., 95 South Wabasha Street, St. Paul, has placed on the market an electric fire-alarm siren.

MOTOR-DRIVEN PUMP.—The Arrow Pump Company, Buhl Building, Detroit, has placed on the market a motor-driven centrifugal pump, in which it has incorporated its ring-oiled packing-gland feature.

WIRES AND CABLES.—The United States Rubber Company, 1790 Broadway, New York City, is distributing a new catalog covering its "U.S." paracore wires and cables.

CONDUIT FITTING.—The Killark Electric Manufacturing Company, Easton and Warne Avenue, St. Louis, has developed a new conduit fitting, type "Y," which is used in making a right-angle bend in rigid conduit.

LIGHTING FIXTURES.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing a folder covering its various types of "Vaporproof" condulets complete with reflectors. Bulletin No. 2,001 issued by the company describes its flexible fixture hangers.

AUDIOMETER.—Adam Hilger, Ltd., 75a Camden Road, London, N. W. 1, is distributing a pamphlet describing the Low-Hilger "audiometer," formerly known as the Hilger "optical sonometer," designed to record the pressure variation caused by sound waves.

AMPERE HOUR METER.—Bulletin No. 62 issued by the Sangamo Electric Company, Springfield, Ill., covers its "Locomotive" type ampere hour meter. This meter is built especially for use on electric trucks, electric pleasure vehicles, storage-battery tractors and mine locomotives.

IGNITION COIL.—The American Bosch Magneto Corporation, Springfield, Mass., has brought out a new ignition coil, known as the Bosch "Armored", in types TC-30 and TC-40, which is described in the May issue of the *Bosch News*. The company has also developed a new type 600 Bosch ignition system for Ford cars.

CAPSTAN CAR PULLER.—The Gifford-Wood Company, Hudson, N. Y., is distributing bulletin No. 74, describing the new "G-W" electric capstan car puller.

INCLOSED KITCHENETTE.—An electrically wired kitchenette inclosed in a console-type cabinet has been brought out by the Space-Saving Furniture Company, 11 West Thirty-second Street, New York.

RECEPTACLES.—A new line of standard receptacles and plugs for convenience outlets known as "T-Slot," has been brought out by Pass & Seymour, Inc., Solvay, N. Y.

ELECTRICAL REFRIGERATING SET.—The National Refrigolier Company, Greenville, Ohio, has placed on the market an electrical refrigerating set for domestic use.

FLASHLIGHT.—A two-in-one flashlight, "Double-Duty," has been developed by the Yale Electric Corporation, Brooklyn, N. Y., which at one end gives a diffused light over a wide radius and at the other end a spotlight with focusing reflector and lens.

## New Incorporations

THE OKLAHOMA HYDRO-ELECTRIC COMPANY, Oklahoma City, Okla., has been incorporated with a capital stock of $10,000 by Abram Stanfield, Tracy Wilkerson, both of Tulsa, and M. A. Schull, Oklahoma City.

THE CENTRAL QUEBEC POWER COMPANY, Quebec, Que., has been incorporated with a capital stock of $1,000,000 by Jacques Perron, Auguste Mathieu and James McCullum, all of Montreal.

THE LEAGUE CITY (TEX.) LIGHT & POWER COMPANY has been organized with a capital stock of $2,400 by W. M. Truxaw, E. T. Arnett and C. Trifton, to supply electricity in League City.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

NASHUA, N. H.—Conveying machinery and power equipment, traveling crane, etc., will be installed in the new creosote wood-treating plant to be erected at Nashua by the Boston & Maine Railroad Company, to cost about $150,000.

SHELDON SPRINGS, VT.—The Mississippi Pulp & Paper Company contemplates building a manufacturing unit and power plant, etc., to cost about $500,000.

BOSTON, MASS.—Electric power equipment will be installed in the automobile service building to be erected by the Department of Public Works, to cost about $150,000. Mulhall & Homers, 248 Boylston Street, are architects.

BOSTON, MASS.—The Edison Electric Illuminating Company is preparing plans for the construction of a substation on West Canton Street. Bigelow & Wadsworth, 3 Hamilton Place, are architects.

LOWELL, MASS.—The Lowell Electric Light Company plans an addition to its power plant, to cost about $80,000. A new steel coal and ash-handling conveyor system will be installed. Stone & Webster, Inc., 147 Milk Street, Boston, is engineer.

## Middle Atlantic States

LOCKPORT, N. Y.—The Niagara, Lockport & Ontario Power Company has issued $3,000,000 in notes, part of the proceeds to be used for extension to plant to develop a maximum of 225,000 hp., and for line extensions.

MINEVILLE, N. Y.—Witherbee, Sherman & Company, 2 Rector Street, New York, contemplates rebuilding their power plant at their iron-ore properties, recently destroyed by fire with loss of about $75,000.

NEW YORK, N. Y.—Electric power equipment will be installed in the municipal repair works and reclamation building to be erected on Barren Island by the Department of Plants and Structures, for which an appropriation of $4,500,000 has been granted.

NEW YORK, N. Y.—Electric power equipment will be installed in the printing plant to be erected at 13 Frankfort Street by the Press Publishing Company, 63 Park Row, to cost about $150,000. Cross & Cross, 385 Madison Avenue, are architects.

SCOTIA, N. Y.—The Scotia Electric & Manufacturing Company, recently organized, plans to erect an electric transmission line and distributing system. J. H. Gould, Schenectady, is representative of the company.

ALLENTOWN, PA.—Plans for the proposed new relay plant to be erected by the Bell Telephone Company between Allentown and Emaus, to cost about $250,000, include an electric power plant.

ERIE, PA.—Plans are being considered by the City Council for the installation of a conduit system in East Tenth, Upper Peach, West Thirty-first, South Cherry, Parade, Liberty and East Twenty-first Streets, to cost about $70,000. F. G. Lynch is city engineer.

GLENSIDE, PA.—The Abington Township School Board has had plans prepared for a power house at the local high school. Heacock & Hokanson, 1218 Chestnut Street, Philadelphia, are architects.

HARRISBURG, PA.—The South Creek Township Electric Company, the Columbia Township Electric Company and the Springfield Township Electric Company are being organized by H. R. Palmer and F. H. Hill, Harrisburg, to construct and operate a transmission system, with distributing lines, in the townships named. Spencer G. Nauman and J. E. B. Cunningham, Harrisburg, represent the companies.

MAHANOY CITY, PA.—The Lehigh Valley Coal Company, Wilkes-Barre, Pa., is planning to install motors, controllers and other equipment at its No. 1 Park works, near Mahanoy City.

NANTY GLO, PA.—The Nanty Glo Business Men's Association and the New York Silk Manufacturing Syndicate are consider-

ing the erection of a mill and a power house, to cost about $150,000.

PHILADELPHIA, PA. — The Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, contemplates the erection of a steam power house and pumping plant at Passyunk Avenue and the Schuylkill River.

PHILADELPHIA, PA.—A power plant will be built at the proposed bakery to be erected at 4811 Germantown Avenue by J. S. Ivins' Sons, Inc., 619 North Broad Street, to cost about $600,000. W. E. S. Dyer, Land Title Building, is engineer.

PHILADELPHIA, PA. — Plans for the proposed hat-manufacturing plant of Frank Schoble & Company, Tenth and Oxford Streets, include a power plant. William Steele & Sons Company, Arch and Sixteenth Streets, is engineer and contractor.

PITTSBURGH, PA. — Receivers for the Pittsburgh Railways Company, 435 Sixth Avenue, plan to purchase twenty electric railway motors, an electric grade shovel and other equipment.

PITTSBURGH, PA. — The Blanchard-Moshannon Mining Company, Fulton Building, recently organized with a capital of $800,000, plans to install electric power equipment and mining machinery at its properties in Clinton County.

PITTSBURGH, PA.—Bids will be received by John P. Moore, county controller, Court House, Fifth Avenue, until June 27 for electric power and lighting equipment for installation in the Liberty tunnels, now in course of erection. A. D. Neeld, Bakewell Building, is county engineer.

ANNAPOLIS, MD.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 19, for one motor-generator set for use at the local naval station. (Schedule 933.)

BALTIMORE, MD. — The Baltimore & Ohio Railroad Company contemplates the construction of a substation on its proposed general merchandise pier on the Patapsco River, to cost about $2,000,000.

PERRYVILLE, MD.—Bids will be received by the United States Veterans' Bureau, Arlington Building, Washington, D. C., until June 25 for construction of an occupational therapy building at United States Veterans' Hospital No. 42, including electrical and heating installations. Frank T. Hines is director.

WILLIAMSPORT, MD.—The Potomac Edison Company, recently organized to take over the Williamsport Power Company and to acquire and merge the Edison Electric Illuminating Company and the Cumberland Electric Railway Company, both of Cumberland, has issued $3,900,000 in bonds, the proceeds to be used in part for a steam-operated generating plant at Williamsport, with capacity of 20,000 hp., designed for an ultimate output of 240,000 hp. Extensions will be made in transmission lines.

BLUEFIELD, W. VA.—The Appalachian Power Company contemplates extensions to its electric power plants and transmission system for power service in the West Virginia coal fields.

CLIFTON, W. VA.—The Richland Coal Company contemplates the installation of electric power equipment and other machinery at its properties.

NORFOLK, VA. — The Miles Lumber Company, recently organized, is planning to build a new mill and power house, to cost about $100,000. G. Benson Ferebee is president.

ROANOKE, VA. — The Roanoke Street Railway & Electric Company plans extensions and improvements in its electric plant and system to cost about $100,000.

STAUNTON, VA.—Electrically operated pumping machinery will be installed in connection with the new water supply system for the municipal waterworks, to cost about $1,000,000. Fuller & McClintock, 170 Broadway, New York City, are consulting engineers.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until June 26 for miscellaneous fuses and fuse elements, for various navy yards. (Schedule 924.)

## North Central States

GRAND RAPIDS, MICH.—Permits have been granted for buildings for the Père Marquette Railroad Company, to cost about $630,000, including a power house, to cost about $114,000, and a locomotive and boiler shop, to cost $462,000.

ISHPEMING, MICH. — The Hercules Power Company is planning to build a power plant to cost about $125,000.

LORAIN, OHIO.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system on Broadway and Erie Avenue.

PADUCAH, KY.—The Paducah Electric Company has authorized Stone & Webster, Inc., Boston, engineer, to prepare plans for a power-plant addition, to cost about $350,000. The equipment will include a 2,500-kw. generator, coal and ash-handling and conveying machinery, etc. Another plant unit of approximately the same size will be built later.

PIKEVILLE, KY.—The property and franchises of the Sandy Valley Light & Power Company have been acquired by the Kentucky & West Virginia Power Company, Pikeville, which will extend and operate the lines.

CAMBRIDGE CITY, IND.—Robert Ashe has secured permission to purchase the local municipal electric plant. A company will be formed to operate the system. Extensions and improvements will be made.

KENDALLVILLE, IND. — Plans are under consideration for extensions to the municipal electric and waterworks plant, to cost about $40,000. H. H. Morteroff is city engineer.

MOUNT VERNON, IND.—The Southern Indiana Gas & Electric Company has been granted permission to acquire the property of the Mount Vernon Electric Light & Power Company. Additions and improvements will be made, including transmission line extensions.

WHEATFIELD, IND. — The Kankakee Valley Electric Company has received permission to purchae the Wheatfield Light & Power Company. Extensions are contemplated to the local plant and transmission lines.

CHIPPEWA FALLS, WIS.—The Wisconsin-Minnesota Light & Power Company contemplates building a power plant here.

LA CROSSE, WIS.—Plans for the proposed factory to be erected by the Weiss Manufacturing Company include a power house.

MANITOWOC, WIS. — The Manitowoc Portland Cement Company, a subsidiary of the Newaygo Portland Cement Company, Newaygo, Mich., plans to build a power plant in connection with its proposed local cement mill, to cost about $1,500,000.

ST. PETER, MINN.—Plans are under consideration for remodeling the power plant at the State Hospital, to cost about $100,000. Bids, it is understood, will be asked this summer for the work. D. F. Mullan, Capitol Building, St. Paul, is secretary of state board of control.

BONAPARTE, IOWA.—The Iowa Electric Company, Cedar Rapids, has appropriated $22,475 for a 13,200-volt transmission line from Birmingham to Bonaparte, to connect up the latter town with the Fairfield plant. The company was recently granted a franchise in Bonaparte and will install a local distributing system, to cost about $8,900.

DUBUQUE, IOWA.—The proposed new pumping station to be erected at Eagle Point by the City Water Department will be equipped with electrically operated pumping machinery.

JOPLIN, MO.—At an election to be held June 19 the proposal to issue $80,000 in bonds for improvements to the street-lighting system will be submitted to the voters.

REPUBLIC, MO.—The Lawrence County Light & Power Company, Aurora, has applied to the City Council for a franchise to supply electricity here.

STOCKTON, MO.—Bonds to the amount of $20,000 have been voted for the installation of a municipal electric light plant.

CUSTER, S. D.—Plans have been prepared by Chenoweth, Kennedy & Rittenhouse, consulting engineers, Sioux Falls, for a combined power and heating plant for the South Dakota State Sanatorium at Custer.

MADISON, S. D.—The project for the erection of a transmission line from the municipal electric plant to the Chatauqua grounds at Lake Madison has been postponed until next year.

CODY, NEB.—Bonds have been voted for the erection of an electric transmission line from Cody to the hydro-electric plant at Valentine.

HEBRON, NEB.—The Hebron Light & Power Company has consolidated with the Union Light & Power Company of Abilene, Kan. A transmission line will be erected connecting with the system of the Southern Nebraska Power Company at Deshler, the latter line being owned by the Union company.

OXFORD, KAN.—W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., engineers, have been commissioned to prepare plans for a municipal transmission line from Winfield to the Arkansas River station (5½ miles) to cost $18,000. Bonds have been voted.

## Southern States

HENDERSON, N. C.—Work has started on the second hydro-electric development of the Blue Ridge Power Company on the Green River in Polk County, to be known as the Turners Shoals. It is proposed to develop 10,000 hp. at a cost of about $1,000,000.

HIGH POINT, N. C.—Plans are being prepared by the J. B. McCrary Company, Atlanta, Ga., for a hydro-electric plant and for water and sewerage systems, to cost about $100,000.

SYLVA, N. C.—Plans are in progress for the construction of a new power house at the Cullowhee Normal & Industrial School. H. A. Underwood, Raleigh, is engineer.

CAYCE, S. C.—The Pace Lumber Company, Hendersonville, N. C., plans to construct a power house at its proposed local mill.

CHARLESTON, S. C.—The installation of a new street-lighting system is under consideration by the Council. Louis D. Rubin is chairman of the lighting committee.

COLUMBIA, S. C.—The University of South Carolina will install additional equipment in the power house at the institution. Lefaye & Lefaye, Loan and Exchange Building, are architects.

HEATH SPRINGS, S. C.—Bonds to the amount of $35,000 have been voted for the installation of an electric lighting system and waterworks. The project includes the erection of an electric transmission line (11 miles) connecting Lancaster and Heath Springs, to cost about $17,300. The Ryan Engineering Company, Columbia, is engineer.

ATLANTA, GA. — A permit has been granted to the Georgia Railway & Power Company to build a substation on Stewart Avenue between Wells and Glenn Streets, to cost about $20,000.

HAMILTON, GA.—A power house will be installed at the proposed local brick and tile manufacturing plant to be built by a new company now being organized by Thomas M. Walker.

JASPER, FLA.—Preliminary surveys are being made by B. M. Hall & Sons, Atlanta, Ga., for a proposed hydro-electric plant near here.

MIAMI BEACH, FLA.— The Miami Beach Power Company plans extensions and improvements to its plant, to cost about $150,000.

TAMPA, FLA.—Plans are being considered for the construction of a power house in connection with the proposed local phosphate-fertilizer works to be built by the Chemical Construction Company, Charlotte, N. C., to cost about $1,000,000.

COVINGTON, TENN.—Steps are being taken for the construction of a municipal electric power plant, to cost about $30,000. It is proposed to use oil for fuel.

KNOXVILLE, TENN. — The Knoxville Power & Light Company has applied to the Federal Power Commission for permission to build hydro-electric plants on the Holston River with total capacity of 150,000 kw.

FLINT, ALA. — The Southern Rock Asphalt Company contemplates the construction of a power house at its proposed local refining plant, to cost about $150,000.

HUNTSVILLE, ALA. — The Council is considering the installation of an electrically operated pumping machinery in the waterworks station.

MONTGOMERY, ALA.—Work has started by the Alabama Power Company on the reconstruction of the Tallassee dam, to cost about $500,000. About 10,000 hp. will be developed and a transmission line will be erected from Montgomery to Tallassee.

LOUISVILLE, MISS.—Bonds have been approved for $30,000 for the installation of a municipal electric plant.

DOVER, ARK.—The Arkansas Light & Power Company plans to erect a transmission line from Russellville 5 miles.

HAMMOND, LA.—The Louisiana Utilities & Manufacturing Company, recently formed with a capital of $1,000,000, plans an addition to its local power plant, including the installation of new equipment. It is also purposed to construct an ice-manufacturing and cold-storage plant.

MINCO, OKLA.—The proposal to grant a twenty-five-year franchise to the Chickasha (Okla.) Gas & Electric Company in Minco will be submitted to the voters on June 26.

CANYON, TEX.—The installation of an ornamental lighting system is under consideration.

DENTON, TEX.—A special election has been called July 7 to vote bonds for $90,000 for a municipal electric power plant, extensions in the waterworks and sewerage systems.

HOUSTON, TEX. — Contract has been awarded by the Navigation District Commission for excavation on the site of six wharves to be built on the north side of the turning basin. The plans for port improvements include construction of six wharves, grain elevator and wharf, railway yards, water supply and electric system. Bonds to the amount of $4,000,000 have been sold for the work.

WAELDER, TEX.—The City Council has granted E. Koenig a franchise to construct and operate an electric light plant here.

## Pacific and Mountain States

MOUNT VERNON, WASH.—The Skagit Valley Power Company, recently organized with a capital of $400,000, plans to construct a power plant and transmission system. C. J. Henderson is interested in the company.

VANCOUVER, WASH.—The Northwestern Equipment Company, Seattle, is reported to be planning to erect a branch plant, including a power house, in Vancouver for making logging trucks.

THE DALLES, ORE.—The Pacific Power & Light Company will commence surveys for a site for a hydro-electric power plant on the Deschutes River, with initial capacity of 40,000 hp., to cost about $2,000,000.

AUBURN, CAL.—Application has been made by the American River Water & Power Company for permission to construct and operate a hydro-electric power plant on the Middle Fork of the American River to develop 150,000 hp.

BERKELEY, CAL.—The Pacific Gas & Electric Company will receive bids at once for the construction of a substation at Hearst and McGee Avenues, to cost about $50,000.

GRASS VALLEY, CAL.—Sidney Wood and associates, care of Nilon & Nilon, attorneys, have made application for permission to construct and operate a hydro-electric power plant on the Big Canyon Creek, Nevada County.

LOS ANGELES, CAL.—Application has been made by the Municipal Power Bureau for permission to construct and operate two hydro-electric power plants on Big Pine Creek, and Cottonwood Creek, with rated capacities of 27,900 hp. and 11,300 hp., respectively. The cost is estimated at $3,188,000 and $1,900,000, respectively.

LOS ANGELES, CAL. — The French China Company, Sehring, Ohio, plans to construct a power house at its proposed local pottery, to cost about $1,200,000.

SAN FRANCISCO, CAL.—The Yuba Development Company, Hobart Building, has applied for permission to construct and operate a hydro-electric power plant on the Yuba River, Yuba County, to cost about $6,000,000.

SARATOGA, CAL. — Steps have been taken by the Saratoga Improvements Club for the formation of a lighting district.

DENVER, COL. — The State Utilities Commission has granted the Colorado Power Company permission to operate plants in the towns of Antonito and Manassa. The company will take over the plants already in operation.

## Canada

OWEN SOUND, ONT.—The proposal of the Hydro-Electric Power Commission of Ontario to erect a tie line connecting Eugenia with the Niagara system between Harriston and Mount Forest and a second flume at Eugenia to increase the output to 8,000 hp. has been indorsed by the Eugenia Electric Association.

TORONTO, ONT.—Work will soon begin on a large addition to the Hydro substation at Carlaw Avenue and Gerard Street, to cost about $300,000.

YORK TOWNSHIP, ONT.—An issue of $150,000 in debentures has been authorized by the Township Council to meet the cost of extensions to the Hydro-Electric power distribution system.

ST. ADEPHE-DE-CHAMPLAIN, QUE.—The Electric Service Corporation, Shawinigan Falls, has been granted permission to erect a transmission and distribution system to supply electricity here.

MORSE, SASK.—The Municipal electric light and power plant was recently damaged by fire, causing a loss of about $12,000.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued May 22, 1923)

1,456,300. MOTOR GOVERNOR; W. W. Dean, Wilmette, Ill. App. filed June 20, 1919. For phonograph motors.

1,456,343. ELECTRIC HEATING APPARATUS FOR WAVING OR CURLING THE HAIR; E. F. Suter, London, England. App. filed Sept. 19, 1922.

1,456,385; FUSE BOX; A. T. Kvarnstrom, Detroit, Mich. App. filed July 30, 1920. Switch or fuse box in detachable units.

1,456,420. STORAGE-BATTERY CONNECTION; B. B. Blackburn, St. Petersburg, Fla. App. filed Jan. 11, 1921. Non-corrosive terminal.

1,456,440. FLASHLIGHT ATTACHMENT FOR GUNS; J. P. Hist, Hightown, Va. App. filed March 3, 1922.

1,456,495. MANUFACTURE OF CARBON ELECTRODES; S. E. Sieurin, Hoganas, Sweden. App. filed July 31, 1920. From tar and carbon powder.

(Issued May 29, 1923)

1,456,500. ADJUSTABLE MOUNTING FOR TERMINAL BANK PANELS; O. F. Forsberg, Yonkers, N. Y. App. filed Dec. 4, 1919. Relates to automatic telephone systems.

1,456,501. DESK STAND FOR HAND TELEPHONES; O. M. Giunt, Rutherford, N. J. App. filed Aug. 19, 1920. For automatic systems.

1,456,504. ELECTRODE-SUPPORTING DEVICE; W. G. Housekeeper, New York, N. Y. App. filed April 13, 1920. For vacuum tubes.

1,456,505. ELECTRIC DISCHARGE DEVICE; W. A. Knoop, Brooklyn, and P. P. Cioffi, New York, N. Y. App. filed May 12, 1919. Electron tube.

1,456,507. TANDEM ALLOTTING SYSTEM; A. E. Lundell, New York, N. Y. App. filed May 21, 1919. Distribution of apparatus in automatic telephone systems.

1,456,508. NUMBER-INDICATING SYSTEM; A. E. Lundell, New York, and T. van Amstel, Douglaston, N. Y. App. filed July 26, 1919. Interoffice automatic telephone systems.

1,456,510. TRANSMISSION CIRCUITS; R. G. Mathes, New York, N. Y. App. filed Nov. 21, 1919. Two-way telephone repeating systems.

1,456,511. TRANSMITTER; J. P. Minton, New York, N. Y. App. filed Sept. 5, 1919. For places subjected to severe noises or vibrations.

1,456,516. CONNECTING PLUG; W. E. Riecken, Glendale, N. Y. App. filed April 26, 1918. Telephone jack.

1,456,517. MEASURING INSTRUMENT; F. W. Roller, East Orange, N. J. App. filed Oct. 22, 1920. Method of damping ammeters, voltmeters, etc.

1,456,520. ENERGIZATION AND CONTROL OF VACUUM TUBES; H. E. Shreeve, New York, N. Y. App. filed May 28, 1921. For telephone systems.

1,456,523. METHOD OF AND APPARATUS FOR TREATING METALS; R. F. Trimble, Elizabeth, N. J. App. filed July 19, 1919. Manufacture of electron tube elements.

1,456,528. ELECTRIC DISCHARGE DEVICE; H. D. Arnold, East Orange, N. J. App. filed May 10, 1915. Vacuum tube with large current output.

1,456,533. TYPEWRITING MACHINE; P. H. Burdick, Geneva, Ill. App. filed Nov. 6, 1920. Magnetically operated.

1,456,534. PRINTING TELEGRAPHY; H. A. Burgess, New York, N. Y. App. filed Nov. 25, 1919. Receiving apparatus of type-bar sort.

1,456,536. TELEPHONE SYSTEM; E. H. Clark, New York, N. Y. App. filed Dec. 4, 1919. Selective signaling apparatus for subscribers' lines.

1,456,537. TELEPHONE EXCHANGE SYSTEM; E. H. Clark, Richmond Hill, N. Y. App. filed May 19, 1920. Relates to machine-switching apparatus.

1,456,538. ACOUSTIC APPARATUS; I. B. Crandall, New York, N. Y. App. filed Dec. 24, 1917. Telephone receiver.

1,456,549. COMPOSITE SIGNALING CIRCUITS; B. P. Hamilton, Brooklyn, N. Y. App. filed Aug. 29, 1919. Plurality of signaling channels imposed upon same circuit.

1,456,550. ELECTRIC DRIVE MECHANISM; G. E. Hampton, Pittsburgh, Pa. App. filed Jan. 10, 1917. Reciprocatory element employed.

1,456,556. DUPLEX TELEGRAPH SYSTEM; E. A. Hudson, Brooklyn, N. Y. App. filed Dec. 29, 1921. For full duplex operation and half duplex operation.

1,456,568. MULTIPLE-FILAMENT LAMP; G. E. Quandt, Lockport, N. Y. App. filed June 29, 1922. Extra filament connected into circuit when lamp burns out.

1,456,591. THERMAL AMMETER; W. N. Goodwin, Jr., Newark, N. J. App. filed March 24, 1920.

1,456,595. RECORDING APPARATUS; C. A. Hoxie, Schenectady, N. Y. App. filed April 13, 1918. Recording photographically radio signals.

1,456,602. CALLING DEVICE; W. Kaisling, Chicago, Ill. App. filed Jan. 17, 1920. Dial for automatic telephone system.

1,456,652. ELECTRIC POWER GENERATING SYSTEM; A. M. Rossman, Chicago, Ill. App. filed June 11, 1921. Method of increasing power-plant efficiency.

1,456,658. ALTERNATING-CURRENT COMMUTATOR MOTOR; O. Turk and J. Kozisek, Charlottenburg, Germany. App. filed Oct. 29, 1915.

1,456,742. SOUND TRANSMITTER; P. V. Rooney, Morristown, N. J. App. filed April 4, 1921. For large powers met with in the operation of wireless or radio telephony.

1,456,746. CABLE TERMINAL FOR ARC LAMPS; T. F. Uhlemann, New York, N. Y. App. filed Nov. 29, 1918. For motion-picture machines.

1,456,755. ELECTRICAL HEATING APPARATUS; P. Bergeon, Grenoble, France. App. filed Oct. 6, 1921.

1,456,760. ELECTRIC SOLDERING IRON; F. W. Borton, Miami, Fla. App. filed Oct. 18, 1921. Used with electric currents of any voltage.

1,456,792. CONDUIT OUTLET BOX; W. G. Franke, Detroit, Mich. App. filed Dec. 15, 1919. Sectional outlet box.

1,456,798. PROCESS FOR THE EXTRACTION OF LEAD FROM SULPHIDE ORES; W. H. Hannay, Trail, British Columbia, Can. App. filed April 30, 1920. By electrolysis.

1,456,851. BINDING ELEMENT; C. F. Kettering, Dayton, Ohio. App. filed Jan. 6, 1922. Preparatory to heating in induction furnace.

1,456,863. ELECTRIC HEAT-RADIATING DEVICE FOR WATER-HEATING SYSTEMS; T. J. Blong, St. Louis, Mo. App. filed Feb. 11, 1921.

1,456,865. TERMINAL FOR ELECTRIC FURNACES; P. H. Brace, Wilkinsburg, Pa. App. filed April 21, 1921. Water-cooled electrode terminals.

1,456,867. APPARATUS FOR THE RECEIPT OF WIRELESS IMPULSES; F. Conrad, Pittsburgh, Pa. App. filed May 15, 1919. For remote control of electrical apparatus.

1,456,873. ALUMINUM DIRT TRAY AND REFLECTOR; F. F. Forshee, Flint, Mich. App. filed July 19, 1920. For placing under heating elements of electric stoves.

1,456,878. ELECTRICAL HEATING DEVICE; M. M. Kohn, New York, N. Y. App. filed Jan. 28, 1921. Toaster.

1,456,891. ELECTRIC FURNACE RESISTOR; G. M. Little, Pittsburgh, Pa. App. filed May 24, 1921. Built-up resistor of carbonaceous elements compressed in chamber.

1,456,892. PROTECTED ELECTRODE FOR ELECTRIC FURNACES; G. M. Little, Pittsburgh, Pa. App. filed May 24, 1921.

1,456,893. ELECTRIC FURNACE WALL CONSTRUCTION; G. M. Little, Pittsburgh, Pa. App. filed May 24, 1921.

1,456,894. TELESCOPING ELECTRODE PROTECTOR; G. M. Little, Pittsburgh, Pa. App. filed May 24, 1921. Protecting exposed portion of carbonaceous electrode.

1,456,901. TANK OR VESSEL FOR ELECTROLYTIC APPARATUS AND OTHER PURPOSES; R. D. Merson, New York, N. Y. App. filed Jan. 8, 1920. Apparatus airtight but provided with breathing means.

1,456,907. ELECTRIC HEATER FOR FLUIDS; C. T. Penton, Detroit, Mich. App. filed Aug. 17, 1921.

1,456,909. WAVE CONDUCTOR; M. I. Pupin, Norfolk, Conn. App. filed Oct. 10, 1918. For balancing the phase and amplitude of alternating electro-motive force waves.

1,456,923. TRAFFIC SIGNAL OR INDICATOR; A. C. Fowls, New Philadelphia, Ohio. App. filed March 27, 1920. For automobiles.

1,456,927. WRITING PAD; D. M. Kumpf, Pekin, Ill. App. filed April 14, 1922. Electrically illuminated.

1,456,937. HIGH-VOLTAGE PANCAKE-TYPE COIL; A. Schneeberger, Turtle Creek, Pa. App. filed June 13, 1917. Employed in shell-type transformers.

1,456,941. ELECTROLYTIC CELL; J. Slepian, Wilkinsburg, Pa. App. filed Dec. 9, 1919. Serves as condenser and lightning arrester.

1,456,955. MEANS FOR OBTAINING HIGH MOMENTARY CURRENT; C. F. Wagner, Pittsburgh, Pa. App. filed Feb. 26, 1921. For electro-percussive welding machines.

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# How Much Do You Believe?

THEORETICALLY all electrical men believe in electricity. They are convinced that electric light is the best light and electric power the best power and that the modern home should be equipped with all the modern electrical appliances. But how much do they believe?

Not long ago the president of a large electrical appliance manufacturing company was riding on a Western train with a party of electrical men bound to an electrical convention. The conversation worked around to merchandising policies and the future of appliances. The manufacturer asked all of them in turn if in their homes they were then using washing machines, ironing machines and vacuum cleaners. None of them was, though one of these men was selling this manufacturer electrical supplies in quantity and another sold him advertising space. He took two orders on the spot.

They all believed in these three appliances—but how much? It is another case of "Physician, heal thyself!"

Within the last few months there have been a number of contests held at meetings of electrical people to see which one lives in the best electrically equipped home. At the N. E. L. A. convention, as told elsewhere in this issue, several prominent central-station men won prizes and some others equally prominent were far down on the list. But each time a mere fraction of those present and eligible enter the contest. Only a handful can claim any adequate equipment. In every case it has been a striking demonstration of the fact that electrical men, at least in their own homes, are not "doing it electrically." They believe in electrical appliances, but apparently not enough to offset the inertia of the too common attitude that these are devices to be sold for other folk to use.

There are about 150,000 employees of the central stations that serve the U. S. A. Half of them might easily be using several appliances. One-tenth of them could be living in homes completely electrically equipped. This would mean 15,000 permanent electric homes on demonstration through the land, each exhibiting to its neighborhood and its own circle of friends the benefits of modern electric service. Consider what an influence for the more extended use of electricity such a conspicuous example would be.

# Frederick Darlington

*A specialist in the conservation of natural resources and the increasing of human efficiency by the use of power.*

A STRIKING exemplification of the progress made by engineering science in recent years is found in the fact that it is necessary to deal with aggregations of engineering projects involving large areas and aggregations of industry when planning a power system. Men with a creative imagination and broad vision are required to grasp modern complex power situations.

Economical planning to meet the present and future needs for power is the inspiring task of Frederick Darlington, consulting engineer for the Westinghouse Electric & Manufacturing Company. Among the details that figure conspicuously in his plans are the development of water powers, the centralization of the generation of power, the elimination of all small and inefficient power plants, the electrification of the railroads and the general use of electricity for all possible purposes.

Though Mr. Darlington has always advocated these principles, he was especially impressed with the necessity of their adoption on a national scale through his experience as chief of the Power Section of the War Industries Board.

Mr. Darlington was born at Lincoln University, Pa., in 1867. He was graduated from the Pennsylvania State College in 1886. His first work of consequence was as chemist for the Westinghouse Electric Company in 1891, when he took part in some of the early developments of electrochemistry. He then joined the United Electric Light & Power Company and the Brush Illuminating Company, New York, engaged with construction and operation; but in 1898 he gave this work up for the more congenial task of undertaking engineering and scientific investigations in gases and electrochemical reactions with William Stanley and C. C. Chesney in Great Barrington, Mass.

In 1898 he again became associated with the Westinghouse Electric & Manufacturing Company in an engineering capacity, and in 1905 he was appointed vice-president and general manager of the Alabama Power Company, where he once more encountered the practical details of electrical engineering.

In order to be a factor in the preparation and execution of plans for nation-wide development, he accepted in 1913 the position of consulting engineer with the Westinghouse organization, which post he has held ever since except for an interval during the war.

Mr. Darlington is interested in many activities in the industry and possesses a host of friends. He is a fellow of the A. I. E. E. and a member of the Union League, Engineers', Lawyers' and other clubs.

# Editorial Comment

Electrical World, June 23, 1923

Volume 81 Number 25

## A Gifted Engineer Passes Away

IN THE death of Dr. Louis Bell of Boston the electrical industry loses an engineer of wide reputation and great versatility—one who added dignity and luster to the profession he represented and whose acquaintanceship was highly prized abroad as well as at home. Dr. Bell grew up with and formed part of the electrical industry. He was a pioneer in the transmission of electrical energy and in the art of illumination. He it was who proposed fifty cycles as a standard frequency at a time when frequencies were uncommonly numerous, but his proposal, except in southern California, went unheeded, and, as it subsequently developed, much to the industry's loss. Dr. Bell plied a facile and gifted pen and from 1890 to 1892 he was editor of the ELECTRICAL WORLD and up to the time of his death a valued editorial contributor.

He possessed a strong personality and was fearlessly aggressive. What he believed he believed with all his might. There was no half-heartedness in his advocacy. He held firm convictions, never stood on ceremony in expressing them and was an excellent champion for causes he approved. To the staff of the ELECTRICAL WORLD Dr. Bell's loss comes as a wrench after years of close association and good fellowship. Long acquaintance served but to increase esteem and admiration. His departure removes from the industry a figure of influence and force, while at the same time adding to the list of departed leaders who have left examples worthy of emulation.

## Higher Temperatures Must Await Developments in Metallurgy

IT WAS very encouraging to hear Fred N. Bushnell of Stone & Webster express the opinion before the Technical Section of the National Electric Light Association at the recent convention that he is confident of the soundness of seeking greater plant economies through use of higher steam pressures. Materials and methods available at present will probably permit the use of steam pressures up to 1,200 lb., but temperatures higher than 750 deg. must await further developments in metallurgy. There is no proposal to go to temperatures which materials have not already proved their ability to withstand.

Since the opinion is expressed by several authorities that higher temperatures cannot be handled with existing designs and materials, it behooves the industry, and especially manufacturers of pipes, valves and fittings, to make exhaustive tests of the characteristics of different metals at temperatures above those now considered standard. A fruitful source of information will be supplied if analyses are made of the results which are being obtained with high-temperature pipes, valves and fittings in the oil-refinery field. There must surely be a definite determination made as to whether the elastic limit of steel is greatly lowered by high temperatures since deformation of the metal thereby may be the chief cause contributing to ultimate failure. Torsional strength of heated steel and fatigue of structures when subjected to expansion and contraction under stress and high temperature offer other subjects for investigation. Studies must also be made of designs which are particularly adapted to equalizing high-temperature stresses as well as of construction which will permit the least serious deformation. It is not to be doubted that the answers to these many questions will lead to high-temperature practices, but engineers are not minded to experiment much without knowing the ground they are treading.

## A Permanent Place for Electrical Exhibitions

ELSEWHERE in this issue information will be found about the newly completed permanent "home of electrical industries" in Leipsic. While there is nothing in this country that corresponds to the "Leipziger Messe," an annual fair on an international scale, yet our electrical industry is surely of such importance that it should have annual co-operative exhibition places in New York and in Chicago, and possibly in a few other industrial centers. Any one who has had anything to do with temporary exhibits and with annual shows knows how unsatisfactory it is to demonstrate electrical apparatus under crowded conditions in a flimsy booth, without adequate wiring or supports, and before visitors who are mostly bent on having a good time or are collecting souvenirs. Contrast this with a large stone building of dignified architecture bearing an inscription "Permanent Exhibit of Electrical Industries," where various manufacturers could have permanently assigned space fitted to suit their particular requirements. The exhibitors could show the same apparatus year after year, making changes where new types have been developed.

In New York the best place for such a home would probably be near the Engineering Societies Building, and the exhibit building could be open either the year around or only during the winter months when conventions and meetings of all sorts occur there in almost uninterrupted succession. In fact, such a permanent exhibition should become an additional attraction of the city.

Already other industries have permanent exhibits in this country, so that the electrical industry of America could not claim the distinction pertaining to the industry in Germany of having built the first permanent exhibit home. Nevertheless the time is ripe to give this matter serious thought. Groups of our industry are already linked together through the Joint Committee for Business Development, the Society for Elec-

trical Development and other associations. It should not be difficult to obtain co-operation for building and operating a few homes for exhibits, the stock to be held principally by the exhibitors themselves. The idea of the "home electrical" has been tried on a small scale and proved to be a great success, electrical shows have drawn large attendance in many cities, and it would seem that the same idea extended to exhibitions of applications of electricity in various industries should be a still greater success. The advantages to our foreign trade of a national exhibit home should also be borne in mind.

## At Last Some One Takes Notice of the Operating Man

STANDARDS have been made in technical nomenclature, standards have been worked out for ratings, standards for tests, standards for this, that and the other; but it has apparently not occurred to any one to produce any group standards for the operating man in whose care equipment is placed and upon whom dependence is placed for continued uninterrupted satisfactory service. Individual manufacturers have issued instructions on particular equipment; individual operating companies have devised their own operating codes. But it has remained for the Electric Power Club to take a real constructive step by starting to issue a series of booklets, as a group activity, on the care and operation of various classes of equipment within the purview of the club. The first booklet is that on the "Care and Operation of Power Transformers"—an eight-page pamphlet, just issued, which can be obtained from any member of the Transformer Section of the club.

Those who are charged with the care and operation of electrical equipment will certainly be grateful to the club members for following their equipment into service and for their joint action, as a club, in extending their standardizing efforts to the use of equipment as well as to its manufacture and rating.

## The S. E. D. Finding Its Place and Gaining Prestige

THERE is real encouragement to electrical men in the evidences, now multiplying, that the Society for Electrical Development is at last finding itself and becoming established as the recognized workshop to which publicity and promotional jobs may be taken by any group in the industry with the assurance that they will be effectively done. The N. E. L. A. Commercial Section at the recent convention reported the organization of three national campaigns for the promotion of industrial heating, electric ranges and electric trucks, and the operation of these campaigns is placed in the hands of the society. The society is also harmoniously functioning as the workshop of the Joint Committee for Business Development, providing the working staff and producing the printed matter which the joint committee divisions require. These activities are all being co-ordinated through the Advisory Publicity Council and good progress is being made.

Now comes the announcement that F. M. Feiker is to join the staff of the society, subject to special work which he is now doing for the United States Department of Commerce and for which he was reluctantly released by the McGraw-Hill Company. The further fact that W. E. Robertson, W. I. Bickford, N. G. Harvey and George E. Cullinan have joined the directorate of the society in the jobber group, George F. Morrison and H. D. Shute in the manufacturers' group, C. L. Chamberlain and W. A. Jackson in the contractors' group, and E. N. Hurley and E. W. Rockafellow as directors-at-large will add to the prestige of the S. E. D. as an industry institution.

It has taken a long time for the society to find its true place in the industry as a common, neutral workshop in the center of the various class associations of electrical men, available to serve them all. It has been hard to "sell" this conception of its function to the associations. Under the wise guidance of C. L. Edgar and W. W. Freeman, however, the dreams of J. Robert Crouse, that pioneer in co-operation, seem to be crystallizing in service of the most practical sort, with good promise of adequate financing to carry out the high hopes of those leaders of the industry who in 1913 organized the society, so confidently seeing in it an instrument of advancing the common interests of all classes of electrical men through commercial development.

## Beneficial Effects of Currents on Molten Metals

THAT metals melted in electric furnaces usually have better physical properties than those otherwise wrought has long ago been found out from practice, but all the "whys and wherefores" are not yet fully and clearly understood. If the exact nature of the action which produces this betterment were more clearly understood, it might be possible to increase, hasten or cheapen the production of these desired effects. In the June 16 issue of the ELECTRICAL WORLD Dr. Saklatwalla made some interesting suggestions concerning the possible effect on physical properties of metals. For steel the extremely high temperatures of the arc no doubt have some beneficial effect in producing greater fluidity, but the current itself, owing chiefly to the energy in the flux surrounding it, is now known to produce important useful effects by developing forces some of which were recognized and studied only within the last decade or two. By properly directing these forces they may, for instance, be made to produce an upward circulation which brings all the particles of suspended impurities and gases in turn to the surface, where they then remain or are caught by the slag, thus hastening and improving the slow and expensive "killing" process still in use.

When a current passes through a column of molten metal at sufficiently high current densities, one of these magnetic forces, known as the pinch effect, acts in a manner analogous to that of a centrifugal separator, forcing the better conducting materials to the central axis and thereby squeezing the more poorly conducting materials, like slags, oxides or gases, to the outside of the column. This force is shown strikingly by passing a sufficiently large current through a trough of mercury on which is floated an amalgamated copper rod—when the current is passed this rod instantly disappears, being sucked to the central axis. Vibrations produced by alternating magnetisms may, also, by the different inertias of different materials or by different induction

in heterogeneous masses, produce desired effects. When an iron bar is held over a trough of liquid metal through which a large current is passing, these forces will raise up the metal, forming the curious effect of a steady little hill of the liquid, which is sustained dynamically by a strong upward flow; if the iron bar is held below, the forces produce a depression which may break the circuit. A horizontal magnetic flux passing through such a trough from side to side in the proper direction produces the same effect as greatly increasing the gravity force on the better conductors, thus tending to separate the poorer conductors by causing them to float. A density of about 4 has in this way been given to water for concentrating minerals.

As iron at a red heat loses its property to add more magnetism to that of the current, one is apt to conclude that there is little magnetism around the current alone; but in furnaces in which the heating is desired the current densities may be made very great, and the kind of magnetism which is produced by the current alone is not destroyed by heat. Moreover, the energy in it increases as the square of the current; hence the forces which it could produce may become quite formidable. It seems that most of the wrought brass produced in this country is now being refined and made homogeneous by the proper application of some of these newer electromagnetic forces. The very thorough stirring which these forces may be made to produce when properly applied not only produces the much desired homogeneity of alloys, but doubtless also finer grains which deter segregation. Some of these forces have now been recognized, studied and applied; there may be others that have not yet been studied and are not yet described in textbooks. Human inertia in resisting the acceptance of new forces not included in the older "classics" is unfortunately very great, which makes progress slow and difficult. Besides the useful mechanical action of these newer forces, it is not at all unlikely that a current might also produce molecular or atomic effects, now that we know that the electron, with its strong electromagnetic and electrostatic forces and immense quantities of energy, plays such an important part in the constitution of the atom.

## A Chart for Line Regulation

WHEN an engineering problem is reducible to comparatively simple mathematics and when in the course of routine office work such a problem has to be solved a great many times for different numerical data, some one is sure to find a short cut in the form of a chart, a table, a specal slide rule, a mechanical device or something else. Most of these "first aids to the rushed" never leave the office in which they have originated. They may even remain in the notebook of the man who evolved them as part of his personal stock in trade. Now and then a public-spirited engineer gives to the profession at large the benefit of a short-cut method and thus scores for himself another point in the forthcoming argument with St. Peter.

Dr. Hutchinson's chart for a quick calculation of line-voltage regulation, published in this issue, commends itself because of the extreme ease with which it can be used, even by the proverbial "office boy." Its simplicity is due to a skillful arrangement of the two sets of curves and also to the fact that the line capacitance and leakage have been neglected. In other words, only the line resistance and inductance are taken into consideration. Of course, this limits the use of the chart to lines and other electrical devices where such a simplification of the actual conditions is permissible. With these limitations the shart should find its place of usefulness in the notebook of any engineer who deals with short transmission and distributing lines. It must be left to the engineer's judgment whether or not this chart should be used when the capacitance is also an appreciable factor. After all, sound judgment is one of the most valuable assets in an engineer, and if he lacks judgment, it may not be safe to intrust him even with a plain multiplication table.

## A Commendable Solution to the 40-Deg.-50-Deg. Controversy

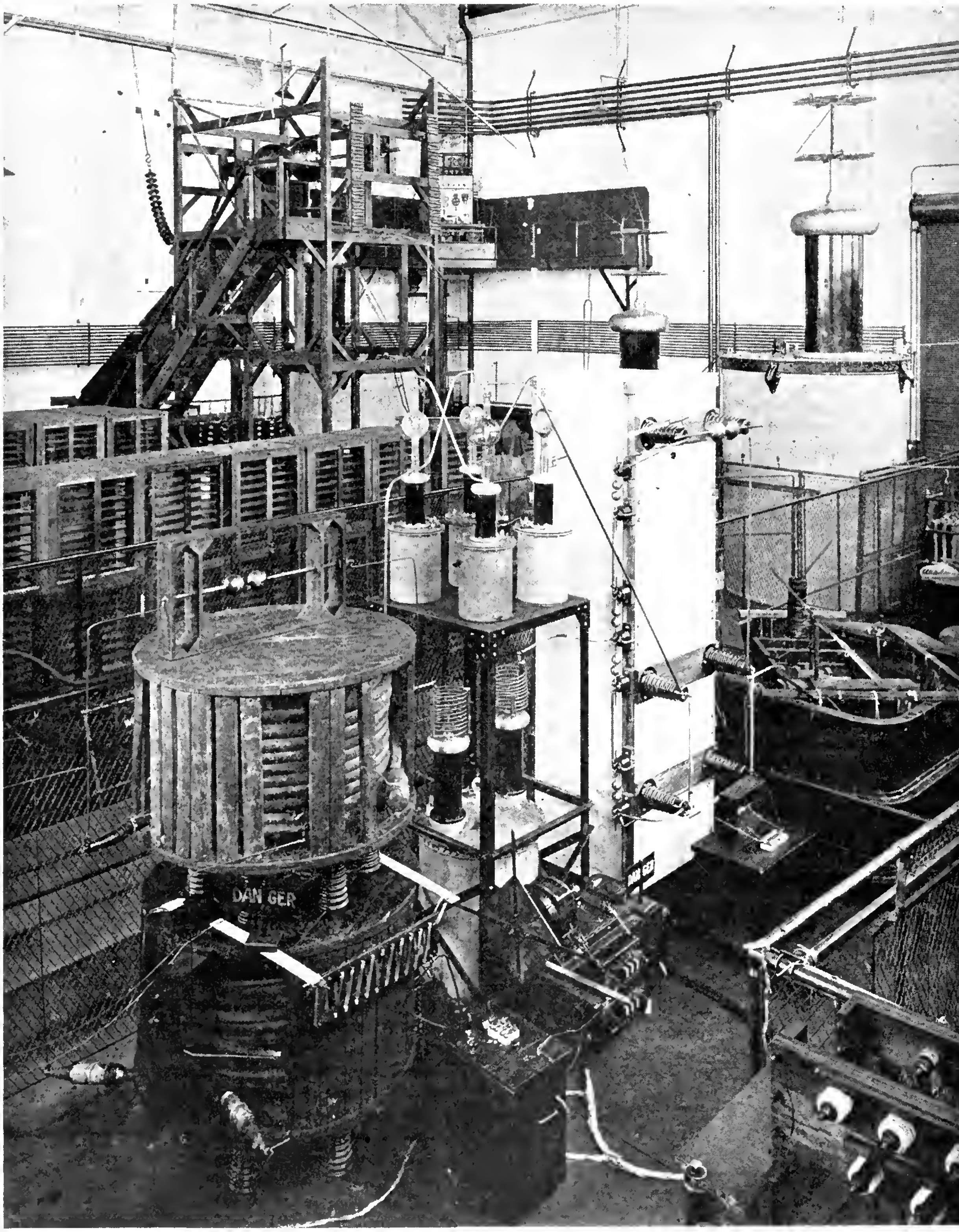
THE purchaser of general-purpose motors, as has repeatedly been pointed out in these columns, is interested primarily in knowing that "10 hp." means the same thing every time he buys a 10-hp. motor. That he will be so assured in the future is to be the beneficent result of the Electric Power Club's recent commendable action in abandoning its two standards of rating motors—one the 40-deg.-55-deg. double rating, the other the 50-deg. single rating—and in adopting as "recommended practice" the 40-deg. single rating without definite overload guarantee. This commercial-engineering question has been before the industry, not only nationally, but with international complications, for at least seven years. What particular solution was to be reached was not so important as that a single solution be reached. As was pointed out after the Geneva meeting of the International Electrotechnical Commission committees last fall, commercial experience seemed to dictate that the 50-deg. single rating was not the most workable. The newly recommended standard thus avoids a rating commercially difficult and at the same time provides a single rating without the complication of overload guarantees with given temperature behavior.

It should be noted with gratification that the new rating provides that the non-technical purchaser is assured of a generous motor—that is, a motor with a certain "reserve" capacity—and this is advisable. A technical user who fits his motor to his duty cycles demands temperature curves and other data, but the non-technical user, accustomed to factors of safety in other equipment, has his only protection in having a certain reserve to meet temporary emergencies. This assurance the 40-deg. single rating provides—and this apparently was the demand which made the Geneva conference decide that the 50-deg. single rating was not generally practicable commercially. At the same time, a single rating indicates a definiteness of behavior, which any standard of rating really should do.

The effect of the American decision on the ultimate international standard is, of course, not yet determinable. But it is to be hoped that not only the Power Club but also the rating bodies of other countries will follow the advice of the Power Club's board of governors and change from "recommended practice" for "adopted standard" the definition:

"An open-type general-purpose motor shall be capable of carrying full rated load continuously with a temperature rise not exceeding 40 deg. C."

# Laboratory Where Lightning Is Made to Order




MUCH comment has appeared in the newspapers recently regarding the "terrific" lightning bolts which have been produced artificially at the Pittsfield works of the General Electric Company.

In these manifestations of popular interest engineers will recognize the so-called "lightning generator" with which Steinmetz and Peek have been experimenting for some time. As shown herewith, the equipment consists essentially of a million-volt transformer (in the right background) and stacks of air-dielectric condensers (in the left background) which can be charged from the high-voltage transformer through the medium of kenotrons (on the elevated platform in the foreground).

So far voltages of two million have been obtained. With the condensers in use a large amount of power can be stored up and suddenly released with a very steep wave front.

# Automatic Substations in Mine Service

## Continuity of Service, Good Voltage Regulation, Minimum Wear of Equipment and Flexible Location Are Inherent Characteristics—Field of Application and Economic Comparisons with Manual Operation

By C. E. H. VON SOTHEN
*Power and Mining Engineering Department, General Electric Company*

THE automatic substation is becoming more and more widely used in mines for supplying direct current to the haulage system, cutting machines and pumps. The past year has witnessed a marked increase in the number of equipments sold and installed, principally because of the successful operation of stations previously put into operation. Articles describing some of these installations have been published, so that the method of operation of the automatic station has become quite well known. A discussion of the subject, however, from an economic and operating standpoint may be of assistance to those who have not had an opportunity to study it.

There are a few differences of opinion as to what constitutes an "automatic substation," but the term is generally understood to mean a station which, upon proper indication by a master element, goes into operation by an automatic sequence, maintains by an automatic means the required character of service, shuts down and clears itself upon the opposite indication of the master element, and protects itself while starting, running and shutting down. The master element may be a remote-control switch, time switch, contact-making voltmeter, etc., or the station may be started and stopped by switching the alternating-current supply. Because of the fact that the cost of electrical energy is usually only a few per cent of the cost per ton of coal or ore loaded for shipment, it is usually best to start the equipment in the morning by some device such as a remote-control switch and permit it to run continuously during the hours when it may be needed suddenly. The peaks of a mining load develop so rapidly that a machine usually does not have time, when started by a contact-making voltmeter or ammeter, to get up to speed and on the line in time to be of assistance. There are special cases, of course, where this method of starting may be used to advantage.

Although the cost of electrical energy is only a small part of the total cost of operating a mine, the service rendered by the electrical equipment must be of such a quality that the desired output of coal or ore may be obtained. This is what is meant by "the required character of service" and implies continuity of service and good voltage regulation. It is also important that the apparatus be subjected to the minimum wear consistent with good service and that the equipment be as simple as possible within the limits prescribed by good practice.

It has been found that, because of the elimination of the human element and the possibility of more advantageous location, the quality of service afforded by an automatic substation is better than that rendered by the ordinary manually operated mining substation and equal to that of the best. Most coal mines were operated only a few months last year so that results for a full year are not available, but automatic mining substations have had a severe test and have been found entirely adequate. A synchronous motor-generator equipment which has given very satisfactory service is illustrated in Fig. 3. The station is on the surface approximately 4 miles from the tipple and is started and stopped by a push-button placed at a convenient place on the main haulage. The direct-current feed lines and control wires to the push-button are taken into the mine through a bore hole. This station operates in multiple with four other stations, and the automatic equipment on the direct-current side was especially designed for the application. It consists of one section of load-limiting resistance and an automatic reclosing equipment. Each of these will be described later.

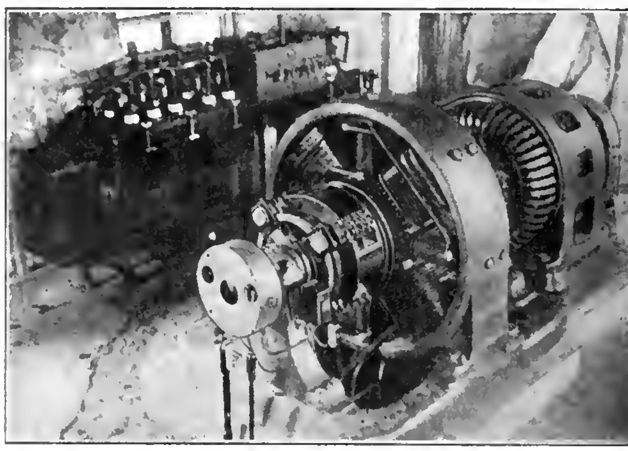


FIG. 1—AUTOMATICALLY CONTROLLED MOTOR-GENERATOR SET OF THE STAR COAL & COKE COMPANY

One of two 150-kw., 550-volt direct-current synchronous motor-generator sets with oil-immersed starting and running contactors and compensators installed at Red Star, W. Va. The set is equipped with speed limit device, bearing temperature relays and flash barriers for the generators.

Voltage regulation is of considerable importance from the standpoint of production, for low trolley voltage results in the slowing up of all the operations of the mine. Owing to their slower speed, motors have to carry overloads for longer periods and may eventually burn out, thus further hampering production. Good voltage regulation therefore has in itself a real economic value. While it was possible several years ago to maintain good voltage at the face by locating the substations near the working places, this has become practically impossible from an economic standpoint because of the great increase in wage rates. Consequently there has developed a practice of grouping the stations, placing one man in charge of several. This results in increased copper losses, increased voltage drop, a greater number of interruptions and longer ones, and an all-around poorer quality of service because one man cannot properly care for several stations.

When the load center is distant from all buildings or places where an attendant would regularly be stationed, an automatic substation, properly located, will save not only the copper and copper losses incident to long feeder runs, but also the wages of one or two operators. The direct-current distribution problem has been successfully solved in this manner at the Drifton colliery of the Lehigh Valley Coal Company.

The workings of this colliery are divided into several sections by the topography of the country. It was found that the haulage requirements of two of these sections could be supplied at 250 volts from a single substation without providing extremely large feeder capacity. In order that the substation might be at the approximate load center of the two sections, it was placed about 3,000 ft. from the nearest point at which an engineer was on duty every hour of a twenty-four-hour day, this man being in charge of a slope hoist. An automatic synchronous-converter substation equipment was installed in such a way that it might be started and stopped from the hoist house by means of a remote-control switch and pilot wires. Two direct-current feeders run in opposite directions from the station to the two sections of the mine, being carried through bore holes at the points where they tie in to the trolley.

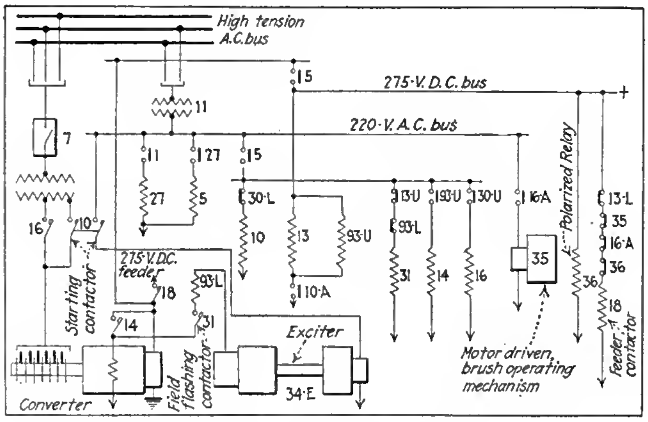



FIG. 2—SIMPLIFIED DIAGRAM OF AUTOMATIC CONTROL FOR MINING CONVERTERS

Assuming the incoming alternating-current lines to be energized and the manually operated oil circuit breaker No. 7 to be closed, closing master starting element No. 1 causes relay No. 27 to close its contacts. This picks up control contactor No. 5, which in turn energizes and closes starting contactor No. 10. This connects the converter to the low-voltage taps on the secondary side of the power transformer; it also connects the motor of the small exciter set, 34E, to the 220-volt alternating-current control bus. Relay No. 13, which is connected across the converter commutator, will pick up only on direct voltage and therefore does not close its upper contacts until the machine reaches synchronism.

When relay No. 13 picks up, it closes field-flashing contactor No. 31, connecting the converter shunt field to the small 250-volt exciter. This connection is maintained until the voltage across the commutator and the flashing current are in the proper direction with respect to each other, as determined by relay No. 93. Proper polarity is therefore assured and the polarizing takes a maximum of only three or four seconds. Relay No. 93, in picking up, drops out contactor No. 31 and closes contactor No. 14, thus self-exciting the machine. At about one-half normal field current relay No. 30 closes its contacts, dropping out starting contactor No. 10 and closing running contactor No. 16. The brushes are next lowered on the commutator by the motor-driven brush-operating mechanism No. 35. Relay No. 36 is a polarized device for verifying the converter polarity, and until it has closed its contact feeder contactor No. 18 cannot close. When the relays of the automatic reclosing equipment indicate proper conditions, contactor No. 18 connects the converter to the 275-volt direct-current feeder.

### Protection Against Overloads

When several manual substations are interconnected on the direct-current side through a trolley or distribution system, the loads may, of course, shift about in such a way as to overload a substation and trip its direct-current circuit breaker. This throws the entire load on the remaining stations and may in an extreme case so heavily overload these stations that their direct-current circuit breakers may open successively. If these breakers do not trip, the stations will continue to supply load, but through such a long length of trolley and feeder that the voltage drop will be excessive. Equipment is available for use with direct-current circuits which permits a station to limit its own load by temporarily inserting one or more blocks of resistance into the feeder, depending upon the amount of overload. Only the excess load is shifted to the other stations, thus providing the greatest continuity of service and best voltage at the working places. Such a "load-limiting" equipment may be applied either to a completely automatic substation or to one which is manually operated on the alternating-current side. Two equipments of the latter type have recently been furnished the Quemahoning Coal Company at Somerset, Pa., for use with 150-kw., 275-volt synchronous motor-generators. One of these is shown in Fig. 4.

Another form of protection for the direct-current side consists of the automatic reclosing equipment. This may be either of two kinds—that for operation independent of any other direct-current source (stub-end feed) or that suitable for either stub-end or multiple feed. In general, these equipments fulfill the following functions:

1. They disconnect the load from the source of power in case the voltage fails or the load exceeds a predetermined value.

2. The load remains disconnected a definite minimum time interval of ten to thirty seconds, regardless of the cause of the opening.

3. At the expiration of this time interval they immediately reconnect the load to the source of power, provided the voltage is restored or the connected load is reduced to a predetermined value. There is no attempt to reclose as long as a short circuit or excessive load remains connected.

The principal advantage of such an equipment over the ordinary manually operated breaker is that it will reclose promptly when conditions have settled down to normal.

The only way in which an operator can tell whether an overload or short circuit has been removed is by trying the circuit out by reclosing his breaker. After several attempts he will usually wait a considerable length of time before trying again, very often causing delays that might have been avoided by the use of the automatic reclosing equipment. The contactor of such an equipment cannot very well be held in by hand during an overload, so that the machines are more fully protected.

### Automatic Operation Can Reduce Maintenance Due to Poor Handling

The greater the degree to which a station can be made automatic, the less will be the wear and tear on the apparatus due to unskillful handling. Because of the present labor shortage, it is more difficult than ever to obtain trained substation operators at the mines, except at very high wages. The result is that the apparatus is more or less abused. Bearings are burned out, circuit breakers are held in during peak loads, resulting in flashovers and burn-outs in machines, and the stations receive little care. If the station is automatically controlled, one trained man can give part of his time to

proper inspection and care. Casual inspections can usually be given daily, but a thorough inspection, during which the various devices are operated by hand, should be given once each week.

In order that the adjustment and operation of these stations may be thoroughly understood by the mine electrician, the automatic equipments have been simplified as much as is consistent with proper operation and protection. In the latest types of control for both motor-generators and synchronous converters for mining service all of the steps in the sequence are performed by relays which respond only to certain electrical conditions. Each switching operation is a direct function of the electrical condition of the apparatus at the particular moment and is dependent upon the proper functioning of the preceding operation. The starting sequence followed for both motor-generators and converters is the same as that considered best practice in manual operation.

## Sequence of Operations

A simplified diagram of the automatic control for synchronous converters for mining service is shown in Fig. 2. It does not show all of the interlocks and protective relays included in a complete equipment, but only the devices necessary for proper starting sequence.

The standard equipments for both synchronous motor-generators and converters include protection against the following: (1) Severe alternating-current or direct-current overload. (2) Failure to complete starting sequence. (3) Loss of excitation. (4) Single-phase starting and undervoltage on incoming line. (5) Overheated bearings. (6) Overheated machine windings. (7) Temporary drop in incoming voltage. (10) Reverse power, if the station is operating in multiple with another. (11) Overheated load-limiting resistors (when these are used).

As an example of the rapidity with which the automatic reclosing equipment will operate, it may be stated that in at least two instances it has opened in time to clear a machine when a short circuit was applied to the feeder immediately outside of the station and not more than 25 ft. from the machine. One of these machines was a 275-volt synchronous converter at the mine of the Carbon Fuel Company, South Carbon, W. Va., and the other a 550-volt generator at the Star Coal & Coke Company's mine, Red Star, W. Va. The latter machine was equipped with flash barriers, as shown in Fig. 1. The view also shows the starting and running contactors for the motor and one of the bearing temperature relays. The flashing in each case was so slight that the commutator did not require any attention. In a few instances bearing temperature relays have operated and have always cut the machine off before any damage has resulted. Only a small amount of scraping has been required in order to put the bearings back into condition for use. Wherever the equipment has had proper inspection and care the protection and operation has been most satisfactory.

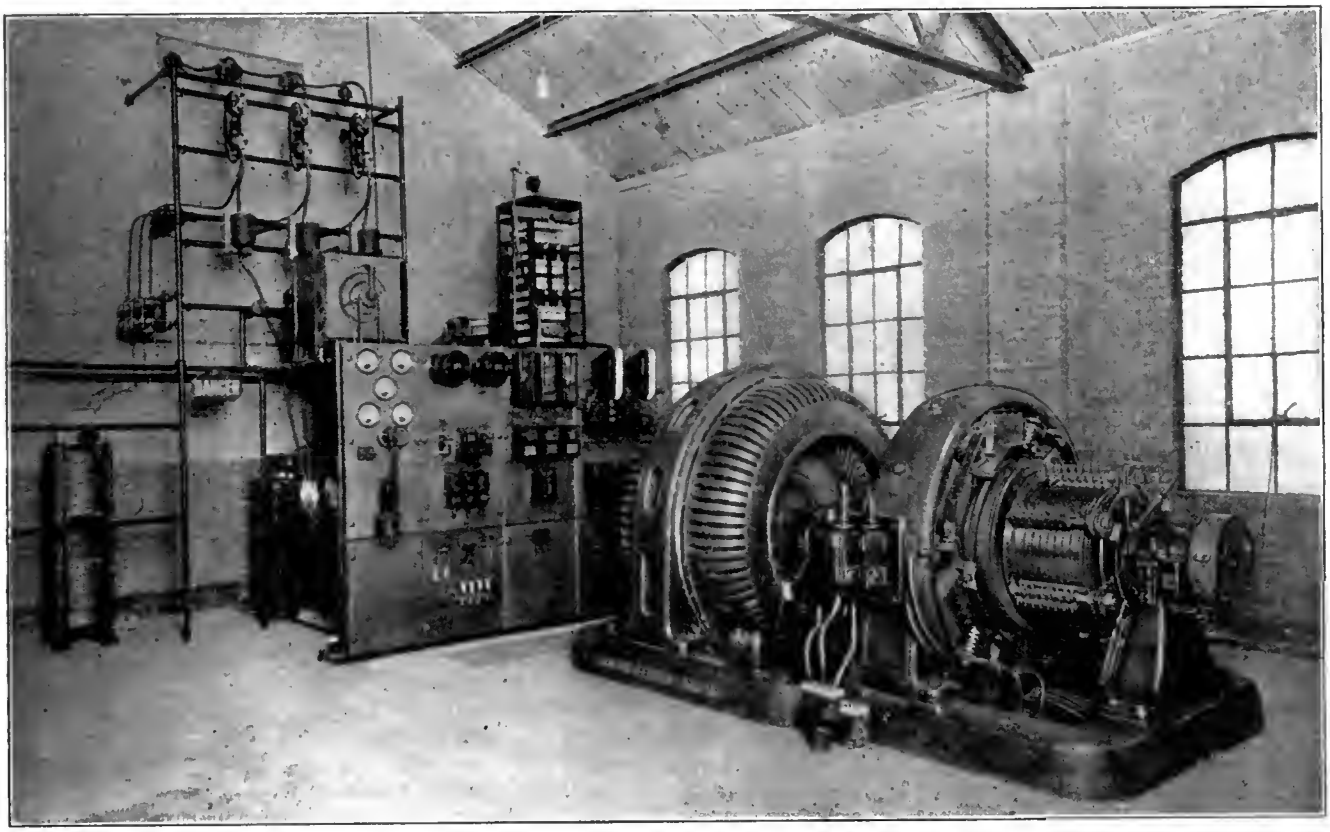



FIG. 3—SYNCHRONOUS MOTOR-GENERATOR EQUIPMENT OF CLEARFIELD BITUMINOUS COAL CORPORATION
The set is rated at 300 kw., 250-275 volts, direct-current, and 6,000 volts, three-phase, 60 cycle, on the alternating-current side. The installation is at Rossiter, Pa.

The protective features are of two kinds—automatic-reset and hand-reset. If the trouble is likely to be of a temporary nature such as overheated machine windings, low alternate-current voltage or overload on the direct-current side, a device is used which will automatically reset when conditions have returned to normal. If the trouble is likely to be of a permanent nature or such that the station should be inspected or repairs made before service is restored, a hand-reset device

is used to give the protection. Examples of this kind of trouble are overheated bearings, loss of excitation and failure to complete the starting sequence. The individual devices are in most cases provided with their own lock-out features, so that it is a simple matter to determine why the station has been shut down.

### Field of Application for Automatic Mine Substation

While the automatic substation has distinct advantages over the manual substation, when properly applied, there cannot always be found a justification for its use. There are, of course, no engineering reasons why an automatic substation cannot be used wherever a manual substation will operate satisfactorily and without an undue amount of attention from the operator, but there are quite a few places where the extra investment would be entirely unwarranted. For instance, the workings of

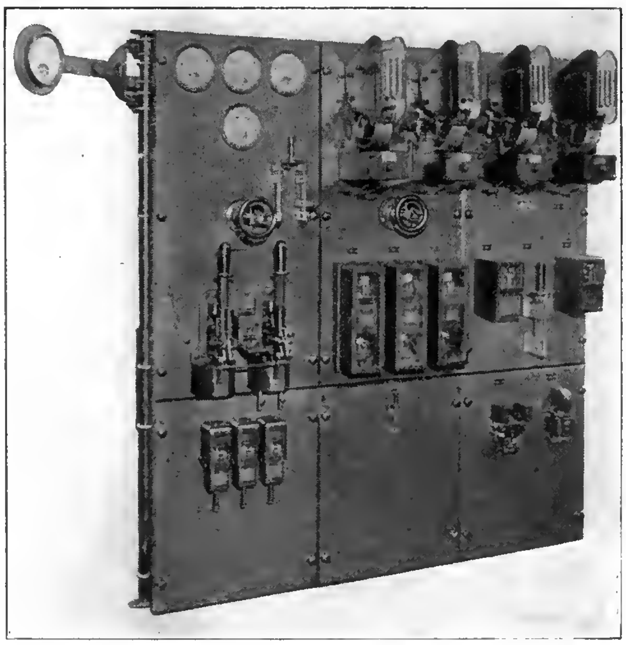


FIG. 4—AUTOMATIC SWITCHING EQUIPMENT OF QUEMAHONING COAL COMPANY, SOMERSET, PA.

Control panels for 150-kw., 2,300-volt, 60-cycle motor-generator set and load limiting equipment for the 275-volt, direct-current feeder.

some mines are so situated that large amounts of power are required in a comparatively small area so that long feeder runs are unnecessary. In such cases there may be advantages to be gained by placing two, three or more machines in the same station, in which case the price of automatic control would be entirely out of line with the saving to be gained by eliminating substation operator.

Again, there are any number of mines at which the substations can be so located that the same man can care for the station and a fan. In other cases the station may be in the same building in which there is located a hoist or shop, so that no additional attendant is required.

However, there are times when the hoist operator or blacksmith is so busy that he cannot give the station proper attention. This often occasions such delays that automatic control, or at least certain automatic features, might well be installed, in order to increase the output of the mine. The increased revenue would then soon pay for the extra investment.

In order that a general idea may be obtained as to the relative total costs of a manually operated and an automatic substation, the following comparison is given. This is based on a 200-kw., 275-volt, direct-current-2,300-volt alternating-current synchronous motor-generator equipment. Assuming the total first cost of the manually operated station to be 100 per cent and referring each item of cost and operation of both the manual and automatic station to it as a base, there results approximately:

| | Manual | Automatic |
|---|---|---|
| | Per Cent | |
| First cost of apparatus | 72.8 | 111.8 |
| Cost of building | 11.8 | 12.4 |
| Installation (material and labor) | 15.4 | 18.4 |
| Total first cost | 100.0 | 142.6 |
| Excess first cost of automatic over manual | .... | 42.6 |
| Annual fixed charges | 20 | 28.5* |
| Annual attendance charge | 25‡ | 2.5† |
| | 45 | 31.0 |

* 0.20 × 142.6.
† 0.10 × 25.
‡Based on an attendance charge of $1,700 per year.

The annual saving of the automatic over the manual is therefore 14 per cent of the total first cost of the manual station. Dividing the excess first cost of the automatic by the annual saving (42.6 ÷ 14), it is seen that the extra investment is paid for in three years. After such time the annual saving will amount to about 33 per cent of the extra investment. If an operator is employed for more than one shift the saving will be greater.

Though the relative percentages will vary depending upon the locality, those given are considered a fair average. The comparison does not include charges for power or repairs. The former will be virtually the same for either manual or automatic and the latter are negligible. Account has been taken of the fact that a slightly larger building is required for the automatic control, but this would usually be compensated for by the fact that a more substantial building and a suitable method of heating are required if an operator is to be maintained. Consequently the figures might be made more favorable to the automatic.

The conclusion may therefore be drawn that, while there are many cases in which an automatic station is not justified, there is no question about its economy when properly applied. Whenever additional substation capacity is required, the whole situation should be given careful thought in order that the best procedure may be followed.

## Only Seven Water-Power Generating Plants in Great Britain

A TOTAL of 536 public generating stations in Great Britain is shown by the report of the "Electricity Commission" for the year ended March 31, 1922. Of this number 366 utilized steam as a source of power, fifty-five produced gas, forty-seven oil engines, and the remainder other means, including water power. The electrical division of the United States Department of Commerce states that only seven British stations depend exclusively upon water power, the largest of which produced 18,763,000 kw.-hr. out of a total of 29,107,000 kw.-hr. generated from this source. The total electric power generated during the year 1921 amounted to 4,844,666,038 kw.-hr., of which steam supplied power for approximately 97 per cent.

# Periodical Inspections Maintain Service

### Three Forms and Inspection Scheduling Cards Control Equipment Maintenance in Plant of 65,000 Kw.—Records Aid Accounting

BY R. D. GILLESPIE
Chief Engineer Millers Ford Plant, Dayton (Ohio) Power & Light Company

GOOD electrical service can be rendered only with good equipment which is maintained in first-class condition. To maintain equipment in good condition it is very necessary to outline a definite program of routine inspection and repairs covering all of the equipment in a station and also to keep records and costs of the inspections and repairs on each separate piece of apparatus.

Such a system is in use at the 65,000-kw. Millers Ford station of the Dayton Power & Light Company, Dayton, Ohio, covering routine inspections, repairs, maintenance costs and record keeping of each separate piece of equipment in the station, including all auxiliaries. The forms were prepared to get the desired information by the most direct and economical route, and the system is kept in operation by two men.

The records and maintenance costs are kept on the unit plan, giving the cost of maintaining each unit of equipment as a whole or its parts. For example, the costs of maintaining one of the turbine units would have as subdivisions the turbine, generator, condenser and condenser auxiliaries. The maintenance costs for the condenser auxiliaries would be further subdivided to cover each piece of apparatus in that group.

An operating record, the turbine room log sheet (Fig. 1), is kept on the turbine unit and shows the hours operated and whether the unit was out of service, available or undergoing repairs. Records and maintenance costs for the boiler units are kept in the same way. The boiler-unit records are further subdivided into boiler, furnace and stoker, and the furnace repairs are again subdivided to cover front wall, bridge wall, right and left side walls.

Boiler operating records are also kept covering the hours of steaming (Fig. 2), the banked time and the number of hours out of service while repairs were being made to either the boiler, furnace or stoker. This record also shows the number of pounds of steam generated daily by the boiler, the number of pounds of coal burned, the steam and flue-gas temperatures, the percentage of $CO_2$ and the boiler efficiency. This is a cumulative record which gives the totals and averages for any date in the month, together with a total and average at the end of the month. The yearly records are kept in the same way by monthly periods. This information is especially valuable when comparing the operation and maintenance costs of one boiler unit with those of another.

#### CARD FILE CONTROLS INSPECTION DATE

Inspections are handled in the following manner: A calendar card file has been prepared which has a space for each day of the year. The file is further separated into months with divisions for each day of the month for convenience in finding dates. The dividers for the months are of different color from those for the days. Then a typewritten inspection card (Fig. 3), 4 in. x 6 in., is kept for each unit in the station and the subdivisions of that unit. This card is headed with the name and number of the unit, and it states what the inspection is to consist of and how frequently inspections are to be made. As these dates are reached the inspection cards are withdrawn from the file and work orders (Fig. 4) are issued to the foreman in charge of the repair force. These work orders state what is to be done, when the work is to be started and when it is to be completed. The inspection cards are then returned to the file and set ahead to the date when the next inspection is required.

A carbon copy of all work orders issued is kept in the chief engineer's office and checked off when the original is returned. When the inspection or work covered by the work order is completed, the foreman turns the original into the office and places on it the name of the workmen together with the number of hours each man worked. To keep in touch with the work covered by work orders, the carbon copy is used to follow up on the original order if the work is not completed on schedule time. The copies are checked over daily, and if for any reason the foreman has failed to complete the work or has forgotten to turn the work order in on the date given him on his work order to complete that work, the copy of this order is handed to the chief engineer. He in turn gets in touch with the foreman in charge of the work and finds out the reason for the delay.

#### WORK ORDERS ISSUED ON ELECTRICAL INSPECTION

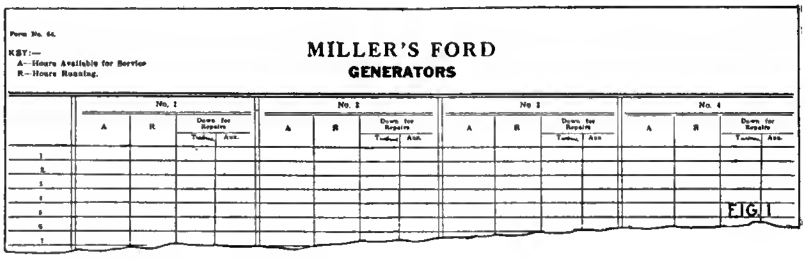
The inspection and maintenance of the electrical equipment, such as oil circuit breakers, motors and transformers, are also taken care of by work orders in the regular way. The oil circuit breakers are inspected at regular intervals. The switch contacts are inspected and repaired if necessary, the oil filtered and a breakdown test given to it. All adjustments are checked, after which the switch is opened and closed a few times to see that it functions properly. An operating record is also kept of all the oil circuit breakers that open automatically, and if any opens automatically more than a given number of times because of short circuits or overloads the switch is taken out of service. The contacts are then repaired, the oil is filtered and tested, and the switch is restored to its normal condition, regardless of whether this falls in the regular routine or not.

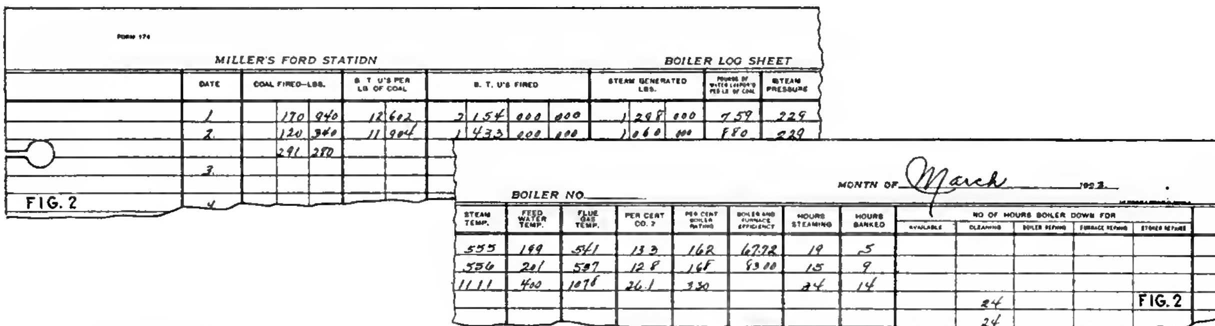
At regular intervals a sample of oil is taken from each transformer and subjected to a breakdown test. If the test shows the oil to be deteriorated, it is run through an oil drying and filtering machine a sufficient number of times to restore it to its original condition. This method has been in use for the past three years, and during this time there have been no transformer failures due to deteriorated oil.

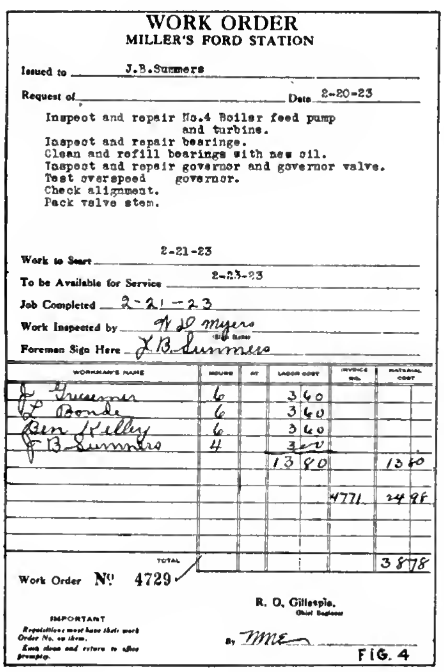
Motors are also inspected at regular intervals. The small motors on the governor control of the main turbines get just as regular attention as the large motors on the condenser circulating pumps. Boiler and furnace inspections are handled on special forms that outline a very thorough inspection. Work orders are issued to cover repairs that are shown by these reports to be necessary on the boiler, the furnace or the stoker.

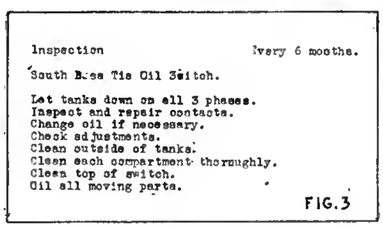
Whenever material is required for making repairs, the foreman issues a requisition (Fig. 5) on the storeroom with the work-order number on the requisition for the material. From this requisition the storeroom man issues an invoice (Fig. 6) covering the material

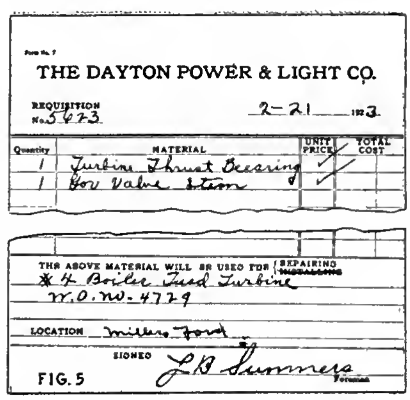
issued, giving the distribution and the work-order number. This is sent to the office, where the cost of the material is put on the invoice numbered and filed. The cost of the material, the invoice number and the labor costs are then transferred to the original work order. The work order is now complete and gives the total cost of the job in labor and material. It also is always carried on the same page number; that is, when a sheet is full it is withdrawn from the book, numbered and then filed. A new sheet is then inserted, having the same page number but with the next higher sheet number. Labor costs are entered daily in the labor distributing book direct from the workman's time card. Material costs are taken from the purchase

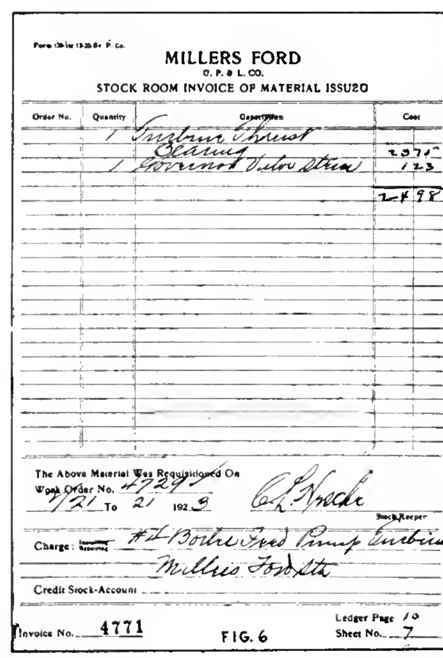



RECORD FORMS THAT FACILITATE INSPECTION AND MAINTENANCE

Fig. 1—Turbine log sheet, giving hours of operation for both turbine and auxiliaries.
Fig. 2—Boiler-room log sheet has space for complete data on boiler operation.
Fig. 3—Typical inspection cards determine date of overhauling besides giving specific instructions for necessary inspection.
Fig. 4—The work order authorizing repair of inspection work also contains the itemized costs of labor and materials.
Fig. 5—The requisition for stock issued by the foreman against the storeroom.
Fig. 6—The stock-room invoice record lists the cost of the materials which have been issued.

indicates when the job was started, when completed, the number and names of men working on the job and the foreman in charge of the work. The work order is then filed under the proper heading in a file provided for that purpose. Work orders are used for all work other than routine work in the station and machine shop.

Maintenance costs are entered in two loose-leaf books having ten ruled column pages, one book being for distributing labor costs and the other book for distributing material costs. For convenience the same account orders and from the storeroom invoices. The distribution books are totaled at the end of each month so that the results make up the monthly maintenance-of-equipment cost sheet, which in turn becomes a part of the monthly manufacturing-cost statement. The monthly totals are then carried to the summary book, which has a column for each unit for labor, material and total cost by months. This book also shows at any time the cost of maintaining any one unit or its subdivision for any given period desired.

# Uniformity in Demand Rates*

## Diversity of Form and Application Makes Standardization Desirable—Characteristics of Meters, Load and Duration of Peaks Have Marked Effect on Registered Demand — Comparison of Time Intervals

By W. M. CARPENTER
*Engineer Empire State Gas & Electric Association, New York City*

METHODS of measuring demand in electric rates show a great diversity in form and application among central-station companies and in an effort to bring about a greater uniformity of practice the Empire State Gas and Electric Association last year formed a committee to investigate the possibilities of standardization. Although this committee is not yet ready to report or make recommendations, it has nevertheless developed a great deal of interesting information and much valuable data. The work of the committee has been directed principally at the general proposition of the measurement and rating of demand rather than the technical features of the meters themselves.

The course of procedure followed by the investigation has included:

First—A tabulation of all demand rates now in effect throughout the state.

Second—A questionnaire to a group of the larger companies, containing the following inquiries:

1. Should the demand charge be stated in the rate as a yearly or a monthly charge?
2. Should the demand charge be based on the yearly peak, or should each month's or each week's bills be based on the monthly or on the weekly peak?
3. If the charge is based on the yearly peak, what constitutes the year; *i.e.*, is the calendar year or the contract year to be used as the basis?
4. What time periods should be used as the basis of demand charge for different situations; *i.e.*, when, for example, should a one-minute, a five-minute, a fifteen-minute or a thirty-minute peak be used?

Third—A collection of typical load curves for industrial plants, in order to discover, if possible, the load characteristics of the various industries.

Fourth—A survey of the metering devices now on the market.

At this point it should be noted that the influence of power factor has not been considered at all, and that the handling of this particular phase of the question has been reserved for a future study.

During the investigation it was found that there is a great diversity in the methods employed by the various companies in connection with their demand rates. There are on file in Albany and New York over one hundred rates, of which hardly five are alike. The time interval varies from an "instantaneous" reading to one hour. Some companies carry the demand, once established, over a period of an entire year; others carry it for a month; a few special cases are for a week only. Some companies, in a happy uncertainty, do not define "demand" at all; others compute it, not from the readings of recording or indicating instruments, but as a percentage of the connected load, and here also there is a wide range of practice.

Due consideration should be given to the fact that the situation must be viewed both from the engineering and from the commercial standpoints. It is a problem which interests equally the commercial, the meter and the engineering departments of the power company. Much of the business affected by demand rates is obtained in competition with private plants. The manufacturer always has steam boilers in his factory, and it is not such an enormous step to increase his equipment a little and install an electric plant in addition. If the manufacturer thinks that he can make electricity more cheaply himself, he certainly will do so. The scores of isolated manufacturing power plants within the limits of the larger cities of the state bear abundant witness to this fact. The large consumer, usually having at least a boiler house, sometimes even generating machinery of his own, is often in a position of considerable independence and can bring this additional factor to bear upon the question.

For this reason the purely engineering considerations

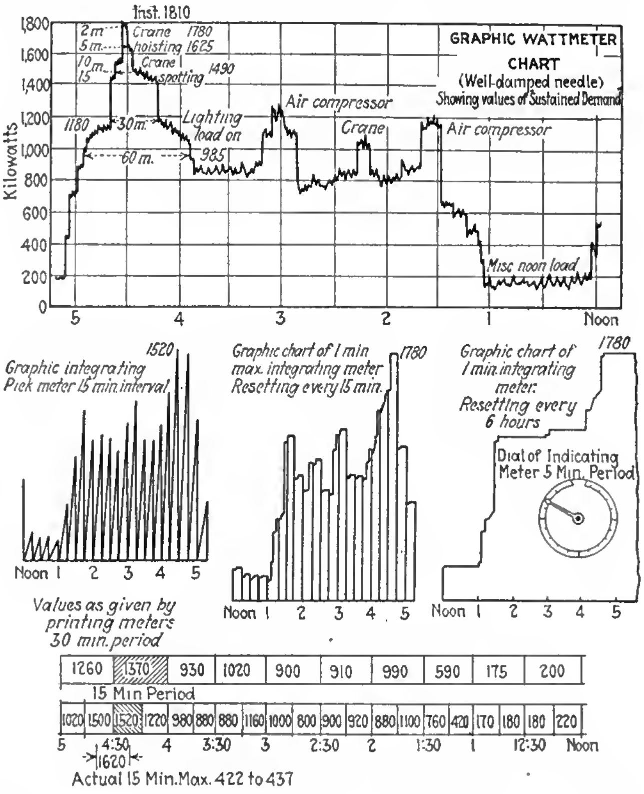



FIG. 1—TYPICAL LOAD, FOUNDRY WITH CRANE, SHOWING VALUES OF DEMAND AS DETERMINED BY VARIOUS METHODS

*From a paper presented at the winter meeting of the Electric Meter Section, Empire State Gas and Electric Association, at Syracuse, N. Y., Jan. 22, 1923.

are often modified so as to obtain a piece of business for which special provisions must be made.

The fundamental difficulty of the whole subject appears to center in the time interval, and while many arguments have been submitted in favor of each particular unit of measurement, the great majority of rates are based on questions of policy rather than upon scientific or engineering facts. The entire question is influenced by broad considerations of rate making, but it is desirable to note what great difference in the size of the customer's bill will be caused by various methods of measurement.

Fig. 1 represents the graphic wattmeter chart of a typical afternoon's work of an iron foundry. In the load there are included, besides the usual tumbling barrels and miscellaneous machinery, a 250-hp. air compressor and an electrically driven crane. When all these happen to operate at once at a time when the evening

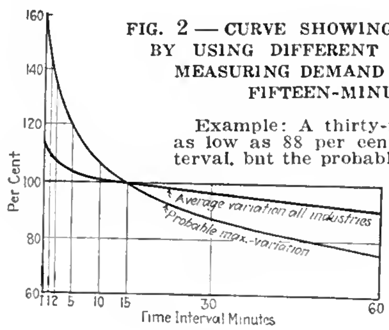



FIG. 2 — CURVE SHOWING VARIATION OF RESULTS BY USING DIFFERENT TIME INTERVALS FOR MEASURING DEMAND AS COMPARED WITH FIFTEEN-MINUTE INTERVAL

Example: A thirty-minute interval may show as low as 88 per cent of the fifteen-minute interval, but the probable average of all industries will be 97 per cent of the fifteen-minute reading. An instantaneous interval may be as much as 160 per cent of the fifteen-minute period, but the probable average of all industries will be 116 per cent of the fifteen-minute values.

lighting load is also on, a peak of considerable size is formed. From this chart it is easy to determine how the various time intervals will affect the amount of the so-called demand. If the "sustained" peak is used as the basis of measurement, the demand found will be lower than that where the "integrated" peak is used and the unit price will have to be raised accordingly. The sustained peak may be defined as that portion of the curve during which the indication remains at its highest value for the duration of the required period of time. While the use of this quantity—in that it cannot exceed the true maximum integrated demand—will usually meet with the customer's entire approval, it is very unfair to the electric company because the value cannot be higher than the minimum point of any depression which may occur during the period. In addition, the depth of the instantaneous minimum as drawn by graphic instruments depends largely upon the amount by which the meter movement is damped. It is also possible for unscrupulous customers to install artificial interrupting devices which will cut off the current long enough to let the meter needle drop and then pick it up again.

From the chart it is evident that a sixty-minute sustained demand will only show 985 kw., while a fifteen-minute period will give 1,400 kw. and a two-minute one will give 1,780 kw.

Similar—though not so extreme—differences are shown by various methods of integration, which give either the actual total or else the average kilowatts used in any period of time. To the left below the wattmeter chart is shown how the curve might look on a graphic integrating meter of the "Piek" type, which resets on a fifteen-minute period. This would show 1,520 kw. A one-minute maximum integrating meter would show 1,780 kw., while a five-minute period would give 1,670 kw.

In the same way the readings given by the various printing meters, or "printometers," would show wide divergences. A thirty-minute period would give 1,370 kw. between 4 p.m. and 4:30 p.m. A fifteen-minute period would show 1,520 kw. between 4:15 p.m. and 4:30 p.m. In these meters there is an added disadvantage that because the time periods are selected by a clock no cognizance is taken of load conditions immediately before or after the interval. Thus, in this particular case, if the clock were seven minutes slow, it would show the real peak from 4:22 p.m. to 4:37 p.m. at 1,620 kw.

Numerous attempts have been made to develop a meter which will overcome this selective characteristic, but as yet they have not found sufficient favor to justify their widespread operation.

A type which has found much use is the so-called "lagged" type, which is really an indicating meter in which a retarding device is used so that some definite period must elapse before the full value is indicated. This retarding device may be either mechanical or thermal, and the time interval is independent of any clock. In all of these, however, the demands shown will differ by an amount which depends upon the particular type of instrument and upon the character of the load curve. With a nearly steady load all instruments of this class will show nearly the same value as the integrating meters and give a very close approximation of the actual demand, but with a fluctuating load each type will give a different result.

This brings us to the second phase of the problem, namely, the effect of the characteristic load curve of the industry upon the size and duration of the peak. Industries vary widely in the manner in which they use electricity. In some limited instances, such as flour mills, electro-chemical industries and an occasional pumping plant, the curve is so regular as to make all considerations of the length of the peak unnecessary. In all others, however, a more or less irregular use of energy is necessary, and as the plant operations become more and more irregular and tend more and more toward the use of heavy machinery, some differences between the peak and the average use becomes inevitable. This is particularly true of heavy, concentrated work, such as is found in rolling mills and stone crushers and in all processes where there are sudden heavy loads, poorly compensated for by insufficient flywheel capacity.

To investigate this, there were collected the graphic wattmeter charts of forty typical industries, selected at random as showing an ordinary day's work and not supposed to represent either the maximum day or the maximum peak. From these the peaks were selected and a tabulation was made up showing the relation of the values found by using the various time intervals. The results of this tabulation showed that:

(*a*) The "sustained demand" as the basis of measurement bears very little relation to the real demand.

(*b*) As a general rule, the shorter the length of the time interval the lower should be the unit price per unit of demand.

(*c*) The sixty-minute peak rarely represents the use of electricity except in the case of two or three industries with exceptionally steady load characteristics.

(*d*) The "maximum momentary demand" is largely dependent upon the damping of the needle of the meter.

(*e*) It appears to be a matter of great difficulty to find a combination of equitable time interval and a suitable meter which will show the demand of all the industries of a community with absolute accuracy. Apparently the fifteen-minute peak comes as near as may

reasonably be expected to representing the actual demand. It was found that the results from two-minute peaks were seldom more than 10 per cent above and those from thirty-minute peaks more than 5 per cent below the results arrived at by using a fifteen-minute interval.

It is evident that the selection of the measuring devices should follow rather than precede the assignment of the time interval. It appears, however, that in a great many cases, particularly among the smaller electrical companies, this procedure has been reversed. Central stations in many instances have adopted a particular type of meter and then have tried to apply a particular rate for this meter.

In conclusion, it must always be remembered that the actual measurement of demand is still in the development stage, and that there is yet a vast field ahead of it. This is especially true in regard to the phase which we all approach with fear and trepidation—the influence of the power factor. It is expected that the recent great progress which has been made in the development of the kilovolt-ampere meter will lead to the determination of true electrical demand without recourse to all the mathematical gymnastics which are now necessary where the element of power factor enters into the bill.

It is expected that the committee which has this problem in charge will develop a set of standards which will more nearly co-ordinate the present great diversity of practice which exists in this field.

# Electric Drive Found Best for Ice Plants*

## Its Use Almost Universal in New York City—Less Skilled Attendance Required than with Other Methods—Comparative Production Costs with Various Kinds of Driving Equipment

By J. R. McCOY
*Assistant Commercial Manager Texas Power & Light Company*

WHEN power can be obtained at a rate which compares favorably with the fuel costs prevailing in a particular locality, the motor-driven plant is the wise selection, and so the average buyer concludes, provided that the supply of such power is reliable. That is a very important factor and one which must enter into the buyer's consideration when he is ready to make his choice.

One factor, of course, always predominates in the matter of selecting a prime mover for an ice-making plant and that is the quality of water available for making fresh-water ice. One does not think any longer in terms of distilled water unless the water supply for the purpose of making ice is strictly unsuitable for the production of a clear, attractive-looking block. In that event a plain distilled-water plant is the only resort. Expensive combinations, such as multiple-effect evaporators, have been tried out, producing distilled water on an economical basis with coal and driving the ammonia compressors by another source of power; but it has almost invariably proved to be a fact that the first cost of this complicated equipment and its high maintenance cost, particularly that of the evaporators, makes it far from a good plan for plain commercial ice manufacture.

This discussion and the comparisons made are concentrated on the fresh-water plant, since that type of plant unquestionably predominates today and should be of greatest interest to the man now in the ice business or the man who contemplates entering it. Not many years ago, even since the development of an efficient fresh-water system, one plant was installed in New York in which the compressors were driven by the uniflow engines and the auxiliary power supplied from a uniflow engine-driven electric unit. That plant made continuously an average of 18 tons of ice per ton of coal, using steam at 165 lb., 150 deg. superheat, and condensing at a 25-in. to 26-in. vacuum. Water supply was from deep wells at about 55 deg. Despite this individual case of economical performance, however, every plant that is started in the city of New York today is a fresh-water motor-driven plant.

The conditions which prevail in the larger cities and centers as to the source of power supply are not always prevalent in newer or less concentrated communities. Therefore there may be reason for the selection of prime movers other than electric motors in many localities until they become modernized as to the source and cost of electric power supply. The time, however, is almost bound to come when virtually every ice plant will be motor-driven.

### RELATIONS OF ELECTRIC AND OTHER FORMS OF POWER

An examination of the relation which electric power and fuel costs bear to the over-all costs of manufacture—namely, operating costs plus fixed charges—is important. Assume, as a practical layout, a 100-ton modern fresh-water ice plant, using cooling-tower water, 1,600 300-lb ice cans in two tanks, about 35,000 ft. of 1¼-in. pipe, with all modern appurtenances for multiple can harvesting and automatic can filling at the dump, operating over a period of eleven months on a 10,000-ton season storage with a year's production of 32,000 tons of ice. The results ascertained by analysis from a plant of this size with various types of prime movers ought to give the answer. The selection of prime movers would involve a consideration of the following:

1. Motor-driven plant, using two ammonia-compressor units, synchronous-motor-driven, direct-connected; all motor-driven auxiliaries.
2. Uniflow engine-driven plant using two compressor units, each direct-connected to uniflow engine, and a uniflow engine-driven generator of sufficient size for driving all auxiliaries by motor; water-tube boilers, 165 lb. steam pressure, 150 deg. superheat, with modern superheaters, economizers, motor-driven boiler-feed pumps, etc., engines operating condensing.
3. Oil-engine-driven plant using two ammonia-compressor units, each belted to full Diesel-type Busch-Sulzer, or equal,

*From a paper presented at the Southwest Geographic Division, N. E. L. A., convention at Oklahoma City, March 14-16, 1923.

oil engine, and one oil-engine-driven generator set of sufficient size for driving all auxiliaries by motors.

4. Oil-engine-driven plant using less expensive oil engines of the semi-Diesel type, Fairbanks-Morse, Worthington, or equal, using two compressor units, each belted to an oil engine, and one oil-engine-driven generator set of sufficient size to drive all auxiliaries by motor.

In each case two ammonia compressor units are considered. That is done, first, to secure a better load factor and, second, to reduce the hazard of interruption. It would hardly be fair to make comparisons based on two units in one case and a larger unit in another case.

There are many other points of advantage to warrant the selection of two compressors, each individually driven, rather than a large single unit. The two compressors need not necessarily be of equal size, but nevertheless there should be two. The power and fuel costs are assumed to be as follows:

Electrical energy at 1.5 cents per kilowatt-hour average for the year, taking into consideration load factors, maximum-demand charge, etc.

Coal at $4.50 per ton, delivered to boiler room in bunkers or otherwise.

Fuel oil at 5 cents per gallon for oil-engine-driven purposes, delivered and placed in tanks at plant.

It is not expected that these three unit costs of power and fuel will simultaneously exist in any one particular point in the country. It is realized that at some points the cost of coal is almost prohibitive while at these same points fuel oil may be very cheap. The same thing might apply to electric power in certain localities where this particular combination exists, and such points represent the average between the oil fields and coal fields. Substitutions can be readily made in the accompanying analysis table for any other fuel or power costs.

### Comparative Manufacturing Costs

The manufacturing cost per ton of ice, which includes operating costs and fixed charges, is as follows:

| | Per Ton |
|---|---|
| Motor-driven plant | $2.17 |
| Uniflow steam-engine-driven plant | 2.34 |
| Full Diesel oil-engine-driven plant | 2.32 |
| Semi-Diesel oil-engine-driven plant | 2.38 |

As between the last two plants an increase of 6 cents per ton will be noted when the cheaper engine is used. That difference is accounted for by higher fuel-oil consumption and particularly by higher lubricating-oil and maintenance cost. The full Diesel-type engine has a much more scientific and efficient lubricating system, everything being force-feed and eliminating splash with consequent evaporization. Moreover, the full Diesel type works under higher pressures and temperatures and is designed and built to operate more economically on fuel oil.

The interesting feature of the accompanying tabulations is the fuel or power cost per year as compared with the total manufacturing cost. As mentioned above fuel costs are often compared without due consideration of much else that enters into the cost of ice. The following will indicate why purchasers are misled in many instances.

### Reasons for Lower Electric Costs

With the motor-driven plant 30 per cent of the total manufacturing cost is for power bills, and yet, according to the tabulation, ice can be made therewith for the least money. First of all, the total investment in the plant is lower, which cuts down the fixed charges. Second, the labor requirements in that plant are less by reason of its simplicity. Third, the upkeep or maintenance cost is bound to be less. Fourth, the type of engineering skill that is, of necessity, needed in a steam or oil-engine-driven plant is not required in a motor-driven plant. Therefore a chief engineer can be engaged at a smaller salary.

The fixed charges, of course, represent the greatest difference and are the charges that are often overlooked or underestimated. In the case of the uniflow-engine-driven plant and oil-engine-driven plants the fuel cost runs from 11.9 per cent to 14.7 per cent of the manufacturing cost, which shows that the power cost in the motor plant is virtually two and one-half times

PERCENTAGE OF POWER OR FUEL TO TOTAL MANUFACTURING COST

| Type of Plant | Total Yearly Manufacturing Cost | Yearly Power and Fuel Cost | Per Cent Ratio of Power or Fuel Cost to Total Manufacturing Cost |
|---|---|---|---|
| Motor-driven | $69,630.00 | $22,100.00 | 32.0 |
| Uniflow steam-engine-driven | 74,932.00 | 9,300.00 | 12.5 |
| Full Diesel oil-engine-driven | 74,362.00 | 8,800.00 | 11.9 |
| Semi-Diesel oil-engine-driven | 76,294.00 | 11,160.00 | 14.7 |

the average cost required with coal or fuel oil; but in the steam plant and oil-engine-driven plants the investment makes the fixed charges soar and the maintenance is bound to be higher. More and better skilled labor is required. Besides, there is more likelihood of service interruption with oil-engine-driven plants than with motors operated from central-station service.

This statement is not intended to be detrimental to the oil-engine builder, but it remains a fact that a high-speed reciprocating unit working under high temperatures and at a continuous full load is much more subject to breakdown than a motor-driven installation. It does not take a very long shutdown in a 100-ton ice plant to curtail the earnings seriously and cause a loss which would probably offset any gain that the owner hoped to reap by the selection of a particular prime mover.

With the steam-engine-driven plant, which makes ice cost $2.32 per ton, 1.86 cents per kilowatt-hour could be spent for power; in the full Diesel oil-engine plant, in which the ice costs $2.32 per ton, 1.83 cents per kilowatt-hour could be spent for power. These figures do not take into account the relative hazard of service interruption, which must necessarily have consideration.

A motor is the only prime mover that really operates at a constant efficiency with a minimum amount of attention. A uniflow-engine-driven or oil-engine-driven plant must be kept in top-notch condition if it is to produce maximum rating at maximum economy under practically full-load conditions throughout a period of eleven months. That requres a top-notch chief engineer who has his heart in the plant—a type of man not always available.

## Bombay Electrification to Proceed

FROM Bombay Assistant United States Commissioner C. B. Spofford reports that announcement has been made by the Great Indian Peninsula Railway of sanctions to proceed with the first 30 miles of the Bombay suburban electrification scheme as far as Thana. Preparations are far advanced and contract will be placed at an early date for the first 20 miles of trackwork and special rolling stock.

# Forcing Most Economical Load Division by Reactors

## Investigation of Values on Boston System Leads to Decision to Install Reactors with Taps Permanently Built Into Reactor Structure — Limits Voltage Drop

By A. H. SWEETNAM

*Assistant Electrical Superintendent*

*Edison Electric Illuminating Company of Boston*

IN RECENT years many of the large central-station companies, owing to their abnormal growth and the resulting large concentration of generating capacity, have found themselves with oil circuit breakers of insufficient interrupting capacity. This condition in many cases has resulted in the application to transmission lines, buses and apparatus of current-limiting reactors. In articles which have appeared from time to time in the technical press, the subject has been treated chiefly from the viewpoint of limiting short-circuit current to a value which can safely be interrupted by the existing breaker installation. In some cases the application of reactors is made for this purpose alone, as experience has shown that in case of fault the bus pressure has been reduced to such a value that synchronous equipment will fall out of step.

TABLE I

External reactance in ohms required in No. 4/0 B. & S. gage cable (operating in parallel with 300,000-circ.-mil cable having 1-ohm external reactor) in order that cables may divide current and kilowatt load in accordance with the respective cross-sections.*

| Length in Miles | Total Reactance (Ohms) Inherent and External | Inherent Reactance (Ohms) | External Reactance (Ohms) |
|---|---|---|---|
| 1 | 1.670 | 0.188 | 1.482 |
| 2 | 1.922 | 0.376 | 1.546 |
| 3 | 2.174 | 0.564 | 1.610 |
| 4 | 2.427 | 0.752 | 1.675 |
| 5 | 2.679 | 0.940 | 1.739 |
| 6 | 2.931 | 1.128 | 1.803 |
| 7 | 3.184 | 1.316 | 1.868 |
| 8 | 3.436 | 1.504 | 1.932 |
| 9 | 3.688 | 1.692 | 1.996 |
| 10 | 3.941 | 1.880 | 2.061 |
| 11 | 4.193 | 2.068 | 2.125 |
| 12 | 4.445 | 2.256 | 2.189 |
| 13 | 4.698 | 2.444 | 2.254 |
| 14 | 4.950 | 2.632 | 2.318 |
| 15 | 5.202 | 2.820 | 2.382 |

*This table is prepared on the assumption of the use of three-conductor. 15,000-volt working-pressure cable (operating at a frequency of 00 cycles per second) having 7/32-in. insulation over each conductor. The formula used in the calculation is: External reactance in ohms for No. 4/0 = 1.4175 $(1+0.178N)-9.188N$, where $N$ = the length of cable in miles.

One application which appears very important has apparently not been treated. This is the use of reactors to apportion load between transmission lines of different cross-sections operated in parallel on the same substation bus. In such a case the current and hence the kilovolt-amperes divide inversely as the respective impedances, while the kilowatts divide inversely as the reactances of the lines.

A concrete case would be a No. 4/0 B. & S. gage and a 300,000-circ.mil three-conductor, 15,000-volt working pressure cable, each having $\frac{7}{32}$-in. paper insulation. The 60-cycle reactance per phase per mile of the No. 4/0 cable is approximately 0.188 ohm, and that of the 300,000-circ.mil cable is 0.178 ohm; hence the kilowatt load will divide approximately 50 per cent to each. The corresponding impedances are 0.334 ohm and 0.264 ohm, and the current will divide approximately 44 per cent and 56 per cent. The copper cross-sections are approximately in the ratio of 41 and 59 per cent. Assuming a load of 10,400 kw. and 80 per cent power factor, the current and kilowatt load would divide as follows:

No. 4/0:

$R = 0.275$ ohm; $X = 0.188$ ohm; $Z = 0.334$ ohm.

5,060 kw., 5,750 kw., 88 per cent power factor, 221 amp.

300,000-circ.mil:

$R = 0.194$ ohm; $X = 0.178$ ohm; $Z = 0.264$ ohm.

5,340 kw., 7,250 kva., 73.7 per cent power factor, 279 amp.

Resultant $X = 0.0914$ ohm. Resultant $Z = 0.147$ ohm.

From these figures it is evident that the smaller line carries more than its proportion of the load, and if the load were to be increased, the smaller line would become appreciably overloaded with full load on the larger line.

In order to utilize the full capacity of copper installed, it would be desirable to install reactors of such rating as would result in the total impedance of the lines being in the same ratio as the resistances. This would result in a division of both current and kilowatt load in accordance with the line cross-sections. However, the problem is complicated by the wide range in reactor sizes which must be installed, as shown in the following:

For the purpose of this study it may be assumed that in order to limit drop in bus voltage (due to line fault) to a value at which synchronous equipment will not fall out of step a minimum reactance of 1 ohm will be required. Such a reactor installed in a 300,000-circ.mil line a mile in length would result in a total impedance of 1.194 ohms. ($R = 0.194$ ohm; $X = 0.178 + 1.000 = 1.178$ ohms).

TABLE II

External reactance in ohms required in 300,000-circ.mil cable (operating in parallel with No. 4/0 B. & S. gage cable having 1-ohm external reactor) in order that cables may divide current and kilowatt load in accordance with the respective cross-sections.

| Length in Miles | Total Reactance (Ohms) Inherent and External | Inherent Reactance (Ohms) | External Reactance (Ohms) |
|---|---|---|---|
| 1 | 0.838 | 0.178 | 0.660 |
| 2 | 0.971 | 0.356 | 0.615 |
| 3 | 1.103 | 0.534 | 0.569 |
| 4 | 1.236 | 0.712 | 0.524 |
| 5 | 1.368 | 0.890 | 0.478 |
| 6 | 1.496 | 1.068 | 0.428 |
| 7 | 1.634 | 1.246 | 0.388 |
| 8 | 1.766 | 1.424 | 0.342 |
| 9 | 1.899 | 1.602 | 0.297 |
| 10 | 2.032 | 1.780 | 0.252 |
| 1 | 2.164 | 1.958 | 0.206 |
| 12 | 2.297 | 2.136 | 0.161 |
| 13 | 2.429 | 2.314 | 0.115 |
| 14 | 2.562 | 2.492 | 0.070 |
| 15 | 2.695 | 2.670 | 0.025 |
| 15.67 | 2.784 | 2.789 | ..... |

In order to have the total impedance in the same ratio to the 300,000-circ.mil line as the resistances the No. 4/0 line ($R = 0.275$ ohm, $X = 0.188$ ohm) would have a total impedance of $(0.275 \div 0.194) \times 1.194 = 1.692$ ohms, and a total reactance of $(0.275 \div 0.194) \times 1.178 = 1.670$ ohms, or an external reactance of $1.670 - 0.188 = 1.482$ ohms. If the length of line were to be 10 miles and the same size of reactor were installed in the 300,000-circ.mil line, the total impedance would become 3.39 ohms. ($R = 1.94$ ohms; $X = 1.78 + 1.00 = 2.78$ ohms.) The total impedance of the No. 4/0 line then must be $(2.75 \div 1.94) \times 3.39 = 4.81$ ohms and the total reactance $(2.75 \div 1.94 \times 2.78 = 3.94$, or an external reactance of $3.94 - 1.88 = 2.06$ ohms.

It becomes evident that with a fixed ohmic (external) reactor in a 300,000-circ.mil line the ohmic reactance required in the No. 4/0 line varies with the length of line. With lines 15 miles in length and with 1 ohm external reactance in the 300,000-circ.mil line the external reactor required in the No. 4/0 line becomes 2.38 ohms, or a 5.5 per cent reactor based on a rating of 200 amp. at 15,000 volts. The 1-ohm reactor assumed for the 300,000-circ.mil line based on 300 amp. at 15,000 volts is equivalent to approximately 3.5 per cent. If reactors as shown in Table I were installed in the No. 4/0 line, the current and kilowatt load would divide in accordance with the cross-sections. The above condition is illustrated graphically in the accompanying illustration (Fig. 1).

In a similar way it can be shown that if the fixed size and rated reactor were to be installed in the No. 4/0 line, the reactor required in the 300,000-circ.mil line (in order to divide current and kilowatts in accordance with line cross-sections) would have a lower ohmic value than that of the fixed reactor and that this ohmic value would vary inversely as the length of the line. Calculations show that for a line 15.67 miles in length no reactor would be required in the 300,000-circ.mil line. Fig. 2 shows the above conditions in graphic form.

Assuming the same load conditions on lines ten miles in length and a 1-ohm reactor in each line, the current and kilowatt load would divide as follows:

No. 4/0:

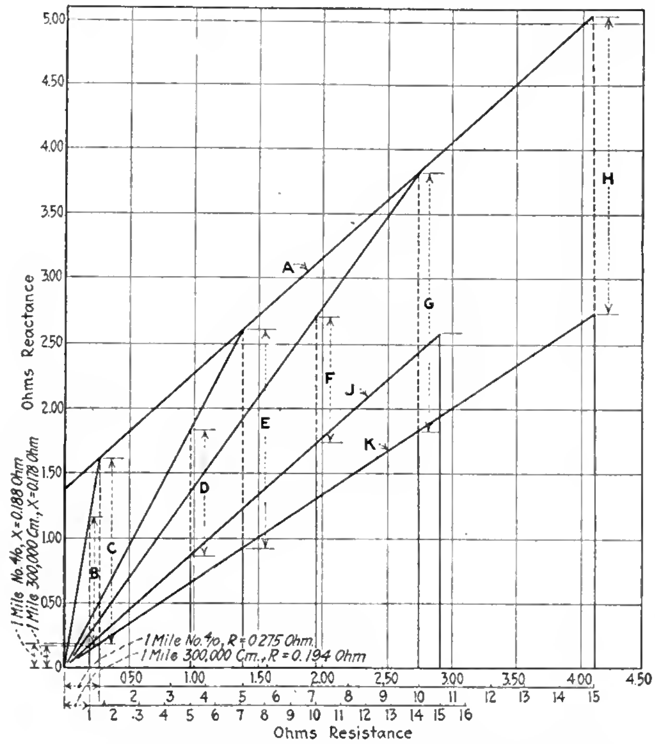
$$R = 2.75 \text{ ohms};\ X = 1.88 + 1 = 2.88 \text{ ohms};$$
$$Z = 3.98 \text{ ohms}.$$

5,106 kw., 5,977 kva., 85.43 per cent power factor, 230 amp.

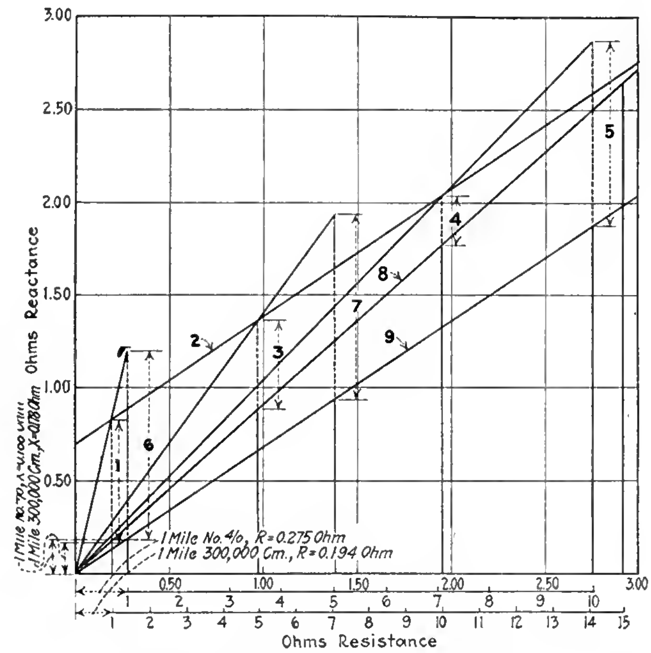
300,000-circ.mil:

$$R = 1.94 \text{ ohms};\ X = 1.78 + 1 = 2.78 \text{ ohms};$$
$$Z = 3.39 \text{ ohms}.$$

5,294 kw., 7.023 kva., 75.38 per cent power factor, 270 amp. Resultant $X = 1.414$ ohms. Resultant $Z = 1.831$ ohms.




A—Total reactance required in No. 4/0 B. & S. line in order to divide current and kilowatt load with 300,000-circ.mil line (having 1-ohm external reactor) in accordance with respective cross-sections.
B—1-ohm external reactor in 300,000-circ.mil, 1-mile line; 1.482-ohm external reactor required in No. 4/0, 1-mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
C—1-ohm external reactor in 300,000-circ.mil, 5-mile line.
D—1.739-ohm external reactor required in No. 4/0, 5-mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
E—1-ohm external reactor in 300,000-circ.mil, 10-mile line.
F—2.061-ohm external reactor required in No. 4/0, 10-mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
G—2.382-ohm external reactor required in No. 4/0, 15-mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
H—300,000-circ.mil cable impedance.
I—No. 4/0 B. & S. cable impedance.




(1) 0.660-ohm external reactor required in 300,000-circ.mil, 1 mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
(2) Curve of total reactance required in 300,000-circ.mil line in order to divide current and kilowatt load with No. 4/0 line (having 1-ohm external reactor) in accordance with respective cross-sections.
(3) 0.479-ohm external reactor required in 300,000-circ.mil, 5-mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
(4) 0.252-ohm external reactor required in 300,000-circ.mil, 10-mile line in order that lines may divide current and kilowatt load in accordance with cross-sections.
(5) 1-ohm external reactor in No. 4/0, 10-mile line.
(6) 1-ohm external reactor in No. 4/0, 1-mile line.
(7) 1-ohm external reactor in No. 4/0, 5-mile line.
(8) 300,000-circ.mil cable impedance.
(9) No. 4/0 B. & S. cable impedance.

FIGS. 1 AND 2—RESISTANCE, REACTANCE AND IMPEDANCE OF NO. 4/0 B. & S. AND 300,000-CIRC.MIL LINES OF VARIOUS LENGTHS

With 1-ohm external reactor in the 300,000 circ.mil line (for division of current and kilowatt load in accordance with respective cross-sections) the reactance required in the No. 4/0 line varies directly as the line length. (See Table I.) With the reactor in the No. 4/0 line the reactance required in the 300,000-circ.mil line varies inversely as the length. (See Table II.)

TABLE III—DIVISION OF KILOWATT, KILOVOLT-AMPERE AND AMPERE LOAD AND POWER FACTOR WITH 1 OHM EXTERNAL REACTOR IN EACH LINE

| Length of Line, Miles | No. 4 B. & S. Kw. | Per Cent of Total Kw. | Kva. | Per Cent of Total Kva. | Amp. | Power Factor, Per Cent | 300,000 Circ.mil. Kw. | Per Cent of Total Kw. | Kva. | Per Cent of Total Kva. | Amp. | Power Factor Per Cent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5,182 | 49.83 | 6,430 | 49.46 | 247 | 80.59 | 5,218 | 50.17 | 6,570 | 50.54 | 253 | 79.42 |
| 2 | 5,162 | 49.64 | 6,338 | 48.75 | 244 | 81.45 | 5,238 | 50.36 | 6,662 | 51.25 | 256 | 78.63 |
| 3 | 5,147 | 49.49 | 6,257 | 48.13 | 241 | 82.26 | 5,253 | 50.51 | 6,743 | 51.87 | 259 | 77.90 |
| 4 | 5,141 | 49.43 | 6,192 | 47.63 | 238 | 83.03 | 5,259 | 50.57 | 6,808 | 52.37 | 262 | 77.25 |
| 5 | 5,130 | 49.33 | 6,133 | 47.18 | 236 | 83.65 | 5,270 | 50.67 | 6,867 | 52.82 | 264 | 76.74 |
| 6 | 5,127 | 49.30 | 6,092 | 46.86 | 234 | 84.16 | 5,273 | 50.70 | 6,908 | 53.14 | 266 | 76.33 |
| 7 | 5,119 | 49.22 | 6,053 | 46.56 | 233 | 84.57 | 5,281 | 50.78 | 6,947 | 53.44 | 267 | 76.02 |
| 8 | 5,117 | 49.20 | 6,022 | 46.32 | 232 | 84.97 | 5,283 | 50.80 | 6,978 | 53.68 | 268 | 75.71 |
| 9 | 5,111 | 49.15 | 6,001 | 46.16 | 231 | 85.17 | 5,289 | 50.85 | 6,999 | 53.84 | 269 | 75.57 |
| 10 | 5,106 | 49.10 | 5,977 | 45.98 | 230 | 85.43 | 5,294 | 50.90 | 7,023 | 54.02 | 270 | 75.38 |
| 11 | 5,105 | 49.09 | 5,958 | 45.83 | 229 | 85.68 | 5,295 | 50.91 | 7,042 | 54.17 | 271 | 75.19 |
| 12 | 5,101 | 49.05 | 5,945 | 45.73 | 229 | 85.80 | 5,299 | 50.95 | 7,055 | 54.27 | 271 | 75.11 |
| 13 | 5,100 | 49.04 | 5,929 | 45.61 | 228 | 86.02 | 5,300 | 50.96 | 7,071 | 54.39 | 272 | 74.95 |
| 14 | 5,097 | 49.01 | 5,919 | 45.53 | 228 | 86.11 | 5,303 | 50.99 | 7,081 | 54.47 | 272 | 74.89 |
| 15 | 5,097 | 49.01 | 5,910 | 45.46 | 227 | 86.24 | 5,303 | 50.99 | 7,090 | 54.54 | 273 | 74.80 |

After the above study, the Edison Electric Illuminating Company of Boston, which found itself faced with this problem, decided to install reactors having taps permanently built into the reactor structure. The plan is to install these tapped reactors in No. 4/0 B. & S. gage lines which are required to operate in parallel with lines of 300,000-circ.mil cross-section, the purpose being to utilize the full cross-section of copper installed and also minimize copper losses.

Assume that two transmission lines operating in parallel, one of No. 4/0 B. & S. gage and the other of 300,000-circ.mil cross-section, to have been equipped with reactors, as above outlined; assume further that the No. 4/0 B. & S. gage line is to be looped in and out the premises of a new customer having a demand in the neighborhood of 1,000 kva., it becomes evident at once that this No. 4/0 line will reach full load in advance of the 300,000-circ.mil line.

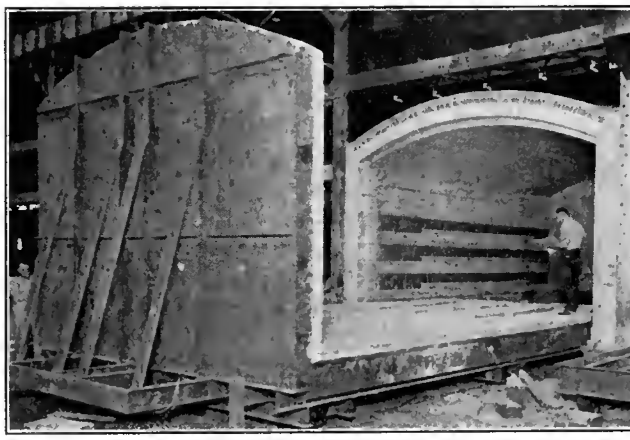
A further advantage of having this smaller line equipped with a reactor having taps is that they limit the current in the smaller line and increase the current in the larger line.

## Electric Furnace for Annealing Turbine Castings

THERE has been installed recently in the Schenectady plant of the General Electric Company an automatically controlled heat-treating furnace which is probably unique both in the matter of size and in the kind of work done. It is used for annealing large turbine castings, some weighing 85,000 lb., to relieve the internal strains left in castings, which would otherwise cause them to break or warp when machined.

The inside dimensions of the furnace are: Width, 15 ft. 10 in.; length, 27 ft. 7 in.; height, 8 ft. 7 in. The total connected load is 700 kw. at 550 volts, three-phase. The temperature maintained is 1,000 deg. F. The load is divided into two sections, 160 kw. being on the car top, which forms the floor of the furnace, and 540 kw. on the two side walls. The furnace is heated with General Electric ribbon resistor units. The door is mounted at one end of the car, the whole being pulled in or out to close or open the furnace.

In order to relieve the strains in a casting properly, it is necessary to have an exact uniformity of temperature in all parts of the furnace. By beginning the car top or floor heaters and the side-wall heaters with independent automatic temperature control a variation which tests have shown to be not greater than plus or minus 10 deg. has been obtained under operating conditions. The furnace has been a complete success, and up to the present there has not been a single case of a casting being rejected because of improper annealing. The great cost of these large castings made it imperative to install a furnace with absolute accurate temperature control.



ANNEALING FURNACE FOR 85,000-LB. CASTINGS

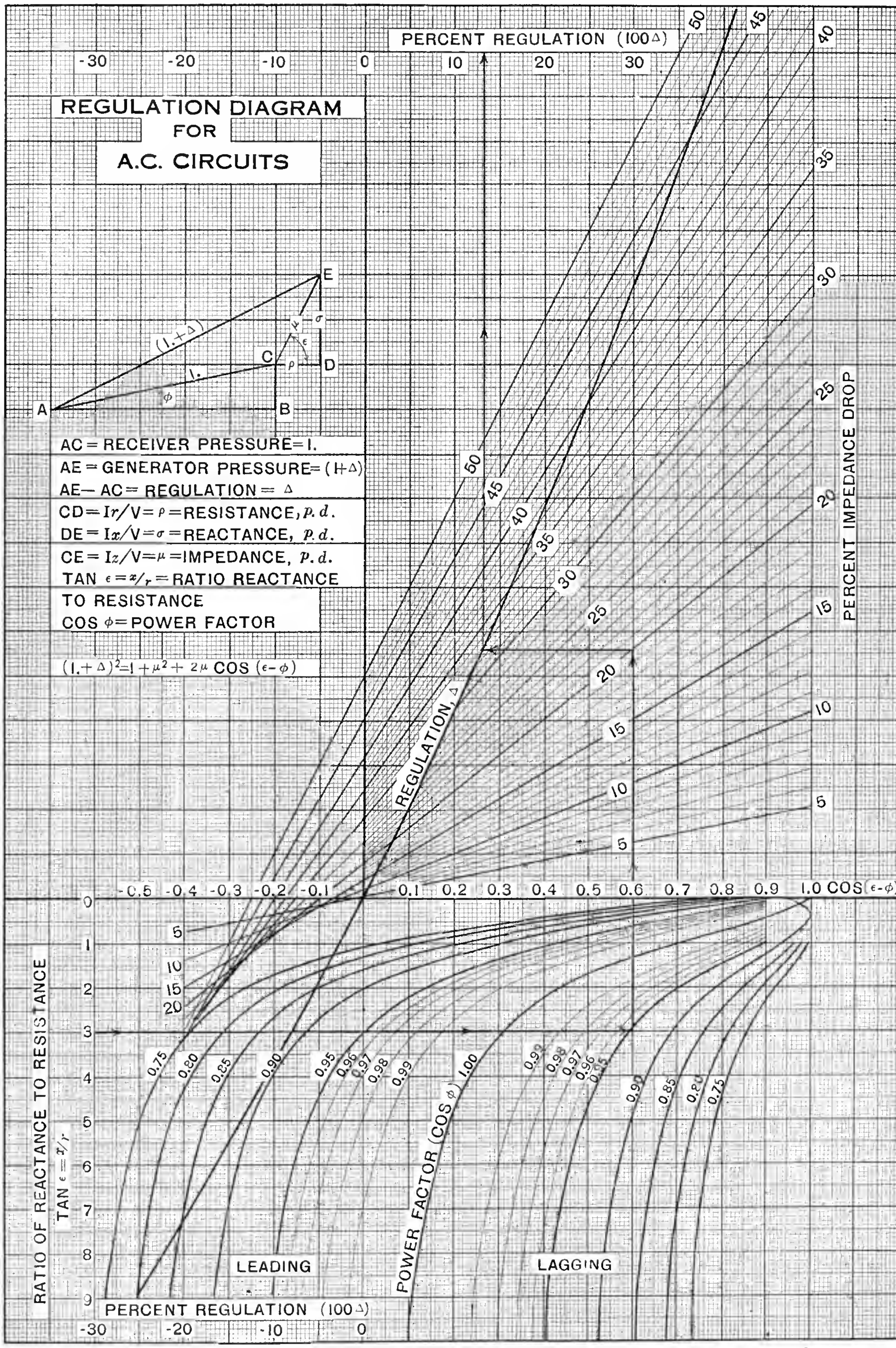
# Quick Calculation of Line Regulation

### Chart Which Permits Determination of the Characteristics that a Line Must Have to Meet Given Performance

BY CARY T. HUTCHINSON
Consulting Engineer, N. Y.

A NUMBER of diagrams for determining the regulation of alternating-current circuits are in use. Several of them, notably that of Baum, involve parts having relative motion; others, as the Mershon diagram, involve either the construction of the impedance triangle on the diagram or the use of a straight edge. as the Dwight. These are all somewhat intricate and do not lend themselves as readily as might be to the quick determination of regulation under different conditions.

The diagram on page 1466 gives the regulation for any circuit at any power factor, either lagging or leading, when the ratio of reactance to resistance, $x/r$, and the impedance pressure drop are known for any given circuit conditions. For explanation of chart see page 1467.



PERCENT REGULATION (100Δ)
-30 -20 -10 0 10 20 30
REGULATION DIAGRAM
FOR
A.C. CIRCUITS
AC = RECEIVER PRESSURE = 1.
AE = GENERATOR PRESSURE = (1+Δ)
AE— AC = REGULATION = Δ
CD = Ir/V = ρ = RESISTANCE, p.d.
DE = Ix/V = σ = REACTANCE, p.d.
CE = Iz/V = μ = IMPEDANCE, p.d.
TAN ε = x/r = RATIO REACTANCE
TO RESISTANCE
COS φ = POWER FACTOR
$(1.+\Delta)^2 = 1 + \mu^2 + 2\mu \cos(\epsilon - \phi)$
PERCENT IMPEDANCE DROP
REGULATION, Δ
-0.5 -0.4 -0.3 -0.2 -0.1 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 COS (ε-φ)
RATIO OF REACTANCE TO RESISTANCE
TAN ε = x/r
POWER FACTOR (COS φ)
LEADING
LAGGING
PERCENT REGULATION (100Δ)
-30 -20 -10 0

## Directions for Use of Chart Enabling Calculation of Line Regulation

Knowing the ratio of reactance to resistance and the impedance pressure drop, proceed as follows: Enter the diagram on the axis of $x/r = \tan \epsilon$ at the lower left edge of the diagram, at the given value of $x/r$, for instance, 3. Follow this ordinate to the right to the curve marked with the power factor of the circuit, e.g., 0.95; follow vertically upward to the diagonal line marked with the value of the impedance pressure drop, e.g., 20 per cent; follow horizontally to the intersection with the "regulation" curve. The regulation is the value of the abscissa of this curve given at the top of this sheet; in this case, 13.2 per cent.

**To determine the power factor required to give any particular regulation, proceed as follows:** Follow horizontally from the value of the regulation—e.g., 15 per cent—to the intersection with the locus of the impedance pressure drop, e.g., 25 per cent; follow vertically down to the intersection of that line with the value of $x/r$, e.g., 3. The point of intersection then lies on the power-factor curve, approximately 0.965.

**For zero regulation** the intersection of the axis of abscissas with the line for the value of impedance drop—e.g., 25—determines the point at which the vertical line to the value of $x/r$ shall be run. If $x/r = 3$, the intersection of this line with the vertical gives a leading power factor of 0.9; i.e., a circuit having a reactance ratio of 3 operated at leading power factor of 0.9 will be self-regulating if $\mu = 25$ per cent.

### BASED ON VECTOR-TRIANGLE SOLUTION

The diagram is based upon the solution of the ordinary vector triangle, as shown. It is accurate to the degree that the scale can be read. The value of $(1 + \Delta)^2$ is plotted in terms of cos $(\epsilon - \phi)$ for constant values of $\mu$, the impedance pressure drop. The equation giving the generator pressure is

$$(1 + \Delta)^2 = 1 + \mu^2 + 2\,\mu \cos (\epsilon - \phi).$$

This gives a family of straight lines for the series of values of $\mu$. The square root of the value of the ordinate, $(1 + \Delta)^2$, is given by the curve marked "regulation." Dropping unity, the value of $\Delta$, the "regulation," is read on the horizontal scale at the top of the diagram.

The first step in the use of the diagram is to find $r$, the resistance per mile, and $x$, the reactance per mile, from tables, or from the following formulas:

$r = 10^{-2} \times 5.6/N$, ohms per mile,

(at 60 cycle) $x = 0.11 + 0.28 \log D/d$, ohms per mile,

where $N$ = area of wire, circular-inches,

$D$ = distance apart of wires in inches,

$d$ = diameter of wire in inches.

The value of $x$ can readily be found by the slide rule.

The following approximation, not a very close one,

$$x/r = 12.5N,$$

will serve for transmission lines with spacing about 8 ft. to 10 ft. and conductors from No. 0 to 0.7 circ.-in.; this assumes $x$ to be constant over the range of sizes included.

For values of $x/r$ greater than 10, the limit of the diagram, 10 may be used with small error, inasmuch as the angle for $\tan \epsilon = 10$ is nearly 90 deg., and considerable differences in the value of $x/r$, when greater than 10, give small differences in cos $(\epsilon - \phi)$ and negligible differences in the regulation, as may readily be proved by trial.

The resistance pressure drop, $\rho$, is related to the power loss, $\lambda$, by the equation

$$\lambda \cos \phi = \rho$$

$\lambda$ may be one of the assumed data.

If the size of conductor is assumed, instead of the power loss, then $\rho$ may be found from the basic data of the problem.

Let $Q$ = apparent power delivered, in kva.,

$P$ = power delivered, in kw.,

$V$ = pressure delivered, in kv.,

$\cos \phi$ = power factor,

$L$ = distance, in miles,

$N$ = area of conductor, in circular inches,

$\lambda$ = power loss, in per cent/100,

$\rho$ = resistance pressure drop, in per cent/100.

Then,

$$Q \cos \phi = P$$

$$\lambda \cos \phi = \rho$$

and $$\rho N = 10^{-5} \times 5.6 \left(\frac{Q}{V}\right)\left(\frac{L}{V}\right).$$

This equation gives either $\rho$ or $N$, when the other is known.

Next, $\mu$, the impedance pressure drop, is determined from $\rho$, the resistance pressure drop, by the equation

$$\mu^2 = (1 + \overline{x/r^2})^2.$$

This value is readily found by slide rule. It is usually sufficient to take

$$\mu = \rho x/r;$$

that is, to take reactance equal to impedance, inasmuch as $x/r$ is usually greater than 3, for 60 cycles.

Having thus found $x/r$ and $\mu$, and cos $\phi$ being given, the regulation is taken directly from the diagram.

The foregoing discussion ignores line capacity. For pressures up to 66 kv. and distances up to 100 miles, the effect of charging current is practically negligible. For example, in that case the charging current would be about 20 amp. and 760 kva. per conductor. If the total apparent power transmitted is 22,800 kva., the charging current is equivalent to about 10 per cent of the line current. The effect of this on regulation can be found by first calculating the equivalent power factor, as follows:

Assume, $\cos \phi = 0.85$, $\sin \phi = 0.53$; the correction to $\sin \phi$ on account of capacity is, $0.10/2 = 0.05$; hence

$\sin \phi' = (0.53 - 0.05) = 0.48$, and

$\cos \phi' = 0.88$.

If $x/r = 5.0$, and

$\mu = 30$, the diagram gives for

$\cos \phi = 0.85$, $\Delta = 22.0$ per cent;

$\cos \phi' = 0.88$, $\Delta' = 20.7$ per cent.

If the pressure is 132 kv., the charging current is doubled and

$\sin \phi' = (0.53 - 0.10) = 0.43$ per cent,

$\cos \phi'' = 0.90$ per cent

$\Delta' = 20.0$ per cent.

Even in this case—i.e., 45,600 kva., 100 miles at 132 kv.—the correction to the regulation is only 10 per cent.

### REFERS TO LINE REGULATION ONLY

The examples given here refer to the line only. The regulation should include the transformer drop as well; therefore, the ratio $x/r$ is not dependent upon the line alone; it is found by summing up the resistance drops and the reactance drops of transformers and line. As an example: Resistance pressure drop in each transformer, 0.75 per cent; reactance, 10 per cent; resistance pressure drop in line, 6.0 per cent; $x/r$ of line = 3. Then total resistance pressure drop = 7.5 per cent, total reactance pressure drop = 10 + 10 + (3 × 6) = 38, and $x/r$ for the circuit = 38/7.5 = 5.06. Regulation is then fixed by $x/r = 5.06$, $\mu = 38$; for $\cos \phi = 0.9$, $\Delta = 26.5$ per cent.

### EXAMPLES THAT ILLUSTRATE THE USE OF THE DIAGRAM

| Data: | Results: |
|---|---|
| 1. $\cos \phi = 0.9$, $x/r = 5$, $\mu = 20$. | 1. $\Delta = 13$, $\rho = 4$, $\lambda = 4.4$, $N = 0.4$. |
| 2. $\cos \phi = 1.0$, $x/r = 5$, $\mu = 20$. | 2. $\Delta = 5.5$, $\rho = 4$, $\lambda = 4$, $N = 0.4$. |
| 3. $\cos (-\phi) = 0.85$, $x/r = 5$, $\mu = 20$. | 3. $\Delta = -5.5$, $\rho = 4$, $\lambda = 4.7$, $N = 0.4$. |
| 4. $x/r = 4$, $\mu = 20$, $\Delta = 10$. | 4. $\cos \phi = 0.98$, $\rho = 5$, $\lambda = 5.1$, $N = 0.32$. |
| 5. $x/r = 4$, $\mu = 20$, $\Delta = 0$. | 5. $\cos (-\phi) = 0.95$, $\rho = 5$, $\lambda = 5.3$, $N = 0.32$. |
| 6. $x/r = 3$, $\rho = 5$, $\Delta = 0$. | 6. $\cos (-\phi) = 0.92$, $\mu = 15$, $\lambda = 5.4$, $N = 0.24$. |
| 7. $P = 28{,}000$ kw. $\cos \phi = 0.85$, $L = 6.6$, $V = 66$, $N = 0.28$. | 7. $Q = 33{,}000$ kva., $\rho N = 10^{-2} \times 2.8$, $\rho = 10$, $x/r = 3.5$, $\mu = 35$, $\Delta = 28.3$, $\lambda = 11.8$. |
| 8. Same as (7) except $\cos \phi = 1.0$. | 8. $\rho = 8.5$, $\mu = 29.8$, $\Delta = 11.7$, $\lambda = 8.5$. |

In the above examples $N$ has been found by the approximate formula above; hence these results are applicable to transmission lines of approximately 8 ft. to 10 ft. spacing, as already stated.

# The Management of Suburban Districts

## An Outline of the Methods that Are Followed in the District Offices of the Detroit Edison Company—Line and Staff Organization—Billing, Collecting and Contact with Customers

By HERBERT SILVESTER
*District Agent the Detroit Edison Company, Ann Arbor, Mich.*

SALESROOM OF THE ANN ARBOR DISTRICT OFFICE, DETROIT EDISON COMPANY, WHICH FUNCTIONS FOR ALL DEPARTMENTS IN THE COMPANY'S RELATIONS WITH THE CUSTOMER AND THE PUBLIC

THE Detroit Edison Company furnishes electric light and power to an area with a radius of approximately 50 miles, surrounding Detroit on the north, west and south. In this area are thirteen incorporated cities and fifty villages. With the exception of five small hydro-electric plants along the Huron River and a steam turbo-generator plant at Marysville, the current is generated in Detroit and transmitted to the outlying districts.

Where possible the departments which function in the metropolis also operate in the suburban districts. That is, the operation of generating plants, substations and transmission lines, the maintenance and construction of overhead lines, general engineering and other work of like nature are directed and supervised by the appropriate Detroit departments, the entire area forming one operating district.

However, because of the necessity of maintaining an intimate contact with the customer, local organizations have been established for the purpose of handling all the relations between customers and the company. To this end nine commercial districts were formed, each in charge of a district agent who reports directly to the vice-president and sales manager. Each district has a complete staff, adequate for taking care of its own business activities, which include, in part, billing customers' accounts, reading meters, collections, applications for new service, connecting and disconnecting meters, selling electrical appliances, soliciting new business, complaints and adjustments and all other work of a commercial nature.

### "LINE AND STAFF" ORGANIZATION

It will be readily seen that the various departments which center at Detroit and reach out into the districts partake of a functional character, while the district organization is of the line or military type. The efficient features of a functional organization have been retained by allocating work of a technical or semi-technical nature to departments best organized to handle it. With one central control all construction and operating is done uniformly and standards are adhered to more rigidly than under nine separate operating units. It is also possible to have a staff of employees whose training is highly specialized in their particular work. But where directness of action is necessary, as in service to customers, the line type of organization in the commercial department is most effective.

The co-ordination of all departments must be smooth indeed to prevent any whipping at the loose ends. It

has been found feasible therefore to place in the field representatives of the Detroit operating departments who work closely with the district agents. The overhead-lines department is represented by a district foreman, who, through his inspectors and gang foreman, keeps closely in touch with the district agent. Orders for extensions and service drops are sent directly to this district foreman. In addition, all estimates for new business extensions are made at the district offices, thereby keeping in local control all matters which are of a local nature. It is essential also that each local office shall have complete and up-to-date reports of proposed line extensions and service drops. Jobs of this kind must, of course, be scheduled and the customers notified regarding the expected date of completion.

The department operating substations and transmission lines must at times interrupt service to customers. When these interruptions can be foreseen, the commercial department greatly assists both company and customer by conferring with the customers affected and then designating the time and period of interruption. In the matter of voltage regulation, the commercial department maintains recording voltmeters on every feeder for the purpose of recording voltage conditions on customers' premises.

As a number of separate municipalities, each with its own political organization and economic problems, are included in each district, it is essential that the company be directly represented by agents who have the support of the general management. Men trained in the company's policies and practices are assigned to this work. Complaints and adjustments are handled direct so as to afford the customer quick and efficient service.

Uniformity of policy is also essential as the geographic boundaries are not always clearly marked and customers in one district must not be dealt with differently from those in other districts. To this end district agents' meetings are held bi-weekly in Detroit with the vice-president and sales manager presiding, at which time questions of policy and practice that may arise are thoroughly discussed.

The billing of customers is generally done at the local offices and on machines if the number of bills rendered from any one office justifies the overhead expense of this equipment. Where machines are used extra copies of the proof or trial-balance manifold sheets are made. The customers' ledgers are kept in a central office, and every local office is furnished with a sheet showing the details of accounts, thereby permitting quick reference in cases of inquiries regarding bills.

Generally, residence bills are rendered for two months' periods. Each district is divided into two areas and each area is billed on alternate months. By this means it is possible to read meters and render bills with a minimum of expense. Monthly reports showing total kilowatt-hours sold and total of the net bills rendered are sent to the general accountant at Detroit for posting to the general ledger. An analysis of earnings showing kilowatt-hours and net bills sold in each class of service is sent monthly to the statistician at Detroit.

### HANDLING COLLECTIONS

Every village and city has a local office where bills are payable, except in cases where the community is too small to justify the maintaining of an office. In this case an agency is established, generally at a local bank. Bills are delivered by hand in cities and villages and are mailed in rural areas. Customers receive the bills before the first of the month and are allowed ten days for payment with discount.

Soon after the discount day overdue statements are mailed. If no attention is paid to the mailed statement, a series of three follow-up letters is started, the last giving notice that the service must be disconnected for non-payment. The obvious follows. If no response is made to the last or "cut-off" letter, some one is sent to discontinue service, without further notice, unless payment is made when he calls. This collection routine is followed in all cases where customers have good records for payment, but if a customer is so negligent as to become a habitual delinquent only the overdue statement and "cut-off" letter are sent out.

Collection of bad debts is taken care of by the local organization, as its members are more intimately informed regarding conditions affecting the account. Sometimes extra pressure is advisable and a collector from Detroit is called in to make an effort to secure a settlement from a different angle. After all ordinary means of collection are exhausted, the unpaid bills are charged to "uncollectible" and the collection bureau in Detroit starts collecting through legal procedure.

All cash collected is deposited daily in a district depository bank. A duplicate deposit receipt is for-


TWO OF THE DETROIT EDISON COMPANY'S DISTRICT OFFICES, LOCATED IN ROCHESTER (LEFT) AND MONROE, MICH. (RIGHT). BUILDINGS ARE DESIGNED OR SELECTED THAT ARE IN HARMONY WITH THE COMMUNITY AND THE LOCATION

warded to the auditor, who keeps a duplicate cash record. Withdrawals can be made only from the district depository banks by the company's treasurer or auditor.

Fuse calls are made during reasonable hours in villages and rural districts—that is, between 7 a.m. and 10 p.m. In cities of more than 25,000 population fifteen-hour trouble service is given. This work is done without charge to the customers. The repairmen locate the source of trouble, if possible remove it, and fuse the circuit. Where it is necessary to do more than make simple repairs the customer is requested to hire a wiring contractor. Repairs are made to domestic appliances and electric ranges. A complete line of washing-machine and vacuum-cleaner repair parts and replacement heating elements is carried.

Special attention is paid to quick servicing, as dead appliances earn no money for the company. If a customer is in the midst of her ironing and her electric flatiron burns out a "loan" iron is immediately sent her for use until her own iron can be repaired and returned. Service motors are also carried for washing machines and vacuum cleaners. These service motors are painted red, numbered and lettered with the company's name. If the motor on a customer's washing machine breaks down in the midst of a washing, the delay is not long as a service motor is installed and remains in use until the regular motor comes back from the factory, where it is sent for replacement or repairs.

This repair service is limited to domestic appliances of the lamp-socket class. Customers are charged for material required at cost plus 10 per cent. No charge is made for the labor, however, as this is compensated for by the energy used during the period in which the appliance would otherwise be laid up and by the good will thus created.

### Contact with Customers

The actual sales work in smaller communities must be a matter of personal contact between the company and its customers. Soliciting new business is done informally through intimate service. Power installations are closely followed up to see that the customers are apprised of the most efficient methods of electric power applications, and should there be a need of expert engineering advice, this is obtained from the Detroit sales department. The same practice applies to large or unusual lighting installations. All new buildings are closely watched to see that the electric wiring is installed so as to be convenient and efficient.

The application of the company's practice and policy is direct and involves a close personal relationship between the customers and the utility. The district agent or his assistants are acquainted with all the merchants and manufacturers. Contacts are made at various social functions and over the tables of luncheon clubs. Complaints are not accompanied by the acrimony that is sometimes present when the large city customers complain. A series of formal letters gives way to informal conversation, and settlements are made by a satisfactory personal handling of the customer's difficulty. While the remedy is being applied the customer has an opportunity to learn in detail of the company's policies.

It will be readily seen that co-ordination of departments must be as real as it is possible to accomplish with human beings if the best results are to be obtained. This company has enjoyed unusual success in the working arrangements between departments, and credit must be given to the fine co-operative spirit which has been shown by the individual employees.

# Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

## Kilowatt-Hour Rate of Two Mills Necessary to Make Electro-Steam Generation Profitable

*To the Editors of the* ELECTRICAL WORLD:

In the issue of the ELECTRICAL WORLD for June 9, 1923, on page 1374, in the article headed "A. S. M. E. Hears of Canada's Water Power," it is stated that "surplus water power was used for electric boilers in several plants, but that energy would have to sell at about two cents a kilowatt-hour before it could compete with ten-dollar coal for such purposes."

In reply to a question by John R. Freeman as to the value of electric power when utilized to produce steam, I stated that "one kilowatt-hour produces very approximately 3 lb. of steam in an electric boiler under normal operating conditions. If we assume an average evaporation of 7½ lb. of steam per pound of coal, then one ton of coal produces 15,000 lb. of steam, and therefore 5,000 kw.-hr. is equivalent to one ton of coal. If the cost of coal is $10 per ton, the equivalent value of 5,000 kw.-hr. is $10, so that one kilowatt-hour is worth two mills."

Your reporter evidently put his decimal point in the wrong place and wrote two cents instead of two mills. Will you be good enough to correct this error in your next issue as the subject of the use of electric power for the generation of steam is attracting so much attention that we do not want an erroneous impression to get abroad regarding the value of power for this purpose.

P. S. GREGORY,
Assistant to the Vice-President.
Shawinigan Water & Power Company,
Montreal, Canada.

## A Tribute to Louis Bell

*To the Editors of the* ELECTRICAL WORLD:

The passing of Dr. Louis Bell removes an engineer of surpassing abilities from the profession which he so greatly adorned, but more than this, it deprives a widening circle of friends of a man whose personal charm was very unusual. Few engineers were so gifted in the use of the mother tongue or so competent to make clear the complexities of physical science to readers of the technical press. Mingled with Dr. Bell's profound knowledge of electrical engineering and his specialized comprehension of the laws and methods of illumination and optics were a humorous understanding of men and an enthusiasm for social intercourse with his intellectual kindred that made him a delightful companion to those fortunate enough to know him. His writings for many years have enriched the literature of applied science. He combined great scientific ability with practical engineering judgment and was equally at home whether addressing the American Academy or a municipal street-lighting committee.

He gave his best to the work before him and inspired others to do likewise. He was always looking forward, and the passing years were but stepping stones to new achievement. Research and practice both called him to distinguished service, and his memory will long remain among those who had the privilege of his acquaintance.

HOWARD S. KNOWLTON.
Cambridge, Mass.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Stripper Ram Repaired by Arc Welding

THE application of electric welding for repairing stripper rams should be of interest to steel-mill maintenance engineers. In the repair work considered below the ram was 10 in. in diameter and was broken off about 3 ft. from the lower end. With the ram lowered to the extreme limit the broken end was still between the tongs and only 20 in. below the housing of the ram. At the upper limit of travel the broken end would be well up in the housing.

COST OF WELDING STRIPPER RAM

| | | |
|---|---|---|
| New ram, 30 ft. long, 10 in. diameter | $200.00 | |
| Removing old ram and installing new ram | 100.00 | |
| | | $300.00 |
| Old method of welding | $500.00 | |
| Cost of preparation | 48.50 | |
| Cost of finishing | 5.00 | |
| | | $553.50 |
| Arc welding: | | |
| Welding labor and material | $200.00 | |
| Cost of preparation | 33.50 | |
| Cost of electric power | 6.00 | |
| Cost of finishing | 2.00 | |
| Total | | $241.50 |

Consequently this eliminated the possibility of leaving any reinforcement at the point of the break.

After analyzing the problem, a new tip for the ram was prepared from new steel stock, leaving the upper end of the piece cut off flat on the end at right angles with the axis of the piece. The stub end of the ram was then beveled off from two sides to form a blunt chisel end, the point for starting the cut for each face located above the end of the ram, a distance equal to the radius of the ram, in this instance 5 in. Each face was cut parallel with a plane through both of the tongs, so as to be easily available to the welder.

The new tip was then secured in place and proper alignment with the ram obtained by means of two bolts on opposite sides of the pieces, these bolts passing through two clamps, one secured near the upper end of the tip and the other secured to the ram just above the beveled faces. These bolts were inserted adjacent to the tongs, so as not to interfere with the welders.

The work was done during cold weather, and to make it possible for the welders to work continuously a platform about 8 ft. square was constructed at the correct height under the ram so that the welders could easily reach the surfaces to be welded. A housing and roof was constructed around this to protect the work and welders.

The total welding time was about eighteen man-hours, during which approximately 100 lb. of $\frac{3}{16}$-in. welding wire was used.

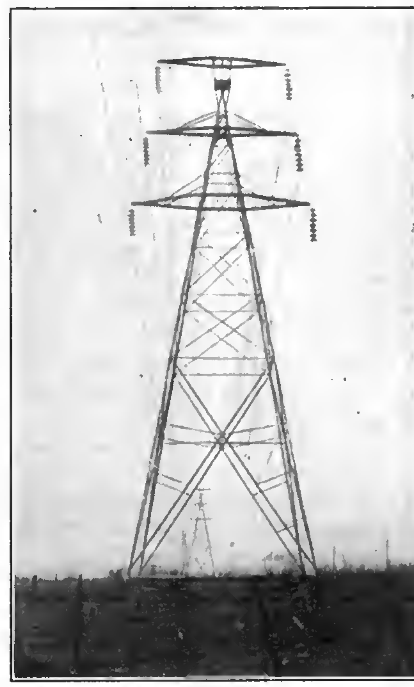
The alignment of the new tip with the main portion of the ram was almost perfect, and after grinding off the excess weld metal the ram could be drawn up into the stripper boom without any binding. This alignment was made possible by maintaining two welders at work at opposite sides, depositing an equal amount of metal on each side.

The cost of carrying out this work was much less than by the former methods, and the stripper was ready for service about twelve hours sooner. By examining the table of costs it appears that the cost of repairing a ram by the arc process shows only a slight saving over the cost of a new ram. However, the delay in obtaining a new ram would amount to several times this value, owing to the operators of the stripper being kept out of work.

A. M. CANDY,
General Engineering Department,
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

## Transmission Power Line Reconstructed

DURING the past year the Niagara, Lockport & Ontario Power Company of Buffalo, N. Y., completed the reconstruction of a 60,000-volt, single-circuit, pin-type insulator steel-tower line to a double-circuit, 110,000-volt line. The reconstructed suspension tower is shown in the accompanying illustration. The original line was built in 1906 with 550-ft. spacing and 214,000-circ.mil full aluminum cable with 19-ft. sag and 30-ft. ground clearance. Through the use of aluminum cable, steel-reinforced, and pulling this cable to a sag of 10½ ft., it was possible to install two circuits and maintain a ground clearance of not less than 25 ft. The decreased sag, of course, required much stronger structures at dead-end and deflection points, which were taken care of by new towers. Moreover, in some instances the intermediate suspension towers had to be raised by 5 ft. or 10 ft. More than 80 per cent of the old towers and 90 per cent of the old foundations could be utilized for this new construction.



RECONSTRUCTION OF 60,000-VOLT LINE FOR 110,000 VOLTS SAVED $2,000 A MILE IN TOWER COST

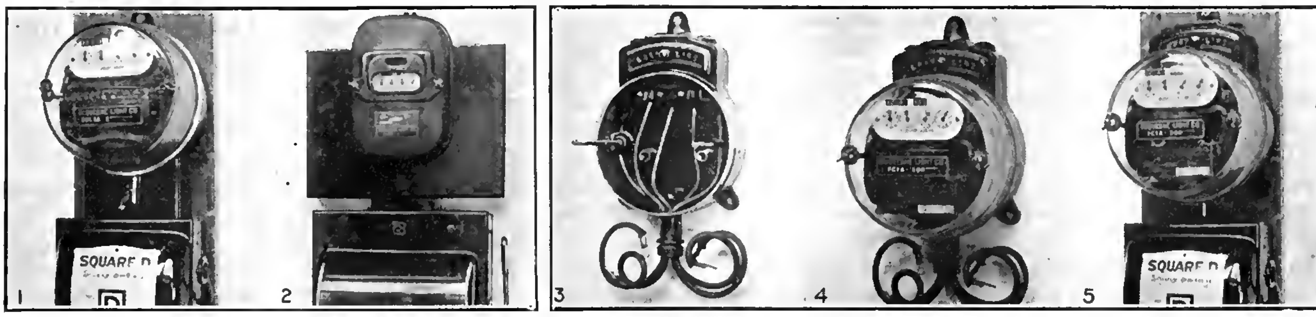
An analysis of the cost of the completed construction showed that the company saved at least $2,000 a mile in tower construction by utilizing the old towers and old foundations wherever possible.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

# Factors Influencing the Selection and Application of Motors and Control

- Industry
  - Product
    - Definition
    - Its Use
    - Process of Manufacture
  - Location with Reference to
    - Raw Materials
    - Labor as affected by
      - Local Economic Conditions
      - Local Sociological Conditions
      - Local Climatic Conditions
    - Transportation
      - Rail
      - Water
    - Markets
      - Domestic
      - Foreign
    - Competitive Processes
    - Power
      - Central Station Service / Local Generation / Steam Power
        - Fuel
          - Coal, Quantity, Quality, Cost
          - Oil or Other Fuel
          - Waste Products
        - Water for Boiler Feed and Condensers
        - Steam for Heating, Drying Ovens, Digesters, etc.
        - Steam Transmission Distances
      - Hydro-Electric Power
        - Meteorological Conditions
        - Continuity of Water Power
        - Liability of Transmission Difficulties
  - Power Requirements
    - Types of Machine
      - Function
      - Group Drive
      - Individual Drive
    - Motor Requirements
      - Electrical
        - Duty
          - Starting Torque / Running Torque
            - Constant
            - Varying as the Nth Power of Speed
            - Maximum
          - Frequency of Starting
          - Frequency of Reversals
          - Jogging
          - Repeated Cycle
          - Fly-wheel Effect
          - Acceleration and Retardation
          - Modification of Cycle
        - Horse Power Capacity
          - Average, Maximum, Minimum
          - Characteristics
            - Constant Speed
              - D. C. Shunt and Compound Motors
              - A. C. Squirrel Cage Induction Motors
            - Varying Speed
              - Series A. C. and D. C. Motors
              - Induction Motors with Rheostatic Control
            - D. C. Motors
              - Shunt Field Control
              - Generator Field Control
            - A. C. Motors
              - Multi-speed
              - Concatenation
              - Modified Scherbius System
              - Rotary Converter—Kraemer Sys.
              - Frequency Changer—Heyland Sys.
            - Reversing Motors
              - Small A. C. and D. C. Motors by reversal of Field Magnetism
              - Large Units—Reversed by Field Control
          - Continuous Rating
          - Intermittent Rating
        - Control
          - Manual
          - Remote
          - Automatic
          - Semi-Automatic
          - Braking
            - Solenoid
            - Magnetic
            - Regenerative
          - Protection
            - Low Voltage
            - Overload
              - Instantaneous or Time Limit
              - Slip Clutches or Gears
              - Breakable Spindles
          - Limit Switches
            - Geared
            - Contact
      - Mechanical
        - Bearings
          - End Shield Type
          - Pedestal Type
          - Furnished by Customer
          - Thrust Type
            - Plate Thrust
            - Breakable End Thrust
        - Stator Movement—Lateral
        - Method of Connection
          - Drive
            - Clutches
            - Couplings
              - Rigid
              - Flexible
              - Insulated
            - Gears (Permissible Speeds)
              - Helical
              - Spur
              - Silent Chain
            - Rope Drive (Permissible Speeds)
              - Multiple
              - Endless
          - Brakes (Steam, Air, Hydraulic or Hand Operated)
            - Band
            - Post
            - Disc
          - Lubrication
            - Ring Oiling
            - Gravity Oiling
            - Forced Oiling
            - Filtration of Oil
    - Electrification of
      - Old Plants
        - Elimination of Unnecessary Frictional and Maintenance Losses
      - New Construction
        - Location with Reference to
          - Ambient Temperature Variation
          - Forced Ventilation
            - Fans on Motors
            - Separate System
          - Air Conditioning
          - Dust and Dirt
            - Magnetic
            - Abrasive
            - Conductive
            - Inert—Explosive—Combustible
          - Gases
            - Explosive
            - Chemically Active
            - Moisture
          - Fire Risks
            - Underwriters' Rules
            - State and Municipal Laws
          - Adequate Foundations
          - Crane Equipment
          - Good Illumination
          - Accessibility
          - Ample Clearances
    - Distribution
      - Power Desirable
        - A. C.-Voltage, Phase, Frequency
        - D. C.-Voltage
      - Transmission
        - Distances
        - Overhead Wiring
        - Conduit Wiring
      - Feeders
        - Number
          - Grouping of Motors
            - By Departments
            - By Duty
          - Load Factor
        - Size
          - Determined by Number of Motors and Load Factor
          - Line Drop
        - Cut-Outs
          - At Source
          - At Point of Distribution
          - Oil Switches
          - Fused Lever Switches
        - Disconnecting Switches
        - Choke Coils
        - Lightning Arresters

This chart was prepared by H. W. Rogers of the General Electric Company, Schenectady, N. Y.



FIGS. 1, 2, 3, 4 AND 5—ADAPTING TOP-CONNECTED METERS TO STANDARD SAFETY CABINETS COST $1.25 PER METER

# Duquesne Company Modifies Meters

### Reconstructs Top-Connected Instruments to Meet Demands of Safety Cabinets and Plans Meters to Dispense with Terminal Lugs by Using Pipe Connection

BY SEALING up the terminals on old types of top-connected meters and bringing the four leads from the terminal block down in back of the meter elements and out through a ¾-in. nipple the Duquesne Light Company plans to utilize 14,000 of these meters in regulation safety cabinets. Up to date several hundred of them have been reconnected and installed on the system and the results obtained have been very satisfactory. Experiments to dispense entirely with the terminals of modern meters, using instead a nipple construction, as shown herewith, have also been made.

The present requirements of this company in regard to self-contained single-phase and polyphase watt-hour meter installations using standard meters are shown in Figs. 1 and 2. In order to make these requirements effective it became necessary to withdraw certain types of watt-hour meters from service. The disposal of the types withdrawn from service and the subsequent reconnection of a large portion of them may present some ideas to other utilities as well as to manufacturers of watt-hour meters.

On June 30, 1922, approximately 50,000 of the 170,000 watt-hour meters owned by the Duquesne Light Company were composed of Westinghouse type C polyphase and Westinghouse types standard, A, B, C, CB, CD, CE and CF single-phase meters. All of these meters were of the self-contained type with current ratings ranging from 5 amp. to 75 amp. Obviously, top-connected meters do not lend themselves to the idea of standardization, nor is it possible to effect an ironclad installation with this type. These considerations, together with the fact that some of the types were obsolete and that it was impossible to secure repair parts for others, were responsible for the order withdrawing all top-connected meters from service.

Standards and type A single-phase meters are now obsolete. Types B and C single-phase and type C polyphase meters are of little use because repair parts cannot be obtained from the manufacturer. It was decided to scrap these types as fast as they were withdrawn from service. Types CB, CD, CE and CF, with the exception of the 5-amp. and 10-amp. meter, were to be disposed of in a similar manner. This left approximately 14,000 5-amp. and 10-amp., top-connected, single-phase meters which could be used providing the method of connection could be changed. Orville Buys, superintendent of the equipment and tests department, developed an ingenious method for making the meters available for future use.

The scheme consists of sealing the entrances in the terminal chamber with high-tension cement and spot-welding the wing nut and bolt so that the plate over the terminal chamber cannot be removed. The bottom of the case is drilled and tapped for a ¾-in. nipple about 2 in. in length. Four marked leads of No. 10 B. & S. gage Clark's cable are attached to the terminal posts and are brought out of the case through the nipple, the space between the leads and the nipple being filled with high-tension cement so as to make a dustproof case. The case and leads of a reconnected type CD watt-hour meter are shown in Fig. 3.

A complete meter ready for installing is shown in Fig. 4. The nipples are supplied with a ¾-in. lock nut and bushing and an end wall containing a 1-in. hole with a center 1 in. from the face of the meter board. These end walls were procured from manufacturers on a special order. They can be made to fit any standard safety switch box. One of the meters and a safety switch box are illustrated in Fig. 5.

Very little trouble has been experienced in effecting the reconnection. As fast as the meters are withdrawn from service those types which are to be reconnected are packed in lots of one hundred meters and are turned over to a local machinist, who is under contract to complete the reconnection and return the meters to the meter department. The contract price is $1.25 per meter. The scrap value per meter is in the neighborhood of $1. Combining the scrap value and the cost of reconnecting the meters represents an investment of $2.25, and for this value the Duquesne Light Company is receiving a first-class watt-hour meter

FIGS. 6, 7 AND 8—SUGGESTED ARRANGEMENT FOR NEW METERS

which is good for a period of service equal to the ordinary life of a meter and one which is even more foolproof than the regular bottom-connected meter. When it is realized that 14,000 meters will be made available for service, and that an equivalent number of new meters would average \$8 per meter, then the benefit of the method adopted will be apparent. The difference between the cost of the reconnection and the average cost of new meters—\$5.75—represents a saving of approximately \$80,000.

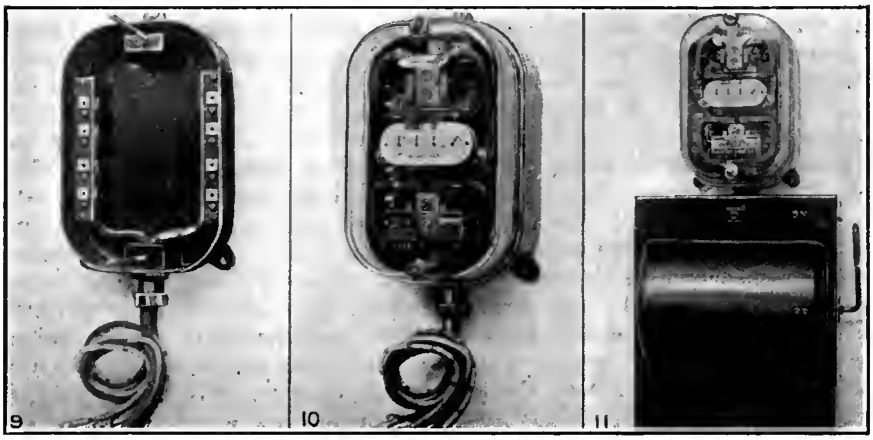
The reconnected meters are tested on the regular meter-testing benches in the meter department. After the final test and calibration is completed each meter is packed in a container and placed in the stockroom. A special end wall is placed in the container by the meter packer. Reports that have been received from the meter foremen of the various districts state that these meters are easy to install on customers' premises and that field testing is simplified because of the flexible leads.

The results obtained from the use of these meters were so satisfactory that Mr. Buys decided to carry on further experiments on methods for connecting watt-hour meters. Fig. 6 shows a Westinghouse type OA single-phase case which was rebuilt in the meter department. The usual terminal chamber was replaced by a fiber terminal block to which four flexible leads were connected. The leads are brought out of the case through a ¾-in. nipple. Fig. 7 shows a complete meter, and Fig 8 shows the meter together with a standard safety switch box. Single-phase meters with this type of case and a similar method of connection are practically proof against tampering. In addition, several other factors, such as lower manufacturing cost, smaller space and more rapid field testing, recommend the adoption of the scheme. This method of connection would not be applicable for use with single-phase high-capacity meters on account of the size of the leads. However, self-contained, single-phase, two-wire meters above a 25 amp. rating are not used on the Duquesne Light Company's system, and leads for current ratings up to and including this value can be successfully handled.

Experimental work with Westinghouse self-contained type OA polyphase meters has brought out the construction shown in Fig. 9. The terminal chambers have been replaced by a nipple and the terminal blocks by two rectangular fiber blocks. Flexible cables are used for the connections to the elements. A complete meter and the same meter with a standard 60-amp. switch box are shown in Figs. 10 and 11. Complete data are not yet available as to the performance of this reconstructed meter.

The only questionable feature concerns the effect of the current in the leads for the upper element upon the lower element. However, up to 50 amp., there is no indication of interference. The highest permissible rating for self-contained polyphase meters is 75 amp., and further tests will be made to determine whether there is material interference with this value of current. Polyphase meters of this type of construction will possess the same advantages as the single-phase meters that were previously described.

C. B. Wright,
Equipment and Tests Department.
Duquesne Light Company,
Pittsburgh, Pa.



FIGS. 9, 10 AND 11—APPEARANCE OF POLYPHASE METER WITH CABINET MUCH NEATER THAN WITH THE ORDINARY ADAPTER

## Economic Loading of Line Transformers

Five methods of determining the loading of transformers were discussed by H. W. Watt, electrical engineer of the Westchester Lighting Company, in a paper presented at the recent convention of the Empire State Gas and Electric Association at Utica, N. Y. The five methods are: Record of meter load, voltage tests during peak load, indicating ammeter and wattmeter readings, recording ammeter and wattmeter, and the use of a thermal indicator. The combination of a thermal indicator with recording ammeter and recording wattmeter was recommended. Operating a transformer underloaded is an inefficient utilization of the investment represented and is, furthermore, productive of low power factor and excessive core loss. Hence it should be avoided as much as exceeding the upper temperature limitation.

A properly loaded transformer may be defined as one in which the maximum load will heat the transformer coils to a temperature not more than 105 deg. or less than 90 deg. C. The upper limit should never be exceeded, the variation in the lower limit depending upon local conditions, such as expectancy of additional load and permanence of installation. Exceeding the upper temperature limitation is liable to burn out the transformer and interrupt the service. Often the latter is more serious than the former. Operating an underloaded transformer results in unnecessary investment, lower power factor and excessive core loss.

The question is what means should be employed to determine the transformer load so that the evils of overloading and underloading can be avoided. Those methods which have been in use for some time and those which have only recently come into use are given below, followed by a brief outline of the relative merits of each method:

1. *Survey of Secondary System and a Record of the Metered Load.*—This method was originally used at a time when the 16-cp. lamp was standard and constituted about 90 per cent of the total load. Domestic appliances were rare. Transformers were rugged and would stand an exceptional overload. Now new lamps are rated from 10 watts to 250 watts and domestic appliances and small motors are found in almost every house. It is not unusual for an incoming tenant to change all small lamps for large ones. The old-style, more rugged type of transformer might have stood this, but the more delicately designed ones now in use certainly can-

not. This method has therefore become obsolete.

2. *Voltage Test During Peak Load.*—This method is fundamentally faulty as it depends upon an overload causing sufficient excessive drop in a transformer. A voltage test taken only on the secondary side of a transformer shows nothing as the primary voltage may be low at the transformer location. The method also necessitates a more or less exact knowledge of the time at which the peak will occur. This is often difficult to predetermine.

3. *Indicating Ammeter or Wattmeter Readings on Secondary or Primary Side with Current Transformer or Split-Core Current Transformer.*—The use of indicating ammeters or wattmeters determines the load on the transformers at the time the reading is taken. This method is open to the objection that there is no record of the load at any other time than that at which the reading is taken.

4. *Recording Ammeter or Wattmeter.*—The use of recording instruments or maximum-demand instruments in place of the indicating instruments used in method No. 3 makes it possible to determine the entire load characteristics and is much superior to any of the above methods.

5. *Thermal Indicators.* — Recently thermal indicators have been used to indicate the load on a transformer by means of its temperature rise. Some of these devices show the actual temperature, while others indicate only when a dangerous temperature has been reached.

On modern secondary systems it is believed that the first three methods have become obsolete and that standard practice should be a combination of the use of thermal indicators with recording ammeters or recording wattmeters. Mr. Watt recommended that companies adopt these two methods with the assurance that by this means they can operate their systems to the best possible advantage, all factors considered.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Inspection and Care of Ring-Oiled Bearings

THE oil supply must be kept up to the proper level in ring bearings, but not too high, as oil might travel out along the rotating shaft, get into the windings of the machines and attack the insulation. The following rules are prescribed in the operating code of the Philadelphia Electric Company to insure the proper maintenance of ring-oiled bearings.

1. At least every hour, and oftener when necessary, examine bearings, noting: (a) That the oil rings are turning over and carrying oil; (b) that the bearing is not overheating; (c) that there is no chattering or vibration.

2. If the temperature rises to 160 deg. F. (70 deg. C.), steps must be taken to reduce it. In no case may the temperature of the oil be allowed to rise beyond 180 deg. F. (80 deg. C.).

3. When bearings are equipped with water-cooling jackets or coils, make sure that the water supply is not interrupted.

4. To reduce the temperature of a heated bearing, draw off the hot oil and at the same time put in a fresh supply, taking care not to allow the oil level to get below the usual point. Another treatment is to place ice on the oil reservoir on the outboard side of the bearing. Provision must be made to drain the water away from the machine to prevent it from running into the bearings or on the commutator or windings. In conjunction with either of the above methods, slightly loosen the bearing caps.

5. If either or both of these methods of treatment fail to cool off the bearings, the machine must be shut down when the oil temperature reaches the maximum as specified above.

6. If a bearing has been allowed to overheat to the point of melting the bearing metal, the load should be taken off and the speed reduced, if possible. Otherwise, it should be shut down at once.

## Cleaning Boilers for Inspection

BEFORE starting to clean a boiler for inspection it should be taken off the line, complying with the rules given on page 811 of the April 7 issue of the ELECTRICAL WORLD. The rules given below, which have been abstracted from the operating code of the Philadelphia Electric Company, should then be followed. The same rules apply to economizers:

1. If the boiler blow-off valves discharge into a common header, see that the valves are blocked to prevent reopening.

2. Remove manhole and handhole caps.

3. Start boring the tubes and scaling the drums as soon as possible after the boiler is empty. Bore all tubes clean and clean all scale from the drums and headers. In boring the tubes the rules given on page 1418 of the June 16 issue ELECTRICAL WORLD should be followed.

4. Sweep the boiler.

5. Remove any obstructions in the air holes of the tuyère plates.

6. Clean all of the openings and holes in the dry pipes.

7. Clean the superheater. Owing to sharp curves and the presence of a core in some types of superheater tubes, it is difficult to get anything that will pass through them. A piece of cable stubbed on the end should be pushed through the tubes not having a core. The tubes should then be blown out with compressed air.

8. Give the water column a thorough inspection: (1) Remove the water glass, cut-out valves and gage cocks. (2) See that all connections are open and clean. (3) Replace the valves, gage cocks and glass. (4) Pack all valves on the water column.

9. Pack all valves on the boiler and blow-down valves.

10. Overhaul all safety valves.

11. Repair the brickwork.

12. Repair the piping.

13. The boiler inspector should make an internal inspection.

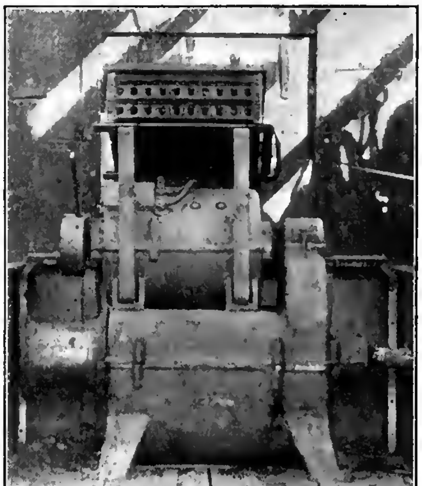
14. Head and cap up the boiler.

15. The boiler inspector should make a hydrostatic test. Care should be used in making the hydrostatic test to see that there is no leakage through the automatic non-return valve. If there is leakage, "blank off" at the automatic non-return valve. Do not allow the water to come in contact with the main stop valve. See that the drains between the main stop valve and the automatic non-return valve are open.

## Electric Truck Winch that Hastens Cable Laying

FOR speeding up the laying and removal of underground cable the Public Service Company of Northern Illinois has mounted an electric winch on one of its electric line trucks. This winch is driven by a 2½-hp., 1,500-r.p.m., motor operated directly from the 80-volt truck batteries. The entire outfit weighs approximately 1,500 lb. It has a gear ratio of 59.8 to 1 with over-all dimensions of 22.5 in. in length, 43.75 in. in width and 43.25 in. in height.

Although no operating costs have as yet been obtained, the winch has



MOTOR-DRIVEN WINCH EFFICIENT FOR LAYING AND REMOVING CABLE

installed 6,500 ft. of four-conductor 300,000-circ.mil cable and removed 5,000 ft. of the same size. The steady torque of the motor has helped in reducing sheath damage. The truck has been placed in service in the Oak Park district.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

# Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

## How to Pay Appliance Salesmen*

**With Central Stations Interested in Appliance Selling as Never Before, the Question of the Type of Salesmen and How to Pay Them Is of Vital Importance**

By Howard A. Lewis
Manager *Electrical Merchandising*, New York

CENTRAL-STATION companies have a certain advantage in employing house-to-house salesmen as each company represents a substantial investment in community service. As an institution the company is known. It is therefore theoretically easier for the central station to make use of house-to-house men, and the sales resistance to be overcome by the individual salesman is less because of the element of public confidence that automatically accrues to the advantage of the company's accredited representatives.

The central station's field man has the maximum of local public confidence in selling electrical merchandise. Other things being equal, a central station's salesmen should do a larger volume of business and should reach his average production in a shorter period of time than will the representatives of any other type of electrical sales organizations.

The above is the first factor to consider in making out a sales compensation plan. A minimum of public suspicion is a cash asset to the specialty worker. The time that a salesman must ordinarily spend in inspiring the prospective customer with confidence in his integrity can in the main be utilized in direct sales solicitation. An increase in the daily number of productive calls is the result.

If we take the local market price for consumer sales work and deduct 10 per cent from the gross commissions paid, assuming that all other factors are equal (merchandise handled, sales management, delivery, service, local advertising, etc.), we have the most elementary basis for a payment schedule. If vacuum-cleaner salesmen receive 20 per cent commission, the central station's schedule figured on the above basis could be 18 per cent.

The second factor to consider is the question of drawing account. Will the salesman finance himself or will the company underwrite all or part of his operations? A certain length of time is necessary before any new man, regardless of his ability, can earn a living wage. It is also true that with an established salesman there are lean weeks or months during a year's cycle. A straight salary basis is the maximum drawing-account arrangement. It is now an accepted principle that every salesman is on a commission basis even though paid a straight salary. No matter how they are arrived at sales costs must bear their proper relationship to gross income if profits are to be made. A salesman's salary and expenses must eventually be figured as a percentage of sales and rewards paid accordingly.

### Advance Cash a Problem

The real problem is how much cash to advance, if any, in anticipation of future sales. There are two sides to this problem, the company's and the salesman's. The company must consider first that the salesman may not make good, in which case all moneys advanced are wasted. This is a business risk which the company does not face if it operates on a straight commission plan. However, the company cannot control the activities of new men so closely when they operate on straight commission, and there is the practical danger of the salesman misrepresenting the merchandising and the company's policy in his anxiety to close sales. This makes for public ill will and kills the development of new "prospects." To overcome this objection to the commission plan, the company must have strong sales management, a sales plan and policy that is worked out in minute detail and actual field supervision by experienced men. This costs money and is apt to make for a high sales overhead expense.

The next factor is the possible dishonesty of the salesman. There is a small army of specialty salesmen who float from job to job. It is standard practice among some of these men to get cash advances, and then if sales do not materialize as quickly and as easily as anticipated they fade from the picture—whereabouts unknown. It is fairly easy for a company to be fooled by these men as they are plausible talkers and some of them are whirlwind salesmen—when they will apply themselves.

### Danger of Fly-by-Night Salesmen

A proper system in hiring men, a surety bond and a sales manager who knows the game will keep these losses down, even though a cash advance plan of payment is used. The greatest damage done by unscrupulous "fly-by-nights" springs from the dishonest statements made in selling. They make enemies for the company, but they are clever enough to cover their tracks temporarily, and the damage does not appear until after they have moved on.

It is standard practice with the larger central stations to operate their house-to-house crews on a straight commission basis.

These men are not left to their own devices; they are carefully supervised—either by the company direct or by the manufacturer whose product is being sold. This is particularly true with vacuum cleaners. Some of the results that are being obtained with this central-station, manufacturer, straight-commission plan of operation are astonishing. It requires high-pressure saleswork and is not a game for amateurs. The turnover of salesmen is very high, varying from better than 100 per cent a year to, in one case, 33⅓ per cent. The average is nearer 100 per cent.

With the smaller central stations which have had no experience with

*Abstract of the Merchandise Sales Bureau's sub-committee report, presented June 7 at the N. E. L. A. convention in New York.

this work and do not desire to turn over the operations of their retail department to a manufacturer's organization the house-to-house proposition is different. As a practical matter, it is cheaper for this type of company to get taken in on a cash-advance transaction early in the game than to have men working on a straight-commission plan without supervision, forcing up their sales at the expense of the company's future business and public good will. Professional house-to-house commission salesmen left to their own devices cannot be trusted.

### Drawing Account Is Necessary

As suggested above, the committee believes that with the smaller central stations which wish to operate one or more house-to-house salesmen a drawing account is necessary. What that drawing account should be brings us to the salesman's side of this problem. No definite figure can be set as to what the amount should be. It must depend first on the type of salesman that is required to sell a device or particular group of devices; second, on general living cost in the particular community, and, third, on the living costs of the kind of men that are selected. Are they married or single? Are they young college graduates or mature salesmen with families to support who have been making their living selling other specialties?

### Type of Selling

This brings us to the third and most important factor to be considered in this report—to wit, the different kinds of consumer soliciting required to sell electrical merchandise. As a practical sales matter it is a long haul from peddling flatirons and vacuum cleaners from door to door to the negotiations involved in the sale and installation of a domestic ice-making machine in the home of a leading citizen. The type of man who can peddle flatirons is not the type of man who can obtain the proper entrée and sell the big idea of domestic ice making to the leading citizens of the city.

As the committee views the problem, there are two kinds or types of consumer selling as applied to electrical merchandise—first, house-to-house peddling or canvassing with popular-priced devices like flatirons or such well known and easily demonstrated appliances as vacuum cleaners; second, for want of a better name, what might be called "negotiation soliciting." This covers the selling of higher-priced items, such as washing machines, ironing machines, ranges and domestic ice machines or unknown merchandise.

With house-to-house soliciting the outstanding sales factors are, first, the total number of calls that are made by the salesman each day; second, the salesman's skill in telling a short story at the front door to get attention and interest and the opportunity to demonstrate and show his device; third, ability to make a convincing demonstration quickly; fourth, a willingness to ask for the order; fifth, a persuasive yet courteous manner in meeting objections; sixth, personal qualifications that include persistency, vitality, enthusiasm, a thick skin and a reasonable amount of native courtesy plus honesty.

### Negotiation Soliciting

The factors in "negotiation soliciting" are, first, the selection of the right people to call on, based on their domestic problems, their financial status and their influence in the community; second, the proper introduction or stage setting before undertaking the sales talk that definitely leads to a demonstration; third, ability to make a complete educational demonstration; fourth, skill in talking the financial phases of the transaction, including the money-saving value of the merchandise in reducing labor and saving time and also the terms of payment; fifth, skill in pointing out the social values and prestige that would result from the purchase; sixth, closing ability; seventh, personal qualifications that include analytical ability, and education and a personality that will allow the salesman to mingle with all classes of society with a feeling of equality, a social sense, a respect for the job and an ability to make others respect it, which means a standing in the community on a par with a good life insurance man or bond salesman.

In the average town a house-to-house salesman working for a central station should be able to make \$100 to \$150 a month. An exceptionally good man should be able to average \$200 a month.

The local commission schedules must be so fixed that the man who makes a full number of calls six days a week can equal this amount. The Fuller Brush organization sets twelve demonstration calls a day as the bogey for a day's work.

During 1922 vacuum-cleaner salesmen averaged three machines a week, insuring a revenue of from \$30 to \$36 a week figured on a 20 per cent commission basis. These figures represent a national average for all vacuum-cleaner men working for manufacturers, dealers and central stations. The turnover, however, of vacuum-cleaner sales was high, a national average probably of 100 per cent a year. When you compare this with a yearly turnover of only 30 per cent, which is the average for one of the largest insurance companies, the sales waste in our industry is apparent.

The committee recommends that we make this task of "negotiation soliciting" a three-thousand-dollar-a-year job with a drawing account high enough to attract three-thousand-a-year men or better, and that we keep our nerve and do not reduce commissions should a good salesman make \$5,000 or \$6,000.

"Negotiation" type solicitors can be used permanently by small central stations as well as large.

An example: Given, a town with two thousand homes wired and no electrical dishwashers in use—possibly a 15 per cent saturation of washing machines, a 36 per cent saturation of vacuum cleaners and a 72 per cent saturation of flatirons.

### Effect of "Crowd Psychology"

A doorbell canvass of the entire two thousand wired homes might produce 5 per cent of sales with 95 per cent of the possible buyers registering a definite no. In a small community the women discuss among themselves their front-door experiences with canvassers. When the majority have said no to a proposition a negative "crowd psychology" develops which is intensified by the fact that each woman knows that her neighbor has also registered in the negative. The costs to the company in such a case are high and the returns to the salesman very low. On the other hand, suppose there is one high grade man assigned to the dishwasher. He knows his public and can get entrée. This man will select 5 per cent of the homes as his "prospects" and then set out and sell to these homes. The people he selects are community leaders. After sales are made to this 5 per cent, dishwashers will be known and talked about. There will be a favorable local opinion about washing dishes electrically as opposed to a wholesale "no," as under the first plan.

When this special salesman's bogey is reached, the town is then

ripe and ready for a doorbell attack, one of the big sales arguments being the local list of satisfied and happy users. Here we have a possibility of volume dishwasher sales, with the company making money and the salesmen satisfied. The special man then moves on to another device.

Regarding payment, while the "negotiation" man has the dishwasher, the commission is 20 per cent or 25 per cent; when the crews take it the commission is 15 per cent or possibly 12 per cent. By this plan, over a period of two years, the commission paid would be an average commission, the volume of sales larger, and all the salesmen better satisfied.

Good "negotiation" salesmen, over a period of time, finance themselves and can be made to show a profit to the company not only on the sales they make directly but from increased store sales. The specialties of yesterday are the staples of today.

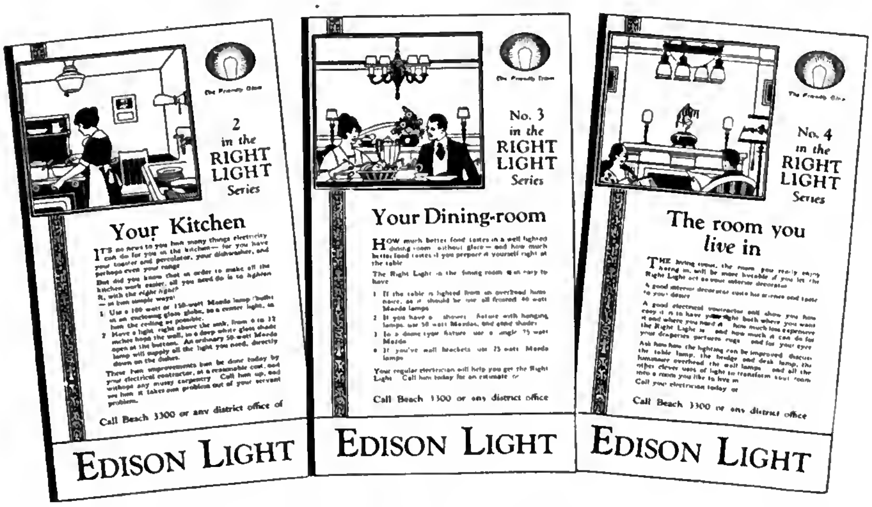
### The Sales Cycle

In this sales cycle of an electrical specialty the proper introductory placing of the appliance has much to do with the time it takes for the specialty to pass through the educational or novelty stage to the canvassing period and to over-the-counter distribution with a profitable volume.

With most central-station companies, if not with all, the washing machine, the ironing machine, the dishwasher, the range and the ice-making machine represent local sales problems that can be solved with "negotiation type" of salesmen. Each central station should develop a sales-payment plan for these "negotiation" men that will attract real brains and ability. The committee believes that the selling of these new electrical specialties should become a sales profession on a par with the best of insurance-selling practice. What is being done today with house-to-house peddling crews is not a precedent. The two types of selling are different—each has its place. Their functions must not be confused when making out payment schedules and building a sales organization.

## "Right Light" Publicity of Boston Edison

Keying its advertisements upon the term "right light," the Edison Electric Illuminating Company of Boston has recently prepared a series of announcements to be run before the end of June in Boston and suburban dailies and weeklies, including news and financial papers. The advertisements feature the value of proper illumination and adequate convenience outlets. What correct lighting means to the laundry, living room, kitchen, dining room and sleeping room is concisely explained in these advertisements, with recommendations for lamp sizes and fixture types.




PART OF A SERIES OF ADVERTISEMENTS SHOWING PROPER LIGHTING FOR THE HOME

Co-operation with the contractor-dealer is an important feature of these displays, the company sending inquiries to representative wiring firms upon request and advising consultation with reliable contractors before the purchase, sale or improvement of residences. The relation of good lighting to profitable real-estate handling is touched upon together with the economic aspect of paying for improved illumination on installments. L. D. Gibbs is superintendent of the advertising department of the Boston company.

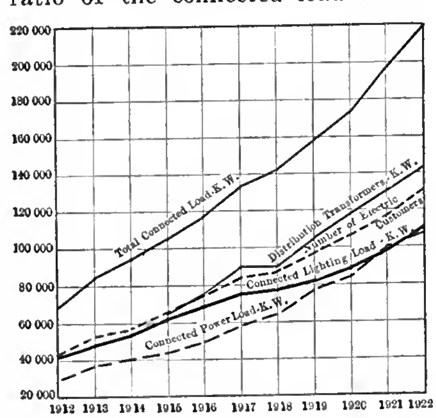
## New York Edison to Merchandise Small Power

With the expansion of its commercial policy to make it easier for customers to buy electrical appliances the New York Edison Company has adopted a practice of merchandising small power appliances and equipment to its existing customers which in the aggregate will bring a substantial increase in energy consumption and revenue. The company's power bureau is now making a survey of its present customers to determine the possibilities of adding to their equipment by the installation of small industrial heating devices, ventilating fans and refrigerating equipment.

To facilitate the purchase of this apparatus by the customer the company is extending the privilege of the deferred-payment plan, whereby the customer may pay for the apparatus in monthly installments extending over a period of one year. As a great deal of the manufacturing done in New York City is in small factories and shops having a connected load of approximately 15 kw., and under, it is believed that here is an almost unlimited field for development of the power load.

## Growth of Power Load in Northern Illinois

Analysis of the power load taken on by the Public Service Company of Northern Illinois in the last few years shows that while the ratio of the connected load to the




GROWTH OF CONNECTED LOAD ON LINES OF PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS

distribution transformer capacity for the years 1915, 1916 and 1917 had been 1.55 this ratio was lowered to 1.51 in 1922. This improvement was made despite the fact that the

power load connected had been increasing at a much faster rate than the lighting connected load. The present appliance load now forms between 10 and 35 per cent of the lighting load.

Examination of the accompanying chart shows that the connected power load gradually approached the lighting load until the latter part of 1920, when the power load exceeded the lighting load. But during the year 1922, because of the great home building program, the lighting load again exceeded the power load. It is expected, however, that during the next year or two the power curve will cross the lighting load, perhaps never again to be recrossed.

## Fresh Capital for Utilities Prevents Community Stagnation

ANOTHER effective advertisement run by the Haverhill (Mass.) Electric Company as part of its educational publicity program points out the importance of attracting capital for community development along essential electric service lines and

**More than $2,500,000 working for this community**

***Keep it working***

SUPPOSE this community had to raise $2,500,000 in order to preserve itself from stagnation—where would the money come from?

It would be drained from the industrial and commercial activities upon which the community thrives.

Yet this community would raise that money—no matter how industry and commerce suffered—rather than do without electricity. For electric light and power are absolutely essential to modern life—industrial, commercial, social.

More than $2,500,000 has been gathered, not *from* this community, but to work *for* this community. In other words, this community has hired that money to provide the power plants, service stations, lines, equipment, and organization necessary to supply electric light and power.

That money works for this community. It works for simple wages. It is entitled to those wages—to a fair rate of interest.

If those wages are not paid, no further money will be lent. If no capital is available, the public utilities cannot expand. And this community —or any other community—can grow no faster than its public utilities.

HAVERHILL ELECTRIC CO.

calls attention to the right of money to "simple wages" when engaged in this kind of work. The advertisement, the text of which is given here, is one of a series which is being prepared by Charles H. Tenney & Company, Boston, managers of the Haverhill and other Eastern utilities.

## Central Station Boosts Its Territory

AN EXAMPLE of how the utility can promote the interests of the territory it serves is seen in this electrical sign, containing 1,500 25-watt daylight lamps, which has been


CENTRAL STATION'S ELECTRIC SIGN BOOSTS TERRITORY SERVED

installed on the screen well of the Waterside station of the Louisville Gas & Electric Company. The sign announces to travelers that Louisville is the "Gateway to the South." It is 200 ft. above the level of the water and 150 ft. above the street level and can be read from the Indiana shore.

## Operating Costs of Electric and Gasoline Trucks

CAREFULLY kept operating costs of four electric trucks used by the San Joaquin Light & Power Corporation indicate that the cost of operation for the first month the trucks were in service was less than half the operating cost of gasoline trucks of the same size.

The table below shows the cost of power per mile for the electric trucks as compared with the cost of gasoline and oil used by gas trucks of the same capacity. The average per ton-mile for the electric trucks was 2.07 cents, while for the gasoline trucks it was 4.16 cents.

COST IN CENTS PER MILE TO OPERATE ELECTRIC AND GASOLINE TRUCKS

| | Capacity, Tons | Electric, Cents per Mile | Gasoline, Cents per Mile |
|---|---|---|---|
| Truck No. 1 | 0.75 | 1.73 | 2.20 |
| Truck No. 2 | 1 | 2.63 | 5.77 |
| Truck No. 3 | 2 | 3.27 | 9.91 |
| Truck No. 4 | 2 | 3.47 | 6.17 |
| Average per ton mile | | 2.07 | 4.16 |

This study was made from carefully kept costs for one month for the electric trucks and from records of gasoline cars extending over a period of several years. In the opinion of the engineering department which made the analysis the cost of operation for the electric trucks will be even lower than is shown by the first month.

## What Other Companies Are Doing

**Franklin, Mass.** — Twenty-five electric ranges were sold in two weeks recently by the Union Light & Power Company, which serves about 3,700 customers in southern Massachusetts. Fifty vacuum cleaners were sold during April on the basis of an allowance of $3 for each old broom turned in. E. S. Hamblen, manager, states that merchandise sales per customer for the company in 1922 were $15.20. This is believed to be a record in this line. L. A. Fiorani is commercial manager.

**Nyack, N. Y.**—In selling 130 vacuum cleaners of a single make in its first month of a campaign recently the Rockland Light & Power Company, a Tenney property, created a new record in cleaner sales for upstate New York. This applies to any organization in the state other than in Brooklyn or New York City, and the company hopes to exceed 1,000 cleaner sales of this type during the year.

**Minneapolis, Minn.**—"The Woman in the Case" is the title of an interesting brochure which the Northern States Power Company has prepared in furthering its customer-ownership plan. It deals with the problem of systematic saving which confronts a newly married couple and brings out the advantages of public utility stock. The story is a narrative of how they progressed toward true economy instead of drifting without any systematic program of saving. The booklet also explains the physical property behind the company's stock.

**Hartford, Conn.**—Plans are afoot to carry on the work of the battery and vehicle department of the Hartford Electric Light Company as a separate corporation to be known as the Electric Transportation Company, Inc. The new organization will take over the company's garage, offices and service station and will continue to operate the battery service system for electric trucks which has been so popular in that city for the past few years. W. M. Thayer is in charge of the battery and vehicle department.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Water Turbines and Regulators for the Ritom Power House.*—V. GELPKE.—The extraordinary requirements of safety and flexibility of operation imposed upon its power houses by the Swiss Federal Railways, particularly in the case of the Gotthard road, necessitated installing in the Ritom hydro-electric power station water turbines, regulators and hydraulic controlling devices which represent one of the most difficult and exacting installations of the kind. The 12,200-hp. single-runner Pelton turbines, operating under a head of 800 m., reach a peripheral speed of 60 m./sec. (333⅓ r.p.m.) impelled by a single water jet of 123 mm. diameter, with a nozzle velocity of 120 m./sec. The turbine and directly connected single-phase generator of 9,000 kw. have been tested at 608 r.p.m. (82 per cent overspeed), under a load of 11,300 hp. with no damage to the set. Needle regulation combined with a jet deflector are provided, both operated by high-pressure servo-motors. An auxiliary water jet, impinging upon the backs of the buckets, reduces the time to stop the set from one hour to three minutes. The article contains eighteen drawings of the complete turbine.—*Zeitschrift des Vereines Deutscher Ingenieure*, May, 5, 1923.

## Transmission, Substations and Distribution

*Terminal Boxes for Lead Cables in Farm Installations.*—E. RAGER.—Lead cables are being used to a great extent in farm installations. Certain difficulties have been encountered in making the connections in such a manner as to exclude the humid air. The author describes a system of terminal boxes which, he claims, will obviate the disadvantages of the old system.—*Teknisk Tidsskrift, Elektroteknikern (Danish)*, March 21, 1923.

*Fire Risk from Poorly Made Farm Installations.* — K. SCHNEIDERMANN. — The constantly increasing number of fires due to poorly installed light and power lines on German farms has resulted in a systematic investigation of a great number of installations. The author gives an extremely interesting account of conditions found on some of these farms and describes the cause of a number of great farm fires. Twenty illustrations give vivid evidences of electric failures, due to carelessness, incompetence or defective material, some of which were discovered in time, but many only after a fire.—*Elektrotechnische Zeitschrift*, April 19, 1923.

*Alternating-Current Secondary Networks.*—D. K. BLAKE.—Great attention has been paid to every detail of power-station and substation equipment and also to the details of transmission lines, but in the past such minute study has not been given to the distribution system. The author takes up this study and treats it in detail in a way that should be of interest to those responsible for the distribution of energy.—*General Electric Review*, June, 1923.

## Generation, Control, Switching and Protection

*Isolated Phase Arrangement of Switching Equipment.*—P. M. CURRIER and W. T. O'CONNELL. — The authors fully describe the "isolated-phase" construction for switching equipment and explain the merits of the system. The vertical and horizontal construction are discussed, and illustrations emphasize the points brought out. Attention is called to the fact that when the phases are isolated phase-to-phase short circuits will be practically eliminated.—*General Electric Review*, June, 1923.

*Calculation of the Dimensions of Oil Circuit Breakers.*—P. CHARPENTIER.—The design of oil circuit breakers, from both the electrical and the mechanical viewpoint, should be based upon the known short-circuit conditions of the circuit in which the breaker is to be used. From an extended study of arcs under oil the author gives a formula for the amount of gas generated by an arc of known energy and duration. This amount of gas, the writer assumes, forms a more or less cylindrical gas pocket within which the ionized gas may be considered as electrically conductive. The transient dimensions of this pocket give, therefore, the required minimum distances between phases of the breaker and between phases and tank walls. The height of the switch tank is determined by the length of the arc, the dimensions of the contacts and the safe oil level above the contacts. To insure the theoretically most advantageous break within half a cycle an entirely too high speed of opening would be required, such as, for example, more than 100 miles an hour for 50,000 volts. In practice one-tenth of this speed is usually the limit. The creation of a vacuum under the oil because of a too rapid motion of the contacts is not to be expected unless the speed of the contacts should exceed 130 miles an hour, assuming a pressure of 5 atmospheres in the immediate vicinity of the break. On checking up the characteristics of existing switches, the author's formulas were found to come within 2 per cent of their dimensions and rupturing capacities. The reticence observed by American designers of switchgear is regretted by the author, who makes the assumption that, if these formulas give such close results, discretion may serve to cover up the possible embarrassment of finding a switch to be either entirely inadequate or too large and costly for the purpose for which it is used.—*Revue Générale de l'Electricité*, May 5, 1923.

## Units, Measurements and Instruments

*Electric Testing Laboratory of a Porcelain Factory.*—P. CRUSSARD.—A laboratory for routine testing of porcelain insulators is described, consisting of a 60-hp. motor-generator set supplying an oil-insulated testing transformer, with series-parallel arrangement of the low-voltage winding to obtain either 125 kv. or 250 kv. on the high-voltage side. The voltage of the single-phase generator on the motor-generator can be regulated from 15 to 500, which gives the wide range of testing voltages on the secondary of the transformer. Three sphere gaps of balls 62, 125 and 250 mm. in diameter are provided to measure voltages of up to 90 kv., 180 kv. and above, respectively. A voltmeter in the low-voltage circuit of the transformer, graduated in values of the high-voltage winding, gives readings previous to the flashover of the spheres. The usual apparatus for rain tests is installed. Safety switches are provided, opening the circuit when the gate to the high-voltage room proper is opened.—*Revue Générale de l'Electricité*, May 5, 1923.

*Permissible Loading of Cables.*—The permissible current loading of British standard impregnated paper-insulated electric cables, as specified in the report of the British Electrical and Allied Industries Research Association, is given. The report includes current-loading tables for cables laid directly in the ground, in the air and drawn into ducts. A great deal of theoretical and experimental work, as, for instance, on power losses in the cable, dielectric constants, thermal constants, current rating, etc., is also included. The tables are for 600-volt to 11,000-volt cable, single-core, concentric and three-core.—*Journal of the (British) Institution of Electrical Engineers*, May, 1923.

## Illumination

*Transmission of Speech by Light.*—A. O. RANKINE.—The transmission of speech by light is effected by modulating the intensity of a beam of light by means of the acoustical vibrations. In the distance the fluctuating beam falls upon the receiver, a selenium cell in circuit with a battery and telephone. The selenium can control the current because it is a better conductor of electricity when illuminated than when in darkness. Thus the brightness of the light and the telephone current vary in correspondence with speech vibrations. In the method described by the author he stated that the transmission

of speech by light still depended upon selenium, though he would gladly abandon selenium in favor of a superior substitute. — *Engineering (London)*, April 27, 1923.

*Artistic Color Lighting in Motion-Picture Theaters.*—S. L. ROTHAFEL.—The lighting effects produced by the author at the Capitol Theater, New York, are the result of study of the psychology of the audience. He has found that the ideal lighting arrangement is soothing to the mind and nerves and at the same time stimulating to the imagination. As a result of this theory he describes the way he builds the lighting effects for various units or parts of a program.—*Transactions of the I.E.S.*, May, 1923.

### Motors and Control

*Electrification of Allegheny Plate Glass Company.*—G. P. WILSON.—Primarily the author discusses the modern developments that have taken place in the plate-glass industry. Many of the processes are quite complicated, but the real solution of most of the problems has been made simple and practical by the use of electricity. The author gives a clear idea of the extent to which electricity is being used in glass plants and then briefly traces the process through which the ingredients must pass and how they are handled before a finished sheet of glass results.—*Electric Journal*, April, 1923.

*Operation of Low-Speed Elevator Electric Motor Controller.*—C. A. ARMSTRONG. — A detailed explanation is given of the controller's operation, after which a number of the troubles which may develop are enumerated and the methods for locating them explained.—*Power*, May 1, 1923.

*Synchronous Motor-Generators for Coal Mines.* — E. J. GEALY. — The author discusses the relative advantages and disadvantages of synchronous motor-generators and rotary converters for coal mines. Present tendencies show that the former may take the place of the latter. Of the two machines, the motor-generator seems to be better adapted for the purpose on account of greater stability, less complication, easier operation and greater adaptability to the coal-mine load, which is very irregular in character.—*Coal Age*, May 3, 1923.

### Heat Applications and Material Handling

*Electric Furnace Detinning and Production of Synthetic Gray Iron from Tin-Plate Scrap.*—C. E. WILLIAMS, C. E. SIMS and C. A. NEWHALL.—Experiments were conducted in a small electric furnace in which tin-plate scrap was melted with different addition agents in attempts to remove the tin from the iron. Sodium chloride, iron sulphide and an oxidizing slag were used under various conditions. The conclusions reached were that in the electric furnace complete detinning is impossible and any detinning impracticable. Melting tests conducted in the cupola showed that the amount of detinning was dependent upon the amount of surface of metallic tin exposed to the oxidizing gases and will be somewhere between the limits of 0 and 50 per cent. Test bars, prepared by melting pig iron with various quantities of tin, were subjected to physical tests. The results showed that a tin content of 1 per cent or less did not seriously affect the properties of gray iron. —*Paper presented before the American Electrochemical Society, New York*, May 3-5, 1923.

### Electrophysics, Electrochemistry and Batteries

*Copper Electric Plating Applied in Metallurgy.*—A. BARATTINI.—It is well known that copper electric plating is used in steel-case hardening to maintain elastic resistance and facilitate the treatment of certain parts of the metal. For example, in hardening a gear copper plating is used at the points of the teeth. Its use forms the subject of this article, in which the author fully describes the latest improvements made in this method, giving scientific and industrial examples. — *Elettrotecnica*, April 15, 1923.

### Traction

*Self-Propelled Electric Locomotive.*—P. OSTERTAG.—A full description, with many illustrations, of the new self-propelled electric locomotive recently tested in Switzerland. This car, which is to operate light trains only, is equipped with a 200-hp., 440-r.p.m. Diesel engine which drives a direct-current generator, the latter energizing two direct-current motors. Benzol is used as a fuel on account of the high cost of gasoline, and its consumption is very reasonable. The maximum speed obtained is 45 miles per hour.—*Ingegneria*, Feb. 1, 1923.

*Observations on Electric Railway Practice.*—W. P. POTTER.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. midwinter convention, Feb. 24, 1923, on page 441.—*Journal of the A. I. E. E.*, May, 1923.

### Telegraphy, Telephony, Radio and Signals

*Impedance of Smooth Lines and Design of Simulating Networks.* — R. S. HOYT.—In the first part of the paper the author presents in a comprehensive manner the dependence of the characteristic impedance of the various types of smooth lines on frequency and on the line constants by means of descriptions accompanied by equations transformed to more suitable forms by graphs. In the last part of the paper he describes the principal networks devised for simulating the impedance of the various types of smooth lines.—*Bell System Technical Journal*, April, 1923.

*Radio Transmission Measurements.*—R. BROWN, C. R. ENGLUND and H. T. FRIIS.—The first section of the article briefly analyzes the radio transmission circuit into (a) the sending or radiating portion, (b) the transmitting portion, consisting of the ether path through which the radiated waves travel, and (c) the receiving portion. The relation of these from the standpoint of the radio transmission engineer is discussed, pointing out the need of quantitative data as to the electric field strength of waves and radio noise conditions to allow the rational design of radio systems. The second section is devoted to descriptions of apparatus which has been developed for measuring the electric field strength of the radio waves, its theory and method of use. The third section deals with the measurement of radio noise.—*Proceedings of the Institute of Radio Engineers*, April, 1923.

*Experiments with the Neon Tube.*—S. O. PEARSON.—The author explains how the neon lamp can be made to produce oscillating current, thus making it applicable for using with radio equipment. He describes how an instrument could be made up giving a whole range of note frequencies, either in steps or continuous. This instrument can be used to determine frequency. As an instance he mentions that the apparatus could be used in testing low-frequency amplifiers over a wide band of speech frequencies, making it possible to detect undesirable resonant frequencies in the amplifier.—*Wireless World*, April 7 and 14, 1923.

*How to Measure Antenna Resistance and Capacity.*—A. F. MURRAY.—Unless the resistance and capacity of an antenna are known the power output or the transmitter efficiency cannot be determined. The author gives a method, known as the substitution method, in which a dummy antenna with the same constants as the actual antenna is built up and measured.—*Q S T*, May, 1923.

### Miscellaneous

*Problems Confronting the Engineering Profession.* — L. W. WALLACE. — In the opinion of the author, engineers have in the past neglected many factors of importance with which the engineers of today must wrestle. There are many phases of industrial leadership yet unsolved, relating particularly to the distribution, financial, production and human factors of industry. The report indicates many fields in which there is ample opportunity in American industry for the engineer to do splendid work. It is the duty and responsibility of the engineer to study and help solve the problems encountered today, and by virtue of his engineering education he is in a position to do this.—*Sibley Journal of Engineering*, April, 1923.

*Oscillations by Breakdown of Condensers.*—R. RUEDENBERG. — Formulas for current and frequency of the arc are deduced in an investigation of an undamped circuit presupposing invariability of sum of magnetic and electrostatic energy. The frequency and the current of a thunderbolt depend on the diameter of the cloud, not on the elevation. — *Tydschrift voor Electrotechniek*, May, 1923.

# News of the Industry

**Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men**

## World Power Conference

### Active Participation of the United States in 1924 London Meeting Voted by National Societies

THE United States will be an active participant in the World Power Conference to be held in London, England, in 1924. This was decided at a meeting of delegates chosen from the various national professional, technical, business and commercial societies, including representatives from the national government, held in New York City on Wednesday of this week. The plan of organization, drawn up by a sub-committee of which John W. Lieb of the New York Edison Company is chairman, was adopted, and the following officers were elected: Honorary chairman, J. W. Weeks, Secretary of War of the United States; chairman, O. C. Merrill, executive secretary Federal Power Commission, Washington; first vice-chairman, Henry J. Pierce of Seattle.

#### Committee of One Hundred

Three other officers elected but without particular designation were: Calvin W. Rice, secretary of the American Society of Mechanical Engineers; Peter Junkersfeld of the firm of McClellan & Junkersfeld, consulting engineers, and W. M. Steuart of the Census Bureau, Washington. According to the present plans, the American committee, World Power Conference, will be made up of a general committee of approximately one hundred with a small executive committee of from nine to eleven persons.

L. B. Stillwell, consulting engineer, New York, outlined some of the work which the committee might profitably undertake, with particular reference to power development in the North African colonies of France. He suggested that the financial and legal as well as the engineering phases of power development should have ample consideration.

H. I. Harriman, banker and public utility operator of Boston, representing the American Chamber of Commerce, laid particular emphasis on the advisability of delegates from the United States dwelling on the economic and political features of power development. He was insistent that the world should know that this nation has made wonderful progress along these lines, chiefly because it stood for private ownership and the exercise of private initiative.

W. H. Onken, Jr., Electrical World, New York, recommended that the United States contribute to the conference certain outstanding features of power development in which it leads the world, including hydro-electric development, electric transmission and interconnection of superpower systems. These are almost universal in their application and on them the United States better than any other nation can make authoritative contributions. The advantage of concentrating on a few subjects of worldwide interest was emphasized.

It was the general understanding that all delegates to the World Power Conference will pay their own expenses and that none of the professional and business associations will be called upon to make any contributions toward operating expenses of the committee.

## Dayton to Be Center of Large Interconnected System

Announcement has been made by the Dayton Power & Light Company that arrangements have been completed for interconnecting power stations with an aggregate capacity of 250,000 hp. at the Miller's Ford station. This, the company says, will make Dayton the center of a "superpower" zone unequaled in that part of the country. The stations to be connected with the Dayton plant are the new West End generating lines of the Union Gas & Electric Company of Cincinnati and two smaller hydro-electric plants at West Milton and Covington. The steam generating plant of the Dayton, Covington & Piqua Traction Company at West Milton will be abandoned under the plan.

## Electro-Steam Boiler Installed at Berlin (N. H.) Mills

The use of excess hydro-electric power for the generation of steam has received a new exemplification at the mills of the Brown Company, Berlin, N. H., where the Electric Furnace Construction Company of Philadelphia has just installed an electro-steam boiler rated at 18,000 kw. and operating at 22,000 volts, three-phase, 60 cycles, with a steam pressure of 135 lb. gage. The boiler consists of three single-phase tanks. This is said to be the only boiler ever installed to operate at so high a voltage, and, according to the manufacturer, the results obtained from its use are remarkably gratifying, surpassing the expectations of both the Electric Furnace Construction Company and the Brown Company.

## Pennsylvania Power Acts

### Résumé of Legislation of 1923 Affecting Hydro-Electric Development and Other Power Projects

THE program of power legislation advocated by Governor Pinchot of Pennsylvania was completed by the passage of the general power bill and the companion condemnation bill on the last day of the legislative session. It included the preparation of what the administration terms sound and far-seeing plans for the future as well as provision for present needs.

#### "Giant Power Survey"

Most significant for the future is the act creating a "giant power survey board" composed of high state officials including the Governor in addition to a deputy attorney-general and an engineer to be appointed by him. This board is to make an outline survey of the power resources available for the supply of Pennsylvania's needs and will recommend a policy to be embodied in legislation by the General Assembly convening in January, 1925. The end in view is the most efficient development of the state's great fuel-power resources, supplemented by water power, the pouring of the general output of these fuel and water-power resources into a common reservoir of interconnected transmission lines covering the Northeastern States and the service of the industries, farms and homes of Pennsylvania from this common reservoir. The possibilities and advantages of locating great power plants at the coal mines, saving the by-products of coal now wasted in fuel-power plants, electrifying railroads and co-ordinating flood prevention and stream purification, so far as practicable, with water-power development are to be investigated.

#### The Tri-State Compact

Related to the "giant power survey act" is the act authorizing the Governor to designate three officers of the commonwealth to negotiate with New York and New Jersey a compact for the regulation of the Delaware River and the apportionment of its waters. New York and New Jersey have passed similar statutes carrying appropriations for surveys and plans. Such a compact negotiated with the consent of Congress will be binding upon all interests when ratified by the three states. The complete regularization of the Delaware by storage of the whole flow, thus preventing floods, will develop power estimated at 400,000 hp.

Present needs are met by an act

regulating future permits granted by the Water Supply Commission for dams and changes in streams to develop water power and to store and use water for steam raising and steam condensation in the generation of electrical energy for use in public service.

As to future permits the principles of the federal water-power act are to be applied. If the waters concerned are under federal jurisdiction, the state permit will be contingent upon the permittee's obtaining a federal license, the conditions of which may be enforced by the commonwealth if and to the extent that the federal government is unable to enforce them or waives them. If the waters concerned are not within the jurisdiction of the United States, the act fixes a maximum time limit of fifty years with extensions and renewals until the capital prudently invested on the faith of the permit has been repaid by the commonwealth or by a new permittee. It also gives to the state broad powers to impose conditions like those in a federal license. A system of fees will be established to pay the cost of administering the act. The right to flood islands owned by the commonwealth, hitherto inalienable, may be granted by the board.

A companion act restores to public service companies holding permits the right to condemn waters and lands under water which was taken away by the Pennypacker act of 1905; their condemnation rights are enlarged in other respects and they may flood, relocate and reconstruct highways, bridges and railroads. The exercise of all these powers is to be controlled at every step by the board.

Another act authorizes the Department of Forests and Waters to lease state forest lands for power projects for periods not to exceed fifty years.

## Premier Drury of Ontario on Public Ownership

Premier E. C. Drury of the Province of Ontario, Canada, has given to the press an appeal addressed to the electors in which he sets forth the achievements of his government since taking office in 1919 and a declaration of his policy for the future if his government is returned to power at the provincial election to take place next Monday. Of interest to public utility men everywhere are his remarks under the head of "Public Ownership," which follow:

"The government is not opposed to the public ownership of public utilities, nor is it antagonistic to hydro-electric development. Our policy is to give every possible support to undertakings of this nature. We stand for two definite principles which are essential to the success of public ownership—first, for definite responsibility on the part of commissions and others engaged in carrying out public-ownership projects to the government and to the Assembly and through them to the people; second, for such care in the projection and execution of public ownership undertakings as will insure that they shall be entered into only after the most careful and accurate estimates, and that they shall be carried out with such economy as will enable them to attain the utmost of efficiency. It is our policy that each public ownership undertaking shall be self-sustaining and that no such undertaking shall be a burden upon the general taxpayer."

## Quebec Premier on Private Versus Public Ownership

Louis A. Taschereau, Premier of the Province of Quebec, in a recent speech said that the prosperity of the province, and, in fact, of all Canada, depended upon increased production, particularly of goods which would find a ready market in the United States and that this industrial development would require tremendous electrical development.

"There are two systems of developing water power," continued Premier Taschereau. "One is the Ontario scheme, by which the government does the work through the Hydro-Electric Commission, and the other is the system in Quebec, by which the government undertakes no obligation itself, but leaves it to private initiative, with the aid of all possible facilities that the government can grant."

Without criticising the Province of Ontario, he pointed out that it had incurred a debt of $250,000,000 for a population of less than three million people, while the debt of the Province of Quebec, with a population of nearly as much, is only $52,000,000.

"We prefer our system of leaving it to private initiative to develop the water power," said the Premier. "By so doing we shall succeed in bringing many millions of foreign capital into our province. Furthermore, if you leave the development of water powers to private initiative, you are keeping the water powers out of the vicissitudes of politics. A government cannot put the technical knowledge and energy into such development works that can be supplied by a private concern."

## Well-Known Men Win Prizes for Electrified Houses

An entirely new "side issue" at the recent convention of the National Electric Light Association in New York was a contest held under the auspices of the Joint Committee for Business Development to award prizes to those whose houses were most fully electrified. This contest was remarkable for the interest it aroused among well-known men of the industry who were attending the convention. Many of them entered the lists as competitors.

W. D'A. Ryan of the General Electric Company, Schenectady, N. Y., with a total of 343 points, was adjudged winner of the contest. C. W. Stone, also of the General Electric Company, was second with 327 points; Samuel Ferguson, vice-president Hartford Electric Light Company, third with 309 points, and C. L. Edgar, president Edison Electric Illuminating Company of Boston, fourth with 307 points. Then followed W. E. Holmes, Newton, Mass., 273 points; F. B. Steele, Utica, N. Y., 266 points; Thomas W. Drought, Broadalbin, N. Y., 256 points; L. L. Elden, Boston, 250 points; Steele R. Sellers, Pittsburgh, 241 points, and Ralph D. Cutler, Hartford, 231 points. Many others got honorable mention.

The prizes were given by *Electrical Merchandising*, and James R. Strong, A. K. Baylor, R. S. Hale and Miss Alice Carroll were the judges.

## S. P. E. E. Gathers at Ithaca

### Educational Research Project to Be Carried Forward by Director and Advisory Board

ENGINEERING leadership and educational research were leading topics at the annual meeting of the Society for the Promotion of Engineering Education at Ithaca, N. Y., on June 20 to 23. More than 300 leading educators from all sections expressed an enthusiastic desire to carry forward the educational research project formulated by two years' work of the committee of investigation and co-ordination. This calls for the investigation of the objects of engineering education and the best curriculum to attain the desired ends. A director is to be appointed, with an advisory board, and Dr. H. S. Pritchett of the Carnegie Corporation has recommended to his directors and to other foundations the expenditure of $108,000. Action is to be taken immediately by appointing a faculty committee at each school to cooperate with the director.

At the opening meeting on Wednesday afternoon Dean D. S. Kimball gave a notable address on training for leadership. He said that precedents were lacking whereby legal leadership in the nation could codify past experiences and that the present epoch utilized pure and applied science so greatly that the engineer was needed. The fundamental curriculum, he thought, should not be changed as such a practice would undermine the standing of the engineer which has been built up over many years. Hope for solving present problems lies in the application of engineering principles by the industrially intelligent, and the present era calls for universal wellbeing, not private, state or corporate profits. In the opinion of Dean Kimball, the chief trouble with the present curricula as regards training leaders is that they afford no historical background. There is also an insufficient number of inspiring teachers.

Excellent arrangements were made for caring for visitors in the Cornell University buildings, and many entertainment features were provided for the visiting ladies. On Wednesday night President Farrand of the university welcomed the members of the society, and President C. F. Scott of the society responded, after which an informal reception was held.

## Baltimore Rates Reduced

### Maryland Commission Fixes Prices Designed to Save Consumers of Energy $700,000 a Year

FIXING a valuation of $81,400,000 on the property of the Consolidated Gas, Electric Light & Power Company, which is $31,200,000 less than the figure arrived at by the company's expert, the Maryland Public Service Commission has ordered a reduction in gas and electric rates, effective July 1, designed to save consumers $1,350,000 a year, while still preserving 8 per cent dividends.

A radical cut is made in the gas department, where $650,000 is to be saved to consumers. The 8-cent primary rate for electricity is not reduced. Electric bills of domestic consumers are reduced, however, by cutting the secondary rate from 5 cents to 4 cents and bringing the secondary rate nearer the primary rate. Consumers hereafter will go on the secondary rate after having used 40 kw.-hr. of energy at the primary rate instead of 50 kw.-hr. No reduction was made in the primary rate because it was demonstrated at the rate hearing that this rate was not compensatory and that it actually cost more to serve those whose entire bills fell within it than the amount they paid the company.

The power rates were reduced about 20 per cent. The commission refused to abolish the fuel rate adjustment and the rates will fluctuate, as heretofore, according to the changes in the price of coal. The base rate will, however, change according to the changes in the price of coal above $5 per ton, instead of $2.70 per ton as heretofore, the variation being one-hundredth of a cent for each 9 cents change in the price of coal instead of for each 3 per cent.

Savings to householders in electric bills are expected to amount to $350,000 a year, and savings to users of electricity for power to $350,000 a year.

The commission's action takes from the company a little more than half the amount of its surplus after dividends and all expenses are paid, and, according to members of the commission, divides between the company and its customers the results of prosperity.

In its decision the commission said:

"There were five estimates of value presented to the commission. We have given careful consideration to every item of each. We cannot adopt the company's 'reproduction cost new' appraisal as the rate base. It would be unfair to the patrons and, we believe, unwise for the company to urge it. The banking and investing public would not accept it. From a long experience with the company, and from a study and consideration of the entire testimony, we are convinced that the security issues now outstanding represent par value in property, a belief evidently shared by the banking fraternity and investing groups."

COMPANY TO ABIDE BY ORDER

Herbert A. Wagner, president of the company, gave out this statement:

"The decision of the commission resulting in a reduction of both gas and electric rates amounting in money to $1,350,000 a year (or nearly $4,000 a day) comes after the most exhaustive inquiry into the conduct of our business that has ever taken place. We have no comment to make as to the commission's point of view.

"Baltimore has been enjoying gas and electric rates lower than those in any other city on the Atlantic seaboard. Now they have been made still lower. In fact, the electric rates for domestic and commercial consumers are now made lower than the pre-war rates, in spite of the fact that commodities generally are still at least 60 per cent higher than before the war.

"The reduction in rates is most drastic and such as we could not have anticipated, but we will accept and obey the commission's order in the best spirit we can and, with the continued co-operation of our customers, will do our best to furnish good service at the exceptionally low rates prescribed."

## Stone & Webster, Inc., to Manage Jamaica Public Utility

Stone & Webster, Inc., Boston, have been appointed managers of the Jamaica Public Service Company, Ltd., recently organized by Montreal banking interests to carry on the electric lighting, power and street-railway business of Kingston, the capital and chief town of the British West Indian island. The financing of the new company is being handled by a syndicate headed by Greenshields & Company and including Æmilius Jarvis & Company and Mackenzie & Kingman, all of Montreal. The West Indian Electric Company, Ltd., and the Jamaica Electric Light & Power Company, Ltd., formerly operating in Kingston, have been purchased. The new company will also serve the parishes of St. Andrew and St. Katherine, the territory having a population of 125,000.

Alfred S. Nichols, for the past six years manager of the Paducah (Ky.) Electric Company, has been appointed manager of the Jamaica company, and Roy S. Nelson, formerly chief engineer of the Eastern Texas Electric Company's generating plant at Port Arthur, Tex., will take charge of the generating plants.

## California Oregon Seeks to Acquire Douglas County

The California Oregon Power Company has made application to the California Railroad Commission for permission to exercise an option for the purchase of the plant and properties of the Douglas County Light & Water Company, which is engaged in the business of generating and distributing electrical energy and water in Douglas County, Ore., and Siskiyou County, Cal., for a purchase price of $600,000. The proposed purchase and merger of the Douglas County Light & Water Company is to be made effective as of July 1, 1923. Headquarters of the Douglas County Company are at Roseburg, Ore.; it has a hydro-electric and a steam auxiliary station at Winchester, Ore., and serves a population of more than seven thousand.

## Alabama Power Gross Earnings Increase $1,200,000

Net income of the Alabama Power Company for 1922 was $573,606, after deductions for interest, taxes and depreciation, or an equivalent of $3.06 a share on the $18,750,000 common stock outstanding. The gross earnings were $5,865,906, compared with $4,629,477 for the previous year.

"This increase," the report just issued says, "was due almost entirely to an increased volume of business in both wholesale and retail electric operations, new services to communities and industries and also from the sale of energy to public utility companies in adjoining states. There was no material increase in the street-railway and gas earnings."

Net operating revenue for the year 1922 was $5,745,320, while net earnings from operation were $2,750,721.

## Indianapolis to Have Large Automatic Substation

A large automatic direct-current substation will soon be in operation by the Indianapolis Light & Heat Company in a remodeled substation building in the rear of the company's offices. The substation, which will contain three motor-generator sets, will have a capacity of 4,000 kw. Two new units that have been put in place recently have a capacity of 1,500 kw. each, and an old unit of 1,000 kw. has been included in the new system. The substation improvements were made at a cost of approximately $700,000.

The machines start and stop themselves as the consumption of energy on the lines justifies an increased or decreased load. In case of mechanical trouble within a machine, such as an overheated bearing, it stops automatically and relays ring a bell, notifying attendants that something is wrong with the equipment. If any part of one unit should become inoperative, the machine is brought to a stop and an undamaged unit is automatically started. The new units will attain the maximum load in twenty seconds from a dead start, whereas the old type of machines require from three to four minutes.

Charles C. Perry, president of the company, said that the substation is to be made a battery-protected station. The battery equipment has been ordered and will be installed in a few months. This will give the company four battery-protected substations to insure against interruption of service in that part of the city receiving direct-current service. In addition to the four battery-protected and direct-current substations the company operates two substations that do not have the battery equipment.

In the past year the company has spent more than $1,000,000 in making additions to its direct-current equipment. Mr. Perry said that underground lines have been placed in the business district which will meet the requirements of a city of a million population. The capacity of the direct-current substations has been increased practically one-third by the improvements.

# Louis Bell Dies at His Home

## Distinguished Electrical Engineer, Authority on Power Transmission and Illumination, Passes Away at West Newton, Mass., at the Age of Fifty-eight

ELECTRICAL engineering suffered another loss on Thursday, June 14, when Dr. Louis Bell, well-known consulting electrical engineer of Boston, died at his home in West Newton, Mass., at the age of fifty-eight. Dr. Bell had been in poor health for some time, and the news of his death, lamented as it was, was not unexpected by his friends and associates. Simple funeral services were held at his home on Saturday, attended by many prominent in electrical and professional circles from Boston and elsewhere.

Louis Bell was born on Dec. 5, 1864, in Chester, N. H. He was graduated from Dartmouth College in 1884 and received the degree of Ph.D. from Johns Hopkins University in 1888, after specializing in physics. In the latter year he joined the faculty of Purdue University at Lafayette, Ind., as professor of physics and applied engineering. Here he organized the department of electrical engineering. In 1890, after a year of engineering practice in Chicago, he became editor of the ELECTRICAL WORLD, retaining that post until 1892, when he resigned to become chief engineer of the newly organized power transmission department of the General Electric Company. His pioneer work in this connection was of the greatest importance in placing this branch of the art on a commercial and an engineering basis. As engineer for the General Electric Company he designed and installed at Redlands, Cal., in 1893 the first three-phase transmission plant for general service. He also installed at Taftville, Conn., the first polyphase transmission plant for cotton-mill drive and for electric railway operation. In 1894 he took charge of the General Electric power work in the Chicago territory, removing to Boston in the following year to establish his own office. From 1895 to 1905 he lectured on power transmission at the Massachusetts Institute of Technology.

### HIS DUAL FIELD

In addition to his work on the transmission of power, Dr. Bell early specialized in illumination problems, coordinating the study of electric lighting with that of optics. In each of these important fields—power transmission and illumination—he produced the earliest standard treatise published in America. His "Electric Power Transmission" (1897) stood as authority for years and was translated into French and German, and his "Art of Illumination" (1902) was the only available volume on illuminating engineering for a long time after its publication. Since 1914 he had lectured on public lighting at Harvard University and on illumination at Harvard Medical School.

Other books of which Dr. Bell was the author are: "The Electric Railway" (1892), with Oscar T. Crosby; "Power Transmission for Electric Railways"

DR. LOUIS BELL

(1896) and "The Telescope" (1922). He was a prolific contributor to the technical press. He supplied the article on "Illumination" in the "Standard Handbook for Electrical Engineers," that on "Power Houses" in the Encyclopædia Americana and those on "Electric Power Transmission" and "Electric Motors" in the tenth and eleventh editions of the Encyclopædia Britannica. His impartiality as between his two chosen subjects is shown by the titles of some of his contributions to societies and periodicals. These include "Absolute Wave Length of Light," *Philosophical Magazine* (1888); "Practical Properties of Polyphase Apparatus," *Transactions* A. I. E. E. (1894); "Physiological Basis of Illumination," *Proceedings* American Academy of Arts and Sciences (1907), and "Star Colors, a Study in Physiological Optics," *Astrophysical Journal* (1910). He had been a regular contributor to the ELECTRICAL WORLD for many years, both editorially and over his own name. His journalistic work, done under high pressure as most of it was, displayed, nevertheless, when at its best, not only his mastery in his chosen fields, but an ability seldom possessed by engineering specialists to impart a graphic touch to a technical subject without wandering from it, and even, without the loss of dignity, to bring a smile to his readers by an occasional humorous sally couched in the passing vernacular of the day.

### HIS MANY AFFILIATIONS

Dr. Bell took out forty patents relating to power transmission and optical apparatus. He was a past-president of the Illuminating Engineering Society, a member of the American Institute of Electrical Engineers, of which he was a manager in 1891-94; a member of the International Electrotechnical Commission and the International Illumination Commission, and a fellow of the American Academy of Arts and Sciences. He received from British illuminating engineers the compliment of being made a vice-president of the Illuminating Engineering Society of London. He was secretary of the power transmission section of the International Electrical Congress held at St. Louis in 1904 and for six years (1895-1900) was chairman of the incandescent-lamp committee of the National Electric Light Association. In 1908 he undertook a roving commission in Europe for the Edison Electric Illuminating Company of Boston, studying the developments in lighting in many cities.

Dr. Bell had a profound knowledge of spectroscopy, alternating-current phenomena, wireless telephony, illumination in all its phases, physiological optics, the physiological interpretation of albedo and oculars. In the world war he was a member of the advisory committee of the Council of National Defense and in collaboration with Norman Marshall of Waltham, Mass., invented a system of signaling by ultra-violet rays which enabled dots and dashes to be transmitted invisibly to the enemy but with accurate reception for several miles by forces provided with the proper apparatus. This important contribution to the art of war was delayed in reaching the front by causes beyond the control of the inventors, although it is understood that it was successfully tested in the zone of advance and would have found widespread use had hostilities continued. His versatility was further shown by his interest in the technique of ordnance. He was a past-president of the Massachusetts Rifle Association. He invented a rifle sight which was used in the late war. His last research work was done in connection with the Sperry searchlight in the detection of helium.

For more than twenty-seven years Dr. Bell had carried on a consulting engineering practice in Boston, leaving design and construction to others and devoting himself to giving the advice and professional opinions that his acquirements so well fitted him to render. He was married in 1893 to Sarah G. Hemenway of Somerville, Mass., who, with a son, survives him.

## Pacific Coast Men Meet

**Interesting Employees in the Association—Promoting Electric Trucks —Western Development**

THE seventh annual convention of the Pacific Coast Electrical Association opened on Tuesday of this week at the Fairmont Hotel, San Francisco, with a big electric truck demonstration. Following a parade in which 116 electric trucks participated, the five hundred convention delegates and the members of the San Francisco Development League gathered for lunch and to hear several short talks on electric trucks. One of the largest users of these trucks in San Francisco stated that the delivery costs of his firm had been reduced more than 50 per cent since the discarding of gasoline trucks.

The most important thing the association has accomplished in the past year, said President James B. Black, is the reviving of the interest of the employee or class B members. The convention this year was being held in a large city to afford many members of this class an opportunity to attend and do some real work themselves, something to make the association worth while to them. The association, President Black said, is endeavoring to work from the bottom up instead of from the top down. This policy has borne fruit in the intensive work done by the Commercial and Technical Sections.

WESTERN DEVELOPMENT CONFERENCE

A special effort was put forth this year to make the "Western development conference," which was held on Friday, a big success. The association felt that it could profit by calling in men from the outside to discuss problems of mutual interest. The program of the conference included addresses by Willis Booth, president of the International Chamber of Commerce and vice-president of the Guaranty Trust Company of New York, who was to speak on "The Importance of the Pacific Coast in World Affairs"; Paul Shoup, vice-president of the Southern Pacific Company, whose subject was to be "The Effect of Government in Business on the Progress of the Country," and D. H. Botchford, vice-president and general manager of the Columbia Steel Company, to whom was assigned "The Steel Industry as a Basic Industry in the Development of the West."

The convention program this year was a departure from the usual type in that a few short crisp papers were presented instead of the usual committee reports. These papers were on correlated subjects to those studied by the committees during the year, and the interest taken in them stamped the plan as a success.

## Electrical Exhibit to Go to Small California Towns

The California Co-operative Campaign decided on an enlarged program at its executive committee meeting on Monday of this week held just prior to the convention of the Pacific Coast Electrical Association at the Fairmont Hotel, San Francisco. A pullman car and baggage car are to be purchased. The pullman will be equipped as a complete electrical home and the baggage car will be fitted out to show the possibilities of the use of electricity on the farm. These cars will be taken to all the smaller towns and communities of the state where it is not practicable to establish a regular "electrical home." The baggage car will be patterned after the cars exhibited by the farm bureau of the agricultural department of the University of California, which exhibited such cars throughout the state as far back as 1912 with great success. The cars will be painted yellow and named "California No. 1" and "California No. 2." It is planned to turn them over to the N. E. L. A. or some other national organization to be used to spread the electrical message all over the country.

The Co-operative Campaign will put on an additional field man, who will work largely among the architects and builders in the San Joaquin and Sacramento valleys. Two other field men will be added, one to work in the Los Angeles and the other in the San Francisco territory. These men will work among the contractor-dealers and other electrical distributing agencies to spread the message of co-operation and to establish a closer relation between the campaign and these branches of the industry.

The first half of the campaign's program for ten electrical homes in the state during the year has been completed. Five more homes will be shown in various cities during the remainder of the year.

# No License to Alabama Power for Lock 17

**Federal Commission Defers Action Because of Protest from Congressmen—Decisions Are Made on Many Applications from California and Other States**

PROTESTS from Representatives Almon, Jeffers and Bankhead of Alabama have caused the Federal Power Commission to withhold action on the application of the Alabama Power Company for a license covering the development of 5,000 hp. at United States Lock and Dam No. 17 on the Black Warrior River. (See ELECTRICAL WORLD for May 5, page 1051, and May 26, page 1229.) The position of the Alabama Representatives is that the State Public Service Commission is considering the issuance of a certificate of convenience and necessity. It is known, however, that the Alabama Representatives mentioned are opposed to any plan whereby the Alabama Power Company will secure a foothold on the Warrior River. They hope that a competitor for the Alabama Power Company will eventually be found through the disposition of Muscle Shoals and the Gorgas and Sheffield steam plants, and they would hold open for that interest such power as can be developed on the Warrior.

THE HIGH DAM AT MERCED

The commission has authorized the issuance of a license to the Merced Irrigation District of California covering a power and irrigation project on the Merced River in that state. Before issuing the license, however, the commission will investigate the safety of the design proposed. The arch structure is somewhat higher than anything which has been attempted heretofore.

SNAKE RIVER TRANSMISSION LINES

In authorizing a license to the Idaho Power Company covering the thirty transmission lines which connect its power stations on the Snake River with their load points, the commission will regard this network of lines—which have an aggregate length of a thousand miles—as a major project. As a rule transmission lines are handled rather perfunctorily as a minor part of a project. The commission's decision will make it necessary for the power company to furnish much more complete information than otherwise would be the case. About 30 per cent of the transmission line mileage is on public lands.

KERN RIVER LICENSE WITHHELD

In connection with the application of the San Joaquin Light & Power Corporation for a license covering a construction project on the Kern River the commission decided to withhold action until complete information is available with regard to the status of lands within the project area.

INTERCOMPANY DISPUTE

There also is a controversy in progress between the San Joaquin corporation and the Southern California Edison Company with regard to the level of the pool above the San Joaquin corporation's diversion dam. The Southern California Edison Company has agreed to a level of 948 ft. above sea level, provided the San Joaquin company agrees to draw down this pool temporarily whenever requested to do so, to enable the Southern California Edison Company to make repairs to its plant. The San Joaquin interests are unwilling to make such an agreement.

LICENSES AND DECISIONS

A license has been authorized for the Southern California Edison Company covering its Borel plant on the Kern River. This license was adjudged necessary in a recent opinion of the Supreme Court of the United States.

Permission to relocate 10 miles of its main transmission line between the Sierra Mountains and Imperial Valley has been extended to the Southern Sierras Power Company, so as to make the line follow the public highway.

Permission also was granted the company to build a 3-mile branch from its Palm Spring transmission line.

The city of Los Angeles has been denied rights on the Kings River. This proposed development is in the area suggested for inclusion in the Roosevelt National Park. The commission has also rejected the application of the San Joaquin Light & Power Corporation for rights on Bubbs Creek and Roaring Fork.

The Burbank Irrigation District will be allowed to place a temporary dam in the Snake River subject to the conditions which the Chief of Engineers has prescribed.

A license has been authorized for a 250-hp. project on Elk Creek in Idaho County, Idaho. The power is to be used for mining purposes by the Unity Gold Mines Company.

A license has been authorized for the Michigan Hydro-Electric Power Company of Three Rivers, Mich. It covers a project on the St. Joseph in southern Michigan.

The commission has authorized a license for the Houston Power Company covering a development on the Choctawhatchee River near Newton, Ala. The company propeses to construct a 50-ft. dam and install machinery capable of generating 5,000 hp.

Permission has been granted the Alabama Interstate Power Company to transfer to the Alabama Power Company the license covering its Cherokee Bluffs development.

PRELIMINARY PERMITS

The commission has authorized the issuance of these preliminary permits:

The Yosemite Power Company, Groveland, Cal., two developments on the Tuolumne River. An application for a permit covering a lower site was denied since it might interfere with the Hetch Hetchy water rights.

The Susquehanna Power Company of New York, covering the proposed 360,000-hp. development on the Susquehanna at Conowingo, Md.

OTHER ACTIONS

The Marianna (Fla.) Light & Power Company has announced its intention to develop a power project in the Chipola River, near Marianna. The commission has accepted jurisdiction.

The commission has authorized the executive secretary to prepare a condensed classification of accounts to be used by licensees not furnishing public service. These include mining companies, manufacturers and other industrial licensees. It also has authorized the executive secretary to act on behalf of the commission in the amending of licenses to embody minor changes in plants.

## Preliminary Permit Granted for Flaming Gorge

Despite the delay in ratifying the Colorado River treaty, which has held up action by the Federal Power Commission on many projects, a preliminary permit has finally been granted to the Utah Power & Light Company by the commission for its Flaming Gorge power development on Green River. The company is starting a preliminary survey and making plans for the construction of a 60,000-hp. plant and dam. An expenditure of $10,000,000 and the employment of a thousand men for three years when the final license is granted are involved. The site is 5 miles south of the Wyoming line in Utah, about 125 miles east of Salt Lake City.

## Commission May Now Act on Colorado River Projects

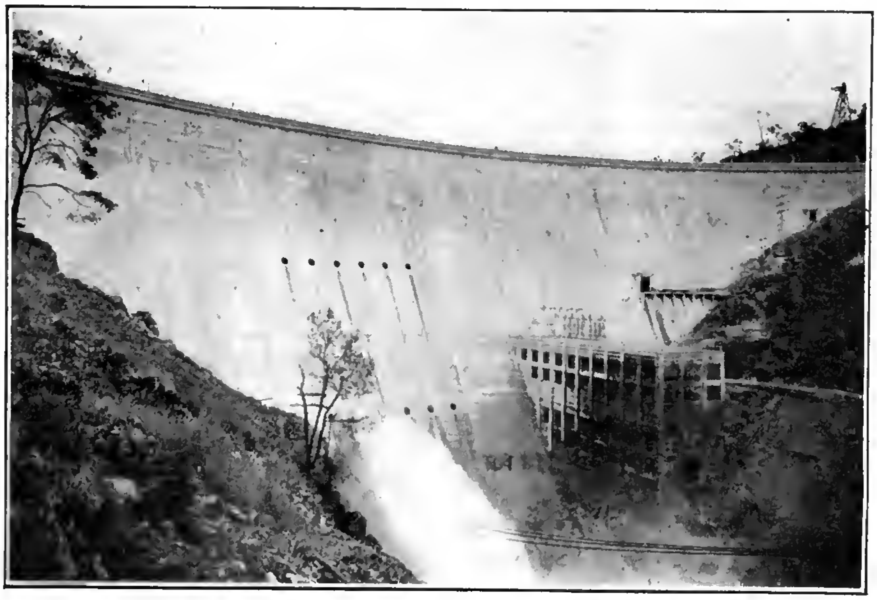
By granting a preliminary permit to the Utah Power & Light Company covering its Flaming Gorge project on Green River the Federal Power Commission has inserted the thin edge of the wedge which is expected to lead to action on the Colorado River projects. Regardless of what Arizona may do with regard to the ratification of the Colorado River compact, it is believed that the commission will this fall award the Girand license covering the large development proposed at Diamond Creek. It is believed that the upstream states could not insist successfully that the Arizona project be held up when they have urged the granting of the Flaming Gorge permit. Prominent officials of both Utah and Colorado are now on record as urging in very vigorous fashion the granting of that permit.

The load of the Utah Power & Light Company has been increasing at such a rate that a steam auxiliary must be put into operation in the near future. Unless the Flaming Gorge development is allowed to proceed as rapidly as possible, it will be necessary to construct additional steam units. It is to avoid this latter situation that so much pressure has been brought to permit the company to proceed with its foundation explorations at Flaming Gorge.

## Power and Irrigation

**Plant of Modesto-Turlock Irrigation District in California Distributes Energy as By-Product**

THE Don Pedro power plant of the Modesto-Turlock Irrigation District is the most recent hydro-electric plant to be placed in operation in California. This is a combination irrigation and power development costing $4,730,000, carried out primarily to increase water storage for irrigating 150,000 acres of land in the San Joaquin Valley. A power plant was built at the dam to utilize the head created and generate power from the water released for irrigation. The dam and power house are about 40 miles up the Tuolumne River from Modesto, Cal. The dam is of the concrete-arch type, 283 ft. high, creating a storage reservoir of 289,000 acre-ft. This storage will lengthen the irrigation season 40 per cent.



DAM AND POWER HOUSE AT DON PEDRO, CAL., ON THE TUOLUMNE RIVER

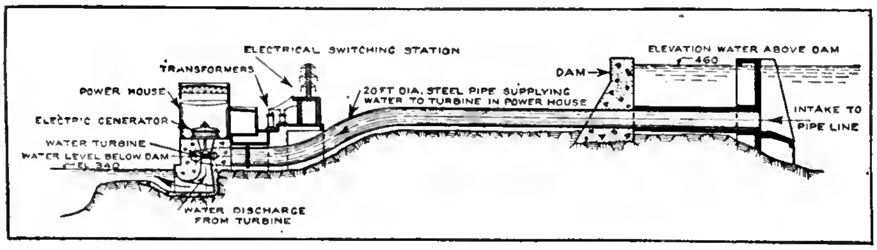
PRESENT CAPACITY 12,000 KW.

The power house, built on the downstream face of the dam, has a present equipment of three 4,000-kw. generators. The turbines are designed for variable-head operation. The efficiency is 91 per cent at 120 ft., the lowest head, and 83 per cent at 240 ft., the maximum head. The capacity at the low head is 62 per cent of full-load rating. Power is transmitted down into the valley over a 33-mile twin-circuit steel-pole transmission line at 66,000 volts. The Turlock district receives two-thirds of the power and the Modesto district one-third. Both districts are building distribution lines and will sell all power in excess of the requirements for pumping. The Turlock district already has many miles of distribution system and plans to build up a large range, water-heater and house-heating load. Rates for electric service are based on the "readiness-to-serve" theory.

## Ready to Start the Dam at Cherokee Bluffs

Following the approval of the Alabama Public Service Commission, Thomas W. Martin, president of the Alabama Power Company, has announced that the company will proceed at once to erect a power dam at Cherokee Bluffs on the Tallapoosa River, near Tallassee, Ala. The development will mean an expenditure of $10,000,000, and the dam, which will be 120 ft. high and 800 ft. long, will have an ultimate capacity of 132,000 hp. It will be the highest dam in the Southern States.

O. G. Thurlow, chief engineer of the Alabama Power Company and its subsidiary, the Dixie Construction Company, estimates that it will require more than two and one-half years to complete construction. Approximately 200,000 cu.yd. of concrete will be used in the dam and power house, and the largest body of water in the state will be formed when a reservoir of 22,500 acres, containing 25,000,000,000 cu.ft. of water, is backed up by the dam. Mr. Thurlow stated that the structure would be of a type popular in the Western States, but little used in the South. The power house will be built down stream from the dam instead of as an integral portion or on the upstream side, and the water will be conducted through penstocks leading from the dam above. Three units, generating 44,000 hp. each, are to be installed, and two of these will be placed in service as soon as possible.




CROSS-SECTION SHOWING PLAN OF CHEROKEE BLUFFS DAM AND POWER HOUSE

Much of the equipment used in building Mitchell Dam will be transported to Cherokee Bluffs, saving it from deterioration through idleness. The nucleus of the executive force which built Mitchell Dam has been retained and will be used in the new project. Cherokee Bluffs is in the center of a triangle formed by Montgomery, Alexander City and Dadeville, Ala.

## Hoover for Expansion of Electric Industry

"Further great application of electricity is one of the surest roads, not only to elimination of waste in industry, but to the stabilization of industry itself," Secretary Hoover said recently when interviewed at Washington. "Beyond this the enlarged scale of generation, distribution and reinforcement of reserve supplies of electrical power, spread over large areas, makes for continuity in industrial production such as cannot be secured in any other way.

"The growing interconnection of existing power systems and their reinforcement with larger centralized production units will serve further to assure the productive industries stability of their own power to a degree of importance that can be compared only to the relation of our Federal Reserve Bank system in stabilizing credit.

"Increased application of electrical power to replace innumerable small units of direct steam production not only becomes a great saving in labor, a general assurance of continuity of operation and a great reduction in the waste of material, but it also is a great contribution to the lightening of manual labor.

"One of the incidental problems of our industrial system is the inevitable growing shortage of common labor and the complete necessity that it shall be replaced with fewer units of skilled labor, performing the laborious task of the many. The more general spread of electrical power is inevitable for this reason, if for no other.

"The time is ripe for a general national program of superpower development. The stretch of economic transmission distances has brought power development from the mouth of our coal mines and from streams to within the economic reach of our industrial centers and our farms."

## Aims of New York Electrical Board of Trade

The board of governors of the Electrical Board of Trade of New York City at a meeting held June 20 accepted the following twenty tentative statements of the specific aims of its organization:

1. To represent the entire electrical industry of New York City in all matters of legislation, city departments, underwriters, etc., and to see to it that the interests of the electrical industry are safeguarded.
2. To co-ordinate generally all the activities of the various branches of the industry in order that no individual branch shall engage in any activities that would interfere with or demoralize any other branch of the industry.
3. To provide a method of co-operative and co-ordinated advertising with a view to accomplishing more far-reaching results and, at the same time, economize in expenditure.
4. To take up the problems of business and distribution of the individual branches of the industry through the board of governors, where all sides can be heard and where a proper disposition of the problems may be made.
5. To maintain a complete record of articles and of materials manufactured or dealt in, not only by members, but by all manufacturers and dealers, no matter where located.
6. To establish a bureau of employment so that any competent person from office boy to president may file an application for employment with the bureau, thus saving both employee and employer time and money in finding each other. The plan further contemplates that a reference from the board would be a thoroughly investigated reference and one that could be entirely relied upon.
7. To establish methods of carrying on the various types of business with a view to stabilizing conditions; i.e., attempting to see to it that methods of doing business are of such a type as to meet with the approval of the public at large, it being distinctly understood that this does not in any way mean the fixing of prices or the maintaining of any form of combination.
8. To maintain a complete and up-to-date mailing list subdivided according to types of business and territory with all the machinery for rapidly and economically distributing information, the idea being that, instead of each member being compelled to assemble and maintain an expensive mailing list, this work could be taken over by the board and the mailing out of materials be handled by the board for the members.
9. To establish a credit department for furnishing general credit information to the members, preferably the taking over of the present New York Electrical Credit Association and organizing it as a department of the board under the present credit manager, thus eliminating one set of expenses and expanding the work of this credit association to cover the membership of the board without additional expense.
10. To establish a bureau so that unknown inventors, who are now unable to market their inventions, may file description of the same with the board, and to appoint an experienced committee of the board, equipped with the knowledge of persons in the industry who might be interested in such inventions and would attempt to bring inventors and interested concerns together.
11. To establish a standing arbitration committee, consisting of the best judicial minds in the various lines of the industry, so that a controversy or disagreement between any members or between members and those not members could be quickly referred to three such arbitrators, thereby having differences settled by men skilled in the line in which the controversy arises, these men having a knowledge of every angle and ramification of the business.
12. To establish a bureau so that any member with a surplus of raw or finished materials could be brought in touch quickly with those in need of such materials.
13. Establishing an advisory committee of experienced and competent business men in the line to give business advice to such concerns as might apply for such advice, or even, possibly, citing a concern before such committee if, in the judgment of the board, it is necessary to do so for the benefit of the industry.
14. To remedy and improve the present bankruptcy methods and laws which now result almost invariably in a complete loss of property to the creditors with a gain only to certain types of attorneys; i.e., to establish machinery for economically and properly handling business failures in the industry.
15. To maintain a bureau for statistical information as to volume of business of various kinds in sight, conditions of the raw and finished material markets, etc.
16. To maintain a permanent exposition of interesting modern electrical devices and also, if possible, to maintain a museum covering the original models and early inventions so as to preserve such materials for the generations to follow.
17. To maintain a bureau of investigation of illegal businesses and particularly to follow up, expose and punish those lending themselves to the furthering of the sale of stolen materials and to so-called dishonest failures.
18. To make the Electrical Board of Trade the headquarters not only for New York men and members, but the New York headquarters for all in the electrical industry, no matter where located.
19. To establish a standing in the electrical business community for all firms holding membership in the Electrical Board of Trade and to bring about as rapidly as possible a condition where no firm or corporation can remain a member that does not conduct its business affairs and its relations with members or the public along lines of fair dealing and sane business and in a way to reflect creditably upon the industry.
20. Finally, to set up in the city of New York an institution, representative of the best talent and brains of the electrical industry, in both a technical and business way—an institution so representative of the electrical industry that citizens will recognize it as such and point to it with pride.

## Stave River Development

**By Means of Tunnel from Alouette Lake British Columbia Company Plans to Develop 115,000 Hp.**

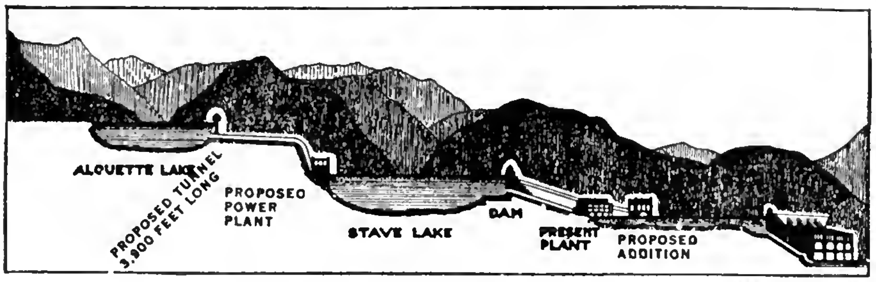
PLANS are announced by the British Columbia Electric Railway Company of Vancouver, which owns the Vancouver Power Company and the Western Power Company of Canada, supplying electric light and power to the city of Vancouver and other cities and towns in the Pacific province, for a power development of 115,000 hp. on the Stave River. This power is to be generated in three plants, the construction of which will be extended over a period of five to ten years. It is anticipated that the expenditure will be in the neighborhood of $10,000,000. The present Stave Falls plant was built by the Western Power Company and taken over by the British Columbia Electric Railway Company after its absorption of the former company in 1920. This plant has an installed capacity of 52,000 hp., the fourth unit, which brought the plant up to capacity, having been installed by the British Columbia Electric Railway Company in 1922. During the last year work has been going on raising the present dam and building a new dam at the Blind Slough, which will increase the water storage 50 per cent at a cost of $1,000,000.

Adjacent to Stave Lake lies Alouette Lake, distant about half a mile at its upper end. The water rights on Alouette Lake have been held by the Burrard Power Company, a subsidiary of the British Columbia Electric Railway Company. It was originally intended to develop power by means of a dam and flume, but with the acquisition of the Stave River watershed it is now proposed to tunnel between the two lakes, building a dam at the lower end of Alouette Lake and diverting the water by means of Stave Lake and River.

This diversion is at present the subject of an application before the provincial authorities, and if permission is given, a power house will be built at the mouth of the tunnel on Stave Lake. This plant will use a head of approximately 140 ft. and will generate 10,000 hp. Although plans are not definitely made, it will probably operate on a load factor of more than 80 per cent.

The second undertaking under the proposed scheme will be the addition of a fifth unit to the present Stave Falls plant, which will be made possible by the diversion of Alouette Lake water. Operating at a lower load factor than the Alouette Lake plant, 25,000 hp. will be developed.

Three miles below the present Stave Falls plant a third plant will be built, to be known as the lower development. At this site it is estimated that a plant of 80,000 hp. can be erected. The total flow from Stave Lake to tidewater will be made use of in the present power house and in the lower development. The upper plant now in operation utilizes a 150-ft. head and the lower plant will utilize the rest. Construction work on the Blind Slough dam is going on under the direction of R. S. Kelsch of Montreal, consulting engineer. E. E. Carpenter, formerly of the firm of Baker & Carpenter, San Francisco, has recently been appointed chief electrical engineer for the company, and he will have immediate superintendence of the proposed new work.




PLAN OF STAVE RIVER DEVELOPMENT

## How Municipal Plants Dwindle in Oklahoma

During the last year municipally owned electric light plants have had a thorough test in Oklahoma, and it is regarded as significant that ten of the plants in that state that were sold or abandoned were municipally owned. These towns decided to dispose of their city-owned plants and take energy from central-station companies.

Among the towns finding municipally owned plants unsatisfactory are Okemah, which has signed a contract with the Oklahoma Gas & Electric Company; Heavener, which sold its plant to the same company; Hunter, Billings, Watonga and Geary, which gave up municipal plants to take service from the Oklahoma company; Boswell and Soper, which signed a contract with the Public Service Company of Oklahoma; Ramona, which voted to abandon its municipal plant to receive service from the Sand Springs Power, Light & Water Company; Wapanucka, which sold its plant to the Public Service Company of Oklahoma, and Pawhuska, which was connected with the high-tension line of the Sand Springs company.

Norman and Lawton also abandoned their municipal electric lighting projects and are buying energy from the Oklahoma Gas & Electric Company. Eldorado a few weeks ago completed a high-tension line to the plant of the Quanah Light & Ice Company at Quanah, Tex., and Purcell is now negotiating for electricity over a line which is to be extended south from the town of Norman and through Noble to Purcell.

## Electrical Contractors Listen to Prominent Speakers

The Eastern division of the Association of Electragists International had its annual meeting in Pittsfield, Mass., June 14, when electrical contractors from the New England States, New York, New Jersey, Pennsylvania, Delaware and Maryland to the number of 150 gathered at the Maplewood Hotel.

Charles L. Edgar, president Edison Electric Illuminating Company of Boston, spoke on the selling of electrical service, saying that the lack of knowledge on the part of the ordinary central-station man as to the work of the contractor and the needs of his business is due to lack of association and contact. The central station, he said, should sell appliances on a price basis that will maintain an ample profit for other dealers. Great good could be done by developing the consulting function of the contractor.

Alice Carroll, a representative of the Society of Electrical Development, offered suggestions on providing good service after the sale is made. Charles L. Eidlitz, commissioner of electrical service for New York City, took as his subject "Back to Quality, Sane Costs and Fair Dealing." He explained the manner of regulating submission of bids, which is said to have met with favor with contractors and city officials, as based on exact understanding of the various items entering into a bid. The plan was interpreted at further length by Lawrence W. Davis, director of the association's department of development, whose address was on "Estimating and Selling the Job." Following these addresses the open and closed shop divisions held conferences.

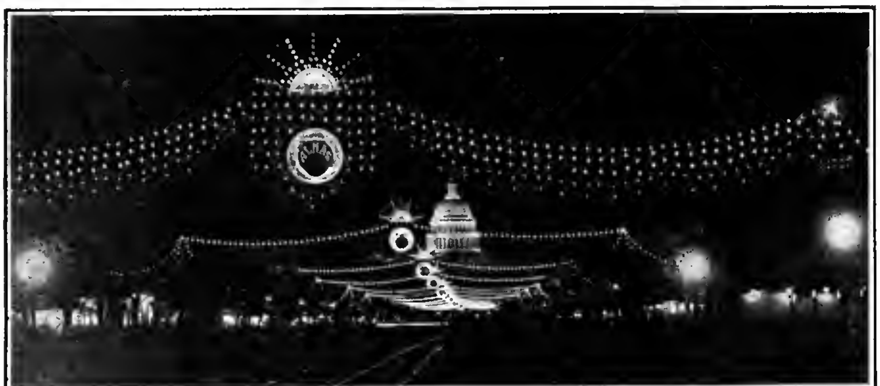
At the evening banquet President James R. Strong was the principal speaker. He urged fuller co-operation among the association members and also with other national organizations, like the plumbers' and steamfitters', whose work touches closely that of the electrical contractors.

## Fraud Charged in Expending Chicago Lighting Funds

George E. Carlson, Commissioner of Gas and Electricity for the city of Chicago, and five others have been indicted by a special grand jury, charged with criminal conspiracy to defraud the city in the expenditure of funds appropriated to the city lighting department. The charges, which are brought by the Citizens' Association of Chicago, allege depredations to the extent of $250,000, mostly caused, it is said, by having the city pay for material which was not delivered. It is further charged that the Commissioner has wasted about $200,000 of the $305,000 he has so far expended out of the proceeds of the two-million-dollar bond issue voted by the people in June, 1922, for the extension of the city's lighting system.

## Electricity at the Shriners' Convention

When the Knights of the Mystic Shrine gathered at Washington this month Pennsylvania Avenue from the Capitol to the Treasury Building, walled in on both sides by buildings bedecked with flags and festoons, presented at night a veritable ceiling a mile long of lights, red, green, yellow and white, divided at intervals by curtains of light extending below the main canopy. More than thirty-seven thousand lamps were used in the decorations, which cost $50,000. Pennsylvania Avenue was the "Road to Mecca," and Lafayette Square, the "Garden of Allah," was beautifully illuminated as a court of honor. The floodlighting of prominent buildings by means of powerful lamps and projectors also added greatly to the brilliant spectacle presented by the city as a whole. The plans were worked out by the Illumination Bureau of the Westinghouse Lamp Company.



©Westinghouse Lamp Company

## Engineers Discuss Standardization Plan

At the regular quarterly meeting of the main committee of the American Engineering Standards Committee, held June 15, at the Engineers' Club, New York, the chief matter of interest was a discussion of the new standardization project of the Department of Commerce. Dr. A. S. McAllister, who is to have charge of this work and who until recently has been on the staff of the American Engineering Standards Committtee as liaison officer of the Bureau of Standards, was present and outlined Secretary Hoover's plans.

The plans contemplate collecting information with regard to existing specifications for the purchasing of commodities and making this information and such specifications available to government departments and state and municipal authorities. In the opinion of the A. E. S. C. this work will have a stimulating effect upon the whole standardization movement and will result not only in a larger use of specifications but in a larger demand for the authoritative standards that are now being developed under the auspices of the federal specifications board and the committee.

# Brief News Notes

**Sioux City Extensions.**—Improvements totaling $3,000,000 are soon to be started by the Sioux City Gas & Electric Company. This includes the plans for a generating station to cost $2,500,000. The plant will contain two turbogenerators rated at 10,000 kw. each.

**Effort to Electrify Railroads in St. Louis.**—The Director of Public Safety of St. Louis is conferring with the traffic committee of the Chamber of Commerce upon an ordinance to compel the electrification of all railroads entering St. Louis. This action is to be taken to aid in abating smoke, and a law similar to that passed by the New York State Legislature to force electrification in Greater New York is favored.

**Rumored Mexican Development.**—Purchase has just been made of extensive water-power rights in the State of Vera Cruz, Mexico, near Orizaba, by Allen Rantell of London, England, and associates. It is asserted that this transaction is preliminary to the construction of one or more large hydro-electric plants which will furnish power for industrial concerns within a radius of more than a hundred miles.

**Public Service Corporation of Quebec to Become Quebec Power Company.**—Shareholders of the Public Service Corporation of Quebec, a subsidiary of the Shawinigan Water & Power Company, have ratified bylaws providing for changing the name to Quebec Power Company and increasing the capital from $3,000,000 to $10,000,000. This company is expected to absorb the Quebec Railway, Light, Heat & Power Company, which it now controls.

**"New York in 1923."**—An unusually attractive souvenir under this title was presented by the New York Edison Company to the delegates at the recent convention of the N. E. L. A. It was got up in very attractive form and contained many artistic photographs not only of familiar places in the city but the unfamiliar ones as well. The great majority of the pictures were taken by the company's own staff of photographers, though there were a few by Van der Weyde.

**New England Power Company to Furnish 12,000 Kw. to Steel Corporation Subsidiary.**—The American Steel & Wire Company, a subsidiary of the United States Steel Corporation, which has been purchasing part of its power during the last ten years, has recently signed a contract with the New England Power Company whereby it will purchase all of its power with the exception of that used in its steel rolling mills. This load is expected to average about 12,000 kw.

**Southern Minnesota Absorbs Spring Valley Utility.**—The Southern Minnesota Gas & Electric Company announces the purchase of the Northwest Utilities Company of Spring Valley, Minn. This adds twenty-two to the chain of towns now served by the Southern Minnesota company, making a total of about sixty-five communities in southern Minnesota and northern Iowa. The twenty-two towns will add four thousand customers to the company's list.

**Rice Lake, Wis., to Purchase Central-Station Plant.**—In accordance with a vote of its citizens registered three years ago, the city of Rice Lake, Wis., is at length about to issue bonds to take over the local electric light and power plant of the Wisconsin-Minnesota Light & Power Company. The property was appraised by the Railroad Commission in August, 1922, at $233,000 and, with subsequent improvements, is valued at approximately $250,000. The city owns much of the lighting equipment and also an auxiliary power generating olant operated by steam.

**Appalachian Water Power Conference.**—With at least one hundred New England cotton-mill owners invited to be present and the question of a survey of the French Broad River as one of the main topics, no little interest attaches to the second annual conference of the Appalachian Water Power Conference to be held in Asheville, N. C., June 25, 26 and 27. A federal appropriation of $200,000 is available for surveys in the Appalachians. The Asheville Chamber of Commerce is endeavoring to secure pledges that if the survey of the French Broad is made the recommendations will be carried out.

**Movement to Abolish Oklahoma Commission.**—A movement for the abolition of the Corporation Commission of Oklahoma was started when initiative petitions for this purpose were filed with the Secretary of State on June 1. The movement is backed by the Farmer-Labor-Reconstruction League and the farm-labor group, which is active in all the state departments. The proposed amendment would substitute for the Corporation Commission a commissioner of railroads and warehouses, who would be elected for four years with a salary of $5,000 a year.

**La Crosse Must Wait for Commission to Fix Rates.**—Efforts of the La Crosse (Wis.) municipal government to speed

up a change of the local electric light and power rates by injunction proceedings came to naught recently in the Wisconsin Supreme Court when that tribunal handed down a ruling that the city has no cause for action against the Wisconsin-Minnesota Light & Power Company pending a revision of rates by the Railroad Commission. When the court held the "loop" system of rates to be unlawful, the city set out to get a court ruling which would require the local company to use the rate in effect in October, 1920, before the "loop" rate was applied.

**Work Begun on Turner Shoals (N. C.) Project.**—The second water-power development recently announced by the Blue Ridge Power Company is now under way on Green River, in Polk County, N. C., where a large force of men is at work excavating for the dam, which will form a lake covering 400 acres and be slightly larger than the Lake Summit development at Tuxedo, several miles above on the same stream. The new development, which will be known as Turner Shoals, is on Green River just above where the highway from Tryon to Chimney Rock crosses the river. The company expects to develop 10,000 hp., and the project involves the expenditure of approximately $1,000,000.

**Westinghouse Units for Kearney Plant.**—The two turbine generators ordered by the Public Service Production Company from the Westinghouse Electric & Manufacturing Company for the mammoth new plant at Kearney, N. J., will be of the standard Westinghouse high-pressure condensing type, designed to deliver 40,000 kw. maximum with high-pressure steam at 325 lb. gage, 270 deg. superheat and 28.5 in. vacuum. They will be supplied with four bleeder openings each for the purpose of bleeding out steam to heat the condensate for boiler-feed water. The generators will be for 35,000 kw. at 80 per cent power factor and will be wound for three-phase, 60 cycles, 13,200 volts, to operate at 1,800 r.p.m.

**Plans for City Lighting in St. Louis.**—Fifty thousand dollars has been appropriated for making the plans for the city lighting system authorized by the St. Louis voters recently. The project involves establishment of approximately 50,000 electric lamps and the abolishment of 23,000 gas lamps. It is planned to place lamps experimentally at various points to determine by actual use which gives the most satisfactory light. One lamp under investigation will, it is claimed, illuminate the sidewalk without shining into the houses alongside. A special refracting lens is placed on the sidewalk side of these lamps which limits the area of illumination, while on the other side the light is thrown far over the street.

**Indiana Company Shows New Plant to Business Men.**—More than two hundred prominent business men of Indianapolis visited the new plant of the Central Indiana Power Company, on the Wabash River, 6½ miles from Terre Haute, last week as guests of the Merchants' Heat & Light Company, under the personal direction of Charles O'B. Murphy, vice-president and general manager. This plant was described in the ELECTRICAL WORLD for March 31, page 770.

**Insull Companies Take Interest in Social Welfare Work.**—A public utility chapter of the Illinois Children's Home and Aid Society with a potential membership of 25,000 among the employees of the Insull properties in Illinois is the latest move of interest in public welfare among utility organizations. A board of governors, with John F. Gilchrist of the Commonwealth Edison Company as chairman, Britton I. Budd as vice-chairman, L. C. Tovay as secretary and F. H. Scheel as treasurer, has been formed. The dues and other funds collected will all be turned over to the parent society, and the incidental office and clerical expense will be borne by the public utility organizations whose employees make up the chapter.

**To Put the River Bann to Work.**—Plans for utilizing the waters of the River Bann, flowing into Lough Neagh, in County Antrim, Ireland, 30 miles from the city of Belfast, have reached the stage at which many influential people are interested in their accomplishment, says Consul Kent, Belfast, in a report to the Department of Commerce. The purpose of this scheme is to generate electricity sufficient to supply all of the industries of that section. A bill was introduced into the British Parliament early this year for the chartering of a company and conferring upon it the necessary powers to proceed with this work. It is said that the people of County Antrim have just begun to realize that the River Bann possesses one of the finest hydro-electric power schemes in the whole United Kingdom and that enough power could be produced to light the whole of the six counties of northern Ireland and supply every mill and factory with power.

# Associations and Societies

**Chicago Section, A. I. and S. E.**—On June 27 the Chicago Section of the Association of Iron and Steel Electrical Engineers will hold an outing aboard a lake steamer sailing from Chicago to Michigan City and return.

**Worcester A. I. E. E. Section Elects Officers.**—The following officers have been elected by the Worcester (Mass.) Section of the A. I. E. E.: Chairman, Lewis E. Pierce; vice-chairman, Henry O. Tilton; secretary and treasurer, Stuart H. Anson.

**San Francisco Engineers' Club.**—Five hundred members of the San Francisco Engineers' Club, the San Francisco Electrical Development League and the Electric Club of Oakland were the guests of the San Francisco-Oakland Terminal Railways on May 28, when they were taken for a ride around the bay on the Hayward, the first turbo-electric ferryboat ever constructed, which is driven by two 1,200-hp. General Electric marine-type motors.

**I. E. S. to Convene at Lake George, N. Y.**—The 1923 convention of the Illuminating Engineering Society is to be held Sept. 24 to 28 inclusive at Lake George, N. Y. The headquarters of the convention will be the Fort William Henry Hotel. A well-balanced program of commercial and technical papers is being prepared by the committee on papers, under the direction of J. L. Stair of Chicago; a good program of entertainment will be provided, and unusual spectacular lighting features are planned.

**Northwest Electric Light and Power Association.**—The annual convention of the Northwest Electric Light and Power Association (geographic division N. E. L. A.) will be held in Seattle, Wash., June 27-30. The commercial and technical sessions will be held at the Washington Hotel in Seattle during the first two days of the convention, and on Friday morning the delegates will leave for Victoria, B. C., via Canadian Pacific steamship. The annual golf tournament will be held in Victoria on Friday afternoon, and following a banquet in the evening at the Empress Hotel the executive session will be held. At this session special reports will be presented and the election of officers will take place.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Southern Appalachian Water Power Conference—Asheville, N. C., June 25-27. J. A. Switzer, Knoxville, Tenn.

American Institute of Electrical Engineers—Annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Atlantic City, June 25-29.

Iowa Section, N. E. L. A.—Mason City, June 26-29. M. A. Linn, Des Moines Electric Co., Des Moines.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29. Frederic Nicholas, 30 East 42d St., New York.

National Council Lighting Fixture Manufacturers—Buffalo, June 26-28. C. H. Hofrichter, 233 Gordon Square Bldg., Cleveland.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association—Cedar Point, July 10-13. D. L. Gaskill, Greenville.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Michigan Electric Light Association—Grand Rapids, Sept. 11-13. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers—Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

# Recent Court Decisions

**Man Who Remains at Work in Dangerous Place After Seeing Companion Injured Cannot Recover Damages for Subsequent Hurt.** — In Straight vs. Western Light & Power Company, the Supreme Court of Colorado upheld the trial court in directing a verdict for the defendant. The evidence showed that Straight and another were working on a roof crossed by high-tension wires and that Straight's companion was slightly injured apparently by electricity leaking from these wires, which he did not touch. Subsequently the plaintiff was severely injured from the same cause. He testified that, although he had been originally warned not to go near the wires, on the day when he was injured the company's agent told him that they were "not leaking now" and it was safe to work under them. The court held that the injury to his companion constituted a warning that Straight, as a matter of law, was culpably negligent in disregarding. (214 Pac. 397.)*

**How Inadequate Income Injures Credit.**—In declaring confiscatory the rates prescribed by the Public Service Commission of West Virginia for the Bluefield Waterworks and Improvement Company (see issue of June 16, page 1429), the United States Supreme Court made these observations on the relation of income to credit and the injury caused by a rate of return too low to afford stability: "Investors take into account the result of past operations, especially in recent years, when determining the terms upon which they will invest in such an undertaking. Low, uncertain or irregular income makes for low prices for the securities of the utility and high rates of interest to be demanded by the investors. The fact that the company may not insist as a matter of constitutional right that past losses be made up by rates to be applied in the present and future tends to weaken credit, and the fact that the utility is protected against being compelled to serve for confiscatory rates tends to support it."

**"Present Fair Value" Not Synonymous with "Present Replacement Cost."**—In the case of the Georgia Railway & Power Company and the Atlanta Gas Light Company against the Public Service Commission of Georgia (see issue of June 16, page 1430), in which the gas rates set by the commission were attacked, there was a great difference between the valuation figures of the company and those of the commission's engineers, as well as a difference as to the rate of return which the proposed new rates would yield, the company asserting that it would be 3 per cent and the commission that it would be 6 per cent. The State Supreme Court dismissed the suit, partly on the ground that the return could not be determined until the lower rate was tried in practice. The majority opinion of the United States Supreme Court concurred in this view. (See also the Brush Electric Company case, issue of June 16, page 1435.) The court of last resort also approved the finding of the Georgia commission that "present fair value" is not synonymous with "present replacement cost," particularly under abnormal conditions. "The refusal of the commission and the lower court to hold that for rate-making purposes the physical properties of a utility must be valued at the replacement cost, less depreciation, was clearly correct," the majority opinion declared.

**Right of Commission to Institute Revaluation Proceedings Upheld.**—The right of the Alabama Public Service Commission to revalue the property of a public utility for rate-making purposes has been upheld in the Federal District Court in a case brought against the commission by the Mobile Gas Company. The court held, however, that the commission could not force the company to produce its books for a second examination. The decision has the effect of declaring constitutional the Brower bill passed by the last Legislature giving the utility board power to revalue a public utility when it deems fit. The opinion, reversing a previous dictum of the court, said that a contract between the state and the gas company did not result from the valuation of the company's property at its own expense.

**Indiana Commission Upheld in Permitting Competition in Indianapolis.**—An injunction against the action of the Indiana Public Service Commission in permitting the Terre Haute, Indianapolis & Eastern Traction Company to enter the competitive field in Indianapolis for supplying electric light and power has been refused by the Superior Court on the ground that there was no showing that the commission had acted beyond its jurisdiction, had acted with fraud, or that its order had violated any constitutional rights of the Indianapolis Light & Heat Company or the Merchants' Heat & Light Company. A salient point in the ruling was that "the public authorities are not prevented from granting a franchise to a subsequent and competing corporation merely because the effect of such subsequent franchise may be the creating of competition which will injure the business of the original corporation." The court said: "Even if there was no evidence of public necessity, yet if we are right, that no terms of any contract the plaintiffs hold have been violated, and if they are not being deprived of any property unlawfully, then, if the action of the commission was within its jurisdiction and no fraud was shown, the action of the commission is final."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Commission Rulings

**Considerations Governing Rural Extensions.**—Dismissing a petition from residents of North Gray who sought to compel the Cumberland County Power & Light Company to serve them, the Maine Public Utilities Commission declared that extensions of service should not be required in a section of a community so situated, by reason of its distance from the distribution line in sparsely settled territory or for any other reason, that service to it can be rendered only at additional or extraordinary cost, unless a guaranteed revenue approximating at least the cost of rendering said service can be had.

**Operation at a Loss.**—A public utility company cannot be compelled to operate at a loss where it is impossible to hold out the possibility of earning operating expenses, depreciation and a fair return upon its property serving the public. So holding, the Indiana Public Service Commission authorized the Winona Electric Light & Water Company to abandon heating service where the plant had been continuously operated at a loss, operating expenses could not be reduced, and where the company, if it was to continue to operate, must secure increased revenue. The likelihood of gaining additional consumers was very slight, and the heating rate was so high as to be practically prohibitive. The commission said that to increase the rate to a point that would permit the payment of operating expenses and a return would not be practicable as the present rate was so high that an attempt to increase it would probably result in a loss in customers and a decrease in revenue.

**Reasonableness of Desired Extension Must Be Determined.**—The public utility is not the only party to be affected by making expenditures in extensions, the Idaho Public Service Commission observed in a case concerning utility service in Cœur d'Alene. "The existing consumers," it continued, "must be considered in determining whether or not an extension should be made. Before an extension should be made there must be taken into consideration not only the necessity of the service but also the reasonableness of the demand. Even though there exists a necessity for the service the extension should not be made unless the demand is reasonable. Otherwise such extensions would result in increasing the rates upon the existing consumers. Extensions should not be made by a public utility where the immediate and prospective revenues to be received from such extensions are out of proportion to the cost of making the extensions. The expenditures for extensions must be guarded in order to protect the existing consumers against exorbitant rates."

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## F. M. Feiker Joins Society for Electrical Development

F. M. Feiker, formerly vice-president of the McGraw-Hill Company, Inc., and more recently on leave of absence as special agent of the Department of Commerce at Washington will after his return from Washington, be associated with the staff of the Society for Electrical Development, New York City. As a result of the appointment of Mr. Feiker the various branches of the electrical industry served by the society will secure the benefit of his broad experience and background, for he will be available to act as a special counselor to engineers, manufacturers, central stations, jobbers, contractor-dealers and publishers. His special training and wide knowledge in the engineering publishing and public relations field of many industries, qualify him eminently for such consulting work. Mr. Feiker will retain a consulting relation to the McGraw-Hill Company, and he will continue in a similar capacity his relation to the problems of personnel and organization of the Department of Commerce at Washington.

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F. M. Feiker

**Alfred S. Nichols**, who has been with the Stone & Webster organization for thirteen years and for the past six years has been manager for it of the light, power, street-car and gas company at Paducah, Ky., has been appointed manager of a new company organized to carry on the electric light, power and street-railway business in Kingston, Jamaica, British West Indies. Montreal banking interests organized the company, and Stone & Webster, Inc., of Boston have been appointed general managers. Mr. Nichols is of English birth and has had a wide business experience in British mercantile work and, during the past twenty years, in the United States in newspaper work and in the operation of public utilities.

**Clive C. Bell** has resigned his position as city salesman for the Wisconsin Valley Electric Company, Wausau, Wis., to become sales manager for the Ironwood (Mich.) branch of the Lake Superior District Power Company.

**John C. Karcher**, who was associated with the Bureau of Standards, Washington, D. C., until last February, has entered the service of the Western Electric Company as research engineer at the Hawthorne plant, Chicago.

**Samuel B. Flagg** has become associated with the Sanford Riley Stoker Company of Worcester, Mass., as special representative at New York City. Mr. Flagg was engaged for several years in fuel studies with the United States Bureau of Mines, and for the past six years has been associated with the Electric Bond & Share Company as fuel expert.

**Frank B. Faris**, formerly attorney-examiner for the Public Service Commission of Indiana and recently associated with the law firm of Haynes & Mote, Indianapolis, has entered the general practice of law in that city under his own name, devoting himself particularly to rate, securities, valuation, tax and other matters affecting public utilities before regulatory boards, commissions and the courts.

**Dr. W. R. Whitney**, director of the research laboratory of the General Electric Company, was recently elected a member of the corporation of the Massachusetts Institute of Technology for a term of five years. He was graduated from the institute in 1890 and has for some time been a non-resident professor of theoretical chemistry there. Walter Humphreys of Brookline and Charles R. Maine, consulting engineer of Boston, were also elected. These three succeed P. W. Litchfield, A. D. Little and E. S. Stevens.

**L. C. Bewsey**, superintendent of the Michigan United Railways, Kalamazoo, Mich., has severed his connection with the company to become general manager for the holdings in Cuba of the Electric Bond & Share Company of New York, with headquarters at Santa Clara. Previous to his association at Kalamazoo Mr. Bewsey spent four years in the Philippine Islands as superintendent of transport and motive powers for the Manila Electric Company and as electrical engineer in charge of estimates, designs and construction for the Pacific Commercial Company of Manila.

## A. H. Timmerman Electric Power Club's New President

Arthur Henry Timmerman, vice-president and chief engineer of the Wagner Electric Manufacturing Company of St. Louis, was elected president of the Electric Power Club at its meeting in Hot Springs, Va., last week. Mr. Timmerman has been associated with the Wagner company since 1899, when he left the School of Mines and Metallurgy of the University of Missouri, where he was professor of physics and electrical engineering, to enter the industrial field as an engineer. In 1908 he was advanced to the position of chief engineer, and in November, 1919, he was made vice-president and chief engineer, the office he occupies at the present time. Mr. Timmerman was born in New York City in 1871. He was graduated from the College of the City of New York in 1891 and later received the degrees of M.E. and M.M.E. from Cornell University. He spent one year as instructor in physics at Washington University, St. Louis, and for five years previous to his association with the Wagner company he was at the University of Missouri. Mr. Timmerman is a fellow of the American Institute of Electrical Engineers and a member of the National Electric Light Association and of the Society of Automotive Engineers.

A. H. Timmerman

**J. W. Denison**, formerly purchasing agent of the Southern Wisconsin Electric Company at Lake Geneva, Wis., has been made assistant treasurer of the Michigan Gas & Electric Company, with headquarters at Three Rivers, Mich.

**Horace H. Dodd**, manager of the Lawton & Duncan Electric Company, Lawton, Okla., has tendered his resignation and will be succeeded by J. S. Boyett. The Lawton & Duncan Electric Company is successor to the Comanche Light & Power Company, the Duncan Electric & Ice Company and the Temple Electric Company, and Mr. Dodd has been identified with these properties for the last fifteen years.

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Breaking Into the Electrical Industry

### Obstacles Encountered by the New Manufacturer a Brake on Progress and a Menace to the Industry

By a Small Manufacturer

THERE is a situation in the electrical industry which I believe should be discussed. Unless it is corrected, it will deprive the industry of the inventive genius and vision of many of our young men by making that part of the industry devoted to the manufacture and sale of wiring supplies an unattractive field to enter.

There is nothing that appeals more strongly to the interest and imagination of the best type of American youth than the mystery and constantly new developments and applications of electricity. As a result, our engineering schools are filled with students who are taking courses in electrical engineering, hoping that with their enthusiasm and vision, backed by their willingness to work hard, they may be able to attain success in their chosen profession. These young men in their home training and in their competitive athletics have developed a high sense of honor and square dealing, and never for an instant imagine that in their chosen electrical field they will meet with other than the square deal, with success the reward to the best man. With the present conditions in the industry they are bound to meet with disappointments which will destroy their faith and ideals.

#### An Opposing Barrier

In order to view the situation clearly, let us assume that some of these young men start to manufacture a line of wiring supplies, first having closely studied the uses to which the various devices are put, and also having studied their competitors' products, so that in their product they may incorporate as many improvements as possible both from an engineering and a quality standpoint. And let us assume that they have turned out a high-grade product that could be sold in fair competition.

They call on all the principal jobbers of electrical supplies and receive a rather cool reception and no orders. Many of the men interviewed remark on the superior quality and cleverness of the designs, but they all frankly state that under no circumstances would they handle any of the product. Some kindly soul then tells them that they are "up against a hopeless proposition," as all of the jobbers on whom they have called are "old line" jobbers, and in the wiring supply field these jobbers rarely handle anything but the products of a small group of large "old-line" manufacturers. And so our young friends will soon discover that it is exceedingly difficult to market their products through the leading jobbers.

#### Using the Patent Feature

It would seem at once that such a relationship between manufacturers and jobbers clearly is in restraint of trade, and it may be wondered how it comes to be permitted, but the answer is soon found. There is some slight detail of the product of this "old-line" group of manufacturers that is covered by a patent. The detail may be trivial or even a disadvantage as compared with some other construction, but it is patented and therein lies its value. If one of the manufacturers in this group has some patented feature with his product that can be made a talking point, although practically of no value, all of the manufacturers in the group embody this feature in their device, and by advertising and sales work endeavor to create the impression that this feature is essential to a device of the kind. The United States government, in granting a patent, grants the recipient of the patent a monopoly for seventeen years on that particular construction. It is therefore clear why these manufacturers attach such importance to some apparently unimportant patented feature.

With the principal outlets for their products shut off from them, our young friends now are forced to seek other channels through which to move their products, and they find that there are a number of smaller dealers and small jobbers who are selling a great deal of material, but at very low prices. While a manufacturer must quote about 10 per cent below the prices of the "old-line" manufacturer in order to obtain the business, still, as the overhead expense of a small manufacturer is very much less than that of a large company, this difference in selling price is under normal conditions not a serious handicap. Therefore, as the young manufacturers have a good product and have made strong connections with the smaller jobbers, they begin to make some headway, but not for long, as the "old-line" manufacturers and jobbers are watching them closely, and as soon as they see that any manufacturer of wiring supplies is getting a foothold they open a barrage of cut prices which they expect will forever quiet the ambitions of any competing manufacturers. The price cutting is confined solely to the products made by the manufacturers under attack, while on other wiring lines prices are kept high to cover losses from cut prices.

#### Obstructive Distribution

If some one manufacturer was to make such sweeping cuts in selling pri es, it would be an indication of gross incompetence, but when a group of manufacturers send out at the same time the identical cut prices, confined to certain articles, it would seem clear that they are acting on a definite plan to eliminate competition. They feel that no manufacturer can exist whose products are confined to those on which they have cut the prices, and the

cut is no doubt made to accomplish that purpose.

To make these cut prices effective the "old-line" manufacturers have to count on the old-line jobbers handing the cut on to the trade, but a jobber realizes that cutting the selling prices in half may have a serious effect on his profits and so does not always want to help out in the plans. It, therefore, has become necessary for the manufacturers to have their own selling force right out on the firing line so that the cut prices can be handed directly to the wiring contractor, and to accomplish this they buy up electrical supply houses in different parts of the country so that the field shall be fully covered.

If our young friends had entered the radio manufacturing field or some other field than wiring supplies, their situation would have been quite different. Here they would have found the same "old-line" jobbers very keen to consider any proposition of merit, as they would not be acting under the restraint that governs them in the wiring supply field. Entirely new manufacturers of radio and other electrical parts have built up large businesses through these same jobbers, which indicates the possibilities of the industry when all restraint is removed from it.

### ARE SMALL MANUFACTURERS NEEDED?

It may be argued that the industry does not need the small manufacturer and that there is no room for him, because the large "old-line" manufacturers can supply all of the needs of the industry; but is this a fact?

Practically all of the improvements in wiring supplies have come from some upstart manufacturer and then have been copied by the "old-line" manufacturers, who by their grip on the industry have secured the profits that should have gone to the men responsible for them and which would have gone to them had it not been for the methods above described.

Another plan frequently used by such manufacturers in their efforts to kill competition is to threaten the smaller men with a suit for infringement of some patent. There may be no real basis for a suit—absolutely no infringement—but attempts are made to bluff some manufacturer into giving up a line that he manufactures rather than face the expense of litigation; for the large company knows that it can frequently wreck a small company by litigation more easily than by any other method, owing to the expense of defending the suit. In other cases dealers are warned by salesmen against buying the product of the new manufacturer and are told they may be liable to a suit for infringement if they do so. This has been tried in a number of cities at the same time, showing it to be part of a definite plan.

Such methods cannot stand the light of publicity, and the quicker they and others like them are exposed the sooner will the electrical industry become what it rightly deserves to be—that is, one offering to the bright American youth wonderful opportunities, with equal right to all and with the reward to the one justly earning success by his contributions to the industry.

# One Profit for the Jobber

**A Policy of Wholesale Business Only Is that Toward Which the Jobbing Industry Must Work as Its Service Grows More Intensive**

BY E. C. WEHLE
President Southern New York Electrical Supply Corporation, Binghamton, N. Y.

THE jobber of the future will have to be contented with one profit. As every man who is studying the trend of the electrical industry knows, the jobber's business is becoming steadily more localized. Contractors are buying more habitually from their nearest sources of supply, and the warehouse and service function of the jobber is becoming of steadily growing importance. The trend seems to be away from the day when the jobber traveled and sold on a wide territory in active competition with a large number of other jobbers and toward a more intensive service in a smaller district which can be served quickly, easily and economically from the warehouse.

Moreover, the customers of the jobber are becoming more and more opposed to competition from those from whom they buy. Put yourself in their place. Would you care to buy your material from a manufacturer who competed with you every workday in the week? Of course, this does not affect the contractor 50 miles from your place of business, but at the same time it is a good argument as it affects the electrical jobber who sells at wholesale only.

I absolutely know that the jobber who is now in the contracting and retail business will increase his wholesale end if he will stop trying to make double profit. Perhaps his earnings will not be so large the first few years, but they will ultimately gain by such a policy. I have heard of jobbers who have a contracting department threatening to put out of business a contractor who did not buy from them. I have seen jobbers establishing retail stores in small towns and cities trying to put the contractors out of business because of some grievance. But such a policy loses friends and customers and kills any business.

I believe that a jobbing house doing a "wholesale-only" business can render better service to its customers because it can devote all its time and energy to that end. The game today for the electrical jobber is to keep down his overhead and not build or rent a building for display purposes; rather, to consider location, yearly rental or investment in building, method of receiving and shipping of material, to give good service and not be too lenient with credits.

I have watched the jobbing business develop for many years. My first experience was at the age of fourteen years. I made a deal with a local locksmith who had a retail store on one of the main streets in Rochester, N. Y. We put in a fifty-dollar stock of electric bells, batteries, etc. I borrowed my $25 from my father. Nichols took the orders for repairing and installing doorbells and I did the work after school hours. We then split the profit at the end of the week. I made $180 the first year. I then decided I would make the electrical business my lifework. After I finished school in Rochester I got enough money to go to an electrical school in Washington.

When I returned from Washington I obtained a position with a Buffalo jobber as road salesman, and for the past sixteen years I have been in the jobbing end of the electrical business and have learned to love my work.

In the twelve years I was on the road I had an increase of business every year with the exception of three. I have always tried to increase my business over the previous year.

I am now president of this company. We have a location in the wholesale section, just off the main street in Binghamton. We pay less rent than any other jobber in the section. Goods received from manufacturers are put in a chute on the front of building and sent on the way to our stockroom. Like most jobbers, we have all the labor-saving devices that are necessary to make prompt delivery at a minimum cost.

Our business is growing very rapidly and I consider our success due to our policy of doing business. We sell at wholesale only, and the interest of our customers is therefore our most important consideration. We are not in competition with them at any point and are free to put our whole mind to serving them and developing the greatest possible amount of business for the territory we cover.

## Bearing of Linseed-Oil Decision on Open-Price Plan

By Franz Neilson
Counsel Association of Electragists International

ON THE fourth of June the United States Supreme Court handed down a decision declaring illegal the operations of the linseed-oil producers in conjunction with the Armstrong Bureau of Related Industries of Chicago. The question has been asked whether it is true that this decision means that all open-price associations must discontinue.

The answer is that it means no such thing. A number of people are as much mistaken in this conclusion concerning the effect of that decision as they were in others in the past, notably the Hardwood case and the Gypsum case.

The linseed-oil plan is no more representative of the things that can be legally done in open-price associations than the Hardwood and the Gypsum plans were.

The linseed-oil arrangement was not an open-price bureau at all. Stripping its written plan of the excess verbiage, there remains an agreement (a) to file price lists and (b) not to cut such filed prices without at once notifying the bureau. Add to this the intense activity of the bureau in pursuing cases where a cut in price was made—instanced by getting members "on the carpet" when such cuts were made—and we have a combination about as unlawful as in the Hardwood case. Filing a price list and agreeing to telegraph if that price should be cut amounts to fixing future prices.

We cannot say that this decision has any bearing on the plain, legally operated open-price exchange—except the psychological one of scaring people who do not understand.

It is plain that the linseed-oil scheme did not fall within the lines of the thumbnail chart previously issued regarding safe conduct under an open-price plan. That chart is as follows:

The members may exchange facts, including past prices and other statistics, and meet in pursuance thereof; but there must not be any agreement, express or implied, or concert of action respecting the things prohibited, which are chiefly prices to be charged, apportionment of territory, allocation of customers, limitation of production, discipline of competitors, etc.

Each member by himself and uninfluenced by the others must arrive at his own conclusions from the facts he has received and decide for himself what he will do, and this without communicating his decision by word or sign to the others.

Argument from business men, as distinguished from lawyers, in favor of statistical activities by trade associations is found in the report of the committee on trade associations of the United States Chamber of Commerce, appearing in the chamber's "Referendum No. 41," published Feb. 26 last.

Excerpts therefrom are:

"That the courts and investigations made by the Secretary of Commerce have disclosed a small minority of associations which may have misused statistics in carrying out a scheme to restrain trade we believe in no way invalidates or discredits legitimate collection and distribution of trade statistics by associations. On the contrary, your committee is confident that proper statistical activities on the part of trade associations not only do not run in contravention of laws respecting restraints of trade, but actively encourage and develop trade. . . .

"Summarizing the preceding discussion, the committee believes that trustworthy information concerning capacity, production, stocks, sales and prices is essential to the effective operation of industry and trade under competitive conditions. The voluntary reporting of such information to trade associations and the subsequent publication or dissemination of such information in a manner which makes it available not only to contributors but also to consumers and to the public generally is beneficial alike to the field of business and the public and does not constitute a restraint of trade."

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

RENEWED activity in trade was reported last week by electrical supply jobbers. Manufacturers are busy in electrical lines and transportation conditions are much improved. Production by central stations is gaining by leaps and bounds. Stocks in distributors' hands are now well rounded, the only shortage reported being in some of the larger sizes of rigid conduit.

Prices weakened slightly last week in rubber-covered and weatherproof wire, with some readjustments in flexible armored conductor. Seasonable weather long delayed is moving fans, but the outlook is not attractive in the coastal sections for a record business in fans this year. Washing machines are selling well, but the demand has slackened somewhat within the past four weeks.

Electrical presents are increasing in popularity for the June bride, and there is a good demand for automobile accessories of electrical character. Motor sales are in excellent volume, but competition is very sharp. Barring weakness in cotton-textile production and excessive labor costs in the building industry, with continued uncertainty as to the outcome of wage demands in the telephone field, Eastern business is in excellent condition. The demand for paper for use in cable manufacture is unusually heavy.

### Permanent Palace for Electrical Industry at Leipsic Fair

FOR some centuries an annual fair has been held in Leipsic, Germany, to which sellers have brought their wares and buyers have come to view them and to purchase. With the development of regular commercial channels and relations, it became usual to bring only samples to this fair, and orders were taken for future deliveries.

Electrical manufacturers have exhibited their apparatus and materials at this fair wherever they could find place, with all the accompanying inconveniences. Press dispatches now tell of the completion of a "Haus der Elektrotechnik," or a home of electrical industries, in which each exhibitor can have the same space year after year,

with permanent wiring, and merely change his exhibits if he so desires.

The exhibitors are divided into ten groups: (1) Large companies with several lines of manufacture; (2) motors, generators and transformers, with starters, regulators, etc.; (3) measuring instruments and meters; (4) communication field and devices using small currents; (5) switchboard equipment and wiring supplies; (6) porcelain products; (7) cables, wires and conduit; (8) raw materials; (9) heating, cooking and medical devices; (10) the illumination field. The building is provided with an auditorium for conventions or for special exhibitions. The electrical interests are said to be the first group of industries to provide a separate building for its exhibits at the fair.

## San Francisco Business Reported on Increase

WIRING crews are very busy, but estimators and outside solicitors for construction work report slower conditions. Store business is better, but the larger socket appliances, such as washers, are in their usual seasonal slump. Pole-line hardware prices have increased about 5 per cent, but other lines remain firm. Steamer rates to the Coast will advance July 30 and so, if for no other reason, further advances in all bulky lines may be expected. The steamer rate increase may be as high as 40 to 50 per cent. Probably half of present shipments are reaching the coast via steamer. Range sales are holding up well in sight of the 1,500 total for 1923 estimated by one of the power companies. Pole line material of all kinds is moving very briskly. Street-lighting material is expected to move very well, $2,000,000 for California being an expert estimate of sales within the next year.

## Chicago Jobbers Report Another Quiet Week

ELECTRICAL jobbers report another quiet week of trade. While a greater amount of contracts for various commodities and work of divers kinds have been figured on this week, the actual orders received have not been up to last week's mark. Pole-line hardware demand, however, has been very good. High-tension equipment demands still remain steady owing to central-station buying, which has been quite active. Certain types of motors of one manufacturer have increased 10 per cent. This increase covers types not increased previously. Conduit stocks have been replenished to a certain extent and firm prices are again being quoted by some manufacturers.

Transformer demand has been the same as previously, with no exceptional demands for this class of material at this time. Prices are firm and deliveries are not being made inside of six to eight weeks. Schedule-material prices are firm and stocks normal. Building permits for this week amount to $5,712,000, as against $5,019,000 last year. Labor unions are still arbitrating wage increases and the closed-shop conditions, which have had a tendency to retard building in this section.

## Delinquent Electrical Accounts in May Showed Improvement

AN IMPROVEMENT in the number of delinquents in electrical accounts for May, 1923, over April, 1923, is shown by the report of the National Electric Credit Association. All territories except New York show a lowered average value for this period. In the Chicago territory the total amount for April, 1923, was $111,130, while in May, 1923, it was lowered to $95,984. However, comparing May with May, 1922, the average amounts were $128 and $113 respectively.

DELINQUENT ACCOUNTS IN MAY

| Branch and Month | Number of Delinquent Accounts Reported | Total Amount | Average Amount |
|---|---|---|---|
| Central Division: | | | |
| April, 1922.... | 799 | $87,991.88 | $110.13 |
| April, 1923.... | 794 | 111,130.28 | 139.96 |
| May, 1922.... | 746 | 84,048.53 | 112.66 |
| May, 1923.... | 749 | 95,984.35 | 128.15 |
| New York: | | | |
| April, 1922.... | 460 | 56,616.00 | 123.00 |
| April, 1923.... | 422 | 63,771.00 | 151.00 |
| May, 1922.... | 440 | 58,401.00 | 133.00 |
| May, 1923.... | 437 | 68,228.00 | 156.00 |
| Philadelphia: | | | |
| April, 1922.... | 232 | 34,454.70 | 148.51 |
| April, 1923.... | 241 | 35,099 19 | 145.80 |
| May, 1922.... | 236 | 22,175.99 | 93.97 |
| May, 1923.... | 225 | 26,399.32 | 117.33 |
| New England: | | | |
| April, 1922.... | 68 | 7,128.00 | 104.82 |
| April, 1923.... | 44 | 7,979.04 | 181.34 |
| May, 1922.... | 108 | 7,908.93 | 63.97 |
| May, 1923.... | 29 | 3,464.08 | 119.45 |
| Pacific Coast: | | | |
| April, 1922.... | 25 | 3,594.67 | 143.50 |
| April, 1923.... | 39 | 8,444.75 | 216.53 |
| May, 1922.... | 24 | 2,133.82 | 88.99 |
| May, 1923.... | 20 | 2,910.69 | 145.70 |

The May, 1923, New York account, as compared with April, 1923, shows an increased average amount of $5. The number of delinquent accounts was 437 and 422 for May and April, 1923. The Philadelphia section for April and May, 1923, had lowered its accounts from $146 to $117, also reducing the number of accounts by sixteen.

The accounts in the New England territory for May, 1923, totaled $3,464, as against $7,979 for April, 1923. The total number of accounts for the same periods was twenty-nine and forty-four. On the Pacific Coast the accounts for May and April of this year were $146 and $217. The total number of accounts was lowered by nineteen.

A complete list of the accounts is reproduced above.

## General Buying Trend Is Still Cautious

MOST of the tests by which business trends are measured show a diminution of buying in primary channels, but a gain in retail distribution, according to Dun's review of trade. These are seasonal phases and do not mark any unusual or unexpected change in the general situation. Close observers of conditions had not anticipated that the noteworthy industrial expansion of the first quarter of this year would continue indefinitely, or that the rise of prices would go on unchecked, and the recent slowing-down process, with reaction in prices, has not been surprising.

The chief interest now centers on the probable course of events after the passing of the summer, and there is a disposition in many quarters to await a clearer insight into the future. This attitude is reflected by the increased conservatism in the placing of advance orders, as well as by the policy of avoiding burdensome accumulations of merchandise. While goods previously contracted for are being taken readily in most cases, isolated instances of cancellations still appear.

## The Metal Market

THE metal markets continue comparatively inactive, though sales of copper have improved. Consumers are not buying for forward delivery to the extent they were a few months ago, as their bookings have declined somewhat owing to the fall in metal prices. Improved export demand for copper has continued and prices are up.

Most producers feel the price should be fairly stable at between 15 and 16 cents. Lead has been remarkably quiet, and the windup of the Pittman act purchases of silver will have a further effe t in lessening production. In Chicago n ost sales have been at 7 cents. Zinc is quiet with less buying by galvanizers due to the price. Consumers are buying tin cautiously with forward deliveries sold ¼ cent less than spot.

NEW YORK METAL MARKET PRICES

| | June 14, 1923 Cents per Pound | June 21, 1923 Cents per Pound |
|---|---|---|
| Copper, Electrolytic. | 15.00 | 15.25 |
| Lead, Am.S.& R.price | 7.25 | 7.25 |
| Antimony.......... | 7.75 | 7.50 |
| Nickel, ingot........ | 27.00 to 32.00 | 27.00 to 32.00 |
| Zinc, spot........... | 6.37 | 6.37 |
| Tin, Straits......... | 41.90 | 41.90 |
| Aluminum, 98 to 99 per cent.......... | 26.00 | 26.00 |

## Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb.......................... | $0.34 | $0.034 | $0.0252 |
| Cold finished shafting, per lb.................... | 0.042 | 0.042 | 0.0328 |
| Brass rods, per lb............................ | 0.1850 | 0.1913 | 0.1533 |
| Solder (half and half), per lb.................... | 0.2862 | 0.2812 | 0.22 |
| Cotton waste, per lb.......................... | 0.1231 | 0.1231 | 0.104 |
| Washers, cast iron (½-in.), per 100 lb............ | 4.66 | 4.66 | 4.00 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100.................................. | 3.08 | 2.96 | 3.11 |
| Machine oil, per gal.......................... | 0.349 | 0.349 | 0.383 |
| Belting, leather, medium, off list............... | 42½% | 42½% | 46½% |
| Machine bolts, up to 1-in. x 30-in., off list........ | 44½% | 44½% | 62½% |

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Rescind Order to Close Lamp Works at Warren, Ohio

Officials of the National Lamp Works of the General Electric Company, Cleveland, at a meeting in New York, have rescinded the decision, previously announced, to close the works at Warren, Ohio.

According to A. M. Sweeney, manager at the plant, they will be continued in operation for an indefinite period, and the plan to concentrate production at the Cleveland works will temporarily be abandoned. The Trumbull (Ohio) plant of the company has been idle for for more than three months and has been placed on the market at a figure of $250,000.

## Nilco Lamp Works Acquires Whitelite Electric

The Nilco Lamp Works, Inc., Emporium, Pa., purchased the equipment, raw material and finished lamps of the Whitelite Electric Company, New York, on May 31. The purchase also included the transfer of the General Electric Company licenses of the Whitelite Electric Company and the New Jersey Tungsten Lamp Company to the Nilco Lamp Works, and they will be applied to increase the licensed quota of the "Nilco" lamps.

The Nilco company is moving its Type C works from Emporium and combining it with its Type B works at St. Mary's, Pa., where the general offices and warehouse will also be located eventually. This concentration of the company's operations will simplify production and facilitate shipments.

## Pelton Water Wheel Orders

The Pacific Power & Light Company has awarded a contract to the Pelton Water Wheel Company, San Francisco, for reconstructing the No. 4 turbine in its Walla Walla River plant, near Milton, Ore.. The work will include the installation of Pelton rubber-seal rings and a modern high-efficiency runner. The Pelton company recently reconstructed the No. 2 turbine in this plant, and the improvement obtained encouraged the Pacific Power & Light Company to have the same work done on the No. 4 unit.

The Montana Power Company has awarded a contract to the Pelton Water Wheel Company for furnishing two 7,500-hp. single-runner, single-nozzle impulse turbines for the first unit of its Mystic Lake (Mont.) development. These turbines will operate under an average effective head of 1,050 ft. and will embody various distinctive Pelton features such as auxiliary relief nozzles and direct-motion governors. The contract includes two hydraulic cylinder-operated gate valves at the power house and a butterfly valve at the head of the penstock. The latter will be equipped for electric motor operation and hand operation and for direct and remote control.

## Sturtevant Making Inquiries for Equipping Wisconsin Plant

The B. F. Sturtevant Company, Hyde Park, Boston, is putting out inquiries for a large list of new equipment for the manufacture of blowers and ventilating systems which will be needed for the retooling of the works of the former Wisconsin Engine Company at Corliss, Wis., recently acquired. The plant was idle six years, during which time the Corliss-engine production machinery was removed while use of the buildings was made by the government as a salvage warehouse. Harry W. Page, Boston, has been appointed works manager at Corliss.

## High Labor Costs Force Allis-Chalmers to Refuse Orders

Otto H. Falk, president of the Allis-Chalmers Manufacturing Company, has recently returned on the Holland-America liner Rotterdam after a four months' trip abroad.

"Allis-Chalmers is operating at about 75 per cent of capacity," he said, "but this is due to labor conditions, not to lack of business. We are turning down orders as we don't intend to increase labor costs because that would cause the price of our product to rise all over the country. Consequently, we are only producing our maximum with the labor we have at hand.

"Nearly all of the European countries are hard pressed for raw material. This is particularly true in Switzerland. Italy has the same lack of raw material. A number of large machinery plants in Europe have been recently closed because of this, and conditions in our line will not improve until the Rhur situation is settled.

"I talked with Dr. Cuno of Germany, and he wants to make every effort to clean up the situation. Dr. Cuno was much impressed with Secretary Hughes' proposal of an international loan to Germany by America and Great Britain. He wanted to arrange this loan and pay cash for a portion of Germany's obligations, and then have a conference of international business men, with Germany sitting in the conference, to decide how much more Germany could pay."

## Copper Export Association Sells Its Quota of 400,000,000 Lb.

The Copper Export Association, which was organized in 1921 to handle exports of copper metal for producers of the United States, has sold all of the 400,000,000 lb. of metal marked for export at that time. The association, it is said, will continue to handle the export business for the larger producers, despite the liquidation of the amount mentioned.

The association was organized at a time when the trade in metal for overseas and domestic account was at a low ebb. The larger companies continued production despite the falling off in business, and as a result stocks in large quantities began to accumulate in this country. Foreign business was not taking its usual amount of copper, and domestic buyers were not interested because of the general falling off in business. To lift a heavy load from the market, producers formed the association.

## Copper and Brass Research Body Adds Eight Members

The Copper and Brass Research Association has just added to its membership the Engels Copper Mining Company, Gransby Consolidated Mining, Smelting & Power Company, Dallas Brass & Copper Company, Merchants & Evans Company, T. E. Conklin Brass & Copper Company, J. M. & L. A. Osborn Company and Richards & Company, Ltd., the present membership of the association being composed of twenty-six copper-mining companies and fifteen copper and brass fabricating and distributing companies.

Information has just been received by the American association of the formation in England of a similar organization, the Copper and Brass Extended Uses Council, which will inform the public regarding the advantages of copper and brass for various purposes for which at present other metals or materials are being used.

## General Electric May and April Bookings Were $63,000,000

The General Electric Company during the months of April and May booked new business totaling approximately $63,000,000, or a monthly average of about $31,500,000. In the first quarter bookings were announced as $80,010,045, or a monthly average of $26,670,015. The total for the three months compared with $51,335,300 in the first quarter of 1922. This would bring the total new business taken on in the first five months of this year up to approximately $143,000,000. While indications point to bookings at an annual rate considerably in excess of $300,000,000, it is considered that if new business for this year totals between $300,000,000 and $320,000,000, the year will be a satisfactory one.

General Electric's business so far,

while diversified, is particularly concerned with heavy apparatus, with some reduction in the lines of smaller apparatus. In some lines departments are running at capacity production with business booked well in advance. The company's plants as a whole are not at present operating at capacity.

Billings of General Electric to May 1 averaged approximately $20,000,000 a month, gradually augmented because of the shipments of heavy apparatus booked over a year ago. Billings for the year may exceed $270,000,000. The current year was entered with unfilled orders of approximately $76,000,000, and with the addition of orders taken since Jan. 1, 1923, the company has had approximately $219,000,000 of business to work on.

## Rubber Independents Unite to Promote American Production

Of particular interest to electrical manufacturers is the recent formation of an independent organization known as the American Rubber Manufacturers, Inc., made up of prominent rubber manufacturers who recently withdrew from the Rubber Association of America.

These independents have been holding conferences in New York City during the last few weeks to further the growing of rubber in possessions of the United States where the climate is favorable.

It is asserted that this movement did not receive the support of the older organization. The officers of the new organization are: T. R. Palmer of the Continental Rubber Company, president; C. E. Murray of the Murray Rubber Company, treasurer, and O. M. Mason of the Mason Tire & Rubber Company, secretary pro tem.

The new organization aims to obtain assurance of a continuous supply of crude rubber, at a reasonable price, which it is stated cannot be obtained now as a result of the present British domination of the crude-rubber supply of the world. It is declared there should be a free movement of rubber unhampered by legislation which creates an artificial price for the product.

## Majestic Electric Development Company Sold

The purchase of the plant and equipment of the Majestic Electric Development Company, San Francisco, by the Majestic Appliance Company, Inc., has recently been announced. The new company will continue the manufacture of "Majestic" heaters and appliances at the San Francisco factory.

The personnel of the new company is: A. T. Burt, president; T. M. Simpson, vice-president and general manager; H. H. Daley, sales manager. According to the announcement, the entire Majestic line of air heaters, pancake and waffle irons has been redesigned and added to.

## Western Electric Company Moves Into New Philadelphia Home

On June 18 the Western Electric Company completed its move from the familiar location at Eleventh and York Streets, Philadelphia, to its new home at 910 Cherry Street. This new five-story building provides floor space of about 50,000 ft., an increase in office and warehouse capacity which has been sorely needed by the organization.

Some of the interesting features of the building, as pointed out by Manager Van Valkenburgh, are special provisions for giving service to customers. A pneumatic tube has been provided to expedite the transfer of orders from office to warehouse; conveyors have been installed for transporting merchandise with the greatest facility from the upper floors to the shipping floor, and broken package stocks are carried on the first floor, easily accessible for delivery over the wholesale counter or to the shipping platform.

Following the best modern practice, the building has been designed to obtain a maximum of light and air. In the section devoted to offices there is light and air on four sides.

## Westinghouse Offers Common Stock to Employees

The Westinghouse Electric & Manufacturing Company announces a plan whereby all employees may participate in the purchase of a new issue of 20,000 shares of common stock to be paid for on the deferred plan at $53 a share (par value $50). Each employee may subscribe for one to twenty shares of stock and pay for it in ten consecutive monthly installments.

No interest will be charged on the deferred subscription payments. When the final payment on each stock subscription becomes due, dividends at the rate declared and paid on the company's common stock after Aug. 1, 1923, when the plan goes into effect, will be credited to the account of each subscriber.

This plan will in no way interfere with the insurance saving fund now in force. In the latter plan the employee, by depositing 2 per cent of his salary in a 4½ per cent interest-bearing savings fund, obtains additional insurance up to $1,500 over the $500 given by the company after six months' service.

Subscription rights are for the benefit of the individual employed and are not transferable.

Commenting on the stock issue, E. M. Herr, president of the company, said: "This opportunity for the purchase of stock by employees is in consideration of the frequently expressed wish of our employees that they be given an opportunity to purchase common stock of this company on a favorable basis.

"We are explaining to the employees that common stock of the company, like all common stock, is necessarily subject in its value to the fluctuating conditions of business. The company is very glad to have its employees become stockholders, but it is clearly understood that their participation in the ownership of the stock is a wholly voluntary act on their part."

## Electric Furnace Maker of Ohio Sells Plant

The plant of the Electric Furnace Company, Salem, Ohio, manufacturer of electric heating and melting furnaces, has been purchased by R. F. Benziger and F. A. Hoyles, Alliance, Ohio, and F. T. Cope, Salem, Ohio. The business will be under the management of Mr. Cope, who had long been connected with the old company. Mr. Benziger will have charge of the sales department.

**The Molded Products Company**, Hartford, Conn., which was recently incorporated with capital stock of $50,000, will manufacture molded and composition products for electrical manufacture. It will not be in a position to start active business for at least six months. The company's address is First National Bank Building, Hartford.

**The Shaw Electric Crane Company**, Muskegon, Mich., has commenced the erection of a two-story addition, 60 ft. x 100 ft., estimated to cost $60,000, including equipment.

**The Lee Duncan Electric & Manufacturing Company**, 4441 Manchester Avenue, St. Louis, recently organized, is perfecting plans for the establishment of a local plant for the manufacture of electric motors and fans. Lee J. Duncan is president.

**The Esterline-Angus Company**, Indianapolis, manufacturer of graphic meters for power-testing service, etc., has purchased the plant at Speedway City, near Indianapolis, formerly occupied by the Highway Tractor Company, comprising a two-acre tract of land, improved with a building, 100 ft. x 200 ft. Extensions and improvements will be made, and the present works at 227 East South Street will be removed to this location. Additional machinery will be installed for larger production. New buildings will be erected on the site in the near future. J. W. Esterline is president.

**The Spaulding Electric Company**, Detroit, has completed plans and will soon commence the erection of a new one-story plant on Michigan Avenue for electrical repair work and parts manufacture. It will cost approximately $25,000. James G. Spaulding, 1344 Michigan Avenue, is president.

**The Hoosier Engineering Company**, specialist in power plants, announces its removal to its new building at 325 South New Jersey Street, Indianapolis.

**The Blaw-Knox Company**, Pittsburgh, has obtained exclusive license to manufacture and sell Blair water-cool parts, reversing valves and removable slag pockets.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Krakow, Poland (No. 6,811), for lighting sets for farms.

An agency is desired in Colim, Mexico (No. 6,839), for electrical machinery.

An agency is desired in Newcastle, Australia (No. 6,862), for radio equipment and appliances.

CATALOGS OF ELECTRICAL MACHINERY DESIRED IN FEDERATED MALAY STATES.—Lewis V. Fox, executive electrical engineer, Government Electricity Board, Kuala Lumpur, Federated Malay States, would like to receive catalogs and price lists of electrical machinery and accessories, hydro-electric generating machinery and high-tension aerial distribution material being of especial interest.

ELECTRICITY SUPPLY COMMISSION IN SOUTH AFRICA. — The Electricity Supply Commission provided for under the electricity act passed by the Parliament of last year, according to *Commerce Reports*, will soon hold its first meeting. It will appoint its own officials, raise its own revenue and generally act as a separate corporate body. As one of the purposes of the act is to keep the supply of electricity in bulk separate from the railways, the commission will take over the large power station in course of construction at Colenso, which will supply energy to the Maritzburg-Ladysmith Railroad when electrified. The commission will construct power stations at Durban and Witbank and will provide power near the Sabie gold fields in the Transvaal.

FUNDS PROVIDED FOR HYDRO-ELECTRIC WORK IN SOUTHERN ITALY.—A loan of 65,000,000 lire (a lira is \$0.048 at present rate of exchange), according to *Commerce Reports*, has been arranged through the Ministers of Finance and Public Works to promote the Sila hydro-electric development in Apulia and Calabria, together with similar enterprises in southern Italy. The three companies on whose behalf the loan is effected are the Societa Forze Idrauliche della Sila, the Societa Meridionale di Elettricita and the Societa Generale Elettrica della Sicilia.

## New Apparatus and Publications

FUEL OIL-BURNING EQUIPMENT.—"A Complete Treatise on the Subject of Oil Burning" is the title of a new catalog issued by the Combustion Engineering Corporation, Broad Street, New York City, in which it describes and illustrates the "Quinn" fuel-oil-burning equipment. It also contains a complete test of the oil burners conducted in a large oil refinery.

TELEPHONE HEAD SET.—C. Brandes, Inc., 237 Lafayette Street, New York, Inc., has developed the "Brandes" clutch for adjusting the receivers for telephone head sets.

COMPOUND KETTLE.—A new double-jacketed compound kettle has been brought out by the P. Wall Manufacturing Company, Pittsburgh, for use with its "Dreadnaught" furnaces for melting joint-filling compounds.

LIGHTING DEVICE.—The Reflector & Illuminating Company, 565 West Washington Street, Chicago, has placed on the market a new lighting device, "Flood-O-Lite, Jr.," form C, which is particularly adapted for the spot lighting of individual parts of a window.

ELECTRIC FURNACE.—Bulletin No. 3 issued by the Ajax Electrothermic Corporation, Trenton, N. J., describes the new Ajax-Northrup 35-kva. converter and the various standard high-frequency furnaces which may be operated from it.

GROUND CAP.—The Line Material Company, South Milwaukee, Wis., has developed a new type of ground cap.

VENTILATOR.—The Emerson Electric Manufacturing Company, 2012 Washington Avenue, St. Louis, has brought out a small "Junior" ventilator, designed for small apartment kitchens, etc.

ELECTRIC THERAPEUTIC BAKERS.—A line of therapeutical bakers for use by hospitals, general medical practitioners and specialists for treating sprains, etc., is manufactured by Walter S. Edmands, 25 Pearl Street, Boston.

SIGN RECEPTACLE.—A new sign receptacle, "Skeedoodle," designed especially for use in transparent window signs and advertising displays, has been developed by the Phelps Electric Company, 227 West Randolph Street, Chicago.

HEATING SYSTEM. — The Winslow Boiler & Engineering Company, Chicago, has brought out an electrically controlled oil-burning heating system, "Kleen-Heet," for heating residences.

VACUUM CLEANER.—The Joseph A. McAnerney Company, 62 West Forty-fifth Street, New York City, is marketing the "Mac" electric vacuum cleaner.

SWITCH BOXES.—The Roach-Appleton Manufacturing Company, 2446 North Crawford Avenue, Chicago, is manufacturing the "Raco" line of switch boxes.

ELECTRIC LAUNDRY STOVE. — The George D. Roper Corporation, Rockford, Ill., has brought out an electric laundry stove, which can be obtained in one, two and three-burner sizes.

POLARIZED LIGHT APPARATUS. — Adam Hilger, Ltd., 75a Camden Road, London, N. W. 1, has issued a booklet describing the polarized light apparatus manufactured by the firm as devised and used by Prof. E. G. Coker, F. R. S., for determining the distribution of stress in structural and machine members.

INSULATORS.—The Jeffrey-Dewitt Insulator Company, Kenova, W. Va., is distributing a new catalog covering its high-tension insulators. Bulletin No. 5 issued by the company gives the electrical mechanical characteristics of the flange-type insulators for switching equipment, bus supports, etc.

## New Incorporations

THE PLATEAU VALLEY LIGHT & POWER COMPANY, Colbran, Col., has been incorporated with a capital stock of \$100,000 by Clarence L. Fenn, George Bullock and M. R. Groves.

THE CAMBRIDGE (OHIO) LIGHT & POWER COMPANY has been incorporated with a capital stock of \$75,000 by Frank M. Taylor, Robert S. Ashe and Wilfred Jessup.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

LYNN, MASS.—The Eastern Massachusetts Street Railway Company has contracted with the Lynn Gas & Electric Company for energy and will close down its local power plant. A substation will be built on Union Street, to be equipped with three 1,500-kw. rotary converters and auxiliaries, to cost \$125,000. The capacity will be doubled at a later date.

NORTH ANDOVER, MASS.—The M. T. Stevens & Sons Company plans to build a 2,000-hp. power plant at its local textile mill, to cost about \$75,000.

PAWTUCKET, R. I.—The Blackstone Valley Gas & Electric Company has filed plans for the erection of a new one-story building at its plant on Jenks Lane for general operating service.

HARTFORD, CONN. — The Hartford Electric Light Company is erecting a new transmission line to carry electricity from the South Meadows plant to New Britain. An additional turbine will be installed in the South Meadows station, which has already been purchased.

MIDDLETOWN, CONN.—The Connecticut Power Company will soon commence work on an addition to its local power plant and will extend its transmission lines to Portland, Cromwell, Middlefield, Durham and vicinity. A new substation will be built. Plans have been prepared by the Hartford (Conn.) Electric Light Company.

NEW HAVEN, CONN.—The American Steel & Wire Company, Fairmont Avenue, will build an addition to its power house, 30 ft. x 42 ft.

## Middle Atlantic States

BUFFALO, N. Y.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until June 26, for lighting fixtures for the local custom house.

COHOES, N. Y.—The Cohoes Light & Power Corporation will soon take bids for the erection of a building at its plant to be used for general operating service. William E. Goddard, 34 Remsen Street, is architect.

NEW YORK, N. Y.—The New York Edison Company plans to build a substation at 127 East 120th Street. William Whitehill, 709 Sixth Avenue, is architect.

NEW YORK, N. Y.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25, for the installation of a street-lighting system on naval property. (Specification 4862.)

NEW YORK, N. Y.—Electric power equipment will be installed in the ice-manufacturing and refrigerating plant to be constructed by the Realty Managers, Inc., 342 Madison Avenue, on 170th Street between Cromwell and Inwood Avenues, to cost about \$800,000.

NORWOOD, N. Y.—A hydro-electric development, including dam, power house, etc., on the Racquette River, near Norwood, to cost about \$750,000, is under consideration by the Power Corporation of New York, Light and Power Building, Watertown. W. P. Creager, Northern New York Trust Company Building, Watertown, is chief engineer.

TROY, N. Y.—Electric power equipment will be installed in the proposed grain elevator to be constructed by the State Canal Board, Albany, at the local Barge Canal terminal, to cost about \$750,000.

HOLLAND, N. J.—The New Jersey Power & Light Company will discontinue work on its proposed local generating plant. The project will be held in abeyance for an indefinite period.

KEARNY, N. J.—The Public Service Electric Power Company, Newark, has secured a site on the Hackensack River at Kearny for its proposed steam-operated electric generating plant, to have an initial output of 200,000 hp. The cost is estimated at \$2,500,000.

TRENTON, N. J.—Bids will be received by the Board of Freeholders until July 3 for motors and other electrical equipment, in connection with a new stone-crushing plant to be installed at the county quarry, Moore's Station, for which bids will be received at the same time. H. Eltinge Breed, 507 Fifth Avenue, New York, is consulting engineer.

GRANTVILLE, PA.—The Grantville Electric Company has been organized to install and operate a local commercial system. S. S. Seyfert and H. C. Stambaugh head the company.

HUNTINGDON, PA.—The Penn Central Power Company contemplates the installation of electric equipment at its coal properties, recently acquired, to be used for fuel supply for its new generating plant at Saxton, Pa.

PHILADELPHIA, PA.—A power house will be built by the Kaufman Plush Company at Mitchell and Rector Streets for service at its mill. W. E. S. Dyer, Land Title Building, is engineer.

PHILADELPHIA, PA.—The Philadelphia Suburban Company is being organized to take over and consolidate the properties of the Philadelphia Suburban Gas & Electric Company, East Pennsylvania Gas & Electric Company, Berks County Electric Company and the Bucks Electric Company. Extensions and improvements are contemplated to plants and transmission lines.

PHILADELPHIA, PA.—R. Van Horn and F. W. Woodcock, care of James Collins Jones, Bullitt Building, attorney, representative, are organizing five electric companies to be known as the Spruce Creek Township Power Company, Jackson Township Power Company, Armagh Township Power Company, Barree Township Power Company and the Cass Township Power Company to operate in the townships named. Transmission lines and distributing systems will be installed.

SCRANTON, PA.—The Suffolk Anthracite Collieries, Inc., is planning to install electric power and other machinery at its properties.

SHARON, PA.—The proposed new sewage-disposal works will be equipped with electrically operated pumps. The cost of the work is estimated at about \$200,000.

PITTSBURGH, PA.—Bids will be received by the Board of Education, Fulton

Building, until July 5, for the installation of electrical and mechanical equipment at the proposed school to be erected on Boggs Avenue. George W. Gerwig is secretary.

SPRINGDALE, PA.—The West Penn Power Company, Pittsburgh, has acquired the property of the Springdale Township Electric Corporation and plans to extend the transmission system.

GILMER, W. VA.—The Quaker Coal Company, recently organized, contemplates the installation of electric power and mechanical equipment at its properties. R. R. Biddle, 1001 Chestnut Street, Philadelphia, is head.

MARTINSBURG, W. VA.—The Eastern Sewer Pipe & Brick Company, recently organized, contemplates the installation of a power house at its proposed local plant.

MOUNDSVILLE, W. VA.—The Kerr Portland Cement Company, Wheeling, recently organized, plans to install a substation at its proposed cement mill in the Beech Bottom district, to cost about $1,200,000.

WEBSTER SPRINGS, W. VA.—Bonds to the amount of $19,000 have been voted for the construction of a municipal electric plant. The power station will be located at Cherry Falls, on the Elk River, 2 miles above the town.

WHEELING, W. VA.—The substation of the Beech Bottom (W. Va.) Power Company, at Beech Bottom, was recently destroyed by fire causing a loss of about $50,000. The structure will be rebuilt.

GLOUCESTER, VA.—The Roaring Springs Marl Company plans to build a power house at its properties.

HAMPTON ROADS, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 26, for four 7½-hp. motors, controllers and four sets of spare parts. (Schedule 953.)

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until July 17, for automatic telephone equipment and air-conditioning apparatus. (Circular 1528.)

## North Central States

ANN ARBOR, MICH.—The State Legislature has appropriated $250,000 for a new power plant at the University of Michigan.

DETROIT, MICH.—The Public Lighting Commission is preparing plans for the construction of an electric power plant and substation on Morrell Street, for which bids will soon be called. Smith, Hinchman & Grylls, Marquette Building, are architects.

EAST LANSING, MICH.—The State Legislature has appropriated $75,000 for an addition to the power house at the Agricultural College.

MARQUETTE, MICH.—An appropriation of $70,000 to build a new power house at the Marquette Prison has been approved by the State Legislature.

CINCINNATI, OHIO.—The Union Gas & Electric Company has applied for a permit to erect an electric substation at Mitchell Avenue and Millcreek, to cost about $22,000.

CINCINNATI, OHIO.—The Columbia Gas & Electric Company has tentative plans under way for the construction of a new electric generating plant to cost about $10,000,000, with transmission system.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until June 29 for outdoor weatherproof, pole-type, constant-current regulators for the division of light and power.

COLUMBUS, OHIO. — The Columbus Railway, Power & Light Company has petitioned the Public Utilities Commission for permission to erect a 13,200-volt transmission line from Bexley to the Hiberian substation.

EAST PALESTINE, OHIO.—The City Council has engaged H. O. Swoboda, consulting engineer, Empire Building, Pittsburgh, to prepare plans for an additional unit for the municipal electric plant.

PIKEVILLE, KY.—The Kentucky & West Virginia Power Company has acquired the lines and franchise of the Sandy Valley Light & Power Company and will extend the system.

CHICAGO, ILL.—The Brunswick-Kroeschell Company, 460 West Erie Street, manufacturer of ice machines, is erecting a plant at 4201-5 Diversey Parkway, including an administration building, machine shop, boiler room, pattern shop and storage and power house. The cost is estimated at $700,000.

ROCK ISLAND, ILL.—Contract has been awarded by the Peoples Power Company, Moline, for remodeling its local substation, at a cost of $25,000. New equipment, to cost $50,000, will be installed. The company will erect another 13,200-volt transmission line from the power plant at Moline to Davenport via Rock Island, to cost about $56,000.

LA CROSSE, WIS.—The Wisconsin-Minnesota Light & Power Company plans to erect a transmission line from La Crosse to French Island, and also a distributing system on the island to furnish electricity there.

SHEBOYGAN, WIS.—The ornamental lighting system on Eighth Street will be extended from Eighth Street to the Chicago & Northwestern Railway Station.

BROWNSDALE, MINN.—The local electric plant will be dismantled and connection by a high-tension transmission line with Albert Lea.

MINNEAPOLIS, MINN.—Arrangements have been made by the Northern States Power Company for extensions and improvements to its systems, including an addition to the Riverside plant at Minneapolis, to cost $1,300,000; an extension to the steam-driven electric plant at Highbridge, St. Paul, to cost $2,000,000, and additions to its plant at Fargo, N. D., and Sioux Falls, S. D.

ST. PETER, MINN.—The State Board of Control, St. Paul, has commissioned the C. L. Pillsbury Company, engineer, 1200 Second Avenue, Minneapolis, to prepare plans for extensions and improvements at the local power plant to cost about $100,000.

CEDAR FALLS, IOWA.—The Cedar Valley Electric Company, Charles City, is planning to build a power plant in Cedar Falls.

CRAIG, IOWA.—Bonds to the amount of $8,000 have been authorized for the erection of a high-tension transmission line from Craig to Le Mars, connecting with the lines of the Iowa Light, Heat & Power Company there.

DUBUQUE, IOWA.—The Dubuque Electric Company has issued $3,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

SHENANDOAH, IOWA.—The City Council is reported to be considering the installation of a municipal electric plant.

SIOUX CITY, IOWA.—Work will soon be started by the Sioux City Gas & Electric Company on improvements involving an expenditure of about $3,000,000, which will include a new electric generating station, to cost about $2,000,000. The equipment will include two turbo-generators of 10,000 kw. capacity each.

ST. LOUIS, MO.—The East St. Louis Light & Power Company has applied to the Board of Supervisors of St. Clair County for permission to erect a transmission line along Mississippi Avenue from Paradise Avenue to Valentine Street in East St. Louis. The proposed line will connect with the Cahokia plant now in course of construction on the river bank south of the Municipal Bridge.

SWEET SPRINGS, MO.—The Kansas City (Mo.) Power & Light Company has applied to the Public Service Commission for permission to purchase and operate the local electric plant.

JAMESTOWN, N. D.—Bids will be received by the State Board of Administration, Bismarck, until June 26 for equipment for power house at the State Hospital for Insane.

## Southern States

NEW LONDON, N. C.—Plans are under way for a municipal electric lighting plant, for which bonds have been voted. J. W. P. Hill is in charge.

PROSPERITY, S. C.—The Saner Lumber Company, Inc., plans to build a power house at its proposed local mill.

THOMASVILLE, GA.—Plans for the proposed new John D. Archbold Memorial Hospital, to cost about $1,000,000, include a power house and refrigerating plant. E. C. Wachendorff, Forsyth Building, Atlanta, is architect.

HOGANSVILLE, GA.—The Stark Mills, Inc., operated by the International Cotton Mills, Inc., 60 Federal Street, Boston, contemplates the installation of an electric substation at its proposed local mill to cost approximately $425,000.

JACKSONVILLE, FLA. — Plans have been prepared by the Schofield Engineering Company, Philadelphia, for an addition to the electric power plant on Talleyrand Avenue and for two new substations, for which, it is understood, bids will soon be called.

JENNINGS, FLA.—The Electric Power Commission is planning to build a hydro-electric plant on the Alpha River to develop 1,600 hp. Transmission lines will be erected between Jennings and Jasper, White Springs and other points in Hamilton County.

STARKE, FLA.—Bids will be received by the Board of Trustees until June 26 for equipment for a municipal electric plant, including two electric generating units, driven by crude-oil engines, each 75 kva. capacity; two electrically driven impeller pumps, submerged type, to operate under 100-ft. and 150-ft. head respectively; storage tank, meters, auxiliary equipment. Joseph E. Craig, 427 King Street, Jacksonville, is consulting engineer.

MEMPHIS, TENN.—The Ford Motor Company, Highland Park, is reported to be planning to construct a power house at its proposed local assembling plant, to cost about $175,000.

BIRMINGHAM, ALA.—The Alabama Power Company, which is erecting a high-tension transmission line from Coosa River to Opelika, will erect a primary substation at New Aubery, where energy will be transformed and transmitted into the company's 44,000-volt lines from Opelika to Lafayette, Roanoke, Auburn, Waverly, Camp Hill, etc. The cost is estimated at $1,000,000.

CHEROKEE BLUFFS, ALA.—The Alabama Interstate Power Company, a subsidiary of the Alabama Power Company, has secured permission to construct and operate a hydro-electric power plant on the Tallapoosa River, near Cherokee Bluffs, to develop 105,000 hp., to cost about $1,000,000.

TALLADEGA, ALA.—An electric substation and transmission system will be constructed for service at the new municipal waterworks, to cost about $265,000.

HATTIESBURG, MISS.—A power house will be erected by the South Mississippi Infirmary at its new hospital, to cost about $175,000. Benjamin Price, Jefferson County Bank Building, Birmingham, Ala., is architect.

JACKSON, MISS.—The Mississippi Power & Light Company has been organized to take over and consolidate the Jackson Public Service Company; Vicksburg Light & Traction Company, Vicksburg; Delta Light & Traction Company, Greenville, and the Columbus Railway, Light & Power Company, Columbus, Miss. The new company plans to erect connecting transmission lines and also extensions to power stations, etc.

BLYTHEVILLE, ARK.—The erection of a high-tension transmission line from Caruthersville connecting Blythesville with the former and Kennet, Mo., is under consideration by the Missouri-Arkansas Power Company. The company is reported to be considering building a substation at Steele, Mo., to serve Steele, Noland, Cotter and other towns in the community.

HOT SPRINGS, ARK.—The Arkansas Light & Power Company has preliminary plans for the construction of a hydro-electric power plant on the Carpenter Dam site, with initial capacity of 12,000 kw. A similar plant is also planned at the Remmel Dam, now in course of construction, with 18,000 kw. initial capacity. Extensive additions will be made to the transmission system. The total cost is estimated at about $4,000,000. Work will soon begin on the proposed hydro-electric station on the Ouachita River, near Malvern, to develop about 15,000 hp., at a cost of about $1,500,000.

NEW ORLEANS, LA.—The Cloverland Dairy Company, Carrolton Avenue, contemplates the installation of a power house at its proposed plant, to cost about $250,000. Fayret & Liraudais, Hibernia Building, are engineers.

OKLAHOMA CITY, OKLA.—Plans are being considered by the Toledo & Ohio Central Railway Company, St. Clair Avenue and West Third Street, Cleveland, for rebuilding and equipping for electrical operation the Shawnee branch of the Missouri, Kansas & Texas Railway Company between Oklahoma City and Shawnee. The cost is estimated at about $2,600,000. J. A. Stocker, Columbus, Ohio, is chief engineer.

SAYRE, OKLA.—The City Council is having plans prepared for municipal improvements, including extensions to the ornamental lighting system, power plant, a complete disposal plant, etc. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

HULL, TEX.—The Gulf Production Company is planning to build an electric plant in the Hull oil field, including the erection

of transmission lines to the oil fields at Batson, Saratoga and Sour Lake. The cost is estimated at about $750,000.

TEMPLE, TEX.—The power plant and mechanical shops of the Southwestern Traction Company were recently destroyed by fire causing a loss of about $100,000.

## Pacific and Mountain States

ABERDEEN, WASH.—The Pacific Cedar Manufacturing Company contemplates the construction of a power house at its proposed local mill, to cost about $150,000.

BLEWETT, WASH.—The Pehastin Lumber & Box Company is considering plans for rebuilding its mill and power house, recently damaged by fire.

LONGVIEW, WASH. — The Longview Public Service Company has acquired the property of the Long-Bell Lumber Company. Extensions will be made including the construction of a 20,000-kw. power plant, and transmission lines to supply electricity for light and power service throughout this district.

SEATTLE, WASH.—Plans are being prepared for the proposed North substation to be erected at Seventy-fifth Street and Eighth Avenue, Northeast, which will distribute electricity generated at the Skagit River plant. C. F. Uhden, Alaska Building, is chief engineer of the Skagit River project.

LA JOLLA, CAL.—Steps have been taken for the installation of an ornamental lighting system on Exchange Place.

LOS ANGELES, CAL.—The City Council has instructed the city attorney to prepare the necessary resolution authorizing the Bureau of Light of the Public Service Department to furnish electricity and maintenance for fifty lighting districts.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 3, for one 200-kw. motor-generator set complete, with four-panel switchboard, for the Mare Island navy yard. (Schedule 943).

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company will build a new substation in the vicinity of Montgomery and Sacramento Streets. The initial installation will include three 2,600-kw. rotary converters. Provision will be made for five additional rotary units of same rating. The cost is estimated at $300,000.

SAN JOSE, CAL.—Bids will be received by the Board of County Supervisors, San José, until July 2, for refrigerating and ice-making machinery, and also for construction of a building for same at the Santa Clara County Hospital, San José. Binder & Curtis, San José, are architects.

SANTA ANA, CAL.—An ordinance has been adopted providing for the installation of an ornamental lighting system on West Fourth Street, consisting of eighty-six double lamp standards.

VAN NUYS, CAL.—The Municipal Power Department will build an electric substation at the proposed service and repair plant for city automobiles, to cost about $100,000.

RENO, NEV.—The Nevada Magnesite Products Company, recently organized, plans to construct a power house at its proposed artificial stone plant, to cost about $125,000. Paul Butler is vice-president.

## Canada

RUSKIN, B. C.—Plans have been prepared by the British Columbia Electric Railway Company, Vancouver, for a 10,000-kw. hydro-electric plant at Stave Lake, to cost about $750,000. Preliminary surveys are being made for a dam and power plant to develop from 80,000 kw. to 100,000 kw. on Stave River, 2 miles north of Ruskin, to cost from $6,000,000 to $8,000,000. R. S. Kelsch, Power Building, Montreal, Que., is consulting engineer.

FORD CITY, ONT.—Plans have been prepared by the Ford Motor Company of Canada for a power house, 112 ft. x 148 ft., two stories, and a screen house, 27 ft. x 31 ft., to be erected on Sandwich Street.

QUEBEC, QUE.—The city officials have appropriated $30,887 to be used by the exhibition committee for the installation of a lighting system in the Industrial Palace and exhibition grounds.

VERDUN, QUE.—The City Council has passed a by-law to be submitted to the ratepayers providing for an expenditure not exceeding $275,000 for local improvements, of which $9,000 will be used for extension of lighting system and $10,000 for transformer station and transformers for the electric lighting system.

# Electrical Patents

Announced by U. S. Patent Office

(Issued May 29, 1923)

1,457,023. AUTOMOBILE HAND-SIGNALING DEVICE; A. R. Ferguson, Buffalo, N. Y. App. filed Oct. 5, 1920. Signal light attached to hand.

1,457,052. SYSTEM OF ELECTRICAL DISTRIBUTION; E. B. Birch, Pittsburgh, Pa. App. filed June 25, 1921. Auxiliary supply takes care of abnormal loads.

1,457,069. RECEIVING SYSTEM FOR ELECTRIC WAVES; L. Levy, Paris, France. App. filed Sept. 27, 1919. Medium and low frequency detector-selector-amplifier provided with vacuum tubes.

1,457,075. DEVICE FOR PRODUCING OR REPRODUCING SOUND; C. H. Hulbert, Chicago, Ill. App. filed March 21, 1917. Increased magnetic area of telephone receiver diaphragm.

1,457,149. PREPARING ALUMINUM OR ITS ALLOYS FOR ELECTROPLATING; H. D. Cunningham, Brighton, England. App. filed May 10, 1920.

1,457,170. TIDAL WATER-POWER PLANT; A. Huguenin, Zurich, Switzerland. App. filed Oct. 5, 1921.

1,457,171. CONDUIT END FITTING; F. I. Johnson, Warren, R. I. App. filed Aug. 27, 1920.

1,457,173. ELECTRICAL DIRECTION INDICATOR; H. Kageyama, Los Angeles, Cal. App. filed May 1, 1918. For automobiles.

1,457,176. BURGLAR ALARM; J. E. Lee, Milwaukee, Wis. App. filed Oct. 9, 1920. Electrically operated device fires cartridges.

1,457,211. RECEIVER FOR TELEPHONES; V. C. Crites, Los Angeles, Cal. App. filed June 29, 1922. Protects ear from direct contact with receiver shell.

1,457,225. METHOD OF MAKING MAGNESIUM; G. Hutchinson, Arcadia, Cal. App. filed June 1, 1922. By electric fusing process.

1,457,239. LAMP FILAMENT AND SUPPORT; A. S. Volpian, Savannah, Ga. App. filed Oct. 25, 1921.

1,457,249. ELECTRICAL PROTECTOR; G. W. Janson, Brooklyn, and L. H. Rovere, Richmond, N. Y. App. filed July 12, 1921. Telephone lightning arrester.

1,457,262. SHOT-FIRING DEVICE; H. Neal, Yukon, Pa. App. filed Feb. 25, 1922. Electrical device for firing explosives in mines.

1,457,263. AUTOMOBILE SIGNAL; G. W. Nicholson and A. J. Kelly, Indianapolis, Ind. App. filed April 4, 1919. Direction signal.

(Issued June 5, 1923)

15,617 (reissue). MEASURING AND INDICATING APPARATUS; H. Brewer, Wilmette, Ill. App. filed Feb. 21, 1919. Thermocouples for measuring temperature.

1,457,312. REVERSING MECHANISM; O. J. Marshick and E. L. Crosby, Detroit, Mich. App. filed Nov. 15, 1920. Automatically reversing rotation of electric furnace drum.

1,457,336. BALANCING CIRCUITS; H. A. Affel, Brooklyn, N. Y. App. filed Sept. 30, 1919. Translating low-frequency signals into higher-frequency carrier currents and vice versa.

1,457,338. SELECTIVE CONNECTION OF TRUNK LINES; L. D. Barrows and L. H. Darrow New York, N. Y. App. filed April 1, 1919. Connecting any one of several telephone substations to a common line passing through all stations.

1,457,359. SYSTEM OF CONNECTIONS FOR MULTIPHASE CHOKING COILS; A. Gaudenzi, Baden, Switzerland. App. filed Aug. 29, 1921. Used with mercury-vapor rectifiers.

1,457,381. DYNAMO-ELECTRIC MACHINE; A. H. Midgley, Uxbridge, England. App. filed April 3, 1922. Constant-output, variable-speed generator.

1,457,438. PERMEAMETER FURNACE; G. A. Kelsall, Belleville, N. J. App. filed March 23, 1921. Device to determine characteristics of magnetic materials at elevated temperatures.

1,457,440. INCANDESCENT ELECTRIC LAMP; C. E. Leece, Youngstown, Ohio. App. filed July 6, 1921. Supplied with two or more filaments.

1,457,447. RADIO RECEIVING CIRCUITS; J. Mills, Wyoming, N. J. App. filed Dec. 22, 1921. Employs principle of successive detection.

1,457,473. COMBINATION TAIL LIGHT AND DIRECTION INDICATOR; A. E. Tinker, Stockton, Cal. App. filed March 16, 1921. For automobiles.

1,457,475. ELECTROMAGNETIC APPARATUS; R. W. Van Norden, San Francisco, Cal. App. filed Jan. 28, 1920. Minimizing losses due to eddy currents in generators, transformers, etc.

1,457,508. FOUNTAIN SOLDERING TOOL; A. Dellman, Mount Clemens, Mich. App. filed May 16, 1921. Electric soldering iron.

1,457,513. ELECTRIC WELDING MACHINE; J. W. Fay, Milwaukee, Wis. App. filed April 19, 1920. For automatically welding long seams and joints.

1,457,597. BATTERY AND BULB TESTER; O. Ohmart, Cairo, Ill. App. filed Sept. 15, 1921. Arrangement of contacts on test board.

1,457,619. AUDIO-FREQUENCY COUPLING TRANSFORMER; S. Cohen, Brooklyn, N. Y. App. filed May 12, 1921.

1,457,671. BATTERY CASE AND SWITCH; W. H. Rector, Williamson, W. Va. App. filed Jan. 17, 1923. For detonating blasting charges.

1,457,677. TROLLEY REPLACER; M. M. Sykes, San Francisco, Cal. App. filed Oct. 26, 1922. Auxiliary guide wheel.

1,457,688. PROCESS OF AND APPARATUS FOR RENOVATING COATED METAL SHEETS; C. F. H. Bohnhardt, Baltimore, Md. App. filed March 8, 1919. Removing lacquer, japan, paint, etc., by electrolysis.

1,457,689. CROSSOVER FOR OVERHEAD TROLLEY LINES; G. W. Bower, Schenectady, N. Y. App. filed Oct. 30, 1922. For points where single trolley wires cross lines of trackless trolley.

1,457,690. ELECTRICAL HEATER FOR OIL WELLS; P. F. Brine, Boston, Mass. App. filed March 22, 1921. For melting paraffin or other heavy products found in oil wells.

1,457,718. ELECTRIC FURNACE; I. R. Valentine, Erie, Pa. App. filed May 5, 1921. For brass, aluminum and copper melting.

1,457,784. TRANSFORMER; E. P. Maurer, Cleveland, Ohio. App. filed Sept. 6, 1919. Bell-ringing type.

1,457,791. PROCESS OF MAKING SUCCINIC ACID; J. F. Norris and E. O. Cummings, Cambridge, Mass. App. filed Oct. 20, 1922. By electrolytic process.

1,457,792. ELECTRICALLY HEATED FLATIRON; R. B. Older, Danville, Ill. App. filed April 14, 1921. Releasing hand from handle cuts off current.

1,457,814. AMPLIFIER; H. I. Becker, Schenectady, N. Y. App. filed Dec. 14, 1921. Magnetically controlled electron-tube amplifiers.

1,457,818. SIGNAL; C. W. Brown, Cleveland, Ohio. App. filed Feb. 1, 1922. Direction signal for automobiles.

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# Electrical World

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## Which Type of Load?

WHAT sort of business should the central-station company select for creative sales development? The question lies face up upon the table. It is a fundamental question to every light and power company. It has always confronted the utility in each community. Strangely enough, however, no organized effort has ever been made to find a definite solution of the problem and to establish on a fact basis which type of load pays best.

IN THE beginning there was only light to sell. Then came power, then domestic cooking, then industrial heating, then the electric vehicle. Now, household appliances are receiving the conspicuous attention. Each new step in the evolution of load has won the center of the stage and held it for a time, the nine-day wonder of commercial opportunity. And so central-station selling through the years has been dominated more by new enthusiasms than by any process of discrimination, more—in a word—by fad than facts.

Today we reach the stage where in an average community there are a dozen different types of load that may be developed profitably. Three national programs of promotion are now in process in which advocates of the electric range, of the electric truck and of industrial heating will all be striving to convince the utility executive that in each of these three directions lies the most attractive waiting market. The truck man points out that one electric garage provides more load than 4,000 dwellings. Another contends that the diversity factor of household appliance business and the ready merchandising profit that comes with it make this field the one which should be cultivated first — and so on. Which is right?

GRADUALLY all kinds of business will be taken on in balanced proportion. Public demand will see to that. But the immediate issue with the central station is just an ordinary business problem. There is at hand so much capacity to sell—no more. Which type of load will pay the best return for the investment? That is the point. And what will be the cost of selling?

The need is for intelligent selection—based upon facts, unwarped by fad or fancy. Sooner or later each company must and will know the actual relative worth of every class of business. And it will sell its energy in the way that pays the best. Is it not time that as an industry we should begin to classify and formulate available experience so that any central-station man may know what kind of load to seek and why? Here is a task to which the N. E. L. A. Commercial Section may well apply itself.

# Robert Francis Pack

*An English boy who, by way of Canada and by unremitting application to the practical side of the electrical art, advanced to the vice-presidency of two great companies in Minnesota.*

BORN on the Isle of Wight, England, in 1874 and educated as a boy for the British Navy, Robert F. Pack came with his parents to Canada in 1889. In 1891 he entered the service of the Toronto Electric Light Company as an office boy and became successively accountant, comptroller, secretary and general manager of that company. He resigned from that company in September, 1912, to accept the post of general manager of the Minneapolis General Electric Company, one of the chief of the properties owned by the Byllesby interests. In 1916 he became vice-president and was appointed as well vice-president, general manager and a director of the Northern States Power Company.

Mr. Pack's wide knowledge of the central-station business has been gained entirely through his practical contact with the industry in the last thirty-two years. He "grew up" with the Toronto company, which, when he entered its service, was solely concerned with lighting the streets and a few of the principal stores by means of old-type arc lamps. While in Canada he took much interest in the Canadian Electrical Association and was largely instrumental in bringing about its affiliation with the National Electric Light Association about twelve years ago. In 1912 he was elected president of the Canadian Electrical Association.

In June, 1917, Mr. Pack was appointed by the Governor of Minnesota a member of the State Board of Arbitration to represent employers. This board consisted of two members only, the other member representing employees. During the entire period of the war no strikes or labor disturbances of any kind took place in Minnesota which were not promptly adjusted by the board.

At the convention of the N. E. L. A. at Atlantic City in May, 1922, Mr. Pack was elected fourth vice-president, and at the recent New York convention he was advanced to be third vice-president. He is a strong believer in the human equation in business, and the Minneapolis company is noted for its excellent relations with its employees and also for the highly satisfactory public relations it maintains with its customers.

Mr. Pack has been of great service to the industry in connection with the co-operative work of the lighting and telephone companies on inductive co-ordination. When this work began there was more or less hostility and suspicion. Owing, however, to Mr. Pack's personality, consideration and tact, all suspicion has been allayed and complete harmony prevails between the two industries.

Mr. Pack is a member of the A. I. E. E. and of various societies in Minneapolis.

# Editorial Comment

Electrical World, June 30, 1923

Volume 81 Number 26

## American Ships for American Commerce

IT OUGHT to be a matter of pride to Americans that the Stars and Stripes trails over the stern of the largest passenger ship sailing the seas. The Leviathan, reconditioned and largely rebuilt after memorable service as a transport during the war, now flies the pennant of the United States Lines, signifying that once more Columbia is the "gem of the ocean," and also, let us hope, that Columbia will occupy its former place in the shipping world. While we would much prefer that American ships should be privately owned and operated and that American seamanship should stand on a parity with the seamanship of other nations, these are conditions which eventually will obtain. The significant thing, and the all-important thing, to us is that the American flag shall remain on the seas, because it stands for American commerce, for American enterprise and for American freedom. With the growth of foreign trade, with the abandonment of ideas of national isolation which were never embraced by any political party or enlightened group of citizens and which the progress of invention has made forever impossible, and with American pay, American comforts and the American type of discipline superseding the Old World conditions that formerly made a sailor's life repugnant to lads reared in a democracy, the rebirth of the United States marine should be at last assured.

## The Man Who Recognized the Importance of Public Relations

IN CONTEMPLATING the wonderful development of the electrical industry it is curious to note the changes in points of view that have taken place in a comparatively short time. Time was when the engineering and operating features of electric central stations were deemed to be the factors of most importance, but within the last two years the company executives have been giving more and more time to the question of public relations. It is recognized that the amenities and courtesies to customers which cost so little have a vast influence on the prosperity of public utilities. Thus what was once considered of secondary importance is now beginning to be paramount.

Without doubt the electric light and power companies possess the keenest appreciation of the value of good public relations, and the man who has done most to convert the industry to this state of mind is Samuel M. Kennedy of the Southern California Edison Company of Los Angeles. Up to the time of his pamphlet, "The Man in the Street," little was thought about public relations and much less was done to improve them. However, the more the subject was investigated the more important it was seen to be, and Mr. Kennedy's book, "Winning the Public," appeared at a most opportune time. It was written in a lucid and racy style; its logic was unassailable, its argument convincing, its presentation cumulative and complete. It may almost be said to have taken the central-station world by storm and did more to arouse the minds of executives to the importance of proper public relations than anything that ever appeared in print. Experience, particularly in California, has shown the great advantages inherent in Mr. Kennedy's philosophy. Elsewhere in the country where his precepts have been heeded excellent results have followed. Certainly, in many a crisis good public relations have been the salvation of the industry, and witness was borne to the now universal recognition of their importance by the large part of the program of the last National Electric Light Association convention devoted to their consideration. The industry should not forget the debt of gratitude it owes to the man who was chiefly instrumental in bringing the whole question into prominence.

## The Economic and Political Importance of Power

THE attention at present devoted to the subject indicates that engineers and statesmen have awakened to the importance of economic power development not only in this country but throughout the world. People have come to realize that where there is no power there is no industry worth talking about. Labor leaders who were fearful that the substitution of power for human labor would throw large numbers of men out of employment have lived to see that it has no such effect, but that, on the contrary, because of the application of power working and living conditions have become better, the laborer receives a higher wage, and instead of a surplus an actual shortage of labor exists, at least so far as this country is concerned.

From an economic as well as from a political standpoint an ample supply of power is a great asset to any state or nation. That is why Pennsylvania proposes to engage in a giant power survey. The Governor of the Keystone State has broadened considerably. His views on conservation are much more intelligent and far-reaching than when he was head of the Forest Service. He now seeks the most efficient development of the state's great fuel-power resources supplemented by water power and the pouring of the general output of these fuel and water-power resources into a common reservoir of interconnected transmission lines covering the whole Northeastern section of the country, from which factory, farm and home can draw.

Adversity is a great teacher, and out of the welter of fire and blood France and Italy have merged with one economic fact clearly defined; that is, the necessity of the development of the water-power resources of the respective nations and the substitution of hydro-electric energy, now in large part running to waste, for expensive power produced from imported coal. Italy

is particularly keen about interesting foreign capital in this work, but has not refused state aid when such capital was not forthcoming. Power has become a subject of world-wide interest, and the surveys that have been made and are being made by the electric light and power industry in the various states were begun none too soon. The demand for power seems insatiable, and it is wise and prudent that those engaged in the business of supplying it should know exactly what the resources are. The World Power Conference scheduled to be held in London next year indicates very clearly how important the question of power supply is becoming throughout the world.

## What a Wonderful Family It Is!

IN THE endeavor of the electrical industry to apply electrical power intelligently to all human needs its structure has become an immense edifice with rooms filled with many men occupied in many activities. Just as the reverberations of the big N. E. L. A. convention dissolve into the distance the Electric Power Club gathers the manufacturers into its fold in annual meeting, the Canadian Electrical Association congregates at Montreal and the A. I. E. E. announces its program for the summer convention at Swampscott. Various other units and organizations in the industry are meeting in local territories, and, as a whole, there is a milling and stirring of busy men at conventions.

Remarkable to relate, each of these electrical groups finds ample work to do, interesting and informative material for programs, committee activities that make for progress, and common interests for holding and inspiring the membership. In fact, the general complaint is of the lack of time available for doing the work that needs to be done to improve the status of the industry. Yet the best thing about the conventions is their educational value and the family spirit that they arouse in the industry. Each has a definite field with boundary lines vaguely defined so that many men of many occupations are brought together. If, for example, the power salesman, the operating engineer, the designing engineer and the technical specialist come together at an A. I. E. E. meeting, all benefit and react upon one another to bring the balance, the knowledge, the close acquaintanceship and the common goal that enable the industry to progress intelligently.

How valuable it would be to have at each of these conventions all the major problems of the industry outlined and discussed! Think of presenting the cream, so to speak, of the activities and thoughts of each phase of the electrical business to groups of men whose detail responsibilities in the industry are so diverse. And the trend is in this direction at all the big conventions. No longer are the technical, commercial, executive and operating groups herded into separate and closely guarded corrals to tackle separately things that affect the whole industry and need the co-operative efforts of all to accomplish.

How encouraging it is to find the electrical industry composed of men linked together for a common purpose —the salesman knowing and interested in the work of the specialist, the executive knowing and appreciating the problems of the engineer, and the financier co-operating cordially with the executive because he knows him and his objectives. Each has something the other requires in his business, and each has come to appreciate the human and social aspects of the association that has developed.

May this wonderful electrical family continue to mingle and to direct its co-operative efforts along the sound constructive lines followed today! Conventions give value received in tangible and intangible assets and should be encouraged and directed with foresight and wisdom.

## A Commission Talks on Legal Aspects of Merchandising Policy—Other Considerations

AN INTERESTING opinion on central-station merchandising policy was expressed in the decision of the Maryland Public Service Commission, reported last week, in which the rates of the Consolidated Gas, Electric Light & Power Company of Baltimore were reduced. Certain dealers of that city had petitioned the commission to restrict the company in its merchandising activities. The opinion of the commission on this point is published elsewhere in this issue.

The Baltimore utility has long been a most active retailer of merchandise, selling out of its store not only gas and electric appliances, but other household equipment, embracing at one time tableware, crockery, glass, kitchenware, cutlery and other "kindred" lines. It operated in effect a department store in which were grouped a large variety of associated household commodities.

The commission said:

"In our opinion the whole field of the ordinary gas and electric appliance business in Baltimore soon will be filled by the company. It is but a step to wiring and pipe fitting. At times the merchandising has bordered on the grocery trade."

But "the terms offered are easy and popular," and although the company enjoys advantages of contact for both selling and collecting that "make the keenest competition and shrewdest merchandising by private concerns futile and vain," the commission, because it "failed to discover any organized opposition or outspoken objection on the part of retail business or skilled labor," declined to interfere. Speaking of the financial side of retail selling, the commission did say, however, that the profit from merchandising "must be reported by the company as miscellaneous revenue," unless "capital for the merchandising department" is "provided from an independent source and charges for rent and services made at adequate and remunerative rates."

This opinion, of course, deals only with the legal aspect of the situation. It does not advert to any possible influence on public relations, for it is not the function of the commission to preach business policy. Yet here is a factor no less vital to the public service company. The question is whether a utility is wise in using powers and capital virtually provided by the public with the intent that they should be applied in a definite public service to enter into competition with individual merchants of the town, whose trade the company decides to invade, though in a field not directly related to that public utility service which the company is organized to render. The commission properly does not express itself as to this, but central-station executives would do well to give the point some thought, for they have more than the legal aspect to consider.

The ruling of the commission as to the revenue from merchandising is just one more sound argument that the retail merchandising business of a central-station

company should be made to stand on its own feet, paying its costs and interest on the capital employed. It suggests that this department may profitably be separately organized, financed and operated if the revenues from merchandise sales are not to be included in reported company earnings.

### Cost Analysis in Small Plants

AN INTERESTING and comprehensive method of studying production costs and overhead charges in small steam and oil-engine plants is presented in this issue by L. V. H. Armstrong. Too little work of this sort has been done in the past, and more must be done in the future. Small central stations bulk large in numbers in the census of the industry, and apart from the spur of necessity to secure low-cost operation, little companies and their larger brethren are or should be keenly interested in getting at the real figures of power-plant economy in installations of a few hundred horsepower or less. The decision of the power user to purchase central-station energy often turns on a very small margin of money, and if this small-power business is to be handled properly from both the generating and the energy sales sides, exactly such studies as Mr. Armstrong has made must become more general.

Power engineering readers will question some of the assumptions of the author, especially in regard to fixed charges in small oil-engine stations. Current opinion in such circles inclines toward a much shorter internal-combustion prime-mover life than is indicated by a depreciation charge of 5 per cent. We have recently seen a maximum guarantee by a reliable oil-engine maker of only seven and a half years' life. Mr. Armstrong has allowed 5 per cent for obsolescence in addition to the above depreciation charge, but the spread between his figures and what leading central-station power engineers regard as conservative is marked and should be reinforced by more data from practice as time goes on. Bearing insurance and taxes in mind, it seems likely that total fixed charges on small oil-engine stations must run nearer 19 or 20 per cent than the 15 per cent assumed. Such figures may change the outcome of particular analyses, but of course they do not affect the value of the method of attack so logically and clearly set forth by the author.

The present state of the art of internal-combustion-engine design and operation forces the analytical engineer and executive to recognize all the factors entering into a final decision to adopt such types of units for commercial service. Many closely adjusted parts are found in typical prime movers of this sort, and continued efficiency in service depends in no small degree upon their close fitting and functioning. Maintenance runs high for this reason. Users in many cases complain vigorously of the high cost of spare parts. Insufficient consideration is often given to the amount of cooling water required, as well as to the increased cost of labor for properly operating such units. The question of reliability is all-controlling in numerous installations, and with some types of engines at least much remains to be accomplished on this score. These comments are somewhat aside from the paper of Mr. Armstrong, but in utilizing the methods of analysis therein illustrated due weight should be given to the characteristics of available apparatus, the guarantees of manufacturers and the results of experience.

### The Problem of Insulation

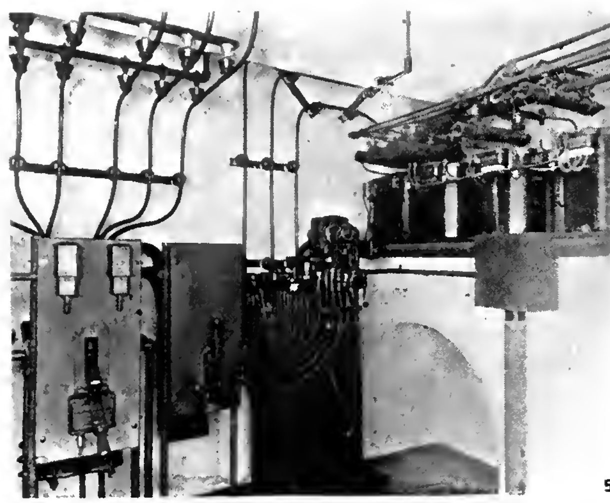
A STRIKING example of the dependence of applied science on pure scientific investigation is presented in the problems of electrical insulation. In the early days of electric power, by reason of the low values of voltage, the safe insulation of electrical equipment introduced no serious difficulty. With increasing voltage, and with appreciation of the importance of temperature, however, the serious limitations of the available insulating materials began to be realized, and in the early nineties there began among manufacturers a serious study of the properties of the known solid, flexible, plastic and fluid dielectrics. Ever since then that study has continued, and as a result we now have at our disposal a remarkable variety of insulating materials, with a wide range of properties, and therefore adapted to the construction of almost any type of electrical device or machine.

In spite of this wealth of material, however, it remains a fact that the design of insulation for high-voltage duty is not based on known laws, is not subject to exact computation and is, in fact, in most cases largely a matter of putting in enough material to prevent initial puncture or flashover at a voltage three or four times the operating value. Such questions as the influence of homogeneity, of mixtures, of temperature, of dielectric loss and of frequency on the disruptive strength and life of insulation are only remotely understood. Although, as indicated, many new materials and improved methods of manufacture have been developed, there is probably no field of experimental electrical study in which the returns in new knowledge have been so meager.

In this state of affairs the committee on insulation of the National Research Council has crystallized the prevailing opinion of electrical engineers that the rational design of insulation with a fair certainty as to its subsequent behavior can come only with a further scientific knowledge of the ultimate nature of the processes involved. The committee in its first report, published in the June *Journal of the A. I. E. E.*, therefore calls for a concerted effort, by physicists and those insulation experts who are familiar with the underlying theory of dielectrics and are skilled in the methods of pure research, toward the solution of the several great unanswered problems of dielectric behavior. In addition to an instructive descriptive statement of the entire problem of insulation, the report also makes specific suggestions of problems for experimental attack under seven major headings and invites co-operation in the prosecution of the work itself. This co-operation it expects to obtain from industrial, university and national research laboratories.

We are accustomed now to large undertakings in the research field by electrical and other manufacturers, but here is a call for co-operative attack by all research laboratories on some of nature's most deeply hidden secrets, yet which are of the foremost importance for the further service of mankind as offered by the electrical engineer. Certainly such an opportunity and such a call should meet a ready response from all who are qualified to respond. If the work is actively prosecuted and its co-ordinated results are digested and recorded by competent experts, it is certain that this undertaking will yield results of immense value to an industry which must place large dependence on insulation.

# Up-to-Date Meter Handling in Detroit



No. 1—A filing system is used to keep an accurate record of all meters.

No. 2—Movable meter stock racks save space and store meters.

No. 3 — Gang board for testing Wright demand meters.

No. 4—Primary and secondary standards are kept in this laboratory.

No. 5—A 4,600-volt transformer and regulator vault furnishes power to the laboratories.

No. 6 — Two-man work henches are best for the repair shop.

# The Detroit Edison's Meter Laboratories

## How Meters Are Calibrated and Inspected on a System Where 340,000 of Them Are Installed—Standardizing and Testing Laboratories Equipped to Test 100,000 Meters a Year—Meter Department Organization

By A. S. ALBRIGHT
*Superintendent of Meters, Detroit Edison Company*

INTERIOR OF CALIBRATION ROOM, SHOWING TEST BOARDS AND PORTABLE TRUCKS

GOOD service necessitates the use of well-maintained meters, and in addition the central-station company must have accurate meters if it is to derive the full income from its service. With the development of many types and sizes of meters and the increased number of meters installed, it becomes increasingly difficult to operate a meter department efficiently. Commission regulations in regard to testing meters for accuracy at frequent intervals have, besides, become more stringent. A study of this situation on the system of the Detroit Edison Company led to the layout of the present meter laboratories and to the operating organization adopted for the meter department.

During the summer and early fall of 1922 the company moved its meter and installation departments into well-equipped quarters in its new service building, thereby bringing virtually all of the departments, including the administrative, under one roof. This change provided an opportunity to install more modern and efficient equipment, which, with the advantages gained by having related departments in close proximity, is producing correspondingly better results.

The meter installation work comes under the supervision of the sales department, whereas the other meter activities are included in the accounting group. This division is unusual, but in Detroit it has been a very satisfactory arrangement, owing to close co-operation between departments.

The Michigan Public Utilities Commission has recently prepared a very complete set of rules governing "Standards for Electrical Service," which deal very largely with meter practice and present probably the most advanced views on the subject. The Detroit company has always done rather intensive meter work, and compliance with the commission's rules will be practically a continuance of former policies. The requirement of ironclad services and inclosed service switches is a step forward and shows the trend of the times. The rules relative to intervals between periodic tests of watt-hour meters are well developed and reasonable. They are as follows:

*Periodic Tests.*—Each watt-hour meter shall be tested according to the following schedule while connected in its permanent position in place of service:

(a) Two-wire and three-wire commutating-type and mercury-type meters, up to and including 50 amp. rated capacity of meter element, at least once every twenty-four months.

(b) Two-wire and three-wire commutating-type and mercury-type of meters of more than 50 amp. and up to and including 500 amp. rated capacity of meter element, at least once every twelve months.

(c) Two-wire and three-wire commutating-type and mercury-type meters of more than 500 amp. rated capacity of meter element, at least once every six months.

(d) Two-wire and three-wire single-phase induction-type meters up to and including 25 amp. rated capacity of meter element, at least once every forty-eight months.

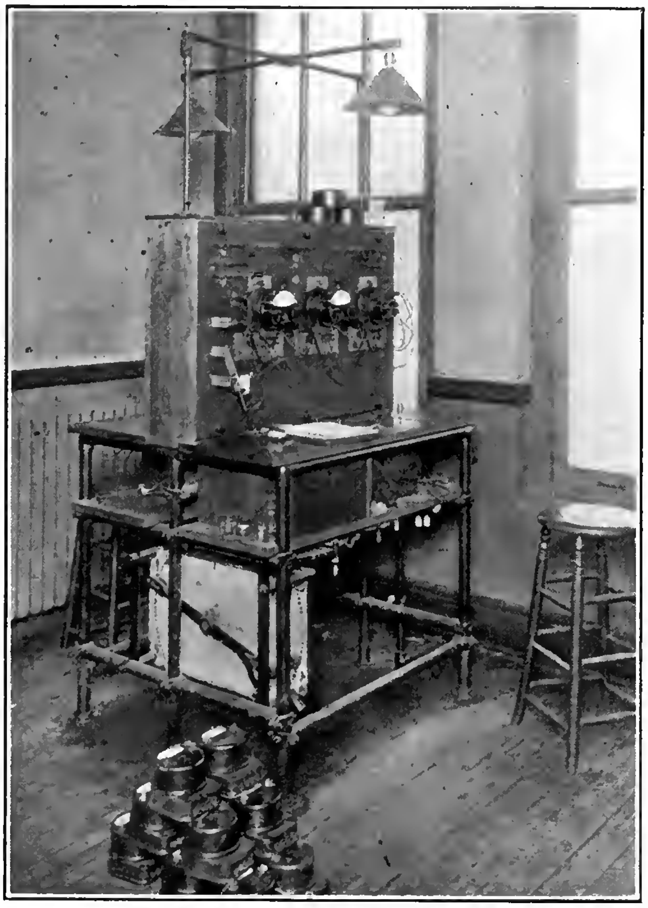
(e) Two-wire and three-wire single-phase induction-type meters of more than 25 amp. rated capacity of meter element, at least once every twenty-four months.

(f) All polyphase induction-type meters up to and including 50 kva. rated capacity of meter element, at least once every twenty-four months.

(g) All polyphase induction-type meters of more than 50 kva. rated capacity of meter element, at least once every twelve months.

### Divisional Organization Used

To take care of this testing work—there being 340,000 meters in service on the Detroit lines, of which approximately 100,000 meters are due for test this year—together with the keeping of records, purchases, etc., the meter department is divided into divisions, each one under a foreman who reports to the superintendent.



ALL TEST BENCHES AND SWITCHBOARDS WERE SPECIALLY DESIGNED AND BUILT IN THE COMPANY SHOPS —A DISTRICT OFFICE TEST BOARD

Thus, the "outside testing division" handles all service and complaint tests and furnishes periodical accuracy reports. The "meter laboratory" makes tests on all new meters received and all incoming meters returned from customers' services. The "standardizing laboratory" carries on special tests in addition to its function of certifying all standards and instruments. The "demand division" inspects and maintains demand meters in service and furnishes demand data for billing. This division also obtains load and utilization data for the steam-heating customers and reads the steam condensation meters. The "meter stock and records division" maintains the meter record files and acts as custodian.

The suburban district foremen, with headquarters in Ann Arbor, Mount Clemens and Port Huron, cities adjacent to Detroit, handle meter work in their territory.

There is also a steam division which handles the installation and maintenance of steam condensation meters, of which 2,000 are in service.

New meters and metering equipment are purchased by the purchasing department on orders placed and scheduled by the meter department. They are received and checked in by the stores department and turned over to the meter laboratory, where, after entries in the meter stock records have been made, they are put through the routine tests. Watt-hour meters and equipment are not carried in the general stores account, but in the meter account, chiefly because of the continual movement to and from service.

Meters removed from service are turned in to the meter stockroom by the installation department and from there delivered to the laboratory for the routine test before reinstallation. Thus every meter receives a test previous to installation regardless of its previous history. Single-phase meters are calibrated on 5 per cent and 75 per cent of rated capacity at unity power factor and at 75 per cent of rated current at 50 per cent power factor. Three-wire meters are also tested for balance of elements, and, if polyphase, each element is separately adjusted. Direct-current meters are calibrated at 10 per cent and 75 per cent of rated capacity, and, if three-wire, are tested for balance. In addition to these accuracy tests, each meter is examined for structural defects and its register is checked on a mechanical checker.

Alternating current is used in all tests except where mercury meters or heavy direct currents are involved. This alternating current is taken from small 220/11/22-volt transformers on each test board, each equipped with Ward-Leonard rheostats. Thus every board is a unit in itself.

The power supply for the laboratories is obtained from a transformer vault in the basement of the building. Here a 4,600-volt, 60-cycle, three-conductor cable is brought in from the adjoining substation, and after passing through an induction regulator controlled by a contact-making voltmeter the high-tension current is transformed in three banks of transformers to 110, 220 and 440 volts. The secondaries of these transformers are brought up to the main distributing switchboard in the meter laboratory, on which are mounted, in addition to the various feeder switches, a graphic voltmeter and the previously mentioned contact-making voltmeter. From this switchboard conduits under the floor carry feeders to a form of ring bus which is carried in a heavy conduit entirely around the laboratory walls, about two feet above the floor. Services to the various test boards are taken from this ring, so there is practically no visible wiring or piping. A compressed-air line follows the bus conduit, giving an air supply wherever needed. The air is passed through a condenser to remove any traces of moisture.

The 5-amp., 110-volt, single-phase meters, which form the greater part of the total, are tested on gang boards equipped with automatic connectors and taking nine meters on each side. This seems to be the maximum number that one man can properly handle at one time. Odd sizes of meters are tested on boards arranged for individual connections. The 10-amp., 120-volt direct-current meters are also tested on a special gang board.

In addition to its regular functions, the meter laboratory serves as training quarters for apprentice testers and inspectors. This training work is quite extensive and rather outside the province of this article.

A special installation of test boards is required for the calibration of Wright demand indicators, a considerable number of which are used on the Detroit

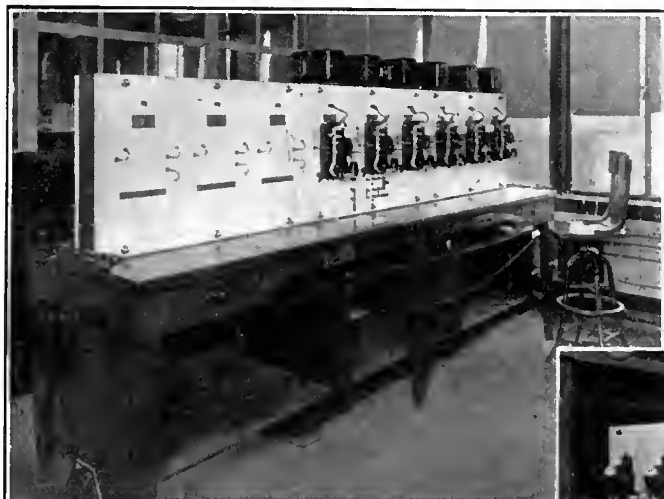
system. These indicators are installed on commercial lighting installations between certain limits of capacity. They are purchased with blank scales and calibrated in the laboratory according to the voltage upon which they are to be used. Testing current is supplied from a multiple-step auto-transformer controlled by a variable reactance coil.

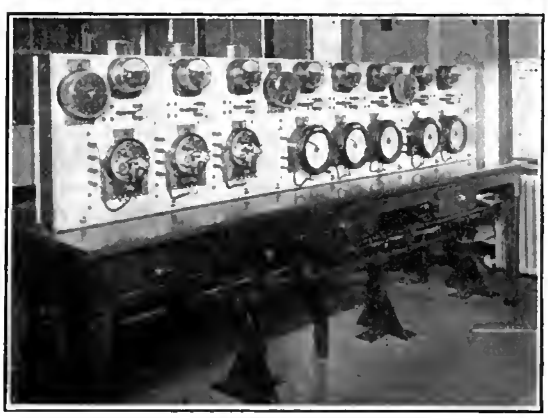
The integrating demand meters are tested and adjusted in a separate glassed-in room, under the care of experienced watch and clock experts. The meters receive a careful inspection and are then hung on the test board and put through a thorough test for timing and performance. The Detroit Edison system frequency is controlled by a Warren master clock, enabling most of the demand meters to be operated by Warren motors. The type C-4 contactor clocks are tested by connecting to small solenoids operating Veeder counters. These counters are locked in a closed compartment at the beginning of the test, and hence at the end of the run the actual number of clock contacts is definitely known. Time switches for use on two-rate metering installations are also cared for in this room.

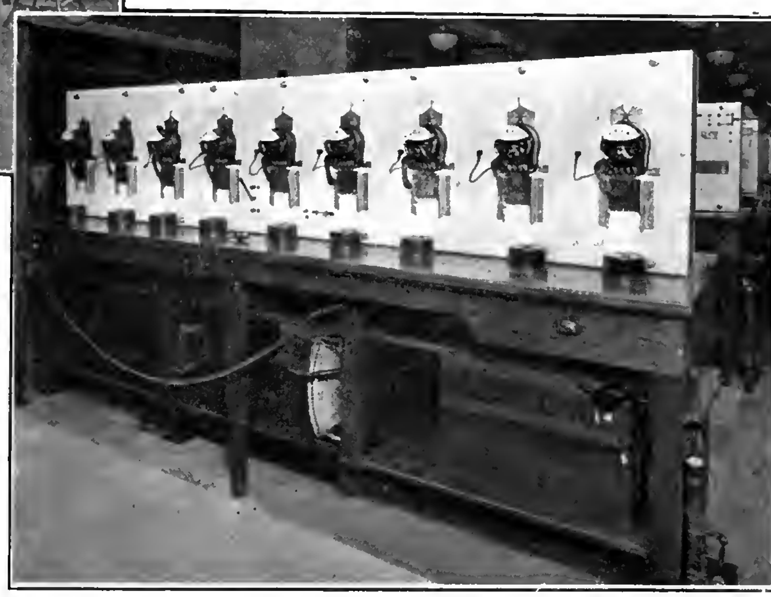
The repair shop is in the general shop building at some little distance from the service building, and meters and other instruments needing repairs or painting are delivered by trucks making regular scheduled trips. The shop was designed to permit of rapid work under agreeable conditions. Four two-man benches are installed, replacing the older arrangement of one long bench at which the men worked side by side. A paint spray outfit together with a buffing and grinding machine enables meters to be cleaned and painted at a very low cost. A substantial supply of repair parts for all meters insures against accumulation of "dead" stock.

The standardizing laboratory, which adjoins the meter laboratory in the service building, is a distinct division of the department and, as previously mentioned, maintains the primary and secondary electrical standards for the company and certifies all working standards, both indicating and rotating, used by the department. Here also are made acceptance tests on new types of metering devices, as well as special tests and investigations, chiefly along metering lines. Instrument transformers used in customers' installations receive the routine ratio and phase-angle tests here, every transformer being tested before installation or reinstallation, the Silsbee testing set being used for current and the Brooks method for voltage transformers. Tests on indicating instruments in the company's stations are made by men from the standardizing laboratory.

The primary standards include a standard clock with compensated mercury pendulum and regulated by Arlington time signal, a set of eight Weston standard cells, two potentiometers, one of which is a Leeds & Northrup type "K" and the other a Weston, and a set of standard resistors.







TOP, LEFT—A SPECIAL BOARD IN AN INCLOSED ROOM IS USED TO TEST INTEGRATING DEMAND METERS. AT RIGHT—NINE 5-AMP. METERS ARE HANDLED AT ONE TIME BY A TESTER. BOTTOM, LEFT—GANG TEST BOARD FOR 10-AMP. DIRECT-CURRENT METERS

For secondary standards there are Weston laboratory standard alternating-current and direct-current ammeters and voltmeters and Westinghouse and Weston standard dynamometer wattmeters. A Thompson double bridge and a precision Wheatstone bridge are also in use.

The working standards comprise a full line of ammeters, voltmeters and wattmeters, as well as the rotating standards in daily use. All of these instruments are periodically checked and certified through reference to the primary standards, which in turn are certified at stated intervals either by the Electrical Testing Laboratories or the Bureau of Standards.

Direct current for testing is supplied from a 300-volt, 0.75-amp. potential battery, a sixteen-cell, 14,560-amp.-hr. battery and a 700-volt, 10-kw. direct-current generator. Alternating current is supplied at the three

general voltages of 110, 220 and 440, and in addition to the small 220/11-volt transformer for individual testing positions there is a pair of 10-kva., 229/5½-volt transformers for heavy single-phase current.

Three-phase, three-wire or four-wire current at 16 volts up to 400 amp. is obtained from a specially connected I. R. T. regulator with bench control, subject to variation of power factor over a 360-deg. range. A bank of balanced carbon rheostats may be connected to this regulator.

Indirect lighting is used throughout the building. An intensity of 15 foot-candles is employed over the test boards, giving plenty of light with very slight shadows.

Within the Detroit city limits the company has established five district offices, and at four of these meter-testing boards and equipment are maintained to cooperate with the installation department in giving speedier service to customers. Meters are delivered from the meter stockroom direct to these offices and are taken out from there by the district installers. Incoming meters are then tested as they accumulate by men sent out periodically from the meter laboratory, and where no major repairs are required they are again available at the same office. This method is found to save considerable transportation of meters.

The suburban territory surrounding Detroit in a radius of about 60 miles is divided into nine districts, in three of which meter department branches are maintained. Each branch is equipped with a small test board, a repair bench, meter storage racks and card record files. The suburban foremen attend biweekly conferences with the department staff in Detroit and thereby keep their meter practice uniform. They are also visited at intervals by the superintendent and assistants.

# Analyzing Power Costs in Small Plants*

## An Investigation of the Various Factors that Are Involved—Use of Turbine and Oil Engines in Typical Installations—Influence of Load Factors on Selection of Prime Mover

By L. V. H. ARMSTRONG
*Engineer, Ingersoll-Rand Company*

IN ARRIVING at the cost of power at the switchboard of an electrical generating plant it is necessary to determine for the existing conditions (1) fixed or standing charges, (2) fuel cost, (3) labor cost, and (4) supply and repair charges. The total of these charges reduced to the kilowatt-hour cost at the switchboard is the determining factor in the choice of a prime mover.

The fixed charge against the power plant has been assumed to be 15 per cent of the initial investment made up as follows: Interest, 5 per cent; depreciation, 5 per cent; and obsolescence, 5 per cent.

In studying fixed charges it will be noted that the three factors affecting the fixed charge per kilowatt-hour are as follows:

1. Size of installation. The larger the plant, the lower the initial cost per rated kilowatt, and therefore for the same yearly load factor the fixed charge per kilowatt-hour will be lower.
2. Number of units into which power is divided. The greater the number of units, the higher the initial investment, and hence the higher the fixed charge per kilowatt-hour for the same yearly load factor.
3. Yearly load factor; that is, percentage of actual kilowatt-hours produced to rated kilowatt-hours. For a constant yearly fixed charge the greater the number of kilowatt-hours produced, the smaller will be the fixed charge per kilowatt-hour.

### Fuel Charge Varies

Fuel cost curves have been plotted on a nominal cost of 1 cent a gallon, making it simple to convert to actual fuel costs. In the same way, the fuel cost per kilowatt-hour for the steam plant is based on a nominal charge of $1 a ton for coal.

The fuel consumptions per brake-horsepower-hour used in plotting curves for the oil engines represent the average of guarantees submitted under bond at competitive biddings by a number of reputable manufacturers. A heating value for the fuel oil of 18,500 B.t.u. per pound has been used and a weight of 7½ lb. to the gallon.

For the steam plants the water rates of the turbines and boiler efficiencies have been obtained in the same way, by averaging the guarantees made by a number of manufacturers. A heating value of 13,000 B.t.u. per pound has been assumed for the coal and a weight of 2,000 lb. to the ton. Bituminous run-of-mine coal is the grade considered.

### Labor Charge Assumptions

The operating force required for the different plants and the salaries are assumed to be as follows:

For the two 100-kw. and one 200-kw. plants:

| STEAM Class of Employee | Monthly Salary | OIL ENGINE Class of Employee | Monthly Salary |
|---|---|---|---|
| One chief engineer | $150 | One chief engineer | $165 |
| Two watch engineers | 125 | Two watch engineers | 135 |
| Three firemen | 110 | | |

For the two 275-kw. and one 550-kw. plants:

| STEAM Class of Employee | Monthly Salary | OIL ENGINE Class of Employee | Monthly Salary |
|---|---|---|---|
| One chief engineer | $175 | One chief engineer | $190 |
| Three watch engineers | 125 | Three watch engineers | 135 |
| Three firemen | 110 | | |

These salaries are totaled and then reduced to an average hourly labor charge, assuming twenty-four hours to the day and 365 days to the year. Using these average labor charges, curves have been plotted for the different plants against hourly load factors.

It should be noted that nothing has been charged against the steam plant to cover handling coal or ashes. On the other hand it is generally believed that oil-

*Abstract of paper presented before the Atlanta Section, A. S. M. E.

engine operators are much more highly paid than steam-engine men. Supply and repair charges are combined and plotted as curves. Four per cent of the initial cost has been used for the oil engines, 3 per cent for the steam and 1 per cent for the electrical equipment. Only normal routine repairs, such as replacing boiler tubes, grates and brickwork, renewing steam piping and lagging, grinding and replacing valves, reboring cylinders, rebabbitting bearings, etc., are covered.

### Comparison of Plants Under Assumed Conditions

(a) The first condition to be considered will be a small municipal power plant with a peak load of approximately 100 kw., a small manufacturing power demand and a constant population during the twelve months of the year. In such a plant it would be necessary to have not less than two units, either of which would be of sufficient size to carry the peak load alone. On account of this standby unit, one may expect the fixed charge per kilowatt-hour to be high, and the burden laid on the plant by this standby unit will be directly proportional to the initial cost of the plant.

The load conditions prevailing during twenty-four hours are assumed to be in accordance with the following table:

| Kw. Load | Number of Hours | Time |
|---|---|---|
| 100 | 3 | 7 p.m. to 10 p.m. |
| 50 | 2 | 10 p.m. to midnight |
| 15 | 6 | Midnight to 6 a.m. |
| 20 | ½ | 6 a.m. to 6:30 a.m |
| 0 | 1 | 6:30 a.m. to 7:30 a.m. |
| 75 | 4½ | 7:30 a.m. to noon. |
| 15 | 1 | 12 noon to 1 p.m. |
| 75 | 4 | 1 p.m. to 5 p.m. |
| 20 | 2 | 5 p.m. to 7 p.m. |

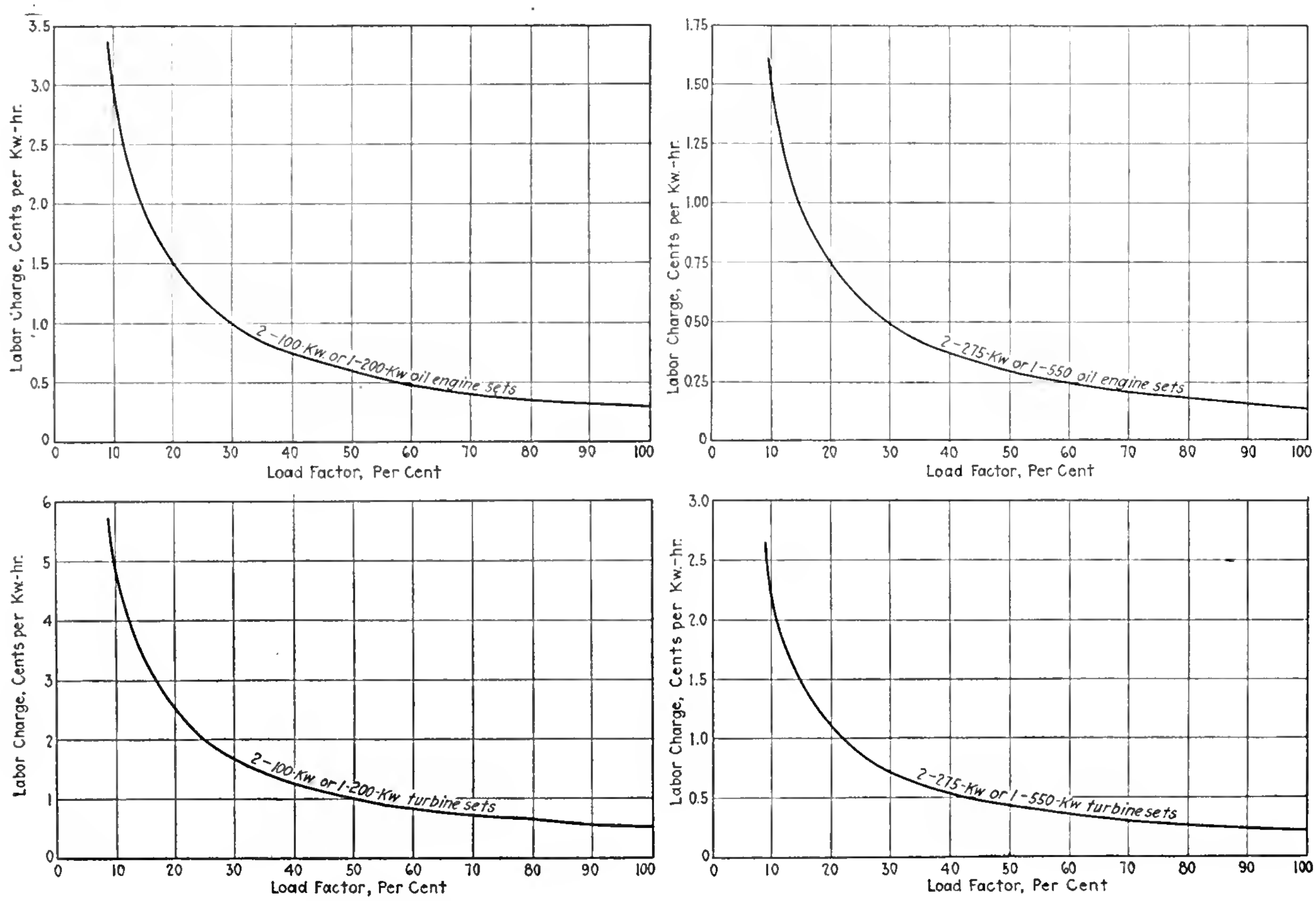
From the above it is found that the actual kilowatt-hours developed represents 25 per cent of the kilowatt-hours possible, both units operating. This load factor enables us to take from the curves the fixed charge, labor charge and supplies and repair charge per kilowatt-hour for the two-unit 100-kw. oil-engine plant. These charges are: Fixed charge, 1.5 cents; labor charge, 1.18 cents; supplies and repairs, 0.165 cent.

Then, assuming a price for fuel oil delivered at the plant of 5½ cents a gallon and using the hourly fuel costs at the loads given in the above table to arrive at an average hourly fuel cost for a period of twenty-four hours, a charge of 0.59 cent per kilowatt-hour for fuel is obtained. Totaling the above charges, one obtains an ultimate cost per kilowatt-hour of 3.435 cents.

With the same data, the following charges for the steam plant of a similar type and size result from the curves: Fixed charge, 1.45 cents; labor charge, 2 cents; supplies and repairs, 0.105 cent.

Assuming a cost per ton of coal delivered of $7, made up of $3.25 cost, f.o.b. mines, $3 freight and 75 cents for unloading and placing in bins, an average fuel charge per hour of 1.372 cents is found. Totaling the above charges, there results a final charge per kilowatt-hour of 4.927 cents.

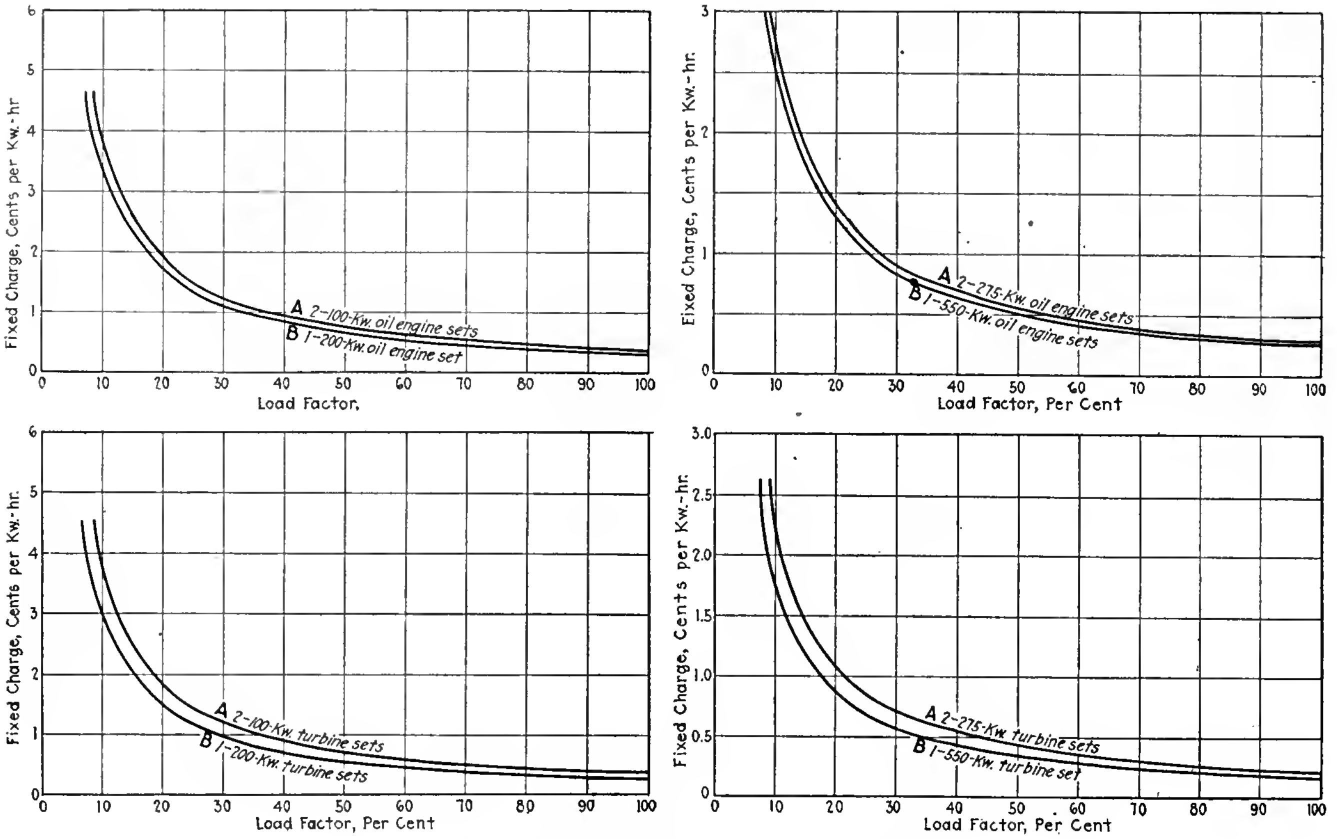
This represents a saving in favor of the oil-engine plant of 1.49 cents per kilowatt-hour, or a yearly saving, based on the load factor assumed to obtain in this plant, of $6,540.



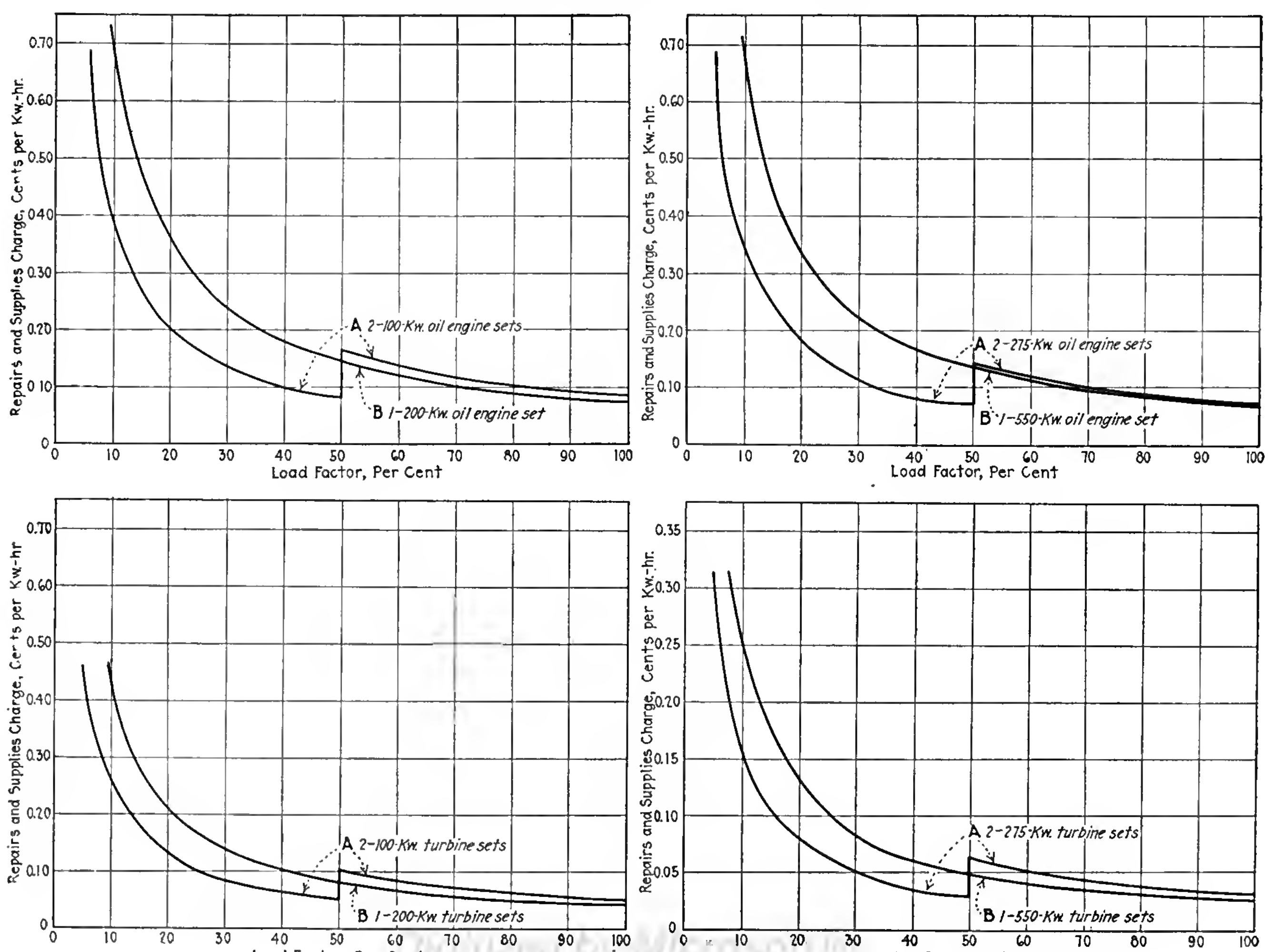

LABOR CHARGE IS LESS FOR THE OIL ENGINE SETS IN SIZES UP TO 550 KW.

In case it should be necessary to pay 11 cents per gallon for fuel instead of 5½ cents, the saving per kilowatt-hour in favor of the oil engine will become 0.9 cent instead of 1.49 cents and the yearly saving will be reduced from $6,540 to about $3,925. In other words, even with an abnormally high price for fuel oil, the oil-engine plant is still the better. It should be noted that in the calculation just made for the steam plant no allowance has been made for banking fires, cleaning fires or raising steam pressure to take care of the peak load. This will amount to a considerable item, as the best authority places the quantity of coal per boiler-horsepower necessary to bank fires at about ¼ lb. The oil-engine plant has no similar factor, as full power can be had in approximately two to three minutes from the starting up of the engine, and, in the same way, as soon as the demand for power ceases the oil engine can be stopped and simultaneously the fuel consumption stops.

(b) Let us now consider a larger town, with a peak power demand of 275 kw. and a power plant consisting of two units, either of them being of sufficient size to handle the




FIXED CHARGES ARE LESS ON THE TURBINE SETS




COST OF REPAIRS AND SUPPLIES FAVOR TURBINE SETS

TABLE I—DETAILED ANALYSIS OF COST ESTIMATES
200-kw. Oil-Engine Plant (two units)

**I. Initial Installation Cost, $44,000.**

Two 150-b.hp. oil engines.
Two 100-kw. generators.
Two exciters, belted.
Two sets foundation bolts.
One gasoline-engine air compressor for starting.
Two motor-driven circulating-water pumps.
Two generator switchboard panels.
Engine foundations, 44 cu.yd. at $15 per cubic yard.
All piping and piping installation.
5-ton crane, installed.
One 15,000-gal. steel storage tank installed.
Two 200-gal. engine day tanks.
One motor-driven transfer pump.
One hand-operated transfer pump.
Brick power house (30 ft. x 35 ft. x 20 ft. at 30 cents per cubic foot).
Hauling and placing on foundations, $20 per ton.
Erector, thirty days at $20.
Common labor, four men, $4 per eight-hour day, thirty days.

Note.—All prices f.o.b. factory.

Initial cost of installation ...... $44,000
Interest, depreciation and obsolescence .................... 0.15

Yearly fixed charge ........ $6,600

Per Kw.-Hr.

100 per cent yearly plant load factor:
$6{,}600 \div (365 \times 24 \times 200) = \$0.00376$
50 per cent yearly plant load factor:
$0.00376 \div 0.50 = 0.0075$
10 per cent yearly plant load factor:
$0.00376 \div 0.10 = 0.0376$

**II. Fuel Charge.**

Per Kw.-Hr.

100 per cent and 50 per cent plant load factor (same—two engines, one engine):
$(150 \times 0.45 \times 0.01) \div (7.5 \times 100) = \$0.0009$
75 per cent plant load factor (75 per cent each engine):
$(0.0009 \times 0.47) \div 0.45 = 0.00094$
10 per cent plant load factor (20 per cent load one engine):
$(0.0009 \times 0.72) \div 0.45 = 0.00144$

**III. Labor Charge.**

$[165 + (2 \times 135) \times 12] \div (365 \times 24) = \$0.596$ (average hourly labor charge)

Per Kw.-Hr.

100 per cent plant load factor:
$0.595 \div 200 = \$0.00298$
50 per cent plant load factor:
$0.00298 \div 0.50 = 0.00596$
25 per cent plant load factor:
$0.00298 \div 0.25 = 0.0119$
etc.
(Labor charges same for single-unit 200-kw. plant.)

**IV. Supplies and Repairs.**

Hourly lubricating oil cost, one hour, one unit:
$(150 \times 0.60) \div 4{,}000 = \$0.0225$.
Hourly lubricating oil cost, one hour, two units:
$2 \times 0.0225 = 0.045$.
Yearly repair cost, one engine, 100 per cent time running:
$0.04 \times 12{,}420 = \$497$.
Yearly repair cost, two engines, 100 per cent time running:
$2 \times 497 = \$994$.
Yearly repair cost, one generator, 100 per cent running:
$0.01 \times 2{,}336 = \$23.50$.
Yearly repair cost, two generators, 100 per cent running:
$2 \times 23.50 = \$47$.
10 per cent plant load factor (20 per cent one unit):

$$\frac{497 + 23.50}{365 \times 24 \times 100 \times 0.20} + \frac{0.0225}{0.20 \times 100} = 0.0041.$$

25 per cent plant load factor (50 per cent one unit):
$(0.0041 \times 0.20) \div 0.50 = 0.00164$.
50 per cent plant load factor (100 per cent one unit):
$(0.00164 \times 0.50) \div 1.00 = 0.00082$.
75 per cent plant load factor (75 per cent both units):
$(0.00082 \times 4) \div 3 = 0.00109$.

peak demand. The fact that the units are larger will reduce the initial cost of the installation per kilowatt and also improve the fuel consumption per kilowatt-hour. As this increase in the size of the plant would not necessitate any material change in the operating force, the labor charge per kilowatt-hour will also be less on account of the fact that more kilowatt-hours are produced. From the curves the following charges are obtained for the oil-engine plant: Fixed charge, 1.10 cents; labor charge, 0.59 cent; repairs and supply charge, 0.14 cent.

Assuming again a cost for fuel oil of 5½ cents a gallon, the fuel cost per kilowatt-hour is found to be 0.538 cent. Totaling the above charge, an ultimate cost per kilowatt-hour of 2.37 cents results.

In the same way, for the steam plant, these charges are obtained from the curves: Fixed charge, 0.85 cent; labor charge, 0.87 cent; supplies and repairs, 0.065 cent.

Assuming a cost of $7 per ton for coal laid down at plant, a fuel charge of 1.13 cents is obtained. Totaling the above charges, the ultimate cost for power delivered is found to be 2.92 cents per kilowatt-hour. In other words, there would be a saving in favor of the oil engine plant of 0.55 cent per kilowatt-hour, which in a year would represent $6,650.

For a plant of the size just described a better installation would consist of three 150-kw. units or four 100-kw. units. Such a plant, instead of having a 100 per cent standby capacity, would have a 50 per cent and a 33⅓ per cent standby capacity. With any one of the units out the remaining units would be able to carry the peak load. The initial cost per kilowatt for the plants with the three and four units would be slightly higher on account of the units being smaller, but inasmuch as the standby capacity is less, the total cost for the installation would be less, and, therefore, the yearly fixed charge would be less. In the case of the oil-engine plant with three or four units the fuel consumption per kilowatt-hour would also be less, inasmuch as it

TABLE II—DETAILED ANALYSIS OF COST ESTIMATES
200-kw. Steam Plant (two units)

**I. Cost of Initial Installation, $43,000.**

Two 100-kw. turbo-generating sets.
Two generator panels.
Two 86-b.hp. water-tube boilers.
Setting of boilers.
Low-level multi-jet condenser and pumps.
Feed-water heater.
Boiler-feed pump.
All piping and fitting.
110-in. steel stack and flues.
Foundations.
Handling and placing on foundations.
Erector, thirty days at $20 per day.
Common labor, four men, $4 per day, thirty days.
Brick building (28 ft. x 16 ft. x 20 ft. + 24 × 24 at 32 cents per cubic foot).

Note.—All prices f.o.b. factory.

Cost of initial installation ...... $43,000
Interest, depreciation and obsolescence .................... 0.15

Yearly fixed charge ....... $6,450

Per Kw.-Hr.

100 per cent plant load factor:
$6{,}450 \div (365 \times 24 \times 200) = \$0.00368$
75 per cent plant load factor:
$0.00368 \div 0.75 = 0.0049$
50 per cent plant load factor:
$0.00368 \div 0.50 = 0.00736$
25 per cent plant load factor:
$0.00368 \div 0.25 = 0.0147$

**II. Fuel Charge.**

Water rates: 24.4 lb., 27 lb., 30.8 lb., 38 lb. (13,000 B.t.u. coal, 70 per cent boiler efficiency).
Coal consumption: 3.12 lb., 3.45 lb., 3.93 lb., 4.85 lb. per kw.-hr.

Per Kw.-Hr.

100 per cent plant load factor (100 per cent both units):
$(3.12 \times 1.00) \div 2{,}000 = \$0.00156$
75 per cent plant load factor (75 per cent both units):
$(3.45 \times 1.00) \div 2{,}000 = 0.00173$
50 per cent plant load factor (100 per cent one unit): Same as above
25 per cent plant load factor (50 per cent one unit):
$(3.93 \times 1.00) \div 2{,}000 = 0.00197$

**III. Labor Charge.**

Hourly labor charge $= [150 + (2 \times 125) + (3 \times 110) \times 12] \div (365 \times 24) = \$1.00$
100 per cent plant load factor:

Per Kw.-Hr.

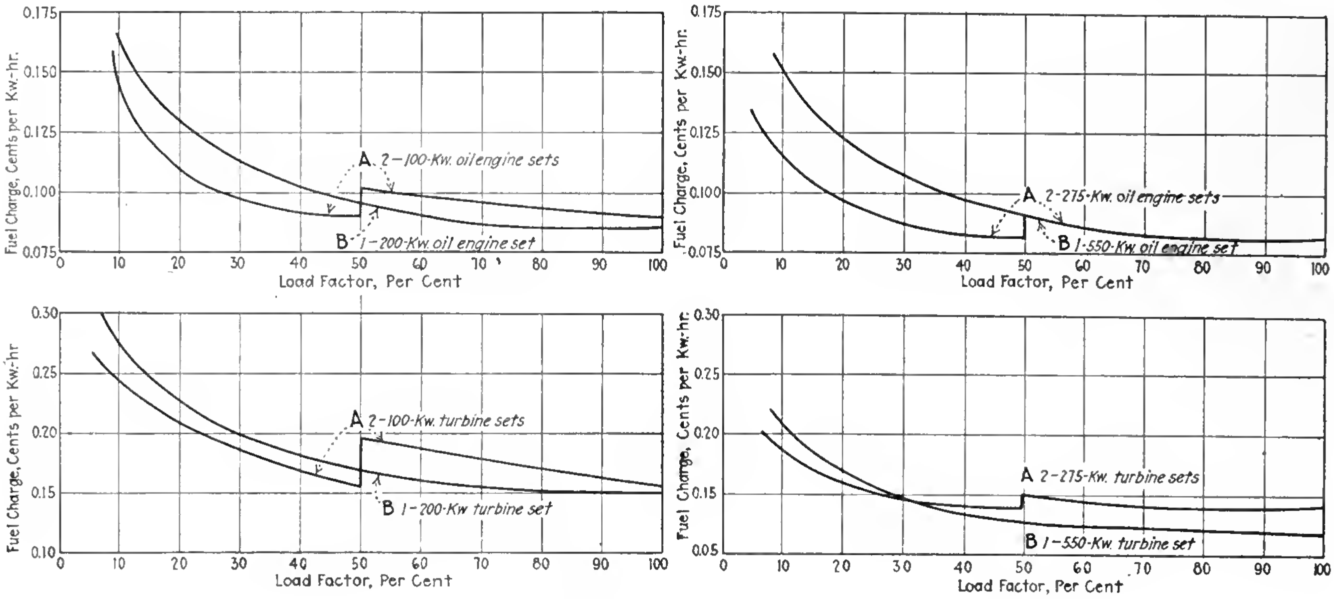
$1.00 \div 200 = \$0.005$
75 per cent plant load factor:
$0.005 \div 0.75 = 0.0067$
50 per cent plant load factor:
$0.005 \div 0.50 = 0.010$
25 per cent plant load factor:
$0.005 \div 0.25 = 0.020$

**IV. Repairs and Supplies**

Yearly repairs, both units running: $0.03 \times \$30{,}385 = \$911.55$
Yearly repairs, one unit running: $0.03 \times \$15{,}192 = \$455.76$
10 per cent plant load factor (20 per cent, one unit):

Per Kw.-Hr.

$456 \div (365 \times 24 \times 0.20 \times 100) = \$0.0026$
25 per cent plant load factor (50 per cent, one unit):
$(0.0026 \times 0.20) \div 0.50 = 0.00104$
50 per cent plant load factor (100 per cent, one unit):
$0.00104 \div 0.50 = 0.00052$
75 per cent plant load factor (75 per cent, both units):
$0.00052 \div 0.75 = 0.00069$




FUEL CHARGES ARE LESS ON THE OIL ENGINE SETS

would be possible to operate a smaller machine during the periods of very light load. The labor charge and the supplies and repairs charge would not be affected by the change in the composition of the plant.

(c) Let us next consider an industrial plant operating six days a week, ten hours to each operating day. It will be assumed that the average load during the operating day is 70 per cent of the power plant's rated capacity. On the basis of these figures, the actual kilowatt-hours developed would represent about 25 per cent of the total kilowatt-hours possible during the year. For such a plant it would be unnecessary to consider any standby capacity, and a power plant consisting of one unit would fill all the requirements. From the curves for the oil-engine installation it is found that the following charges are effective under the operating conditions just described for a power plant of 200 kw. rated capacity: Fixed charge, 1.325 cents; labor charge, 0.4 cent; supplies and repairs, 0.1 cent.

Assuming a cost of 5½ cents a gallon for fuel oil, the fuel charge per kilowatt-hour is 0.478 cent. Totaling the above charges, the ultimate charge per kilowatt-hour for the oil-engine plant is found to be 2.30 cents.

In the same way, for the steam plant, one obtains from the curves the following charges for a single-unit plant of 200-kw. capacity: Fixed charge, 1.175 cents; labor charge, 0.725 cent; supplies and repairs, 0.058 cent.

Using a price of $7 per ton for coal, a fuel cost per kilowatt-hour of 1.085 cents is obtained. Totaling the above charges, one gets an ultimate cost for the steam plant of 3.04 cents, or, in other words, a saving of 0.74 cent per kilowatt-hour in favor of the oil-engine plant. On the basis of the total number of kilowatt-hours produced in a year under the conditions just given, this would represent a yearly saving of $3,232.

(d) Now, let us consider an industrial plant operating under the same conditions but with a rated capacity of 500 kw. in a single unit. For the oil-engine installation, from the curves, one obtains the following charges: Fixed charge, 1 cent; labor charge, 0.206 cent; supplies and repairs, 0.092 cent.

Assuming a fuel cost of 5½ cents a gallon, one obtains a fuel charge of 0.465 cent. Totaling the above, 1.76 cents per kilowatt-hour is obtained.

In the same way, for the steam plant of the same size, from the curves one obtains the following: Fixed charge, 0.69 cent; labor charge, 0.30 cent; supplies and repairs, 0.036 cent.

Assuming a price of $7 per ton for coal, one obtains a fuel cost of 0.865 cent. Totaling the above charges, one gets a total charge per kilowatt-hour for the steam plant of 1.89 cents.

(e) Now, consider an industrial plant operating six days a week, twenty-four hours a day. In such a plant two units might be considered desirable, although it is believed that one unit will meet the requirements with complete success. The shutdown from Saturday night until Monday morning gives ample opportunity for overhaul, adjustment and repairs.

Let us consider such a plant with one unit of 200 kw. rated capacity and with an operating load factor of about 70 per cent. In the same way as previously described for the oil-engine plant, the following charges are found: Fixed charge, 0.525 cent; labor charge, 0.4 cent; supplies and repairs, 0.1 cent; fuel charge, 0.478 cent. Totaling the above charge, an ultimate fixed cost per kilowatt-hour of 1.50 cents is derived.

For the steam plant of similar size and composition, the following charges exist: Fixed charge, 0.45 cent; labor charge, 0.725 cent; supplies and repairs, 0.058 cent; fuel charge, 1.085 cents. Totaling the above charge, a cost per kilowatt-hour of 2.32 cents for the steam plant is obtained.

(f) Next consider an industrial power plant with a single unit of 550 kw. capacity and operating on the same load factor. For such an oil-engine plant the charges would be as follows: Fixed charge, 0.397 cent; fuel charge, 0.456 cent; labor charge, 0.206 cent; supplies and repairs, 0.09 cent. Totaling the above, one gets an ultimate charge per kilowatt-hour of 1.15 cents.

For the steam plant of similar size and characteristics the following charges are obtained: Standing charge, 0.29 cent; fuel charge, 0.865 cent; labor charge, 0.3 cent; supplies and repairs, 0.036 cent. Totaling these charges, there is found to be an ultimate charge per kilowatt-hour of 1.49 cents.

## Intense Construction Activities by Central Stations in Norway

During the year 1922 fifty-two new stations were installed in the districts of More, Sogn og Fjordene and Hovdaland, in Norway. There are 664 power stations, with a total generating capacity of 279,855 kw., in this district at the present time. Supplies for these stations are imported from Germany, Sweden, England and the United States. Equipment is also manufactured locally at the Norwegian plants of German companies and of one American concern. Although German houses have been dominant in this trade, the situation has so changed recently that at the present time there appears to be an excellent opportunity for American equipment manufacturers to secure a good share of the business.

Electrification of railroads also is making progress in Norway, the Ofot line being about to go into operation. It runs from Narvik, on the Arctic Ocean, to the Swedish border, where it joins the Swedish line to Lulea, on the Gulf of Bothnia, giving an all-electric line from the Arctic to the North Baltic.

STREET LIGHTING AT MIAMI BEACH, FLA., WHERE PROPER SUPERVISION AND MAINTENANCE ARE ENFORCED

# City Zoning of Street Lighting

## Improvements in Public Illumination Should Be Carried Out Under Comprehensive Programs Co-ordinated with and Included in City Zoning Plans—Central Stations Are Logical Sponsors

By CHARLES J. STAHL
*Manager Illuminating Bureau, Westinghouse Electric & Manufacturing Company, South Bend, Ind.*

IN DESIGNING ornamental street-lighting installations the most important consideration is to obtain efficient illumination at low operating and maintenance costs. The original cost of a street-lighting installation is seldom greater than its cost of operation over a two-year period. Most installations last from ten to fifteen years, so it is plain that a little saved or a little more spent on the original installation becomes an insignificant consideration when compared with the importance of wise planning from the standpoint of maintenance and operation costs.

In past years the usual practice has been to confine street-lighting improvements to limited sections. Just as city planning has in the past been almost wholly confined to scattering about the city a few beauty spots such as civic centers, parks and playgrounds, so has street lighting been scattered through the agency of localized improvements carried out as private developments or in the form of improvement districts. Nearly always the aim has been to boom a restricted area to commercial leadership through the establishment of "white ways." The work of so-called improvement districts may be made valuable if regulated under a general improvement plan; but without centralized leadership the result is haphazard patchwork.

There are several causes for this "spotty" development in street lighting. One is the failure of the public in the past to realize and appreciate the importance of good lighting to the community. But the public is not wholly to blame, for there has been little consistent advertising of the advantages thus to be derived. Central-station companies' sales departments are the logical advocates, but they seldom act in that capacity, and often an air of mystery and of sensitive political complications seems to surround the street-lighting contract. In obtaining franchise renewals and in overcoming the propaganda of politicians trying to ride into office on a campaign aimed against public utilities, central-station companies are often unjustly forced to use the street-lighting contract as a sedative. Consequently such contracts are often taken at a loss to the central station, and naturally no effort is subsequently made for a growth in unprofitable load. Furthermore, to keep the street-lighting loss as low as possible, the equipment is neglected and fails to operate at normal efficiency.

City administrations usually aim to keep a record of outages in order to collect penalties imposed under the terms of the street-lighting contract, but "semi-outages" usually pass unobserved.

### USUAL CRITICISMS OF STREET LIGHTING AND THE REMEDY

The average run of street lighting throughout the United States is more or less subject to the following criticisms which are given approximately in the order of their relative importance:

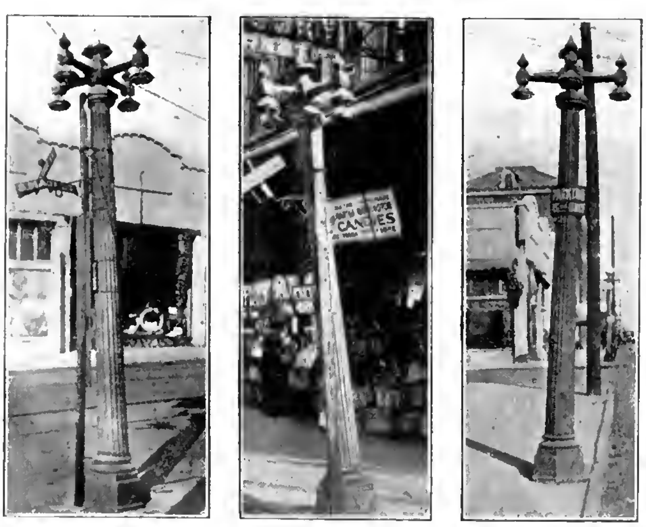
1. Inadequate illumination.
2. Miscellaneous growth without a definite relationship to a comprehensive city plan.
3. Inconsistent transitions and gaps in passing from one section to another.

AN EXCELLENT INSTALLATION OF LIGHTING ON McELMORE AVENUE VIADUCT, MEMPHIS, TENN.

4. A lack of standardization.
5. A lack in classifying streets and no unity of treatment for streets of the same classifications.
6. Too many unsightly or disfigured streets because of insufficient attention to architectural grace and ornamentation.
7. Too much temporary construction instead of building for flexible permanence.
8. Too little application of correlated intelligent effort, research and talent.

Without taking space to elaborate on the foregoing negative considerations, it is better to advance to the positive or constructive side of the question by establishing a definite set of rules, here offered as a guide to correct procedure in the design of ornamental street-lighting installations:

1. The justifiable expenditure for street lighting (construction plus operation and maintenance) may be graded according to traffic density.
2. Except in the rare case of uniformly loaded through arteries, intensities of illumination on streets of uniform character may be graduated as traffic streams split and thin out.
3. On purely residential side streets carrying little traffic except that originating from abutting residences intensities and types of lighting may be chosen primarily from the standpoints of crime prevention and of ornamentation.
4. On streets carrying slow-moving heavy traffic, such as trucking and freight-station business, moderate intensities of illumination are acceptable, but not by means of unsightly overhead construction.
5. On the streets having little traffic and low property values moderate intensities of illumination must nevertheless be maintained for the prevention of crime and unsightly overhead construction should be avoided.
6. Statistics on the increasing popularity of good lighting and the decreasing cost of electric power show a definite trend upon which fairly precise allowance may be based to provide capacity and flexibility for future improvement and intensification.
7. The practice of extinguishing a portion of the lights at about midnight is hazardous, complicated and seldom justified except on streets where very high values of illumination exist and where traffic is practically nil during certain hours.
8. The so-called "moonlight schedule" is obsolete and should have no consideration.
9. All street-lighting design and construction can and should be developed on a scientific basis correlated with the city zoning plan, dealing with the future of unimproved areas as well as the immediate requirements.
10. It is logical to have a somewhat higher illumination at intersections than at midway points.



THE USUAL RESULTS OF LOCALIZED IMPROVEMENTS, WHICH AS A RULE ARE CARELESSLY OPERATED AND MAINTAINED AND SOON BECOME DERELICTS

The construction of the underground portion of an ornamental street-lighting system may often be timed to coincide with repairs or reconstruction in paving, sewers or water and gas mains. One can appreciate what the results would be if an office building were to be constructed by employing workmen of the different crafts and permitting each to proceed according to his own ideas, yet this is in a large measure the procedure followed in the building of our cities. Most communities have plans, but too many lack a comprehensive plan to associate and correlate in their relative importance the individual plans of the different municipal departments, which usually follow a fragmentary development based largely on guesswork instead of on a scientifically derived analysis and forecast.

Putting into effect the practice of designing street-lighting systems along with zoning or expansion plans permits standardization, simplified supervision, reduced maintenance costs and the most efficient arrangement for transmitting energy to centers of distribution. The

longer we delay in working out a comprehensive foresighted and farsighted street-lighting plan comprising the entire area within the city limits and such areas as are likely to be annexed, the greater will be the loss in tearing down and reconstructing. Without such a plan one thing is sure, and that is that piecemeal plans are certain to be uncertain and unsatisfactory.

### Planning a Specific Case

In order to discuss the subject more in detail, suppose there is before those concerned the plat of a city of more than 100,000 population; say Indianapolis, where a short time ago a zoning ordinance was passed by the Council crowning a year's work of the City Planning Commission. On the plat it is easy to outline the intensified business section. It can be called Lighting Zone A, and one can proceed to make up Zone A specifications. These specifications need not call for an immediate remodeling of the lighting. Although it may be found inadequate according to the advanced standards of today, there is another consideration of equal importance, and that is that in all study and planning there should be a comprehension of what the requirements are likely to be ten years hence.

Usually more than half of the cost of ornamental street lighting is in the underground construction, and it is this portion of the work that should be made flexible and adapted to fit future developments and higher intensities without extensive reconstruction. Zone A specifications should, of course, call for the best of ornamental street-lighting equipment. Traffic, both vehicular and pedestrian, is dense, which means that property has a high valuation in comparison with which the street-lighting cost becomes an insignificant figure.

Number one of the foregoing rules states that the justifiable expenditure for street lighting may be graded according to the traffic density. One's first impression may be that it should be graded according to property values, and there is in fact no reason why the property instead of the traffic consideration may not be applied, for property values are created by and are directly proportional to the traffic.

In continuing the study of the plat certain main arteries of traffic are found. They may run east and

THE BEAUTY OF CIVIC CENTERS IS ACCENTUATED BY THE INSTALLATION OF APPROPRIATE LIGHTING EQUIPMENT (GRANT PARK, CHICAGO)

west and north and south, or they may be radial or a combination of all.

The point is that they are the main members of the framework upon which the city is built and is to continue its growth. In most cities heavy trucking is allowed on these arteries, but others are regarded more as passenger express routes with right-of-way over the contributing cross streets. At any rate, a liberal quantity and good quality of illumination should be applied to expedite and safeguard this traffic, in which the possibilities for misjudgment must be eliminated as far as possible. The same considerations may be extended to the use of the roadways by the Fire Department's equipment and to police supervision, detection and pursuit. Units should be mounted fairly high and glare reduced to the minimum. The selection of these streets falling within the area covered by lighting specifications for Zone A is, of course, provided for, and thenceforth specifications for Zone B apply.

A description of the particular characteristics of the various types of street-lighting equipment now available would become complicated and possibly tiresome. Correct selection of equipment can readily be made after a comprehensive plan is established, so it is not necessary

A COMPREHENSIVE STREET-LIGHTING PLAN HAS BEEN CARRIED OUT AT LIMA, OHIO, UNDER CAREFUL MANAGEMENT AND TECHNICAL TALENT

to consider details of the individual zoning specifications, but simply to outline the principal results that each is to produce.

### Contemplating Changes in Lighting Requirements and Standards of Construction

In predicting the requirements of the future it will perhaps never be possible to reach perfection. No one can expect his forecasts to be 100 per cent correct, and some replacement problems are bound to arise. Advance planning has the advantage of reducing them to the minimum. The intensive business section will expand, and parts of Zone B will merge into the Zone A district; therefore provision must be made so that parts or all of Zone B lighting may with a minimum of reconstruction be converted into Zone A lighting, and this is the very condition that makes a comprehensive plan beneficial and indispensable.

Flexibility is obtained by making such provisions in the underground network of electrical circuits that it becomes possible to make substitutions in the lighting units. Then as units in Zone B are replaced they are not lost but become available for growth in the extremities of that zone. In other words, it becomes possible to transplant without disturbing the roots. The most essential provision is an adequate system of underground conductors forming a network in which, as in the case of the streets, there must be high-tension main arteries, intersections and low-tension branches, in order that the electrical energy, like the traffic, may circulate expeditiously.

Few civic administrations realize the full gravity of the problems of distribution which often confront the management of a central-station company serving a city without definite community plans which would be an aid in forecasting the trend of developments and also the city's future requirements.

TENDENCY TOWARD HIGH MOUNTING (NEWARK, OHIO)

Returning to the plat, several different districts could be outlined, each requiring a different type of equipment as far as the portion above the ground is concerned. A third specification would be necessary for secondary business streets; a fourth for the manufacturing and wholesaling districts; a fifth for parks, playgrounds, civic centers, boulevards and other areas for recreational purposes. A sixth becomes necessary under some of the most modern city plans, which contemplate the elimination of grade crossings where cross streets intersect boulevards. In such an arrangement either the boulevard or the cross street becomes for a short distance a viaduct or a subway. In either case special treatment is required in order to obtain effective illumination.

A seventh specification is required for alleys in business sections and an eighth for alleys in outlying sections. However, all of these specifications can have many features in common. As a result the variety of articles to be carried in stock is substantially reduced, and prompt repairs are made possible with a minimum of "standby" material in the warehouse and a corresponding reduction in the inactive investment.

Aërial traffic, including night flying, is no longer to be disregarded, so another specification covering the lighting of landing fields, depots and hangers may be required in the near future. Some cities also have use for a similar specification for the floodlighting of municipal bathing beaches. So, under a set of from twelve to fourteen standardized types of lighting, all having numerous features in common, the varied lighting requirements of a large city can be economically provided. It is interesting to contrast the results of such simplification with the conditions now existing in many American cities. For example, in a Western city of 250,000 population there are forty-seven separate and distinct types of lighting, with a complete lack of interchangeability and with no logical associations or relationships. A better effect could be obtained with no more than ten types properly applied, and great economy in supervision, maintenance and operating costs could be brought about.

Fortunately, in some localities city planning is being broadened into regional planning; in other words, coöperative planning between communities is being advocated and in a few localities is already being practiced. From the illuminating engineer's standpoint the idea should be encouraged, for the lighting of interurban highways is already an important consideration under the good roads movement. Tourists do not select a route because the streets of a certain city on that route are well paved and lighted. Their choice is based on the average character of the route throughout. In this and many other ways the success of almost every city depends in some measure upon the activities of the neighboring cities.

The immense volume of high-speed traffic brought about by the use of automobiles has caused an enormous increase in traffic accidents. A careful study based on accident statistics from thirty-two cities shows that 17.8 per cent of all night traffic accidents are due to inadequate illumination. Evaluated, this represents an annual property loss of at least $54,000,000 in addition to human misery, loss of life and enforced care of dependents and those permanently disabled. On the other hand, according to census reports, the total expenditure for street lighting in the United States does not exceed $50,000,000 per year.

### Adequate Street Lighting a Solution of Headlight Problem

Good street lighting is a great benefit to automobile drivers, whose vision after dark depends upon the fairly constant and uniform illumination from the street lights and the spasmodic, violent influence of approaching automobile headlights. Although the average street illumination throughout the country is inadequate, the greatest danger, excepting grade crossings, is in glaring

automobile headlights, and with the continual growth in automobile traffic it is becoming evident that some solution of the headlight problem must be brought out. There are at least two possible solutions, namely:

1. The establishment of one-way streets and interurban or trunk highways.

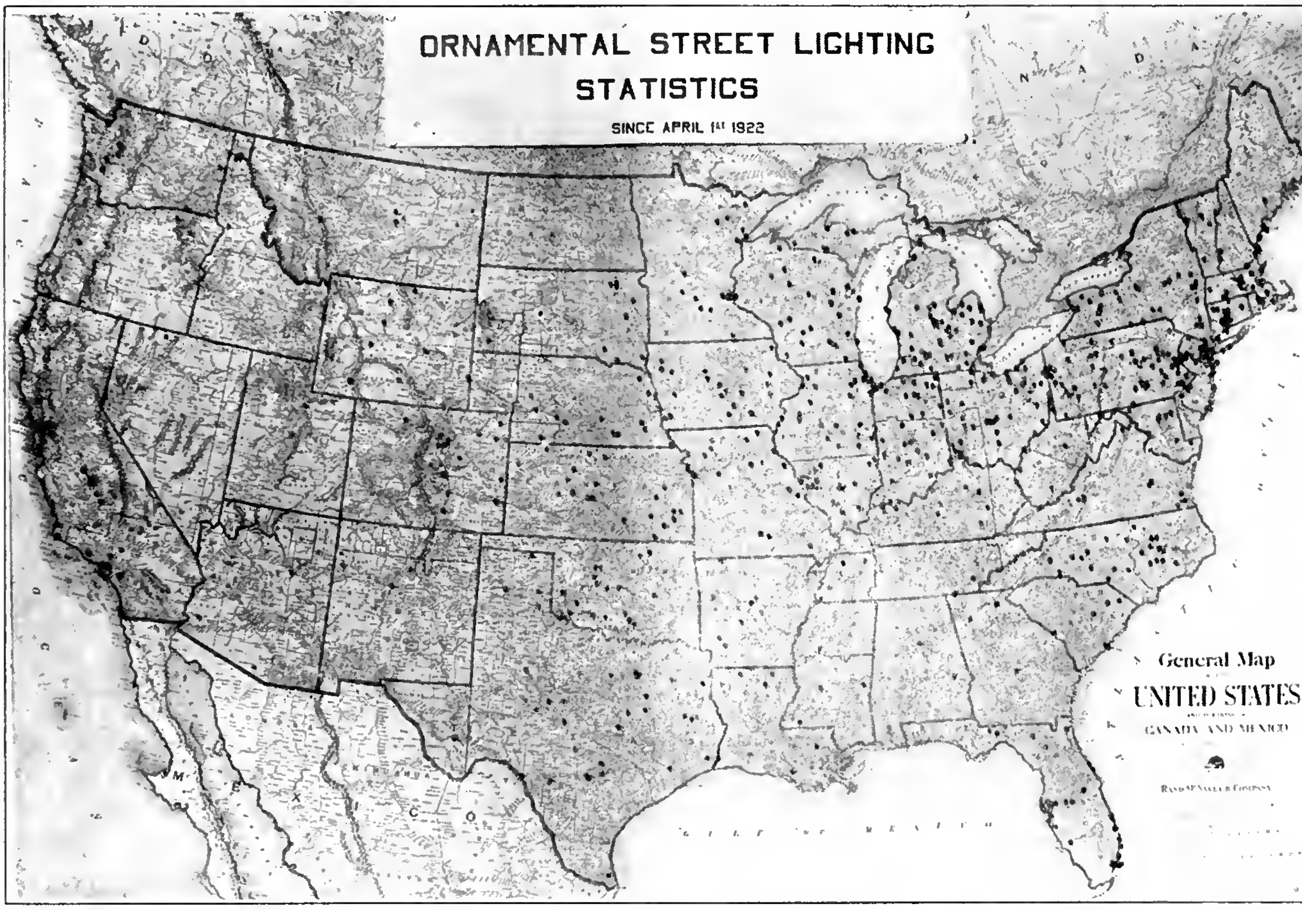
2. The lighting of trunk highways so that with dimmed headlights cars may be operated with safety and in comfort at the customary cross-country speeds.

Efficient highway-lighting fixtures have been developed, and their use is being advocated by the leading manufacturers of street-lighting equipment and has been sponsored by the Illuminating Engineering Society after considerable study and experiment.

The cost of lighting a highway does not exceed 5 per cent of the cost of duplicating the highway in order to provide for one-way traffic, so it is obvious that the second method is more economical than the first.

Many states have put into effect very definite regulations requiring the use of improved headlight lenses, governing their adjustment and various other details. Some have employed illuminating engineers and maintained a substantial force of traffic officers especially trained to insure competency in enforcing the headlight rules, but the success attendant on the most conscientious and persistent supervision has been small and unstable. The solution lies in supplying such illumination on the main highways that drivers will not need their headlights except perhaps as markers to define the width of the car or the limits of the area to be avoided in passing, and on city streets to make the approach of automobiles readily apparent to the persons who may be crossing a street.

So far obsolescense has not been mentioned. However, it presents no serious difficulties except to cities possessing extensive arc-lighting systems. Most Mazda lighting units are adaptable to whatever changes may take place in the design of lamps and glassware, so a further development in the Mazda lamp will in all probability only necessitate corresponding adjustments already provided for in the construction of modern fixtures.

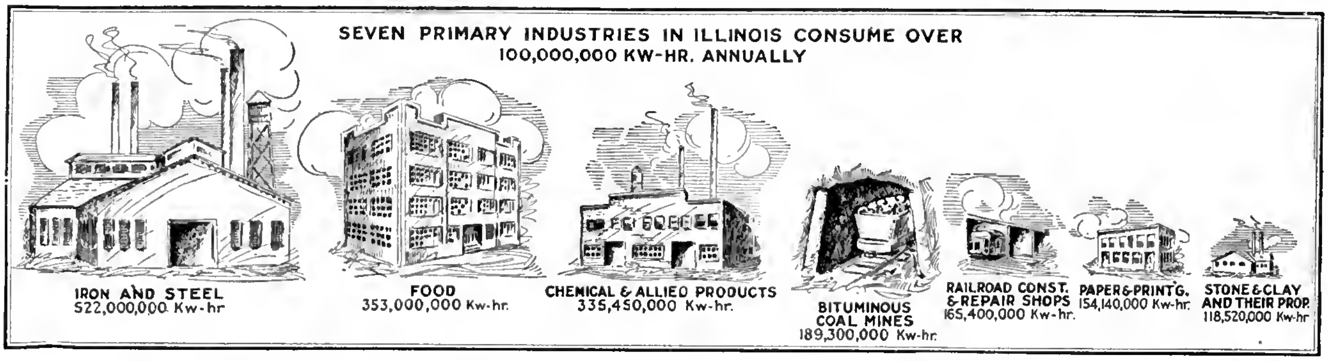



CITIES NOW ACTIVELY NEGOTIATING FOR ADDITIONAL ORNAMENTAL STREET-LIGHTING EQUIPMENT, EITHER FOR EXTENSION OR FOR REMODELING OF OBSOLETE INSTALLATIONS

A scientifically derived, comprehensive and farsighted street-lighting program correlated with a city zoning plan is not easily worked out. It calls for specialized talent in many lines of work, and in most cases city officials can profit by bringing into consultation the engineers found in the organizations of public utility companies, whose success depends largely upon their ability to foresee future requirements and to meet them with a minimum loss in reconstruction. This nation is becoming possessed of many vast cities, and most of them have in the past been more or less like "Topsy"—they just grew. Our large industrial establishments and other privately owned projects exemplify the economy of employing talented engineers and architects. The city is, of course, more important than any of its contributing factors, yet there is in most large industrial companies an array of engineering talent, with well-thought-out policies on research and development, that is rarely found among the entire personnel of the average city's administrative body.

# Industrial Energy Consumption in Illinois

**Almost Half of the 2,345,173,000-Kw.-Hr. Consumed by the Industrial Plants and Mines of Illinois in 1920 Was Generated in Central Stations—Iron and Steel Industry Leads in Energy Consumption**




THE IRON AND STEEL MILLS OF ILLINOIS FAR OUTSTRIP ANY OTHER INDUSTRY OF THAT STATE IN THE ANNUAL CONSUMPTION OF ELECTRICAL ENERGY

DURING the past four years the ELECTRICAL WORLD has conducted a country-wide survey to ascertain the extent to which electrical energy is being used by the various industries. The survey has been undertaken by states, and Illinois is the seventeenth state in the series.

The total consumption of electrical energy by the mills, factories and mines of Illinois during 1920 is estimated at 2,345,173,000 kw.-hr., of which 1,224,961,000 kw.-hr. was generated in private stations of the plants and mines. It is estimated that 3,424 generators were installed in private generating plants, with a total rating of 731,971 kw., of which machines rated at 295,333 kw. are direct-current generators. By far the largest user of electrical energy in Illinois is the iron and steel industry, which in 1920 consumed 522,000,000 kw.-hr., or 22.2 per cent of the total electrical energy consumed for power purposes by the plants and mines of that state. The food products industry is second, with a total consumption of 353,000,000 kw.-hr. in 1920. The extent to which operations in the iron and steel industry were curtailed during the late industrial depression is indicated by the large decrease in the amount of electrical energy consumed in 1921 as compared with 1920, as shown in Table I.

It is estimated that there are 111,692 electric motors installed in the factories and mines of Illinois, with a total rating of 1,353,965 hp. Of these motors 45,267, or 40.6 per cent, are under 5 hp. About 56.7 per cent of the machines are belt-driven, 37.3 per cent are directly connected, and only 6 per cent are chain-driven.

The returns indicate that eighteen voltages are in use

**Table I—"Electrical World" Estimate of the Use of Electrical Energy by the Industrial Plants of Illinois in 1920 and 1921**

| | Electric Generators (In Private Plants) | | | | Electrical Energy Consumed | | | |
|---|---|---|---|---|---|---|---|---|
| | Direct-Current | | Alternating-Current | | | | | |
| Industry | No. | Total Rating, Kw. | No. | Total Rating, Kw. | Purchased from Public Utilities 1920, Kw.-Hr. | Generated in Private Plants 1920, Kw.-Hr. | Total Energy Consumed 1920, Kw.-Hr. | Total Energy Consumed 1921, Kw.-Hr. |
| Agricultural implements | 39 | 7,930 | 12 | 9,790 | 35,000,000 | 41,100,000 | 76,100,000 | 34,200,000 |
| Chemicals and allied products (total) | 260 | 37,297 | 396 | 114,803 | 109,148,000 | 226,302,000 | 335,450,000 | 209,880,000 |
| Rubber and rubber products | 0 | 0 | 3 | 1,620 | 3,500,000 | 7,870,000 | 11,370,000 | 9,330,000 |
| Glass and glass products | 14 | 2,690 | 3 | 1,380 | 6,900,000 | 6,310,000 | 13,210,000 | 8,720,000 |
| Chemicals | 149 | 23,180 | 105 | 90,600 | 67,800,000 | 120,700,000 | 188,500,000 | 139,500,000 |
| Smelting and refining of metals | 11 | 2,240 | 4 | 2,780 | 5,920,000 | 11,630,000 | 17,550,000 | 4,030,000 |
| Artificial-gas manufacture | 4 | 437 | 1 | 873 | 2,108,000 | 3,792,000 | 5,900,000 | 5,800,000 |
| Miscellaneous chemical industries | 82 | 8,750 | 280 | 17,550 | 22,920,000 | 76,000,000 | 98,920,000 | 42,500,000 |
| Electrical equipment and machinery | 6 | 362 | 9 | 18,788 | 14,630,000 | 33,100,000 | 47,730,000 | 58,200,000 |
| Food and kindred products | 290 | 19,180 | 106 | 26,220 | 230,300,000 | 122,700,000 | 353,000,000 | 339,000,000 |
| Iron and steel and their products | 341 | 46,200 | 160 | 114,800 | 170,000,000 | 352,000,000 | 522,000,000 | 208,800,000 |
| Leather and its products | 176 | 15,600 | 0 | 0 | 8,700,000 | 16,340,000 | 25,040,000 | 26,300,000 |
| Lumber and its products | 49 | 4,580 | 27 | 6,020 | 18,800,000 | 10,500,000 | 29,300,000 | 25,200,000 |
| Metals and metal products other than iron or steel | 13 | 2,190 | 20 | 23,410 | 80,150,000 | 55,150,000 | 135,300,000 | 60,850,000 |
| Bituminous-coal mines | 513 | 88,300 | 322 | 63,300 | 57,100,000 | 132,200,000 | 189,300,000 | 207,500,000 |
| Metal mines | 0 | 0 | 0 | 0 | 2,680,000 | 0 | 2,680,000 | 1,152,000 |
| Stone quarries | 2 | 351 | 1 | 269 | 27,330,000 | 1,380,000 | 28,710,000 | 21,530,000 |
| Miscellaneous mines and quarries | 1 | 234 | 0 | 0 | 0 | 533,000 | 533,000 | 347,000 |
| Petroleum and natural gas | 1 | 152 | 0 | 0 | 102,000 | 34,000 | 136,000 | 128,000 |
| Paper and printing | 118 | 13,180 | 31 | 12,420 | 117,600,000 | 36,540,000 | 154,140,000 | 92,400,000 |
| Railroad-shop construction and repairs | 11 | 13,500 | 13 | 4,680 | 71,400,000 | 94,000,000 | 165,400,000 | 165,800,000 |
| Stone and clay and their products | 171 | 20,400 | 52 | 11,180 | 82,600,000 | 35,920,000 | 118,520,000 | 110,200,000 |
| Textiles | 27 | 927 | 42 | 6,783 | 28,520,000 | 9,800,000 | 38,320,000 | 38,250,000 |
| Tobacco | 0 | 0 | 0 | 0 | 102,000 | 0 | 102,000 | 99,000 |
| Vehicles for land transportation | 11 | 1,750 | 4 | 1,175 | 14,100,000 | 3,412,000 | 17,512,000 | 12,260,000 |
| Miscellaneous | 123 | 23,200 | 77 | 23,000 | 52,150,000 | 53,950,000 | 106,000,000 | 76,300,000 |
| Totals for all manufacturing industries, mines and quarries in Illinois | 2,152 | 295,333 | 1,272 | 436,638 | 1,120,412,000 | 1,224,961,000 | 2,345,173,000 | ,688,396,000 |

## Table II—"Electrical World" Estimate of Motors Installed in the Industrial Plants of Illinois

| Industry | Motors Run by Purchased Energy: Number | Motors Run by Purchased Energy: Total Rating, Hp. | Motors Run by Energy Generated in Private Plants: Number | Motors Run by Energy Generated in Private Plants: Total Rating, Hp. | Total Motors in All Plants: Number | Total Motors in All Plants: Total Rating, Hp. | Total Motors in All Plants: Motors Under 5 Hp. | Distribution of Drives: Belt, Number | Distribution of Drives: Chain, Number | Distribution of Drives: Directly Connected, Number |
|---|---|---|---|---|---|---|---|---|---|---|
| Agricultural implements | 2,045 | 21,312 | 1,620 | 24,979 | 3,665 | 46,291 | 918 | 1,666 | 110 | 1,889 |
| Chemicals and allied products (total) | 2,517 | 36,878 | 4,855 | 70,498 | 7,372 | 107,376 | 2,233 | 4,330 | 448 | 2,594 |
| Rubber and rubber products | 100 | 2,000 | 196 | 4,490 | 296 | 6,490 | | | | |
| Glass and glass products | 427 | 3,159 | 204 | 2,891 | 631 | 6,050 | ... | ... | ... | ... |
| Chemicals | 1,480 | 20,314 | 2,740 | 36,090 | 4,220 | 56,404 | ... | ... | ... | ... |
| Smelting and refining of metals | 115 | 3,934 | 332 | 7,725 | 447 | 11,659 | ... | ... | ... | ... |
| Artificial gas manufacture | 27 | 630 | 94 | 1,133 | 121 | 1,763 | ... | ... | ... | ... |
| Miscellaneous chemical industries | 368 | 6,841 | 1,485 | 22,659 | 1,853 | 29,500 | ... | ... | ... | ... |
| Electrical equipment and machinery | 2,036 | 11,582 | 2,890 | 18,286 | 4,926 | 29,868 | 3,420 | 3,531 | 56 | 2,339 |
| Food and kindred products | 13,030 | 116,276 | 5,925 | 61,920 | 18,955 | 178,196 | 8,350 | 11,365 | 2,480 | 5,110 |
| Iron and steel and their products | 9,360 | 133,713 | 10,380 | 215,618 | 19,740 | 349,331 | 4,970 | 8,952 | 596 | 10,192 |
| Leather and its products | 998 | 6,258 | 1,122 | 11,740 | 2,120 | 17,998 | 851 | 1,920 | 108 | 92 |
| Lumber and its products | 2,180 | 21,988 | 876 | 12,280 | 3,056 | 34,268 | 1,123 | 2,236 | 119 | 701 |
| Metals and metal products other than iron and steel | 5,580 | 53,280 | 1,575 | 16,756 | 7,155 | 70,036 | 3,718 | 5,114 | 357 | 1,694 |
| Bituminous-coal mines | 1,070 | 41,365 | 3,165 | 95,916 | 4,235 | 137,281 | 1,472 | 1,125 | 161 | 2,949 |
| Metal mines | 61 | 1,948 | 0 | 0 | 61 | 11,948 | 20 | 16 | 2 | 43 |
| Stone quarries | 293 | 12,880 | 25 | 819 | 318 | 13,699 | 110 | 88 | 12 | 218 |
| Miscellaneous mines and quarries | 0 | 0 | 26 | 400 | 26 | 400 | 9 | 7 | 1 | 18 |
| Petroleum and natural gas | 8 | 74 | 2 | 25 | 10 | 99 | 3 | 2 | 1 | 7 |
| Paper and printing | 11,750 | 45,746 | 953 | 14,223 | 12,703 | 59,969 | 6,465 | 10,200 | 543 | 1,960 |
| Railroad-shop construction and repairs | 2,860 | 48,311 | 4,025 | 63,712 | 6,885 | 112,023 | 715 | 1,657 | 228 | 3,810 |
| Stone and clay and their products | 1,443 | 37,950 | 581 | 16,466 | 2,024 | 54,416 | 648 | 1,158 | 256 | 610 |
| Textiles | 2,720 | 16,564 | 546 | 5,700 | 3,266 | 22,264 | 1,970 | 1,450 | 262 | 1,554 |
| Tobacco | 18 | 76 | 0 | 0 | 18 | 76 | 12 | 16 | 0 | 2 |
| Vehicles for land transportation | 2,450 | 19,028 | 367 | 3,254 | 2,817 | 22,282 | 1,360 | 1,713 | 155 | 949 |
| Miscellaneous | 6,730 | 47,250 | 5,610 | 48,894 | 12,340 | 96,144 | 6,900 | 6,756 | 817 | 4,767 |
| Total for all manufacturing industries, mines and quarries in Illinois | 67,149 | 672,479 | 44,543 | 681,486 | 111,692 | 1,353,965 | 45,267 | 63,302 | 6,712 | 41,498 |

## Table III—Direct-Current Motor Operating Voltages of Industrial Plants of Illinois

| Industry | Total Number of Companies Reporting Direct-Current Motor Voltages | 80 | 110 | 115 | 120 | 125 | 130 | 200 | 210 | 220 | 225 | 230 | 240 | 250 | 275 | 440 | 500 | 550 | 600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Number of Companies Reporting Various Motor-Operating Voltages — Voltages | | | | | | | | | | | | | | | | | |
| Chemicals and allied products | 19 | | 3 | | | | | | | 11 | | 1 | 1 | 1 | | 1 | | 1 | |
| Electrical equipment and machinery | 15 | | 4 | 1 | | | | | | 8 | | 2 | | | | | | | |
| Food and kindred products | 27 | | 9 | 3 | | | | | | 13 | | 1 | | | | 1 | | | |
| Iron and steel and their products | 90 | | 11 | | | | | 1 | | 60 | | 9 | 2 | | | 3 | 3 | | 1 |
| Leather and its products | 6 | | 1 | 1 | | | | | | 4 | | | | | | | | | |
| Lumber and its products | 10 | | 1 | | | 1 | | | | 4 | | 1 | | | | 2 | | 1 | |
| Metals and metal products other than iron or steel | 14 | | 1 | | | | | | 1 | 8 | | | | 3 | | 1 | | | |
| Mining, miscellaneous | 27 | 2 | | | | | | 1 | | 2 | 1 | 1 | | 17 | 3 | | | | |
| Paper and printing | 30 | | 3 | 2 | | | | | 1 | 15 | | 6 | | 1 | | 1 | 1 | | |
| Railroad-shop construction and repairs | 3 | | | | | | | | | 2 | | | | | | | | | 1 |
| Rubber and its products | 3 | | | | | | | | | 2 | | 1 | | | | | | | |
| Stone, clay and glass | 13 | | 1 | | | | | | | 11 | | | | 1 | | | | | |
| Textiles | 18 | | 5 | | | | | | | 10 | | 2 | | | | 1 | | | |
| Vehicles for land transportation | 5 | | 3 | | 1 | | | | | | | | | | | 1 | | | |
| Miscellaneous | 36 | | 8 | 1 | | 1 | 1 | | | 21 | | 3 | | 1 | | | | | |
| Totals for all industries of Illinois | 316 | 2 | 50 | 8 | 1 | 2 | 1 | 2 | 2 | 171 | 1 | 27 | 3 | 24 | 3 | 11 | 4 | 2 | 2 |

## Table IV—Prime Mover and Boiler Equipment of Industrial Plants and Mines of Illinois

(Prime-mover data from U. S. Census Reports; boiler data estimated by ELECTRICAL WORLD)

| Industry | No. of Plants in State | Total Hp. of Prime-Movers in Industrial Plants | Steam Engines No. | Steam Engines Hp. | Steam Turbines No. | Steam Turbines Hp. | Internal-Combustion Engines No. | Internal-Combustion Engines Hp. | Waterwheels No | Waterwheels Hp. | ELECTRICAL WORLD Estimate of Boilers in Industrial Plants No. | ELECTRICAL WORLD Estimate of Boilers in Industrial Plants Hp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Agricultural implements | 68 | 33,296 | 131 | 22,000 | 17 | 10,134 | 3 | 72 | 12 | 1,090 | 114 | 24,270 |
| Chemicals and allied products (total) | 897 | 103,412 | 846 | 76,678 | 116 | 25,000 | 29 | 1,732 | 1 | 2 | 489 | 114,638 |
| Rubber and rubber products | 20 | 460 | 2 | 450 | 0 | 0 | 1 | 10 | 0 | 0 | 2 | 438 |
| Glass and glass products | 97 | 8,217 | 26 | 4,717 | 3 | 2,500 | 8 | 1,000 | 0 | 0 | 28 | 6,500 |
| Chemicals | 531 | 36,797 | 335 | 31,468 | 11 | 5,143 | 9 | 184 | 1 | 2 | 190 | 45,000 |
| Smelting and refining of metals | 24 | 17,472 | 37 | 11,647 | 5 | 5,667 | 3 | 158 | 0 | 0 | 56 | 13.100 |
| Artificial gas manufacture | 70 | 21,282 | 288 | 14,869 | 80 | 6,187 | 5 | 226 | 0 | 0 | 113 | 26,300 |
| Miscellaneous chemical industries | 155 | 19,184 | 158 | 13,527 | 17 | 5,503 | 3 | 154 | 0 | 0 | 100 | 23,300 |
| Electrical equipment and machinery | 161 | 21,078 | 9 | 1,995 | 7 | 19,000 | 1 | 83 | 0 | 0 | 37 | 11,900 |
| Food and kindred products | 4,388 | 178,577 | 2,140 | 156,956 | 126 | 17,625 | 148 | 3,092 | 23 | 904 | 754 | 178,400 |
| Iron and steel and their products | 1,450 | 360,153 | 701 | 236,467 | 97 | 79,273 | 234 | 42,723 | 22 | 1,690 | 1,020 | 238,800 |
| Leather and its products | 354 | 15,427 | 107 | 12,524 | 11 | 2,890 | 1 | 13 | 0 | 0 | 62 | 12,720 |
| Lumber and its products | 961 | 51,675 | 713 | 47,803 | 9 | 2,849 | 49 | 843 | 4 | 180 | 321 | 63,150 |
| Metals and metal products other than iron and steel | 1,142 | 37,933 | 164 | 31,333 | 6 | 4,791 | 23 | 618 | 19 | 1,191 | 122 | 28,000 |
| Bituminous-coal mines | 499 | 205,777 | 1,609 | 186,926 | 36 | 17,725 | 88 | 1,126 | 0 | 0 | 1,138 | 243,000 |
| Metal mines | 6 | 30 | 1 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 35 |
| Stone quarries | 66 | 16,030 | 219 | 13,641 | 5 | 1,953 | 34 | 436 | 0 | 0 | 86 | 18,500 |
| Miscellaneous mines and quarries | 17 | 4,771 | 78 | 4,597 | 1 | 50 | 10 | 124 | 0 | 0 | 26 | 5,510 |
| Petroleum and natural gas | 236 | 35,326 | 170 | 3,588 | 0 | 0 | 1,723 | 31,738 | 0 | 0 | 20 | 4,260 |
| Paper and printing | 3,010 | 37,727 | 174 | 30,382 | 4 | 2,003 | 248 | 1,286 | 12 | 4,056 | 124 | 34,930 |
| Railroad-shop construction and repairs | 201 | 65,365 | 289 | 42,126 | 43 | 22,122 | 20 | 1,117 | 0 | 0 | 231 | 56,600 |
| Stone and clay and their products | 795 | 67,019 | 556 | 55,893 | 15 | 8,783 | 92 | 2,243 | 1 | 100 | 247 | 58,250 |
| Textiles | 1,613 | 11,939 | 48 | 10,085 | 2 | 1,450 | 7 | 154 | 1 | 250 | 49 | 11,330 |
| Tobacco | 1,182 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vehicles for land transportation | 1,136 | 9,424 | 41 | 5,222 | 3 | 3,090 | 95 | 912 | 6 | 200 | 42 | 11,030 |
| Miscellaneous | 1,235 | 71,681 | 386 | 49,692 | 54 | 19,172 | 56 | 894 | 31 | 1,923 | 394 | 81,900 |
| Total for all manufacturing industries, mines and quarries in Illinois | 19,417 | 1,326,640 | 8,382 | 987,938 | 552 | 237,910 | 2,861 | 89,206 | 132 | 11,586 | 5,277 | 1,197,223 |

in Illinois by mines and factories for the operation of direct-current motors and that seventeen voltages are used in the operation of alternating-current motors. It appears that about 54.1 per cent of the direct-current motors are operated at 220 volts, but a large percentage are also operated at 110, 230 and 250 volts. Iron and steel mills particularly report a high percentage of direct-current motors operated at other than 220 volts. More than two-thirds of the alternating-current motors are operated at 220 volts, and about one-fifth are operated at 440 volts. It appears from these figures that there is much yet to be done toward the standardization of voltages in Illinois.

About 82 per cent of the companies reporting on type of motor control use knife or safety switches exclusively or in conjunction with other types of motor control. About 43 per cent of the companies reported installation of automatic starters, and only 31 per cent reported circuit breakers in use in their plants, mines or quarries.

## Table V—Alternating-Current Motor-Operating Voltages of Industrial Plants

| Industry | Total Number of Companies Reporting on Alternating-Current Motor Voltages | Number of Companies Reporting Various Motor-Operating Voltages — Voltages: 110 | 115 | 200 | 210 | 220 | 230 | 240 | 250 | 290 | 400 | 440 | 480 | 550 | 2,200 | 2,300 | 2,500 | 4,000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chemicals and allied products | 19 | 1 | ... | ... | ... | 13 | ... | ... | ... | 1 | 1 | 3 | ... | ... | ..... | ..... | ..... | ..... |
| Electrical equipment and machinery | 21 | 3 | ... | ... | ... | 15 | 1 | 1 | ... | ... | ... | 1 | ... | ... | ..... | ..... | ..... | ..... |
| Food and kindred products | 40 | 5 | ... | ... | ... | 23 | ... | ... | 1 | ... | ... | 10 | ... | ... | 1 | ..... | ..... | ..... |
| Iron and steel and their products | 113 | 5 | ... | ... | ... | 74 | ... | 1 | ... | ... | 1 | 26 | ... | 1 | 2 | 1 | 1 | 1 |
| Leather and its products | 13 | 1 | ... | ... | ... | 8 | ... | ... | ... | ... | ... | 4 | ... | ... | ..... | ..... | ..... | ..... |
| Lumber and its products | 28 | 3 | ... | ... | ... | 20 | ... | ... | ... | ... | ... | 5 | ... | ... | ..... | ..... | ..... | ..... |
| Metals and metal products other than iron and steel | 28 | 2 | ... | ... | ... | 21 | ... | ... | 1 | ... | 1 | 3 | ... | ... | ..... | ..... | ..... | ..... |
| Mining, miscellaneous | 14 | ... | ... | ... | 1 | 7 | 1 | ... | 1 | ... | ... | 2 | ... | ... | ..... | 2 | ..... | ..... |
| Paper and printing | 22 | 3 | ... | ... | ... | 13 | 2 | ... | ... | ... | ... | 3 | 1 | ... | ..... | ..... | ..... | ... |
| Railroad-shop construction and repairs | 6 | ... | 1 | ... | ... | 2 | ... | ... | ... | ... | ... | 3 | ... | ... | ..... | ..... | ..... | ..... |
| Rubber and its products | 2 | ... | ... | ... | ... | 1 | ... | ... | ... | ... | ... | 1 | ... | ... | ..... | ..... | ..... | ..... |
| Stone, clay and glass | 18 | ... | ... | ... | ... | 10 | ... | ... | ... | ... | ... | 5 | ... | 2 | 1 | ..... | ..... | ..... |
| Textiles | 26 | 3 | ... | 1 | ... | 19 | 1 | ... | ... | ... | ... | 1 | 1 | ... | ..... | ..... | ..... | ..... |
| Vehicles for land transportation | 6 | ... | ... | ... | ... | 4 | ... | ... | ... | ... | ... | 2 | ... | ... | ..... | ..... | ..... | ..... |
| Miscellaneous | 33 | 2 | 1 | ... | ... | 25 | ... | ... | ... | ... | ... | 5 | ... | ... | ..... | ..... | ..... | ..... |
| Totals for all industries of Illinois | 389 | 28 | 2 | 1 | 1 | 255 | 5 | 2 | 3 | 1 | 3 | 74 | 2 | 3 | 4 | 3 | 1 | 1 |

## Table VI—Size of Largest and Smallest Motors Installed in the Industrial Plants of Illinois

| Industry | No. of Companies Reporting on Size of Motors | Largest Motor Installed: Under 10 Hp. | From 10 to 25 Hp. | From 26 to 50 Hp. | From 51 to 100 Hp. | From 101 to 200 Hp. | From 201 to 300 Hp. | From 301 to 1,000 Hp. | Over 1,000 Hp. | Smallest Motor Installed: Under 1/8 Hp. | From 1/8 to 1/4 Hp. | From 1/4 to 1/2 Hp. | From 1/2 to 1 Hp. | From 1 to 2 Hp. | From 2 to 3 Hp. | Over 3 Hp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chemicals and allied products | 34 | 6 | 6 | 8 | 5 | 3 | 2 | 2 | 1 | 1 | 11 | 1 | 5 | 6 | 3 | 7 |
| Electrical equipment and machinery | 30 | 9 | 11 | 4 | 4 | 1 | 1 | 0 | 0 | 4 | 9 | 4 | 7 | 2 | 0 | 3 |
| Food and kindred products | 68 | 10 | 22 | 19 | 5 | 8 | 3 | 1 | 0 | 4 | 25 | 8 | 14 | 7 | 3 | 4 |
| Iron and steel and their products | 188 | 18 | 62 | 60 | 34 | 7 | 1 | 3 | 3 | 12 | 49 | 28 | 33 | 11 | 25 | 26 |
| Leather and its products | 17 | 3 | 7 | 5 | 1 | 0 | 1 | 0 | 0 | 1 | 2 | 3 | 4 | 2 | 3 | 1 |
| Lumber and its products | 37 | 6 | 14 | 12 | 3 | 2 | 0 | 0 | 0 | 0 | 8 | 4 | 6 | 8 | 5 | 5 |
| Metals and metal products other than iron or steel | 39 | 4 | 16 | 9 | 4 | 4 | 0 | 1 | 1 | 5 | 13 | 8 | 4 | 2 | 5 | 1 |
| Mining, miscellaneous | 31 | 1 | 3 | 7 | 9 | 7 | 1 | 1 | 1 | 0 | 4 | 1 | 2 | 6 | 6 | 12 |
| Paper and printing | 49 | 18 | 19 | 7 | 4 | 1 | 0 | 0 | 0 | 2 | 29 | 7 | 4 | 4 | 0 | 1 |
| Railroad-shop construction and repairs | 7 | 0 | 2 | 2 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 3 |
| Rubber and its products | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Stone, clay and glass | 30 | 2 | 5 | 8 | 6 | 7 | 1 | 1 | 0 | 0 | 6 | 2 | 2 | 9 | 3 | 8 |
| Textiles | 50 | 20 | 22 | 4 | 2 | 1 | 0 | 0 | 1 | 4 | 11 | 6 | 7 | 3 | 7 | 8 |
| Vehicles for land transportation | 12 | 2 | 4 | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 4 | 3 | 2 | 1 | 1 | 1 |
| Miscellaneous | 80 | 15 | 32 | 12 | 5 | 9 | 5 | 1 | 0 | 8 | 31 | 16 | 6 | 11 | 4 | 4 |
| Totals for all industries of Illinois | 674 | 115 | 225 | 159 | 86 | 52 | 15 | 12 | 7 | 42 | 203 | 92 | 96 | 72 | 67 | 84 |

## Table VII—Types of Fuses in Industrial Plants of Illinois

| Industry | Total Number of Companies Reporting on Fuses | Standard Fuses: Number of Companies Using This Type | Standard Fuses: Fuses Used per Month: Number | Standard Fuses: Fuses Used per Month: Number per Motor | Refillable and Renewable Fuses: Number of Companies Using This Type | Refillable and Renewable Fuses: Fuses Used per Month: Number | Refillable and Renewable Fuses: Fuses Used per Month: Number per Motor | Electrical World Estimate of Fuses Used per Month by All Industrial Plants of U. S.: Standard | Electrical World Estimate: Renewable and Refillable |
|---|---|---|---|---|---|---|---|---|---|
| Chemicals and allied products | 19 | 8 | 238 | 0.656 | 15 | 490 | 0.450 | 1,189 | 2,500 |
| Electrical equipment and machinery | 17 | 8 | 1,458 | 0.506 | 12 | 443 | 0.701 | 2,023 | 621 |
| Food and kindred products | 46 | 12 | 309 | 1.540 | 43 | 1,639 | 0.998 | 3,180 | 16,860 |
| Iron and steel and their products | 108 | 38 | 721 | 0.343 | 94 | 2,617 | 0.470 | 1,860 | 6,730 |
| Leather and its products | 15 | 3 | 85 | 1.810 | 13 | 222 | 0.467 | 344 | 900 |
| Lumber and its products | 19 | 4 | 32 | 0.696 | 17 | 347 | 0.940 | 235 | 2,556 |
| Metals and metal products other than iron and steel | 18 | 11 | 246 | 0.674 | 11 | 410 | 0.244 | 862 | 1,435 |
| Mining, miscellaneous | 13 | 4 | 90 | 1.084 | 12 | 323 | 0.770 | 833 | 3,585 |
| Paper and printing | 25 | 12 | 147 | 0.535 | 21 | 1,001 | 0.453 | 750 | 5,124 |
| Railroad-shop construction and repairs | 9 | 6 | 1,032 | 1.088 | 2 | 347 | 0.647 | 4,790 | 1,605 |
| Stone, clay and glass | 21 | 15 | 241 | 0.600 | 9 | 156 | 0.377 | 595 | 389 |
| Textiles | 21 | 12 | 85 | 0.375 | 11 | 466 | 1.082 | 422 | 2,312 |
| Vehicles for land transportation | 6 | 2 | 10 | 0.715 | 5 | 150 | 0.200 | 38 | 553 |
| Miscellaneous | 47 | 29 | 1,162 | 0.778 | 22 | 954 | 0.542 | 5,730 | 4,700 |
| Totals for all industries of Illinois | 384 | 164 | 5,856 | 11.400 | 287 | 9,565 | 15.940 | 22,851 | 49,870 |

**Table VIII—Frequencies Used in Industrial Plants of Illinois**

| Industry | Total Number of Companies Reporting on Frequency | Number of Companies Reporting Various Frequencies Used. (The first figure gives number of phases: the second figure the number of cycles.) 1–25 | 3–25 | 3–30 | 3–40 | 1–60 | 2–60 | 3–60 |
|---|---|---|---|---|---|---|---|---|
| Chemicals and allied products | 22 | .. | 2 | .. | . | 1 | .. | 19 |
| Electrical equipment and machinery | 19 | .. | . | .. | .. | . | .. | 19 |
| Food and kindred products | 41 | 1 | 1 | .. | .. | 1 | 3 | 35 |
| Iron and steel and their products | 131 | .. | 4 | .. | .. | 5 | 14 | 108 |
| Leather and its products | 11 | .. | 1 | .. | .. | .. | .. | 10 |
| Lumber and its products | 26 | .. | 1 | .. | 1 | .. | 3 | 21 |
| Metals and metal products other than iron or steel | 33 | .. | 1 | 1 | .. | 1 | 2 | 28 |
| Mining, miscellaneous | 17 | .. | 1 | .. | .. | .. | .. | 16 |
| Paper and printing | 18 | .. | 2 | . | .. | 3 | .. | 13 |
| Railroad-shop construction and repairs | 8 | .. | | 1 | .. | .. | .. | 7 |
| Rubber and its products | 2 | .. | | . | .. | .. | .. | 2 |
| Stone, clay and glass | 25 | .. | | . | .. | .. | .. | 25 |
| Textiles | 27 | .. | 1 | .. | .. | 3 | .. | 23 |
| Vehicles for land transportation | 8 | .. | | . | . | .. | 1 | 7 |
| Miscellaneous | 37 | .. | 1 | . | .. | .. | 1 | 35 |
| Totals for all industries in Illinois | 425 | 1 | 15 | 2 | 1 | 14 | 24 | 368 |

The largest motor installed was reported by an iron and steel plant, but only seven companies in the state reported motors of more than 1,000 hp. Slightly more than 50 per cent of the companies in the state reported the largest motors under 25 hp. More than 36 per cent of the companies reported that the smallest motor installed ranged between $\frac{1}{8}$ hp. and $\frac{1}{4}$ hp.

### ODD FREQUENCIES USED TO CONSIDERABLE EXTENT

More than 86 per cent of the plants and mines use three-phase, 60-cycle service in the operation of their motors and almost 6 per cent reported the use of two-phase, 60-cycle service. Of the other odd frequencies used three-phase, 25-cycle was used by fifteen companies. The use of odd frequencies to such a large extent is probably due to the continuous operation of private electric generating plants which were installed several years ago. Table VIII shows the use of the various frequencies in the industrial plants and mines of Illinois.

It is estimated that there are a total of 5,277 boilers installed in the industrial plants, mines and quarries of Illinois. The total estimated rating of these boilers is placed at 1,197,223 hp., or an average rating of 230 hp.

**Table IX—Types of Motor Control Used in Industrial Plants of Illinois**

| Industry | No. of Companies Reporting on Motor Control | Number of Companies Reporting Various Types of Motor Control: Snap Switches | Knife or Safety Switches | Auto-Starters | Magnetic Switches | Remote Control | Circuit-Breakers |
|---|---|---|---|---|---|---|---|
| Chemicals and allied products | 32 | 7 | 27 | 14 | 9 | 6 | 9 |
| Electrical equipment and machinery | 21 | 9 | 18 | 9 | 5 | 1 | 3 |
| Food and kindred products | 55 | 13 | 44 | 25 | 13 | 10 | 16 |
| Iron and steel and their products | 157 | 36 | 133 | 75 | 31 | 26 | 50 |
| Leather and its products | 14 | 1 | 11 | 4 | 5 | 2 | 4 |
| Lumber and its products | 28 | 3 | 23 | 10 | 4 | 2 | 10 |
| Metals and metal products other than iron or steel | 31 | 11 | 27 | 16 | 7 | 9 | 8 |
| Mining, miscellaneous | 27 | 6 | 21 | 16 | 5 | 5 | 16 |
| Paper and printing | 38 | 16 | 32 | 15 | 8 | 11 | 7 |
| Railroad-shop construction and repairs | 7 | .3 | 3 | 5 | 1 | 1 | 1 |
| Stone, clay and glass | 29 | 5 | 20 | 12 | 7 | 6 | 11 |
| Textiles | 35 | 13 | 26 | 9 | 4 | 12 | 8 |
| Vehicles for land transportation | 11 | 1 | 9 | 3 | 0 | 1 | 3 |
| Miscellaneous | 69 | 19 | 55 | 28 | 9 | 12 | 25 |
| Totals for all industries of Illinois | 554 | 143 | 449 | 241 | 108 | 104 | 171 |

# Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

## Westinghouse Disclaims Special Advantages in Superpower Development

*To the Editors of the* ELECTRICAL WORLD:

Some time ago the Westinghouse Electric & Manufacturing Company became interested in the work of Frank G. Baum, a consulting hydro-electric engineer of San Francisco, in preparing a plan for the ultimate electrification of the United States by means of superpower or interconnected systems, involving the development of water powers and the construction of steam plants in a manner most economically to produce and distribute this power. Mr. Baum's plan involves the use of main trunk or reservoir lines carrying a pressure of 220,000 volts. This voltage, although only recently accomplished in practical service, is in successful use in California and is planned for use in other sections. A superpower system such as Mr. Baum describes in his "Atlas" will permit transmission of power long distances, and by the interconnecting of these superpower systems it is entirely feasible to cover the whole United States, although certain sections in areas west of the Mississippi River may not immediately be developed.

The Westinghouse company associated itself with Mr. Baum in this work, and its engineers believe his principles to be sound. The Westinghouse company, however, is not in the public utility business and has no financial interest in the public utility; and, while it has and will support the electrical development of the United States along the lines of Mr. Baum's report or some modification of it, the actual accomplishment of this tremendous work, which will be of great benefit to the people of the country, lies in the hands of the public utility men themselves. There is nothing in our connection with superpower development which gives the Westinghouse company any manufacturing advantage over any other electrical manufacturer.

GUY E. TRIPP,
Chairman of Board.

Westinghouse Electric & Manufacturing Company, New York, N. Y.

## Bureau of Mines Findings on Powdered Coal Disputed

*To the Editors of the* ELECTRICAL WORLD:

On page 19 of Bulletin 217, entitled "Preparation, Transportation and Combustion of Powdered Coal," by John Blizard, published by the Bureau of Mines, the following conclusions have been reached by the author:

"In the direct system the coal may be blown directly to the furnaces from the grinding room in a current of low-pressure air. With the indirect system separate bins and feeders are required for each furnace, but the extra expense involved is offset by three factors, namely, (1) less danger from explosion, (2) greater control over the rate of feeding the coal to the furnace, and (3) greater reliability, since with the direct system the whole plant will be shut down should the central distributing fan break down."

In the above quoted paragraph Mr. Blizard has ar-

rived at three conclusions which are erroneous and misleading and are not borne out by real facts and careful investigation.

First—Will Mr. Blizard set forth statements and facts to prove that the direct system as described by him, if correctly designed and intelligently operated, is subject to any possible danger of explosion?

Second—Will Mr. Blizard show us in what possible manner there is less control of the coal feeding into the furnace by the direct system than with the indirect system?

As for the third statement, any schoolboy knows that his father carries a spare tire on his automobile to use in the event of a puncture or blow-out, and will Mr. Blizard point out any reason why a spare fan cannot be installed and connected to the distributing system so as to be available at all times? With such a fan the direct system affords a greater sense of reliability as regards all of the furnaces than is possible with any other system. C. F. HERINGTON.

Heyl & Patterson, Inc.,
Pittsburgh, Pa.

### Declares Megohm Readings Most Significant When Tested Circuits Are Isolated

*To the Editors of the* ELECTRICAL WORLD:

Since March, 1921, we have made megohm-meter tests of more than thirty-five thousand objects, and, properly analyzed, this really means we have made more than a hundred thousand actual tests because several separate tests are usually made on each object. We have found that tests are wholly without value unless the part to be tested is isolated electrically from other parts of the same machine. For instance: A 500-kw. direct-current generator was a source of much annoyance, involving a lawsuit and a great deal of unpleasant argument between testing engineers of certain great electrical manufacturing concerns and an independent engineering organization. The Royal Indemnity Company was called in as a sort of arbitrator and was able to convince the engineers that their various elaborate testings of the machine really did not give them the results which they expected, merely because they had tested the machine as a fully assembled unit instead of isolating its several parts. Our tests were made by first disconnecting the fields from each other and from the circuit, disconnecting the field rheostat, placing several thicknesses of writing paper between field connections and the frame, disconnecting the armature and series fields, disconnecting the brush lead, and, in short, isolating every part so far as practicable, except that commutator lug connections were not disturbed nor were the fields removed from the frame.

Under the above condition the machine showed infinity everywhere except from the casting on one brush yoke to a brass washer, which latter normally made connection from the lead to the brushes. A test at this point showed only about 21,000 ohms resistance. When the insulating bushing was removed from this yoke it was found to be in apparently perfect external condition but was thoroughly carbonized internally, the carbonizing being much in the form of a laminated steel plate where both surfaces seem to be perfect.

With alternating-current motors it is more frequently than not very difficult to isolate the stator from the leads to the compensator or switch, because the leads are so frequently soldered and disconnection cannot be made without stopping a machine for too great a time.

In another case a 25-kva., single-phase, 33,000-volt transformer showed practically no resistance to ground from any one of the high-tension leads to the transformer case. It was decided that the coil should be lifted out of the case, and after this was done the test showed infinity. Two defects were found, but since only one test was made after lifting the coils out we did not know which of the defects produced the ground. One defect consisted of a piece of U-shaped bare No. 4 copper wire which had in some manner become wedged between one of the coil connections and the case; the other defect consisted of a bushing which must have been defective at the time it was installed in the factory.

We have discontinued the placing of much dependence upon megohm-meter tests of transformers except in those cases where we are able to isolate the coils and other parts from each other. This, of course, is seldom practicable, but obviously it is a great waste of our money to replace a transformer which shows a low reading and have this transformer sent to a repair shop, when perhaps some minor condition produces a ground.

In one case the connection from one coil of a three-phase transformer touched the casing, the connection having been left too long at time of installation and been bent in such a manner that it touched the casing and eventually grounded. Actually, the only repair necessary was to cut out a short piece of the lead and solder in a new piece properly insulated, and if we had isolated the several parts before making the megger tests, we should have saved in repair cost.

Machines with a considerable amount of electrostatic capacity make it absolutely essential that meggers should be properly connected to the work; that is, that the user of the megger must be certain to observe the plus and minus signs on the megger binding posts and not connect the minus lead to the part where the plus lead must be connected. For with improper connecting it is known that high-resistance grounds (and these are usually concealed) may become sealed over through the action of hydrogen bubbles and an untrue conclusion be arrived at.

The use of our megohm meters has not been without attendant embarrassment to us, for very frequently the readings require us, as a matter of self-protection, to suspend insurance on certain objects which have been fully approved by other testing engineers who may be on the ground at the time, and in order to relieve ourselves of the embarrassment and justify our position, we are sometimes put to considerable expense in proving our case. Nevertheless, we know from ample experience that the use of the megger is essential.

We have no set rules for determining how low a reading may be before we will condemn the object, each individual case requiring the use of judgment on the part of the testing engineer. Nominally the following is about what we practice:

Where the machine is in apparently perfect dry and warm condition, we require that it show a reading of not less than 250,000 ohms. Where the machine is in "wet" condition, as in the humidity rooms of textile plants or in mines, refrigeration plants, wet basements, ice-cream plants, chemical works, tanneries and other "wet" industries, we will pass machines which show only 150,000 ohms, and not infrequently we pass those which show 100,000 ohms, but never any under any circumstances those which show less than 100,000 ohms. This includes only machines whose voltages are in excess of 200. WARREN HILLEARY,

Superintendent.
Royal Indemnity Company,
New York, N. Y.

# Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

## Pioneer Powdered-Coal Installation Data

**More than 190,000 Tons of Coal Burned by Western Company with Boiler Efficiency of 80 per Cent—Description of Complete Plant—Operating Costs Itemized**

BURNING coal in pulverized form has been found to be a very satisfactory solution of the difficulties encountered by the Puget Sound Power & Light Company in using the poor grades of coal which are found in its territory. The advancing price of oil made it necessary to consider changing the Western Avenue steam-heating plant from oil to coal burning, so the company decided to equip one of the boilers of this plant for burning pulverized coal, making tests on various coals before installing a complete plant.

A 300-hp. B. & W. boiler was used for the tests. The coal was prepared by the Pacific Coast Coal Company, which already had a pulverized-fuel installation. Few changes were made to the furnace other than removing the oil-burning equipment. Practically all of the coals mined on the Pacific Coast were burned, and the results were so good on this boiler that it was decided to equip the entire plant of ten boilers, with a total rating of 4,100 hp., for pulverized burning. An installation of a complete drying and pulverizing plant was also made.

### Average Boiler Efficiency 80 per Cent

Already more than 190,000 tons of coal has been burned in the completed plant, and an average boiler efficiency of 80 per cent has been maintained. High boiler ratings have also been made without trouble. The coal used in this plant is a refuse that had accumulated at the company's mine over a period of twenty years. The coal had been discarded from the washery and is very fine in size, practically all of it passing a twenty-mesh screen. Owing to the fact that a great deal of mine dirt was also mixed with the coal, it was found advantageous to install a washing plant at the coal dump, thereby reducing the ash in the coal from 25 per cent to about 12 per cent and eliminating the freight cost on the 13 per cent difference as well as the expense which would be entailed in drying, pulverizing and handling this amount of material from the boiler furnaces.

It might be interesting to note that in another plant where coal is burned in an excellent stoker installation an average of only 65 per cent boiler efficiency is attained and the overloads that may be carried are limited. The coal used in the stoker installations is uniform size pea coal, carrying less ash and moisture.

### Cost of Preparing Fuel 71 Cents a Ton

The yearly load factor for the pulverizing equipment is about 39 per cent, this low figure being due to the fact that the plant is purely a heating one with periods of extremely low output in the summer months. The actual operating cost of preparing plant, not including overhead cost of taxes, interest, depreciation, etc., is about 71 cents per ton. This cost is itemized in the accompanying table. The over-all efficiencies on the basis of pulverized coal averaging approximately 9,300 B.t.u. per pound range from 77 to 81 per cent. This figure represents operating conditions with firing of from two to five cold boilers a day.

The costs of labor and power for pulverizing, as shown in the table, are undoubtedly higher than would be the case in a plant originally designed to handle pulverized coal, on account of the raw coal being conveyed a considerable distance to the plant and because the coal, being very fine and wet, requires considerable power in its preparation. The period for which the figures were obtained was, moreover, one when labor was at its peak. As the plant has a capacity of 300 tons per day and an average of only about 150 tons is used, the labor cost is further affected.

OPERATING COST OF PREPARING PULVERIZED FUEL

| | Per Ton | |
|---|---|---|
| Maintenance: | | |
| Driers | $0.014 | |
| Mills | 0.038 | |
| Miscellaneous equipment | 0.023 | |
| Total maintenance | | $0.075 |
| Operation: | | |
| Labor | $0.312 | |
| Power (estimated at 1 cent per kilowatt-hour) | 0.260 | |
| Fuel | 0.060 | |
| Total operation | | 0.632 |
| Total operation and maintenance | | $0.707 |

### Boiler Combustion Space of 2.3 Cu.Ft.

The equipment was designed and installed by Stone & Webster. After a good deal of experimenting it was finally decided that vertical firing was not practicable on account of there being so little depth available for furnaces under the boilers. Consequently all of the boilers were equipped with horizontal burners. As the furnaces were finally constructed a combustion space of 2.3 cu.ft. per rated horsepower was obtained under the four 300-hp. and the three 400-hp. boilers. Under a 500-hp. and a 600-hp. boiler 2.5 cu.ft. per horsepower was obtained, while under a 600-hp. boiler it was possible to install a furnace which gave a capacity of only 1.89 cu.ft. per rated horsepower.

With the installation of two horizontal burners on the smaller-size boilers it is possible to maintain higher ratings and efficiencies than when these boilers were oil-fired.

In the drying and pulverizing plant two indirect pulverized coal-fired driers are used and, as originally installed, had exhaust fans and cyclones, the purpose of the latter being to remove the coaldust from the gases. However, it was found that all of the dust was not removed so a washer was installed in conjunction with the cyclones. This consists of a simple spray washer of concrete construction, the baffles being of spruce wood. It has proved satisfactory and entirely eliminates the

dust nuisance which is generally encountered when driers are installed.

In the pulverizing part of the plant are three Fuller screen mills and one Raymond air separator mill. The screen mills deliver the pulverized coal into a screw conveyor, and in so operating it was found that the mill room became quite dusty. A fan was installed and connected to the boiler furnaces. It was found that a slight suction on the screen mill could be maintained which eliminated all of the dust from the plant and also materially increased the capacity of the mills. This proved so satisfactory that another fan was installed and connected with the return air line of the separator-mill system, which improved the operating condition of this mill.

The drying and pulverizing plant is situated one block below the main business and mercantile sections of the city, but no complaint regarding ash from the stacks or dust from the pulverizing plant has been made. One of the reasons for this is the very high-flame temperature maintained on the pulverized coal. The burners are equipped with steam jets which shorten and intensify the flame. Approximately 75 per cent of the ash from the coal is removed from the furnaces, rear passes and breeching. The ash from the rear connections and breechings is, of course, very fine, and this is handled by sluicing, whereas the ash and slag from the furnaces is raked out and handled in a small dump car. This car is pushed along on a track in front of the furnaces and delivers into a skip hoist electrically operated that empties into a concrete bunker from which the ash is drawn off and transported either by truck or railroad car.

W. J. SANTMYER,
Superintendent Steam Heating.
Puget Sound Power & Light Company,
Seattle, Wash.

# Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

## Routine Care and Maintenance of Auxiliary Apparatus

THE rules given below for the routine care and maintenance of stokers, stoker motors, fans, feed-water heaters, evaporators and soot blowers have been abstracted from the operating code of the Philadelphia Electric Company. These rules, which are not complicated, should always be kept in mind by central-station operators.

STOKERS

1. Clean the external mechanism daily.
2. Gear boxes should be inspected weekly and oil renewed when necessary.
3. Brush the chains with a wire brush daily (before oiling).
4. Oil the chains daily.
5. Inspect and oil the line shaft on each shift.
6. Examine the clutches and bushings weekly.

STOKER MOTORS

1. Change the oil and clean the bearings every two weeks.
2. Motors should be thoroughly cleaned periodically as directed by the chief electrician.

FANS

1. Blow the soot from the induced-draft fans when necessary.
2. Clean the runners of the induced-draft fans every two weeks or oftener if necessary.
3. When a boiler is off the line, inspect the fan runners and stay rods for wear and corrosion and clean them.
4. Clean the interior of the fan housing and flues every year, or oftener if necessary.

FEED WATER HEATERS

1. Clean the control valves on the heaters every eight weeks, or oftener if the valves stick.
2. Inspect the heaters every six months and clean when necessary.

EVAPORATORS

1. Remove the coils from first-effect and second-effect shells every six months and inspect for scale formation.
2. If the scale has not been completely removed by the daily cracking-down process, remove the coils from the headers and immerse them for twenty-four hours in a 10 per cent solution of commercial hydrochloric acid.
3. Inspect the evaporator auxiliary heater.
4. Examine the blow-down valves weekly for leakage.
5. Test the safety valves monthly.

DUST BLOWERS

1. Inspect the stops, hand wheels and chains and see that they are not broken or fouled.
2. Repack stuffing boxes, if necessary.

## Operating Constant-Voltage Transformers

WHERE the secondary switches of transformers are disconnecting switches, it might be thought that these switches would be incapable of breaking the load current and therefore that the primary switch should be opened first. This is not true in most cases, as a transformer on being shut down is nearly always running in parallel with another and, on account of the alternative path through the other transformer, the secondary circuit can be broken by the disconnecting switch with practically no arc. This leaves the primary oil switch to perform the more difficult duty of breaking the magnetizing current, which would cause a serious arc if broken in air by the disconnecting switch.

It is important, in shutting down transformers, to open the primary and secondary switches before shutting off the cooling medium in order to prevent any possibility of rise of temperature after shutting down the cooling apparatus.

## Requirements Necessary for Pit-Shaft Cables

OWING to lack of experience or real interest in the subject by some electrical mining engineers, a great deal of trouble is caused by the wrong choice of their pit-shaft cables. This class of work is certainly a severe test on the cable installed, yet by care in the selection of the type to be used faults, with the expensive loss of service they entail, can be eliminated. Owing to the great variation in pit shafts, depth, water and the method by which the shaft casing has been carried out, every engineer should make an individual study of his own pit.

The problem of primary importance to be solved by the electrical mining engineer about to install power and light below surface is the types of cables to be used. These readily fall under the following headings: (1) Vulcanized bitumen cables, (2) paper lead-covered, (3) paper leadless, and (4) rubber.

VULCANIZED BITUMEN DOUBLE WIRE ARMORED CABLES

Vulcanized bitumen double-wire armored cables are, speaking broadly, the best for pit-shaft work, provided suitable care is taken in their manufacture. When using bitumen cables, it should be insisted they be all bitumen—that is, each core separately insulated with bitumen, laid round a center core of bitumen and the whole incased in bitumen. The interstices in the core are filled up with a bitumen compound, thus preventing water spreading down the cable at a damaged point. This filling compound is of such a nature that

it will not melt in the event of the overloading of the copper. It naturally follows that in the event of mechanical damage to this class of cable only the por.ion impaired will need attention. Some difficulty was at first experienced due to the decentralization of the bitumen at high temperatures and its brittleness at low. This manufacturing trouble has now been eliminated, thus it becomes possible to utilize this class of cable for working conditions where the temperature ranges from, roughly, 20 deg. to 130 deg. F.

Further, all materials of a hygroscopic nature have by careful research work on the actual properties of the bitumen been proved to be unnecessary. The importance of protecting the armoring of the cable is one which must not be overlooked. The inner and outer jute layers, which are in the former laid up over the over-all sheath of the bitumen and in the latter over the double steel-wire armoring, should in conjunction with the armor be efficiently compounded with a heavy waterproofing mixture. As most pit shafts are generally very wet and the water therein far from pure, care must be exercised to guard the armor from corrosion. The method of waterproofing just described will secure the cables against action due to acids in the seepage, but electrolytic trouble caused by leakage currents can be prevented only by an adequate system of mechanical and electrical bondings to a proper earth.

Another kind of armoring which may be utilized is water-resisting impregnated manila rope, which is not shrinkable and has the great advantage of considerably reducing the weight of the cable, besides allowing single-core cables to be used for alternating work—something not feasible with steel armoring. Bitumen cables, which follow the same law as lead-covered cables, must not be installed after long exposure to low temperatures. These cables should be supported at very frequent intervals, the distance naturally depending on the weight.

### Paper-Insulated, Lead-Covered Armored Cables

One of the advantages possessed by paper-insulated, lead-covered cable with wire armor is the manner in which it is able to stand external heat and the easy internal dissipation of the heat, but it has the disadvantage of being composed of hygroscopic materials. This cable, therefore, when damaged calls for much greater and more expensive repairs than a vulcanized bitumen-insulated cable. Water being usually present in pit shafts, it follows that upon puncture of the lead sheath and the consequent entry of moisture a considerable amount of water will become absorbed and be drawn down through the interstices of the core with the result of further faults.

The insulation of the dielectric of these cables being of oil, trouble often occurs due to the compound draining away to the lower level. Cases have been known where the lead sheathing has burst open owing to the pressure exerted by the flowing of the compound. This can be remedied by the use of a hard compound and the insertion of a clause in the cable contract calling upon the manufacturers to suspend a length of cable vertically for forty-eight hours at a temperature equal to that of the pit shaft, etc., with the end open. The amount of "bleeding" can then be noted. Owing to the acids in the water of many pit shafts, the lead and armor are open to attack unless exceedingly great care is taken during manufacture. Vulcanized bitumen is proof against acid pit-shaft waters, and it has been said that it does better in acid than in pure water.

Another class of paper-insulated, lead-covered armored cables used which may interest mining engineers is made of impregnated paper with a vulcanized bitumen sheath over it.

### Paper-Insulated, Leadless Armored Cables

Except for the absence of lead covering, paper leadless armored cables fall in the class just mentioned and are simply those insulated with paper, vulcanized bitumen or rubber sheathed and armored. They have approximately the same advantages as regards heat dissipation as a lead-covered cable has.

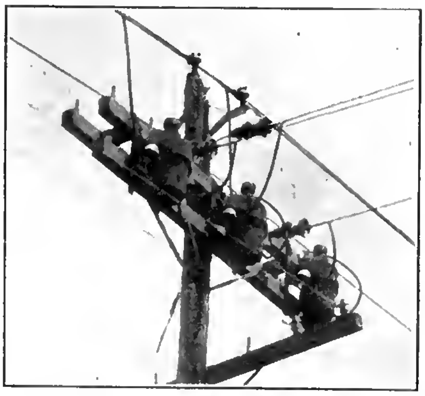
### Rubber Cables

There is no doubt that rubber cables under general conditions are the best from both electrical and physical standpoints. Rubber has the disadvantage when applied to large cables of being a virtually impossible commercial proposition on account of its high cost. In short lengths, however, such as are needed for connections from joint boxes and trailing cables, it is generally used after treatment with fire-resisting tapes and will give excellent results. For these purposes only the very best rubber should be utilized in under-surface operation, as one of the objections has been the difficulty found in testing the rubber. Numerous tests have been devised, but it has been found possible to make a composition which will pass any of these tests individually and a combination of many of them and yet be of a low-grade material.

W. E. BOYLE,
New York, N. Y. Engineer.

## Service Tap-Off Made with Minimum Equipment

SERVICE from a three-phase line operated at 6,600 to 13,200 volts and traversing outer suburban territory presents to the central-station engineer the problem of minimizing



INDUSTRIAL-PLANT HIGH-TENSION SERVICE READILY ACCESSIBLE

material without sacrificing convenience of operation. The United Illuminating Company, Bridgeport, Conn., utilizes the pole construction illustrated for this work, only three close-spaced cross-arms being required in addition to the metal bracket carrying the feeder phases. The feeder is run at the top of the pole, one phase being carried on a pin-type insulator and the two other phases on similar insulators supported on a metal bracket. Parallel to the feeder are three well-braced cross-arms, two of which are cross-connected near the ends by short filler pieces. Pole-type high-voltage oil cut-outs are mounted on two of the arms as shown, and short taps are run to the cases from the feeder phases. The feed to the factory is dead-ended in each phase on strain insulators attached to the upper arm above the cut-outs, and short taps connect these leads with the cut-outs. The whole construction is accessible, with direct wiring runs, and yet requires little material.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

RESULTS OF NINE TESTS WHICH ESTABLISH THE DOLLARS AND CENTS VALUE OF GOOD LIGHTING

| Tests at | Type of Work | Average Foot-Candles with Old System | Average Foot-Candles with New System | Increase in Production, per Cent | Cost of Addition in Percentage of Payroll |
|---|---|---|---|---|---|
| Pyott Foundry Company | Pulley finishing | 0.2 | 4.8 | 35 | 5 |
| Foote Brothers | Soft-metal bearing | 4.6 | 12.7 | 15 | 1.2 |
| Lee Loader & Body Company | Heavy steel machine | 3 | 11.5 | 10 | 1.2 |
| Stromberg Carburetor Company | Carburetor assembly | 2.1 | 12.3 | 12 | 0.9 |
| Dolphin Jute Mills | Jute spinning | 1.5 | 9.0 | 17 | No data |
| Dover Manufacturing Company | Manufacturing electric and gas sad irons | 0.7 | 13.5 | 12.2 | 2.5 |
| General Electric Company | Semi-automatic buffing brass shell sockets | 3.8 | 11.4 | 8.5 | 1.8 |
| Detroit Piston Ring Company | Manufacturing piston rings | 1.2 | 18.0 | 25.8 | 2 |
| U. S. Post Office Department | Letter separating | 3.6 | 8.0 | 4.4 | 0.6 |
| Average | | 2.3 | 11.2 | 15.5 | 1.9 |

## Better Lighting Increases Production 35 per Cent

ALTHOUGH former tests indicated that production could be increased from 10 per cent to 35 per cent merely by improved illumination, a certain amount of hesitation seemed to exist, both within and outside of the lighting profession, about accepting the extremely great "productive value" of lighting so strongly indicated by the tests. Therefore a number of other investigations of similar nature were begun. These were carried on in different industries covering a variety of industrial operations. The results of nine such tests are now available and are given in the accompanying table. In every case when the intensity was raised and a more even distribution of light provided production increased.

Among the tests reported, special interest attaches to the results of the investigation recently made in the United States Post Office Department. In this investigation, conducted by the Office of Industrial Hygiene of the United States Public Health Service, it was definitely ascertained that when 8 foot-candles of illumination was provided instead of 3.6 foot-candles there was an average increase in speed of at least 4.4 per cent in the work of the letter separators. Assuming that the same relative increase of speed would prevail in all the divisions of the post office—a reasonable assumption—the net saving for the one post office in which the principal survey was made would be about $109,000 per year, or almost three times the increased cost.

Average figures can serve to give only a very general indication of the results that may be obtained by installing higher levels of lighting in industrial plants. Averaging the results of these nine tests, however, we find that raising the average initial illumination from about 2.3 to 11.2 foot-candles resulted in an increase in production of more than 15 per cent, at an additional cost of only 1.9 per cent of the payroll.

Taken together, this group of tests in widely separated industries firmly establishes the fact that, in addition to its obvious value in preventing accidents, lessening eye strain, raising shop morale and bettering conditions generally, good lighting has a definite and tangible production value which can be expressed in terms of dollars and cents. The plant in which the workmen are handicapped by poor lighting is carrying an extra burden in meeting the competition of other plants having abundant, properly distributed and well-diffused light.

EARL A. ANDERSON,
Illuminating Engineer.
National Lamp Works,
Nela Park, Cleveland, Ohio.

## Preventing Accidents from Falling Material

A PROLIFIC cause of accidents in overhead-line work is the falling of tools or other small objects that are being raised by means of hand lines. To prevent such accidents the Philadelphia Electric Company uses a wooden-bottom canvas bucket for the hoisting of all small tools and materials. Experiments are also being conducted with an inverted conical tent around the pole to catch falling articles and prevent injury to workmen or passersby.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

## Typical Trouble Report Form Used by One Southern Company

1-21-1m. B. & A

TROUBLE REPORT

__________ STATION. __________ 192__

TIME TROUBLE OCCURRED__________ CURRENT OFF______ CURRENT ON______

APPARATUS IN TROUBLE__________
NAME OF MACHINE, SWITCH OR TRANSFORMER

CONTROLLING __________

NAME MANUFACTURER__________ ) KW. KVA ______ VOLTS______ AMPS

SERIAL No.______ S. O. No.______ SPEC. No.______ ______ PHASE

PART DAMAGED__________

POSITION OF PART DAMAGED WITH RESPECT TO MACHINE __________

__________
USING LINE AND LOAD SIDE AND S. W., AND H. T. AND L. T. ON TRANSFORMERS

DESCRIPTION OF DAMAGE__________

LOCATION OF DAMAGE WITH RESPECT TO APPARATUS DAMAGED__________

__________

WAS IT NECESSARY TO REMOVE DAMAGED PART BEFORE MACHINE COULD BE OPERATED?______

HAVE YOU MATERIAL IN STOCK NECESSARY FOR REPAIR? __________

IF SO, WHEN WAS (OR WILL BE) REPAIR MADE?__________
GIVE TIME

IS REPAIR TEMPORARY OR PERMANENT?__________

REMARKS:__________
WAS LIGHTNING, STORM, OR LINE TROUBLE, ON AT TIME OF TROUBLE?

__________
DESCRIBE TROUBLE--OR UNUSUAL CONDITIONS AT TIME OF TROUBLE

__________

SIGNED__________

Use Reverse Side For Sketch Showing Location of Damage; Also For Reporting Damage To Building.

## Public Utility Bonds as Investments for Mutual Savings Banks*

### Factors Essential in a Utility Company's Set-Up to Make Its Securities Desirable as Well as Legal Investments for Savings Institutions

By George Stevenson
Treasurer Society for Savings, Hartford, Conn.,
Chairman of Public Utility Committee, Mutual Savings Bank Association

THE public utility business as we know it today is still young. It has not had time yet to standardize itself. It is a splendid business. It is as fundamental to human needs as transportation. It is managed, very generally, by men of high integrity, commanding ability and public spirit. The advances they are making in methods employed and results attained are measured almost by days. They deserve support. They are good custodians of capital. Can the savings banks at the present stage supply to them a part of what they need? If not, can the savings banks point out to them the prerequisites to doing so in the future? I speak for you all, I am sure, when I say that the savings banks want to see a way opened for investing in the bonds of public utility companies, if it can be done with a sufficient degree of safety. In this, the banks have two motives. The lesser one is to broaden the field of possible investment; the greater is to assist in the building up of our American communities to greater prosperity and larger comfort and happiness.

The theory of loaning on tangible security is that the lender takes in his hand a string by the pulling of which he may, if necessity requires, bring to himself the thing pledged. This thing he does not want to retain in his possession, with the burden of managing it; he wants to be able to turn it into dollars—enough dollars to cover the loan he made. The chief characteristic required in the thing pledged is that it gives promise, beyond any fair doubt, of continuing to produce income under any circumstances reasonably conceivable. Bricks and stone, steel and copper, no matter how well and intricately fashioned, are valueless as security unless they earn money—a fair return on their cost, with all proper allowances—and seem sure to continue to do so.

What, in a general way, must be the set-up of a public utility company to enable it to conform to this requirement? Let us agree for the moment to consider only the company which furnishes electric light and power—with gas not more than a small subsidiary, and without commitment in any large way to ownership in street-railway properties or to dependence for any large fraction of its earnings upon energy sold to a street railway.

#### Essential and Qualitative Factors

The factors involved may be divided into two classes—essential and qualitative. If any particular company fails to conform to the first, there would be no use in testing it by the second.

The essential factors may be indicated as follows:

1. Is the company under the regulation of a state public utility commission constituted in accordance with enlightened, conservative thought and with a high regard for the rights of private property?
2. Does the commission require accounts to be kept according to a uniform national classification adopted by a substantial number of other states?
3. Does the company deal directly with the ultimate consumer in the greater part of its business?
4. Does its franchise extend well beyond not only the maturity of the issue of bonds under question, but also any other large maturities?

The qualitative factors are questions of degree, but are of great importance to the investor.

1. What is the ratio of customers to population? Saturation is said to be reached in retail electric companies when there exists one customer to every four of the population. A worse ratio than one in twelve indicates a partly developed territory and one in which the majority of the inhabitants are not dependent upon the utility.
2. What is the nature of the territory? Are its interests well diversified and sure to be permanent? Is it subject to booms and declines, requiring the company to expand with the boom and giving it "hard sledding" in the decline?
3. What is the character of the property? How does it allow for depreciation and for obsolescence? Can it take care of sudden and unexpected obsolescence due to new inventions and revolutionary improvements?
4. What is the proportion of debt to equity? With some companies 50 per cent equity would be enough, but with most companies it would be far too little.
5. What is its earning and dividend record? This point is important, but it is far from being the true yardstick which it is often taken to be. The absence of a good record is, of course, prohibitive, but the presence of a good record is only one of many factors which must be considered.
6. What is the ratio of earnings to plant investment?
7. Is the company controlled by a holding company which may strip it of all possible earnings in order to pay dividends upon a thin upper layer of pretended equity, unjustified by any possible economies in management or operation?
8. Of what type is the management? Is it high-minded? Has it a proper conception of serving the public? Is it on good terms with its public? Has it the courage to tell the public the truth? Does it possess financial common sense? On the strictly technical side of manufacturing and distributing electrical energy, how does it compare with the management of other companies?
9. What is the local political situation? We need not dwell on this, but we must not leave it out of our reckoning.

I have set down above what seem to me to be the chief factors in the strength or weakness of a public utility promise. The four which I have classed as "essential" are easily susceptible to embodiment in a formula. Of the nine which I have termed "qualitative" some can be so embodied, others not. The latter are in many respects the more important.

I confess my own utter inability even to start to make up a formula in accordance with which I should be

*From an address before the annual convention of the National Association of Mutual Savings Banks at Buffalo, N. Y., June, 1923.

willing to see the bank with which I am connected buy public utility bonds. I should feel safer in buying such to rely solely on horse sense, after we had studied every possible phase of the security in question. Yet I am unwilling to surrender the principle of the formula for determining what securities the savings banks in our state shall buy.

To me it appears that we shall require further time, more information and a further step toward standardization by the public utility companies before we can formulate the conditions under which the savings banks can safely invest in public utility securities. In the meantime we can seek earnestly and with open minds for further light.

## Baltimore Merchandising Policy Approved by Commission

IN CONNECTION with the reduction of rates of the Consolidated Gas, Electric Light & Power Company of Baltimore, as reported on page 1484 of the ELECTRICAL WORLD last week, the Maryland Public Service Commission included in its decision an interesting opinion regarding the company's merchandising policy. Aside from indicating that the receipts from merchandise sales must be reported by the company as miscellaneous revenue, the commission investigated the company's methods of conducting this business.

Some time ago the Baltimore company engaged in very extensive merchandising operations, embracing the sale of a rather wide variety of related kitchen equipment, crockery, glassware and so forth. Although this policy has since been largely discontinued, there had been certain complaints by dealers that the practice of the company precluded successful competition by private concerns. The commission made a careful study of the problem and in its decision pointed out that among customers there is a decided approval of the company's service and perhaps even a desire for extension of this branch of the business.

That part of the commission's decision referring to the Baltimore company's merchandising policy reads as follows:

It is our belief that the attitude of the commission toward the extensive merchandising business conducted by the company should reflect the prevailing public opinion of our age and generation and particularly contemporary local judgment on the social and economic consequences that will result from the course now being pursued by the company.

In our opinion the whole field of the ordinary gas and electrical appliance business in Baltimore soon will be filled by the company. It is but a step to wiring and pipe-fitting. At times the merchandising has bordered on the grocery trade.

The terms offered are easy and the service is convenient and popular, but the opportunities for soliciting and selling afforded the representatives of the company when in the homes for meter inspecting or reading and the advantages of prompt and certain collection on merchandise billed with charges for gas and electric consumption, which latter may be enforced by shutting off the service, make the keenest competition and shrewdest merchandising by private concerns futile and vain.

In our efforts to elicit expressions of opinion from retail merchants, tradesmen, artisans and the general public concerning the merchandising conducted by the company, we have failed to discover any organized opposition or outspoken objection on the part of retail business or skilled labor to the continuance of the marketing of appliances by the company, and we are led to believe that among the company's patrons there is a decided approval of the present service and perhaps a desire for extension of this branch of the company's business.

Under these circumstances, we feel that we should not comply with the request of certain dealers who ask that the company be restricted in its merchandising activities and practices. We do not concede, however, as contended by the company's counsel, that the commission is powerless to prevent a public service corporation, enjoying the privileges of a monopoly through the protection afforded by the commission pursuant to legislative will and current economic thought, from employing those special rights and advantages to extend its monopolistic control over lines of endeavor that otherwise would remain individualistic and competitive, yet, in the absence of an expressed or ascertainable public opinion on the subject, we believe that we should not at this time interfere with the comnany's merchandising department other than to order that the revenues from this branch shall be reported by the company and considered by the commission as other miscellaneous revenue.

If the company desire that this revenue be treated in any other way, then capital for the merchandising department must be provided from an independent source and charges for rent and services must be made at adequate and remunerative rates.

# Spokane's Record-Breaking Range Sale

### In a Six Weeks' Campaign the Washington Water Power Company Sold 431 Electric Ranges, Which Will Increase Its Gross Annual Revenue by $39,000

DISCUSSION of this electric range campaign and the value of the load aroused a great deal of interest at the N. E. L. A. convention in New York, June 4-9. It was pointed out by J. V. Strange of the Pacific Power & Light Company, Portland, Ore., that the additional revenue from these 431 ranges would increase the average annual income of the Washington Water Power Company by at least $1 per customer.

ON MAY 15 the Washington Water Power Company of Spokane completed a six weeks' campaign on electric ranges. Complete returns available the following day showed a total sale of 431 ranges, all of which were sold with a water heater, having a combined rating of 7 kw. A little more than one-half of these were sold in Spokane and the rest in various towns served by the company within a radius of 150 miles from Spokane. Most of the ranges sold were Westinghouse—types 2-19B and 3-19B.

The evening of May 14 a banquet was given by the Washington Electric Supply Company to celebrate the sale of 300 ranges, that being the total at close of business that day. However, J. F. Farquhar, general agent of the Washington Water Power Company, announced that he had yet to hear from fifty-five towns, and R. B. McElroy, speaking for Spokane, said that still more contracts would be taken the following day, the last of the campaign. These predictions were verified, as on the fifteenth 131 range sales were added to the list.

The total sale of 431 ranges in six weeks is a record for the country and shows what can be done by intelligent planning and persistent sales work, supplemented with adequate advertising. The essential details of the campaign are shown in Table I.

#### SPECIAL INDUCEMENTS

With each installation one four-piece "Cloverleaf" cooking set was given, and a bread-baking contest has been arranged for the month of June in which all purchasers are invited to participate. The winner of this contest will receive her range free of charge.

The banquet celebrating the sale was attended by forty guests, representing the Washington Electric

TABLE I—DATA ON SPOKANE RANGE CAMPAIGN

| | |
|---|---|
| Ranges sold in Spokane | 232 |
| Number of salesmen | 10 |
| Six city men, outside; four in electric shop | |
| Ranges sold outside of Spokane by 25 district agents | 199 |
| Total number of ranges sold | 431 |
| Gross sales value of ranges and water heaters | $107,000.00 |
| Annual revenue for energy | 39,000.00 |
| Average price of range and water heater installed | 249.75 |
| Terms, $9.75 down, $10 minimum monthly payment | |

Supply Company, the Westinghouse Electric & Manufacturing Company and the Washington Water Power Company. Willard Sebara, manager of the Washington Electric Supply Company, presided and outlined the features of the campaign. Lewis A. Lewis, sales manager of the Washington Water Power Company, stated that he had hoped to sell 150 to 200 ranges and that the results had surprised him. He pointed out that the success was due not only to the high caliber of the salesmen, but also to the co-operation of the other departments of his company, particularly the service, line and accounting departments.

J. E. E. Boyer, assistant to the general manager of the Washington Water Power Company, expressed his satisfaction and amazement at the results as a careful survey of

TABLE II—TERRITORY SERVED BY THE WASHINGTON WATER POWER COMPANY

| | Spokane | Towns Directly Served by Company | Total |
|---|---|---|---|
| Population | 115,000 | 55,000 | 170,000 |
| Residential consumers | 24,700 | 7,500 | 32,200 |
| Number of electric ranges in service, including those sold during campaign | 2,583 | 1,878 | 4,561 |
| Percentage of range users based on residential consumers | 10.5 | 25 | 13.9 |

business conditions throughout the territory made prior to the campaign had led him to believe that no exceptional success could be expected.

In Spokane the only preliminary advertising was a blind advertisement which appeared in the local papers one week before the campaign began. This was a 10 in. display consisting merely of "$9.75," inclosed in a circle. Beginning April 2, an insert was inclosed with every bill sent out by the Washington Water Power Company to residential consumers. Several illuminated signboards were installed April 1 in conspicuous positions on principal car lines. At the same time advertising was inserted in the three Spokane papers, as summarized in Table III,


BLIND ADVERTISEMENT WHICH AROUSED INTEREST PRIOR TO CAMPAIGN

and was run until the close of the campaign.

In the towns of the "Inland Empire" served directly by the company no preliminary advertising was done. Beginning April 1, a moderate program was carried out, consisting of window cards, slides for motion-picture shows and advertising in local papers, most of which are weeklies. A Westinghouse range demonstrator visited the fifteen principal district offices during the campaign. The net extra cost of actual advertising expense chargeable to the sale of ranges in the country towns did not exceed $3 per range.

From the most conservative standpoint, it can be stated that in proportion to the magnitude of the results the advertising was remarkably small in volume and low in expense.

### What the Range Sales Mean in Added Business

Before the campaign began 4,030 electric ranges were in service in Spokane and the "Inland Empire," representing the total sales since 1913, a period of ten years. By the intensive work of six weeks a total

TABLE III—NEWSPAPER DISPLAY ADVERTISING, APRIL 1 TO MAY 15

| | Morning Paper | Two Evening Papers | Total |
|---|---|---|---|
| Number of insertions | 10 | 21 | 31 |
| Total inches of advertising matter | 593 | 1,428 | 2,011 |

equal to 10 per cent of all range sales of the preceding ten years was reached. To put it differently, one year's work at the same rate would have equaled the results of the preceding ten years.

To central-station managers the revenue value of this business is at once apparent. The gross revenue resulting from the sale of 431 ranges and water heaters, at $90 per year, amounts to nearly $39,000.

The figures showing percentage of residential consumers who use electric ranges are especially interesting. They are as follows: Spokane, 10.5 per cent; Inland Empire, 25.0 per cent; Spokane and Inland Empire, 13.9 per cent.

Some of the towns have even higher percentages. Odessa, for example, shows 33 per cent. In such a comparison Spokane is somewhat handicapped because there artificial gas is available for cooking and coal and wood are generally a little cheaper than in most of the other towns. It is a safe inference that the percentage of range users in the territory will continue to increase rapidly during the next few years, so that this progressive community will hold its place as one of the most completely electrified in the country.


THIS KIND OF OUTDOOR ADVERTISING PROVED VERY EFFECTIVE

## An Argument for Better Street Lighting

A SURVEY made recently in thirty-two cities goes to show that from 17½ to 50 per cent of all automobile accidents are directly traceable to poor and insufficient street illumination.

In a list of the ten principal causes of motor accidents poorly lighted streets rank fifth. A census taken for 1921 showed that eleven thousand persons lost their lives from automobile accidents, while in 1916 only four hundred deaths were recorded. Though the increased popularity of the motor car is responsible for the increased ratio in later years, still had improvements in street-lighting equipment kept pace with the added number of car owners, the death toll of today would not have assumed such alarming proportions.

## Corner Stores to Exemplify Better Lighting

"WE AIM to get good lighting on each main corner in the cities and towns served by us," said Julius Daniels, head of the illuminating division of the Boston Edison Company, recently. "We have thirty-six stores operated by our company in the Boston and suburban territory, and by installing modern equipment in these strategic locations we expect to interest local merchants by demonstrating before their eyes the benefits of good illumination. This will be done in the forty-two municipalities reached by our lines. Stores will be canvassed actively during the summer in anticipation of fall business, and an endeavor to establish a 10 foot-candle standard of illumination in windows will be made."

Speaking of recent growth of store lighting, Mr. Daniels said that eight of the larger department stores of the city have been gone over, with the result that they are investing about $25,000 a year in additional electrical energy for illumination. The energy sales of the Edison Electric Illuminating Company of Boston have been increased in this way by about 600,000 kw.-hr.

## Opportunity in Extension of Highway Lighting

AT THE recent meeting of the Electric Section of the Empire State Gas and Electric Association at Utica, N. Y., some of the advantages and improvements in highway lighting were outlined by K. V. Farmer of the Syracuse Lighting Company.

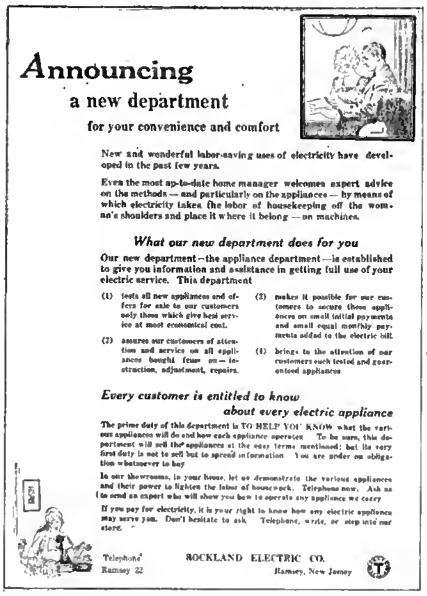
With the large and constantly increasing traffic on our highways, he pointed out, the necessity for some form of illumination to cover at least the congested sections and danger points becomes more and more apparent. Automobile clubs and individuals in various parts of the country are pressing the matter with numerous town and county officials, and it is possible that many more lighting installations of this nature will be made within a very short time.

The advantages of highway lighting may be listed as shown by the following:

1. It prevents accidents: (a) By reducing headlight glare; (b) by illuminating dangerous curves; (c) by throwing light upon the signs at the sides of roads and upon obstacles.
2. It adds to the comfort of night driving: (a) By relieving eye strain; (b) by assisting in making repairs; (c) by discouraging hold-ups.
3. It increases night traffic and thereby relieves day congestion.
4. It decreases running time and increases road capacity.
5. It helps bring electricity to the farm by providing a pole line.
6. It increases real estate values: (a) By tending to expand the city along highways; (b) by extending electrical conveniences.

## Fourfold Function of an Appliance Department

ANNOUNCING the recent establishment of an appliance department, the Rockland Electric Company, Ramsey, N. J., operated by Charles H. Tenney & Company, Boston, published the accompanying "feature advertisement," locally emphasizing the education and co-opera-




ADVERTISEMENT EXPRESSES RESPONSIBILITY OF UTILITY TO KEEP CUSTOMERS POSTED ELECTRICALLY

tive objects of the department in relation to electrical appliances and service.

Going far beyond the usual conception of an appliance department as a mere retail distributor of devices for lightening home labor, the company's publicity focuses attention upon the readiness of the utility to test appliances for quality and economy of service, to insure proper adjustment and repairs as well as instruction in their correct use, to arrange for easy terms of purchase and to keep customers advised upon developments in the field of appliance design. Similar publicity is being utilized in some of the other communities reached by Tenney service.

## What Other Companies Are Doing

**Worcester, Mass.**—A new schedule to be known as the "S" rate will shortly be placed in effect by the Worcester Electric Light Company to encourage the greater use of electricity in residences. Instead of being based upon the area of the residence with an energy charge added, the rate will be of the graduated-block type. The number of rooms will determine the number of kilowatt-hours to be billed at the initial rate, energy consumption in excess being billed at a lower figure. The smaller residences will be required to pay for fewer kilowatt-hours at the initial charge than will the larger houses.

**Thompsonville, Conn.** — Another step in the direction of central-station energy supply for interurban electric railway service in Massachusetts and Connecticut is planned in the projected dismantling of the generating station of the Hartford & Springfield Street Railway at Warehouse Point, the receiver of the road having requested court permission to eliminate the plant and purchase power, at a saving of $15,000 per year, from the Northern Connecticut Light & Power Company. Last year's operation of the railway plant cost about $64,000, and it is estimated that the necessary equipment to operate the road by central station energy can be provided for about $25,000. W. P. Schwabe is manager of the Northern Connecticut company.

**San Francisco, Cal.** — The employees of the Pacific Gas & Electric Company have organized a co-operative sickness and disability plan to provide financial assistance to employees when incapacitated by sickness or accident not classed as a compensation case. Upon payment of $1 initiation fee and $1 monthly any employee under fifty-five years of age and in good health will be assured a benefit at the rate of $20 a week for fifteen weeks. A period of fifteen weeks without benefit intervenes and then payments are resumed for another fifteen-week period.

**Chicago, Ill.**—Sales of appliances by the Public Service Company of Northern Illinois for the first four months of 1923 were considerably above the figures for the corresponding period in 1922. The merchandise sales department announced that the greatest volume of appliances included electric irons, vacuum cleaners and washing machines.

# Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

## Hydro-Electric Development and Steam Equipment

*Three-Phase Generators for Waterwheel Drive.*—G. LEWINNEK.—Economic use of iron, steel and copper in large generators, together with the constantly increasing speed of waterwheels, has brought about a great improvement in these machines. Although in 1897 the best generator known weighed about 51 kg. per kva. at a speed of 55 r.p.m., in 1908 this weight was reduced to 5.8 kg. at 500 r.p.m., while today generators running at 750 r.p.m. weigh 3.1 kg. per kva. The author describes the different problems which were encountered before such highly efficient machines could be built safely. Artificial cooling and very strong mechanical construction were the main tasks which had to be solved. The paper gives the characteristic data for a number of actually built generators for different conditions, both with vertical and with horizontal shafts, pointing out their salient features. Modern stator and rotor constructions are described for sizes up to 20,000 kva. Methods are described for fastening pole pieces to rotors of high peripheral speed with and without the use of bolts. Fan construction for rotors, the design of collector rings and finally the lubrication methods are mentioned.—*A. E. G. Mitteilungen*, April, 1923.

*Problems in Steam-Plant Operation.*—E. A. QUINN.—In its report the prime movers committee of the Pacific Coast Electrical Association outlines practical suggestions as to types of apparatus and methods of operation which have proved successful in Western power-plant practice and recommends that a special study be given to an operating code.—*Journal of Electricity and Western Industry*, May 15, 1923.

## Generation, Control, Switching and Protection

*Low-Voltage Lightning Arresters.*—C. REINDL.—In the design of high-voltage protective apparatus simplicity of construction and a straight-line connection between line and ground were soon found to be essential for a dependable functioning of the arrester. Little has been done in this direction for low-voltage arresters. Very complicated designs and anything but a straight-line connection will be found in almost all of these types. It is claimed that all apparatus with an unprotected outdoor horn gap is useless for low voltages, because the gap cannot be set closer than 3 mm., which requires several thousand volts to bridge. The author recommends the use of an inclosed sphere gap, in a series of which two resistance rods in parallel are placed.—*Elektrische Betrieb*, April 24, 1923.

*Development of Automatic Control.*—H. C. HOYT.—The author considers the development of automatic control for electric stations. A great deal of information hitherto uncovered in former publications is included.—*General Electric Review*, June, 1923.

## Units, Measurements and Instruments

*Development and Testing of High-Voltage Insulators.*—J. F. SCHIED.—After a short historical sketch of the early beginnings of electric line insulators, the author describes the rapid progress which was made after the satisfactory experience with the first delta type of porcelain insulators. A number of mechanical difficulties were met when multi-petticoat porcelains were first introduced. The cementing of the individual parts to one unit with a cementing material of a different heat-expansion coefficient than that of the porcelain caused many a failure and started extensive research work. Not only was a suitable cement found, but such a shape was given to the parts as to minimize as much as possible any internal strain which might arise from stresses in the joints. The use of a yielding material between porcelain and metal, such as lead, did not prove to be successful. A great deal of suspicion is still entertained regarding the use of cemented porcelains, but in modern well-made insulators this is not founded. Multi-petticoat insulators with their individual parts fused together are much more unreliable, because there is no assurance that the fusing is perfect, and should air pockets remain between the parts, the unavoidable glow discharges through these will soon destroy the insulator. It has also been found that fusing frequently introduces irregular internal stresses, which make these types of insulators very susceptible to temperature changes. Sphere-head insulators, double-cap insulators, Jeffrey-Dewitt and screw-cap chains are described and criticised. Finally the equipment necessary for the electrical and mechanical testing of porcelain insulators is dealt with.—*Elektrotechnik und Maschinenbau*, April 29 and May 6, 1923.

*Orifice Coefficients—Data and Results of Tests.* — J. M. SPITZGLASS. — The author discusses the results of experimental work conducted on the use of orifice plates for measuring the flow of fluids in pipes. Extensive tests were carried on for a period of several years to determine the effect of the varying factors, such as the orifice ratio, the size of the pipe and the distance of the upstream and downstream connections, upon the pressure difference across the orifice plate. The tests were conducted on seven sizes of pipe, 2 in. to 12 in. in diameter. The paper includes a number of tables and a collection of characteristic curves that may be employed for determining the flow through orifice plates in a given size of pipe.—*Mechanical Engineering*, June, 1923.

## Transmission, Substations and Distribution

*Influence of the Form of the Voltage Wave on the Commutation of Rotary and Cascade Converters.*—R. J. JENSEN.—The author gives a review of an investigation by W. Linke of this problem on rotary converters (*Archiv für Elektrotechnik*, Vol. 10, 1914). Recent investigations made by himself indicate that the conditions in cascade converters are greatly complicated, especially if the number of poles in the two machines is different. A system which is loaded with a cascade converter may have a variety of harmonics. The author explains the reasons for the blackening of individual commutator bars on certain converters.—*Teknisk Tidsskrift, Elektroteknikeren (Danish)*, April 4, 1923.

*Automatic Mercury-Vapor Rectifiers.*—The Birmingham Corporation (England) electricity supply undertaking has had a steel-cylinder mercury-vapor rectifier working successfully for about eighteen months, and during the past twelve months this rectifier has been automatically controlled, supplying a lighting network. The system used employs a 230-kw., 500-amp., 460-volt tube connected to the outer busbars of the three-wire distribution system, the balancing being done by a battery of accumulators. The rectifier transformer is supplied with 5,000-volt, three-phase, 25-cycle current. Wiring diagrams for the installation are given.—*Electrical Review* (London), May 4, 1923.

*Large Power Transformers.*—W. S. MOODY.—The design and problems of transformers are of vital interest to all responsible for the transmission and distribution of electric power. The author gives data which will enable central-station engineers to understand the manufacturer's problems, as well as help operating engineers to a better understanding of the solution of their own problems.—*General Electric Review*, June, 1923.

## Illumination

*Flickering of Incandescent Lamps in Relation to the Unsteadiness of the Prime Mover.*—J. HEIN.—The main cause for flickering of lamps is the unsteady speed of the engine driving the generator. But other factors have a part, such as the characteristic of the prime mover (whether a reciprocating machine, a four-stroke cycle or a two-stroke cycle gas engine, a turbine, etc.), the speed of the engine, the voltage and current system and the type of lamp.

Considering the combined effect of all these factors, a formula is given to determine the maximum permissible voltage variation of a generator to obviate a disturbing flicker in any given conditions. A tabulation of lamp characteristics gives the required lamp factors. In three examples the way is shown to calculate the voltage fluctuations for given irregularities, moment of inertia, type of engine and speed.—*A. E. G. Mitteilungen*, April, 1923.

*Developments and Requirements in Street Lighting.*—Two papers—"Recent Developments and Modern Requirements in Street Lighting," by H. T. Harrison, and "Street Lighting in Relation to Safety," by L. Gaster—that were given before the Illuminating Engineering Society in England are printed with the complete discussion that followed their presentation. The first paper discusses the devices employed to concentrate the light at angles slightly below the horizontal, in order to illuminate effectively the parts of the street most remote from the source. In such circumstances care is necessary to avoid glare, and the best solution of the problem is found in cases where the light is not only redirected but softened by the aid of globes and lanterns of diffusing glass. The proportion of light that can be allotted effectively to pavements and to the surfaces of buildings is also discussed. In the second paper reference is made to the intimate relation between conditions of permanent lighting and accidents in streets, and to the desirability of central authority to supervise the lighting of cities.—*Illuminating Engineer* (London), Vol. 26, No. 1.

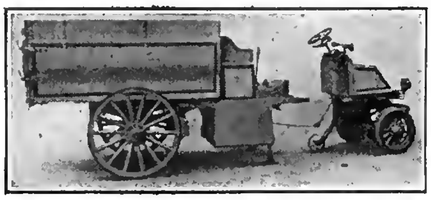
## Motors and Control

*Electricity in the Packing Industry.*—Very large increases in production have followed the introduction of electric drive in the packing industry. Hand methods are replaced by electrically driven machines, and the materials of manufacture are moved rapidly through the plants on conveyor systems propelled by motors. The author considers a typically electrified plant and shows results of careful planning.—*Electrical News*, May 15, 1923.

## Heat Applications and Material Handling

*Design and Construction of Electric Furnaces.*—L. P. BARTON.—In the design of the electric furnace there are three features that must be considered, namely, electrical, metallurgical and mechanical. In the practical working out of these points there are many different combinations available, several of which are discussed in detail by the author.—*Blast Furnace and Steel Plant*, May, 1923.

*Electrically Driven Street-Cleaning Vehicles.* — R. WERNEKKE. — Horse-driven watering wagons, sweeping cars and trucks can be easily electrified by removing their front wheels and substituting the motorized front drive shown in the accompanying illustration, consisting of two solid-rubber-tired wheels driven independently by two 4-hp. motors. The storage battery is hung under the rear part of the car. The controller, metering apparatus and steering mechanism are all contained in the removable front part of the car. It is thus possible to use the same drive for several types of vehicles, a feature which is of particular advantage in street cleaning. A speed of 12 km. to 20 km. per hour can be reached and a



HORSE-DRAWN TRUCKS ELECTRIFIED BY SUBSTITUTING MOTORIZED FRONT DRIVE

distance of 60 km., on the average, may be covered with one charge of the 310-amp.-hr. battery. Five speeds forward and three backward are provided on the controller. Two men can disconnect the front drive from one vehicle and mount it on another one within a few minutes. Charging requires 28 kw.-hr.—*Elektrische Betrieb*, April 10, 1923.

## Telegraphy, Telephony, Radio and Signals

*Radio Telephony from Trains.*—B. ROSENBAUM.—On the railway between Berlin and Hamburg an experimental radio-telephone equipment has been tested for some time and gives very satisfactory results. Any subscriber in Berlin can now communicate with a passenger en route to Hamburg and vice versa. An antenna of six horizontal wires is stretched out over the roofs of two adjoining cars, while a telephone wire carried on poles parallel to the entire length of the track represents the sending antenna. Connection diagrams illustrate the arrangement of the used apparatus.—*Jahrbuch der Drahtlosen Telegraphie und Telephonie*, April, 1923.

*Cracking Noises in Telephones.*—D. BÄHR.—The origin of sharp cracking noises in a telephone receiver has usually been assumed to be the hitting of the membrane upon the magnets or a heavy bending of the membrane. After a series of tests the author came to the conclusion that this assumption is not fully true and that these noises may be also caused by electrodynamic or condenser action of the coils themselves. Removing the membrane from a receiver and replacing the cover, the author claims that he could still hear a cracking noise, though of fainter character. — *Elektrotechnische Zeitschrift*, May 3, 1923.

*A Decimal Classification of Radio Subjects.*—The whole subject of radio communication is put in its proper place in the Dewey decimal classification—621.384. It is suggested that in a purely radio library these figures be abbreviated by the use of the letter "R" as a prefix for the numbers which designate the divisions of the subject. An abbreviated classification is provided for the use of small libraries or collections, and an alphabetical index enables one to refer readily to the classification number of any subject desired.—*Circular No. 138 of the Bureau of Standards.*

*The Pallophotophone.*—C. A. HOXIE.—A description of this device may be found in the ELECTRICAL WORLD, March 24, 1923, on page 691. The original paper was presented at the midwinter convention of the A. I. E. E.—*Journal of the A. I. E. E.*, May, 1923.

## Electrophysics, Electrochemistry and Batteries

*Electric Battery Locomotives for Surface and Underground Haulage.*—An abstract of a paper read by T. M. McGlashan before the Association of British Mining Electrical Engineers. The author discusses the two classes of locomotives—that is, those for surface haulage and those for underground haulage. These he subdivides into the trolley-pole type, the battery or semi-contained type and the combined trolley and battery type. Although there is practically no limitation to either the battery type or the trolley type for surface haulage, it is otherwise with underground haulage, where the risk of sparking in gaseous mines has to be avoided. The author also discusses the development and operation costs of underground locomotives.—*Electrical Vehicle* (London), April-May, 1923.

## Traction

*Main-Line Electrification in Italy.*—F. A. SHEPLEY.—The program now under way contemplates the electrification of all main lines by 1926. Much of this work has already been completed, but there still remains about 2,810 miles of line to be electrified. On the lines already electrified the author gives an account of the rolling stock, sources of power supply, form of generating units and power plants, system of overhead conductors, consumption of energy, etc. Comparisons between various types of locomotives and between steam and electrical operation are also made.—*Electric Traction*, May, 1923.

*Electric Railroad Ticket Printer.*—SIEMENS.—The article is a description of a fully automatic, electrically driven machine which prints railroad tickets at the instant of demand. The ticket agent has a small metallic plate for each station on the road, on one side of which is fastened an electrotype bearing the name of the starting point and the destination, the distance in kilometers between the two and the class of car. On the other side of the plate are a number of holes in some of which pilot pins are placed, their number and position representing the price of the particular transportation. The driving motor of the printer consumes about 180 watts during the actual printing and 120 watts running idle.—*Siemens Zeitschrift*, May, 1923.

# News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

## Thirteen Hundred Register at Swampscott

**President Jewett Deals with Increasing Complexity of Engineering Society Activities—Discussion on Differences Between Sectional and National Viewpoints—Entertainment**

IF ANY proof of the popularity of the summer convention of the American Institute of Electrical Engineers is needed, the convention held at Swampscott, Mass., this week should allay any doubt. Almost thirteen hundred had registered by Wednesday evening, the second day of the convention proper. The morning meetings were unusually well attended and of real value and interest; the afternoons were devoted to sports and inspection trips, and the evenings, containing both professional profit and entertainment, gave a good balance to the day. Members and guests were all enthusiastic.

On Monday the section delegates held the floor, discussing local and regional problems. A complete resurvey of the Institute's technical activities is in progress, and by 1924 it is expected that a report will be ready with recommendations. President F. B. Jewett declared that it might be desirable to supplement the sectional meetings of the Institute by regional meetings on account of the wealth of material now available for presentation in papers and for discussion.

President-elect Harris J. Ryan pointed out how the A. I. E. E. is helping the engineer to keep the country moving. Professor Ryan touched upon the value of a continental power network as a factor in creating a greater and a happier nation.

### Local and National Viewpoints

The reading by Chairman A. W. Berresford of a proposed clause qualifying the authority of A. I. E. E. sections' utterances in relation to public affairs precipitated a lively discussion. The advocates of the clause urged that without its use the public would frequently be misled into thinking that the views set forth represented the A. I. E. E. as a body and that conflicts between local and national viewpoints might result. The opponents, on the other hand, declared that if the clause were accepted, the action of any section on local matters of public significance would be without weight. A committee was appointed to draft a new clause upon which general agreement might be reached, and its report, which was accepted, was that a preamble be included in all public utterances by sections to the effect that, as the A. I. E. E. is a national organization, the opinion, or recommendations expressed represent only the views of the individual members of the section making the utterance.

Three other motions were passed. One was a recommendation to the board of directors that an alternative method of transferring members from one grade to another be considered. A second was that one meeting of district executives each year be made mandatory and that their expenses be paid from the general fund. The last was a recommendation to omit mathematics from *Journal* articles and publish mathematical articles in full, but in separate pamphlets, which could be mailed, separately from the *Journal*, to any one desiring them, and would also be included in full in the *Transactions*, the *Transactions* being made available at nominal charge or possibly supplied without cost.

Methods by which sections are endeavoring to create the greatest benefits from their meetings were also extensively discussed. Among the ways mentioned were having good speakers give the same address before different sections in rotation, preparing programs for an entire year in advance, offering prizes for the best papers presented, catering to operating engineers, and holding "engineer days" at universities.

E. E. F. Creighton mentioned the fact that the national organization is considering the engagement of a liaison man, who will be the secretary of the meetings and papers committee, to coordinate activities of committees and sections. The possibility of engaging consulting editors for the *Journal* was also mentioned.

### President Jewett's Address

The conditions under which all engineering organizations are operating are becoming more and more complicated by the increasing number of societies, the duplication of certain activities and the inextricable mass of relationships, Dr. F. B. Jewett asserted in his annual address on Tuesday. It is imperative to determine anew the guiding principles which should prevail and then tackle the problem of enforcing these principles. Since it is the purpose of national organizations to improve the status of engineers, they should deplore any short-cut royal roads to success. Dr. Jewett re-emphasized the fact that there is a growing need for engineers in public affairs to draw unbiased conclusions from ascertainable facts. He concluded by expressing the belief that executives in the engineering field will be increasingly drawn from technical colleges in the future, but they must also have business acumen and the ability to lead and direct men.

The papers scheduled by Dr. C. P. Steinmetz, J. L. R. Hayden and W. N. Eddy, and D. M. Simons on Tuesday were well received. On Wednesday the account of the new Weymouth station by I. E. Moultrop and Joseph Pope aroused much interest, as did the other technical papers presented.

### Fourteen Presidents in Line

The president's reception Tuesday evening was notable for the number of Institute past-presidents in line. Besides President Jewett and President-elect Ryan, there were Past-presidents Elihu Thomson, A. E. Kennelly, Carl Hering, C. F. Scott, P. M. Lincoln, William McClellan, A. W. Berresford, E. W. Rice, Calvert Townley, R. D. Mershon, D. C. Jackson and C. P. Steinmetz. Secretary F. L. Hutchinson was also in line. Most of them were accompanied by their wives. Dancing followed the reception and was as usual a feature of each evening.

On Wednesday morning there was a demonstration of life saving by the Coast Guard crew of the Nahant station. Tuesday afternoon Prof. Vladimir Karapetoff gave a popular demonstration of his new kinematic device built to explain the Einstein theory. Wednesday afternoon Prof. C. E. Magnusson gave a talk illustrated with colored stereopticon views of the State of Washington. Colored motion pictures and orchestra music from Boston broadcasted by the Public Service System were evening features. There was brilliant and decorative illumination each evening accompanied by a demonstration of a 30-kw. incandescent lamp. Automobile drives, boat rides, golf, tennis, bridge and similar entertainment helped make the entire convention week enjoyable.

### Coming Meetings

The plans for future conventions contemplate, besides the fall meeting at Del Monte, Cal., in October, a midwinter meeting at Philadelphia at which railroad electrification will be a topic of prominence. It is expected that a spring meeting will be held in Atlanta or Birmingham and the next summer convention in the Great Lakes district, provided suitable accommodations can be obtained.

## Southern Men Reorganize

### Water Power Conference Adopts New Constitution Providing for Three Main Bureaus

A MAIN feature of the annual meeting of the Southern Appalachian Water Power Conference at Asheville, N. C., on Monday to Wednesday of this week was the adoption before adjournment of a new form of constitution designed to develop a closely knit organization. The new policy provides for an organization embracing state public utilities commissions, public utility companies, engineers, bankers, chambers of commerce and industrial or commercial interests concerned with the development, utilization, operation and regulation of the natural resources of the Southern Appalachian States. The organization plan provides for the establishment of three bureaus with a full-time director in charge who will organize the personnel. This director will report to an executive committee, which will carry out through him any specific recommendations of the conference.

#### THREE BUREAUS PROVIDED

A Bureau of Public Relations will be established to effect a more harmonious relation between public utilities, public service regulatory bodies and the general public. A Bureau of Industrial Development is provided to furnish a clearing house for accurate information relative to the location of developed and undeveloped power, and a Bureau of Research is recommended to provide a means of compiling information relative to the scientific facts needed in the development of natural resources.

A number of addresses were made covering every phase of the water-power resources of the South and the essentials for their development to the best advantage. The conference went on record as favoring forestry protection. It also condemned legislation proposed in several states to prohibit the transmission of power to neighboring states.

Assistant Secretary of War Dwight Davis, in an address prepared for the conference, said that consideration of the water-power possibilities and supplementary coal deposits in the Southern Appalachian region indicated promise of great industrial development within the next decade. He urged that peace-time development should keep in view possible war-time emergencies, stressing the necessity of co-ordination and flexibility of distribution systems.

Executive Secretary O. C. Merrill of the Federal Power Board contributed a paper on "Some Popular Fallacies Concerning Power Development," dealing especially with cost of development and distribution of operating costs.

H. L. Wills of Atlanta was elected president of the reorganized Southern Water Power Conference; Col. Edgar Jadwin of Charleston, S. C., vice-president; J. A. Switzer of Knoxville, Tenn., secretary; Thorndyke Saville of Chapel Hill, N. C., treasurer, and Dr. Joseph Hyde Pratt of Chapel Hill, chairman of the executive committee.

## Secretary Work Forces A. P. Davis to Resign

Arthur Powell Davis, director of the United States Reclamation Service since 1914 and for eight years previously its chief engineer, has at the request of Secretary of the Interior Work tendered his resignation and has been succeeded by D. W. Davis, formerly Governor of Idaho, who is not an engineer. According to report, the deposed director is a victim of politics, which is said to be intertwined with the question of federal construction of the Boulder Dam project on the Colorado River. Former Director Davis, during whose administration the Roosevelt, Elephant, Shoshone and other great dams were built, was an advocate of government construction and control at Boulder. This policy is said not to have pleased Colorado and California power companies interested in the development of the river. Another stand taken prominently by Mr. Davis was opposition to the proposed development at Diamond Creek, which is backed by Arizona copper interests.

## Ontario Government Overwhelmingly Defeated

The Drury government, which has been in power in the Province of Ontario since 1919, was defeated in general provincial elections on Monday by a landslide, the Conservative party winning seventy-five seats, the Liberal party sixteen, and the United Farmer-Labor Coalition party, of which Premier Drury was the leader, only twenty. G. Howard Ferguson, Conservative leader, will now form a government. Champions of the Ontario Hydro-Electric Commission claim that the result is a popular vindication of that body. The government had been responsible for the investigation by the Gregory royal commission, the results of which went to establish charges of mismanagement and waste on the part of the Hydro-Electric Commission. Sir Adam Beck, the chairman of the Hydro-Electric Commission, opposed the administration and was elected to the Legislature from the city of London by a tremendous majority.

A body known as the Ontario Municipal Electric Association sent out a questionnaire to candidates for the Legislature asking them to pledge themselves to two statements—the first that they were in favor of the policy carried out by the Hydro-Electric Commission since its inception, the second that they were in favor of municipal representation on the commission. According to a representative of the Municipal Electric Association, about 70 per cent of these pledges were returned, nearly all signed by the candidates. The answers were not, however, published in the press of Toronto, although the Mayor of that city is president of the association.

## A. M. E. S. Mark Advance

### New London Conference Records Progress in Simplification and a Closer Bond Between Manufacturers

A VERY decided advance in the cause of simplification in the electrical industry was recorded at the annual convention of the Associated Manufacturers of Electrical Supplies held at the Hotel Griswold, New London, Conn., from Tuesday until Friday of this week. William A. Durgin, chief of the Division of Simplified Practice of the United States Department of Commerce, whose address at the Electrical Supply Jobbers' Association's convention at Hot Springs, Va., last month was so enthusiastically received, was invited to appear before the manufacturers and interpret to them the purposes of simplification in industry and the methods by which Mr. Hoover's staff is endeavoring to assist this movement. Simplification was a conspicuous note throughout the program of the meeting.

In the absence of President S. L. Nicholson, who is abroad, William L. Thornley occupied the chair. In his written message the president stressed the fact that there has never been a time when there has been such great need for co-operation and co-ordination among the manufacturing interests of the electrical as well as other industries, owing to the number of regulatory rules that are now being promulgated throughout the country, and he advocated a closer union of manufacturers through the association to make possible an advancement of standardization, statistical knowledge and their common purposes and benefits.

S. I. Whitestone, controller of the General Electric Company, presented a paper on uniform accounting and urged the establishment of a bureau of cost methods which would promote the standardization of accounting practice within the industry. Action on this recommendation had not been reached at the time of going to press.

#### CLOSER ORGANIZATION EFFECTED

Definite steps were taken at the "general and annual meeting" of the association to perfect a closer organization of the manufacturing interests of the electrical industry. The A. M. E. S. has consisted in the past of a group of autonomous sections, each consisting of representatives of the manufacturers of similar products, all sections loosely joined in an association, but holding no joint meeting and engaging in practically no co-ordinated activity. Two years ago this association was combined with the Electrical Manufacturers' Club and the Power Club in joint membership with the Electrical Manufacturers' Council. Last year the holding of one joint meeting of the A. M. E. S. was instituted. This year's meeting has increased the prominence of open joint meetings and by a revision of rules has emphasized the character of the organization as representative of the broad manufacturing interests of the supply lines of the electrical industry.

## New Colorado Pact Idea

**Tri-State Commission for Lower Basin Suggested at Western Development Conference**

THE meeting of the Western Development Conference on Friday, June 22, marked the close of the intensive four-day convention of the Pacific Coast Electrical Association at the Fairmont Hotel, San Francisco. This conference has been made a regular feature of the association's annual convention, and the meeting this year was particularly interesting and well attended. Governor James G. Scrugham of Nevada deplored the fact that the Colorado River Basin states have not been able to get together on a plan for development. He suggested as a solution to the deadlock created by the refusal of Arizona to ratify the Colorado River compact the formation of a commission by the joint action of Arizona, Nevada and California to be given authority to issue bonds and proceed with power development on the lower river. Such a body would protect Arizona against the features of the compact to which she objects and would pave the way to an amicable settlement of the differences of the states concerned in power development in the lower basin. The commission proposed would not retail or distribute power but wholesale it to existing agencies.

Willis Booth, president of the International Chamber of Commerce and vice-president of the Guaranty Trust Company of New York, in speaking on "The Importance of the Pacific Coast in World Affairs," indorsed the plan of Governor Scrugham and said that the East considers the development of the Colorado River the most important factor in the growth of the West. Italy and other foreign countries, he said, have learned by experience that public ownership is not in the best interest of their development and as rapidly as possible are returning to private ownership of utilities.

At the election of officers on the last day of the convention L. M. Klauber of the San Diego Consolidated Gas & Electric Company was elected president, William Baurhyte of the Los Angeles Gas & Electric Corporation, first vice-president, F. A. Leach, Jr., second vice-president, S. B. Anderson, treasurer, and Samuel H. Taylor, secretary.

## Railroads Must Surrender Advantage at Coal Mines

The Interstate Commerce Commission has overthrown the long-established practice of the railroads of assigning cars to the mines which produce their fuel. This always has been a thorn in the side of the public utilities, which had not been allowed to use this advantage in securing their coal. Those opposed to the practice always have contended that it results in the public's paying a portion of the railroad fuel bill, because the operator of a mine who is assured 100 per cent car supply can afford to make a price to the railroad which is lower than the cost of production. It is contended that the abolishing of assigned cars will do a great deal toward stabilizing the production and distribution of coal in that it will force the railroads to provide storage.

## Canada to Contribute to World Power Conference

The government of the Dominion of Canada plans to take an active part in the World Power Conference, June, 1924, in London, England. As a result of its call on the Canadian Electrical Association, three of the five Canadian papers are to be presented by members of the association, as follows: "Transmission and Distribution of Electrical Energy," by Julian C. Smith, vice-president Shawinigan Water & Power Company, Montreal; "The Application of Hydro-Electric Energy for Public Utility Purposes," by P. T. Davies, commercial manager Southern Canada Power Company, Montreal, and "The Financial Aspect of Power Development in Canada," by Sir Herbert Holt, president Montreal Light, Heat & Power Company.

## Big Plant for Cincinnati

**Union Gas & Electric Company Plans to Erect New Power House at Cost of $12,000,000**

ANOTHER has been added to the many large generating stations now being planned or already under way in the Middle West by the announcement of W. W. Freeman, president of the Union Gas & Electric Company of Cincinnati, that before the end of the year plans will be completed for an additional electric power plant to be built in that city by his company, at a cost of $12,000,000.

Pointing out the development of the industry in Cincinnati, Mr. Freeman cited figures covering a period of several years. In 1921, he said, the company registered 14,000 new electrical consumers, in 1922, 20,000, and 7,500 during the first four months of 1923. Of the total number of consumers at the present time, reaching more than 100,000, Mr. Freeman said, 80 per cent have become customers in the past six years.

Details of construction for the new plant are not yet available. It is hoped to have the part to be built first in operation inside of three years.

# Canadians Discuss Accounting Problems

**With Commercial Topics, These Form Principal Theme of Montreal Convention, Which Is One of the Largest Ever Held by the Association—Technical Subjects Debated**

THE Canadian Electrical Association held its thirty-third annual convention at the Mount Royal Hotel in Montreal on Thursday, Friday and Saturday, June 21-23. It was probably the best-attended convention which this association has ever held, and it was made especially interesting this year, from the standpoint of accounting, by the fact that the National Accounting Section, N. E. L. A., executive committee held its meeting in Montreal on June 20 and its members remained over for the convention. Accounting was thus one of the principal topics. Intelligent commercial development was the subject to which most of one day was devoted, talks on residence and industrial lighting development being given.

In his presidential address on Thursday P. T. Davies, commercial manager Southern Canada Power Company, said, in response to the criticism that the association had heretofore devoted too much attention to technical matters, that more provision was made this year for commercial and accounting study, the Technical Section being left to run itself.

### PUBLIC OWNERSHIP

With reference to public ownership in Canada, Mr. Davies said:

"Your association, while insistent upon guarding the rights of its own member companies to live and fill a legitimate and protected place in our modern social structure, is quite satisfied that time alone will show to the owner of property in Ontario and also to the people at large the economic impossibility of operating for any length of time those necessities which history has again and again proved can only be run permanently by private agents.

"The association does feel that it is unfair for any governmental body, such as the Hydro-Electric Commission of Ontario, to escape the payment of the normal taxes incident to the operation of such a system by private ownership. The fact that the Hydro-Electric Commission in its operation pays neither income tax to the government of the country nor any provincial taxes whatsoever is benefiting the few customers in Ontario at the expense of not only the non-users in Ontario but also every other person in the Dominion of Canada. When this freedom from taxation is carried to the limit that the Hydro-Electric system pays no sales taxation on the appliances which it buys for resale, a legitimate ground for criticism is present among those dealers in Ontario who have to sell in competition with such merchandising outlets."

The public relations committee recommended a division of public relations work along lines now prevalent in the N. E. L. A. and pointed to the way the United States is outdistancing Canada in the matter of customer ownership. John W. Gilchrist, speaking to this point, on invitation, said that the experience of the Commonwealth Edison and associated companies proved that

customer-ownership activities, meant no lowering of dignity, as originally feared, but that on the contrary they were one of the greatest elements for good public relations as well as for financial stability. From his experience Mr. Gilchrist advised: "Don't go at it in a half-hearted way. Don't depend alone on over-the-counter sales. Don't get discouraged at apparently early failure."

### Present-Day Accounting

At the meetings of the Accounting Section papers were presented corresponding to the reports of the N. E. L. A. but containing views and expressions particularly applicable to Canada. The principal speaker was H. M. Edwards, auditor of the New York Edison Company, who gave an impressive talk on the history and work of the Accounting Section of the N. E. L. A. Mr. Edwards' address was responded to by A. Monroe Grier, former president of the Canadian Electrical Association. The sessions were also addressed by J. W. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago; W. A. Jones, chairman National Accounting Section, N. E. L. A., New York City; William Schmidt, Jr., former chairman National Accounting Section, and Fred R. Jenkins, accounting education committee, N. E. L. A.

The great interest shown in the Canadian Accounting Section this year is largely due to the persistent efforts of W. Paxton Little, its chairman, who has given a great deal of time to stimulating its activities. Mr. Little is also vice-chairman of the National Accounting Section, N. E. L. A.

In the discussion of the accident prevention committee report there was a plea for greater executive support of this work. Point was made of the fact that there are many by-products of accident prevention work in public relations and in money, aside from humanitarian motives.

F. M. Feiker at the Thursday luncheon showed the opportunities—the necessity as well—for group or association activity in solving many of the present-day problems resulting from a complex civilization with its greater demands and higher costs.

### Technical Sessions

As usual, the reports of all committees were printed in advance and available for study before the meetings. In the discussion of the electrical apparatus committee report P. T. Davies said he felt that ideas of distribution to the customer would eventually have to undergo radical changes. As a suggestion, for example, he mentioned the idea of 2,200-volt or 4,400-volt distribution to the customer with concentric cables—the outer grounded sheath being one conductor—with voltage regulation on the customer's premises. He also predicted a commercial development of from 500 kw.-hr. to 1,000 kw.-hr. per month to the average customer as a load to be reckoned with in technical development of distribution systems.

In discussing the meter committee report, it was brought out that records show meters from smaller companies to be more frequently in error than those of larger ones. It was also stated that meters mounted outdoors so that they are subjected to the extremes of heat and cold are generally affected in such a way that they get slow.

Wills Maclachlan, discussing overhead lines, said trained linemen are getting more and more scarce, that simple things are not understood by linemen or bosses, and that one problem the companies have is to educate linemen.

### Dinner-Dance

The dinner-dance on Thursday evening was an elaborate and well-attended affair. John W. Gilchrist, in his address, dwelt on the three points of public relations, customer ownership, and possibilities for the sale of appliances. The first included employee relations, which should come first; the second put a stop to government ownership theories, and the third should be developed by the trustees of electrical supply as a duty to the public.

"We are not doing what we ought to do," said Mr. Gilchrist, "from the standpoint of our shareholders and the greater obligation to the public. We do not appreciate the extent to which these devices actually give strength and health and serve the welfare of our nation." Mr. Gilchrist then pleaded for a cost analysis and a profit basis of carrying on merchandising business. On the small scale of years ago losses could be charged as promotion, but not on a large scale. He pointed out the character of men on the merchandising policy committee of the N. E. L. A. as indicative of the magnitude and importance of the problem as viewed by the industry.

### Residence Lighting

The Friday morning session was devoted largely to residence lighting as a means of increasing business and interpreting electric service to the public. M. Luckiesh interpreted the N. E. L. A. committee report on this subject, showing how to use it, and further elaborated on methods of residence lighting, illustrating his talk with lantern slides. Mr. Luckiesh suggested that electrical men watch real-estate plans and sales and get in on the ground floor of residence home-lighting plans.

W. H. Johnson, president-elect N. E. L. A., at luncheon Friday, said the past year of the association was its most successful one and had been largely devoted to public relations and customer ownership. One reason why the good work of the electrical industry is not fully recognized is that it is so well done. Publicity, not propaganda, is needed, and more of it. Mr. Johnson gave great credit for the present position of the central-station industry to the work of the N. E. L. A. and urged continued and greater co-operation between the central stations of the United States and Canada.

L. A. Hawkins of the General Electric research laboratory warned against the excessive use of the word "research" and said the industry must plan to go forward with fundamental research and not slip back to the pre-war condition of calling "experimenting" research. He said that about 30 per cent of the General Electric Company's business was on things which originated in the General Electric research laboratory.

Mr. Hawkins traced the research which led to the present large vacuum tubes and predicted the future transmission of energy by tube-controlled high-tension direct-current lines. He emphasized that all research must "keep its touch with firm earth" and have sufficient contact with practice to give it strength and guidance.

At the Friday afternoon session S. G. Hibben talked on industrial lighting, illustrating his remarks by experiment and lantern slide. The possibilities of the development of this business are entirely impossible of prediction for present intensities are as yet so far below daylight that it is not practicable to tell where artificial light should stop, Mr. Hibben said. There is much to be done also in methods of application.

Street and highway lighting and shop-window lighting were also discussed.

### Electrical Veterans' Night

An innovation in the way of an "electrical veterans' night" was staged on Friday evening, at which a large number of those twenty years or more in the electrical business took a prominent part.

Saturday morning was devoted to an analysis of how to get insurance rate reductions as outlined by the N. E. L. A., to customer ownership and to meter seals. The attempt is being made to extend the period at which customers' meters must be sent to the government for check from the present period of five years to ten years.

## Canada to Separate Lighting and Heating Figures

According to President P. T. Davies of the Canadian Electrical Association, "cost of living" figures in Canada will no longer contain misleading figures on lighting as an element of cost of living. Representations were made and data presented to the Minister of Trade and Commerce which persuaded him to separate out the item of lighting from heating, so that in the future, instead of the items being combined and showing apparently, for example, that lighting in 1923 is 188 per cent of 1914 prices, they will show a decrease in the average cost of lighting per family during this period. The Minister has announced that he has the necessary information and that his statistical department is at work on the average figures.

## Commission Prevents Link

**Alabama Power May Not Build Line from Huntsville to Muscle Shoals—Postpones Action on Lock 17**

NOT only has the Federal Power Commission, as reported last week (page 1486), postponed action on the issue of a license to the Alabama Power Company for its proposed development at Lock 17 on the Black Warrior River, near Tuscaloosa, but the Alabama Public Service Commission has indefinitely postponed consideration of the power company's petition for permission to build a hydro-electric plant there. The commission has also denied to the company the right to erect a transmission line from Huntsville to the government steam plant at Muscle Shoals.

The commission based its action on the Lock 17 petition on several grounds. It held that the power company had failed to show how much it proposed to pay the government for the power to be developed and that no detailed survey had yet been made of the Warrior River. Piecemeal development of the power in the state should not be permitted, the board said, adding that it had been advised that the Legislature at the coming session will devise a comprehensive policy on water-power development.

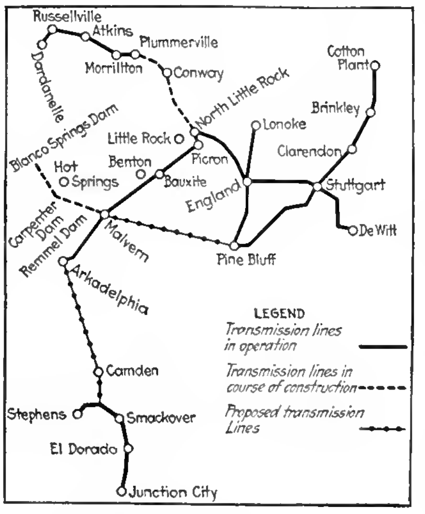
In denying the petition of the power company to construct the Sheffield-Huntsville transmission line, which (as shown in the ELECTRICAL WORLD for May 5, page 1052) would give the company a transmission "ring" from Muscle Shoals to Mitchell Dam and back by Anniston and Huntsville, the commission contended that the power company does not own the government steam plant at Sheffield or the transmission line from Gorgas to Sheffield. The commission said that the government might end its contract with the Alabama Power Company for the Sheffield plant and the Gorgas line. On this account it could not allow the company to spend more than $600,000 in building the proposed line. The commission maintained that the company should give Huntsville power from some other source, but did not suggest a way. Huntsville's power needs would not be solved by erection of the line, according to the utility board.

## Last Unit of San Francisquito No. 1 Cut In

On Sunday, June 10, the last 16,000-hp. generating unit of the Los Angeles municipal power plant No. 1 in the San Francisquito Canyon went into service. The new unit, constructed at a cost of more than $300,000 from the revenues of the municipal bureau of power and light, marks the limit of hydro-electric development along the Los Angeles aqueduct, the improvement bringing No. 1 plant to a generating capacity of 58,000 hp. The total capacity of the five municipal power plants, it was announced by Chief Electrical Engineer E. F. Scattergood of the power bureau, now is 115,000 hp. Despite the additional supply, the Bureau of Power and Light will still be forced to purchase more than 30 per cent of the electricity the city distributes to its consumers.

## Progress of Arkansas Light & Power Company

Work on the Remmel Dam, on the Ouachita River, between Malvern and Hot Springs, Ark., has, as already announced in the ELECTRICAL WORLD, been begun by the Arkansas Light & Power Company, Pine Bluff. This company, under the guidance of President H. C. Couch, is now operating ten central power stations, more than 500 miles of transmission lines, thousands of miles of distribution systems and serving growing cities and towns and hundreds of farms in sixteen counties containing one-quarter of the population of Arkansas.




TRANSMISSION SYSTEM OF ARKANSAS LIGHT & POWER COMPANY

The Remmel Dam will be 50 ft. to 60 ft. high and 900 ft. long at the crest. The power station at this dam will produce 15,000 hp. The cost is estimated at $1,500,000. Two other dams and power stations are provided for in the ten-year program, which contemplates converting the water power of the Ouachita River into 120,000 hp. of electrical energy, incidentally controlling floods in the river. The storage capacity will be equal to 1,000,000 acre feet, equivalent to a lake 70 miles long by one mile wide. The estimated cost of the entire program is placed at $15,000,000.

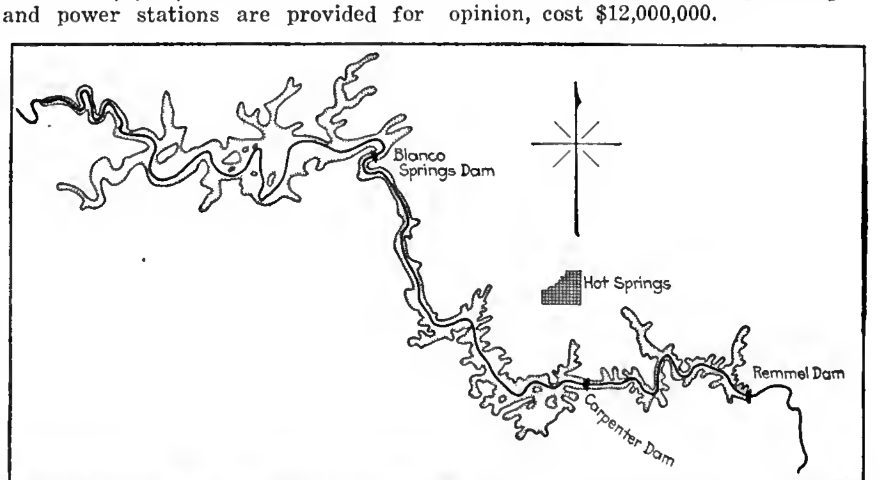
The second dam and power station will be constructed at what is known as the Carpenter Dam site, a few miles south of Hot Springs, and the third dam and station at the Blanco Springs site, a few miles northwest of Hot Springs. The Carpenter Dam will have a height of 100 ft. and a length of 1,340 ft. The Blanco Springs Dam will be 130 ft. to 175 ft. high and 905 ft. long.

## Detroit Council Votes to Buy Four 20,000-Kw. Units

The Detroit City Council has rejected the proposal of the Detroit Edison Company to furnish power for the street railway and public lighting on the east side under a ten-year agreement, provided that the city limited its own proposed municipal power plant to three turbo-units of 20,000 kw. rating each. Instead, the Council voted unanimously to reaffirm its approval of the letting of a contract to the Westinghouse Electric & Manufacturing Company for the installation of four turbo-generators of 20,000 kw. rating each in the new power plant to be built by the city at the foot of Morrell Street. The contract calls for a total expenditure of $1,254,000, to be paid for out of a twelve-million-dollar bond issue.

The Edison company's proposal was to furnish power to the city at a suggested cost of 1.3 cents a kilowatt-hour, the ultimate rate to be fixed by the Michigan Public Utilities Commission.

The city's requirements for power now closely approach 60,000 kw. It is the intention to hold one of the Westinghouse units in reserve. The new plant is to be so designed as to admit of expansion. It is to be completed in 1925, and will, according to expert opinion, cost $12,000,000.




PROPOSED DEVELOPMENT OF OUACHITA RIVER BY ARKANSAS LIGHT & POWER COMPANY

## F. A. E. S. Will Be Represented at World Power Conference

Growing participation by engineers in public affairs was strongly evident at the June meeting in St. Paul of the executive board of the American Engineering Council of the Federated American Engineering Societies. General round-table discussion revealed that local groups in many sections of the country are taking a constructive part in solving community problems. This local effort embraces traffic, smoke abatement, water supply, city planning, state and municipal legislation relating to engineering matters and related subjects.

The committees on transportation, coal storage and a proposed registration law for engineers reported and will continue their work along the same progressive lines. A request was received from the Cleveland Engineering Society asking that the federation support the movement for the appointment by Congress of a technical commission to make a thorough study of the engineering and economic phases of the proposed St. Lawrence waterway before making any definite decision regarding the project.

The executive board voted to participate in the World Power Conference to be held in London in 1924 and authorized President Cooley to appoint representatives. It accepted an invitation from the Chamber of Commerce of Rochester, N. Y., to hold its next meeting there during the first two weeks in October.

## Lynn Company to Sell Railway 9,000,000 Kw.-Hr. a Year

The Eastern Massachusetts Street Railway Company has entered into a contract with the Lynn Gas & Electric Company under which the street railway will be supplied with all of the electrical energy required for the operation of its electric cars in its Lynn division, consisting of about 60 miles of track in Lynn, Saugus and Swampscott.

The lighting company expects to begin to supply electric power under the contract not later than Feb. 15, 1924. The power will be in the form of 13,200-volt alternating current, transmitted through about one mile of duplicate underground cables to the new substation of the railway company, to be erected at the center of direct-current distribution, near the corner of Union and Washington Streets, Lynn. The substation, which will cost $125,000, is to house three 1,500-kw. standard rotary convertible units and control equipment, with room for an additional 1,500-kw. unit. It will be manually operated.

The lighting company will realize material savings in fuel economy made possible by better plant and machine load factor, reduction in labor costs per unit of electrical energy sold and reduction in average distribution losses, the block of 9,000,000 kw.-hr. per year being sold to the railway company, at the lighting company's station. The railway company will be able to realize more fully the economy of light rolling stock resulting from taking energy from a source where the cost is proportional to the amount of energy needed and used. It also will profit from the reduction in unit costs due to improvement in fuel economy and the reduction in cost of station labor due to the combination of the two plants. The contract was negotiated by Macomber & West, engineers, Boston.

## Fuel and Public Relations Ohio Men's Topics

Steam generation by powdered fuel and with mechanical stokers, public relations and new-business problems will dominate the program of the Ohio Electric Light Association convention, which will be held at Cedar Point, Ohio, from July 10 to 13. The Wednesday morning session will be given over entirely to the East Central Geographic Division of the N. E. L. A., consisting of Ohio, Kentucky and West Virginia, and the afternoon to sports. On Thursday afternoon Newton D. Baker, ex-Secretary of War, will deliver an address. The annual banquet will be held Thursday evening. The tentative program follows:

TUESDAY, JULY 10

*Afternoon.*—President's address, report of secretary-treasurer, report of executive committee.

WEDNESDAY, JULY 11

*Morning.*—"United Utility Effort," Donald McDonald, Louisville Gas & Electric Company; "How a Public Utility Company Can Promote Sound Public Relations," Victor H. Morgan, Cleveland; "Utility Development in West Virginia," A. Bliss McCrum, secretary Utilities Association, Charleston, W. Va.

THURSDAY, JULY 12

*Morning.*—"Future Emphasis in Public Utility Regulation," Prof. C. O. Ruggles, Columbus; report of new-business co-operations committee, C. G. Eichelberger and A. C. Shepherd; "Merchandising Wiring," G. H. Miller; "Merchandising Light," A. E. Turner; "Merchandising Appliances," C. S. Beardsley.

*Afternoon.*—"League of Nations or a World Court?" Newton D. Baker; report of meter committee, J. L. Wright.

FRIDAY, JULY 13

*Morning.*—Report of transmission and distribution committee, R. R. Krammes; report of station-operating committee, J. J. Dolan; "Mechanical Stokers and the Future of Burning Coal," C. F. Herrington; "Generation of Steam by Powdered Fuel," Joseph G. Worker; election of officers.

## Ford May Generate 25,000,000 Kw.-Hr. a Year at Ironwood

The Ford Motor Company of Detroit has applied to the Wisconsin Railroad Commission for a permit to construct, operate and maintain a dam in the Menominee River in Florence County, Wis. The dam would be 400 ft. long and 30 ft. high, designed to provide water power to develop 25,000,000 kw.-hr. of electrical energy annually for the Ford plant in northern Michigan. The site is 3 miles west of Ironwood, Mich., which is the boundary between Wisconsin and upper Michigan.

## Southern Power Suit Off

**Dispute with North Carolina Cotton Mills Is Settled, the Latter Paying Rates Asked**

A JUDICIAL order in the United States District Court in Greensboro, N. C., signed by Judge James E. Boyd, brought to a close the long-pending litigation between the Southern Power Company and sixteen cotton mills in North Carolina. As previously related in the ELECTRICAL WORLD, the Southern Power Company sued the mills for sums alleged to be due for electrical energy at rates fixed by the North Carolina Corporation Commission and many of the mills refused payment, alleging breach of contract and that the new rates were excessive. Judge Boyd's order, which explains the basis of settlement, reads:

"The plaintiff [Southern Power Company], through its attorney, W. S. O'B. Robinson, Jr., having come into court at this, the June term, 1923, and announced that the defendant [the mill company in each case] has fully paid the alleged indebtedness for the recovery of which this action was instituted, and that all matters of difference between the parties have been settled, and having consented that this action be dismissed at the cost of the plaintiff, except that no attorney's fees be taxed in the costs, it is adjudged that the plaintiff's action be and the same is hereby dismissed and that the plaintiff pay the costs to be taxed by the clerk, but that no attorney's fees be included in the costs."

Although there were only sixteen defendants in the action affected by this final decree, a total of twenty-six suits were settled, there being in some instances two suits against the same defendant company.

## Weaver's Books on French History Go to Princeton

Among the many interests of the late W. D. Weaver, long the editor of the ELECTRICAL WORLD, was the study of the French Revolution, and his collection of books and pamphlets on this period of history was an extremely valuable one, comprising three thousand or more entries. In the later years of his life this collection was housed in Mr. Weaver's residence at Charlottesville, Va., where he delighted to show it to his friends and visitors.

The collection has just been purchased by James H. McGraw, president McGraw-Hill Company, and by him presented to Princeton University for incorporation in its library. In making the donation to Princeton through President John Grier Hibben, Mr. McGraw said that he was prompted by his high regard for Mr. Weaver and by a motive to make the valuable collection available to students of Princeton and "to show my appreciation of what Princeton University has done for the higher education of the young men of our time."

# Public Service, Industry and Business

### These Three Fields for the Engineer Are Discussed Before the S. P. E. E. at Ithaca—Educational Specialization by Function as Well as by Industry Advocated

OTHER proceedings of the annual meeting of the Society for the Promotion of Engineering Education, held at Cornell University, Ithaca, N. Y., last week, besides those summarized in the ELECTRICAL WORLD for June 23, included a paper by T. H. MacDonald, chief of the Bureau of Public Roads, Washington, D. C., on "The Engineer as a Leader in Public Service," in which he said that, although the public does not hastily impose authority on any class or group of men, but waits for demonstrations of competency, the accomplishments of engineers have changed the conception of government and modified the ways heretofore used to support human existence. Regulatory commissions he termed a fourth branch of the government, constantly engaged in constructive investigation and research.

"The Engineer as a Leader in Transportation" was the topic of E. H. Lee, chief engineer Chicago & Northern Indiana Railroad, who told how human relationship became important and is now the primary factor in railroad development.

#### THE ENGINEER IN INDUSTRY

Dealing with "The Engineer as a Leader in Industry," O. S. Lyford of the National Industrial Conference Board, whose paper was the result of the work of a joint committee, said that engineers should be leaders because they have a well-considered method of attack and a scientific mind. Three questions presented themselves: Does industry need more or fewer engineers than are now available? What kind of education should they have? What is the responsibility of the industry in their work? Final answer can be had only through co-operative effort. One big factor will be the keen competition of European countries when they emerge from the present political, financial and industrial slump.

The percentage that the college men bear to the adult males of the nation is, Mr. Lyford pointed out, very small. We have 129 engineering schools with 53,000 students enrolled. They form an essential part of industry, and industry is showing a growing tendency to select and use them. A study of graduates who have been out of Rensselaer, Harvard, Lehigh and Stevens for five, ten, twenty and twenty-five years shows a decided shift from engineering work to other work as years elapse. Some of the shift is due to failure, but most is due to a logical change in occupation and promotion to positions of leadership and responsibility.

The following recommendations of a group of executives were embodied in Mr. Lyford's paper: (1) Methods of selection should be improved; (2) better fundamental training is needed and not specific training; (3) broader training should be given; (4) more practical training for instruction should be required, and (5) more practical training should be incorporated with the theoretical, preferably during the course. The paper was discussed by Dean A. A. Potter of Purdue, Dean P. F. Walker of Kansas and Prof. P. M. Lincoln of Cornell.

#### THE ENGINEER IN BUSINESS

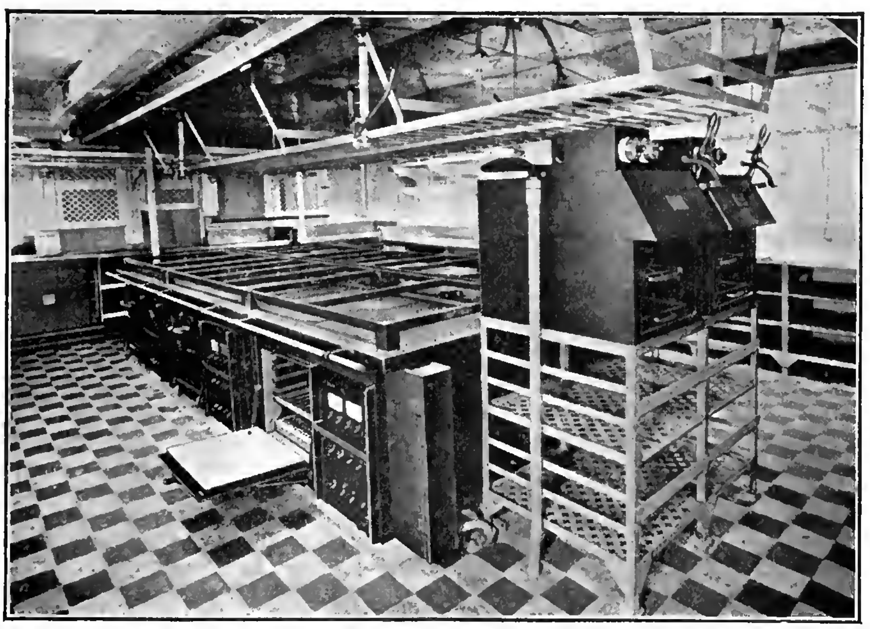
W. E. Wickenden, assistant vice-president American Telephone & Telegraph Company, spoke on "The Engineer in Business," and read a report from a committee which held that a broader equipment must be possessed by engineering teaching staffs and that economic and physical analyses should be a larger element in the pedagogical process. The broad viewpoint of engineering must, the report said, be the engineering and economic adaptation of science for industrial and social well being. The place of the engineer as a leader in business is not assured, Mr. Wickenden asserted, although his leadership in industry is assured. The business world is dominated by considerations which offer handicaps to engineers, and leaders cannot be produced in standardized lots by schools. They possess no standardized qualities. He cautioned the educators about attempting to train leaders directly through any college course.

#### FUNCTIONAL TRAINING

Prof. Edward Bennett of the University of Wisconsin presented a carefully reasoned paper on "Engineering Courses for the Functional Rather than the Industrial Divisions of Engineering." He made a plea for the recognition of the necessity for a new type of specialization in engineering education, grouping the functional divisions under the basic classifications "sales," "management," "supervision," "design" and "research," which all alike should run through the industrial engineering divisions—civil, mining, mechanical, electrical, chemical, etc., each with its various subdivisions. "The distinctive general feature of the functional engineering courses," said Professor Bennett, "should be the separate provision for the needs of men of superior aptitude and for those of moderate aptitude by profoundly technical and moderately technical treatments of the different branches of science, particularly of the introductory mathematics and physics of the first two years."

Prof. H. E. Dyche, head of the department of electrical engineering of the University of Pittsburgh, discussed

## Electric Cooking and Galley Equipment on Leviathan



THE accompanying photograph shows an electric range and broiler in the Ritz-Carlton galley of the steamship Leviathan, which will leave on its first trip to Europe in its reconditioned form as an American passenger ship on July 4. The service in the Ritz-Carlton galley is completely electric, consisting of six Edison hotel-type heavy-duty ranges, two smaller-size broilers and one No. 200 baking oven. In the dining rooms electrically heated service tables keep the courses at right temperatures while meals are being served, reducing the waiters' trips. All serving pantries and bars are equipped with a small griddle or two-burner hot plate for serving. Without electric equipment this class of service is impossible on board ship.

The entire cooking and galley installation on the Leviathan is the product of the Edison Electric Appliance Company, Chicago.

'Fundamentals" as applied to electrical engineering courses, giving a symposium of opinions expressed by many electrical engineers and executives.

Dean Perley F. Walker, dean of the School of Engineering of Kansas University, was elected president of the society for the coming year.

# Divisional Work Praised at Minneapolis

### Its Advantages Find Recognition from Delegates to North Central Geographic Division, N. E. L. A.—Distribution Losses, Rural Lines and Safety Discussed

HOW the best brains of the industry have been made available to all central-station men who care to avail themselves of the opportunities offered by the organization and work of the National Electric Light Association and its geographic divisions was recounted by L. O. Gordon of Albert Lea, Minn., in discussing the value of the North Central Geographic Division to operators of small plants before the convention of this division at Minneapolis held last week from Wednesday to Friday. Pointing out the opportunity that the small-plant operators have to come together in the geographic division meetings for a discussion of their individual problems and the way in which the work of all the national committees is brought directly to the members of the divisions, he expressed the opinion that attendance at the division meetings is of greater benefit to the small than to the large operators.

C. G. Hadley of Rochester, Minn., dwelt upon the work of the national association in the coal-supply troubles, the work of the accounting and rural lines committees and the public relations work as things that in themselves had returned more to the small-plant operators than the dues of the association had cost. Further discussion brought out the view that convention programs should be arranged to promote informal discussion of common problems among men unaccustomed to public speaking and discussion, and action was taken to arrange for such discussions at the next meeting.

Lee Boyer of Deadwood, S. D., thought that more attention should be given construction and operation. Public relations, he said, are relatively less important in very small communities because close personal contact with customers necessarily exists there.

#### Reducing System Losses

Pointing out that losses of energy up to 35 per cent were not uncommon in small distribution systems, D. M. Bunn of Minneapolis said that the three-phase, four-wire system meets distribution needs best and provides the greatest capacity per dollar invested. He criticised the common practice in minor plants of putting up too small copper and too many transformers of small capacity and recommended a careful study of territory so that future growth could be provided for and the practice of tacking on conductors and equipment without consideration of their effect on losses avoided. He gave an example of the difference between a two-wire No. 8 copper-wire secondary circuit which had been found in use in a small system and the three-wire No. 6 circuit that was substituted, losses between the transformer and the consumers' premises being reduced from 7.6 to 4.4 per cent. Mr. Bunn recommended reducing the number of transformers to as low a value as possible, using the larger sizes as a means of cutting the energy losses. The effect of poor power factor in causing losses was brought out, and the speaker cited instances in which the use of synchronous or static condensers had not only improved distribution conditions but had made actual savings to power customers who were purchasing energy under a rate with a power-factor penalty clause.

S. B. Hood called attention to the need of using induction regulators in securing economy. Lee Boyer characterized the use of No. 8 copper wire on overhead lines as a fallacy because of its lack of mechanical strength and said that care must be taken in the location of condenser equipment so that as far as possible the transfer of wattless current can be avoided. Oscar Gaarden questioned whether some of the uses suggested for condenser equipment could be justified, saying that the installation of such equipment was a matter of balancing the cost against the savings.

#### Electricity as a Plant Hazard

In discussing accident prevention C. B. Scott of Chicago said that, though an analysis of ten thousand accidents in central-station work had shown that only 9 per cent were due to electricity, this 9 per cent included 75 per cent of the fatalities, 70 per cent of the lost time and the same percentage of the cost. Switching operations, carelessness in killing and re-energizing lines and overloading of apparatus are, he said, principal causes of accidents. He criticised linemen for their frequent violation of fundamental safety rules and obstinate failure to use safety devices. Accidents were due 88 per cent to man failure and 12 per cent to condition of the physical property. Careful selection of men, constant preaching of individual responsibility and, above all, close supervision are the remedy.

Arthur Huntington of the Iowa Railway & Light Company told of the organization of the Committee on the Use of Electricity in Agriculture, in which the American Farm Bureau Federation. National Electric Light Association, American Society of Agriculture, Department of Agriculture and individual electric plant manufacturers are interested.

Prof. G. D. Shepardson of the electrical engineering department of the University of Minnesota urged co-operation between the electrical and agricultural interests, suggesting among other things a study of the use of electric trucks on the farm, refrigeration, irrigation in the non-irrigated sections of the country and the study of industries of the manufacturing type that might be developed in the rural sections as off-season occupations. Highway construction would better load factors on rural lines.

#### Farmer Has Right to Electricity

Prof. E. A. Stewart of the agricultural department of the state university said that the use of electrical energy by the farmer might not be profitable in all cases, but, regardless of this, the farmer is entitled to its use as a means of improving his living conditions. He said that the farmer must expect to pay the cost of the service and in a keen analysis of rate forms pointed out the weakness of the minimum-charge forms of rates, which, he said, either by a high minimum charge and a low energy rate or a low minimum charge and high energy rate discouraged the use of energy. Professor Stewart said that a fixed service charge and a low energy rate was the best means of building up usage. He criticised the lack of uniformity in building lines and giving service, said that this had created distrust in the mind of the farmer and called attention to a form of contract being worked out in the department of agriculture in the state university.

C. A. Atherton, chairman of the rural electric service committee of the American Society of Agricultural Engineers, said that the discussion of the problem among so many groups was promising and brought greater possibilities of a solution.

J. E. Davidson, vice-president of the National Electric Light Association, gave a summary of the work of the association during the past year and told of the convention in New York. Henry S. Ives of Chicago, speaking for the insurance interests, took a strong stand against government control of business. N. W. Kingsley of the Northwestern Bell Telephone Company gave a chalk talk on the causes of and remedies for inductive interference. W. J. Canada, engineer of the National Electric Light Association, also spoke on this subject.

The convention was the largest held in the four years of the existence of the division, 405 being registered. R. M. Howard of Winona, Minn., was elected president for the coming year, with G. O. House of St. Paul as vice-president. Recommendation was made to the executive committee that a permanent secretary be engaged. It was also recommended that a committee on public utility information be formed.

## New York Electrical Society Seeks Sustaining Members

To cover the increased expenses which have lately confronted the New York Electrical Society it is proposed by constitutional amendment to establish a class of "sustaining members" which will be recruited from individuals, companies, firms or associations "interested in the objects of the society and desirous of contributing to its support." The annual dues for this new class of members will be $10 for individuals and $25 to $100 optionally for companies, firms or associations. An appeal will be sent out for a liberal enlistment of sustaining members throughout the metropolitan district, and no doubt is felt that it will meet a full response from individuals and organizations interested in the development and progress of the electrical industry.

The New York Electrical Society is the oldest electrical society in the country and has had an uninterrupted history of achievement. Its activities are of such a broad character that they do not conflict with, but rather supplement, the work of other electrical societies and associations. Philip Torchio is president and Thomas Commerford Martin secretary of the society.

## Georgia Electrical Association Meets at Tybee

At the second annual convention of the Georgia Electrical Association, held at Tybee on June 21, President L. W. Roberts, Jr., led a discussion on the subject of the letting of general building contracts and electrical installation contracts separately.

A plea for the use of non-technical terms in selling electrical goods to the retail trade was made by M. C. Turpin of the Westinghouse Electric & Manufacturing Company. Mr. Turpin said that two of the largest electrical goods firms have recognized the value of a well-trained sales force and are emphasizing this phase of their distribution system. He asserted that there are seven million electric flatirons in use in the United States and that nearly four million vacuum cleaners are now installed in the homes of the country. The majority of the three and a half million fans in use are in business offices, and Mr. Turpin pointed out the field for the sale of fans in the homes. He also discussed window-display and other methods of advertising.

W. D. Yates of the General Electric Company also addressed the gathering. New officers were elected as follows: President, J. E. Mellett, Atlanta; vice-president, Henry Morton, Columbus; secretary-treasurer, W. C. Drake, Atlanta. The members of the executive committee, of which Norton Frierson of Savannah is chairman, are C. F. Ludwig, Dublin; Joseph McNeil, Augusta; Sam Hatfield, Macon, and F. C. Landors, Valdosta.

# Brief News Notes

**Cedar Rapids to Have New Turbine.**—The Iowa Railway & Light Company has ordered a 10,000-kw. turbo-generator for its Cedar Rapids plant which is expected to be installed before the end of the year. In the boiler room a 680-hp. boiler with a chain-grate stoker will be installed. The total cost will be $500,000.

**Fort Dodge Spending $750,000 for Extensions.**—Construction work on the new generating plant of the Fort Dodge (Iowa) Gas & Electric Company, to cost $750,000, is rapidly progressing. The foundations are completed and boilers are being installed. Operation of the first unit will be started about Nov. 1. When completed the plant will have a capacity of 15,000 kw.

**Savannah Companies Are Merged.**—The Savannah (Ga.) Electric & Power Company has arranged to purchase the entire business and plant of the Savannah Lighting Corporation for the sum of $1,062,894. The electric company has applied to the Georgia Public Service Commission for authority to issue $1,000,000 of two-year 6½ per cent gold notes to be utilized in the purchase of the lighting corporation.

**Consumers' Power Said to Have Absorbed Citizens' Electric of Battle Creek.**—The Citizens' Electric Company of Battle Creek, Mich., which has for some time been in the hands of a receiver, has been disposed of by public sale for $765,000 to an agent thought to be acting for the Consumers' Power Company, in whose territory Battle Creek has long been included. The sale must be confirmed by the courts and approved by the Michigan Public Utilities Commission.

**War Radio Code Drawn Up.**—A complete code governing the use of wireless in time of war is the unique feature of the agreement on war rules by representatives of the governments of the United States, France, England, Italy and Japan, assembled at The Hague under authority of a resolution adopted at the Washington Arms Conference. It is the first time such a code has been drafted. By this code a neutral vessel or airship transmitting military intelligence for the immediate use of a belligerent will be subject to attack or capture.

**Montana Power Company Volunteers Rate Reduction.**—The Montana Power Company has requested the Public Service Commission of Montana to permit it to make a voluntary reduction in its rates. The action comes in answer to a citation to show cause why there should not be a substantial reduction. The new schedule proposed by the power company provides for a reduction ranging from 2 cents per kilowatt-hour for the first 100 kw.-hr. to 4 cents for all consumption in excess of 150 kw.-hr. for residential service. The rates are designed to save from $288,000 to $300,000 a year to 40,000 customers.

**Interconnection in Ohio.**—Toledo became a part of the great power transmission line tying together Pittsburgh, Youngstown, Warren, Alliance, Canton and the Toledo district recently when the connecting line between Toledo and Pemberville went into operation at 66,000 volts. At the latter city the power goes over the lines of the Ohio Power Company to Fostoria and from there over the lines of the Ohio Public Service Corporation to Cleveland, Mansfield and other Ohio cities. The link between Warren and Alliance has also gone into operation. It transmits energy at 132,000 volts.

**Reduction in Indianapolis Charges.**—A considerable reduction in the rates for electrical energy charged large industrial consumers in Indianapolis by the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company has been ordered by the Indiana Public Service Commission, effective at once. The reduction will benefit several hundred firms and will in some cases be as much as 10 per cent. It is estimated that it will reduce the revenue of the first-named company from $80,000 to $100,000 a year and that of the Merchants' company from $40,000 to $50,000 a year. The new rate includes a demand charge of $1.25 a month per kilowatt and an energy charge of from 2.2 cents to 1.3 cents a kilowatt-hour. A reduction to domestic consumers was made about a year ago.

**Seeks Consolidation of Seven New York Companies.**—The New York Central Electric Corporation, which has been active in western New York during the last few months, has petitioned the Public Service Commission for permission to consolidate its western New York utilities companies in one organization and also for permission to finance the work. The companies that are to be consolidated are the Hornell Electric Company, the Perry Electric Light Company, the Warsaw Gas & Electric Company, the Dansville Gas & Electric Company, the Yates Electric Light & Power Company of Pen Yan and the Wayne Power Company of Sodus. These concerns have all been purchased by the corporation, which is a subsidiary of the E. L. Phillips interests of New York. The company asks permission to issue $4,100,000 in securities for the development of its property. It is reported that the company is contemplating a large hydro-electric development in southern New York.

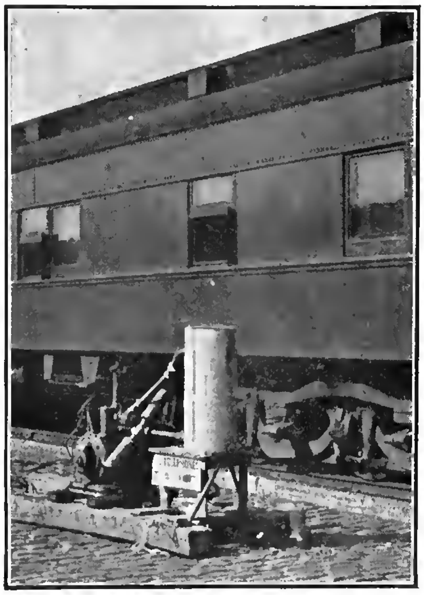
**Kansas Company Expands.**—The Empire District Electric Company of Kansas has ordered from the Westinghouse Electric & Manufacturing Company a 20,000-kw. turbo-generator unit for its station at Riverton. The turbine will be a high-pressure, condensing-type machine and will operate on 190 lb.

gage steam pressure, 120 deg. superheat and 29 in. vacuum. It will be provided with four openings for bleeding steam to heat the boiler-feed water. The unit will be designed so as to be converted readily for operation with 350 lb. steam pressure and 200 deg. superheat, since it is the company's intention to operate on this pressure later on. The turbine will be designed for a maximum rating of 25,000 kw. The generator will be designed for 25,000 kva. and will be wound for three-phase, 25 cycles and 6,900 volts, to operate at 1,500 r.p.m. It will be excited by a 250-volt flat compound-wound exciter. The total length of the unit will be 52 ft. and it will have a net weight of approximately 933,000 lb.

**"Overelectrification" Demoralizing New Yorkers, Says French Savant.**—New York City is in a bad way from "overelectrification," according to a French savant who just returned home from America in bad health, which he attributes to the action of the enormous number of electric currents of New York on his nervous system. Who this savant is is not revealed, but he has confided his case and what he believes to be its cause to a scientific writer, Dr. Charles Nordmann, who in an article declares his belief that his friend's complaints are well founded. Neither Dr. Nordmann nor the sufferer from New York will go so far as to say that the inhabitants of that city are either all sick or all crazy as the result of the partial electrocution from which they suffer every day, but there is an implication in Dr. Nordmann's article that many may be thus affected, however sublimely unaware of it they may be. He declares stoutly and with apparent seriousness his opinion that the overelectrification of cities is undoubtedly affecting the nerves, health and brain capacity of city dwellers.

**Promoting International Standardization.**—The second conference of secretaries of national standardizing bodies will be held in Baden, Switzerland, July 3 to 7. The American Engineering Standards Committee will be represented at the conference by its secretary, P. G. Agnew, who sailed June 20. Following the conference, Mr. Agnew will make a study of the industrial standardization work in the European countries in which it is most active. As a result of the first conference, which met in London in April, 1921, systematic co-operation between the different bodies was initiated and is now in effect. It is expected that the coming conference will lead to the extension of such co-operative work, which at present is largely limited to the systematic interchange of information on the status of industrial standardization activities in the various countries. There are now national standardizing bodies in eighteen countries, and it is expected that almost all of them will be represented. These are Australia, Austria, Belgium, Canada, Czechoslovakia, Denmark, Finland, France, Germany, Great Britain, Holland, Hungary, Italy, Japan, Norway, Sweden, Switzerland and the United States.

**Electricity Helps Turn Pullman Trains Into Hotels.**—Washington, D. C., was confronted with a great problem in the accommodation of the thousands of outsiders who visited the national capital during the recent Shriners' council. Nearly four hundred pullmans in the yards of the Pennsylvania Railroad were used as hotels, accommodating ten thousand persons, and in order to keep the storage batteries charged to furnish light and power for the electric fans 130 "Farmelectric" lighting plants, with a capacity of 1½ kw. each, were installed between the tracks on skids, each machine charging three cars at once. No two plants were nearer



each other than 200 ft., and in many cases they were several hundred yards apart. These lighting plants could not only furnish the energy cheaper than by any other method, but as the pullmans use 32-volt current, no alteration in the batteries was necessary.

**Oklahoma Properties Little Damaged by Flood.**—The Oklahoma Gas & Electric Company's properties suffered virtually no damage in the recent Oklahoma flood. The plants of the company, including construction work under way, were unharmed, despite the fact that the waters rose in Oklahoma City to the highest stage on record. Untiring work by the operating and construction forces of the company was responsible in large measure for the manner in which the properties in inundated sections withstood the ravages of the waters. One reason for the small damage was the strategic locations of the plants with respect to flood danger. During the entire flood period electric service was given to all properties. The new 20,000-hp. Harrah plant of the company under construction at Horseshoe Lake, 23 miles from Oklahoma City, and the 30,000-hp. River Bank power station under construction on the Arkansas River, 4½ miles from Muskogee, suffered no damage whatever.

# Associations and Societies

**Seattle Section, A. I. E. E.**—Charles Lund of the Municipal Lighting Depart- of Tacoma has been elected chairman and Joseph Hellenthal of the Puget Sound Power & Light Company secretary of the Seattle Section, A. I. E. E., for the ensuing term.

**Boston Section, A. I. E. E.**—The following officers were elected by this section at its recent annual meeting: Chairman, Alexander Macomber; vice-chairman, F. S. Dellenbaugh, Jr.; secretary and treasurer, Ira Cushing; executive committee, E. W. Davis, J. W. Kidder and W. R. McCann.

**Meetings of Association of Electragists.**—Coming section meetings of the Association of Electragists International (the contractor-dealer body) are announced as follows: Lakes Division (Michigan, Ohio, Indiana, Illinois and Wisconsin), Chicago, July 12; Central Division (Minnesota, Iowa, Missouri, Kansas, Nebraska, North and South Dakota), Omaha, July 13; Mountain Division (Idaho, Montana, Wyoming, Utah, Colorado and New Mexico), Denver, July 16; Pacific Division (Southern California and Arizona), Los Angeles, July 20; Pacific Division (Middle California), San Francisco, July 23; Pacific Division (Oregon and Washington), Portland, July 25; Western Canada Division (British Columbia, Alberta, Saskatchewan and Manitoba), Vancouver, B. C., July 27. The national officials of the organization who make this trip will visit also Salt Lake City on July 18, Calgary, Alberta, on July 30 and Moose Jaw, Saskatchewan, on July 31. The national convention will be held on **Oct. 8-13** at Washington, D. C.

## Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Ohio Electric Light Association — Cedar Point, July **10-13**. D. L. Gaskill, Greenville.

National Electrical Credit Association—Boston, Aug. 9-10.

New England Division, N. E. L. A.—Swampscott, Mass., Sept. 6-8. Miss O. A. Bursiel, 149 Tremont St., Boston.

Michigan Electric Light Association—Grand Rapids, Sept. 11-13. Herbert Silvester, Detroit Edison Co., Ann Arbor.

Rocky Mountain Division, N. E. L. A.—Glenwood Springs, Col., Sept. 17-19. O. A. Weller, 900 15th St., Denver.

Illuminating Engineering Society—Lake George, N. Y., Sept. 24-28. S. G. Hibben, 29 West 39th St., New York.

Association of Iron and Steel Electrical Engineers — Buffalo, Sept. 24-28. J. F. Kelly, 513 Empire Bldg., Pittsburgh.

Indiana Electric Light Association—French Lick Springs, Sept. 26-29. T. Donahue, Northern Indiana Gas & Electric Co., Lafayette, Ind.

American Electrochemical Society—Dayton, Ohio, Sept. 27-29. Colin G. Fink, Columbia University, New York.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

## Commission Rulings

**Pole Preservation—Merchandise Expense—Investment of Depreciation Fund.**—In prescribing rates for the Kootenai Power Company, the Idaho Public Utilities Company made these among other decisions: The cost of treating poles in order to extend their life should be included in the capital account. Expenses connected with merchandise sales should not be included in operating expenses when revenues from merchandise sales are not included in the estimate of return. The company was required to invest at least 60 per cent of the depreciation fund not reinvested in the plant in income-bearing securities in the selection of which the chief consideration would be that of safety.

**Effect of Transmission-Line Loss on Rates.**—Holding that a higher rate must be charged for energy delivered to a distribution company over a long line with a comparatively large line loss than for energy delivered to a company having a shorter line with comparatively little line loss, the Maine Public Utilities Commission, in increasing the rates of the Farmington Falls Electric Company, declared that rates should be increased when it appears that power is purchased by the wholesale company at 3 cents a kilowatt-hour, transmitted over its lines for varying distances, and then sold under contract for the same or a less rate to the distributing company, since it is self-evident that such loss, if continued, would impair the ability of the company to render service.

**Chattel Mortgages on Crops as Security for Service to Irrigation District.**—A requirement by the Idaho Power Company that the Gem Irrigation District make advance payment for power used for pumping was not considered reasonable by the Idaho Public Service Commission, in spite of the fact that the district was in arrears for charges assessed during past years. It appeared that it was impossible to raise a cash payment, that chattel mortgages on crops had been accepted in the past and had been collected by officials of the district for the present year, and that any delay would seriously threaten the success of agriculture in the district. The power company was required to accept such chattel mortgages, although these mortgages had previously proved unsatisfactory, the commission holding that since these mortgages were all the security the district could muster, under the circumstances a refusal to accept them, although possibly justifiable financially, would not be reasonable. On the other hand, it was held that under these circumstances the power company was justified in supplying the district only in such amounts and at such times as power might be available from its present power plant and not required for the service of other customers, in view of the fact that its inability to build additional capacity wherewith to meet all demands imposed in its field was due in some part to the failure of the district to make payment.

**Maryland Commission on "Reproduction Cost New."** — Condemning the "lavish expenditures" of the Baltimore Gas, Electric Light & Power Company in presenting nearly 6,000 pages of testimony besides about 500 printed pages of briefs in support of its case in the recent rate proceedings before the Maryland Public Service Commission, "of which appalling array of words and figures the greater part relates to the reproduction-cost-new appraisal presented by the company," the commission said: "The company's experts adopted as a premise words cut from the pages of the highest judicial opinions, and by abstract logic deduced the familiar theory advanced by utilities that the Supreme Court of the United States authorizes the company to present and requires the commission to give an almost controlling consideration to the cost new of a theoretical plant constructed by the brain processes of the expert on the witness stand, through the employment of imaginary promoters, lawyers, financiers, general and sub-contractors and workmen, at a cost that includes every conceivable omission, contingency or expense short of the romantic and ridiculous, in a market admittedly unable to supply the needed material in the assumed period of two years, all in a city like unto the real Baltimore in population, improvements, commerce and industry, but conceived as hitherto without central gas and electric plants. We cannot agree that the courts have decreed that this administrative body, dealing as did the General Assembly before it with the rates of each utility as a problem all its own, must, in order to proceed according to due process of law, ignore the thousands of facts concerning this company and its properties which the commission knows and which its staff had learned as a part of the day's work in the twelve years of commission control during which the present plants have been largely constructed, facts of which the records and proceedings of the commission constitute a faithful chronicle and which the books of the company would, at the will of its officers, settle beyond all doubt. . . . Having clearly in mind the ends and aims of commission rate making and knowing that these can be attained only by treating each utility as a particular problem with all facts presented and otherwise ascertainable receiving due consideration, we must acknowledge that we have given but little weight to the 'reproduction cost new' appraisal of a theoretical plant as presented by the company when both commission and company have means of finding the present fair value of the real utility property. . . . We do not read the decisions as requiring us to do otherwise than we have done in this case."

## Recent Court Decisions

**Rates Established by Commission Cannot Be Altered by Company Unless Disallowed by Court.**—In Kilworth vs. Citizens' Light, Heat & Power Company of Lawrence, Kan., a dispute as to the effect of a federal court decree led the company to promulgate new rates including a service charge. The Kansas Supreme Court, holding that the federal court decree had not set aside the rate, and declaring that until the rate established by the rate-making authority has been set aside by a court of competent jurisdiction the utility has no right to promulgate a rate of its own or to make an added charge for the services rendered, disallowed the company's new rates and ordered the extra charge, which had been impounded, returned to customers. (212 Pac. 86.)*

**Water Site Owned by Utility May Be Expropriated.**—The Scituate Light & Power Company and others lost suits to prevent possible expropriation of their property for waterworks purposes by the city of Providence, R. I., through a decision recently rendered by the United States Supreme Court. The Rhode Island Legislature passed an act authorizing Providence to investigate a new source of water supply in the north branch of the Pawtucket River. It was stipulated that a fair price should be paid for any property necessary to this water supply and that the cost of removing to another site in New England any mill or factory on such property should be paid by the city. The complainants, whose property would be affected, alleged the act to be unconstitutional. The Supreme Court sustained its constitutionality, as had the State Supreme Court.

**Testimony to Good Condition of Electric Installation Alleged to Have Caused Fatality Raises Issue of Fact Merely.**—Reversing a directed verdict for the defendant and remanding the case for retrial, the Supreme Court of Iowa, in Welsh vs. Charles Frusch Light & Power Company, held that testimony to the good order of the wires alleged to have caused the death of a woman whose body was found near her washing machine merely raised a question of fact for the jury. Evidence of burns which went to show that she was killed by electric shock threw on the company the burden of explaining the assumed overloading of the wires extending into the basement with an excessive and dangerous current on some theory consistent with its exercise of due care in the maintenance, care and management of its system, notwithstanding any defect in the washing-machine motor. (193 N. W. 427.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

## H. T. Sands Elected a Vice-President of N. E. L. A.

Howard Tuxbury Sands, who was elected fourth vice-president of the National Electric Light Association at its recent convention in New York, has been identified with the electrical industry since 1896, when he joined the Mechanics Falls Water, Electric Light & Power Company as superintendent of construction for a hydro-electric plant at Mechanics Falls, Me. He served there as superintendent, wireman, meterman, bookkeeper, collector, station mechanician and station operator. From 1901 to 1905 he was at Auburn, Me., as superintendent of the electric light company, relinquishing that post to become manager of the Haverhill (Mass.) Electric Company. Since that date Mr. Sands has been connected in various capacities with different properties of Charles H. Tenney & Company of Boston.

H. T. SANDS

Mr. Sands' election as a vice-president of the National Electric Light Association is the natural result of his distinguished services during the past year as chairman of the Public Relations Section of the association and of his untiring efforts in the successful establishment and maintenance of the New England Bureau of Public Service Information, which has contributed so much to the promotion of amicable relations between the public and the utilities in New England.

**E. L. Milliken**, assistant manager of the Blackstone Valley Gas & Electric Company, Woonsocket, R. I., has been made chairman of the management section of the Providence Engineering Society.

**C. S. Anderson**, formerly electrical engineer for the Duquesne Light Company, Pittsburgh, is now connected with the Electric Bond & Share Company, New York.

**C. Melvin Sharpe** has been made executive assistant to William F. Ham to assist particularly in the direction of the activities of the Washington (D. C.) Railway & Electric Company. Mr. Sharpe formerly was associated with the Chamber of Commerce of the United States but comes directly to his new position from the La Salle Extension University of Chicago.

**Arthur Kempston**, formerly Los Angeles district manager of the Majestic Electric Development Company, has become associated with Charles T. Phillips as a partner in the Charles T. Phillips Company, consulting engineers of San Francisco. Mr. Kempston was for a number of years city electrician of San Francisco and later was a field representative of the California Electrical Co-operative Campaign.

**F. M. Farmer**, chief engineer of the Electrical Testing Laboratories, New York, is at present in Europe for the purpose of comparing European cable practice with modern practice in the United States. He is studying especially the high-tension cables and the prospects for development in this field. Mr. Farmer will visit the various testing laboratories and his itinerary will include visits to England, France, Italy, Germany, Switzerland, Belgium and Holland.

**Gerhard M. Dahl**, who played a conspicuous part in the recent reorganization of the New Orleans Railway & Light Company as the New Orleans Public Service, Inc., was elected on June 14 to be chairman of the executive committee of the board of directors of the Brooklyn-Manhattan Transit Corporation. Mr. Dahl is a past vice-president of the Electric Bond & Share Company and is at present on the executive committee of the New Orleans Public Service, Inc., and a director of the Alabama Power Company, the Alabama Traction, Light & Power Company, the Lehigh Power Securities Corporation, the Duquesne Light Company and other utilities.

**Gen. James G. Harbord**, president of the Radio Corporation of America, accompanied by Mrs. Harbord, sailed for Europe on Wednesday, June 27, on the French liner *Paris*. General Harbord will attend the meeting of the Consortium of International Radio Corporations, which convenes on July 5 in London to discuss plans for a world-wide radio system. He will also be the representative of the War Department at the dedication of Belleau Wood by the Belleau Wood Memorial Association. **Owen D. Young**, chairman of the board of directors of the Radio Corporation and of the General Electric Company, and **Edward J. Nally**, managing director of international relations of the Radio Corporation, also sailed to attend the radio conference.

## Reginald M. Campbell Resigns

Reginald M. Campbell, who was appointed last year special representative of the American Copper Products Company with headquarters in New York City, recently resigned. For eight years previous to his association with the American Copper Products Company Mr. Campbell was identified with the Habirshaw Electric Cable Company, which he joined when he severed his connection with the Ohio Brass Company. He is well known in electric light and electric railway circles and also in the steam-railroad field. Mr. Campbell is a member of the New England Street Railway Club and the Railroad Club and Engineers' Club of New York. His present address is Engineers' Club in New York.

R. M. CAMPBELL

**J. B. Carter**, formerly district manager at Corcoran for the San Joaquin Light & Power Corporation, has been made agricultural sales engineer for the company with headquarters in Fresno. **Fred C. Carroll**, formerly assistant manager at Merced, will succeed Mr. Carter at Corcoran.

**R. G. Cushing**, formerly electrical engineer with the Winchester Repeating Arms Company, New Haven, Conn., has joined the electrical engineering division of Stone & Webster, Inc., with headquarters at Boston. Other recent additions to the electrical engineering division include **H. O. Murphy** of the engineering staff of the Bedford (Ind.) Stone Company and **Chester C. Dodge**, formerly of the marine engineering department of the General Electric Company at Schenectady.

**J. W. O'Brien**, line and service superintendent of the Utah Power & Light Company in the Ogden district, has been made division manager at Park City, Utah.

**Ralph A. Belmont** has received an extended leave of absence as sales manager of the Beaver Machine & Tool Company of Newark, N. J. While Mr. Belmont is away Lester H. Appel will be general sales manager.

**Dr. H. W. Nichols** of the research department of the Western Electric Company has been made the recipient of the Fahie premium by the Institution of Electrical Engineers of London, England, for his lecture on transoceanic wireless telephony.

**Morgan Brooks**, professor of electrical engineering at the University of Illinois, has just returned from Europe, where he spent the past nine months in travel combined with study of things electrical in Europe. Readers of the ELECTRICAL WORLD will recall Professor Brooks' "Intimate Notes from Italy," which appeared in the Nov. 18 issue. He expects to spend some time in the East before returning to Illinois.

**Calvin L. Jones**, welding engineer of the Westinghouse Electric & Manufacturing Company, Atlanta, has been elected vice-president of the American Welding Society. Mr. Jones has been elected for a two-year term and will be in charge of the activities of the society in its Southern division.

**Lee C. Mason**, treasurer of the Indiana & Michigan Electric Company, South Bend, Ind., has resigned from that position in order to take up the management of the new National Storage Warehouse Company. Mr. Mason's resignation takes effect July 1. He has been connected with the electric company for nineteen years.

**Charles G. Blakeslee** of Binghamton, N. Y., has been appointed counsel to the Public Service Commission of New York State, succeeding Ledyard P. Hale, whose resignation became effective today. Mr. Blakeslee was appointed a member of the commission in 1921. His term expired early this year, when he was succeeded by James A. Parsons of Hornell.

**Eli F. Bush**, formerly connected with the sales department of the Western Electric Company at Los Angeles, has resigned to practice law in that city. Mr. Bush has been with the Western Electric Company for the past two and a half years and before going to Los Angeles was in the Philadelphia office of the Westinghouse Electric & Manufacturing Company.

**E. Whitmore**, first vice-president and treasurer of the Manhattan Electrical Supply Company, Inc., New York, will retire from the company July 1. Mr. Whitmore became associated with the company shortly after it was formed thirty-three years ago. Rising from the ranks, he has served as general manager, secretary and vice-president and treasurer.

F. S. TERRY

## F. S. Terry and B. G. Tremaine General Electric's New Officers

Franklin S. Terry, chairman of the advisory board of the National Lamp Works, Nela Park, Cleveland, was elected vice-president of the General Electric Company and B. G. Tremaine, vice-chairman of the advisory board of the National Lamp Works, was elected a director at a meeting of the board of directors held in New York City on June 22. Mr. Terry was a pioneer in the incandescent-lamp business and has been an active promoter of progress in electric lighting. In 1880 he became associated with the Electrical Supply Company of Ansonia, Conn., his native town, and four years later he was sent to Chicago to establish a branch office there. In 1889 he organized the Sunbeam Incandescent Lamp Company of Chicago, of which he took personal charge on leaving the Electrical Supply Company in 1893.

It was at this time that Mr. Terry made the acquaintance of Mr. Tremaine, who, like himself, had conceived the idea of bringing together the numerous lamp companies that were fighting to maintain their existence. In 1901 their purposes were realized and the National Electric Lamp Company has its inception. Ten years later, when the company was merged with the General Electric Company, Mr. Terry and Mr. Tremaine were made managers of the National Lamp Works at Nela Park. Previous to his association with Mr. Terry Mr. Tremaine had not confined his efforts to any one particular line of work. He organized a fire-insurance business in Cleveland and later allied himself with a real-estate concern. In 1898 he became connected with the Cleveland Gas & Electric Fixture Company, and in 1899 he became a director and stockholder of an electric railway corporation in Fostoria, Ohio, where he helped organize the Fostoria Incandescent Lamp Company. In the latter part of the same year he met Mr. Terry, then manager of the Sunbeam Incandescent Lamp Company.

B. G. TREMAINE

**M. M. Myers**, formerly in the Eden washing machine department of the Union Electric Light & Power Company of St. Louis, has recently been made factory representative in St. Louis of the Sunbeam Electric Manufacturing Company of Evansville, Ind., maker of the Sunbeam "Surf-action" electric washer.

# Obituary

**Henry N. Spencer**, president of the Howell Electric Motors Company, Howell, Mich., died at his home in that city on Monday, June 4.

**W. R. Abbott**, manager of the Denver branch of the American Steel & Wire Company, died in that city June 18 after a short illness. Mr. Abbott took an active part in the affairs of the Colorado Public Service Association and various civic organizations in Denver.

**Charles A. Kilbourne**, president of the Kilbourne & Clark Manufacturing Company of Seattle, which he organized in 1900, died recently at Nyack, N. Y. Mr. Kilbourne was a pioneer of Seattle, having established the Seattle Electric Company, which was taken over by Stone & Webster interests.

**Chauncey C. Baldwin**, for more than twenty years connected with the Standard Underground Cable Company at Perth Amboy, N. J., died at his residence there June 7 after a brief illness. Mr. Baldwin had been one of the outstanding figures in the copper-rolling and wire-drawing industry for many years. His connection with the Standard Underground Cable Company dates from 1902, when he became superintendent and manager of its metal departments at Perth Amboy, including its copper-melting furnaces and equipment for the production of copper and brass rods and wire, weatherproof tubes and magnet wire products. In 1916 he was elected a vice-president of that company, which position he held at the time of his death. He took an active part in local affairs and for some years past had been president of the Perth Amboy Industrial Association.

## Work for Trade Associations*

### Importance of Production and Distribution Statistics—Need of Collective Action by Organizations to Secure Beneficial Standardization—Educating the Buyers


By F. M. Feiker

Special Representative United States Department of Commerce


During the first year of Herbert Hoover's administration as Secretary of the Department of Commerce definite steps were taken by that department to correlate its activities and services with the trade associations of the country. With this idea in mind committees were established in statistics in standardization, in foreign trade and other subjects. Soon after the department undertook to co-ordinate the work of the associations with the services of this branch of the government came the so-called "Hardwood decision," of the Supreme Court, which was open to a variety of interpretations by trade association executives, and as a result the department was deluged with inquiries as to what trade associations might do and might not do. These inquiries concerned particularly the gathering of statistics. The department, in order to answer intelligently the questions being put to it from a great variety of trade associations, undertook an inquiry into the activities of such bodies, with the result that forty or fifty separate activities were found, a large proportion of which could in no sense be construed as not in the public interest.

This inquiry resulted for the time being in the so-called Daugherty correspondence, in which the department asked the Attorney-General a group of hypothetical questions, which he in turn answered, with the idea of eliciting what were and were not fair and unfair practices in trade association activities.

My inquiries into these matters at Mr. Hoover's direction led me into a very much deeper study of the whole question of trade associations, with the result that, with the co-operation particularly of E. W. McCullough, chief of the Fabricated Production Division of the Chamber of Commerce of the United States, and Nathan Williams, counsel for the National Manufacturers' Association, I gathered together a very detailed classification of the constructive activities of trade associations, which later was rearranged and classified into a broad classification of about fourteen headings, including statistics, legislative activities, simplification, standardization, cost accounting, credit, collection activities, trade disputes in ethics, employee relations, insurance, public relations, traffic and transportation, commercial research and industrial research.

#### Practice Varies Widely

Three or four general truths stand out of this investigation of several hundred trade associations. It is evident that the practice of individual associations varies widely. Some of them have only one or two of the fourteen or fifteen classes of activities suggested. Others have perfected five or six of the activities, and others have found that emphasis on one or two is the true purpose of the association and constitutes the vital interest of its members. Very few trade associations have their objectives stated broadly or definitely enough. This misunderstanding of objectives has tended to create misunderstandings not only between members in a single group, but between associations and societies of various kinds, with the result that there is a considerable overlapping, and time and money would be saved by the opportunity that exists to coordinate and help give a sense of direction to the different movements within a trade.

A book or two might be written on this subject. The chief point to emphasize is that the trade association offers a natural clearing house for the collection of statistical data, in which most industries are lamentably weak. Many industrial policies, not only of individual businesses but of a group of businesses as a whole, are based either on partial knowledge or on a complete lack of definite statistical information. The development of statistics ranges through the whole field of manufacturing and of marketing, starting with production statistics, taking up employment statistics of various classes, shipments, sales, stocks on hand, orders and cancellations and the whole field of price quotations.

Production statistics of one kind or another have been collected for more than sixty years, and there is more information in the statistics of production than in any other single field of statistical inquiry, and yet here there are great gaps in essential production statistics even with regard to such basic commodities as agricultural products. Some associations, such as the Rubber Association of America, make monthly reports to the Bureau of Census and these monthly reports form the basis for the public distribution of the information. The *Survey of Current Business*, which is published by the Department of Commerce under the auspices of the Bureau of Census, brings together several classes and groups of production statistics. The greatest paucity of information lies in the field of statistics of distribution.

An interesting side-light on the collection of industrial statistics is the fact that the average group of manufacturers is more interested in the statistics of the people from whom they buy and to whom they sell than in the collection of their own data. They forget they are the sources of supply or the market in their turn for other classes of industry. They forget that there is no such thing as one industry being apart from all others, that there is an interdependence between all industries. The plate-glass manufacturers, for example, are very much interested in the trend of the production of automobiles because plate glass enters into the manufacture of

*An address before the meeting of the Electric Power Club at Hot Springs, Va., June 11-14, 1923.

automobiles so extensively today, and in their turn every automobile manufacturer is as much interested in the agricultural statistics which represent the farmer's buying power as he is in the relative output of his own product as compared with the total number of cars produced by all manufacturers. We can never get a basic statistical control in business until we have much more highly developed sources of statistical information and, what is probably much more important, a development of the practical use of such statistics to go hand in hand with the development of the statistics themselves.

### LEGISLATIVE ACTIVITIES

Next to the statistical activities, by far the larger number of trade associations and organizations of manufacturers are interested in legislative activities in various forms. Inquiry into the activities of associations in this respect touches on practically all classes of legislation, including tariffs and subsidies, transportation and traffic legislation, trade restriction and trade practice, laws affecting standardization and the establishment of standard specifications such as pure food and drug laws, labeling and branding, and so on. There are, of course, measures directly pertaining to labor, conditions of employment, employment insurance laws, labor welfare and labor union relations and so on.

Several associations have special committees working directly with the various government departments. The main purpose of the association in this direction is to act as a fact center, and, public opinion to the contrary, if a trade association procures the facts and sets them forth in a non-partisan manner, with the interests of the public as well as the trade in mind, the legislative committees of our state and federal governments will be found eager for these facts. By way of illustration, the legislative committee of the National Automobile Chamber of Commerce, working in harmony with similar committees of the automobile associations, the Rubber Association, the Motor Accessories Association and other bodies, has proposed uniform vehicle laws, so that interstate travel of motor vehicles will not be handicapped by the lack of uniformity between states. Scores of illustrations of this constructive legislative development can be given.

It is estimated that the automotive industry alone saved $750,000,000 in 1920 by the adoption of the dimension standards of the Society of Automotive Engineers. One implement and vehicle manufacturer told me that he had cut his inventory $200,000 because of carrying through the work that he had undertaken as a result of his War Industries Board activities.

Broadly, there are two classes of programs involved in association activities in standardization and simplification. Standardization in general involves technical or scientific laboratory research, while simplification is more a matter of commercial procedure and involves rather the question of dimensions and the elimination of excess variety and style.

My observation of the work of associations is that the greatest need lies in putting technical standards into actual commercial practice. After all, it is the buyer who determines whether standards will stick, and in a broad way, the education of the buyer has not been sufficiently included in the consideration of the broad problems in simplification and standardization which touch an individual industry.

### COST ACCOUNTING

In the paper industry and in the manufacture of chairs, also in the Paint Manufacturers' Association and several of the textile organizations, very advanced work has been done in devising uniform cost systems. In the promotion of uniform-cost determination associations should be warned against arbitrary uniform costs as to any items of expense. In the so-called Hoover and Daugherty correspondence the Attorney-General has said that it is as clearly a violation of the law to agree upon the cost of an item that constitutes a substantial part of the total cost price as it is to agree upon sales price. But much work can be done in the direction of the assurance of uniform cost accounting by the plan carried out, for instance, by the Harvard Graduate School of Business Administration. The need is to be sure that every individual in an association or trade group figures his costs on the same number and kind of items. Individual costs per item may differ, but the total cost should include the same number and kind of items.

Individual members of an industry often gain by agreeing to give to a trustee, which may be a trade association, a power of attorney to grant licenses to other members under all patents which they own, with the understanding that the trustee will license every member of the association to employ all of the patented inventions either with or without a reasonable money consideration. The National Automobile Chamber of Commerce solved many vexing legal problems by adopting this method, so that today most of the leading automobile manufacturers receive without payment of money royalty the full benefit of all improvements in motor-car construction.

### COMMERCIAL AND INDUSTRIAL RESEARCH

The functions of commercial research involve, broadly speaking, general and trade information service, commercial development and promotion publicity and protective measures, whereas industrial research involves questions of technical development and co-operation between manufacturers investigating common technical problems. It was recently estimated that $35,000,000 is spent each year by American enterprise in research in industry and commerce. Seventy trade associations, besides other manufacturers, are concentrated upon research, and trade association investment in research involves sums up to $100,000 annually. It is becoming more and more apparent that there are problems of common interest which are so fundamental and of such broad application that the resulting data interest many manufacturers' establishments, and that this type of research may be conducted without interfering with competitive interests or the relative commercial positions of the co-operating firms.

Two main subjects stand out from my study of the trade association movement in the United States. The first is the fact that the only way to solve some of the problems facing industry is through collective action by organizations. While the association idea has been fairly well established as a method of accomplishment, there are still many who forget that co-operation means that all individuals banded together carry a much greater load than that which each individual carries.

The second great principle that stands out of this survey is that there are two sides to any problem,

whether it be a problem of sale of a product, sale of a service or sale of an idea. One is the seller's side and one is the buyer's side. Associations representing sellers in general sometimes forget the buyer and emphasize primarily the selfish motives of the seller. They also sometimes forget that what the seller sets up as ideal may be turned down by the buyer, so that the ideals established will be nothing more than paper standards.

### Associations' Real Opportunities

This last observation applies particularly to the work of standardization in industry, and it seems to me that one of the real opportunities that face the members of the Power Club and other electrical associations is the opportunity for educating the buyer in industry. It is quite possible to set up standards which are useful in the development of manufacturing and the reduction of production costs. These the members of an association themselves control. It is quite possible to set up standards which are intrinsically much better from an engineering viewpoint. But there remains the commercial consideration of what is the buyer's relation to such standards. Until the buyer is convinced as to the value of particular standards established they cannot be enforced on any basis of economics. The good old law of supply and demand is the only one that we in America wish to see applied in the development of a less wasteful program for industry. We do not wish to see the government step in and say, "You must do so and so." We resent it when any single group, whether of manufacturers or labor leaders or a professional class, steps forward and says, "This is the way you must do something." Rather in America we believe in taking the buyer's point of view into consideration so that the conclusions we arrive at shall be acceptable to both him and ourselves.

This requires education of the buyer. We are fortunate in America to have a technical press which has this vision of its service to industry. This is one of the great forces of industrial education. But there are greater opportunities for the collective education of the buyer through association activity that are being used in some associations and are not being taken advantage of in others. In selling agricultural commodities, where the Sherman law does not hold, collective advertising of trade-marked brands is possible as a part solution for the problem I have outlined. Such a program is not economically possible where the manufacturers are prevented from banding together by the Sherman law and where such action might be in restraint of trade. But the opportunity for collective advertising, for example, of a program of standardization is a sound one, if it is not confused with the opportunity of the individual to advertise. In this direction several associations have done important work.

Another great opportunity facing the electrical industry particularly is the study of markets. We have grown as an industry as engineers. We ought not to take too much satisfaction in the growth of our industry because a large percentage of that growth is due to the normal demand and not to any high enterprise on our part.

All of us are now approaching a time when enterprise is needed, if we are to keep the curve of sales upward, and we have through the association an opportunity for collective action in marketing programs which is very specific and very definite. I look to see this organization take steps in this direction, because we all believe that there is still great opportunity for the application of electricity in the "pursuit of life, liberty and happiness" in the United States.

# Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

FUNDAMENTAL conditions in Eastern district business were mainly sound at the beginning of this week, and representative jobbers were handling a large volume of trade in heavier wiring material, fans and lamps. Stocks were reported complete in nearly all lines, although buying has been strictly confined to requirements evident in the near future and to current demands.

Prices were fairly steady last week. Interest in electric ranges is growing rapidly in this district. Washers and cleaners were in good supply Monday, with intense competition for business. Retail trade of a seasonal sort has responded to the warm-weather stimulus. A lull in the textile industry continues, and building contracts fell off sharply last week compared with last year.

Money is fairly easy. The demand for linemen exceeds the supply, and central-station extension work is being hard pressed in some cases on this account. A split between unions in the telephone field throughout New England made it appear probable Monday that the strike called for Tuesday would lose many adherents.

Sales activities on behalf of jobbers and manufacturers are marked throughout this territory, and a large amount of business is being handled by distributors and many records are being chalked up by electrical concerns in the way of maximum volume of sales, units of product or output in many cases considerably exceeding the 1920 figures.

### Wiring Device Manufacturers Report Spotty Sales

MANUFACTURERS of wiring devices report a reduced demand of late for sockets and switches, although the production of the latter for electric range use is increasing rapidly in volume, this being the brightest spot at the moment in this branch of trade. In some plants employees have been laid off temporarily, while in others sufficient work is on hand in the way of building up stocks and filling back orders to keep production active for some time.

Jobbers are buying with great care and there is little disposition in territories where distributors are located near the manufacturing plants to accumulate stocks much above current

### Comparative Prices of Station Supplies

| | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|
| Soft steel bars, per lb. | \$0.034 | \$0.034 | \$0.0252 |
| Cold finished shafting, per lb. | 0.042 | 0.042 | 0.0325 |
| Brass rods, per lb. | 0.1850 | 0.1913 | 0.155 |
| Solder (half and half), per lb. | 0.2862 | 0.2812 | 0.22 |
| Cotton waste, per lb. | 0.1231 | 0.1231 | 0.104 |
| Washers, cast iron (½-in.), per 100 lb. | 4.66 | 4.66 | 4.00 |
| Emery, disks, cloth, No. 1, 6-in. diameter, per 100 | 3.08 | 2.96 | 3.11 |
| Machine oil, per gal. | 0.349 | 0.349 | 0.34 |
| Belting, leather, medium, off list | 42½% | 42½% | 46¾% |
| Machine bolts, up to 1-in. x 30-in., off list | 44¼% | 44¼% | 59¾% |

requirements. Wiring-device makers have enjoyed a very fine spring business, as a rule, and in well-informed circles one hears little pessimism as to the prospects for next winter's business.

Wages have been maintained at a high level, and deliveries of brass and porcelain have given considerable trouble until quite recently. In fact, the porcelain situation is reported as still abnormal, uneven filling of orders tending to delay the delivery of complete shipments in many cases. There seems little doubt that the inordinate demands of labor in the building trades have put a brake on the progress of wiring-device production for the time being, at least in some localities.

Prices are somewhat unsteady, reflecting readjustment tendencies. South American business is fairly good, according to wiring-device exporters.

## Estimates $125,000,000 Will Be Spent for Transmission Lines

BETWEEN 125,000,000 lb. and 200,000,000 lb. of copper will be consumed for transmission lines to be erected this year at a cost of approximately $125,000,000, according to estimates made last week by the Copper and Brass Research Association. A statement issued by the association last week says in part: "The estimated expenditure of $900,000,000 for transmission-line construction in the United States during the next five years will afford a market for copper wire and cable of between 900,000,000 lb. and 1,500,000,000 lb."

## Chicago Jobbers and Dealers Have Quiet Business

CHICAGO jobbers and dealers have experienced a quiet week, although wiring device sales have stiffened up somewhat and demand for rubber-covered wire has progressed. Some lower prices were being quoted on future deliveries of lead-covered wire, but no reductions in prices were announced. Pole-line hardware and high-tension equipment sales have been good, as central-station buying keeps up.

The unusually warm weather which descended upon this territory this week caused a demand for fans. Sales were very numerous and jobbers placed large orders. The number of fans sold this week is considerably above the number sold last year at this date.

## Denver Suffers Slight Slump in Building Operations

A SLIGHT slump in building operations during the past fortnight has been noted. This is generally believed due to propaganda about high building costs and the advisability of waiting six months, a year, or even longer, to consider additional construction. Large buildings and industrial projects have not been affected, while in the case of dwellings, in so far as electrical work is concerned, the prices charged to the public are not so high as those in force two years ago.

The banks indicate a secure financial situation. In the agricultural areas farmers are being accommodated to a major degree, and with the prospects of good crops, the outlook is more optimistic than in 1922. The storms sweeping Wall Street have hardly created a ripple in local financial circles. In fact, bankers seem to be more interested in the call-money rate than in stock-market fluctuations.

Government reports state that every able-bodied man in the Rocky Mountain region who wants to work can get a job. Industrial plants linked with building materials are running to capacity. New railroad construction in Montana, Wyoming and New Mexico is making more jobs for workers, and business as a whole in those sections is better.

## Gain of $1,201,368 Shown in April Electrical Exports

TOTAL exports of electrical machinery, apparatus and appurtenances for April were $5,981,191, a gain of $1,201,368 over April, 1922, when the total amounted to $4,779,823. In March, 1923, total electrical exports amounted to $6,344,842. The accompanying figures are supplied by the Bureau of Foreign and Domestic Commerce.

## The Metal Market

THE metal market has been inactive without exception all week. Consumers all report that their plants are as busy as the supply of labor will permit, but there continues to be less business booked ahead, and with the general tendency to a decline in the commodity price level, they are not buying metal so far forward as normally.

The export copper market has tapered off somewhat, but the volume is still fairly good, at prices netting producers about ¼c. above domestic business.

NEW YORK METAL MARKET PRICES

| | June 21, 1923 Cents per Pound | June 28, 1923 Cents per Pound |
|---|---|---|
| Copper, Electrolytic | 15.25 | 14.87½ to 16.00 |
| Lead, Am.S.& R.price | 7.25 | 7.25 |
| Antimony | 7.50 | 7.50 |
| Nickel, ingot | 27.00 to 32.00 | 27.00 to 32.00 |
| Zinc, spot | 6.37 | 6.00 |
| Tin, Straits | 41.90 | 41.00 |
| Aluminum, 98 to 99 per cent | 26.00 | 26.00 |

ELECTRICAL EXPORTS FOR APRIL, 1923, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

| Articles | Value April 1922 | 1923 |
|---|---|---|
| Turbines | $122,947 | $35,290 |
| Generators: | | |
| Direct-current: | | |
| Under 500 kw | 34,268 | 87,953 |
| 500 kw. and over | 107,803 | 58,211 |
| Alternating-current: | | |
| Under 2,000 kva | 31,354 | 9,846 |
| 2,000 kva. and over | 114,000 | 259,453 |
| Accessories and parts for generators | 10,202 | 72,040 |
| Self-contained lighting outfits | 22,622 | 53,812 |
| Batteries: | | |
| Primary | 87,511 | 112,220 |
| Storage | 109,300 | 211,249 |
| Transforming and converting apparatus: | | |
| Transformers— | | |
| Power | 124,337 | 255,865 |
| Other | 117,461 | 40,012 |
| Rectifiers, condensers, double-current and motor generators, dynamotors synchronous, and other converters | 45,814 | 89,626 |
| Transmission and distribution apparatus: | | |
| Switchboard panels, except telephone | 227,911 | 190,198 |
| Switches and circuit breakers above 10 amp | 157,974 | 182,256 |
| Fuse and fuse blocks | 15,169 | 26,601 |
| Meters and measuring instruments: | | |
| Watt-hour, and other measuring instruments | 73,662 | 50,341 |
| Volt, watt, and ampere meters and other recording indicating and testing apparatus | 64,218 | 74,712 |
| Lightning arresters, choke coils, reactors, and other protective devices | 30,571 | 29,265 |
| Motors, starters and controllers: | | |
| Motors under 1 horsepower | 54,126 | 267,178 |
| Stationary motors 1 to 200 horsepower | 212,567 | 259,772 |
| Stationary motors over 200 horsepower | 82,585 | 8,462 |
| Railway motors | 300 | 3,466 |
| Electric locomotives: | | |
| Railway | ........ | 242,177 |
| Mining and industrial | ........ | 78,035 |
| Other motors | 59,966 | 19,608 |
| Rheostats, controllers and other starting and controlling equipment | 43,170 | 147,684 |
| Accessories and parts for motors | 65,633 | 137,132 |
| Electrical Appliances, etc.: | | |
| Electric fans | $96,593 | $25,080 |
| Electric lamps: | | |
| Incandescent— | | |
| Carbon filament | 6,123 | 10,161 |
| Metal filament | 78,237 | 77,138 |
| Other electric lamps | 11,096 | 21,012 |
| Flashlights | 10,707 | 48,183 |
| Searchlights and projectors | 18,096 | 18,820 |
| Motor-driven household devices | 58,489 | 91,273 |
| Domestic heating and cooking devices | 59,947 | 48,122 |
| Industrial electric furnaces and ovens | 11,205 | 12,514 |
| Therapeutic apparatus, X-ray machines, galvanic and Faradic batteries, etc | 52,988 | 71,216 |
| Signal and communication devices: | | |
| Radio and wireless apparatus | 116,221 | 244,195 |
| Telegraph apparatus | 43,088 | 30,843 |
| Magneto telephones | * | 17,354 |
| Other telephones | 290,188 | 10,887 |
| Magneto switchboards | * | 2,639 |
| Other telephone switchboards | * | 4,341 |
| Railway signal switches and attachments | 54,332 | 39,964 |
| Bells, buzzers, annunciators and alarms | 4,985 | 13,435 |
| Other electrical apparatus and appurtenances: | | |
| Spark plugs, magnetos and other ignition apparatus | 85,852 | 132,115 |
| Insulating material | 57,127 | 157,470 |
| Metal conduit, outlet and switch boxes | 26,790 | 41,476 |
| Sockets, receptacles and lighting switches | 28,061 | 76,813 |
| Other wiring supplies and fixtures | 86,652 | 158,262 |
| Other electrical apparatus not elsewhere specified | 770,127 | 706,347 |
| Globes and shades for lighting fixtures | 42,110 | 34,340 |
| Electrical glassware, except for lighting | 9,736 | 13,401 |
| Electrical porcelain | 107,784 | 122,420 |
| Electrical carbons, carbon brushes and electrodes | 49,928 | 151,592 |
| Insulated wire and cable (iron or steel) | 23,819 | 58,313 |
| Other manufactures of aluminum | 64,815 | 49,906 |
| Copper: | | |
| Bare wire | 308,340 | 158,230 |
| Insulated wire and cable | 190,916 | 270,943 |
| Total electrical machinery apparatus and appurtenances | $4,779,823 | $5,981,191 |

* Not separately stated prior to Jan. 1, 1923.

# Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

## Wagner Electric Pays Preferred Stock Dividends

The directors of the Wagner Electric Corporation, St. Louis, directors at a recent meeting voted to pay the regular quarterly dividend of $1.75 per share on the 15,000 shares of 7 per cent preferred stock of the company. These dividends are to be payable July 1, 1923. The officers of the company report sales for the month of May as the largest of any month of the current year.

A general price advance of 10 per cent on practically all of the well-known lines of the company became effective May 15. The cash position of the corporation continues to be very comfortable—current liabilities being confined entirely to merchandise obligations not yet due and without bank borrowings of any character.

## Canadians Remain in Control of Canadian General Electric

Control of the Canadian General Electric Company, which has large factories in Toronto and in Peterboro, will remain in Canada, A. E. Dyment, president of the company, declared last week, commenting on a revival of rumors that the Canadian organization would be absorbed by the General Electric Company, of Schenectady, N. Y., on Sept. 1.

He declined to discuss the reported merger and asserted there had been no change in the status of his organization as a Canadian corporation.

It was reported some time ago that the American company had acquired a large block of stock in the Canadian company and was seeking a controlling interest.

## Offers Prize for Best Electric Locomotive for Coal Mines

Lieut.-Col. G. R. Lane Fox, British Secretary for Mines, announces that, in order to encourage the production of a safe and efficient type of electrical storage-battery locomotive for use underground in coal mines, and with a view to displacing pit ponies in deep and hot mines, Charles Markham, colliery director of Ringwood Hall, Chesterfield, has placed at his disposal the sum of £1,000, to be offered as a prize for the best vehicle. Judges representative of the coal-mining industry of Great Britain, the Institutions of Mining and Electrical Engineers and the Mines Department have been appointed to lay down the conditions under which the competition is to be conducted and to adjudicate upon the merits of competing designs.

The competition will be open to manufacturers of any nationality and will remain open for a period adequate to allow competitors in foreign countries and the British Dominions to submit their designs. Working trials in England of those vehicles selected for test will subsequently be arranged.

The preliminary details in connection with the competition are approaching completion and a formal announcement will shortly be made of the conditions.

## Promoting "Universal" in Denver

H. W. Woeber, representative of the electrical department of Landers, Frary & Clark in the Denver territory, is assisting the Moore-Bird Company, recently organized as a hardware distributing agency at 1720 Wazee Street, in the development of an electric appliance department featuring "Universal" equipment. Mrs. Lena West, factory demonstrator, has been assigned to Denver for special development work in conjunction with the display to be made by Landers, Frary & Clark at the Colorado "pageant of progress" in July.

## Orton & Steinbrenner Election

The Orton & Steinbrenner Company, 608 South Dearborn Street, Chicago, manufacturer of material-handling equipment, announces the election of the following officers: P. A. Orton, president and general manager; E. B. Ayers, vice-president; Herbert Mertz, secretary and sales manager; Harry Shaffer, treasurer and purchasing agent; G. L. Niederst, chief engineer, and Alex Orton, works manager.

No change in the management, control or policy has been made, nor is any contemplated. The reorganization is occasioned only by the resignation of H. G. Steinbrenner as president and the disposal of his interest in the company.

## Louis Allis Appointments

The Louis Allis Company, manufacturer of direct-current and alternating-current motors, Milwaukee, announces the following changes and additions to its sales representation:

The H. M. Thomas Company, Oakland Bank Building, Oakland, Cal., has recently been appointed as exclusive sales representatives for the entire State of California; E. H. Albrecht & Company, 309 Lewis Building, Portland, Ore., have been appointed as exclusive sales representatives for Oregon; J. W. Jones, 704 Pontiac Building, St. Louis, has been appointed as exclusive sales representative for the St. Louis territory.

## Plans Habirshaw Wire Merger

Plans for the reorganization of the four Habirshaw wire and cable companies have been worked out and copies were sent last week to the holders of securities of the four companies concerned. The four concerns will be consolidated into one company, known as the Habirshaw Electric Cable Company. The companies to be thus merged are the present Habirshaw Electric Cable Company, the Electric Cable Company, the Habirshaw Electric Cable Company, Inc., and the Bare Wire Company.

The new company will take over the properties of the four existing concerns and in turn issue new stock, both preferred and common. Equal voting privileges will be accorded both the preferred and the common stockholders. The preferred stock issue will consist of $1,500,000 of $100 par stock and the common stock will be comprised of 300,000 shares. The preferred stock is to be used for sale to depositing creditors and the underwriting syndicate. Half of the common stock issue will be distributed to depositing creditors and the other half will be sold to depositing creditors and the underwriting syndicate.

It was announced that Dillon, Read & Company would underwrite 15,000 shares of preferred and 150,000 shares of common stock of the new company. Part of the proceeds will be used for the settlement of claims of the United States government and for payment of taxes, obligations and liabilities of receivers and for additional working capital.

The plan of reorganization was worked out by Malcolm D. Whitman, chairman of the committee; J. B. Beaty, Wylie Brown, F. J. Leary, E. A. Potter, Jr., E. N. Potter and T. E. Quisenberry.

## Campaign Against Unscrupulous Battery Makers and Sellers

With the announcement that it purposes to curb and, if need be, to aid in the prosecution of deceptive advertising in the battery and automotive electrical fields, the national vigilance committee of the Associated Advertising Clubs of the World and its affiliated better-business bureaus and commissions have launched a campaign against unscrupulous manufacturers and dealers.

That some service stations known and advertised as the authorized representatives of well-known manufactures are prone to trade upon the established good name of reputable concerns through the substitution of foreign or inferior parts in the reconstruction of batteries is the contention of the vigilance committee.

"The automobile owner is at the mercy of a battery station in the matter of having his battery charged, changed, rebuilt or repaired," says a special report issued by the committee, "for the reason that it is impracticable to dissemble a battery and identify the parts.

"If the owner wants the repair parts put out by the maker of his battery," the report continues, "he is entitled to receive them, even though there may be repair parts made by others which could be used just as efficiently. Substitution under such circumstances constitutes a fraud upon the public and jeopardizes the good will and reputation of the battery manufacturer which the service station purports to represent."

The vigilance committee states that complaints have come to it from many sources to the effect that the motoring public is being imposed upon from time to time by unscrupulous concerns which offer a remedy for all battery troubles through the medium of pastes, fillers, solutions and other compounds to take the place of regular electrolytes. Tests and analyses of several of these "dope" solutions indicate that, while they apparently give a battery greater momentary "kick," they oftimes contain ingredients which are absolutely ruinous to the plates and separators, thereby shortening the life of the battery from 50 to 75 per cent.

Purchasers are warned to inquire carefully regarding such solutions, and assure themselves that the substitute they are procuring has real merit and will not damage the battery, before placing their orders.

Another misleading and sometimes fraudulent feature attends the manner in which many so-called "dry batteries" are advertised, the committee says. Some of these are exploited as "new and wonderful" inventions that "never need to be taken to a service station," that "require no water" nor added charge "no matter how long in use," "cannot freeze," etc.

## Beaver Machine & Tool Moves General Office to Newark

The Beaver Machine & Tool Company, Newark, N. J., announces the removal of its general office from 50 Church Street, New York City, to 625 North Third Street, Newark, where the company has just completed a new wing for office use, affording additional space for sales and executive offices.

The Hotpoint Electric Appliance Company, Ltd., of 21 Berners Street, Oxford Street, London, has been appointed sole selling agent for the British Isles by the Beaver Machine & Tool Company, Inc., manufacturer of the "Beaver" line of wiring devices.

## Denver Supply Firm Organized

W. J. Keating, formerly one of the executives of the Electrical Supply & Construction Company, Denver, has organized a new company, which was recently incorporated under the name of the United Electric Company. Associated with him in the new undertaking are A. P. Ware and S. S. Keating. It is understood that a line of lighting fixtures and parts will be distributed and that a manufacturing plant and plating works will be operated.

**The Bristol Company**, Waterbury, Conn., manufacturer of measuring instruments, has taken bids for a large two-story addition to its plant in the Platts Mills section.

**The Watertown Manufacturing Company**, Watertown, Conn., manufacturer of insulating products, has awarded a contract for a one-story addition, 70 ft. x 120 ft., which is estimated to cost $50,000.

**The Continental Storage Battery Manufacturing Company, Inc.**, 111 West Washington Street, Chicago, recently organized with $15,000 capital stock, has leased 4,000 ft. of floor space at 221 East Twenty-first Street, Chicago, to manufacture storage batteries and storage-battery plates. J. W. McCormack is the president of the company.

**The Rome Wire Company**, Railroad Street, Rome, N. Y., will commence the immediate erection of a new addition to its branch plant on Clyde Street, Buffalo, to cost about $70,000. Plans have been filed.

**The Acheson Graphite Company**, Niagara Falls, N. Y., has perfected plans for the reopening of its Buffalo plant, constructed during the war period and inactive for some time past. It will be operated in conjunction with the Niagara Falls works and given over exclusively to the production of heavy electrodes for electric steel furnaces.

**The Seneca Copper Corporation**, 120 Broadway, New York City, is arranging for a bond issue of $1,500,000, of which $1,000,000 will be sold at once, a portion of the proceeds to be used for extensions and improvements.

**The Electric Signal Manufacturing Company**, Miami, Fla., recently formed with a capital of $500,000, will operate a local plant for the manufacture of electric signal apparatus. H. W. LaVan is president.

**The Walker Vehicle Company**, Chicago, manufacturer of electric trucks, announces the opening on June 1 of its new service station at Thirteenth Street and Ely Avenue, Long Island City, New York. E. T. Teepe is service manager.

**The Eureka Vacuum Cleaner Company**, Detroit, on June 14 held a dinner at the Hotel Pennsylvania, New York City, in honor of Fred Wardell, president, and A. L. McCarthy, its vice-president and general sales manager. More than three hundred salespeople connected with its Eastern sales agencies were present.

**The Bijou Motor Appliance Company**, Fifteenth and Garden Streets, Hoboken, N. J., manufacturer of electric lighting and starting equipment, has been acquired by the General Electric Company for a consideration said to be $250,000 and will be continued in operation for the same line of production, with certain additions. The purchasing company is also understood to have secured the rights of manufacture of the Bijou equipment.

**The Crescent Insulated Wire & Cable Company**, North Olden, Trenton, N. J., has awarded a contract for a one-story addition to its plant.

**The Chambers Manufacturing Company**, Butler, Pa., manufacturer of farm-lighting plants and other electrical equipment, has acquired a plant at East Butler, Pa., and will remove to that location. Additional equipment will be installed.

**The Spaulding Electric Company**, 1344 Michigan Avenue, Detroit, James G. Spaulding president, is taking bids on a general contract for a new one-story plant on Michigan Avenue for repair and parts manufacture, estimated to cost $25,000.

**The Pyle National Company**, 1338 North Kostner Avenue, Chicago, manufacturer of locomotive lighting equipment, searchlights, floodlights, etc., has awarded a contract for a two-story buffing shop, 45 ft. x 69 ft., at 1358 North Kostner Avenue, to cost $25,000.

**The Triumph Electric Company**, Cincinnati, announces the removal of its offices in New York City to 25 Church Street. George F. Adams is in charge.

**The Birtman Electric Company**, Chicago, manufacturer of house-cleaning devices, has opened offices at 2003 Magnolia Building, Dallas, Tex., with Fred E. Roegge as Southern division manager. Dallas has been chosen as one of the ten divisional distribution centers in the United States.

**The Niagara Blower Company**, Buffalo, has opened a new plant at Ontario Street and the New York Central Railroad tracks.

**The North American Manufacturing Company**, Cleveland, has opened a branch office at 53 West Jackson Boulevard, Chicago, to handle low-pressure gas and oil burning equipment.

**The American Insulator Company**, Danbury, Conn., manufacturer of electrical insulators, etc., has completed plans for the erection of a new one-story addition, to be equipped as a drying and heater department. Another extension will be constructed to the polishing department.

**The Locke Insulator Company**, Charles and Cromwell Streets, Baltimore, manufacturer of insulators for high-tension service, has filed plans for the construction of two additions, 60 ft. x 80 ft. and 32 ft. x 40 ft. Parker, Thomas & Rice, Union Trust Building, Baltimore, are architects.

**The Edwin F. Guth Company**, St. Louis, lately incorporated, will take over and merge the St. Louis Brass Manufacturing Company, Washington Street, and the Brascolite Company, Jefferson and Washington Streets, the last noted having been operated as a subsidiary of the St. Louis Brass Company. The new company will continue in the same line of electric lighting equipment manufacture, and plans are being considered for general expansion in the different departments. Edwin F. Guth is president.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Rotterdam, Netherlands (No. 6,959), of ammeters for motorcycles.

An agency is desired in Wellington, New Zealand (No. 6,877), for electrical supplies and specialties.

Purchase is desired in Apia, Samoa (No. 6,881), for equipment for hydro-electric plants and appliances for home lighting, etc.

Purchase is desired in Malmo, Sweden (No. 6,955), of lamps, wire, heating appliances and specialties; also purchase (No. 6,955) of wiring devices.

An agency is desired in Liège, Belgium (No. 6,938), for electric motors.

Purchase and agency is desired in Ahmedabad, India (No. 6,968), for electric motors, electrical fixtures, fittings, sundries, and lamps particularly.

Purchase is desired in Rivière du Loup, Canada (No. 6,888), for radio equipment.

Purchase or agency is desired in London, England (No. 6,908), of radio parts of all kinds.

An agency is desired in Rio de Janerio, Brazil (No. 6,926), for specialties, such as storage batteries and lighting fixtures.

An agency is desired in Vienna, Austria (No. 6,935), for air compressors with electric motors. Purchase and agency is also desired (No. 6,886) of automobile equipment, including lamps, etc.

CABLE TERMINALS FOR BRISBANE, AUSTRALIA.—Tenders will be received by the Postmaster-General's Department, Brisbane, Australia, until July 31 for cable terminals.

TELEPHONE SWITCHBOARDS FOR MELBOURNE, AUSTRALIA.—Tenders will be received by the Postmaster-General's Department, Melbourne, Australia, until Aug. 7 for telephone switchboards.

ELECTRICALLY DRIVEN PUMPS FOR SYDNEY, AUSTRALIA.—Tenders will be received by the Department of Public Works, Sydney, New South Wales, Australia, until July 23 for pumping machinery for the Glen Mines (New South Wales) water supply, including electrically operated pumps, switchgear, transformers, cables and wiring, etc.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT IN NEW SOUTH WALES, AUSTRALIA.—The New South Wales Railway Commissioners are reported to have selected a site at Middle River, Maarangaroo, on which they will erect a power plant to supply electricity to the towns and railway on the western line. The station will ultimately be connected up with Sydney.

PROPOSED POWER SCHEME FOR NEW ZEALAND.—The Provisional Electrification Committee, Dunedin, has adopted a report for a power scheme for the Otugo district presented by A. P. Aldridge, engineer of the committee. Electricity will be supplied from Port Chalmers to Palmerston. The cost of the entire project is estimated at about £150,000.

## New Apparatus and Publications

UNDERFEED STOKER.—"Built on Advanced Engineering Principles" is the title of a bulletin distributed by the Detroit Stoker Company, General Motors Building, Detroit, in which it describes and illustrates the "Detroit" level-fuel-bed, multiple-retort underfeed stoker.

LAMP-MAKING MACHINES. — Charles Eisler, 750-760 South Thirteenth Street, Newark, N. J., has developed the "Eisler" unit lamp-making machines. This unit is made in several styles, for regular vacuum lamps, miniature lamps and gas-filled lamps.

EVAPORATORS AND DISTILLERS.—The Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa., is distributing bulletin No. 15, covering the "Bethlehem-Weir" evaporators and distillers.

FLEXIBLE VARNISHED TUBING.—The Acme Wire Company, New Haven Conn., is distributing a leaflet describing the "Acme" flexible varnished tubing which it has added to its line of products.

SOOT BLOWER.—The Bayer Company, 4066 Park Avenue, St. Louis, Mo., is distributing a folder describing the "Bayer" blower.

SPLICING SLEEVES AND TWISTING TOOLS.—The High Tension Company, 120 Broadway, New York City, has issued bulletin No. 1-A, covering its high-tension, seamless-copper splicing sleeves and twisting tools.

WATCHMAKERS' LATHE MOTOR.—A combination watchmakers' lathe motor and polishing motor, furnished complete with foot controller, reverse switch, pulley and buffing and grinding attachment, has been brought out by the Fidelity Electric Company, Lancaster, Pa.

HEAVY-DUTY REELITE.—A device for paying out and automatically retrieving electric conductors for power and light which is adaptable for cranes, dredges, mining machinery, etc., has been developed by the Appleton Electric Company, 1701 Wellington Avenue, Chicago.

TUMBLER SWITCH. — A new shallow tumbler switch made in double-pole and four-way types has been placed on the market by the Hart & Hegeman Manufacturing Company, Hartford, Conn.

ELECTRIC FURNACE.—The Booth Electric Furnace Company, 411 North Wells Street, Chicago has placed on the market an electric melting furnace of the ladle type.

## New Incorporations

THE SHILOH LIGHT & POWER COMPANY, Statesville, N. C., has been incorporated with a capital stock of $10,000 by H. M. Morrison, G. W. Nash and S. G. Caugill.

THE BANCROFT LIGHT, HEAT & POWER COMPANY, Ltd., Bancroft, Ontario, Canada, has been incorporated with a capital stock of $1,000,000. Donald L. Cameron is director.

THE GLENIRON (PA.) POWER & TOOL COMPANY has been incorporated with a capital stock of $500,000 by R. F. Boop, John T. Church, Gleniron, and J. W. Shook, Bellefonte, Pa. The company proposes to operate an electric and gas plant.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

MARLBORO, N. H.—The Keene (N. H.) Gas & Electric Company will soon begin work on its proposed hydro-electric power plant, to cost about $300,000.

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 10, for three motor-generators and three sets of spare parts for the local navy yard. (Schedule 981.)

GARDNER, MASS.—The Gardner Electric Light Company has applied for permission to issue $176,750 in capital stock, part of the proceeds to be used for extensions.

## Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Company is planning to erect a three-phase, high-tension transmission line through the towns of North Greenbush, Stephantown, Nassau and Sand Lake, to connect with the lines of the New England Power Company. The cost is estimated at about $50,000.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has acquired property in the vicinity of its Noyes Island substation for proposed additions.

BROOKLYN, N. Y.—The Kings County Lighting Company will build a power house at 880 Sixty-fifth Street, to cost $50,000. Hugh Cuthrell is architect for the company.

BROOKLYN, N. Y.—An expenditure of more than $1,750,000 on new equipment and improvements has been authorized by the directors of the new Brooklyn-Manhattan Transit Corporation. Of this amount about $580,000 will be expended for cables and substations and the remainder for new cars.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 10, for storage-battery testing outfits and hydrometers (Schedule 1012), also for wire and cable, for use at the local navy yard (Schedule 1000).

NEW YORK, N. Y.—The New York Edison Company will build a service and storage building at 708-20 First Avenue, to cost about $2,000,000. Thomas E. Murray, 55 Duane Street, is engineer.

OSSINING, N. Y.—The I. Terwilliger & Sons Lumber Company plans to rebuild its power house and lumber mill, recently destroyed by fire, causing a loss of about $100,000.

STRATFORD, N. Y.—The Adirondack Power & Light Corporation, Amsterdam, has petitioned the Public Service Commission for approval of a franchise granted by the town of Stratford. The company contemplates an extensive development in Stratford and Oppenheim.

WATERTOWN, N. Y.—The Northern New York Utilities, Inc., has issued $2,212,200, in bonds, part of the proceeds to be used for a new generating plant and improvements.

BELLE MEAD, N. J.—The Belle Mead Electric Light & Power Company, recently organized with a capital of $125,000, plans to install a local system for commercial light and power service.

CARTERET, N. J.—Arrangements have been made by the Ichabod T. Williams & Sons Company, Eleventh Avenue and Twenty-fifth Street, New York, for the construction of its proposed local hardwood mills, including power house, to cost about $500,000.

MORRISTOWN, N. J.—The Jersey Central Power & Light Company has issued $1,156,000 in capital stock, part of the proceeds to be used for extensions and improvements.

RIDGEFIELD PARK, N. J. — Electric power equipment will be installed in the proposed ice-manufacturing plant to be erected by the Bergen Hygeia Ice Company on Tucker Street, to cost about $150,000.

VERONA, N. J.—Bids will be received by the Board of Freeholders, George C. Bergen, county purchasing agent, Court House, Newark, until July 10 for electrical work in connection with a power-house addition at the county sanitorium. Guilbert & Betelle, Chamber of Commerce Building, Newark, are architects.

COOPERSBURG, PA.—The Pennsylvania Power & Light Company, Allentown is negotiating for the purchase of the system of the Coopersburg Light, Heat & Power Company. A substation will be built and transmission lines extended to Coopersburg.

DELTA, PA.—The Edison Electric Light & Power Company, York, has acquired the properties of the Delta Electric Power Company and the Delta Water & Power Company. Extensions will be made in the systems, and the transmission lines extended to Castle Fin, about 20 miles.

PHILADELPHIA, PA.—Plans are being made by the trustees of the Franklin Institute, 15 South Seventh Street, for remodeling four buildings at Nineteenth and Race Streets for the establishment of new laboratories, consisting of about twenty rooms, equipped with electrical and mechanical precision apparatus for complete experimental research. The work will be done under the direction of the Henry W. Bartol Research Foundation of the institute.

PITTSBURGH, PA. — Bids will be received by the Superintendent of Buildings, Board of Education, Fulton Building, until July 12 for electric work in the proposed Chatham school, Waldorf and Bonvue Streets.

PITTSBURGH, PA.—The managers of the Phipps Power Building, Duquesne Way and Cecil Place, have engaged Dwight P. Robinson & Company, Inc., 125 East Forty-sixth Street, New York, engineer, to prepare plans for an addition to the building, to cost about $250,000.

READING, PA.—The Metropolitan Edison Company is organizing three subsidiaries, to be known as the South Londonderry-Lebanon Electric Company, West Cornwall-Lebanon Electric Company and the Cornwall-Lebanan Electric Company, to erect transmission lines through the respective territories. The Metropolitan company has called a special meeting for Aug. 14 to arrange an increase in capital from

90,000 to 300,000 shares of stock, part of the proceeds to be used for expansion.

RED HILL, PA.—The Red Hill Power & Light Company has been organized to construct a transmission system in this district. Thomas J. Perkins, Allentown, Pa., represents the company.

BALTIMORE, MD.—Bids will be received by the Board of Awards, care of F. A. Dolfield, City Register, until July 5 for about 100,000 ft. of single vitrified-clay conduit for the city electrical commission. Charles F. Good is chief engineer of the commission.

HUNTINGTON, W. VA.—The Consolidated Power & Light Company has issued $1,500,000 in capital stock, the proceeds to be used for expansion, including the completion of the 20,000-hp. power plant now being erected at Kenova and transmission-line extensions.

SUTTON, W. VA. — The Monongahela-West Penn Public Service Company contemplates extensions in its transmission lines, with substation improvements in plants recently acquired at Parsons, Elkins and Sutton.

KILMARNOOK, VA. — The Kilmarnook Light & Power Company, recently organized, plans to build a substation, with distribution system, for commercial light and power service in sections of Lancaster and Northumberland Counties. W. L. Masen is president.

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 17 for automatic telephone equipment and air-conditioning apparatus.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Aug. 1 for Signal Corps cable, totaling about 75,000 miles of different types, gutta-percha-insulated. Alternate bids will be received for rubber insulated. (Proposal 15085—1 CP.)

WASHINGTON D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Deparment, Washington, D. C., until July 18 for extension to battery storage and overhaul at Pearl Harbor, Hawaii.

## North Central States

DETROIT, MICH.—The City Council has voted to proceed with the construction of the four-unit lighting plant at the foot of Morrell Street, to cost about $12,000,000.

IRONWOOD, MICH.—The Ford Motor Company, Highland Park, has applied to the Federal Power Commission for permission to build a hydro-electric plant on the Menominee River, to cost about $500,000, for service at its Northern Michigan works.

LANSING, MICH.—The Durant Motor Company is planning to double the capacity of the power plant at its local works.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until July 6 for mechanical stokers for the division of light and power.

BOWLING GREEN, KY.—The Kentucky-Tennessee Public Service Company is completing plans for tying in all properties of the Kentucky Public Service Company and the Kentucky-Tennessee Light & Power Company located in southern Kentucky and northern Tennessee. These plans will involve the erection of approximately 95 miles of high-tension lines. The company has franchises in all counties connecting its different stations. O. E. Wessell is assistant general manager of the Kentucky Public Service Company.

HOPKINSVILLE, KY.—The Kentucky-Tennessee Light & Power Company Bowling Green, has started construction on a 3,000-kw. addition to its local power plant, to cost about $300,000. The plans include a new turbine, changes to boilers and spray pond. Provision is being made to increase the capacity of the station to 9,000 kw. O. E. Wessel is assistant general manager.

LOUISVILLE, KY.—The erection of a 33,000-volt transmission line from Richmond to Winchester (20 miles) is under consideration by the Kentucky Utilities Company, Louisville.

MURRAY, KY.—The Council contemplates the purchase of a 200-hp. oil engine and auxiliary equipment for the municipal electric light plant. M. T. Morris is in charge.

INDIANAPOLIS, IND.—The directors of the Robert W. Long Hospital and the James Whitcomb Riley Hospital for Children have received permission from the Public Service Commission to install an electric power plant for the joint use of the institutions. An appropriation of $250,000 is available.

LINTON, IND.—The High Grade Coal Company, Terre Haute, contemplates the rebuilding the power house at its local properties, recently destroyed by fire.

SOUTH BEND, IND.—The Twin Branch Power Company, a subsidiary of the American Gas & Electric Company, New York, is preparing plans for the construction of a six-unit generating plant on the St. Joseph River, each unit to have a capacity of 35,000 kw., to cost about $10,000,000, with transmission system.

ELLIS JUNCTION, WIS.—The Wisconsin Public Service Company, 559 Marshall Street, Milwaukee, is asking for bids for outdoor substation, switchboard, two 200-ft. penstocks, six Tainter gates, two sluice-gates. Mead & Seastono, Journal Building, Madison, are engineers.

FLORENCE, WIS.—Extensive improvements are contemplated by the Peninsular Power Company, Madison, to its local plant, involving an expenditure of about $250,000. The plans call for the erection of a building adjacent to its present plant to be equipped with a Diesel-oil-engine-driven unit.

LA CROSS, WIS.—Bids will be received by the La Crosse Lutheran Hospital Association for building a nurses' home and for remodeling power house, to cost about $150,000. O. A. Merman, Linker Building, is architect.

STEVENS POINT, WIS.—Steps have been taken by property owners on Clark Street for the installation of an ornamental lighting system.

LITCHFIELD, MINN.—Extensions to the municipal electric light and power plant to cost about $75,000 are under consideration. L. P. Wolff, Guardian Life Building, St. Paul, and E. D. Jackson, Endicott Building, St. Paul, are engineers.

ANAMOSA, IOWA.—The Iowa Electric Company is erecting a high-tension transmission line from Anamosa to Olin, which will be extended from Olin to Oxford Junction, to replace the line which is now in operation.

IDA GROVE, IOWA.—The Ida Grove Electric Company contemplates improvements to its system, to cost about $25,000.

CAMERON, MO.—The Council has engaged E. E. Harper, 3031 Park Avenue, Kansas City, engineer to prepare plans for improvements to the municipal electric plant, to cost $85,000, for which bonds have been voted.

ST. LOUIS, MO.—The Missouri-Pacific Railroad Company has plans under way for the construction of a power house on Choteau Avenue, to cost about $55,000. A similar plant will also be built in connection with a number of mechanical buildings on Van Buren Street to cost $100,000.

MULVANE, KAN.—Plans are being prepared for extensions and improvements to the municipal electric plant.

## Southern States

RALEIGH, N. C.—The Carolina Power & Light Company has issued $2,500,000 in bonds, part of the proceeds to be used for extensions, including a new power plant with initial capacity of 15,000 kw. and a transmission system.

RUTHERFORDTON, N. C.—The Taylor Lumber Company contemplates the construction of a power house at its proposed local mill.

WHITAKERS, N. C.—Bids will be received by the Mayor and Board of Aldermen until July 11 for furnishing material, equipment, etc., for the construction of a three-phase, 6,600-volt wood-pole transmission line between Whitakers and Endfield, a distance of about 6 miles. W. T. Hearne is superintendent of lighting department.

WILMINGTON, N. C.—Plans for the proposed mill to be erected by the Wilmington Wood Products Company include a power house. The cost of the project is estimated at $60,000. L. L. Merritt, Wilmington, is engineer.

CHARLESTON, S. C. — The Southern States Lumber Company, recently incorporated, is reported to be planning the construction of a new mill and power house, to cost about $100,000. B. O. Elting is president.

TALLAPOOSA, GA. — The Tallapoosa River Power & Textile Company, recently organized, is planning to build a hydro-electric plant to cost about $100,000. A transmission system will be built to supply service in this district.

MIAMI, FLA.—The Ocean-River Corporation, First National Bank Building, will build an electric power plant at its properties. Bids will be called at once.

TAMPA, FLA.—The Tampa Bay Fertilizer Company, recently organized, plans to build a power house in connection with a new local mill, to cost about $250,000. S. W. Allen is president.

WINTER HAVEN, FLA. — The Tampa Electric Company plans extensions and improvements to the system of the Winter Haven Light & Power Company, a subsidiary.

MADISONVILLE, TENN.—Bids will be received by the City Council until July 3 for pumping and other equipment, including four centrifugal pumping units, two electric motors with automatic control, two gasoline engines and auxiliary equipment for the municipal waterworks. The Ambler Engineering Company, Travelers Building, Richmond, Va., is engineer.

MEMPHIS, TENN.—The Memphis Power & Light Company is planning to increase the output of its generating plant by 15,000 kw.

NASHVILLE, TENN. — The Du Pont Fibre Silk Company, Buffalo, N. Y., plans to construct a power house in connection with its proposed local mill, to cost about $500,000.

HOLLYWOOD, ALA.—The installation of electrically driven pumping machinery in the municipal waterworks is under consideration. Prices are also being asked on oil-engine equipment. J. C. Wall is engineer.

TALLASSEE, ALA.—The Alabama Power Company, Birmingham, has been granted permission to purchase the dam and power house of the Vernon-Woodbury cotton mills on the Tallapoosa River, near Tallassee. The Alabama company contemplates increasing the output of the plant by 8,000 hp., and plans are also under way to install an additional unit of 15,000 hp. Eventually a plant of 60,000 hp. will be built.

GARNER, ARK.—The Kelly Lumber Company plans to construct a power house at its proposed new mill to cost about $90,000.

RUDY, ARK.—The Fort Smith Fertilizer Company, Fort Smith, Ark., plans to construct a power house at its proposed local plant, to cost about $75,000.

GIBSLAND, LA.—The City Council has taken over the electric plant of the Gibsland Light & Power Company, to be owned and operated by the municipality.

MONROE, LA.—The Brown Paper Mill Company, Inc., Orange, Tex., plans to build a power plant in connection with its proposed local paper mill, to cost about $1,000,000.

WELCH, OKLA.—The Commissioners of Craig County have granted the Empire Electric Company, Joplin, Mo., a franchise to erect a transmission line from the county line through Welch to Hudson, a distance of about 12 miles.

DENTON, TEX.—Plans are under way for the construction of an addition to the State College of Industrial Arts. R. F. Taylor, Western Indemnity Building, Dallas, is engineer.

FORT WORTH, TEX.—Bids will be received by the Board of Commissioners until July 3 for a motor-driven centrifugal pump of 12,000,000 gal. capacity per twenty-four hours, under a head of 270 ft. Alternate bids will be received for a Diesel-engine-driven pumping unit. Dudley L. Lewis is city engineer.

GIDDINGS, TEX.—The light and power plant of the Giddings Cotton Oil Company has been acquired by the Giddings Manufacturing Company. Extensions and improvements will be made, including the installation of additional equipment.

HOUSTON, TEX. — Plans have been adopted by the Houston Lighting & Power Company for extension and improvements to its system, to cost $4,492,000, as follows: New power station, $2,632,000; improvements to underground system in business district, $330,000; new substation, Houston Heights, $140,000; new substation, Washington and Fourth Streets, $19,000; improvements to Gable Street power station, $330,000; improvements to distribution lines, $300,000; short extensions, meters and transformers, $403,000; miscellaneous work, $308,000.

KINGSVILLE, TEX. — The Legislature has approved an appropriation of $330,000 for the construction of a power plant and administration building at the local South Texas Teachers' College. Plans have been approved also for improvements in the power plant at the West Texas Teachers' College, Canyon, including the installation of additional electric and steam equipment.

RISING STAR, TEX.—The Rising Star Light & Power Company contemplates a number of extensions and improvements. The company has increased its capital stock from $15,000 to $25,000.

SANGER, TEX.—At an election to be held by July 7 the proposal to issue $90,000 in bonds for the construction of waterworks, sewer system and an electric light and power plant will be submitted to the voters.

## Pacific and Mountain States

TUMWATER, WASH.—The Puget Sound Power & Light Company, Seattle has been granted a franchise for a transmission line from Tumwater to Tenino. Work will be placed under way at an early date.

BEND, ORE.—The L. E. Myers Company, 53 West Jackson Boulevard, Chicago, has acquired the plant and system of the Bend Water, Light & Power Company. Plans are under consideration for extensions and improvements.

KLAMATH FALLS, ORE.—The Secretary of the Interior has authorized the sale of the Keno and Ankeny canals in the Klamath irrigation project to the California-Oregon Power Company. The company proposes to develop the power, at a cost of $750,000 to supply electricity to lumber mills and other industrial enterprises in this vicinity.

PORTLAND, ORE.—Shafer, McLaughlin & Hillier, Inc., will install a power house at its proposed new lumber plant at the Columbia Boulevard and Vancouver Road.

PORTLAND, ORE.—Surveys are being made by the Pacific Power & Light Company, Portland, along the Deschutes River, in the vicinity of Ketchum station, covering a distance of 10 miles, on a proposed site for a hydro-electric power plant. The plans call for a development of about 40,000 hp., the cost of which will be between $2,000,000 and $3,000,000.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has issued $2,500,000 in bonds, part of the proceeds to be used for extensions.

LOS ANGELES, CAL.—The County Supervisors plan to install an ornamental street-lighting system on Walnut and Palm Avenues, Spencer, Roane, 162d and San Pedro Streets.

LOS ANGELES, CAL.—The Pacific Electric Railway Company plans improvements to the San Bernardino line, to cost about $100,000. The wooden substations will be replaced by steel and concrete buildings, and the present 1,000-kw. motor generator set will be replaced with a 1,500-kw. automatic installation.

MADERA, CAL.—The Madera Irrigation District has applied to the State Water Commission for permission to construct a hydro-electric plant on the Fresno River, to cost about $2,000,000.

SAN FRANCISCO, CAL.—The Great Western Power Company of California plans to increase the output of its electric plants at Las Plumas and Caribou. A third unit will be installed at the Caribou, at a cost of about $1,000,000. Extensions will be made to the Las Plumas plant, to cost about the same amount.

## Canada

BANCROFT, ONT.—The Bancroft Light, Heat & Power Company, recently incorporated, contemplates the construction of two hydro-electric plants on the York branch of the Madawaska River. Donald L. Cameron is director.

CAMPBELLFORD, ONT. — Preparations are being made by the Hydro-Electric Power Commission of Ontario for a hydro-electric development, to cost about $250,000, at dam No. 8, near Campbellford. Plans, it is said, have been prepared for a similar plant, to be located nearer the town, to be known as No. 9.

ST. THOMAS, ONT.—The Hydro-Electric Power Commission of Ontario plans to erect 15 miles of transmission lines in the district adjoining St. Thomas, to cost about $50,000. F. A. Gaby is chief engineer.

TORONTO, ONT. — The Hydro-Electric Power Commission of Ontario is planning to connect Niagara with the Eugenia plant. The project includes increasing the output of the plant at Eugenia, constructing new pipe line, installing frequency changer, etc. The cost is estimated at $75,000.

UNITY, SASK.—Tenders will be received by J. M. Jenson, town clerk, Unity, until July 5 as follows: Tender A—For furnishing and erecting an internal combustion engine; tender B—for furnishing and installing a generator, exciter, switchboard and other apparatus; tender C—for construction of addition to power house. A. A. Murphy, Saskatoon, Sask., is consulting engineer.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued June 5, 1923)

1,458,105. RHEOSTAT; S. R. Hipple, Williamsport, Pa. App. filed Sept. 6, 1922. Granular resistance varied by pressure.

1,458,120. MAGNET AND DYNAMO-ELECTRIC MACHINE STRUCTURE; R. B. Williamson, Milwaukee, Wis. App. filed June 8, 1918. Framework for magnets on large generators.

1,458,121. DYNAMO-ELECTRIC MACHINE; A. J. Brown, Milwaukee, Wis. App. filed Aug. 29, 1918. Bearing construction for vertical hydro-electric generators.

(Issued June 12, 1923)

15,623 (reissue). EXCITING SYSTEM OF PHASE CONVERTERS; R. E. Hellmund, Swissvale, Pa. App. filed Aug. 7, 1916. Converting single-phase current to polyphase of railway locomotives.

1,458,124. BATTERY HANDLAMP; E. Alschuler, St. Louis, Mo. App. filed Jan. 4, 1919. Flashlight.

1,458,126. TRANSFORMER; R. V. Bingay, Pittsburgh, Pa. App. filed Oct. 1, 1920. Structure and tank for small oil-cooled transformers.

1,458,138. CLAMP FOR WELDING-MACHINE ATTACHMENTS; H. W. Krantz and J. Lukes, Cleveland, Ohio. App. filed May 24, 1920. For holding ends of wheel rims during welding operation.

1,458,139. COMBINED IGNITION AND LIGHTING GENERATOR; L. J. Le Pontois, Lakewood, Ohio. App. filed Aug. 23, 1917.

1,458,153. VACUUM-TUBE BASE AND RECEPTACLE; F. H. Shaw, East Orange, N. J. App. filed Aug. 20, 1919.

1,458,165. SYSTEM OF ELECTRICAL CONTROL; W. W. Coblentz, Washington, D. C. App. filed Sept. 22, 1920. Remote control of apparatus by radio.

1,458,180. ADVERTISING DEVICE; J. H. Hammond, Jr., Gloucester, Mass. App. filed June 1, 1916. Automatic light-flashing sign.

1,458,182. ELECTROTHERMAL BATH CABINET; M. F. Hasemeier, Woodward, Okla. App. filed Jan. 25, 1922. Patient treated by heat and light rays produced by electricity.

1,458,193. MULTIPLE BALANCING ARRANGEMENT FOR MULTIPLEX TRANSMISSION; H. S. Osborne Montclair, N. J. App. filed Sept. 13, 1919.

1,458,225. MULTIPLE BALANCING ARRANGEMENT FOR MULTIPLEX TRANSMISSION; L. Espenschied, Hollis, N. Y. App. filed Aug. 29, 1919. High-frequency carrier currents used for transmission of signals.

1,458,247. WIRE CLAMP; J. F. Schleper, Amsterdam, Netherlands. App. filed Feb. 20, 1920. Connector especially adapted to conduits.

1,458,273 and 1,458,274. WELDING PROCESS; M. S. Clawson, Upper Montclair, N. J. App. filed April 23, 1920. Resistance welding method.

1,458,291. APPARATUS FOR DEHYDRATING PETROLEUM OILS; F. W. Harris, Los Angeles, Cal. App. filed June 28, 1921. Magnetic displacement of current carrying path through emulsion.

1,458,307. DRY ELECTRIC BATTERY; L. Levaillant, Zurich, Switzerland. App. filed Jan. 12, 1923. Built up of flat cells.

1,458,329. HAND BAG; C. S. Elfelt, Los Angeles, Cal. App. filed May 16, 1921. Electrically lighted.

1,458,336. ILLUMINATED AUTOMOBILE SIGNAL; S. G. Grandjean and J. J. Darcey, Braithwaite, La. App. filed July 2, 1921. Rear direction signal.

1,458,338. HEIGHT INDICATOR FOR LIQUIDS; R. Grimshaw and C. J. Weis, Clyde, Ohio. App. filed Oct. 9, 1919. Operating arm working over series of contacts gives direct indication of height of liquid.

1,458,377. STORAGE BATTERY; E. Anderson, Dayton, Ohio. App. filed Nov. 18, 1919. Separator of porous vitrified ceramic product.

1,458,418. SAFETY DEVICE AND SWITCH; C. L. Johnston, Oakland, and C. M. F. Friden, Piedmont, Cal. App. filed March 6, 1922. Cut-out switch for handle of flatiron.

1,458,430. MELTING OR SOLDERING POT; E. Millner, St. Louis, Mo. App. filed Sept. 29, 1920. Heating element entirely surrounded by material to be melted.

1,458,466. ANTENNA SELECTOR SWITCH; A. Crossley, Washington, D. C. App. filed July 7, 1919. To connect various combinations of underground, elevated or loop antennas to receiving apparatus.

1,458,500 and 1,458,501. RHEOSTAT; F. A. Rojas, New York, N. Y. App. filed Nov. 18, 1921. Compressible resistance type for lamp sockets.

1,458,525. PROCESS FOR FIXATION OF ATMOSPHERIC NITROGEN; F. Daniels, East Falls Church, Va. App. filed May 12, 1919. By employing streaming electric discharge.

1,458,533. GROUND CLAMP; G. Lipschutz, Philadelphia, Pa. App. filed April 26, 1921. Thin strap drawn through holes makes connection.

1,458,545. IMPULSE TRANSMITTER; W. T. Powell, Rochester, N. Y. App. filed June 13, 1919. For automatic telephone systems.

1,458,555. TELEPHONE SYSTEM; F. M. Slough, Rochester, N. Y. App. filed Oct. 14, 1914. Associate multiple is employed.

1,458,601. ELECTRODYNAMIC TRANSMISSION SYSTEM FOR VEHICLES; H. L. Tanner, Brooklyn, N. Y. App. filed Feb. 5, 1917. Generator-motor drive for low speeds and electromagnetic drag for higher speeds.

1,458,611. LIGHTNING ARRESTER; L. S. Brach, East Orange, N. J. App. filed May 17, 1921. Low-voltage vacuum-type arrester.

1,458,613. PLANER AND SYSTEM OF MOTOR CONTROL THEREFOR; H. L. Blood, Plainfield, N. J. App. filed Jan. 31, 1920. Main starting switches prevented from closing except under proper conditions.

1,458,620. FLUID-TIGHT APPARATUS; G. Fussner, Menominee, Mich. App. filed Oct. 12, 1920. Waterproof electric bell.

1,458,634. TRANSFORMER COOLER AND ELECTRIC HEATER; A. H. Waage, Rosedale, N. Y. App. filed Nov. 10, 1921. Windings made of tubes through which cooling water is forced.

1,458,647. ELECTRIC CLOCK; E. Fowler, Baltimore, Md. App. filed July 7, 1919. Secondary clocks controlled by master.

1,458,665. SIGNAL LANTERN; G. W. Stewart, Chicago, Ill. App. filed March 29, 1922. For railway service.

1,458,682. SHORT-CIRCUITING DEVICE; H. L. Brump, Dayton, Ohio. App. filed April 4, 1922. For repulsion motors having series-motor characteristics.

1,458,692. CONDUCTOR ARRANGEMENT OF ELECTRIC TRACTION SYSTEM; C. E. Fairburn, London, England. App. filed Sept. 22, 1920. Combination of third-rail and overhead systems.

1,458,711. VEHICLE DIRECTION INDICATOR; F. Koppenhafer, Shinrock, Ohio. App. filed Nov. 1, 1920.

1,458,728. ELECTRIC APPLIANCE RECEIVING AND METER PROTECTING BOX OR CASING; J. Sachs, Hartford, Conn. App. filed April 2, 1918. Switchbox and adapter for bottom-connected meter.

1,458,749. SWITCH MECHANISM; F. S. Denison, Minneapolis, Minn. App. filed Dec. 2, 1920. Thermostatical control.

1,458,754. INSULATOR; W. T. Goddard, Victor, N. Y. App. filed Dec. 8, 1917. Space between successive petticoats.

1,458,755. INSULATOR; W. T. Goddard, Victor, N. Y. App. filed April 11, 1918. Method of connecting units of high-tension insulators together.

1,458,756. STRAIN INSULATOR; W. T. Goddard, Hamilton, Ontario, Can. App. filed Oct. 25, 1919. Flexible connection between porcelain and metal.

1,458,757. PILLAR-POST STRUCTURE FOR BATTERIES; P. Goldsborough, Minneapolis, Minn. App. filed March 19, 1921. Special construction for automobile use.

1,458,763. ELECTRIC RADIATOR; C. A. Head, Royal Oak, Mich. App. filed June 26, 1922. For house heating.

1,458,803. INSULATED ELECTRIC WIRE; H. B. Burley and H. E. Rooney, Brookline, Mass. App. filed Feb. 6, 1922. For high-voltage transmission.

1,458,806. ELECTRIC GENERATING GROUP; E. L. P. Colardeau, Paris, France. App. filed Oct. 22, 1918. Operation of railway motors.

1,458,819. VEHICLE SIGNAL; J. S. Graham, U. S. Navy. App. filed July 1, 1921. Rear direction signal.

1,458,901. BATTERY TERMINAL; A. E. Buchenberg, Toledo, Ohio. App. filed April 4, 1918.